Ameren Missouri Refrigerator Recycling Impact and Process Evaluation: Program Year 2014

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Nexant

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Executive Summary

Ameren Missouri (Ameren) engaged Cadmus and Nexant (the Cadmus team) to perform annual process and impact evaluations of the Refrigerator Recycling program for a three-year period from 2013 through 2015. This annual report covers the impact and process evaluation findings for Program Year 2014 (PY14), the period from January 1, 2014, through December 31, 2014.

Program Description

The Refrigerator Recycling program offers Ameren's residential customers a $50 incentive and free pickup service for recycling an operable refrigerator and stand-alone freezer manufactured before 2002 (up to a total of three per customer per year). Customers may also recycle a working room air conditioner or dehumidifier, along with a qualifying refrigerator or freezer. Incentives are not provided for air conditioners or dehumidifiers. The program is implemented by the Appliance Recycling Centers of America, Inc. (ARCA). In PY14, Ameren changed the name of the program from ApplianceSavers (used in PY13) to the Refrigerator Recycling program.

During PY14, the Refrigerator Recycling program recycled 8,988 appliances (6,978 refrigerators and 2,010 freezers). ARCA also collected a limited number of room air conditioners (41) and dehumidifiers (48). The scale of the program in PY14 was considerably larger than in PY13 (6,881=, and nearly achieved the program's peak collection efforts in PY11 (9,084).

Key Impact Evaluation Findings

As with previous evaluations, the Cadmus team estimated gross energy savings by combining PY14-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 PY14 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	1,007	70%
Freezers	1,429	867	61%

Similar to PY13, the two main reasons for the differences between the *ex ante (*which Ameren based on the PY10 evaluation) and PY14 *ex post* savings was the availability of additional metering data to support our analysis and the adoption of the Uniform Methods Project (UMP) Protocol. (The PY13 evaluation included significant details about the disparity.)

While the *ex ante* and *ex post* savings differ greatly, the PY14 *ex post* gross savings are nearly identical to the savings that Cadmus estimated as part of the previous three recycling evaluations (PY11 to PY13). As evident in Table 2, the per-unit *ex post* gross energy savings for refrigerators—the program's primary measure—has consistently been between 997 and 1,013 since PY11.

Table 2. Comparison of Per-Unit *Ex Post* Gross Energy Savings (kWh/Year)

Appliance	PY10	PY11	PY12	PY13	PY14
Refrigerators	1,440	997	1,011	1,013	1,007
Freezers	1,429	789	922	969	867

To estimate PY14 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 3 compares these *ex post* and *ex ante* values for the program's most common measures.

Table 3. *Ex Ante* and *Ex Post* Net-to-Gross Ratios

	Ex Ante	*Ex Post*			
Appliance	NTG	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG
Refrigerators	64%	35.9%	0%	6.5%	70.6%
Freezers		34.0%	0%		72.5%
Total	**64%**	**35.0%**	**0%**	**6.5%**	**71.5%**

We applied these NTG values to PY14 participation and *ex post* per-unit gross savings to calculate the program's net energy savings (Table 4).

Table 4. *Ex Post* Net Energy Savings

Appliance	PY14 Participants	Gross Per-Unit Energy Savings (kWh/Year)	NTG	Total Energy Savings (MWh/Year)
Refrigerators	6,978	1,007	70.6%	4,961
Freezers	2,010	867	72.5%	1,263
Room Air Conditioners	41	830	71.5%	24
Dehumidifiers	48	964	71.5%	33
Total	**9,077**	**n/a**	**71.0%**	**6,281**

*Due to very limited participation, we did not assess NTG for these measures separately. 71.5% represents the weighted average of the refrigerator and freezer NTGs.

As shown in Table 5, the program achieved 53% of its proposed net energy savings target for PY14 (11,950 MWh). The program achieved a greater percentage (73%) of the demand reduction target. Ameren's targets were codified in their residential tariff and approved by the Missouri Public Service Commission (MPSC).

Table 5. Refrigerator Recycling Net Savings Comparisons (PY14)

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)	11,950	12,932	8,850	6,281	53%
Demand (kW)	1,664	1,677	1,698	1,207	73%

[1] http://www.ameren.com/-/media/missouri-site/Files/Rates/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 PY14 Refrigerator Recycling 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 nearly two thirds of respondents said they were more likely to participate in another Ameren energy-efficiency program as a result of their experience with Refrigerator Recycling.

Ameren and ARCA stimulated greater participation later in PY14 (particularly in August and November) through increased, targeted marketing efforts and a shift toward clearer program branding (i.e., dropping the name "ApplianceSavers") but fell short of the annual participation and energy savings target.

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 Refrigerator Recycling in PY14. 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 Refrigerator Recycling program. ARCA also opened a dedicated phone center (which reduced customer wait times) and a local decommissioning center (which improved the efficiency of pick-up routes). Both improvements contributed to the program's continued high satisfaction levels.

Conclusion 2. The program is not reaching its participation goals despite rebranding improvements and more efficient marketing expenditures.

> **Recommendation. Continue the targeted marketing efforts initiated in PY14, as well as research into how to get Refrigerator Recycling participant to enroll in other programs.** Similar to PY13, we recommend considering additional incentives for participating in other programs (such as Home Energy Analysis, which offers a range of energy-saving measures) that will leverage the participants' recent and positive experience with Refrigerator Recycling and make them more likely to take additional energy-efficiency actions.

Cadmus also examined the actions taken on the PY13 evaluation's recommendations to track their implementation status. These findings are presented in Table 6.

Table 6. PY13 Evaluation Recommendation Tracking

PY13 Recommendation	Cadmus Findings	Explanation
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.	Partially Implemented	To reach the Refrigerator Recycling program's own goals, Ameren did not re-allocate its budget to promote participation in other programs. However, cross-marketing opportunities were implemented including program information being included with rebate checks for the HVAC program, and partnering with APT to display and maintain Refrigerator Recycling program materials in retailers participating in the Efficient Products program. Program information for the Lighting program and the HVAC program were also included with rebate checks for the Refrigerator Recycling program.
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.	Not Implemented	Ameren did not implement this recommendation due to concerns regarding installation rates for unsolicited kits that were not directly installed, and their desire to prioritize program funds on marketing and collecting refrigerator and freezer units to attain the Refrigerator Recycling program goal.
Recommendation 2. Monitor reaction to the Energy Hog marketing materials and, when developing new marketing materials, emphasize creativity to enhance appeal. [. . .] We recommend that Ameren consider each:	Partially Implemented (See Below):	Ameren implemented Google AdWords and Pandora marketing. The Fill-A-Fridge Campaign was not implemented. Due to the feedback Ameren received mentioning that the campaign did not lead to a quantifiable spike in participation, and to the logistical obstacles to execute and manage such a program, Ameren decided not to implement this recommendation.
Google AdWords.	Implemented	
Pandora	Implemented	
Fill-A-Fridge Campaign	Not Implemented	

Introduction

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Program Description

Through its Refrigerator Recycling 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 the Refrigerator Recycling program 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.

Program Activity

In PY14, Ameren changed the name of the program from ApplianceSavers (used in PY13) to the Refrigerator Recycling program. During PY14, the Refrigerator Recycling program recycled 8,988 appliances (6,978 refrigerators and 2,010 freezers). As in previous years, the majority of the units recycled (78%) were refrigerators. Through the program, some room air conditioners (41) and dehumidifiers (48) were also collected by ARCA. This was the second year those measures were eligible.

Table 7. Program Participation (PY14)

Appliance	Units	Percentage of Participation
Refrigerators	6,978	78%
Freezers	2,010	23%
Total	8,988	100%

[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.

The scale of PY14 was considerably larger than PY13, and just slightly less than that of PY11 (9,084), the program's most successful year. Table 8 and Figure 1 summarize Ameren's historical appliance recycling activity. As shown, Ameren has recycled more than 27,000 appliances since the program launched in late 2010.

Table 8. Historical Program Participation (PY10-PY14)

Appliance	PY10*	PY11	PY12	PY13	PY14	Total
Refrigerators	518	6,978	2,186	5,237	6,978	21,379
Freezers	186	2,106	784	1,644	2,010	6,544
Total	704	9,084	2,970	6,881	8,988	27,923

*Only two months long.

Figure 1. Historical Program Participation (PY10-PY14)

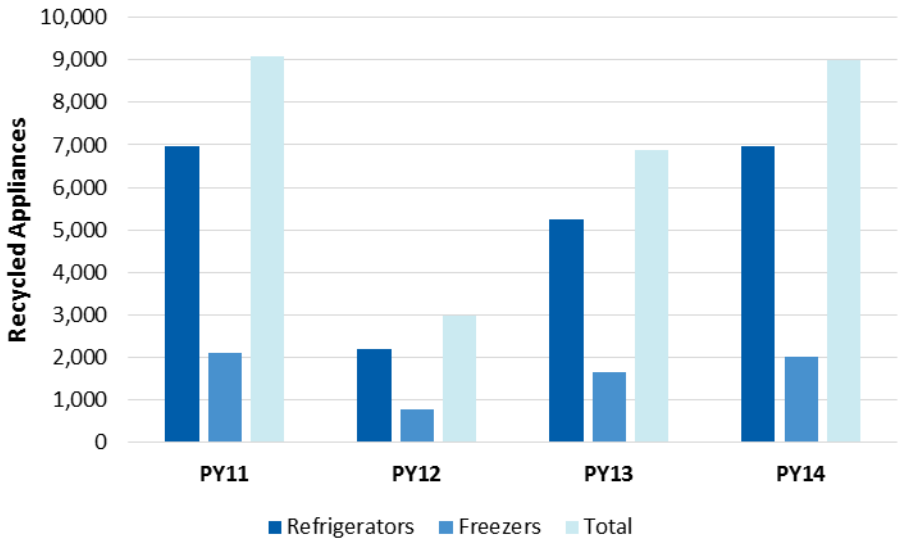


Figure 2 shows PY14 program participation by month. Participation for both appliance types was highest in August, with another peak in November.

