Ameren Missouri ApplianceSavers Impact and Process Evaluation: Program Year 2013

May 15, 2014

Ameren Missouri

Nexant

The Cadmus Group, Inc.

An Employee-Owned Company • www.cadmusgroup.com

This page left blank.

CADMUS

Prepared by:
Doug Bruchs
Zachary Horváth
M. Sami Khawaja, Ph.D.
Cadmus: Energy Services Division

This page left blank.

CADMUS

Table of Contents

EXECUTIVE SUMMARY

Ameren Missouri (Ameren) engaged the Cadmus team (composed of Cadmus and Nexant) to perform annual process and impact evaluations of the ApplianceSavers 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

The ApplianceSavers program offers Ameren's residential customers a $50 incentive and free pickup service for recycling an operable refrigerator and stand-alone freezer (up to a total of three per customer per year). ApplianceSavers is implemented by the Appliance Recycling Centers of America, Inc. (ARCA). Customers may also recycle a working room air conditioner or dehumidifier, along with a qualifying refrigerator or freezer (with a limit of three per customer per year). Incentives are not provided for air conditioners or dehumidifiers.

During PY13, ApplianceSavers recycled 6,881 appliances (5,237 refrigerators and 1,644 freezers). Under this program, some room air conditioners (23) and dehumidifiers (48) also were collected by ARCA. The scale of the program in PY13 was considerably larger than in PY12. The latter program-year period was shortened because it was a bridge year for all Ameren programs—between those completed in 2009–2011 and those in the 2013–2015 program cycles. However, participation in PY13 was less than that of PY11 (9,084), the last 12-month program year.

Key Impact Evaluation Findings

As with previous evaluations, the Cadmus team estimated gross energy savings by combining PY13-specific appliance characteristics with the results of a multivariate regression model using *in situ* data collected through multiple metering studies for other recycling program evaluations. This approach results in an accurate and cost-effective value tailored to Ameren's program. We also applied the prospective part-use rates, which we determined through a survey of PY13 participants to estimate the average per-unit gross energy savings for refrigerators and freezers.

As shown in Table 1, the *ex post* energy savings (annualized savings calculated by Cadmus as Ameren's evaluator) are significantly less than Ameren's *ex ante* estimates (annualized savings reported by Ameren and documented in its technical resource manual [TRM]).

Table 1. Per-Unit Gross Energy Savings (kWh/Year)

Appliance	*Ex Ante*	*Ex Post*	Realization Rate
Refrigerators	1,440	1,013	70%
Freezers	1,429	969	68%

There are two main reasons for the differences between the *ex post* savings and the *ex ante* savings, which Ameren based on the PY10 evaluation:

- ***Incorporation of Additional Metering Data.*** Between PY10 and PY13, we metered 160 refrigerators and freezers for two Michigan utilities: Consumers Energy and Detroit Edison. Adding data from these studies increased the total analysis sample by 40% (from 404 to 564 units), which yielded two benefits:
  - The larger sample size enabled us to model refrigerators separately from freezers for the first time. (Due to data limitations in PY10, particularly for freezers, we used a single model for both appliance types.)
  - We metered half of the Michigan appliances in fall and winter. (Previously, we had done all metering in summer.) Having a greater variety of weather conditions enabled us to include both cooling and heating interactions in our models. (In the PY10 evaluation, we could only calculate cooling interactions.)
- ***Adoption of Uniform Methods Project (UMP) Protocol.*** In April 2013, the Department of Energy (DOE) published a set of seven measure-specific Uniform Methods Project protocols. DOE launched the voluntary UMP protocols to standardize the evaluation practices for key measures. Cadmus co-authored the protocols and incorporated feedback from the UMP's technical advisory group, steering committee, and public review process. The final protocol included elements (such as prospective part-use) not applied in PY10.

While the *ex ante* and *ex post* savings differ greatly, the PY13 *ex post* gross savings are nearly identical to the savings that Cadmus estimated for PY12: 1,011 for refrigerators and 922 for freezers (which also utilized the additional Michigan data and UMP methodology). In fact, had we used the model and data available in PY10 to evaluate the PY13 program, the per-unit gross savings for refrigerators would have been 1,345 kWh. This value suggests that the difference between the PY13 *ex ante* and *ex post* savings primarily is due to having more data and better evaluation methodologies rather than a radical shift in what was accomplished through the program.

To estimate PY13 net-to-gross (NTG) ratios for refrigerators and freezers, the Cadmus team used the following formula:

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

However, market effects, the fourth NTG input, are not appropriate for appliance recycling programs, as we already accounted for the program's impact on the regional used-appliance market by estimating induced replacement and secondary market impacts. As a result, we did not adjust evaluated NTG for market effects.

To determine NTG, we used findings from our surveys of participants regarding their likely actions independent of the program and from our surveys of nonparticipants (in which customers reported how they *actually* discarded of operable units). This approach, recommended by UMP, improves the reliability of the participants' self-reported actions—which are commonly subject to socially desirable response bias—by combining participant responses about likely actions with the actions reported by nonparticipants. Table 2 compares these *ex post* and *ex ante* values.

Table 2. *Ex Ante* and *Ex Post* Net-to-Gross Ratios

	Ex Ante	*Ex Post*			
Appliance	**NTG**	**Free Ridership**	**Participant Spillover**	**Nonparticipant Spillover**	**NTG**
Refrigerators	64%	40%	0.4%	12.4%	73%
Freezers		34%	0%		78%
Total	**64%**	**38.6%**	**0.3%**	**12.4%**	**74%**

Similar to the per-unit gross savings, a large difference exists between the program's *ex ante* and *ex post* NTG. Again, there are two main reasons for the difference:

- ***Adoption of UMP Protocol.*** Methodological changes resulting from UMP impacted net savings even more than gross savings. Specifically, UMP recommends accounting for induced replacement and secondary market impacts, neither of which were part of the pre-UMP PY10 evaluation.
- ***Spillover***. We estimated participant and nonparticipant spillover as part of the PY13 evaluation. While we estimated participant spillover to be quite limited in PY13 (less than 0.5%), we estimated nonparticipant spillover—driven by considerable program marketing (~$540,000)—to be 12.4% of ApplianceSavers' PY13 gross energy savings.

We applied these NTG values to PY13 participation and *ex post* per-unit gross savings to calculate the program's net energy savings (Table 3).

Table 3. *Ex Post* Net Energy Savings

Appliance	PY13 Participants	Gross Per-Unit Energy Savings (kWh/Year)	NTG	Total Energy Savings (MWh/Year)
Refrigerators	5,237	1,013	73%	3,873
Freezers	1,644	969	78%	1,243
Room Air Conditioners	23	830	74%	14
Dehumidifiers	48	964	74%	34
Total	**6,952**		**74%**	**5,164**

*Due to very limited participation, we did not assess NTG for these measures separately. 74% represents the weighted average of the refrigerator and freezer NTGs.

As shown in Table 4, due to lower per-unit energy savings and lower-than-expected participation rates, the program achieved only 44% of its proposed net energy savings target for PY13 (11,739.5 MWh) in Ameren's residential tariff approved by the Missouri Public Service Commission (MPSC).

Table 4. ApplianceSavers Net Savings Comparisons

Metric	MPSC-Approved Target[1]	*Ex Ante* Gross Savings Utility Reported[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)	11,739.5	9,897	6,963	5,164	44%
Demand (kW)	1,636	1,800	1,338	992	61%

[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

Similar to participant responses from previous program years, the PY13 ApplianceSavers participants expressed satisfaction with the program. In fact, none of the surveyed participants reported being dissatisfied with their experience. (That is, no participant used the satisfaction rating of either "not very" or "not at all.") Further, all but one participant reported they would recommend the program to a friend or family member, and 79% said they were more likely to participate in another Ameren energy-efficiency program as a result of their experience with ApplianceSavers.

While the level of satisfaction was high, the program struggled to generate the expected level of participation, ultimately reaching less than two-thirds of its PY13 goal of 11,000 total units. Stakeholders identified various factors that contributed to the tepid early participation response, including the following:

- The PY13 program's name change (previously the Refrigerator Recycling Program);
- Discontinuity in service due to the shortened PY12 bridge year; and
- Marketing materials that were less engaging than the previous materials due to a company-wide rebranding effort.

Ameren and ARCA stimulated greater participation later in PY13 (particularly in August and November) through increased marketing efforts, market expansion through participating and promoting retail efforts, and a change in marketing materials; however, the late surge in participation was not enough to overcome the program's slow start (see Figure 1).

Key Conclusions and Recommendations

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

Conclusion 1. As in previous program years, participants expressed very high satisfaction levels (100%) with ApplianceSavers in PY13. Specifically, 99% of surveyed responded said they would recommend the

program to family or friends. However, 92% of respondents indicated they had not participated in any other Ameren energy-efficiency programs since recycling their appliance through the ApplianceSavers program.

> **Recommendation 1a. Target marketing efforts at recent participants.** Offering additional incentives for participating in other programs (such as PerformanceSavers, which offers a range of energy-saving measures) will leverage the participants' recent and positive experience with ApplianceSavers and make them more likely to take additional energy-efficiency actions. Similarly, Ameren could provide incentives or additional efficiency measures to participants who recommend Ameren programs to a friend.
>
> **Recommendation 1b. Ameren should have ARCA provide energy-efficiency kits (including compact fluorescent light bulbs and other easy-to-install measures) at the time they pick up an appliance.** Including the aforementioned special offers in the energy efficiency kit also would limit costs.

Conclusion 2. Stakeholders consistently reported that the marketing approach employed by the program early in PY13 was not sufficiently engaging and may have contributed to the program's slow start. Mid-year changes—such as using the "Energy Hog" creative materials popular in Illinois—appeared to have helped.

> **Recommendation 2. Monitor reaction to the Energy Hog marketing materials and, when developing new marketing materials, emphasize creativity to enhance appeal.** Utilities and marketing firms at a recent appliance recycling-specific meeting cited the following marketing activities as creating "success," and we recommend that Ameren consider each:
>
> - ***Google AdWords.*** An appliance recycling manager from a Midwest utility said an analysis of their marketing showed Google AdWords as their second-most cost-effective marketing tactic, behind bill inserts.
> - ***Pandora.*** Several utilities and marketing firms expressed satisfaction with targeted advertisements on Pandora, the Internet streaming radio station.
> - ***Fill-A-Fridge Campaign.*** The Energy Trust of Oregon partnered with the Oregon Food Bank to enable participants to donate their recycling incentive to the Food Bank. According to the marketing firm that ran the promotion, the campaign did not lead to a quantifiable spike in participation, but it generated significant media attention, which raised the program's profile. The marketing firm said the promotion likely sustained higher participation levels during the winter. Similar types of altruistic marketing could lead to similar earned media gains for Ameren; such gains become more difficult to generate as a program matures. Potential customers may also find this this type of altruistic earned media more engaging than typical earned media, such as milestone events.

INTRODUCTION

Ameren Missouri (Ameren) engaged the Cadmus team (composed of Cadmus and Nexant) to perform a process and impact evaluation of the ApplianceSavers program for a three-year period. This 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

Through its ApplianceSavers program, Ameren offers residential customers a $50 incentive and free pickup service for recycling operable refrigerators and stand-alone freezers. Customers may also recycle a working room air conditioner or dehumidifier, along with a qualifying refrigerator or freezer, with a limit of three per customer per year. The incentive is not provided for air conditioners or dehumidifiers. The program implementer, Appliance Recycling Centers of America, Inc., (ARCA) decommissions the appliances in an environmentally responsible manner,[1] thereby ensuring that the appliance is permanently removed from the grid.

All of Ameren's residential electric customers qualify for ApplianceSavers if their appliance meets the following criteria:

- Must be at the electric customer's account location;
- Must be operational at the time of pickup;
- Must be between 10 and 27 cubic feet; and
- Must be manufactured before 2002.

There were several changes to the program design in PY12. First, Ameren increased the incentive level to $50 from $35. Second, ApplianceSavers began accepting primary refrigerators in addition to secondary refrigerators and freezers. Finally, the program began accepting window air conditioners and dehumidifiers in conjunction with a refrigerator or a freezer; however, there were no rebates for these two measures. All of these changes were recommended by Cadmus in previous evaluation reports.

In addition to these changes, Ameren also changed the name of the program itself. Before PY13, the program was called the Refrigerator Recycling Program (RRP). Ameren transitioned the name to ApplianceSavers to unify its seven PY13 residential program offerings (which all use the "Savers" suffix). Ameren changed the program name as part of its portfolio-wide rebranding effort.

Program Activity

During PY13, ApplianceSavers recycled 6,881 appliances (5,237 refrigerators and 1,644 freezers). As in previous years, the majority of the units recycled (76%) were refrigerators. Through the program, some

[1] ARCA properly disposes of oils, polychlorinated biphenyls, mercury, and trichlorofluoromethane foam; recycles or destroys dichlorodifluoromethane; and recycles hydrofluorocarbon refrigerants (specifically HFC-134a), plastic, glass, steel, and aluminum.

room air conditioners (23) and dehumidifiers (48) were also collected by ARCA, and this was the first year those measures were eligible.

The scale of PY13 was considerably larger than PY12, which was a shortened bridge year for all Ameren programs (between the completed 2009–2011 and the 2013–2015 program cycles). However, PY13 participation was less than that of PY11 (9,084), the last full program year.

Table 5. Program Participation (PY13)

Appliance	Units	Percentage of Participation
Refrigerators	5,237	76%
Freezers	1,644	24%
Total	6,881	100%

Table 6 summarizes Ameren's historical appliance recycling activity. As shown, Ameren has recycled nearly 20,000 appliances since the program launched in late 2010.

Table 6.Historical Program Participation (PY10-PY13)

Appliance	PY10*	PY11	PY12	PY13	Total
Refrigerators	518	6,978	2,186	5,237	14,919
Freezers	186	2,106	784	1,644	4,720
Total	704	9,084	2,970	6,881	19,639

*Only two months long.

Figure 1 shows PY13 program participation by month. Participation for both appliance types was highest in August, with another peak in November.

Figure 1. PY13 Program Participation by Month

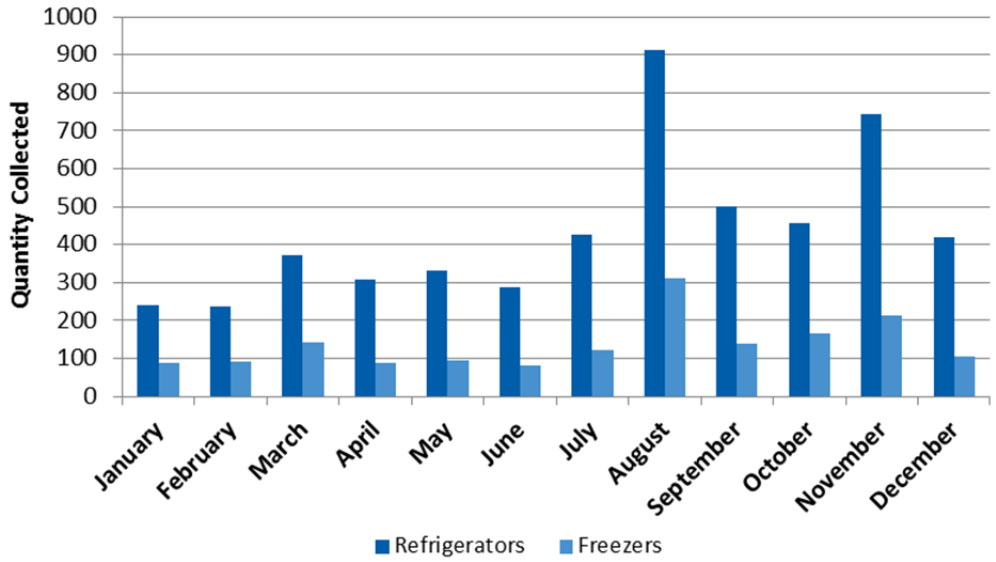
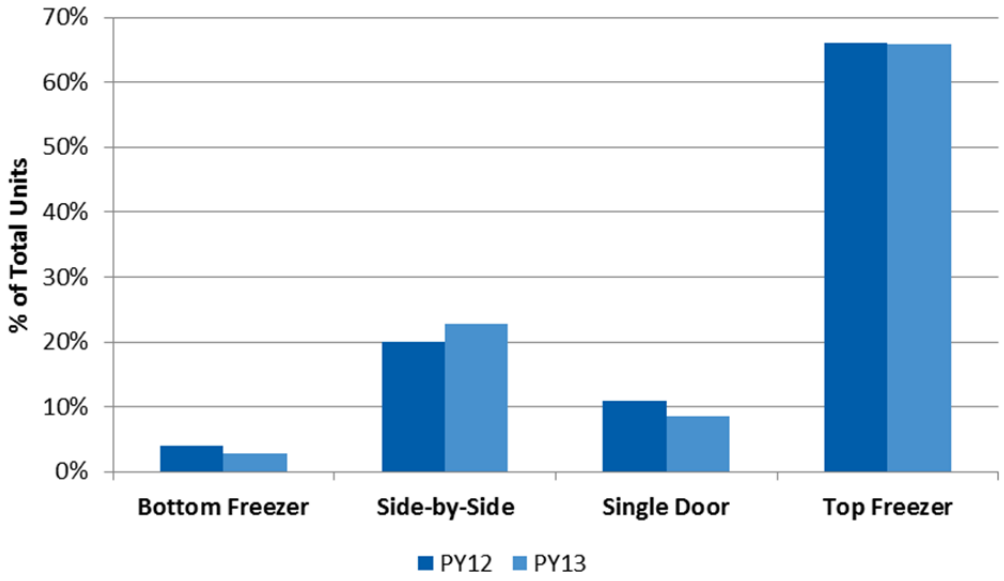


