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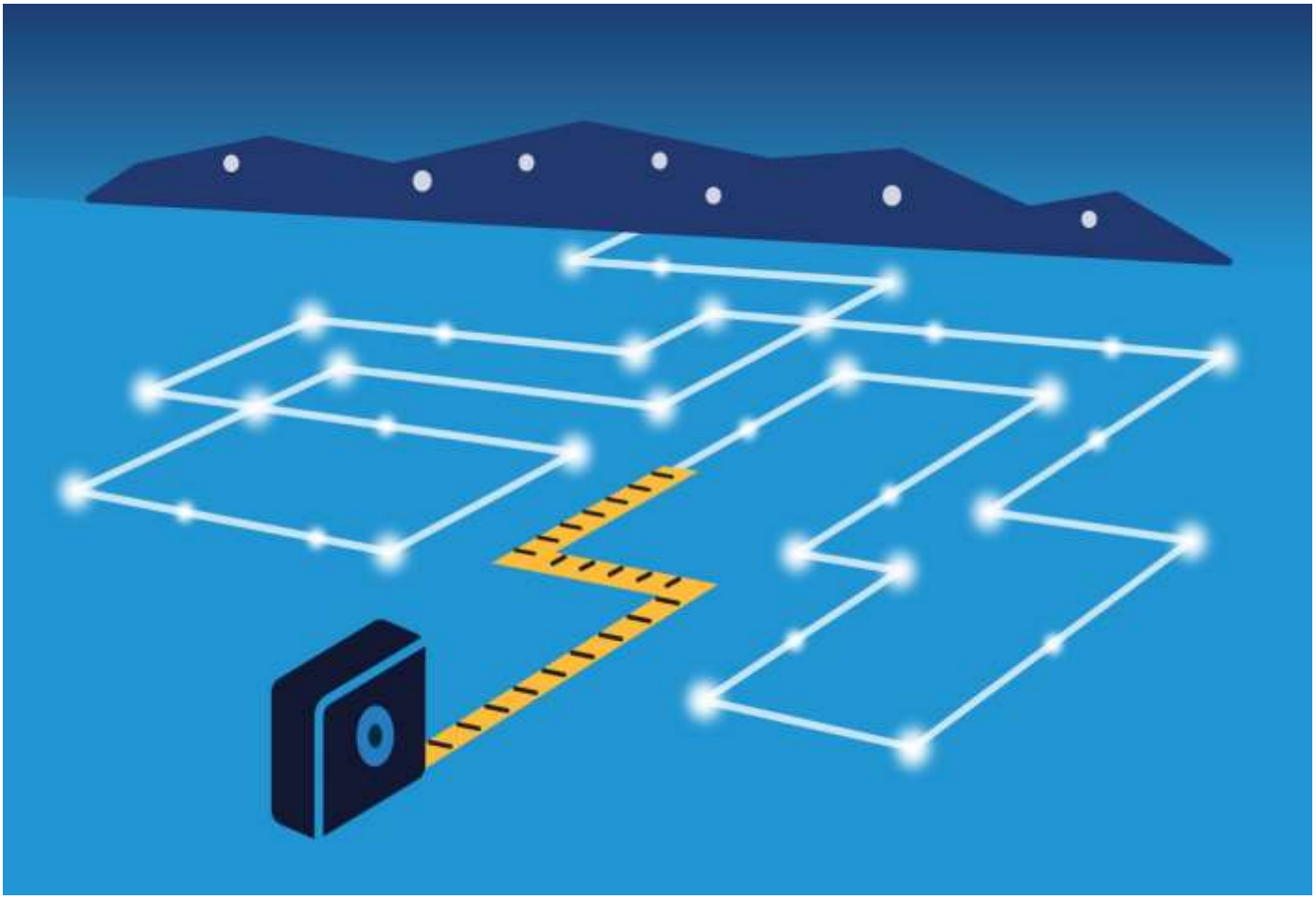

Impact and Process Evaluation of 2014 (PY7) Ameren Illinois Company Appliance Recycling Program

Final

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1. Executive Summary

The Ameren Illinois Company (AIC) Appliance Recycling Program (ARP) offers free recycling of refrigerators, freezers, and room air conditioners for residential and small commercial customers. AIC expected ARP—now in its seventh year of operation—to achieve approximately 5% of the electric savings for AIC's overall residential portfolio in Program Year 7 (PY7). Leidos manages the program and oversees its advertising. Appliance Recycling Centers of America (ARCA), serving as a subcontractor, primarily markets and implements the program. This includes scheduling, pick up, and recycling as well as customer service.

Program Impacts

Table 1 summarizes the net electricity and demand savings from the PY7 ARP Program, which saves 4,693 MWh and 0.58 MW. The program achieved high gross and net realization rates as a result of the evaluation team's application of the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 3.0 (Statewide TRM Version 3.0) algorithm to estimate savings along with the Stakeholder Advisory Group (SAG)-approved net-to-gross ratios (NTGR) for this program: the PY4 NTGR of 62% for freezers, the PY5 NTGR of 56% for refrigerators, and the PY5 Commonwealth Edison's (ComEd) evaluation determination of 50% for room air conditioners.