Figure 2. PY14 Program Participation by Month

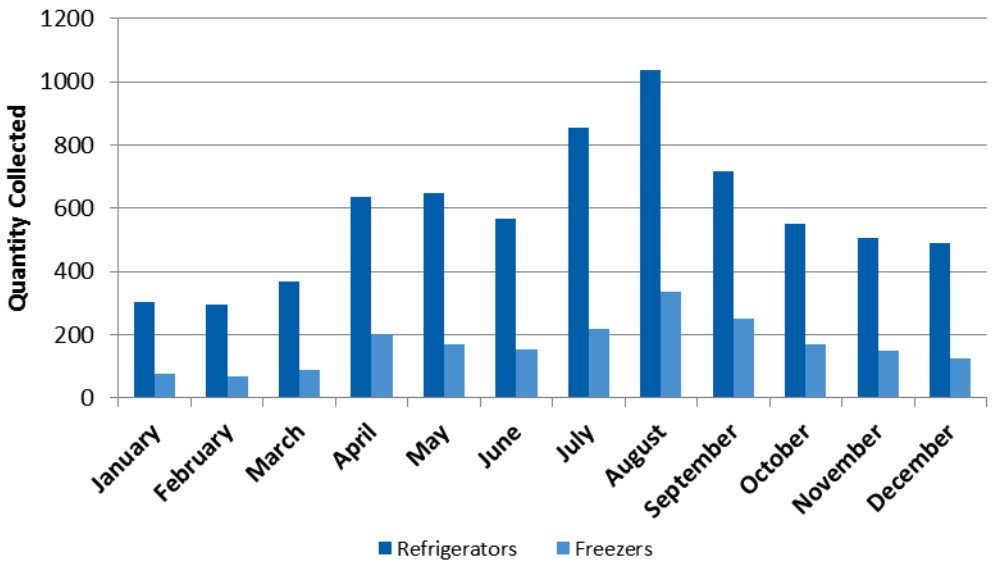
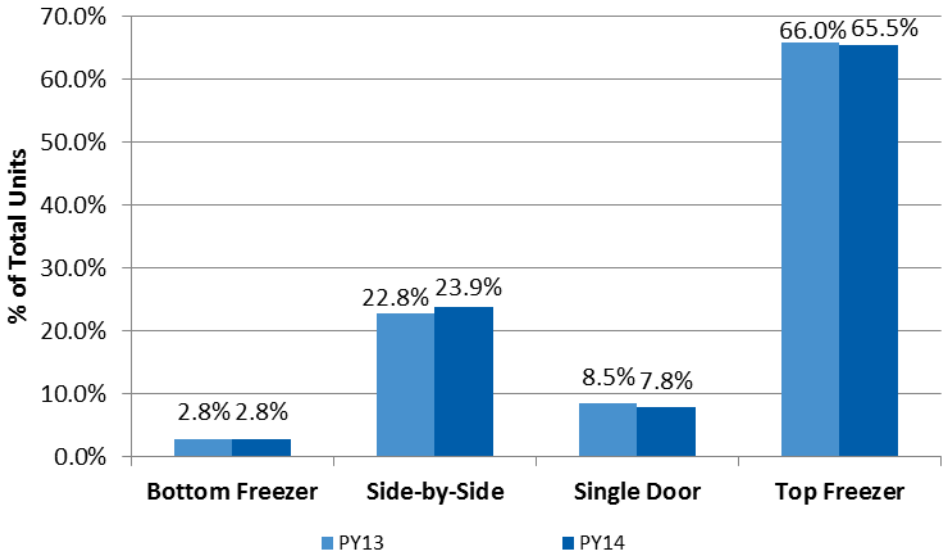


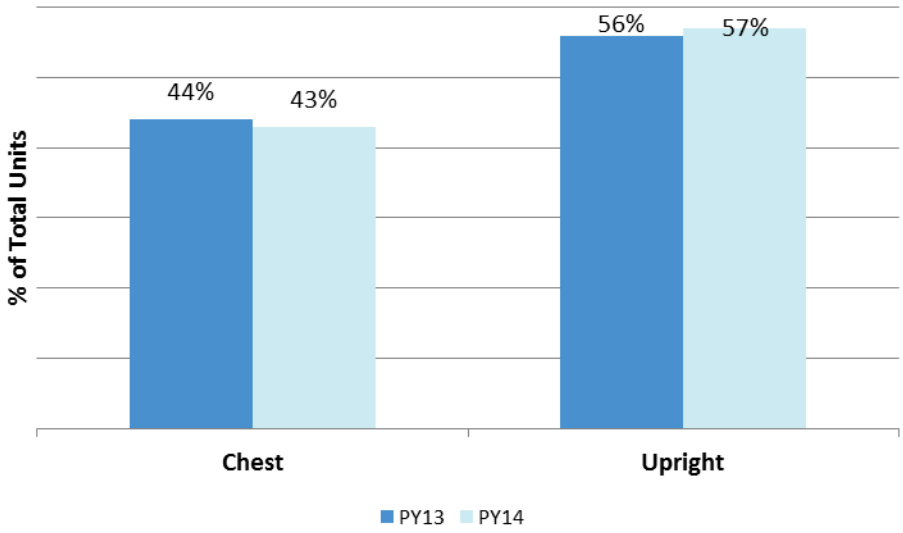
Figure 3 presents the distribution of refrigerator configurations recycled in PY14, and compares it to that of PY13. The distribution of refrigerator configurations in PY14 was nearly identical to PY13. As in PY13, the majority of recycled refrigerators were top-freezer models. This distribution of refrigerator type is typical for mature recycling programs.

Figure 3. PY13 vs. PY14 Refrigerator Configurations



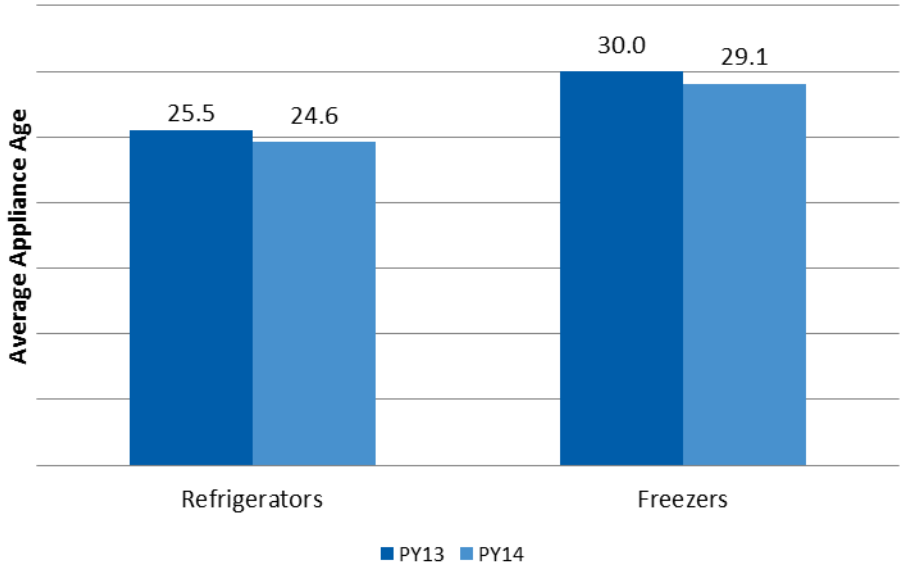
The distribution of freezer configurations (Figure 4) did not change significantly in PY14.

Figure 4. PY13 vs. PY14 Freezer Configurations



The average ages of both appliance types decreased in PY14 (Figure 5). Again, the decreasing average age of appliances recycled through the program is typical for maturing appliance recycling programs.

Figure 5. Comparison of Average Ages (Years Old), PY13 and PY14



Evaluation Methodology

The Cadmus team used the U.S. Department of Energy's (DOE) Uniform Methods Project (UMP) evaluation protocol to evaluate the Refrigerator Recycling program in PY14. This is the same approach we used to evaluate the program in PY13.

Uniform Methods Project

In 2011, the 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.

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 PY14.

Impact Evaluation Priorities

- Determining the gross and net energy savings generated from participating appliances;
- Tracking trends by comparing the PY14 average gross energy savings and other key program and evaluation metrics from previous evaluations;
- Investigating—in the program's absence—the percentage of participating appliances that would have remained active on Ameren 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

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

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

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

Table 9 lists our evaluation activities and a brief explanation of the purpose of each activity. Following the table are overviews of each activity.