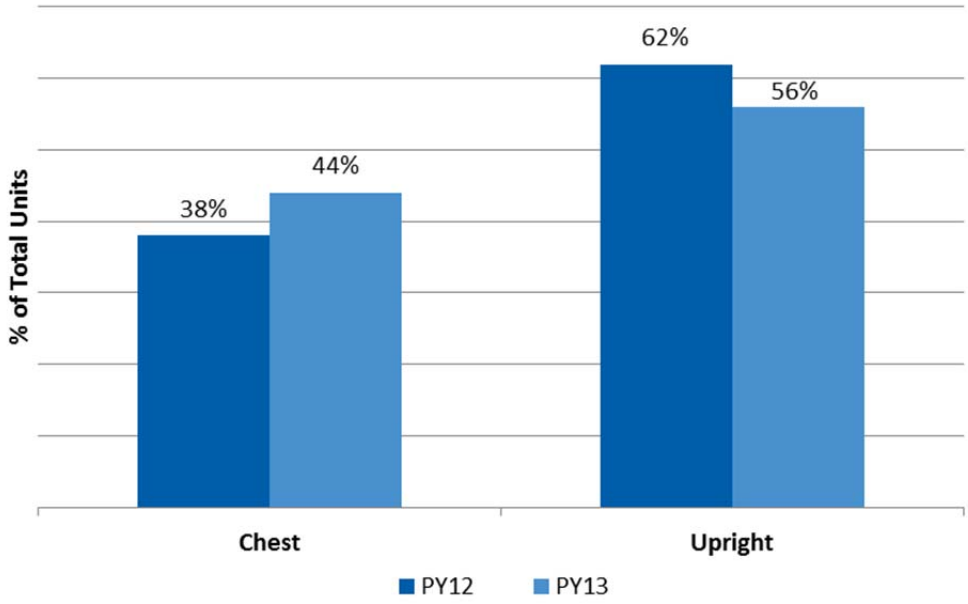
Figure 2 presents the distribution of refrigerator configurations recycled in PY13. Similar to PY12, the majority of recycled refrigerators were top-freezer models. However, a comparison of the remaining configurations indicated a subtle shift toward recycling refrigerators with more contemporary designs. Specifically, the percentage increased for side-by-side models (23% in PY13, as compared to 20% in PY12) and declined for single-door models (8% in PY13, as compared to 11% in PY12). These trends are common as recycling programs mature.

Figure 2. PY12 vs. PY13 Refrigerator Configurations



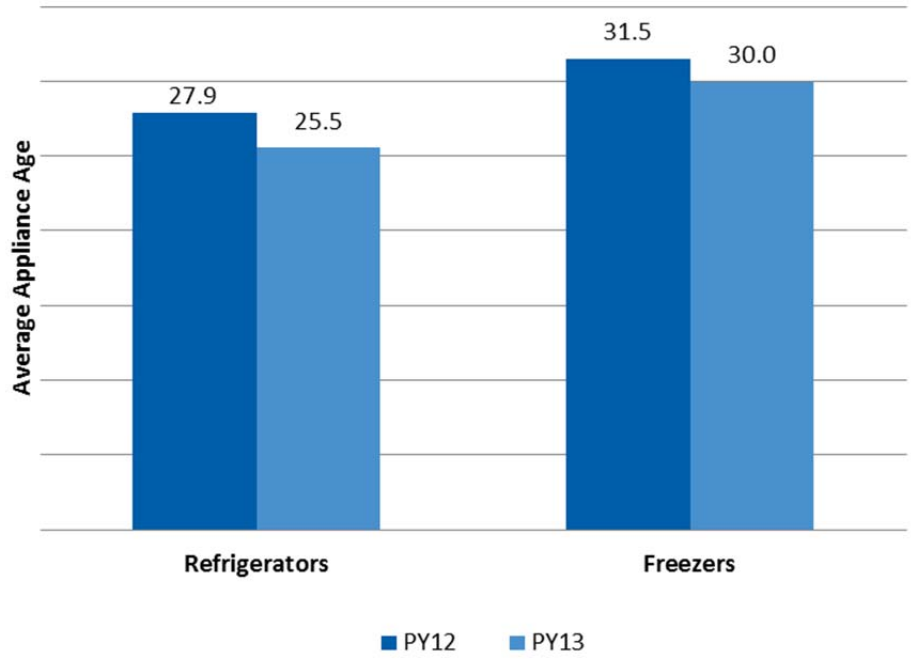
The distribution of freezer configurations also shifted (Figure 3), with the proportion of chest freezers increasing to 44% in PY13 from 38% in PY12.

Figure 3. PY12 vs. PY13 Freezer Configurations



The average ages of both appliance types decreased in PY13 (Figure 4). Again, the decreasing average age of appliances recycled through the program (Figure 2) is typical for maturing appliance recycling programs.

Figure 4. Comparison of Average Ages (Years Old)—PY12 and PY13



EVALUATION METHODOLOGY

The Cadmus team used the Department of Energy's Uniform Methods Project (UMP) evaluation protocol to evaluate ApplianceSavers in PY13. While this protocol is similar to the one used in the PY12 evaluation, it is different from the methodology Cadmus used to evaluate the PY10 program (which used information from the Technical Resource Manual (TRM) for the program's *ex ante* per-unit gross and net savings values).

Uniform Methods Project

In 2011, the Department of Energy (DOE) launched the UMP with the goal of "strengthen[ing] the credibility of energy savings determinations by improving EM&V, increasing the consistency and transparency of how energy savings are determined."[2] The UMP identified seven common residential and commercial demand-side management (DSM) measures—including refrigerator recycling—and enlisted subject matter experts to draft evaluation protocols for each measure. The DOE engaged Cadmus to manage the UMP process for refrigerator recycling and to be the lead author for the recycling protocol.

Through a collaborative process that entailed reviews by a technical advisory group (TAG) and a steering committee (SC) and a public review and response period, the resulting UMP protocols capture the consensus of the evaluation community. In addition to establishing broadly accepted best practices for the evaluation of these key measures, each protocol identifies and explains the key parameters, data sources, gross algorithms, and net-related algorithms.

Since Cadmus was the lead author of this protocol, the methodology in UMP largely mirrors Cadmus' previous recycling evaluations. However, input from the broader evaluation community through the SC, TAG, and public review process caused Cadmus to make several meaningful changes to its previous methodology. We applied this updated methodology to the PY12 and PY13 evaluations.

We have summarized the four most notable changes below, and we discuss each in detail (where appropriate) in the Gross Impact Evaluation Results and Net Impact Evaluation Results sections.

- ***Prospective Part-Use***. UMP dictates that part-use be assessed based on how the recycled appliance was likely to have been used had it not been recycled, rather than on how it was previously used. For example, if a primary refrigerator would have become a secondary unit independent of the program, its part-use should reflect the average usage of secondary refrigerators.
- ***Induced Replacement***. UMP states that replacement is an unavoidable and naturally occurring aspect of the appliance market. As a result, program savings should not be estimated as the difference in energy consumption between the recycled appliance and the appliance that replaces it. However, UMP recognizes an exception to this rule when recycling programs induce

[2] http://www.nrel.gov/docs/fy13osti/54945.pdf

a replacement that otherwise would not have occurred. In such a scenario, savings should be assessed as the difference in energy consumption between the recycled appliance and its replacement, rather than the energy consumption of the recycled appliance.

- ***Secondary Market Impacts.*** UMP takes a grid-level approach to estimating net program savings. Therefore, the program's impact on the used-appliance market must be considered. Does the program actually reduce the total number of older appliances operating on the grid, or do the would-be recipients of appliances recycled through the program find an alternate unit instead (since the appliance recycled by the program was unavailable)?
- ***Regression Model Specification***. UMP stipulates a model specification for estimating each appliance's annual energy consumption when it is not feasible to use utility-specific, *in situ* metering and modeling. The UMP model reflects the availability of more winter metering data and the need to create a more universal and weather symmetrical model (i.e., one that accounts for the effects of heating and cooling degree days).

More information about UMP is available on the DOE's Website.[3]

Evaluation Activities

The Cadmus team identified these impact and process evaluation priorities for PY13.

Impact Evaluation Priorities

- Determining the gross and net energy savings generated from participating appliances;
- Tracking trends by comparing the average gross energy savings from PY13 to the average savings from PY12;
- Investigating—in the program's absence—the percentage of participating appliances that would have remained active on Ameren's Missouri's grid and the percentage that would have been destroyed anyway;
- Determining the percentage of the replacement units that will be induced by the program *and* whether the program encouraged participants to purchase an ENERGY STAR®-rated appliance as the replacement; and
- Calculating the total net energy savings and demand savings from the program.

Process Evaluation Priorities

- Assessing the impacts of program design changes, marketing activities, and program processes;
- Assessing the program's achievements against its goals;
- Examining participant experience, satisfaction with various program design elements, and decision-making motivations; and

[3] http://www1.eere.energy.gov/office_eere/de_ump.html

- Identifying primary market barriers and offering suggestions for effectively overcoming them through program design and delivery improvements.

Table 7 lists our evaluation activities and a brief explanation of the purpose of each activity. Following the table are overviews of each activity.

Table 7. PY13 Process and Impact Evaluation Activities and Rationale

Evaluation Activity	Process	Impact	Rationale
Review the TRM			Review TRM values and assumptions and then conduct an engineering analysis to provide updated information for future program years.
Review the Data Tracking	•	•	Provide ongoing support to ensure all necessary program data are tracked accurately; identify gaps for evaluation, measurement, and verification (EM&V) purposes.
Interview Stakeholders	•		Obtain information and insights into program design and delivery.
Review Marketing Materials	•		Identify gaps and opportunities in marketing and outreach strategies and activities.
Survey Participants	•	•	Verify measure installation; collect data to inform the net-to-gross ratio; collect process-related data.
Survey Nonparticipants	•	•	Obtain an in-depth understanding of the program and identify its successes and challenges.
Analyze Gross and Net Impacts		•	Develop per-unit gross savings from the impact analysis, using appliance characteristics data from the program database and *in situ* metering data from existing industry/evaluation databases
Analyze Cost-Effectiveness		•	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

For each ApplianceSavers measure, the Cadmus team reviewed Ameren's TRM and the TRMs used by other utilities for similar measures. As part of this review, we benchmarked each measure's key values against other TRMs and attempted to identify—early in the program year—potential differences between the values Ameren assumed in the TRM and the values that may result from the formal evaluation process. Our goals were the following:

- To enhance our understanding of the specific measures that Ameren's delivering; and
- To provide early feedback that could potentially allow Ameren's implementers to make mid-year course corrections for improving program delivery.

Data Tracking Review

In conjunction with the TRM review, the Cadmus team reviewed the ApplianceSavers program tracking database. Specifically, we assessed whether ARCA was gathering the data necessary for our evaluation and whether the data were complete and of sufficient quality. Our review did not reveal any issues.

Stakeholder Interviews

In July 2013, the Cadmus team interviewed two program stakeholders: Ameren's internal ApplianceSavers implementation program manager and Ameren's main point of contact at ARCA, who serves as the day-to-day implementation and marketing manager.

Prior to conducting the interviews, we prepared a guide consisting of questions designed to elicit comprehensive information about the program's design and current performance. We also asked for suggestions regarding mid-stream course corrections that would improve the program. Our questions addressed the following topics:

- Design and implementation
- Offering pick-up services through retailers
- Cross-program promotion
- Participation goals
- Initial participation
- Marketing

A copy of the stakeholder interview guide is provided in Appendix F.

Marketing Review

At the beginning of PY13, the Cadmus team reviewed copies of all marketing materials for ApplianceSavers. We also reviewed documentation on the program's short-term and long-term marketing plans, recaps, marketing-metrics tracking reports, the strategic marketing plan, calendar, materials, outreach channels (e.g., Website, social media), metrics, and survey findings. Our goals were:

- Assess the current state of program marketing efforts; and
- Identify potential opportunities for: (1) optimizing marketing, outreach, and communications to specific customer segments; and (2) efficiently generating customer participation in ApplianceSavers.

We then compared the program plans and materials to those of similar programs and to industry best practices so we could identify opportunities and offer actionable recommendations for increasing the effectiveness of the marketing.

Participant Surveys

In PY13, the Cadmus team conducted two waves of participant surveys: In August 2013, we surveyed 85 randomly selected participants; and in December 2013, we surveyed another 86 randomly selected participants. Of those surveyed, 123 participants recycled refrigerators and 47 recycled freezers. Together, these samples yielded survey findings that met these minimums:

- 90% confidence and 7.4% absolute precision for refrigerators, and
- 90% confidence and 12.1% absolute precision for freezers.

Across appliance types, our survey findings have a minimum of 90% confidence and 6.3% absolute precision.

The topics discussed in our participant surveys addressed these pertinent evaluation issues:

- Verification of program participation;
- How participants learned about the program;
- Whether participants had been using the recycled appliance;
- What alternative disposal methods participants were used independently of program participation; and
- Program satisfaction.

A copy of the participant survey instrument is provided in Appendix D.

Nonparticipant Surveys

In November 2013, the Cadmus team conducted 401 general-population surveys and identified three customers who participated in ApplianceSavers. After omitting them from our sample, we asked the remaining 398 customers a series of questions about recent appliance discards or purchases. Among those, we identified 27 "ApplianceSavers nonparticipants," defined as Ameren customers who discarded an operable refrigerator and/or freezer outside of the program in 2013. These 27 nonparticipants discarded 22 refrigerators and 5 freezers. (A copy of the ApplianceSavers nonparticipant module from the general population survey is provided in Appendix E.)

Surveying nonparticipants is important because these customers provide valuable insights into what would likely have happened to participating operable appliances had they not been recycled through the program. Experience has shown that surveyed participants in utility programs often exhibit socially desirable response bias—that is, they shape their answers to reflect what they perceive the surveyor thinks is the right answer. In this case, the tendency toward social bias would result in participants exaggerating their likely behavior regarding recycling their old appliances independently of the ApplianceSavers program. Therefore, collecting information from nonparticipants as to how they actually discarded their operable appliance outside the program offers us a way to assess the reliability of the hypothetical responses provided by participants. Also, using both participant and nonparticipant

surveys is in alignment with evaluation industry best practices for appliance recycling programs (per UMP) and increases the reliability of the final net savings estimates. The demographics of the surveyed participants were similar to those of the general population. Though general population survey respondents were less likely to own their homes than participant survey respondents (74% and 93%, respectively, owned their homes), they were just as likely as ARP participants to have a bachelor's degree or better (42% for both groups), and both groups had similar incomes (42% and 41%, respectively, had household annual incomes of $60,000 or more).

We used the supplementary information about actual disposal methods to mitigate any bias inherent in the hypothetical disposal methods suggested by program participants. Specifically, we combined the information collected from nonparticipants with the net-to-gross we calculated based on participant self-reports, which resulted in a more accurate assessment of ApplianceSavers true NTG.

Impact Analysis (Gross and Net)

Our impact analysis for PY13 mirrored our analysis from the evaluation we conducted in PY12. To estimate gross unit energy consumption (UEC) for each participating refrigerator, we used the multivariate regression model specification detailed in the UMP refrigerator recycling protocol. As UMP is refrigerator-specific, we used the analogous freezer model created for PY12 to estimate freezer UECs.

Similar to our PY12 approach, the UMP model we used in PY13 relied on an aggregated *in situ* metering dataset[4] consisting of approximately 564 appliances metered during five recent California and Michigan evaluations.[5]

Cost-Effectiveness Analysis

Using the final PY13 ApplianceSavers participation data, implementation data, the *ex post* gross savings estimates, and the *ex post* net savings estimates (presented in this report) with the DSMore[6] tool, Morgan Marketing Partners (MMP) determined the program's cost-effectiveness. MMP also calculated measure-specific cost-effectiveness (as shown in the Cost-Effectiveness chapter) using the five standard perspectives produced by DSMore:

- Total Resource Cost
- Utility Cost
- Societal Cost Test

---

[4] *In situ* metering involves metering units in the environment in which they are typically used. This approach contrasts with lab testing, where units are metered under controlled conditions.

[5] Southern California Edison, Pacific Gas & Electric, San Diego Gas & Electric, DTE Energy, and Consumers Energy.

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

- Participant Cost Test
- Ratepayer Impact Test

PROCESS EVALUATION

This section details the findings from the Cadmus team's stakeholder interviews, participant surveys, and marketing review.

Stakeholder Interview Findings

Our interviews with two ApplianceSavers stakeholders (one from Ameren and one from ARCA) provided insight into PY13 implementation, as well as the future of ApplianceSavers.

Program Design

According to both stakeholders, Ameren and ARCA made four changes to the design and implementation of ApplianceSavers in PY13.