Table 9. PY14 Process and Impact Evaluation Activities and Rationale

Evaluation Activity	Process	Impact	Rationale
Interview Stakeholders	•		Obtain information and insights into program design and delivery.
Survey Participants	•	•	Verify measure installation; collect data to inform the net-to-gross ratio; collect process-related data.
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.

Stakeholder Interviews

In November 2014, the Cadmus team interviewed two groups of program stakeholders: Ameren's internal implementation program managers and several members of ARCA's team, including the day-to-day project manager, account manager, information technology lead, and business development lead.

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, particularly regarding changes since PY13;
- Offering pick-up services through retailers;
- Participation goals; and

- Marketing.

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

Participant Surveys

In December of PY14, the Cadmus team conducted a participant survey of 200 randomly selected participants. These surveys were administered between December 8th, 2014, and December 10th, 2014. Of those surveyed, 158 participants recycled refrigerators and 42 recycled freezers. Due to the small sample for freezers, Cadmus chose to increase the reliability of the freezer-specific results by combining PY14 freezer survey responses with those from PY13, increasing the number of freezer survey participants to 86. Together, these samples yielded survey findings that met these minimums:

- 90% confidence and 6.63% absolute precision for refrigerators; and
- 90% confidence and 8.87% absolute precision for freezers.

Across appliance types, our survey findings have a minimum of 90% confidence and 5.31% 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 G.

Survey Timing

Survey results may be influenced by the time elapsed between a participant's engagement with a program and a survey's administration. Logic implies that a participant's memory will be more accurate (i.e., greater recall) closer to the time of participation and less accurate (i.e., recall bias) further from the time of participation. With greater recall, survey results more accurately reflect a participant's experience with a program and installation activities.

However, allowing greater elapsed time between program participation and survey administration enhances a study's ability to capture installations over time, measure retention, and estimate spillover. Insufficient evidence exists indicating whether recall bias systematically increases or decreases free ridership estimates.

Optimally, participant surveys would be administered immediately after participation to capture greater recall and further from the time of participation to capture later installations, retention, and spillover[4]. Conducting multiple participant surveys, however, is constrained by program and evaluation timelines as well as budget considerations.

In PY14, the Cadmus team completed surveys in a single wave, with surveys administered in late fall. This allowed us to include the greatest number of PY14 participants in our sample, ensuring our findings reflected programmatic changes that occurred over the course of the year and appropriately balancing the impact of recall bias with respondents' ability to address measure retention and spillover.

Impact Analysis (Gross and Net)

Our impact analysis for PY14 mirrored our analysis from the evaluation we conducted in PY13. 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 originally created for PY12 evaluation to estimate freezer UECs.

Similar to our previous evaluations, the UMP model we used in PY14 relied on an aggregated *in situ* metering dataset[5] consisting of approximately 564 appliances metered during five recent California and Michigan evaluations.[6]

Cost-Effectiveness Analysis

Using the final PY14 Refrigerator Recycling participation data, implementation data, the *ex post* gross savings estimates, and the *ex post* net savings estimates (presented in this report) with the DSMore[7] 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 (TRC) test
- Utility Cost Test (UCT)
- Societal Cost Test

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4 Violette, M., and Rathbun, P. "Estimating Net Savings: Common Practices." The Uniform Methods Project. National Renewable Energy Laboratory. 2014.

5 *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.

6 Southern California Edison, Pacific Gas & Electric, San Diego Gas & Electric, DTE Energy, and Consumers Energy.

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

- Participant Cost Test (PART)
- Ratepayer Impact Measure (RIM) test

Impact CSR

According to the Missouri Code of State Regulations (CSR), demand-side programs that are part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria. Specifically, the CSR requires that impact evaluations of demand-side programs satisfy the requirements noted in Table 10. The table indicates the data our team used to satisfy these impact CSR evaluation requirements for the Refrigerator Recycling program. We provide a summary of the process CSR requirements in Table 14 at the end of the Process Evaluation section.

Table 10. Summary Responses to CSR Impact Evaluation Requirements

CSR Requirement	Method Used	Description of Program Method
Approach: The evaluation must use one or both of the following comparisons to determine the program impact:		
Comparisons of pre-adoption and post-adoption loads of program participants, corrected for the effects of weather and other intertemporal differences	X	The program compares the estimated pre-participation load based on the characteristics of recycled appliances, usage data from surveys, weather, and participants' self-reported alternative disposal methods, with the estimated post-participation load based upon these same data given that the appliance was taken off the grid by the program.
Comparisons between program participants' loads and those of an appropriate control group over the same time period		
Data: The evaluation must use one or more of the following types of data to assess program impact:		
Monthly billing data		
Hourly load data		
Load research data		
End-use load metered data	x	Cadmus used yearly energy consumption data from 563 appliances metered in DTE, Consumer's Energy, PGE, SCE, and SDGE service territories to model annual unit energy consumption as a function of each unit's age and configuration and Ameren PY14 average part-use and appliance location (conditioned or unconditioned space).
Building and equipment simulation models		
Survey responses	x	Cadmus surveyed PY14 RRP program participants to determine average part-use, freeridership, and secondary market impacts.
Audit and survey data on:		
Equipment type/size efficiency	x	Evaluation team received the age and configuration of all appliances recycled through the program from ARCA and used this data in combination with the survey results (see above) to determine unit energy consumption and gross and net savings.
Household or business characteristics		
Energy-related building characteristics		

Process Evaluation

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

Stakeholder Interview Findings

Our interviews with two groups of Refrigerator Recycling stakeholders (two from Ameren and four from ARCA) provided insight into PY14 implementation, as well as the future of the program.

Program Design

According to stakeholders, the program design was largely unchanged in PY14 after several changes to incentives and eligibility requirements were made in PY13.

It is important to note however that Ameren did revert the program name to the Refrigerator Recycling Program. In PY13 Ameren used ApplianceSavers, which was part of a larger rebranding effort by Ameren with the goal of unifying the residential programs through a common naming convention.

Although name changes can hurt marketing continuity, and in turn participation, both Ameren and ARCA said the change was positive and believed it had little effect on participation. They cited that since the program was previously called Refrigerator Recycling, the change was less impactful than it otherwise might have been. They also noted that the clarity and simplicity of the current name allowed interested customers to quickly identify the program.

Offering Pick-Up Services Through Retailers

Similar to PY13, a very small percentage of the program's total participation came through the retail channel. Specifically, Ameren estimated only 5 to 10 units per month. However, the channel does provide some benefits by allowing 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.

Stakeholders did note that Ameren leverages CLEAResult, the Lighting and Efficient Products implementer, circuit riders presence in retail stores to efficiently deliver recycling program related promotion materials to appliance department staff.

Implementation Improvements

In PY14, ARCA and Ameren made two important changes to the program's infrastructure that improved the participant's experience.

First, in July 2014 ARCA opened a local decommissioning facility. (Previously ARCA shipped the units to a similar facility in Springfield, Illinois.) Having a closer decommissioning facility allowed ARCA to develop more efficient pick-up routes, better accommodate customers in need of flexibility, and generally reduce the time between a customer's first contact with the program and their pick-up appointment. To ensure the new facility's success, ARCA assigned an experienced facility manager to oversee its

operation. Stakeholders noted that the new facility yielded also economic benefits in the form of local job creation.

Second, prior to PY14 ARCA answered calls from prospective Ameren participants using call center staff that served multiple utility clients. However, in PY14, ARCA established a dedicated set of call center staff that took all of Ameren-related calls. Accordingly to stakeholders, this change reduced customer wait time (now less than 10 seconds) and improved call center familiarity with Ameren's program and customers.

Marketing

At the end of PY13, Ameren and ARCA shifted away from the ApplianceSavers-specific marketing, which both stakeholder groups described as busy and wordy. With the name change officially occurring this year, stakeholders said the movement toward simpler and clearer marketing continued. Specifically, marketing materials increasingly relied on simple block text, green coloring to associate with environmental benefits, and placed a greater focus on the program's incentive.

Stakeholders also noted the program employed a more targeted marketing approach in PY14 that leveraged customer propensity scores developed by Shelton. According to stakeholders, Shelton identified 200,000 of Ameren's approximately 1.2M residential customers that exhibit a propensity to participate in the recycling program.

The program also started analyzing previous Recycling Program participants to understand which customer segments were enrolling in the program. Through this research stakeholders learned that middle income customers were most likely to participate and that this customer segment should be the focus of direct marketing efforts. The research also revealed that higher income customer were largely unwilling to part with their secondary unit, regardless of the incentive, as they often have the space to store it and require the additional refrigerator/freezer to support their lifestyle.

In addition, Ameren noted improvements to the organization of the Act on Energy website that allowed customers to more directly connect with the programs that most interest them.

Communication

As true in previously evaluations, all stakeholders said communications between Ameren and ARCA were conducted weekly and effectively.

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 PY14. In fact, no respondents reported being dissatisfied with the program, and only one respondent said they would not recommend

the program to friends or family members. This high level of participant satisfaction for PY14 is in line with participant responses from PY13, PY12, and PY11, when over 98% were satisfied or somewhat satisfied with their program experience.

Marketing

Table 11 shows the sources through which participants became aware of the program (multiple responses were allowed). In PY14, the leading source of information for the program was bill inserts (35%), the second most-cited source was direct mail (32%), and the third most-cited source was word-of-mouth (22%). These results are similar to PY13, when the leading source of information for program awareness was bill inserts (38%), and the second most-cited source was word-of-mouth (27%).

Table 11. PY14 Program Awareness

Type of Marketing	Percent Responding
Bill Inserts/Contact	35%
Direct Mail	32%
Family/Friends/Word of Mouth	22%
Television	12%
Newspaper/Magazine/Print	7%
Internet Advertising/Online Ad	6%
Radio	4%
Ameren Missouri Website	4%
Other Website	4%
Appliance Retailer	3%
Ameren Missouri Representative	2%
Billboard/Outdoor	1%

Reason and Timing for Recycling

As shown in Table 12, the survey responses indicate that the program's financial incentive (the rebate, which was mentioned by 34%) and the convenience of free appliance pick-up (mentioned by 33%) were the main factors influencing participants' decisions to recycle their appliance with Ameren when they did. The financial incentive was less of an influence than in PY13, when 37% mentioned it.

Over half (65%) 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 12. PY14 Main Reason for Choosing Program

Reason Cited	Refrigerator		Freezer		Total	
	n	Percent Responding	n	Percent Responding	n	Percent Responding
Program incentive	52	35%	28	32%	80	34%
Convenience / Free pick-up	50	34%	27	31%	77	33%
Energy conservation / Good for the environment	18	12%	14	16%	32	14%
Other	28	19%	18	21%	46	20%
Total	**148**	**100%**	**87**	**100%**	**235**	**100%**

Appliance Location

The location of an appliance in the home is a factor in energy consumption. In PY14, the typical locations of participant refrigerators and freezers (shown in Table 13) were very similar to those reported in PY13.

Table 13. PY14 Location of Recycled Appliance

Location	Refrigerator		Freezer		Total	
	n	Percent Responding	n	Percent Responding	n	Percent Responding
Kitchen	59	37%	4	4%	63	26%
Garage	43	27%	19	21%	62	25%
Porch/patio	1	1%	1	1%	2	1%
Basement	50	32%	58	65%	108	44%
Other*	5	3%	7	8%	12	5%
Total	**158**	**100%**	**89**	**100%**	**247**	**100%**

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

CSR Summary

As previously mentioned, the Missouri CSR,[8] requires that demand-side programs that are part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria. Process evaluations must address, at a minimum, the five questions listed in Table 14. The table provides a summary response for each specified CSR process requirement, taken from both this year's evaluation and the prior year. We previously offered a summary of the data used to meet with impact CSR requirements in Table 10.

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

Table 14: Summary Responses to CSR Process Evaluation Requirements

CSR 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, misconceptions regarding the market for used appliances or costs associated with appliance disposal, 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), age, part-use, or aesthetic condition.
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. The program continued this practice in PY14. As recommended in PY13, the program could also provide energy-efficiency kits (including CFLs and other easy-to-install measures) to achieve deeper savings and encourage 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, which makes the program convenient for participants. Participants consistently express 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?	In PY13 Cadmus suggested that customer acceptance and awareness of appliance operating costs could potentially be increased through additional online advertising (such as Google AdWords or Pandora targeted ads) and earned media (through partnerships with local non-profit organizations). In PY14 Ameren implemented the advertising recommended by Cadmus, but there is still an opportunity to increase awareness through earned media in PY15.

Gross Impact Evaluation 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. This section focuses exclusively on refrigerators and freezers, the program's primary measures. Information about the gross savings of dehumidifiers and freezers is provided in Appendix E.

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 15 shows the UMP model specifications used to estimate a PY14 refrigerator's annual energy consumption and its estimated parameters.

Table 15. 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 16 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 16. 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 PY14 program database. Table 17 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 International Airport weather station.

Table 17. PY14 Participant Mean Explanatory Variables

Appliance	Independent Variables	PY14 Mean Value or Proportion
Refrigerator	Age (years)	24.60
	Dummy: Manufactured pre 1990s	0.44
	Size (cubic feet)	18.93
	Dummy: Single Door	0.08
	Dummy: Side-by-Side	0.24
	Dummy: Primary	0.37
	Interaction: Unconditioned Space x HDDs	3.57
	Interaction: Unconditioned Space x CDDs	1.18
Freezer	Age (years)	29.05
	Dummy: Unit Manufactured Pre-1990	0.65
	Size (cubic feet)	15.64
	Dummy: Chest Freezer	0.43
	Interaction: Unconditioned Space x HDDs	3.02
	Interaction: Unconditioned Space x CDDs	1.00

Using values from Table 15, Table 16, and Table 17, we estimated the UEC of the average refrigerator and freezer recycled by participants in Refrigerator Recycling in PY14. An example of the calculation (for freezers) follows:

$$\begin{aligned} Freezer\ UEC = {} & 365.25\ days \\ & * (-0.8918 + 0.0384 * [29.05\ years\ old] + 0.6952 \\ & * [65\%\ units\ manufactured\ pre - 1990] + 0.1287 * [15.64\ ft.^3] + 0.3503 \\ & * [43\%\ units\ that\ are\ chest\ freezers] - 0.0313 * [3.02\ Unconditioned\ HDDs] \\ & + .0695(1.00\ Unconditioned\ CDDs) = 1{,}028\ kWh \end{aligned}$$

Unit Energy Consumption

Table 18 shows the average per-unit UEC that the Cadmus team calculated for refrigerators and freezers, both of which are slightly lower than PY13. This decrease in UEC is the result of subtle changes in the PY14 participant profile relative to last year.

Table 18. Average UEC by Appliance Type (PY14)

Appliance	Average Unit Energy Consumption (kWh/Year)	Standard Error	Relative Precision (90% Confidence)
Refrigerator	1,157	6%	9.5%
Freezer	1,028	5%	17.6%

When we benchmarked the estimated Refrigerator Recycling PY14 UEC with the evaluated UECs for other programs (Table 19), we determined that Ameren's savings were within the expected range.

Table 19. Benchmarking: Average Program UECs

Utility (Year)	Years Implemented	Average UEC (kWh/Year)	
		Refrigerator	Freezer
Ameren Missouri (PY14)	4.5	1,157	1,028
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 PY14.

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 5.3 for secondary refrigerators and 4.7 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.

These three steps resulted in the following information about how refrigerators and freezers were operated prior to recycling (Table 20).

Table 20. Part-Use Factors by Category

Usage Type and 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 = 96**					
Not in Use	7%	0.00	-			
Used Part Time	18%	0.44	505			
Used Full Time	75%	1.00	1,157			
Weighted Average	100%	0.83	957			
All Units (Primary and Secondary)	**n = 155**			**n = 88**		
Not in Use	5%	0.00	-	8%	0.00	-
Used Part Time	11%	0.44	505	13%	0.39	397
Used Full Time	85%	1.00	1,157	80%	1.00	1,028
Weighted Average	100%	0.89	1,034	100%	0.84	867

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 the program), 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 the Refrigerator Recycling program because the future usage of that appliance would be determined by another customer.)

We then combined the historically based part-use factors in Table 20 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 21, produces the program's part-use factor for refrigerators (0.87) and freezers (0.84) in PY14.[9]

Table 21. PY14 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	1%		
	Kept (as secondary unit)	0.83	13%		
	Discarded	0.89	23%		
Secondary	Kept	0.83	31%	0.84	42%
	Discarded	0.89	32%	0.84	58%
Overall			**0.87**	**100%**	**0.84**

As shown in Table 22, the part-use factor for refrigerators rose by 1% in PY14, but the part-use factor for freezers fell to 0.84, which was similar to PY12.

Table 22. Part-Use Factors: PY11– PY14

Appliance	PY12	PY13	PY14
Refrigerators	0.86	0.86	0.87
Freezers	0.86	0.90	0.84

The PY14 part-use estimate for refrigerators is similar to the part-use factors determined for other evaluated programs.

[9] Since the future usage type of discarded refrigerators is unknown, the Cadmus team applied the weighted part-use average of all units (0.89) 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 23. Benchmarking: Part-Use

State or Utility	Years Implemented	Part-Use	
		Refrigerators	Freezers
Ameren Missouri (PY14)	4.5	0.87	0.84
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 24, the Cadmus team provides estimates of average PY14 per-unit evaluated (or *ex post*) gross energy savings after adjusting the determined UECs to account for part-use.

Table 24. Per-Unit PY14 Gross Energy Savings

Appliance	UEC (kWh/Year)	Part-Use Factors	Gross Energy Savings (kWh/Year)	Relative Precision (90% confidence)*
Refrigerators	1,157	0.87	1,007	11.2%
Freezers	1,028	0.84	867	20.5%

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

Table 25 lists the program's total *ex post* gross energy savings, calculated using the per-unit gross savings shown in the previous table and PY14 participation.

Table 25. Total PY14 Gross Energy Savings

Appliance	Per Unit Gross Energy Savings (MWh/Year)	PY14 Participation	Total Program Gross Savings (MWh/Year)
Refrigerator	1.007	6,978	7,027
Freezer	0.867	2,010	1,743
Total		**8,988**	**8,770**

Replacement

In most cases, the per-unit gross energy savings attributable to the Refrigerator Recycling program 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 the program 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 the program.