- Ameren changed the program's name from the Refrigerator Recycling Program to ApplianceSavers. The change was part of a larger rebranding effort by Ameren, which had the goal of unifying the seven residential programs offered in PY13 using a common naming convention (the "Savers" suffix). Both Ameren and ARCA noted that changing the name required some re-education of potential customers, an effort that could have affected early participation levels and overall program adoption. The ARCA contact said ARCA had expressed some early concerns that the change exacerbated discontinuity issues caused by the shortened PY12 bridge year. ARCA also felt the name "ApplianceSavers" might confuse customers seeking an appliance recycling program as it was more oriented towards a new appliance purchase/rebate program.
- Ameren increased the refrigerator and freezer incentive amount from $35 to $50 to stimulate greater participation. This increase aligned the incentive with that of a neighboring utility (Ameren Illinois), and—based on ARCA's experience in implementing recycling programs nationwide—it takes the incentive to a threshold that attracts greater interest and participation.
- Unlike the past years, the ApplianceSavers program did not limit participation to secondary refrigerators (units located outside of the kitchen). However, since previous evaluations had determined that participants were already recycling primary refrigerators (units in the kitchen), it is not surprising that Ameren reported the eligibility change had not caused a significant difference in participation. Thus, the average age of appliances did not decrease substantially, as primary units are generally newer appliances.
- The program began accepting two appliances—room air conditioners and dehumidifiers—not collected in past years. Stakeholders noted that collecting these secondary appliances is an opportunity for obtaining additional savings at low marginal cost, as ARCA only picks them up in conjunction with a refrigerator or freezer. Also, stakeholders felt that collecting these additional appliances created a more comprehensive appliance recycling program for Ameren customers. Since the saturation of these appliances is less than refrigerators and freezers, the total savings potential is somewhat limited; however, stakeholders saw no downside to their inclusion and felt this change enhanced the program's customer service.

Offering Pick-Up Services Through Retailers

At the time of the PY13 interviews, both stakeholders said that the proposed design change of offering pick-up services through retailers had not yet occurred. Having this the channel would allow participants to: (1) enroll in the program when purchasing a new appliance at select participating retailers, and (2) schedule a single appointment to have their new unit dropped off and their existing unit picked up for recycling. (To date, participants schedule separate appointments, one with the retailer and one with the program.)

According to Ameren's program manager, the PY13 program had an internal goal of generating from 10% to 15% of the program's participation through the retail channel. However, after the first major retail partner—SEARS—experienced software issues when attempting to implement a retail channel for other utilities, SEARS wanted to wait until these technical issues were fully resolved. Thus, Ameren and ARCA delayed the timeline for launching the retail pick-up service. Since this evaluation occurred, a participating retail program with Sears (three locations) began.

In the meantime, the program staff members have initiated discussions with Home Depot and have focused attention on partnering with smaller local retailers, such as Slyman Brothers Appliance Centers. However, the interviewed stakeholders noted that the smaller volumes sold by independent retailers will necessitate a limit on the amount of resources that the program should expend in working with them.

Cross-Program Promotion

Beginning in early July, the ApplianceSavers program staff started working with APT (Ameren's implementer of LightSavers and RebateSavers) to cross-promote the recycling program when APT's field representatives visited retailers. Specifically, the APT staff provided both ApplianceSavers point-of-purchase advertising and some basic training to retailer staff about the benefits of the recycling program for the retailer's customers.

Goals

According to Ameren, the goal of the PY13 program was to recycle 11,000 appliances. This is considerably more than the 2,970 appliances recycled during the shortened PY12 bridge year, and it is approximately 20% more than the 9,084 appliances recycled the last time the program was in the field for a full year (PY11).

Another goal for the PY13 program was to recycle an 80/20 mix of refrigerators and freezers, respectively. (No goals were set for room air conditioners or dehumidifiers.) As previously noted, Ameren also had an internal goal of from 10% to 15% of participation coming through a new retail channel.

The ARCA contact said that during the PY13 planning process, ARCA expressed concerns about the feasibility of the retail channel goal since that was not expected to produce large volume, especially in the early phase of the program implementation cycle. ARCA's concern stemmed from the appliance and

customer verification processes needed to accurately harvest units from retailers, coupled with a decrease in consumer spending on new appliances.

Initial Participation

Both stakeholders agreed that early participation fell short of expectations and internal monthly goals. Early in PY13, the program was averaging approximately 100 appliances per week, a pace that would result in not achieving the annual goal. While part of the slow early update may be attributed to the time of year (recycling programs typically see their greatest participation between April and October), ARCA also identified three other possible factors:

- Re-launching the program after the PY12 hiatus,
- The name change, and
- Having less engaging marketing materials (detailed in the next section).

Whether due to seasonality or marketing (discussed later in this report), the program experienced an increase in participation in July and August, when from 200 to 300 appliances were collected each week. At this pace, the program would have exceeded its goals. Both stakeholders were interested in learning whether the summer participation rate would continue through the fall and winter or would return to the lower rate observed earlier in the year.

Communication

All stakeholders said communications between Ameren and ARCA were conducted weekly and effectively. Stakeholders also noted that to adapt the program to changing timelines during PY13, more frequent interactions had been necessary.

Participant Survey Findings

The Cadmus team's participant surveys resulted in insights into participant satisfaction and information about marketing, appliance location, and motives for participating.

Satisfaction

Participants expressed an extremely high level of satisfaction with the program; nearly 100% stated they were either *somewhat satisfied* or *very satisfied* with their experience in PY13. In fact, no respondents reported being dissatisfied with the program, and only two respondents said they would not recommend the program to friends or family members. This high level of participant satisfaction for PY13 is in line with participant responses from PY12 and PY11, where over 98% were satisfied or somewhat satisfied with their program experience.

Marketing

Table 8 shows the sources through which participants became aware of the program (multiple responses were allowed). In PY13, the leading source of information for program awareness was bill inserts (38%), and the second most-cited source was word-of-mouth (27%). These results are in reverse of those from PY12, where 22% of participants cited word-of-mouth and 21% cited bill inserts.

Table 8. PY13 Program Awareness

Type of Marketing	Percentage Responding
Bill Inserts/Contact	38%
Family/Friends/Word of Mouth	27%
Radio	24%
Direct Mail	21%
TV	17%
Internet Advertising/Online-ad	16%
Newspaper/magazine/Print	12%
Appliance Retailer	10%
Email	3%
Ameren Missouri Representative	1%
Ameren Missouri Web site	1%
Billboard/outdoor	1%
Other Newsletter	1%
Personal Energy Report	1%

Reason and Timing for Recycling

As shown in Table 9, the survey responses indicate that the program's financial incentive (the rebate, which was mentioned by 37%) and the convenience of free appliance pick-up (28%) were the main factors influencing participants' decisions to recycle their appliance with Ameren when they did. The financial incentive was a stronger influence in PY13 than in PY12, when only 31% cited the incentive as the main reason for choosing the program. This is likely due to the greater incentive offered ($50 versus $35).

However, over two-thirds (70%) of refrigerator participants self-reported they would have participated without any incentive, which supports the high number of customers citing free pick-up as a main reason for participation. Other motivations mentioned for participating in the program were energy conservation, savings on electric bill, and the assurance that the appliance would be recycled.

Table 9. PY13 Main Reason for Choosing Program

Reason Cited	Refrigerator		Freezer		Total	
	n	Percentage Responding	n	Percentage Responding	n	Percentage Responding
Program incentive	42	36%	18	39%	60	37%
Convenience / Free pick-up	35	30%	11	24%	46	28%
Energy conservation	12	10%	8	17%	20	12%
Savings on electric bill	9	8%	3	7%	12	7%
Other	18	16%	6	13%	24	15%
Total	**116**	**100%**	**46**	**100%**	**162**	**100%**

Appliance Location

The location of an appliance in the home is a factor in energy consumption and, in PY13, the typical locations of participant refrigerators and freezers (shown in Table 10) were different from those reported in PY12.

- The proportion of recycled appliances located in basements decreased to 42% (from 50% in PY12);
- The proportion of recycled appliances located in kitchens increased from 27% (from 20% in PY12);
- The proportion for garages increased to 27% (from 25% in PY12).

The proportion located on porches and patios remained at 1%.

Table 10. PY13 Location of Recycled Appliance

Location	Refrigerator		Freezer		Total	
	n	Percentage Responding	n	Percentage Responding	n	Percentage Responding
Kitchen	44	36%	2	4%	46	27%
Garage	35	29%	10	21%	45	27%
Porch/patio	1	1%	1	2%	2	1%
Basement	41	34%	30	64%	71	42%
Other*	1	1%	4	9%	5	3%
Total	**122**	**100%**	**47**	**100%**	**169**	**100%**

* Other responses include utility room, laundry room, deck, and dining room.

Marketing Review

As in previous program years, ARCA is managing PY13 marketing efforts. However, unlike previous years, ARCA benefited from the additional resources provided by Ameren's corporate marketing team. From June through August, the corporate marketing team promoted ApplianceSavers (as well as CoolSavers) through its Act on Energy® marketing channels. During those months, the corporate marketing team prioritized these two programs (over Ameren's other five residential programs) to leverage the higher levels of interest that typically occur for both programs during the summer. While it is not possible to definitively separate the impact of these specific marketing efforts from the role of seasonality on increased summer participation, both stakeholders said that the additional marketing resources played a critical role in raising the programs' profiles and increasing weekly pick-up rates.

Both stakeholders also noted that Ameren funded the corporate marketing through a different channel, so ARCA was able to use the ApplianceSavers marketing budget to continue its existing marketing efforts and develop complementary marketing tactics.

Marketing Plan and Materials Review

The Cadmus team received the original PY13 ApplianceSavers program marketing schedule and several creative samples. Through our review of this material and our discussions with stakeholders, we determined that the marketing plan was well-designed, effectively using a varied mix of marketing, media channels, and tactics.

ARCA built out the marketing schedule, which contained a monthly breakout that highlighted specific marketing tactics and budget allocations for each task over the year. The planned tactics were organized into the following categories:

- Direct to Consumer
- Digital Media
- General Awareness (Mass Media)
- Promotions

Although information indicated the schedule may have shifted after we received it, the current version indicated that the category with the highest spending (65% of program marketing funds) was the direct-to-consumer channel (door hangers, direct mail, bill inserts, newsletters), followed by general awareness (print, out-of-home, radio, mall, and Pandora) at about 27%. The digital media and promotions categories received significantly less funding, around 4% and 3.5%, respectively.

We reviewed each creative piece mentioned in the memo's methodology section and found that, overall, the pieces had a consistent look and feel, included a direct call-to-action, and closely followed the Act On Energy brand guidelines (e.g., fonts, colors, and layout). Further, each piece we reviewed featured the Ameren logo, in addition to a prominently displayed ApplianceSavers program marketing logo, which delivered brand and program recognition to the audience. Also, all of the pieces we reviewed featured the toll-free number in boldface, the ActOnEnergy.com URL, and call-outs highlighting program offerings (e.g., $50 rebate and free pick-up) and potential savings (up to $100 per year). While all pieces included standard imagery of an older refrigerator and/or freezer, some pieces (such as newspaper advertisements) included an image of a customer, creating a more personal and relatable feel to the program.

Due to the use of templates, however, stakeholders expressed concerns regarding a lack of excitement or engagement in the current creative pieces.

In addition to traditional media, the program implementer ran an Appliance Package Giveaway promotion early in PY13, in which a randomly selected participant received a new set of three kitchen appliances. Ameren stakeholders were unable to identify an appreciable change in participation during the promotion.

Act On Energy Campaign and Cross-Program Promotion

In PY13, Ameren's corporate marketing team and residential energy-efficiency management teams enabled and supported promotion of the ApplianceSavers program. In addition to the collaborative efforts involved in program-specific marketing planning, Ameren has focused its Act On Energy campaign efforts on developing innovative and integrated platforms to drive program participation.

Ameren also has conducted segmentation, potential, and usability studies to inform program design and outreach efforts. The segmentation study conducted by the Shelton Group revealed the following high-level findings and implications specifically relating to the marketing efforts for the ApplianceSavers program:

- 22% of customers will likely participate in the fridge/freezer recycling program.
- Demographics of potential Appliance Recycling program participants include the following (compared to the overall customer surveyed):
  - More likely to be female than male
  - Ages 18 to 22
  - Well-educated, with 23% having a master's degree
  - More likely to have a household income of <$35K
  - Predominantly white (73%)

Shelton has segmented the target audience as follows: True Believers (32%); Working Class Realists (29%); Concerned Parents (29%). The characteristics, values, and attitudes for Shelton's segments are these:

- Marketing channel preferences: Internet search, word-of-mouth, Ameren website, e-mail, social media, personal energy report.
- Message types that appeal to potential participants (more than to the overall population): Performance, Waste, Control, and Financial Security messages.
  - ***Performance/Waste:*** "You take your responsibilities seriously and take pride in your home. Making energy-efficient home improvements is the best way to make sure that your home is operating at peak efficiency and that you're not wasting your hard-earned resources."
  - ***Control/Financial Security:*** "When you make changes to use less energy, you can feel more financially secure because you're better controlling your energy consumption and expenses."

Summer 2013 Campaign

As previously mentioned, from June to August 2013, the corporate marketing team promoted the ApplianceSavers program (in addition to the CoolSavers program) through its Act On Energy marketing and media. The efforts sought to increase mass awareness of the programs throughout Ameren's service territory and to increase participation for the two programs, specifically during the summer months. Participation in the ApplianceSavers program sharply increased during these months, and

additional Act On Energy marketing played a critical role in raising the programs' profiles and increasing weekly pick-up rates.

The campaign relied on these techniques: radio spots, digital billboards, out-of-home billboards, transit windscreens, animated and static banner advertisements, social media, direct mailers, gas toppers, and e-mail marketing. Radio and direct marketing appeared to drive most of the traffic, and online marketing significantly increased the number of visitors to the website.

In PY13, Ameren also identified and coordinated cross-promotional opportunities between programs. The ApplianceSavers program implementer worked collaboratively with the implementer (APT) of Ameren's RebateSavers and LightSavers programs to promote the recycling program during visits to retailers. APT's field representatives visit retailers provided point-of-purchase (POP) materials, collateral for in-store events, and basic education to retailer staff about ApplianceSavers program benefits.

Stakeholders discussed two other marketing efforts in PY13.

- ARCA focused more on radio and direct mail in PY13, which–in combination with other ARCA-led marketing tactics and Ameren's corporate marketing—decreased the per-participant marketing costs.
- Early in the program year, ARCA ran an Appliance Package Giveaway promotion, in which a randomly selected participant received a new set of three kitchen appliances. However, according to Ameren, it was unclear whether this specific promotion had an appreciable impact on participation.

In conjunction with changing the program name in PY13, ARCA used new, uniform marketing materials and templates that had similar branding across all programs and advertised Ameren's Act on Energy campaign. Unfortunately, both stakeholders said that the new materials were not well received by customers, so both considered introducing new materials. Specifically, stakeholders thought the existing materials were not sufficiently engaging and believed that something "catchier" would increase customer interest. Stakeholders noted that one option was to employ Ameren Illinois' "Energy Hog" program mascot.

CSR Summary

According to the Missouri Code of State Regulations (CSR),[7] 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 11. While the process evaluation findings discussed in this report touch on each of these topics, the Cadmus team offers a summary response for each specified CSR requirements below.

Table 11: 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 understanding of the operating costs of old or secondary refrigerators, and, in many cases, the inability to physically discard the appliance without assistance.
2	Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the target market segment is appropriately defined as it serves all single-family residential customers regardless of the appliance's usage type (primary or secondary).
3	Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	Yes, the current mix of end-use measures included in the program is appropriate. In PY13 the program began collecting room air conditioners and dehumidifiers with eligible refrigerators and freezers, providing additional benefits for customers and savings for Ameren. However, providing energy-efficiency kits (including CFLs and other easy-to-install measures) could further improve customers' awareness and participation in other programs.
4	Are the communication channels and delivery mechanisms appropriate for the target market segment?	The implementer ARCA handles the scheduling and pickup for appliances recycled through the program. Participants expressed very high satisfaction with the program, suggesting that the communication channels and delivery mechanisms 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?	Customer acceptance and awareness of appliance operating costs can be increased through additional online advertising (such as Google AdWords or Pandora targeted ads) and earned media (through partnerships with local non-profit organizations).

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

GROSS IMPACT EVALUTION RESULTS

This section of the Cadmus Team's gross impact evaluation report organizes the program results under two subsections: Annual Gross Unit Consumption and Gross Savings.

Gross Annual Unit Energy Consumption

The Cadmus team used the UMP-specified regression model to estimate consumption for refrigerators and a similar model developed outside of UMP for freezers. The coefficient of each independent variable indicates the influence of that variable on daily consumption, holding all other variables constant.

- A positive coefficient indicated an upward influence on consumption
- A negative coefficient indicated a downward effect.

The value of the coefficient indicates the marginal impact on the unit energy consumption (UEC) of a one-point increase in the independent variable. For instance, a 1-cubic foot increase in refrigerator size results in a 0.067 kWh increase in daily consumption.

In the case of dummy variables, the value of the coefficient represents the difference in consumption if the given condition is true. For example, in the refrigerator model, the coefficient for the variable indicating a refrigerator was a primary unit is 0.60; this means that, all else being equal, a primary refrigerator consumes 0.60 kWh per day (or 219 kWh per year) more than a secondary unit.

Refrigerator Model

Table 12 shows the UMP model specifications used to estimate a PY13 refrigerator's annual energy consumption and its estimated parameters.