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 Ameren 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 Evaluation 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 PY14 participants and information gathered from interviewed market actors as part of previous Ameren evaluations—presents all of the program's possible savings scenarios. We used a weighted average of these scenarios to calculate the net savings attributable to the Refrigerator Recycling program. 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 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 26). The percentage of respondents who had considered disposing of their recycled appliance before hearing about the program did not change significantly from PY13 for refrigerators (72%) or freezers (70%).

Table 26. Pre-Program Intentions

Had Considered Disposing Recycled Appliance Prior to Hearing about Refrigerator Recycling	Indicative of Free Ridership	Refrigerators (n=151)	Freezers (n=85)
Yes	Varies by Discard Method	71%	72%
No	No	29%	28%
Total		**100%**	**100%**

Next, we asked the remaining participants (those who had at least considered discarding the existing appliance before learning about the program) 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 Refrigerator Recycling. 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 previous interviews with local market actors, 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 the Refrigerator Recycling program, we calculated the percentage of refrigerators and freezers that would have been kept or discarded (Table 27).

Table 27. Final Distribution of Kept and Discarded Appliance

Stated Action Absent Program	Indicative of Free Ridership	Refrigerators (n=154)	Freezers (n=86)
Kept*	No	47%	43.0%
Discarded	Varies by Discard Method	53%	57.0%
Total		**100%**	**100%**

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

As evident in Table 28, the percentage of Ameren participants (in all program years) who stated they would have kept their appliance in the absence of the Refrigerator Recycling program is considerably higher than the benchmarked programs. The percentage of participants self-reporting that they would have kept their refrigerators independent of the program increased to 47% in PY14 (from 40% in PY13).

Table 28. Benchmarking: Keep/Discard Scenarios

Utility	Years Implemented	Percentage Likely To Have Been Kept Independent of the Program	
		Refrigerators	Freezers
Ameren Missouri (PY14)	4.5	47%	43%
Ameren Missouri (PY13)	3.5	40%	43%
Ameren Missouri (PY12)	2.5	67%	46%
Ameren Missouri (PY11)	1.5	52%	54%
Northwest 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 the 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 29.

Table 29. Details of Discard Scenarios

Stated Method of Disposal Absent Program	Indicative of Free Ridership	Refrigerators (n=84)	Freezers (n=50)
Sold it to someone directly	No	23%	22%
Sold it to a used appliance dealer	No*	2%	0%
Given it away to someone for free	No	24%	22%
Given it away to charity organization	No	10%	20%
Left it on the curb with a free sign	No	1%	4%
Had it removed by the dealer where you got your new appliance	No	6%	10%
Taken it to a dump or recycling center yourself	Varies by appliance age**	14%	8%
Had someone take it to the dump or recycling center	Yes	20%	14%
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 the Refrigerator Recycling program. 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 the program's 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.[10]

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.[11] 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 6 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 D.) As evident in the figure, accounting for market effects results in three savings scenarios:

- Full savings (per-unit gross savings);

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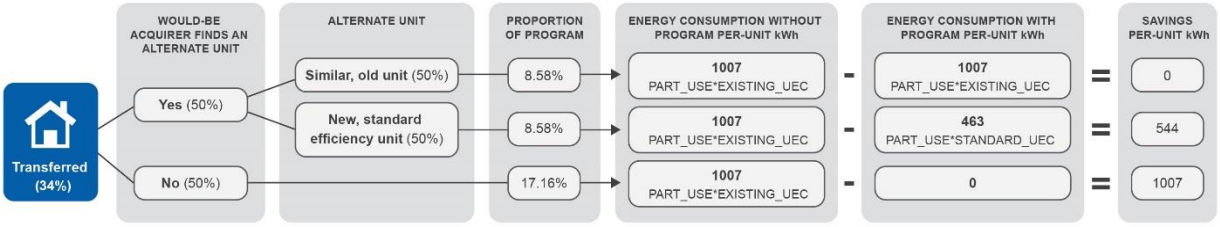
[10] Some evaluators have employed a bottom-up approach that centers on identifying and surveying recent acquirers of non-program used appliances and asking these acquirers what they would have done had the specific used appliance they acquired not been available. While this approach results in quantitative 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.

[11] 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).

- 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).

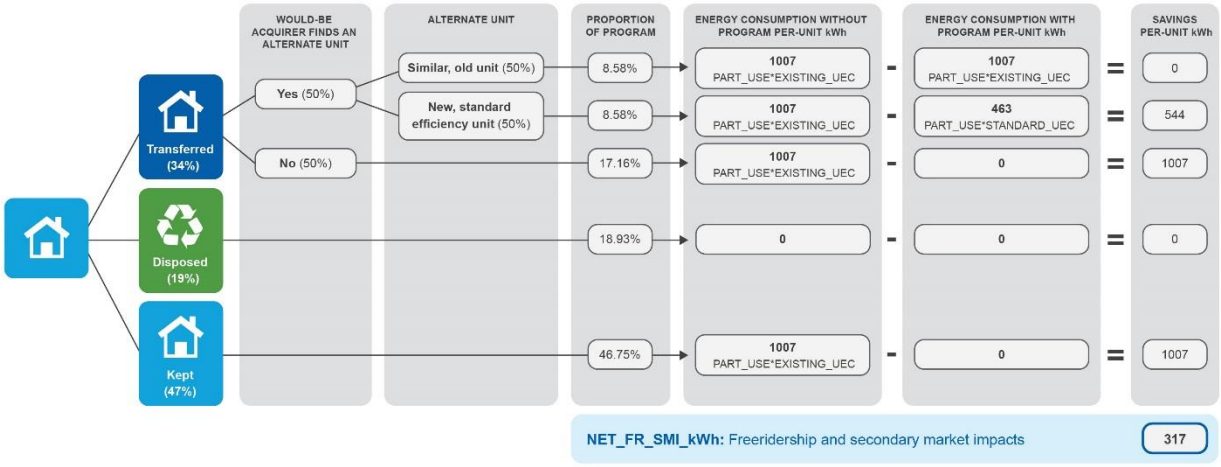
Figure 6. Secondary Market Impacts: Refrigerators



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 7 shows how these values are integrated into a combined estimate of savings net of free ridership and secondary market impacts.

Figure 7. 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 the Refrigerator Recycling program does not necessarily indicate induced replacement.

The Cadmus team relied on information from the PY14 participant surveys to determine if any of the replacement refrigerators and freezers acquired were induced by the Ameren's program. First, we determined the total number of replacements—induced or otherwise. As Table 30 shows, 70% of participants replaced their refrigerators and 34% replaced their freezers.

Table 30. PY14 Replacement Rates

Replacement Scenario	Refrigerators	Freezers
No replacement	30%	66%
Replaced with high efficiency used appliance	11%	1%
Replaced with standard efficient used appliance	5%	1%
Replaced with high efficient new appliance	50%	29%
Replaced with standard efficient new appliance	3%	3%
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 Refrigerator Recycling 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 Refrigerator Recycling. 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 PY14 process evaluation, 33% of program participants cited convenience as the primary reason for participation (Table 12). 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 PY14, we determined that 15% of the 110 replaced refrigerators and 8% of the 12 replaced freezers replacements were induced by the program. This means that the program induced 10% of total refrigerator participants and 3% of total freezer participants to purchase a unit they otherwise would not have (Table 31).

Table 31. PY14: Induced Replacement Rates

Appliance	Induced Replacement Rates
Refrigerator	10%
Freezer	3%

In PY12 and PY13, Ameren refrigerators had a higher rate of induced replacement than in two recent evaluations in the Pacific Northwest. In PY14, refrigerator induced replacement increased to 10%, which is higher than the benchmarked rates but the midpoint of the previous two Ameren evaluations. The induced replacement rate for freezers (3%), however, is similar to the benchmarked programs.

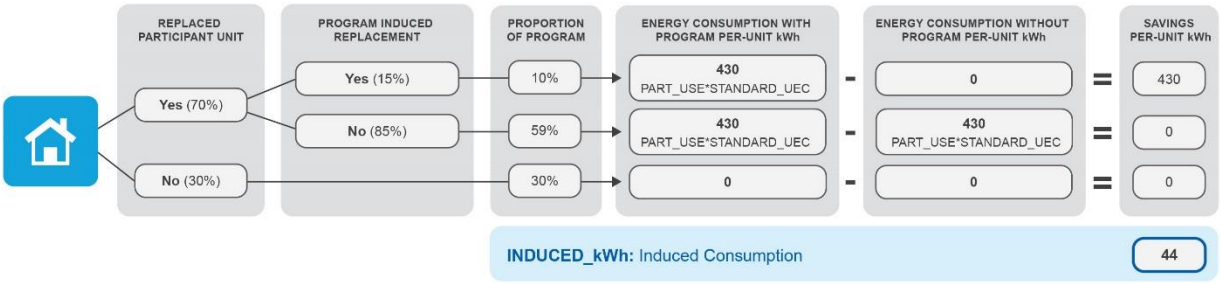
Table 32. Benchmarking: Induced Replacement Rates

Utility	Years Implemented	Induced Replacement Rates	
		Refrigerator	Freezer
Ameren Missouri (PY14)	4.5	10%	3%
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 program's net refrigerator savings is shown in Figure 8. As shown, the induced replacements in PY14 generated a per-unit increase of 44 kWh for refrigerators. Like free ridership, induced replacement enters the net savings calculation with a negative sign.