Table 12. Refrigerator UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, R^2 = 0.31*)

Independent Variables	Coefficient	p-Value	Standard Error
Intercept	0.5822	0.33	0.60
Age (years)	0.0269	0.08	0.02
Dummy: Unit manufactured pre-1990s	1.0548	<.0001	0.21
Size (ft.3)	0.0673	0.02	0.03
Dummy: Single Door	-1.9767	<.0001	0.42
Dummy: Side-by-Side	1.0706	<.0001	0.26
Dummy: Primary	0.6046	0.01	0.22
Interaction: Unconditioned Space x HDDs	-0.0447	0.03	0.02
Interaction: Unconditioned Space x CDDs	0.0200	0.33	0.02

*It is important to note that cross-sectional models, such as the refrigerator UEC regression model, typically yield lower R^2 values. The R^2 determined is within the range of acceptable explanatory power for these types of models.

Freezer Model

Table 13 lists the Cadmus team's the final model specifications for estimating the energy consumption of participating freezers and the results of those calculations. Again, because UMP only specifies a refrigerator model, we created an analogous freezer model.

Table 13. Freezer UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, R^2 = 0.48*)

Independent Variables	Coefficient	p-Value	Standard Error
Intercept	-0.8918	0.30	0.85
Age (years)	0.0384	0.01	0.01
Dummy: Unit Manufactured Pre-1990	0.6952	0.03	0.31
Size (ft.3)	0.1287	<.0001	0.04
Dummy: Chest Freezer	0.3503	0.20	0.27
Interaction: Unconditioned Space x HDDs	-0.0313	0.05	0.02
Interaction: Unconditioned Space x CDDs	0.0695	0.06	0.04

*It is important to note that cross-sectional models, such as the freezer UEC regression model, typically yield lower R2 values. The R2 determined is within the range of acceptable explanatory power for these types of models.

Extrapolation

The Cadmus team analyzed the corresponding characteristics (the independent variables) for the participating appliances, as captured by ARCA in the PY13 program database. Table 14 lists the program averages or proportions for each independent variable. CDDs and HDDs are based on typical meteorological year 3 (TMY3) data from the Lambert-St. Louis Airport weather station.

Table 14. PY13 Participant Mean Explanatory Variables

Appliance	Independent Variables	PY13 Mean Value or Proportion
Refrigerator	Age (years)	25.53
	Dummy: Manufactured pre 1990s	0.52
	Size (ft.3)	18.58
	Dummy: Single Door	0.08
	Dummy: Side-by-Side	0.23
	Dummy: Primary	0.36
	Interaction: Unconditioned Space x HDDs	3.88
	Interaction: Unconditioned Space x CDDs	1.29
Freezer	Age (years)	29.96
	Dummy: Unit Manufactured Pre-1990	0.73
	Size (ft.3)	15.98
	Dummy: Chest Freezer	0.44
	Interaction: Unconditioned Space x HDDs	3.00
	Interaction: Unconditioned Space x CDDs	0.99

Using values from Table 12, Table 13, and Table 14, we estimated the UEC of the average refrigerator and freezer recycled by participants in ApplianceSavers in PY13. An example of the calculation (for freezers) follows:

$$Freezer\ UEC = 365.25\ days$$
$$* (-0.8918 + 0.0384 * [29.96\ years\ old] + 0.6952$$
$$* [73\%\ units\ manufactured\ pre - 1990] + 0.1287 * [15.98\ ft.^3] + 0.3503$$
$$* [44\%\ units\ that\ are\ chest\ freezers] - 0.0313 * [3.00\ Unconditioned\ HDDs]$$
$$+ .0695(0.99\ Unconditioned\ CDDs) = 1{,}078\ kWh$$

Unit Energy Consumption

Table 15 shows the average per-unit UEC that the Cadmus team calculated for refrigerators and freezers, both of which are higher than PY12. This increase in UEC is the result of multiple factors such as the inclusion of additional *in situ* metering data, model re-specification, and changes in the PY13 participant profile.

Table 15. Average UEC by Appliance Type (PY13)

Appliance	Average Unit Energy Consumption(kWh/Year)	Standard Error	Relative Precision (90% Confidence)
Refrigerator	1,178	± 6%	9.5%
Freezer	1,078	± 7%	16.3%

When we benchmarked the estimated ApplianceSavers PY13 UEC with the evaluated UECs for other programs (Table 15), we determined that Ameren's savings were within the expected range.

Table 16. Benchmarking: Average Program UECs

Utility	Years Implemented	Average UEC (kWh/Year)	
		Refrigerator	Freezer
Ameren Missouri (PY13)	3.5	1,178	1,078
Ameren Missouri (PY12)	2.5	1,175	1,072
Ameren Missouri (PY11)	1.5	1,092	940
Focus On Energy (2012)	1	1,045	940
Progress Energy Carolinas (2011)	2	1,032	805
Ameren Illinois (2011)	3	1,239	1,172
Ontario Power Authority (2010)	4	1,126	1,045
Ontario Power Authority (2011)	5	1,240	1,172
PacifiCorp (Washington)	5	1,153	935
Avista	6	1,147	1,074

Gross Savings

To convert UEC estimates above into per-unit gross savings, the Cadmus team used responses from the participant survey to determine the part-use factor for PY13.

Part-Use

"Part-use"—an adjustment factor specific to appliance recycling—is used to convert the UEC into an average per-unit gross savings value. The UEC itself is not equal to the gross savings value, because:

- The UEC model yields an estimate of annual consumption.
- Not all recycled refrigerators would have operated year-round had they not been decommissioned through the program.

While the UMP part-use methodology uses information from surveyed customers regarding pre-program usage patterns, the final estimate of part-use reflects how appliances were likely to have been operated had they not been recycled (rather than how the appliances were previously operated). For example, it is possible that a primary refrigerator operated year-round would have become a secondary appliance and been operated part-time.

The UMP methodology accounts for these potential shifts in usage types. Specifically, part-use is calculated using a weighted average of the following prospective part-use categories and factors:

- Appliances that would have run full-time (part-use = 1.0)
- Appliances that would not have run at all (part-use = 0.0)
- Appliances that would have operated a portion of the year (part-use is between 0.0 and 1.0)

Using information gathered through the participant survey, the Cadmus team undertook the following multi-step process to determine part-use as outlined in UMP.

1. We determined if recycled refrigerators were primary or secondary units. (All stand-alone freezers are considered secondary units.)
2. We asked those participants who indicated they had recycled a secondary refrigerator if the refrigerator was unplugged, operated year-round, or operated for a portion of the preceding year. (We assume all primary units were operated year-round.) We asked the same question of all freezer participants.
3. When participants said that their secondary refrigerator or freezer was operated for only a portion of the preceding year, we asked them to estimate the total number of months that the appliance was plugged in. The average number of months specified by this subset of participants was 4.2 for secondary refrigerators and 6.96 for secondary freezers. We then divided both values by 12 to calculate the annual part-use factor for all secondary refrigerators and freezers operated for only a portion of the year. For PY13, we calculated that the average secondary refrigerator had a part-use factor of 0.35 and the average secondary freezer had a part-use factor of 0.58.

These three steps resulted in the following information about how refrigerators and freezers were operated prior to recycling (Table 17).

Table 17. Part-Use Factors by Category

Usage Type & Part-Use Category	Refrigerators			Freezers		
	Percentage of Recycled Units	Part-Use Factor	Per-Unit Energy Savings (kWh/Yr)	Percentage of Recycled Units	Part-Use Factor	Per-Unit Energy Savings (kWh/Yr)
Secondary Units Only	n = 76					
Not in Use	7%	0.00	-			
Used Part Time	17%	0.35	408			
Used Full Time	76%	1.00	1,178			
Weighted Average	**100%**	**0.82**	**969**			
All Units (Primary and Secondary)	n = 120			n = 24		
Not in Use	4%	0.00	-	7%	0.00	-
Used Part Time	11%	0.35	408	9%	0.58	629
Used Full Time	85%	1.00	1,178	85%	1.00	1,078
Weighted Average	**100%**	**0.88**	**1,043**	**100%**	**0.90**	**969**

Next, we asked participants how the appliances likely would have been operated had they not been recycled through the program. For example, when surveyed participants indicated they would have kept a primary refrigerator (independent of ApplianceSavers), we asked if they would have continued to use the appliance as their primary refrigerator or if it would have been relocated and used as a secondary refrigerator. (We did not ask a similar question of participants who said they would have discarded their appliance independent of ApplianceSavers, because the future usage of that appliance would be determined by another customer.)

We then combined the historically based part-use factors in Table 17 with the participants' self-reported action in the absence of the program. This resulted in the following distribution of likely future usage scenarios and corresponding part-use estimates. The weighted average of these future scenarios, shown in Table 18, produces the ApplianceSavers part-use factor for refrigerators (0.86) and freezers (0.90 in PY13.[8]

[8] Since the future usage type of discarded refrigerators is unknown, Cadmus applied the weighted part-use average of all units (0.88) for all refrigerators that would have been discarded independent of the program. This approach acknowledges that discarded appliances might be used as primary or secondary units in the would-be recipient's home.

Table 18. PY13 Part-Use Factors by Appliance Type

Use Prior to Recycling	Likely Use Independent of Recycling	Refrigerator		Freezer	
		Part-Use Factor	Percentage of Participants	Part-Use Factor	Percentage of Participants
Primary	Kept (as primary unit)	1.00	2%		
	Kept (as secondary unit)	0.82	8%		
	Discarded	0.88	26%		
Secondary	Kept	0.82	30%	0.90	43%
	Discarded	0.88	34%	0.90	57%
Overall		**0.86**	**100%**	**0.90**	**100%**

As shown in Table 19, the part-use factor for refrigerators was unchanged from PY12; however, the part-use factor for freezers rose in PY13 to 0.90.

Table 19. Part-Use Factors: PY11– PY13

Appliance	PY11	PY12	PY13
Refrigerators	0.91	0.86	0.86
Freezers	0.84	0.86	0.90

The PY13 part-use estimate for refrigerators is similar to the part-use factors determined for other evaluated programs.

Table 20. Benchmarking: Part-Use

State or Utility	Years Implemented	Part-Use	
		Refrigerators	Freezers
Ameren Missouri (PY13)	3.5	0.86	0.90
Ameren Missouri (PY12)	2.5	0.86	0.86
Ameren Missouri (PY11)	1.5	0.91	0.84
Focus On Energy (2012)	1	0.67	0.81
Progress Energy Carolinas (2011)	2	0.90	0.93
Ameren Illinois (2011)	3	0.88	0.93
Commonwealth Edison (2010)	3	0.90	0.75

In Table 21, the Cadmus team provides estimates of average PY13 per-unit evaluated (or *ex post*) gross energy savings after adjusting the determined UECs to account for part-use.

Table 21. Per-Unit PY13 Gross Energy Savings

Appliance	UEC (kWh/Year)	Part-Use Factors	Gross Energy Savings (kWh/Year)	Relative Precision (90% confidence)*
Refrigerators	1,178	0.86	1,013	11.2%
Freezers	1,078	0.90	969	18.3%

* Reflects the combined effect of error generated by the regression model used to determine the UEC and the survey-based part-use estimate.

Table 22 lists the program's total *ex post* gross energy savings, calculated using the per-unit gross savings shown in the previous table and PY13 participation.

Table 22. Total PY13 Gross Energy Savings

Appliance	Gross Energy Savings (kWh/Year)	PY13 Participation	Total Program Gross Savings (MWh/Year)
Refrigerator	1,013	5,237	5,307
Freezer	969	1,644	1,593
Total		**6,881**	**6,900**

Replacement

In most cases, the per-unit gross energy savings attributable to the ApplianceSavers are equal to the energy consumption of the recycled appliance (rather than being equal to the difference between the consumption of the recycled appliance and its replacement, when applicable). This is because the energy savings generated by the program are not limited to the change within the participant's home, but rather to the total change in energy consumption at the grid level.

This concept is best explained with an example. Suppose an Ameren customer decides to purchase a new refrigerator to replace an existing one. When the customer mentions this to a neighbor, the neighbor asks to use that existing refrigerator as a secondary unit. The customer agrees to give the old appliance to the neighbor. However, before this transfer is made the customer learns about ApplianceSavers and decides to participate (since the incentive offsets a small portion of the cost of the new refrigerator). The existing refrigerator is hauled away and decommissioned and, as a result of the program's intervention, the customer's appliance is permanently removed from operation in the utility's service territory.

From Ameren's perspective, the difference in grid-level energy consumption—and the corresponding increase in program savings—is equal to the consumption of the recycled appliance *and not* to the difference between the energy consumption of the participating appliance and its replacement. In this example, it is important to note that the participant planned to replace the appliance and had considered disposing the appliance prior to learning about ApplianceSavers.

In general, the purchase of a new refrigerator is part of the naturally occurring appliance lifecycle, typically independent of the program and tantamount to refrigerator load growth. It is not the purpose

of the program to prevent these inevitable purchases, but rather to minimize the grid-level refrigerator load growth by limiting the number of existing appliances that continue to operate after they are replaced. This is the replacement philosophy described in UMP, and that Cadmus has applied it in previous ApplianceSavers evaluations.

However, UMP does note that when a recycling program ***induces*** replacement (i.e., the participant would ***not*** have purchased the new refrigerator in the absence of the recycling program), that savings must account for replacement. UMP considers this induced replacement to be a net impact, since the additional energy consumption induced by the program is akin to negative spillover. More information about induced replacement in provided in the Net Savings section.

NET IMPACT EVALUTION RESULTS

This section details the Cadmus team's approach to determining net savings. In the case of appliance recycling, programs only generate net savings when the recycled appliance would have continued to operate absent program intervention (either within the participating customer's home or at the home of another utility customer). The UMP protocol contains two parameters related to net savings—secondary market impacts and induced replacement. In addition, UMP employs a decision-tree approach to calculate and present net program savings.

The decision tree—populated by the responses of surveyed PY13 participants and information gathered from interviewed market actors—presents all of the program's possible savings scenarios. We used a weighted average of these scenarios to calculate the net savings attributable to ApplianceSavers. The decision tree accounts not only for what the participating household would have done independent of the program but also accounts for the possibility that the unit was transferred to another household, whether or not the would-be acquirer of that refrigerator finds an alternate unit instead. To highlight specific aspects of our net savings analysis, we provide specific portions of the decision tree throughout this chapter.

To estimate PY13 net-to-gross (NTG) ratios for refrigerators and freezers, the Cadmus team used the following formula:

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

However, market effects, the fourth NTG input, are not appropriate for appliance recycling programs, as we already accounted for the program's impact on the regional used-appliance market by estimating induced replacement and secondary market impacts. As a result, we did not adjust evaluated NTG for market effects.

Free Ridership

For our free ridership analysis, we first asked participants if they had considered discarding the participating appliance before they learned of the ApplianceSavers program. When participants indicated no previous consideration to dispose of the appliance (that is, they had no pre-program intentions to discontinue using the appliance), we categorized them as non-free riders and excluded them from our free ridership analysis (Table 23). The percentage of respondents who had considered disposing of their recycled appliance before hearing about the program rose sharply from PY12 for refrigerators (58%) and slightly for freezers (67%).

Table 23. Pre-Program Intentions

Had Considered Disposing Recycled Appliance Prior to Hearing about ApplianceSavers	Indicative of Free Ridership	Refrigerators (n=121)	Freezers (n=46)
Yes	Varies by discard method	72%	70%
No	No	28%	30%
Total		100%	100%

Next, we asked the remaining participants (those who had at least considered discarding the existing appliance before learning about ApplianceSavers) a series of questions to determine the distribution of participating units that were likely to have been kept or discarded absent the program. With the two possible scenarios for discarded units, there are three possible scenarios independent of program intervention:

- Unit is discarded and transferred to another household
- Unit is discarded and destroyed.
- Unit is kept in the home.

To determine the percentage of participants in each of the three scenarios, we asked participants about the likely fate of their recycled appliance had it not been decommissioned through ApplianceSavers. We categorized their responses as follows:

- Kept the appliance.
- Sold the appliance to a private party (either an acquaintance or through a posted advertisement).
- Sold or gave the appliance to a used-appliance dealer.
- Gave the appliance to a private party, such as a friend or neighbor.
- Gave the appliance to a charity organization, such as Goodwill Industries or a church.
- Leave the appliance on the curb with a “Free” sign
- Have the appliance removed by the dealer from whom the new or replacement refrigerator was obtained.
- Hauled the appliance to a landfill or recycling center.
- Have the appliance picked up by local waste management company

To ensure the most reliable responses possible and to mitigate socially desirable response bias to the greatest extent possible, we asked some respondents additional questions. For example, through our interviews with local market actors (described in the Process Findings chapter), we determined that used appliance dealers are unlikely to purchase appliances more than 15 years old.

We asked participants whose appliance was more than 15 years old and who indicated they “would have sold their unit to a used appliance dealer” what they would have likely done *had they been unable*

to sell the unit to a dealer. From their responses, we assessed free ridership. In our experience, this dynamic, market research-based approach to surveying improves the reliability of the hypothetical self-reported actions of participants.

Once we determined the final assessments of participants' actions independent of ApplianceSavers, we calculated the percentage of refrigerators and freezers that would have been kept or discarded (Table 24).

Table 24. Final Distribution of Kept and Discarded Appliance

Stated Action Absent Program	Indicative of Free Ridership	Refrigerators (n=121)	Freezers (n=46)
Kept*	No	40%	43%
Discarded	Varies by Discard Method	60%	57%
Total		100%	100%

*Any participants that had not previously considered disposing the appliance before hearing of ApplianceSavers were categorized as "Kept"

As evident in Table 25, the percentage of Ameren participants (in all program years) who stated they would have kept their appliance in the absence of the ApplianceSavers is considerably higher than the three benchmarked programs. However, the percentage of participants self-reporting that they would have kept their refrigerators independent of the program dropped to 40% in PY13 (from 67% in PY12). The PY13 value is lower than, but closer to, the value observed in PY11.

Table 25. Benchmarking: Keep/Discard Scenarios

Utility	Years Implemented	Percentage Likely To Have Been Kept Independent of the Program	
		Refrigerators	Freezers
Ameren Missouri (PY13)	3.5	40%	43%
Ameren Missouri (PY12)	2.5	67%	46%
Ameren Missouri (PY11)	1.5	52%	54%
NW Utility	6	11%	-
Atlantic Coast Utility	4	41%	33%
Avista	6	17%	17%
Ontario Power Authority	4	7.3%	9.5%
PacifiCorp (Washington)	5	20%	20%

The Cadmus team then determined which of the self-reported discard methods mentioned by participants indicating that they would not have kept appliance were indicative of free ridership. (That is, which discard methods would have led to the removal of the appliance from the grid without program intervention.) The results are shown in Table 26.

Table 26. Details of Discard Scenarios

Stated Method of Disposal Absent Program	Indicative of Free Ridership	Refrigerators (n=74)	Freezers (n=27)
Sold it to someone directly	No	7%	19%
Sold it to a used appliance dealer	No*	15%	0%
Given it away to someone for free	No	18%	26%
Given it away to charity organization	No	11%	15%
Left it on the curb with a free sign	No	5%	4%
Had it removed by the dealer where you got your new appliance	No**	14%	11%
Taken it to a dump or recycling center yourself.	Varies by age	16%	7%
Had someone take it to the dump or recycling center	Yes	15%	19%
Total		**100%**	**100%**

* As noted above, participants stating they would have sold a unit to a used appliance dealer that was older than 15 years old were asked what they would have done had they been unable to sell the unit (which our market research indicates is most likely). We used the participants' follow-up response to determine free ridership for these participants.

** All units 15 years old or younger were designated as non-free riders (as they have resale value and would have been resold by some appliance dealers). All units older than 15 years were categorized as free riders (as market research indicates they most likely would have been destroyed by the appliance dealer picking up the unit.)

Secondary Market Impacts

When we determined that the participant would have directly or indirectly (through a market actor) transferred the unit to another customer on the grid, we asked what that potential acquirer might do since that unit was unavailable because it was recycled through ApplianceSavers. There are three possibilities:

- Possibility A. None of the would-be acquirers would find another unit. That is, program participation would result in a one-for-one reduction in the total number of refrigerators operating on Ameren Missouri's electrical grid. In this case, the total energy consumption of all avoided transfers (participating appliances that otherwise would have been used by another customer) should be credited as savings to the program. This position is consistent with the theory that participating appliances are essentially convenience goods for would-be acquirers. That is, the potential acquirer would have accepted the refrigerator had it been readily available, but since the refrigerator was not a necessity, the potential acquirer would not seek out an alternate unit.
- Possibility B. All of the would-be acquirers would find another unit. Thus, program participation has no effect on the total number of refrigerators operating on the grid. This position is consistent with the notion that participating appliances are necessities and that customers will always seek alternate units when participating appliances are unavailable.

- Possibility C. Some would-be acquirers would find another unit, while others would not. This possibility reflects the awareness that some acquirers were in the market for a refrigerator and would acquire another unit, while others were not seek to buy a refrigerator and would only have taken the unit opportunistically.

It is difficult to answer this question with certainty, absent Ameren-specific information regarding the change in the number of total number of refrigerators and freezers (overall and used appliances both) that were active before and after ApplianceSavers' implementation. Since this information is rarely (if ever) available), UMP recommends adopting Possibility C: some of the would-be acquirers would find another unit, while others would not. Therefore, UMP recommends that evaluators assume that half (0.5, the midpoint of possibilities A and B) of the would-be acquirers of avoided transfers did find an alternate unit. Having no information to the contrary, we used UMP's recommendation in this evaluation.[9]

Once we determine the proportion of would-be acquirers who are assumed to find alternate unit (assumed to be half), we then address the issue of whether the alternate unit was likely to be another used appliance (similar to those recycled through the program) or, presuming fewer used appliances are available due to program activity, whether would the customer acquire a new standard-efficiency unit instead.[10] Again, for the reasons previously discussed, it is difficult to estimate this distribution definitively. Thus, when primary research is unavailable, the UMP protocol recommends a midpoint approach: evaluators should assume half (0.5) of the would-be acquirers of program units would find a similar, used appliance and half (0.5) would acquire a new, standard-efficiency unit.

To determine the energy consumption of these new, standard-efficiency appliances, the Cadmus team used the ENERGY STAR® Website. Specifically, we averaged the reported energy consumption of new, standard-efficiency appliances of comparable sizes and similar configurations as the program units.

Figure 5 shows our methodology for assessing the program's impact on the secondary refrigerator market and our application of the recommended midpoint assumptions when primary data are unavailable. (A freezer-specific diagram is provided in Appendix B.) As evident in the figure, accounting for market effects results in three savings scenarios:

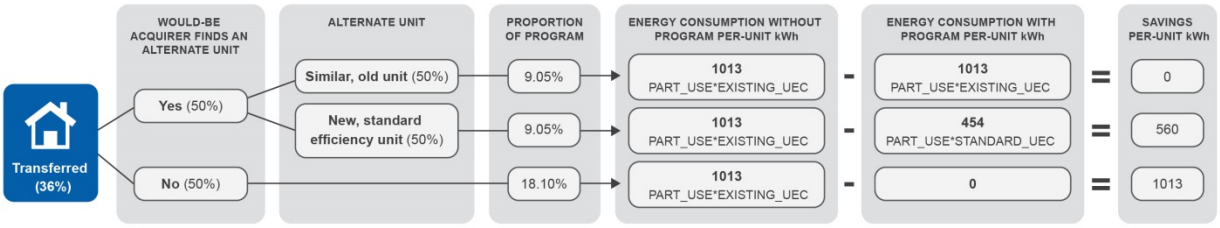
---

[9] Some evaluators have employed a bottom-up approach that centers on identifying and surveying recent acquirers of non-program used appliances and asking these acquirers what they would have done had the specific used appliance they acquired not been available. While this approach results in quantitative data to support evaluation efforts, the Cadmus team does not believe this approach yields reliable results since it is uncertain if a) the used appliances these customers acquired are in fact comparable in age and condition to those recycled through the program and b) these customers can reliably respond to the hypothetical question. Any sample composed entirely of customers who recently acquired a used appliance seems inherently likely to produce a result that aligns with Possibility B.

[10] It is also possible the would-be acquirer of a program unit would select a new ENERGY STAR unit as an alternate. However, it seems most likely a customer in the market for a used appliance would upgrade to the new lowest price point (a standard efficiency unit).

- Full savings (per-unit gross savings);
- No savings (the difference in energy consumption of the program unit and a similar, old unit); and
- Partial savings (the difference between the energy consumption of the program unit and the new, standard-efficiency appliance that was acquired instead).

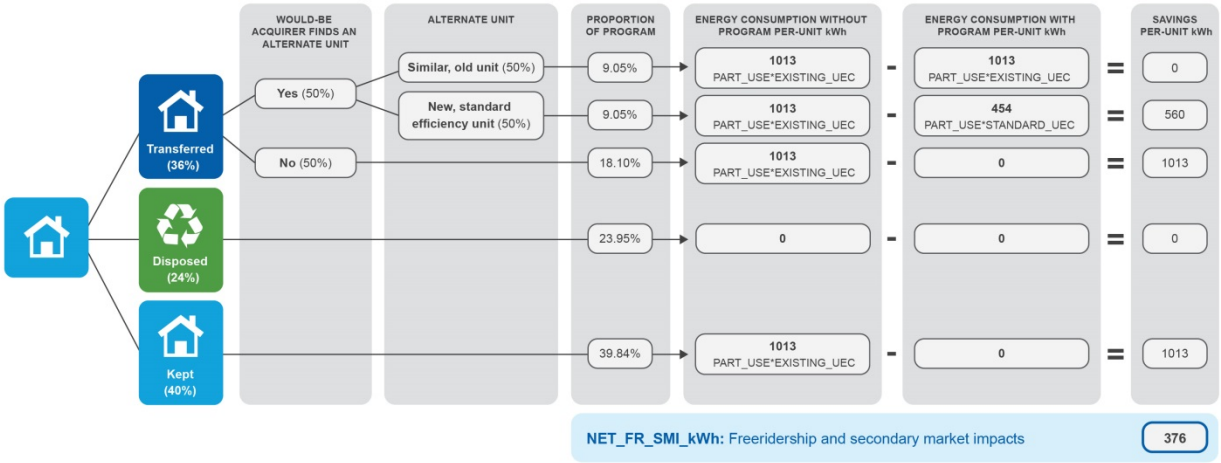
Figure 5. Secondary Market Impacts – Refrigerators



Integration of Free ridership and Secondary Market Impacts

Once the parameters of the free ridership and secondary market impacts are estimated, the Cadmus team used the UMP decision tree to calculate the average per-unit program savings net of their combined effect. Figure 6 shows how these values are integrated into a combined estimate of savings net of free ridership and secondary market impacts. Again, the application of secondary market impacts is the result of UMP and was not accounted for in previous ApplianceSavers evaluations.

Figure 6. Free Ridership and Secondary Market Impacts - Refrigerators



Induced Replacement

UMP states that evaluators must account for the energy consumption of replacement units *only* when the program induces the replacement. (That is, when the participant would *not* have purchased the replacement refrigerator in the absence of the recycling program). In the case of non-induced

replacements, the energy consumption of the replacement appliance is not germane to the savings analysis since that appliance would have been purchased or acquired regardless of program. It is critical to note that the acquisition of another appliance in conjunction with participation in ApplianceSavers does not necessarily indicate induced replacement.

The Cadmus team relied on information from the PY13 participant surveys to determine if any of the replacement refrigerators and freezers acquired were induced by the ApplianceSavers program. First, we determined the total number of replacements—induced or otherwise. As Table 27 shows, 65% of participants replaced their refrigerators and 38% replaced their freezers.

Table 27. PY13 Replacement Rates

Replacement Scenario	Refrigerators	Freezers
No Replacement	35%	62%
Replaced with high efficiency used appliance	13%	3%
Replaced with standard efficient used appliance	2%	0%
Replaced with high efficiency new appliance*	49%	31%
Replaced with standard efficient new appliance	1%	5%
Total	**100%**	**100%**

*The efficiency level of replacement units was reported by participants and not physically verified by Cadmus. It is possible the actual distribution of high and standard efficiency units might differ.

These survey results indicate that ApplianceSavers continued to reduce the total number of used appliances operating within Ameren's service territory and to raise the average efficiency of the active appliance stock.

Next, the Cadmus team assessed the participant surveys to estimate the proportion of these replacements that were induced by the customer's participation in ApplianceSavers. All participants who said they replaced an eligible appliance were asked, "Were you already planning to replace your [refrigerator/freezer] before you decided to recycle your existing unit through Ameren Missouri's Refrigerator Recycling program?"

Since an incentive of $50 is unlikely to be sufficient motivation for most participants to purchase an otherwise-unplanned replacement unit (which can cost $500 to $2,000), we asked a follow-up question of participants who responded "No." Our question, intended to confirm the participants' assertion that the program alone caused them to replace their appliance, was this: "Let me make sure I understand: you would not have replaced your [refrigerator/freezer] with a different [refrigerator/freezer] without the program? Is that correct?"

Induced replacement is not solely a motivated by program incentive. As determined through the PY13 process evaluation, 28% of program participants cited convenience as the primary reason for refrigerator participation (Table 9). The fact that the program removes the unit from the home (which often requires dealing with stairs) is a major driver of the high levels of customer satisfaction regarding appliance recycling programs. In this context, note that the program's assistance in removing an

appliance—which the customer otherwise may not have been able to remove independently—can also generate induced replacement.

To increase the reliability of these self-reported actions, we also considered two other factors in our analysis of induced replacement: (1) whether the refrigerator was a primary unit, and (2) the participant's stated intentions in the absence of the program. For example, if a participant indicated the primary refrigerator would have discarded independent of the program, it is not possible that the replacement was induced (since it is extremely unlikely the participant would live without a primary refrigerator). However, for all other usage types and stated intention combinations, induced replacement is a viable response.

As one might expect, only a portion of the total replacements were induced. For PY13, we determined that 11% of the 80 replaced refrigerators and 6% of the 18 replaced freezers replacements were induced by the program. This means that among participants, the program induced 7% of all refrigerator replacements and 2% of all freezer replacements (Table 28).

Table 28. PY13: Induced Replacement Rates

Appliance	Induced Replacement Rates
Refrigerator	7%
Freezer	2%

In PY12, Ameren refrigerators had a higher rate of induced replacement than in two recent evaluations in the Pacific Northwest. In PY13, refrigerator induced replacement decreased to 7%, which is closer to the benchmarked rates.

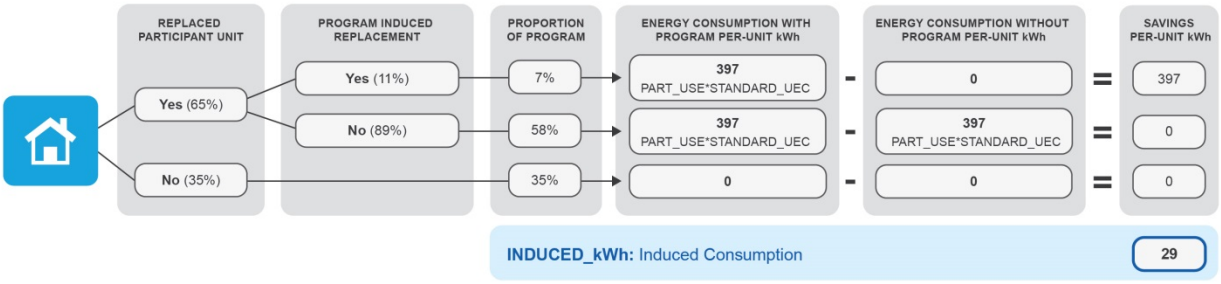
Table 29. Benchmarking: Induced Replacement Rates

Utility	Years Implemented	Induced Replacement Rates	
		Refrigerator	Freezer
Ameren Missouri (PY13)	3.5	7%	2%
Ameren Missouri (PY12)	2.5	13%	2%
Avista	6	4%	4%
PacifiCorp (Washington)	5	3%	3%

Once we determined the number of induced replacements, we combined these results with the energy consumption information (obtained from the ENERGY STAR Website) for the replacement appliance. All induced-replacement participants indicated their replacement unit was high-efficiency.

The energy impact of these induced replacements—in per-unit terms—on the ApplianceSavers net refrigerator savings is shown in Figure 7. As shown, the induced replacements in PY13 generated a per-unit increase of 29 kWh for refrigerators. Like free ridership, induced replacement enters the net savings calculation with a negative sign.

Figure 7. Induced Replacement - Refrigerators



Participant Spillover

UMP does not recommend quantifying and applying participant spillover for the other self-reported efficiency improvements unrelated to refrigerators and freezers, as the savings associated with these actions are either being claimed by a different utility efficiency program or cannot be defensibly attributed with ApplianceSavers.

However, since ApplianceSavers provides education about the operating costs of inefficient refrigerators and freezers (as part of the program's marketing message), it is possible that participants were more cognizant of operating costs and, therefore, more likely to select an ENERGY STAR-qualified refrigerator or freezer when making their replacement purchase.

To assess this potential source of program-attributable spillover, the Cadmus team compared the percentage of ApplianceSavers participants who reported replacing their recycled appliance with an ENERGY STAR refrigerator or freezer with the percentage of nonparticipants who reported replacing their units with ENERGY STAR appliances.[11] (This method is different from the one we used in PY12, when we compared participants' reported ENERGY STAR replacement rates with sales data of ENERGY STAR units.) Using self-reported ENERGY STAR penetration data from GPS responses (instead of sales data) mitigates any socially desirable response bias present in the reports of program participants.

In our survey, we found that 95% of participants who replaced a refrigerator and 87% of participants who replaced a freezer chose an ENERGY STAR unit. These percentages are not substantially higher than nonparticipants' average reported adoption rate for ENERGY STAR appliances (88%). (Note that Spillover is only calculated for replacements that are not deemed to be induced by the program.)

To calculate the spillover savings shown in Table 30, we used the following formula.

$$Spillover\ (kWh\ per\ unit) = Replacement\ Rate * (\Delta ENERGY\ STAR\ Rate) * (\Delta kWh)$$

[11] Since Ameren Missouri does not incentivize ENERGY STAR refrigerators or freezers through a rebate program, there are no concerns regarding the double-counting of these energy savings.

Where:

- Replacement Rate = the percentage of participant survey respondents who replaced their appliance
- $\Delta ENERGY\ STAR\ Rate$ = the proportion of participant survey respondents who replaced their units with ENERGY STAR, minus the proportion of nonparticipant survey respondents who replaced their units with ENERGY STAR
- ΔkWh = Annual kWh consumption of a standard efficiency appliance minus the annual kWh consumption of an ENERGY STAR appliance.