Figure 8. 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 Refrigerator Recycling.

However, since Refrigerator Recycling 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 Refrigerator Recycling 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.[12] (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 General Population Survey responses (instead of sales data) mitigates any socially desirable response bias present in the reports of program participants.

Unlike PY13, our survey of PY14 participants did not reveal differences in ENERGY STAR purchase rates between Refrigerator Recycling participants and the nonparticipants. As a result, we have not adjusted the program's NTG value based for nonparticipant spillover.

In PY14, 63% of surveyed participants said their experience in the program made them much 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

[12] 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.

resulting savings are captured by other program evaluations and cannot be claimed specifically as Refrigerator Recycling 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 (DSM) activity.

During PY14, Ameren Missouri spent over $1.53 million dollars to market individual residential efficiency programs and the portfolio-wide Act on Energy campaign. This amount almost equals Ameren's PY13 marketing expenditure ($1.55M).

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 in PY13. We will repeat the survey in PY15 to compare differences in awareness and energy-efficiency actions between the first and last year of Ameren's three-year program implementation cycle.

While Cadmus did not conduct a similar general population survey in PY14, we believe—given Ameren's continued program activity and comparable marketing expenditure—we can use the PY13 survey results to estimate NPSO that probably occurred in PY14.

Methodology

In PY13, the Cadmus team randomly selected and surveyed 401 customers, using Ameren's entire residential customer information system as the sample frame. We determined that our sample contained a small number of customers (n=36) self-reporting that they participated in an Ameren residential program during PY13. When estimating NPSO, we excluded these customers from analysis, focusing on 365 identified nonparticipants; this avoided potential double-counting of program savings and/or program-specific spillover.

We also limited the NPSO analysis to the same efficiency measures rebated through Ameren programs (known as "like" spillover). Examples include removing a secondary refrigerator and installing a programmable thermostat. We did, however, exclude one notable category of "like" measures: lighting products. This precluded double-counting NPSO lighting savings already captured through the upstream Lighting program market affects analysis.

To ensure the responses included in the analysis represent electric spillover savings, Cadmus asked customers questions about fuel type for water heaters, heating systems, and cooling systems. Only

savings associated with measures where there was a corresponding electric water heater, electric heat, or central air conditioning were counted as spillover in the 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 the following:

- They were familiar with Ameren's campaign; and
- Ameren's efficiency messaging motivated their purchasing decisions.

Results

Of 365 nonparticipants surveyed, 11 cited Ameren's marketing as "very important" or "somewhat important" in their decisions to purchase non-rebated, high-efficiency measures during 2013:[13]

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

The analysis excluded nonparticipant responses indicating Ameren's programs or Act On Energy were "not very important" or "not at all important" to their efficiency actions.

Table 33**Error! Reference source not found.** shows measures and PY13 gross evaluated kWh savings attributed to Ameren, with average savings per spillover measure of 242 kWh.

[13] 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 3% middle point remains the most likely value. With 3% of the population undertaking actions on their own, the sample size of nearly 10,000 surveys would be needed to detect such a level with ±10%—clearly a prohibitive undertaking.

Table 33. NPSO Response Summary

Individual Reported Spillover Measures	Influence of Ameren Information on Purchase	PY13 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 Efficient Products program.
*Assumption used for the HVAC 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 Appliance Recycling program.
**Assumption used for the HVAC 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 Home Energy Performance program.

To arrive at a single savings estimate (Variable A in Table 33**Error! Reference source not found.**), the Cadmus team used numbers in the Total kWh Savings column to calculate an average for the 11 measures assessed for NPSO. Thus, the estimate of 242 kWh represents average nonparticipant energy savings, per respondent attributing 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 34**Error! Reference source not found.**):

- **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, and calculated by dividing B by C, and then multiplying the result by A and D.

- **F** is Ameren's total reported 2014 program year *ex ante* gross savings for Appliance Recycling, HVAC, Lighting, Home Energy Performance, and Efficient Products. (Similarly to PY13, the PY14 analysis did not include the Low Income and New Homes programs.)[14]
- **G** (representing NPSO as a percentage of total evaluated savings) is the nonparticipant percentage used in the NTG calculations.

Using this information, the Cadmus team estimated overall, portfolio-level NPSO at 3.6% of total PY14 reported *ex ante* gross savings, as shown in **Error! Reference source not found.**. While, in percentage erms, a larger amount than last year (2.8% in PY13), this NPSO value represents the same number of MWH NPSO savings (7,592); it is only larger because total reported gross savings were lower in PY14. As discussed, the program's marketing expenditure in PY14—the primary driver of NPSO—was nearly identical ($1.55M vs. $1.53M) between PY13 and PY14.

Table 34. 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 Reported Gross *Ex Ante* Savings (MWh)	210,530	2014 Program Evaluations
G	NPSO as Percent of Total Evaluated Savings	3.6%	E ÷ F

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

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

4. **Even Allocation**: The most straightforward approach, this allocates NPSO evenly across residential programs (i.e., makes a 3.6% adjustment to each program's NTG). Doing so, however, is equivalent to applying NPSO at the portfolio-level, which, as noted, assumes all programs contribute equally to generating NPSO.

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

5. **"Like" Programs:** This approach allocates NPSO savings to specific programs, based on the measure installed by the nonparticipant or by the action they took. For example, one nonparticipant reported tuning up their CAC, based on energy-efficiency messaging from Ameren. Using this approach, we would assign NPSO savings associated with an HVAC tune-up. While this approach establishes a clear connection between a reported NPSO measure and Ameren's program promoting that measure, our research has found this direct measure-program relationship does not prove as straightforward as it appears. 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 (six of 11) reporting NPSO measures were unfamiliar with the program or the programs corresponding to the measure they installed. These findings indicate Ameren generated NPSO through the cumulative effects of various program-specific and portfolio-level marketing efforts. Mapping NPSO measures solely to the program offering that measure could undervalue overall impacts of cumulative and sustained energy-efficiency messaging.
6. **Marketing Budget and Program Size.** The final allocation approach the Cadmus team considered—and eventually chose to use—assigns overall NPSO 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 most commonly is associated with mass media marketing campaigns, the scale of program activity 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 find this approach accurately reflects and attributes NPSO to programs, ensuring proper accounting for total costs (including marketing) and total benefits (net savings, including NPSO) when assessing overall program cost-effectiveness.

The Cadmus team distributed the portfolio-level result of 7,592 MWh NPSO to Ameren's residential programs (excluding Low Income and New Homes). As noted, we considered the PY14 program size (in terms of total gross *ex ante* MWh savings) and each program's marketing budget (as shown in Table 35) when allocating NPSO across programs.

Table 35. Program-Specific Savings and Marketing

Program	Program *Ex Ante* Gross Savings (MWh)	Percentage of Portfolio Savings	Total Marketing	Percentage of Total Marketing
Appliance Recycling	8,176	3.9%	$471,192	30.8%
HVAC	42,214	20.1%	$882,041	57.7%
Lighting	147,749	70.2%	$87,684	5.7%
Home Energy Performance	650	0.3%	$36,627	2.4%
Efficient Products	11,741	5.6%	$50,655	3.3%
Total	**210,530**	**100%**	**$1,528,199**	**100%**

The results of this approach—shown in Table 35 Error! Reference source not found. and Table 36—reflect each program's impact on the nonparticipant population, based on marketing expenditures and magnitude of the program's intervention in the regional marketplace.

Table 36. Combined Savings and Marketing Allocation Approach

Program	*Ex Ante* Gross Energy Savings (A)	Marketing Spending (B)	Combined Savings/Marketing (AxB)	Percentage of Combined Savings/Marketing
Appliance Recycling	3.9%	30.8%	1.2%	7.0%
HVAC	20.1%	57.7%	11.6%	68.1%
Lighting	70.2%	5.7%	4.0%	23.7%
Home Energy Performance	0.3%	2.4%	0.007%	0.04%
Efficient Products	5.6%	3.3%	0.2%	1.1%
Total	**100%**	**100%**	**17.0%**	**100%**

Analysis credited two programs with the greatest NPSO: HVAC (accounting for over one-half of all marketing dollars) at 5,171 MWh; and Lighting (accounting for 70% of total energy savings) at 1,799 MWh. As NPSO impacts program-specific NTG results,[15] all NPSO estimates have been reported as a percentage of each program's total gross energy savings.

As shown in Table 37, the Cadmus team allocated 576 MWh of NPSO to the Refrigerator Recycling program, representing 7.6% of the combined residential portfolio savings and marketing expenditure. This resulted in a 6.5% adjustment to the program's PY14 NTG.

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

Table 37. 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
Refrigerator Recycling	8,176	**7,592**	7.0%	535	6.5%
HVAC	42,214		68.1%	5,171	12.3%
Lighting	147,749		23.7%	1,799	1.2%
Home Energy Performance	650		0.04%	3	0.5%
Efficient Products	11,741		1.1%	83	0.7%
Total	**210,530**		**100%**	**7,592**	**3.6%**

Net Savings Summary

Table 38 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 (Appendix C and D).

Table 38. *Ex Ante* and *Ex Post* Net-to-Gross Ratios

Appliance	*Ex Ante*	*Ex Post*
Refrigerators	64%	70.6%
Freezers		72.5%
Overall*	**64%**	**71.5%**

*Reflects PY14 appliance participation mix and includes free ridership (35.0%), participant spillover (0%), and nonparticipant spillover (6.5%).

Table 39 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 39. NTG Ratio Components

Appliance	Free Ridership	Participant Spillover	Nonparticipant Spillover	NTG Ratio
Refrigerators	35.9%	0%	6.5%	70.6%
Freezers	34.0%	0%		72.5%
Total	**35.0%**	**0%**	**6.5%**	**71.5%**

Applying these NTG values to PY14 participation and *ex post* per-unit gross savings yields the program's net energy savings (Table 40). The total MWh/year savings and NTG ratio include nonparticipant spillover savings attributed to the program as a whole.

Table 40. *Ex Ante* and *Ex Post* Net Energy Savings

Appliance	PY14 Participants	Gross Per-Unit Energy Savings (kWh/Year)	NTG	Total Energy Savings (MWh/Year)
Refrigerators	6,978	1,007	70.6%	4,961
Freezers	2,010	867	72.5%	1,263
Room Air Conditioners	41	830	71.5%	24
Dehumidifiers	48	964	71.5%	33
Total	**9,077**		**71.0%**	**6,281**

*Due to very limited participation, we did not assess NTG for these measures separately. 71.5% represents the weighted average of the refrigerator and freezer NTGs.

As shown in Table 41, the program achieved 53% of its proposed net energy savings target for PY14 (11,950 MWh). The program achieved a greater percentage (73%) of the demand reduction target. Ameren's targets were codified in their residential tariff and approved by the Missouri Public Service Commission (MPSC).

Table 41. Refrigerator Recycling 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)	11,950	12,932	8,850	6,281	53%
Demand (kW)	1,664	1,677	1,698	1,207	73%

[1] http://www.ameren.com/-/media/missouri-site/Files/Rates/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 Refrigerator Recycling program. In Table 42—which lists the estimates of UEC, part-use, and NTG of those utilities—"R" indicates refrigerator and "F" indicates freezer.

Table 42. Refrigerator Recycling Benchmarking Results: Mail-in Rebates

State or Utility	Years Implemented	*UEC*		Part-Use		NTG	
		R	F	*R*	F	*R*	F
Ameren Missouri (PY14)	**4.5**	**1,157**	**1,028**	**0.87**	**0.84**	**70.6%**	**72.5%**
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 43. 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 PY14 Refrigerator Recycling program, MMP utilized DSMore and assessed cost-effectiveness using the following five tests as defined by the California Standard Practice Manual:[16]

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

DSMore takes hourly prices and hourly energy savings from the specific measures installed through Refrigerator Recycling and correlates both prices and savings to 30 years of historic weather data. Using long-term weather data ensures the model captures the low probability/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.

Table 44 lists key assumptions the Cadmus team used in the analysis, and the source of each assumption.

Table 44. Key Assumptions for Cost-effectiveness Analysis

Assumptions	Source
Discount Rate = 6.95%	Ameren Missouri 2012 MEEIA Filing (2013 – 2015 Energy Efficiency Plan)
Line Losses = 5.72%	
Summer Peak occurred during the 16th hour of a July day, on average.	
Avoided Electric T&D = $31.01/kW	
Escalation rates for different costs occurred at the component level, with separate escalation rates for fuel, capacity, generation, transmission and distribution, 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 (PY14-specific Refrigerator Recycling 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

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

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 PY14 Ameren program spending data: actual spending broken down into implementation, incentives, and administration costs. MMP applied these numbers at the program level—not the measure level. While applying incentives at the measure level is useful for planning purposes, it is unnecessary for the cost-effectiveness modeling, as the results are based on the program overall.

As determined through a consensus building process with stakeholders, all the cost-effectiveness results shown include the program's share of portfolio-level or indirect costs. Each program's share of these costs was determined using the present value of each program's UCT lifetime benefits (i.e., the present value of avoided generation costs, as well as deferral of capacity capital and transmission and distribution capital costs). More details are provided in the residential portfolio summary report.

Table 45 summarizes the cost-effectiveness findings by test. Any benefit/cost score above 1.0 passed the test as cost-effective. In addition, the table includes the net present value (in 2013 dollars) of the UCT net lifetime benefits (net avoided costs minus program costs).

As seen in the table, the Refrigerator Recycling program passes the TRC, UCT, and Societal tests and the UCT net lifetime benefits are just over $2M.

Table 45. Cost-Effectiveness Results (PY13)

Program	UCT	TRC	RIM	Societal	PART	UTC Net Lifetime Benefits Less Costs
Refrigerator Recycling	2.53	2.53	0.61	2.87	N/A	$2,048,503

Appendix A. *Ex Post* Demand Reductions

MMP determined *ex post* demand reductions using the *ex post* energy savings estimated in this PY14 report and DSMore (using load shapes provided by Ameren).

Table 46. PY14 Summary: Net *Ex Post* Per-Unit Demand Reductions

Measure	PY14 Participation	Net Per-Unit *Ex Post* Demand Reduction (kW)	Total Net *Ex Post* Savings (kW)*
Refrigerators	6,978	0.168	875.866
Freezers	2,010	0.199	305.833
Room Air Conditioners	41	0.654	20.264
Dehumidifiers	48	0.144	5.231
Total	**9,077**	**n/a**	**1,207**
*Accounts for line losses			

Appendix B. Stakeholder Interview Guide

Respondent name:____

Respondent phone: ___

Interview date: Interviewer initials: ___

Introduction

1. What are your main responsibilities for Ameren Missouri's Fridge/Freezer Recycling Program?
2. What percent of your time is dedicated to the program?
3. What tasks do you regularly spend the majority of your time on?

Program Implementation

4. Other than the program name change, have there been other to the program design between PY13 and PY14? If yes, what were they and what was the impetus for the change?
5. What impact, if any, do you feel the name change has had on participation and program awareness?
6. Can you please tell me about the program's marketing efforts this year? How, if at all, have these efforts differed from PY13?
7. Have you done any cross-marketing of any other Ameren Missouri program to ApplianceSavers participants?
8. What do you think have been the most marketing strategy this year?
9. In general, what would you say is working particularly well so far in PY14? Why is that?
10. Conversely, what is not working as well as anticipated? Why is that?

Program Goals

11. How has the program performed in PY14 relative to its filing goals?
12. Why do you think this is?

Measures

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

Retail Channel

14. What is the status of the program's retailer channel?
15. What do you think is the future retailer channel in future program years?