Table 30. PY13 ENERGY STAR Refrigerator and Freezer Spillover

Appliance	Replaced (Excluding those induced)		ENERGY STAR		ENERGY STAR Market Saturation	Delta kWh	Appliance Spillover kWh
Refrigerators	Yes	58%	Yes	95%	88%	101	4
			No	5%			
	No	42%					
Freezers	Yes	36%	Yes	87%	88%	58	0
			No	13%			
	No	64%					

This results in a spillover savings of only 4 kWh for refrigerators and no spillover savings for freezers. For PY12, we used sales data instead of nonparticipant surveys, and the resulting nonparticipant ENERGY STAR replacement rates were 56% for refrigerators and 21% for freezers. This resulted in higher spillover savings, but did not account for socially desirable response bias.

Table 31. PY13 Participant Spillover

Appliance	Spillover (kWh/unit)	
	PY12	PY13
Refrigerators	13	4
Freezers	15	0

In PY13, 76% of surveyed participants said their experience in ApplianceSavers made them either *much more likely* or *somewhat more likely* to participate in another Ameren energy-efficiency program in the future. This is due to the program's ease of participation and the resulting extremely high participant satisfaction. While this positive attribute of recycling programs is a reason for its inclusion in a well-balanced residential portfolio, any resulting savings are captured by other program evaluations and cannot be claimed specifically as ApplianceSavers spillover.

Nonparticipant Spillover

Effective program marketing and outreach generates program participation *and* increases general energy-efficiency awareness among customers. The cumulative effect of sustained utility program marketing (which often occurs concurrently for multiple programs) can affect customers' perceptions of

their energy usage and, in some cases, motivates customers to take efficiency actions outside of the utility's program. This phenomenon—called nonparticipant spillover (NPSO)—results in energy savings caused by but not rebated through a utility's demand-side management activity.

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

Methodology

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

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

To confirm a relationship between Ameren's energy-efficiency programs and the Act On Energy awareness campaign and actions taken by nonparticipants, the Cadmus team's survey asked about nonparticipants' familiarity with Ameren's energy-efficiency programs and Act On Energy. To be included in the NPSO analysis, nonparticipating respondents had to indicate: a) they were familiar with Ameren's campaign; and b) Ameren's efficiency messaging motivated their purchasing decisions.

Results

Of 365 nonparticipants surveyed, 11 cited Ameren's marketing as either "very important" or "somewhat important" in their decisions to purchase non-rebated, high-efficiency measures during 2013:[12]

- Among nonparticipants citing their knowledge of Ameren's energy-efficiency programs or the Act On Energy campaign as "very important," we counted *ex post,* gross, per-unit savings, determined through the PY13 evaluation towards the NPSO analysis.

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

- If nonparticipants said Ameren was "somewhat important" in their decisions, we applied a 50% decrement and applied one-half of the *ex post* energy savings for the specified measure.

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

Table 32 shows measures and gross evaluated kWh savings attributed to Ameren, with average savings per spillover measure of 242 kWh.

Table 32. NPSO Response Summary

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

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

To arrive at a single savings estimate (Variable A in Table 33), the Cadmus team used the numbers in the Total kWh Savings column to calculate an average for the 11 measures assessed for nonparticipant spillover. Thus, the estimate of 242 kWh represents the average nonparticipant energy savings per respondent who attributed spillover to Ameren's residential programs.

To determine the total NPSO generated by Ameren marketing in 2013, we used the following variables (as shown in Table 33):

- **A** is the average kWh savings per NPSO response.
- **B** is the number of NPSO measures attributed to the program.

- **C** is the number of nonparticipants contacted by the survey implementer.
- **D** is Ameren's total residential customer population.
- **E** is NPSO energy savings extrapolated to the customer population, calculated by dividing B by C and then multiplying this result by A and D.
- **F** is the total evaluated savings for the 2013 program year, for ApplianceSavers, CoolSavers, LightSavers, PerformanceSavers, and RebateSavers. (The analysis did not include CommunitySavers and ConstructionSavers.)[13]
- **G,** representing NPSO as a percentage of total evaluated savings, is the nonparticipant percentage used in the NTG calculations.

We estimated overall NPSO at 2.7% for the portfolio level, as shown in Table 33.

Table 33. NPSO Analysis

Variable	Metric	Value	Source
A	Average kWh Savings per Spillover Measure	242	Survey Data/Impact Evaluation
B	Number of Like Spillover Nonparticipant Measures	11	Survey data
C	Number Contacted	365	Survey disposition
D	Total Residential Population	1,040,928	Customer database
E	Non-Part SO MWh Savings Applied to Population	7,592	(((B÷C)×A) × D)/1000
F	Total Evaluated Savings (MWh)	280,117	2013 Program Evaluations
G	NPSO as Percent of Total Evaluated Savings	2.7%	F ÷ G

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

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

4. **Even Allocation**: The most straightforward approach allocates NPSO evenly across the residential programs (i.e., makes a 2.7% adjustment to each program's NTG). Doing so, however, is equivalent to applying NPSO at the portfolio-level, and therefore, as noted, assumes all programs contribute equally to generating NPSO.
5. **"Like" Programs:** Another approach allocates NSPO savings to specific programs, based on the measure installed by the nonparticipant or by the action they took. For example, one

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

nonparticipant reported tuning up their CAC, based on energy-efficiency messaging from Ameren. Using this approach, we would assign NPSO savings associated with the tune-up to CoolSavers. While this approach establishes a clear connection between a reported NPSO measure and Ameren's program that promotes that measure, our research found this direct measure-program relationship did not prove as straightforward as it appeared. Specifically, while our study found all 11 respondents reporting NPSO were familiar with Act on Energy or Ameren's energy-efficiency messaging, only nine could cite specific program names. Further, just over one-half of the customers (6 of 11) who reported NPSO measures were unfamiliar with the program or the programs corresponding to the measure they installed. These findings indicated that Ameren generated NPSO through the cumulative effects of various program-specific and portfolio-level marketing efforts, and mapping NPSO measures solely to the program offering that measure could undervalue the overall impact of cumulative and sustained energy-efficiency messaging.

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

The Cadmus team then distributed the portfolio-level result of 7,592 MWh NPSO to Ameren's residential programs (excluding CommunitySavers and ConstructionSavers). As noted, we considered both the PY13 program size (in terms of total gross *ex post* MWh savings) and each program's marketing budget (shown in Table 34) when allocating NPSO across programs.

Table 34. Program-Specific Savings and Marketing

Program	Program *Ex Post* Gross Savings (MWh)	Percentage of Portfolio Savings	Total Marketing	Percentage of Total Marketing
ApplianceSavers	**6,965**	2.5%	**$542,242**	**35.1%**
CoolSavers	25,105	9.0%	$824,949	**53.4%**
LightSavers	232,842	**83.1%**	$33,146	2.1%
PerformanceSavers	189	0.1%	$73,145	4.7%
RebateSavers	15,017	5.4%	$71,788	4.6%
Total	**280,117**	**100%**	**$1,545,270**	**100%**

The results of this approach (shown in Table 35 and Table 36) reflect the impact of each program on the nonparticipant population, based on marketing expenditures and program magnitudes in the marketplace.

Table 35. Combined Savings and Marketing Allocation Approach

Program	*Ex Post* Gross Energy Savings (A)	Marketing Spending (B)	Combined Savings/Marketing (AxB)	Percentage of Combined Savings/Marketing
ApplianceSavers	2.5%	35.1%	0.9%	11.3%
CoolSavers	9.0%	53.4%	4.8%	62.2%
LightSavers	83.1%	2.1%	1.8%	23.2%
PerformanceSavers	0.1%	4.7%	0.003%	0.04%
RebateSavers	5.4%	4.6%	0.2%	3.2%
Total	**100%**	**100%**	**7.7%**	**100%**

Two programs are credited with the greatest NPSO: CoolSavers (accounting for one-half of all marketing dollars) at 4,722 MWh; and LightSavers (accounting for more than 80% of total energy savings) at 1,760 MWh. As NPSO impacts program-specific NTG results,[14] all NPSO estimates have been reported as a percentage of each program's total gross energy savings.

As shown in Table 36, we allocated 861 MWh of NPSO to ApplianceSavers, representing 11.3% of the combined residential portfolio savings and marketing expenditure. This resulted in a 12.4% adjustment to the program's PY13 NTG.

Table 36. NPSO by Program

Program	Program Gross Savings (MWh)	Total NPSO (MWh)	Percentage of Combined Savings/Marketing	Program-Specific NPSO (MWh)	NPSO as a Percentage of Gross Savings
ApplianceSavers	**6,965**		**11.3%**	**861**	**12.4%**
CoolSavers	25,105		62.2%	4,722	18.8%
LightSavers	232,842	**7,592**	23.2%	1,760	0.8%
PerformanceSavers	189		0.04%	3	1.7%
RebateSavers	15,017		3.2%	246	1.6%
Total	**280,117**		**100%**	**7,592**	**2.7%**

Net Savings Summary

Table 37 compares these *ex post* and *ex ante* values. We have also provided a detailed diagram illustrating the UMP approach for estimating net savings in the appendices.

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

Table 37. *Ex Ante* and *Ex Post* Net-to-Gross Ratios

Appliance	*Ex Ante*	*Ex Post*
Refrigerators	64%	73%
Freezers		78%
Overall*	**64%**	**74%**

*Reflects PY13 appliance participation mix and includes free ridership (38.6%), participant spillover (0.3%), and nonparticipant spillover (14.7%)

Table 38 shows the NTG ratio's components: free ridership and secondary market impacts (including induced replacement), participant spillover, and nonparticipant spillover. Cadmus calculated the percentage for each component as the per-unit kWh associated with each component, divided by the per-unit gross savings.

Table 38. NTG Ratio Components

Appliance	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG Ratio
Refrigerators	40%	0.4%	12.4%	73%
Freezers	34%	0%		78%
Total	**38.6%**	**0.3%**	**12.4%**	**74%**

There are two primary reasons for the difference between the program's *ex ante* and *ex post* NTG results:

- ***Adoption of UMP.*** Methodological changes resulting from UMP impacted net savings even more than gross savings. Specifically, UMP recommends accounting for induced replacement and secondary market impacts—neither of which were part of the pre-UMP PY10 evaluation.
- ***Spillover***. The Cadmus team estimated participant and nonparticipant spillover as part of the PY13 evaluation. While we estimated participant spillover to be quite limited in PY13 (less than 0.5%), we estimated nonparticipant spillover—driven by considerable program marketing (~$540,000)—to be 12.4% of ApplianceSavers' PY13 gross energy savings.

Applying these NTG values to PY13 participation and *ex post* per-unit gross savings yields the program's net energy savings (Table 39). The total MWh/Year savings and NTG ratio include nonparticipant spillover savings attributed to the program as a whole.

Table 39. *Ex Ante* and *Ex Post* Net Energy Savings

Appliance	PY13 Participants	Gross Per-Unit Energy Savings (kWh/Year)	NTG	Total Energy Savings (MWh/Year)
Refrigerators	5,237	1,013	73%	3,872.7
Freezers	1,644	969	78%	1,242.6
Room Air Conditioners	23	830	74%*	14.1
Dehumidifiers	48	964	74%*	34.2
Total	**6,952**		**74%**	**5,163.6**

*Due to very limited participation, we did not assess NTG for these measures separately. 74% represents the weighted average of the refrigerator and freezer NTGs.

As shown in Table 40, due to lower per-unit energy savings and less-than-expected participation, the program achieved only 44% of its proposed net energy savings target (11,740 MWh) in Ameren's residential tariff.

Table 40. ApplianceSavers Net Savings Comparisons

Metric	MPSC-Approved Target[1]	*Ex Ante* Gross Savings Utility Reported [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)	11,740	9,897	6,963	5,164	44%
Demand (kW)	1,636	1,800	1,338	1,023	63%

[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.

BENCHMARKING

Cadmus researched other utilities that offered measures similar to those in Ameren's ApplianceSavers program. In Table 41—which lists the estimates of UEC, part-use, and NTG of those utilities—"R" indicates refrigerator and "F" indicates freezer.

Table 41. ApplianceSavers Benchmarking Results: Mail-in Rebates

State or Utility	Years Implemented	*UEC*		Part-Use		NTG	
		R	F	*R*	F	*R*	F
Ameren Missouri (PY13)	**3.5**	**1,178**	**1,078**	**0.86**	**0.90**	**73%**	**78%**
Ameren Missouri (PY12)	**2.5**	**1,175**	**1,072**	**0.86**	**0.86**	**73%**	**68%**
Ameren Missouri (PY11)	**1.5**	**1,092**	**940**	**0.91**	**0.84**	**70%**	**74%**
Focus On Energy (2012)	1	1,045	940	0.67	0.81	51%	52%
Progress Energy Carolinas (2011)	2	1,032	805	0.9	0.93	57%	61%
Ameren Illinois (2011)	3	1,239	1,172	0.88	0.93	79%	82%
Commonwealth Edison (2010)	3	1,855	1,912	0.9	0.75	67%	75%
Ontario Power Authority (2011)*	5	1,240	1,172	0.25	0.33	53%	53%

*UEC and NTG shown here are from units collected by decommissioning agent. Units were also collected by a participating retailer; UEC and NTG were calculated separately for these units.

Table 42. Benchmarking References

State or Utility	Source
Focus On Energy (2012)	http://www.focusonenergy.com/sites/default/files/FOC_XC_CY%2012%20Report%20Volume%20II%20Final_05-3-2013.pdf
Progress Energy Carolinas (2011)	http://dms.psc.sc.gov/pdf/matters/AD6F9528-155D-141F-1D36B8C871618081.pdf
Ameren Illinois (2011)	http://ilsagfiles.org/SAG_files/Evaluation_Documents/Ameren/AIU%20Evaluation%20Reports%20EPY3/AIU%20Appliance%20Recycling%20Evaluation%20PY3.pdf
Commonwealth Edison (2010)	http://ilsagfiles.org/SAG_files/Evaluation_Documents/ComEd/ComEd%20EPY3%20Evaluation%20Reports/ComEd_Appliance_Recycling_PY3_Evaluation_Report_Final_Report.pdf
Ontario Power Authority (2010)	http://www.powerauthority.on.ca/sites/default/files/new_files/2010/2010%20Residential%20Great%20Refrigerator%20Roundup%20Program%20Evaluation.pdf
Ontario Power Authority (2011)	http://www.powerauthority.on.ca/sites/default/files/page/2011ConsumerProgramsEvaluation.pdf
Avista	http://www.nwcouncil.org/energy/rtf/subcommittees/fridgerecycle/Avista%202010-2011%20Electric%20Impact%20Report_FINAL.pdf
PacifiCorp (Washington)	http://www.nwcouncil.org/energy/rtf/subcommittees/fridgerecycle/pacificorp%20wa%202009-10%20rrp%20final%20emv%20cadmus%20120106.pdf

COST-EFFECTIVENESS RESULTS

To analyze the cost-effectiveness of the PY13 ApplianceSavers program, MMP utilizing DSMore. MMP assessed cost-effectiveness using the following five tests as defined by the California Standard Practice Manual:[15]

- 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 ApplianceSavers, 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 ApplianceSavers 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 tell 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 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

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

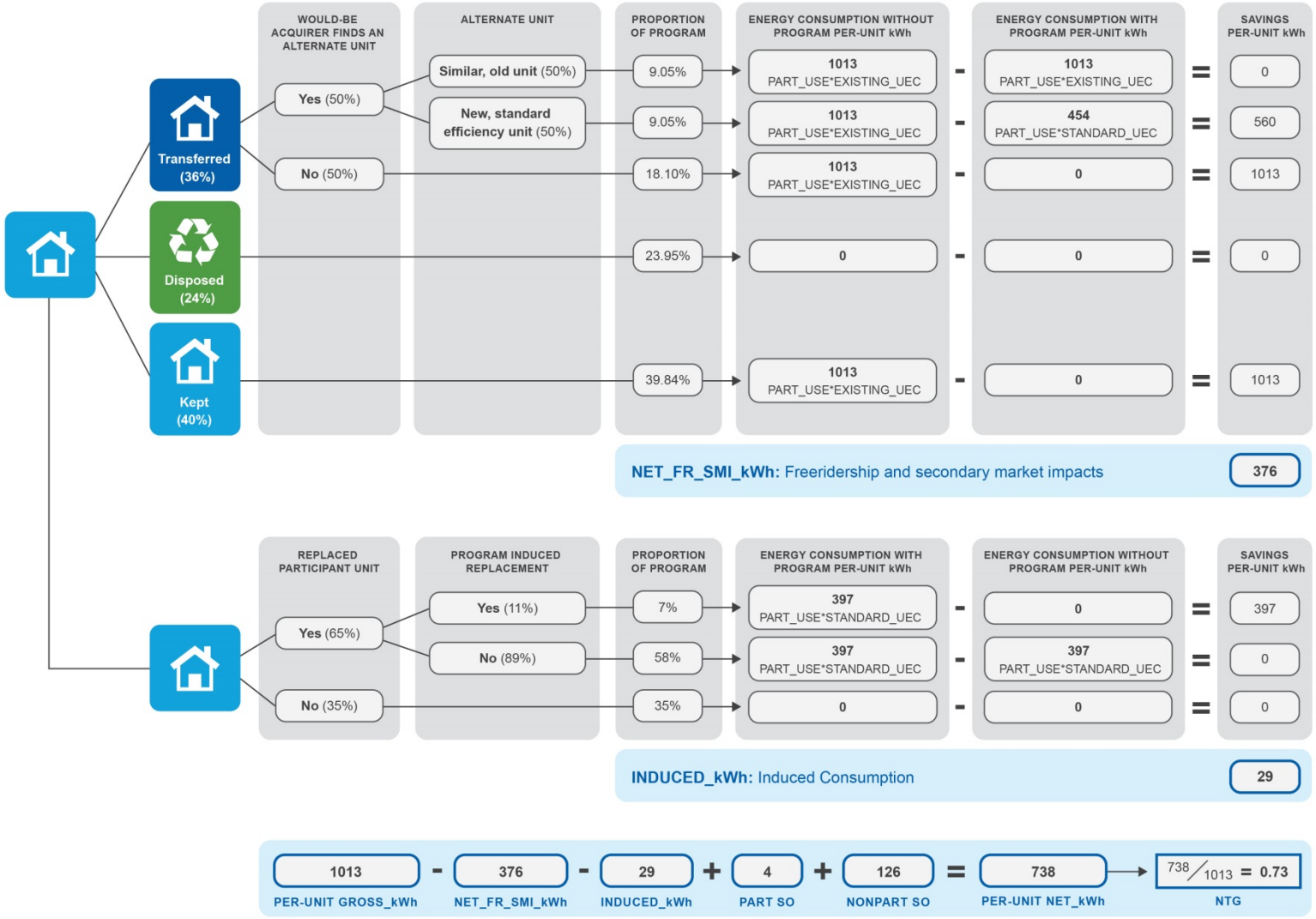
the program level, not the measure level. While applying incentives at the measure level is useful for planning purposes, it is unnecessary for the cost effectiveness modeling as the results are based on the program overall. MMP applied administrative costs (evaluation, potential study costs, and data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

Table 43 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 ApplianceSavers program passes the TRC, UCT, PART, and Societal TRC tests. The critical test for cost-effectiveness in Missouri is the TRC, which the PY13 ApplianceSavers program passes. The CCE is two cents per kWh and net lifetime benefits are $1.6M.