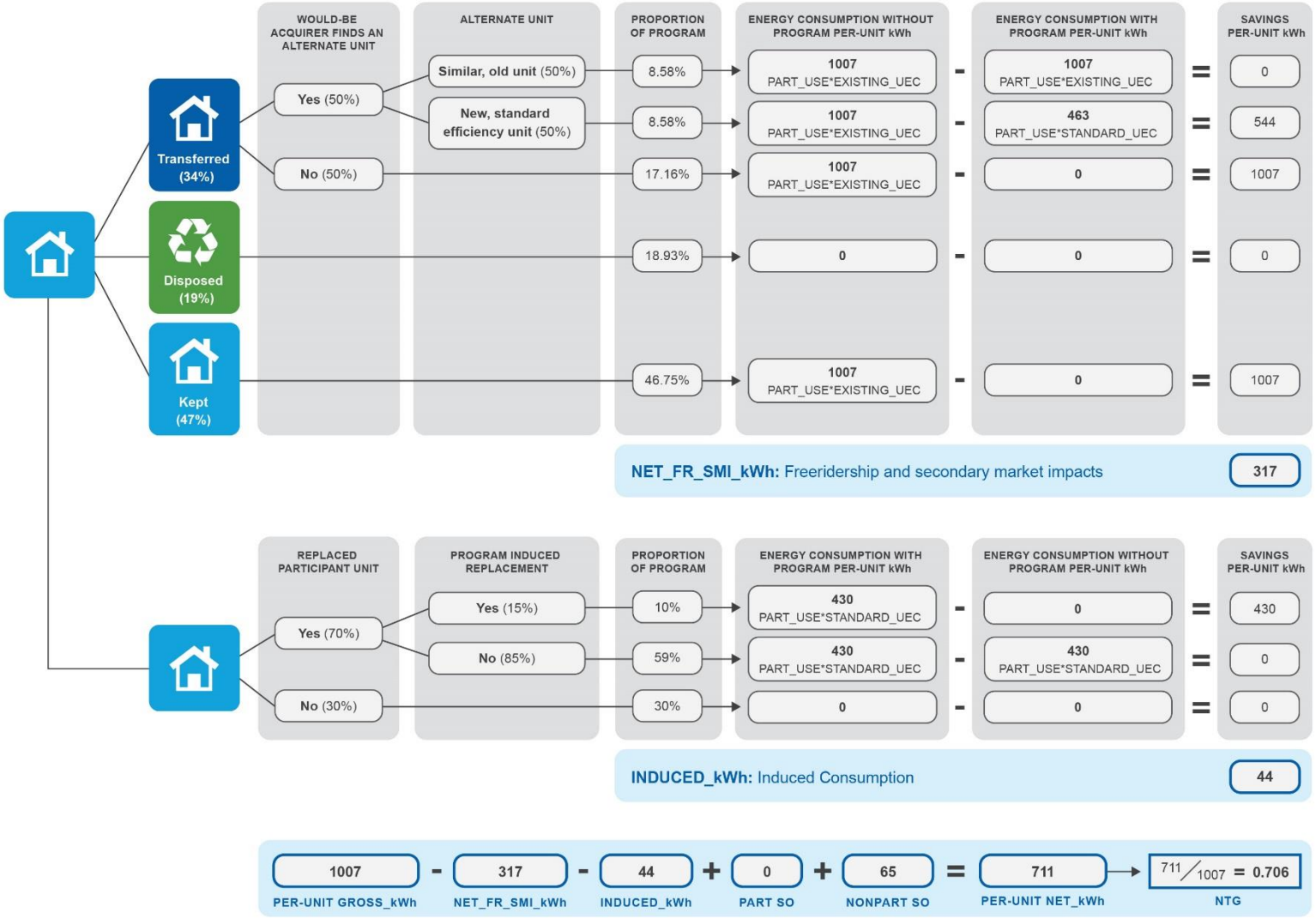
Customer Feedback

16. 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:
17. Do you think your customers understand the energy-related benefits of the program?
18. Are there any recurring or common customer praises or complaints? If so, what are they?
19. Have customer drop-out or cancellation rates changed at all this year?

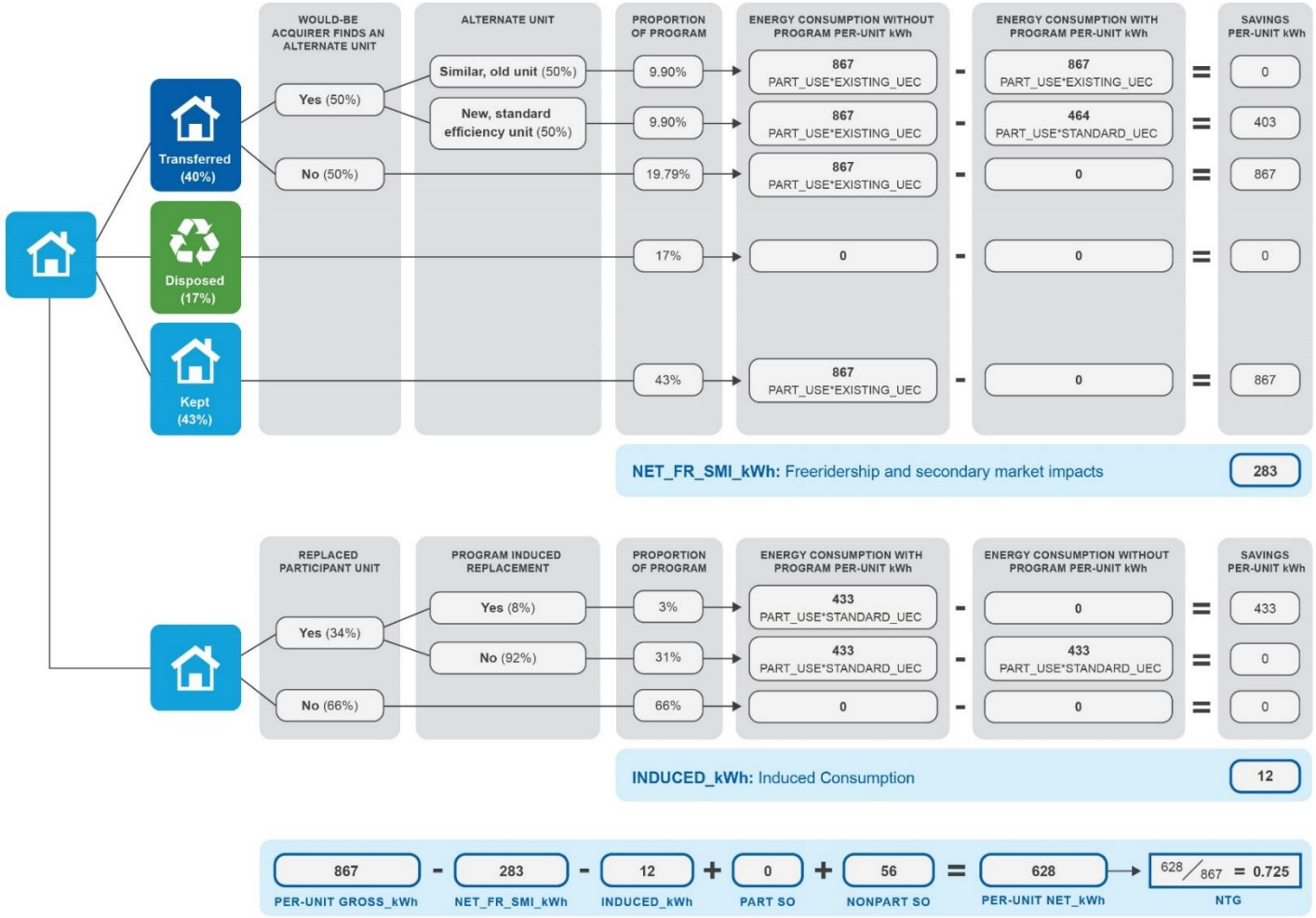
Summary

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

Appendix C. Summary Diagram: Refrigerators



Appendix D. Summary Diagram: Freezers



Note that the NPSO shown above (56 kWh) is rounded. The NPSO value Cadmus used for the NTG calculation was 56.4 kWh, which results in the NTG of 72.5% shown above.

Appendix E. Gross Savings Detail: Room Air Conditioners and Dehumidifiers

Room Air Conditioners

The Cadmus team estimated per-unit RAC savings using the following algorithm and inputs (Table 47):

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

Table 47. PY13 RAC Savings Assumptions

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

The average size of RAC units reported by ARCA in PY14 was 8,388 BTU/hour. However, the Cadmus team felt the average value was unreliable (similar to PY13) due to sample size (only 38 units) and the fact that the Low Income program 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 Appliance Recycling). 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 48. 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 47) are not available.

Table 48. *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 49):

Table 49. 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 50).

Table 50. *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 F. Bibliography

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Missouri Code of State Regulations. *Rules of Department of Economic Development: Division 240-Public Service Commission – Chapter 22-Electric Utility Resource Planning.* Available online at: http://sos.mo.gov/adrules/csr/current/4csr/4c240-22.pdf

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

Appendix G. Participant Survey Instrument

Ameren Missouri Fridge/Freezer Recycling Program

Participant Survey

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."]

Verification

A1. Our records show that on **[PICKUP DATE],** you had a **[APPLIANCE VAR]** removed by the Ameren Missouri's Fridge/Freezer Recycling 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]

3. Yes
4. No
98. Don't know
99. Refused

[TERMINATE IF A2 = 2, 98, 99]

[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 A1 IF 0 = 1]

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

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

[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 A1 IF 0= 1]

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 0= 98, 99]

Part-Use

[ASK ONLY IF QTY > 1, OR A3, A5=NO] 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]**.

A1. **[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)

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

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.
3. Never.
4. **[DO NOT READ]** Other **[SPECIFY]**: _____
5. Don't know

[SKIP TO 0 If 0 <> 2]

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]**

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

Replacement

A1. Did you replace the **[APPLIANCE VAR]** you recycled?

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

[SKIP TO A1 If A1= 2, 98, 99]

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

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

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

[SKIP TO A1 If 0= 98, 99]

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

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

[SKIP TO 0 If 0= 2, 98, 99]

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

Were you planning to replace your **[APPLIANCE VAR]** before you decided to recycle it through Ameren Missouri's Fridge/Freezer Recycling program?

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

[SKIP TO A1 If 0 = 1]

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 A1 IF 0<> 1]

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

Freeridership

A1. Had you considered getting rid of your **[APPLIANCE VAR]** before you heard about the **Ameren Missouri's** Fridge/Freezer Recycling 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 A1=2, SKIP TO D7]

A2. 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

A3. **[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]

A4. 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 A1= 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 A4 = 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 A4 = 4]
Market research suggests many local charities (Goodwill or Vietnam Veterans of America) do not accept large appliances.

[Read only if A4 = 7]
Appliances can be difficult to move and transporting them requires a large vehicle.

A5. **[ASK ONLY IF D4=2 and AGE>15 or D4 = 4 or 7, OTHERWISE SKIP TO D7]** Considering this information, would you have **[READ IN ANSWER FROM A4]**, or would you have done something else?

1. [RESPONSE FROM D4]
2. Something else
98. Don't know
99. Refused

[IF A5= 1, 98, or 99, SKIP TO 0]

A6. 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

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

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 0=2]

Would you have recycled your **[APPLIANCE VAR]** through Ameren Missouri's program if there was no rebate check at all?

1. Yes
2. No

-98. Don't know
-99. Refused

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,
   i. E3.1. Why not? **[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]**

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. Lighting (standard CFLs, specialty CFLs, LEDs)
2. Efficient Products (programmable thermostats , water heaters and window A/C)
3. HVAC (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

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.