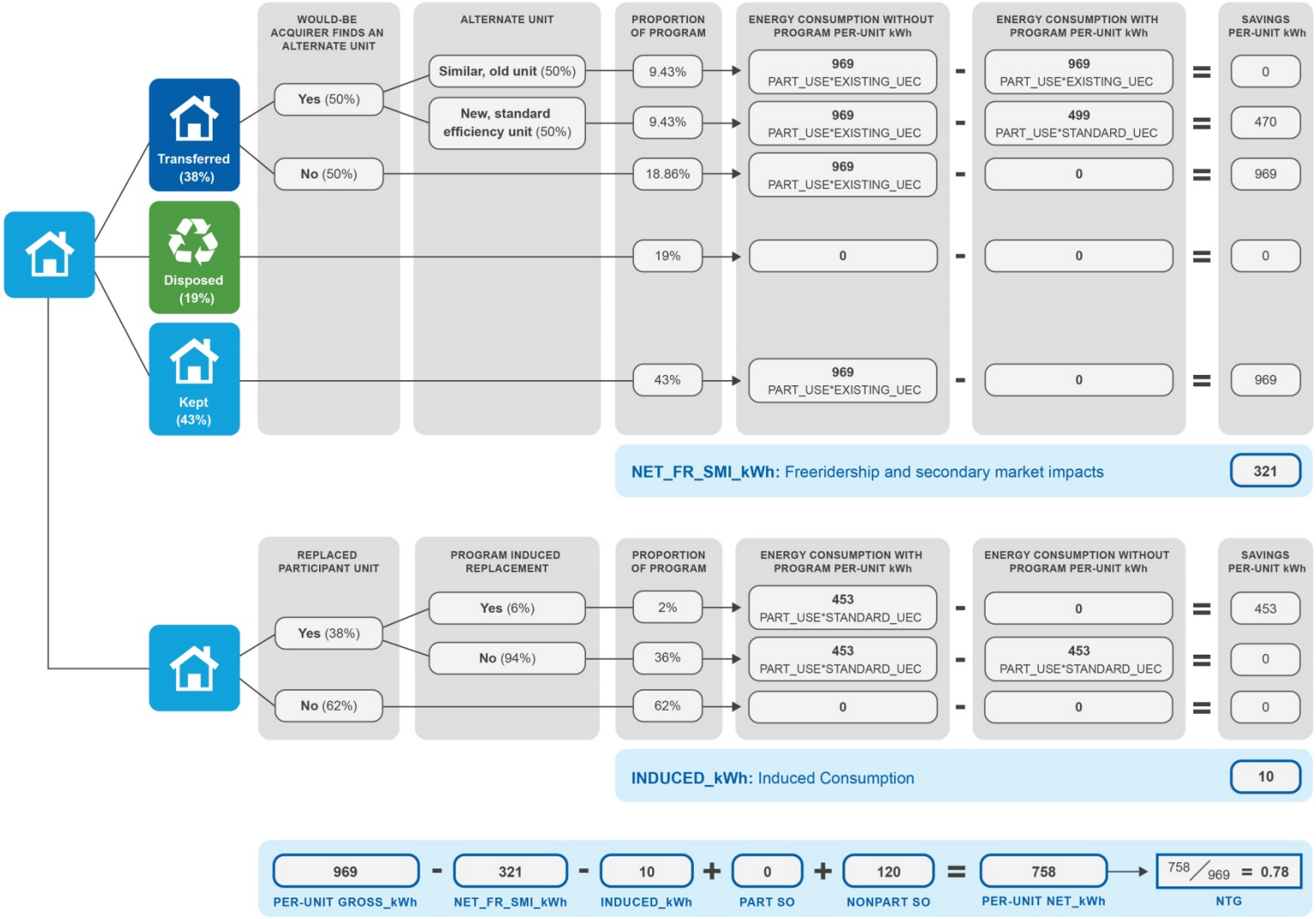
Table 43. Cost-Effectiveness Results (PY13)

	TRC	UCT	RIM	PART	Societal	CCE— $/kWh	Net Lifetime Benefits
ApplianceSavers	2.56	2.56	0.60	N/A	2.93	$0.02	$1,648,098

APPENDIX A. SUMMARY DIAGRAM—REFRIGERATORS



APPENDIX B. SUMMARY DIAGRAM—FREEZERS



APPENDIX C. GROSS SAVINGS DETAILS: ROOM AIR CONDITIONERS AND DEHUMIDIFIERS

Room Air Conditioners

The Cadmus team estimated per-unit RAC savings using the following algorithm and inputs (Table 44):

$$EnergySavings\ (kWh/Year) = \frac{\frac{BTU}{hour} * \frac{1}{EER_{BASE}} * EFLH_{COOL}}{1000}$$

Table 44. PY13 RAC Savings Assumptions

Term	PY13 Value	PY13 Source
BTU/Hour	10,000	Assumption (2013 Pennsylvania TRM)
EER_{BASE}	6.7	OPA laboratory testing of used RACs
$EFLH_{COOL}$	556	Weather-adjusted 2009 CPUC RAC Metering Study

The average size of RAC units reported by ARCA in PY13 was 8,870 BTU/hour. However, the Cadmus team felt the average value was unreliable due to sample size (only 23 units) and the fact that the CommunitySavers unit size for RAC was over 12,000 BTU/hour. We instead assumed a BTU/hour of 10,000 as cited by the 2013 PA TRM. For the baseline EER (EER_{BASE}) value of we rely upon OPA's laboratory testing of used 30 RACs collected in a 2008 OPA appliance bounty program (this characteristic was not collected by ApplianceSavers). Other benchmarked TRMs (NEEP and PA) assume larger baseline EER values (7.7 and 9.07, respectively), but they are based upon engineering estimates and assumptions rather than the actual lab testing of existing, older RACs (as in the OPA study). Finally, for the equivalent full load hours ($EFLH_{COOL}$) we rely upon a weather-adjusted value from CPUC's 2009 RAC metering study similar to RebateSavers.

The resulting *ex post* savings value and the *ex ante* savings value are shown in Table 45. The *ex post* savings value (830 kWh/year) is approximately 735% of the program's *ex ante* value (113 kWh/year), which was based on MML data. The large difference between *ex ante* and *ex post* savings estimates occurs because of our evaluation cites the savings as the full energy consumption of the unit (not the difference between the recycled unit and a replacement). Finally, the MML's assumptions for the key terms in the RAC savings calculation (Table 44) are not available.

Table 45. *Ex Ante* and *Ex Post* Comparison for Room Air Conditioners

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
113 kWh/yr	830 kWh/yr	735%

Dehumidifiers

The evaluated dehumidifier savings of 964 kWh/year come from OPA's 2008 metering of recycled dehumidifiers. Our evaluated savings for this measure are much larger than the Ameren Missouri TRM

(139 kWh/year), which sites the Morgan Measure Libraries (MML). It is difficult to pinpoint the reason for the difference between the *ex ante* and *ex* post savings values without greater insight into the MML assumptions of unit size, efficiency, and annual usage. However, our larger savings value is much closer to those of other programs (Table 46):

Table 46. Dehumidifier Savings Benchmarking

Source	Savings/Unit (kWh/year)	Assumptions
Appliance Savers PY13 (OPA 2008)*	964	-
Ameren Missouri TRM	139	-
NEEP TRM (2013) **	983	46 pints/day capacity, 1632 annual hours of use
PA TRM (2013) ***	988	45-54 pints/day capacity, 1620 annual hours of use
ENERGY STAR calculator****	857	35 – 45 pints/day capacity, 1632 annual hours of use

*http://www.powerauthority.on.ca/sites/default/files/new_files/2008/2008%20OPA%20Residential%20Every%20Kilowatt%20Counts%20Power%20Savings%20Event%2C%20Keep%20Cool%2C%20and%20Rewards%20for%20Recycling%20Evaluation.pdf

** http://www.neep.org/Assets/uploads/files/emv/emv-products/TRM_March2013Version.pdf

*** http://www.puc.pa.gov/electric/pdf/Act129/Act129_TRM-2013_Redlined.pdf

**** http://www.energystar.gov/buildings/sites/default/uploads/files/appliance_calculator.xlsx

The large difference between the *ex ante* and *ex post* savings results in a realization rate of 694% (Table 47).

Table 47. *Ex Ante* and *Ex Post* Comparison for Dehumidifiers

Ex Ante Savings/Unit	*Ex Post* Savings/Unit	Realization Rate
139 kWh/yr	964 kWh/yr	694%

APPENDIX D. PARTICIPANT SURVEY INSTRUMENT

Introduction

Hello, my name is _____ and I'm calling on behalf of Ameren Missouri. I am calling to ask some questions about your household's participation in Ameren Missouri's program where you recycled your **[APPLIANCE VAR]**. All your answers are confidential.

[IF RESPONDENT ASKS HOW LONG, SAY "ABOUT 15 MINUTES."]

A. Verification

A1. Our records show that on **[DATE],** you had a **[APPLIANCE VAR]** removed by the Ameren Missouri's Appliance Savers program. Are you the person in your household most familiar with this pick up?

[IF PARTICIPANT HAD MORE THAN ONE UNIT REMOVED THROUGH THE PROGRAM, ASK THEM TO FOCUS ON THIS ONE UNIT THROUGHOUT THE SURVEY]

1. Yes, I remember
2. No
98. Don't know about the removal

A2. **[ASK IF A1 = 2, 98]** May I please speak with the person most familiar with the pick up?

[IF NOT AVAILABLE, ATTEMPT TO SCHEDULE A CALL BACK]

1. Yes
2. No
98. Don't know
99. Refused

[TERMINATE IF A2 = 2, 98, 99]

A3. **[ASK ONLY IF APPLIANCE VAR = REFRIGERATOR]** Our records indicate you recycled **[QTY]** refrigerator(s) through Ameren Missouri's program on **[DATE].** Is this correct?

1. Yes, that is correct
2. No, that is not correct
98. DON'T KNOW

[SKIP TO B1 IF A3 = 1]

A4. How many refrigerators did you have recycled through Ameren Missouri's program?

1. _____ **[RECORD QUANTITY OF REFRIGERATORS]**
98. Don't know
99. Refused

A5. **[ASK IF APPLIANCE VAR = FREEZER]** Our records indicate you recycled **[QTY]** freezer(s) through Ameren Missouri's program on **[DATE]**. Is this correct?
1. Yes, that is correct
2. No, not correct
98. Don't know

[SKIP TO B1 IF A5= 1]

A6. How many freezers did you have recycled through Ameren Missouri's program?
1. _____ **[RECORD QUANTITY OF FREEZERS]**
98. Don't know
99. Refused

[TERMINATE IF A6= 2, 98, 99]

B. Part-Use

[ASK ONLY IF QTY > 1] Although you recycled **[QTY] [APPLIANCE VAR]**s, we are only interested in talking about one of them. Please answer the rest of the questions about the **[MANUFACTURER] [CONFIGURATION] [APPLIANCE VAR]**.

B1. **[SKIP IF QTY>1]** About how old was your **[APPLIANCE VAR]**? **[RECORD IN YEARS. ENTER "00" IF LESS THAN ONE YEAR OLD. USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.]**

_____ (Record years)

B2. How would you describe the condition of the **[APPLIANCE VAR]** you disposed of? Would you say…? **[READ, RECORD ONE RESPONSE ONLY.]**
1. It worked and was in good physical condition.
2. It worked but needed minor repairs. [example: it would not defrost]
3. It did not work (example: turned on but did not cool).
98. Don't know
99. Refused

B3. During the last year, how much was the **[APPLIANCE VAR]** used? Was it plugged in**…[READ LIST]**?
1. All the time.
2. Part of the time. **[CLARIFY AS "CERTAIN MONTHS OF THE YEAR" OR "SPECIAL OCCASIONS"]**
3. Never.

4. **[DO NOT READ]** Other **[SPECIFY]**: _____
99. Don't know

[SKIP TO B5 If B3 <> 2]

B4. During the last year, how many total months was your **[APPLIANCEVAR]** plugged in? **[USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.]**

_____ **[RECORD MONTHS; RANGE: 1-12; HALF A MONTH=0.5]**

B5. For the majority of the last year, where was the **[APPLIANCE VAR]** located?

1. Kitchen
2. ..Garage
3. ..Porch/patio
4. ..Basement
5. …Other **[SPECIFY]**: _____
98. Don't know
99. Refused

C. Replacement

C1. Did you replace the **[APPLIANCE VAR]** you recycled?

1. Yes
2. No
98. Don't know
99. Refused

[SKIP TO D1 If C1= 2, 98, 99]

C2. Why did you decide to replace your **[APPLIANCEV VAR]**?

1. Wanted an upgrade (example: more space, new features, more efficient)
2. Old appliance was not working well
3. Was planning to give previous **[APPLIANCE VAR]** away
4. Other **[SPECIFY]**
98. Don't know
99. Refused

C3. Was the replacement **[APPLIANCE VAR]** new or used?

1. New
2. Used
98. Don't know
99. Refused

[SKIP TO D1 If C3= 98, 99]

C4. Was the replacement **[APPLIANCE VAR]** an ENERGY STAR or high-efficiency model?

1. Yes
2. No
98. Don't know
99. Refused

[SKIP TO C6 If C4= 2, 98, 99]

C5. How influential was the program in your decision to replace with an ENERGY STAR or high-efficiency model?

1. Very influential
2. Somewhat influential
3. Not very influential
4. Not at all influential
-98. Don't know
-99. Refused

C6. Were you planning to replace your **[APPLIANCE VAR]** before you decided to recycle it through Ameren Missouri's Appliance Savers program?

1. Yes
2. No
98. Don't know
99. Refused

[SKIP TO D1 If C6 = 1]

C7. Let me make sure I understand: The program motivated you to replace your **[APPLIANCE VAR]**.

1. Yes, (I would not have replaced it without the program)
2. No, (I would have replaced it anyway)
98. Don't know
99. Refused

[SKIP TO D1 IF C7<> 1]

C8. What was it about Ameren Missouri's program that encouraged you to buy the replacement unit? Was it [READ; ACCEPT MULTIPLES]:

1. The $50 program incentive
2. The convenience of the home pick-up of the old unit, or
3. Something else [RECORD VERBATIM]
4. (Nothing in Ameren Missouri's program encouraged me to buy a replacement unit)
98. Don't Know
99. Refused

D. Freeridership

D1. Had you considered getting rid of your **[APPLIANCE VAR]** before you heard about the Ameren Missouri's ApplianceSavers program?

[IF NECESSARY, BY "DISPOSE OF," I MEAN REMOVING THE APPLIANCE FROM YOUR HOME BY ANY MEANS, INCLUDING: SELLING IT, GIVING IT AWAY, HAVING SOMEONE PICK IT UP, OR TAKING IT TO THE DUMP OR A RECYCLING CENTER YOURSELF.]

1. ..Yes
2. ..No
98. .Don't know
99. .Refused

[If D1=2, SKIP TO D7]

D2. If the program had not been available, would you have kept your **[APPLIANCE VAR]** or gotten rid of it?

1. ..Kept
2. ..Gotten rid of
98. .Don't know
99. .Refused

D3. **[ASK ONLY IF APPLIANCE VAR=REF, D2=1, AND B5=1]** If you had kept your refrigerator, would you have left it in your kitchen or moved it to another location in your home?

1. Left in kitchen
2. Moved to other location
98. Don't know
99. Refused

[IF D2 = 1 SKIP TO D7]

D4. If the program had not been available, how would you have gotten rid of your **[APPLIANCE VAR]**? **[Allow only one answer]**
[READ LIST IN RANDOM ORDER]

1. Sold it to someone directly [example: friend, family member, Craigslist].
2. Sold it to a used appliance dealer
3. Given it away to someone for free
4. Given it away to charity organization [example: Goodwill or Vietnam Veterans of America]
5. Left it on the curb with a free sign
6. Had it removed by the dealer where you got your new appliance**. [DISPLAY ONLY IF C1= 1]**
7. Taken it to a dump or recycling center yourself [or with help from a friend or family member].
8. Had someone take it to a dump or recycling center [example: handyman or local waste management company]

[Read only if D4 = 2 and AGE > 15]
Used appliance dealers typically only buy appliances that are less than 15 years old and are in very good condition.

[Read only if D4 = 4]
Market research suggests many local charities (Goodwill or Vietnam Veterans of America) do not accept large appliances.

[Read only if D4 = 7]
Appliances can be difficult to move and transporting them requires a large vehicle.

D5. **[ASK ONLY IF D4= 2 or 4 or 7, OTHERWISE SKIP TO D7]** Considering this information, would you have **[READ IN ANSWER FROM D4]**, or would you have done something else?

1. Same thing as D4
2. Something else
98. Don't know
99. Refused

[IF D5= 1, 98, or 99, SKIP TO D7]

D6. What would you have done instead? **[READ LIST IF NECESSARY, Allow only one answer]**

1. Sold it to someone directly [example: friend, family member, Craigslist].
2. Sold it to a used appliance dealer
3. Given it away to someone for free
4. Given it away to charity organization [example: Goodwill or Vietnam Veterans of America]
5. Left it on the curb with a free sign
6. Had it removed by the dealer where you got your new appliance. **[DISPLAY ONLY IF C1= 1]**
7. Taken it to a dump or recycling center yourself [or with help from a friend or family member].
8. Had someone take it to a dump or recycling center [example: handyman or local waste management company]
9. Kept it

D7. What is the main reason you chose Ameren Missouri's program over these other options? **[DO NOT READ. RECORD ONLY ONE RESPONSE]**

1. Convenience/free pick-up service
2. Saving money/lowering my electric bill
3. Good for the environment/wanted to recycle/energy conservation
4. Incentive/rebate
5. Appliance giveaway contest
6. Other **[RECORD VERBATIM]**

-98. DON'T KNOW
-99. REFUSED

D8. Would you have recycled your **[APPLIANCE VAR]** through Ameren Missouri's program if the rebate amount had been lower?

1. Yes
2. No
3. Maybe

-98. Don't know
-99. Refused

[SKIP TO E1 IF D8=2]

D9. What if there was no rebate check at all?

1. Yes
2. No

-98. Don't know
-99. Refused

E. Program Awareness/Satisfaction

Now I'd like to ask you some general questions about the program and how it worked for you.

E1. How did you first learn about Ameren Missouri's appliance recycling program? **[DO NOT READ, PROMPT IF NECESSARY. CHECK ALL THAT APPLY AND RECORD VERBATIM.]**

1. Newspaper/Magazine/Print Media
2. Personal Energy Report
3. Bill Inserts
4. Door Hanger
5. Ameren Missouri website
6. Other website
7. Internet Advertising/Online Ad
8. Family/friends/word-of-mouth
9. Ameren Missouri Representative
10. Radio
11. TV
12. Billboard/outdoor adSporting event
13. Home Shows/Trade Shows/Community Event

14. Retailer/Store
15. Appliance Recycling Contractor
16. E-mail from Ameren Missouri
17. Direct Mail
18. Other **[RECORD VERBATUM]**
98. Don't Know
99. Refused

E2. What are the best ways for Ameren Missouri to inform you about energy-efficiency offerings like the appliance recycling program? **[DO NOT READ. PROMPT IF NECESSARY. RECORD UP TO THREE RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Personal Energy Report
3. Bill Inserts
4. Door Hanger
5. Ameren Missouri website
6. Other website
7. Internet Advertising/Online Ad
8. Family/friends/word-of-mouth
9. Ameren Missouri Representative
10. Radio
11. TV
12. Billboard/outdoor adSporting event
13. Home Shows/Trade Shows/Community Events
14. Retailer/Store
15. Appliance Recycling Contractor
16. E-mail from Ameren Missouri
17. Direct Mail
18. Text message from Ameren Missouri
19. Social media such as Facebook or Twitter
20. Other **[RECORD VERBATUM]**
98. Don't Know
99. Refused

E3. Was it easy to sign up for the program and schedule a pickup time?

1. Yes
2. No, **[SPECIFY]**
98. Don't Know
99. Refused

E4. Was the amount of time between when you signed up and when your appliance was picked up reasonable?

1. Yes
2. No, **[SPECIFY]**
98. Don't Know
99. Refused

E5. Was the program pick-up staff courteous and professional?

1. Yes
2. No, **[SPECIFY]**
98. Don't Know
99. Refused

E6. Did your rebate check arrive in the stated time period?

1. Yes
2. No, **[SPECIFY]**
98. Don't Know
99. Refused

E7. How satisfied are you with your experience with Ameren Missouri's appliance recycling program? Are you…**[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
-98. Don't know
-99. Refused

[SKIP TO QE9 If QE7 = 1, 2, 98, 99]

E8. What about the Program were you dissatisfied with? **[DO NOT READ; MARK ALL THAT APPLY]**

1. Rebate was too small.
2. Contractor never called me back.
3. Contractor never showed up/showed up late.
4. Contractor was unreliable/unprofessional.
5. Difficult to get an appointment time that was convenient for me.
6. Took too long for them to remove our **[APPLIANCE VAR].**
7. Other **[RECORD RESPONSE]** _____
-98. Don't know
-99. Refused

E9. How satisfied are you with your experience as an Ameren Missouri customer overall? Are you…**[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
-98. Don't know
-99. Refused

E10. Would you recommend the program to friends or family members?

1. Yes

2. No
-98. Don't know
-99. Refused

E11. What suggestions, if any, do you have for improving it?

_____ **[RECORD RESPONSE]**

F. Program Influence

F1. Since recycling your **[APPLIANCE VAR]**, have you participated in any other Ameren Missouri energy-efficiency programs?

1. Yes
2. No
-98. Don't know
-99. Refused

[SKIP TO QF4 If QF1 = 2, 98, 99]

F2. Which programs did you participate in? **[CHECK ALL THAT APPLY]**

1. LightSavers (standard CFLs, specialty CFLs, LEDs)
2. RebateSavers (programmable thermostats , water heaters and window A/C)
3. CoolSavers (HVAC replacement and tune-ups)
-98. Don't know
-99. Refused

F3. How influential was your experience with the recycling program on your decision to participate in another Ameren Missouri program? **[READ LIST]**

1. Very influential
2. Somewhat influential
3. Not very influential
4. Not at all influential
-98. Don't know
-99. Refused

F4. **[ASK IF F1<>1]** Based on your experience recycling your appliance, how likely are you to participate in another Ameren Missouri energy efficiency program? Would you say you are… **[READ LIST]**

1. More likely than before
2. Less likely than before
3. The same as before
-98. Don't Know
-99. Refused

F5. Since participating in the program, have you made any other energy-efficiency improvements or purchases without an incentive from Ameren Missouri?

1. Yes
2. No
-98. Don't know
-99. Refused

[SKIP TO QG1 If QF5 = 2, 98, 99]

F6. What actions did you take? **[DO NOT PROMPT, ALLOW MULTIPLE RESPONSES]**

1. Installed a high-efficiency washer
2. Installed a high-efficiency refrigerator
3. Installed a high-efficiency water heater
4. Installed CFLs [Compact Fluorescent Light bulbs or curly bulbs]
5. Installed LEDs
6. Purchased other ENERGY STAR products
7. Other [**RECORD RESPONSE**]_____
-98. DON'T KNOW
-99. REFUSED

F7. How influential was your participation in the recycling program on your decision to take this energy-efficiency action?

1. Very influential
2. Somewhat influential
3. Not very influential
4. Not at all influential
-98. DON'T KNOW
-99. REFUSED

G. Demographics

We have four final questions about you and your home.

G1. Do you own/rent your home?

1. Own
2. Rent

G2. If you rent, do you pay the electric bill or does your landlord?

1. I pay the electric bill
2. My landlord pays the electric bill

G3. What is your highest level of education?

1. Less than a high school degree
2. High school degree
3. Technical/trade school program
4. Associates degree or some college
5. Bachelors degree
6. Graduate / professional degree, e.g., J.D., MBA, MD, etc.
7. Professional certification, e.g., CPA, CNP, etc.

G4. What is your annual household income?

1. Less than $10,000
2. $10,000 – $14,999
3. $15,000 – $19,999
4. $20,000 – $29,999
5. $30,000 – $39,999
6. $40,000 –$49,999
7. $50,000 – $59,999
8. $60,000 – $74,999
9. $75,000 – $99,999
10. $100,000 – $124,999
11. $125,000 – $149,999
12. $150,000 - $199,,000
13. $200,000 or more
14. Prefer not to say

Thanks and terminate.

APPENDIX E. NON PARTICIPANT SURVEY INSTRUMENT

Screening Questions

ASNP1. Have you discarded a refrigerator or freezer since January 2012? By discard, we mean getting rid of it either by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center.

1. Yes, refrigerator(s)
2. Yes, freezer(s)
3. Yes, both appliances
4. No
98. Don't know
99. Refused

[SKIP MODULE if ASNP1= 4, 98, 99]

ASNP2. Did the appliance(s) work? [IF RESPONDENT IS UNSURE, SAY: "Even if it didn't get cold, did the appliance turn on when it was plugged in?"]

1. Yes
2. No
98. Don't know
99. Refused

[SKIP MODULE if ASNP2= 2, 98, 99]

ASNP3. Did you have the appliance(s) picked up through Ameren Missouri's appliance recycling program?

1. Yes
2. No
98. Don't know
99. Refused

[SKIP MODULE if ASNP3= 1]

ASNP4. Ameren Missouri offers an incentive to pick up and recycle old working refrigerators and freezers. A contractor would have picked the appliance up at your home and you would have been paid either $35 or $50 later in the mail. Are you sure your appliance wasn't picked up by Ameren?

1. Yes, I'm sure it wasn't picked up by the program or I received no incentive
2. No, I did get the incentive check
98. I still don't know for sure
99. Refused

[SKIP MODULE if ASNP4 = 2, 98, 99]

Non-Participant Awareness

ASNP5. Were you aware of the program prior to getting rid of your appliance?

1. Yes
2. No
3. DON'T KNOW
4. REFUSED

[IF ASNP5=1, ASK ASNP6, ELSE SKIP TO ASNP8]

ASNP6. How did you learn about the program? **[DO NOT READ LIST. RECORD UP TO 3 RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Personal Energy Report
3. Ameren Missouri website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Ameren Missouri Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Sporting event
12. Home Shows/Trade Shows/Community Event
13. Retailer/Store
14. Appliance Recycling Contractor
15. Other **[RECORD VERBATIM]**
16. Direct mail
98. DON'T KNOW
99. REFUSED

ASNP7. What made you decide not to have your appliance picked up through the program? **[DO NOT READ. RECORD UP TO THREE RESPONSES.]**

1. Unit didn't qualify
2. Did not know how to sign up
3. Was not able to schedule convenient pickup time
4. Too much hassle
5. Other **[RECORD VERBATUM]**
98. DON'T KNOW
99. REFUSED

ASNP8. What are the best ways for Ameren Missouri to inform you about energy-efficiency offerings like the appliance recycling program? **[DO NOT READ. PROMPT IF NECESSARY. RECORD UP TO THREE RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Personal Energy Report
3. Ameren Missouri website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Ameren Missouri Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Sporting event
12. Home Shows/Trade Shows/Community Events
13. Retailer/Store
14. Appliance Recycling Contractor
15. Email from Ameren Missouri
16. Text message from Ameren Missouri
17. Social media such as Facebook or Twitter
18. Direct mail
19. Other **[RECORD VERBATIM]**
98. DON'T KNOW
99. REFUSED

Appliance Characteristics

For the rest of the survey we would like to ask you about the appliance you discarded.

[IF MORE THAN ONE APPLIANCE DISCARDED, SAY:] If you discarded multiple appliances please answer the following questions about the appliance you got rid of **MOST** recently.

ASNP9. Did you get a new appliance to replace the one you got rid of?

1. Yes
2. No
98. Don't know
99. Refused

[IF ASNP9=1, ASK A.ASNP10. ELSE SKIP TO A.ASNP11]

ASNP10. Is this new appliance an ENERGY STAR or high efficiency model?

1. Yes
2. No
98. Don't know
99. Refused

ASNP11. How did you get rid of your old appliance? **[IF NEEDED, PROMPT: "For example, did you sell it or give it away?"]**

1. Sold it to someone directly [example: friend, family member, Craigslist].
2. Sold it to a used appliance dealer

3. Gave it away to someone for free
4. Gave it away to charity organization [example: Goodwill or Vietnam Veterans of America]
5. Left it on the curb with a free sign
6. Had it removed by the dealer where you got your new appliance**.**
7. Took it to a dump or recycling center yourself [or with help from a friend or family member].
8. Had someone take it to a dump or recycling center [example: handyman or local waste management company]
9. Kept it
10. Some other way **[RECORD VERBATIM]**
98. Don't know
99. Refused

ASNP12. At the time you discarded it, about how old was the appliance? **[RECORD AGE IN YEARS]**

98. Don't know
99. Refused

ASNP13. Where was the appliance located before you made the decision to get rid of it?

1. Kitchen
2. Garage
3. Porch/patio
4. Basement
5. Other **[SPECIFY]**

98. Don't know
99. Refused

ASNP14. How would you describe the condition of the appliance you disposed of? Would you say …? **[READ LIST, RECORD ONLY ONE RESPONSE.]**

1. It worked and was in good physical condition
2. It worked but needed minor repairs. [example: it would not defrost]
3. It did not work (example: turned on but did not cool)

98. Don't know
99. Refused

Thanks and terminate.

APPENDIX F. STAKEHOLDER INTERVIEW GUIDE

Respondent name:_____

Respondent phone: _____

Interview date: _____ Interviewer initials: _____

For the PY5, PY6 and PY7 evaluations, Cadmus will interview stakeholders bi-annually. The first interview (Wave 1) will focus on the program's launch and changes to the previous program design. The second interview (Wave 2) will assess the program at year end and identify recommendations for improving subsequent programs. In general, the first interview will focus more prospectively, while the second interview is more retrospective.

A. Introduction

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

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

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

B. Program Design and Implementation

3) How is communication, both formal and informal, between ARCA and Ameren conducted?

4) How does ARCA communicate with retailers?

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

6) Outside of the change in program scale (i.e. from the bridge year), where there any other changes to the program design between PY4 and PY5? If yes, what were they and what was the impetus for the change?

7) How did Ameren determine which measures to rebate?

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

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

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

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

720 SW Washington Street
Suite 400
Portland, OR 97205
Voice: 503.467.7100
Fax: 503.228.3696

12) What do you think have been the most influential program or market factors to attract program participation this year?

13) What program or market factors have you seen serve as a barrier to participation this year?

C. Program Goals

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

15) How are these goals determined?

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

17) How are these goals determined?

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

19) Why do you think this is?

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

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

D. Measures

22) In your opinion, should any additional measures be considered for inclusion in future programs? If so, what measures?

23) Conversely, should any current measures be excluded?

24) How were incentive amounts determined?

720 SW Washington Street
Suite 400
Portland, OR 97205
Voice: 503.467.7100
Fax: 503.228.3696

E. Marketing Efforts

25) In PY4, ARCA handled all the marketing. Is this the case in PY5 as well?

26) What kind of marketing have you done so far in PY5? How does this differ from previous program years?

27) We recognize that marketing methods are designed to work in concert and collectively encourage participation, but do you feel that any of these strategies have been particularly effective or ineffective so far?

28) Have you done any cross-marketing of any other Ameren Missouri program to ApplianceSavers participants?

F. Retail Channel

29) We understand the program is – or will soon be - working with local retailers to collect appliances. Who specifically are you working with? How is this going so far?

30) Have any retailers been unwilling to work with the program? Why do you think that is?

31) Is the program considering any other partners or stakeholders (e.g., EPA RAD)? If so, what roles would they likely play?

G. Quality Control

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

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

H. Customer Feedback

We know from past evaluations that ARCA surveys participants and provides Ameren with a sample of recorded communications with participants. Based on the results of these surveys, and based on your own knowledge:

34) Do you think your customers understand the energy-related benefits of the program?

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

36) Have customer drop-out or cancellation rates changed at all in PY5? What is the current drop-out rate?

720 SW Washington Street
Suite 400
Portland, OR 97205
Voice: 503.467.7100
Fax: 503.228.3696

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

I. Summary

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

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

40) Cadmus 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?

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

720 SW Washington Street
Suite 400
Portland, OR 97205
Voice: 503.467.7100
Fax: 503.228.3696

APPENDIX G. *EX POST* DEMAND REDUCTIONS

MMP 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 48. PY13 Summary: *Ex Post* Per-Unit Demand Reductions

Measure	PY13 Participation	Gross Per-Unit *Ex Post* Demand Reduction (kW)	*Ex Post* NTG	Line Loss Adjustment	Total Net *Ex Post* Savings (kW)*
Refrigerators	5,237	0.169	0.73	105.72%	684
Freezers	1,644	0.222	0.78	105.72%	301
Room Air Conditioners	23	0.107	0.74	105.72%	2
Dehumidifiers	48	0.144	0.74	105.72%	5
Total	**6,952**	**n/a**			**992**