Table 1. PY7 Net ARP Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)					
Total MWh	8,219	100%	8,222	57%	4,693
Demand Savings (MW)					
Total MW	1.00	101%	1.01	57%	0.58

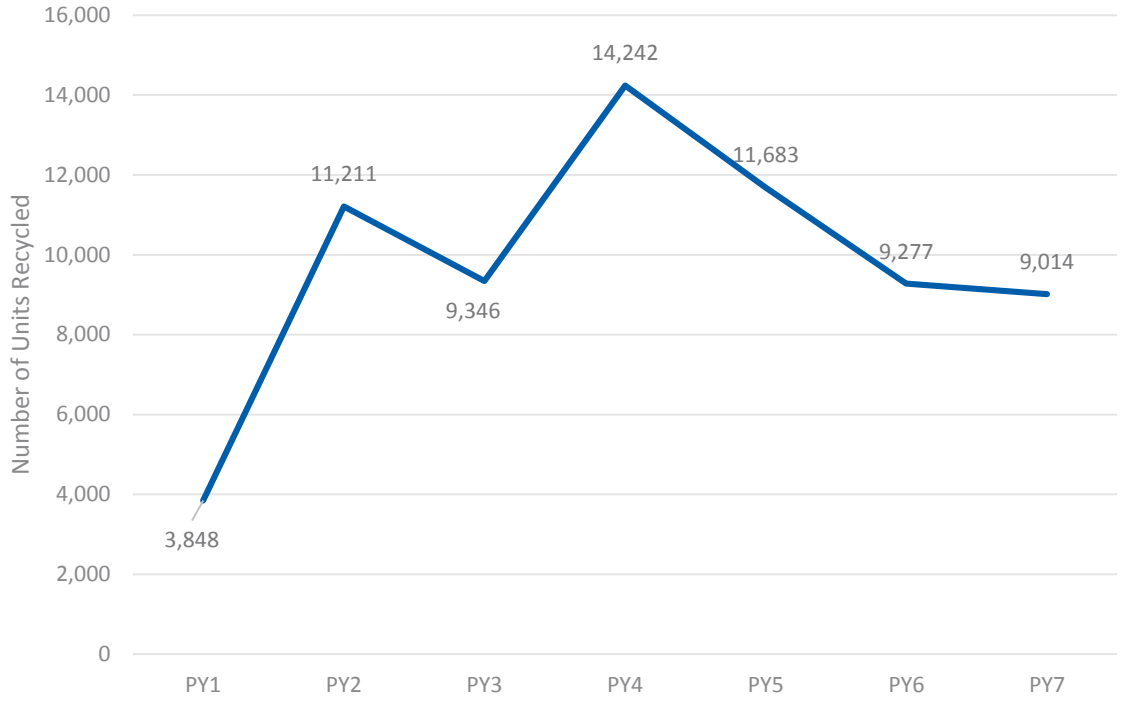
*As ex ante estimates were not provided in the tracking database, PY6 values were used for comparison.

**Ex post determined by applying NTGR and verified participation.

Program Participation

The program recycled 9,014 appliances in PY7, a decrease of 3% compared to PY6. While the overall trend in decreasing participation continued from the program's peak year of PY4, the number of recycled refrigerators and room air conditioners increased slightly over PY6.

Figure 1. Total Units Recycled by Program Year



Key Findings and Recommendations

The program exceeded its participation and energy-savings goals in PY7 and maintained participation levels close to those in PY6. Based on the team's PY7 evaluation activities, we present below the key findings and recommendations for the program:

- **Key Finding #1:** The current marketing plan appears sufficient to sustain participation and stop the decline observed in the prior two years. This was sufficient to meet program goals. However, if AIC is interested in increasing savings achieved by the ARP program, it appears unlikely that AIC will be able to significantly increase ARP participation without expending significant effort. Focusing marketing efforts on increasing savings—rather than on increasing participation—may become an important factor in the ARP's ability to meet future savings goals.

  - **Recommendation:** In addition to general awareness marketing campaigns, AIC could consider increasing marketing strategies to target households with long-term active accounts, toward the goal of identifying homes with older units (on average). Older units produce higher-than-average savings, especially if manufactured before the early 1990s appliance efficiency standards. Combined with program implementers' information on appliance ages in different regions of the service territory, such a targeted marketing strategy could yield higher per-unit savings by increasing the proportion of older appliances recycled through the program. For example, a recent ARP study[1] found that by targeting homes with accounts active for 10 years or more, the average

[1] Navigant Consulting Inc. *2012 EM&V Report for the Appliance Recycling Program*. October 2013. Accessed December 12, 2014. http://dms.psc.sc.gov/pdf/matters/EF1A5FFD-155D-141F-239A7CB4C326E7B7.pdf

age of appliances recycled through the program increased by 27% and gross per-unit savings increased by 19%.

- **Key Finding # 2:** The assumption that appliances younger than 10-years are re-sellable and those older are not, is still the most applicable criteria for use in freeridership calculations for small, local retailers. Smaller, local retailers that sell used appliances indicated some non-working units and many units older than 10 years may be sellable on the used appliance market (however some working units younger than 10 years may not be sellable). Retailers suggested that overall condition and potential repair costs also determine secondary market salability. These criteria, however, prove much more challenging to assess at pickup than using an "age" criteria.
  - **Recommendation 2:** Given the challenge of identifying objective criteria to assess appliances that would sell in the secondary market, continue using the 10-year age cutoff as a reasonable estimate of an appliance's secondary market viability.

2. Evaluation Approach

The PY7 evaluation of the Appliance Recycling Program involved both process and impact assessments. For the process review, the evaluation team reviewed marketing and program tracking data, interviewed program managers from AIC, Leidos, and ARCA, and interviewed local appliance retailers.

To verify program participation and to estimate PY7 savings, the evaluation team reviewed and analyzed the tracking database. The team calculated savings estimates using the regression equation specified in the Statewide TRM Version 3.0. The team applied the SAG approved NTGR adjustments, prospectively based on PY4 and PY5 research. This meant applying the NTGR from AIC's PY5 evaluation for refrigerators and the NTGR from AIC's PY4 evaluation for freezers. The team also applied the NTGR from ComEd PY5 evaluation for room air conditioners.

2.1. Research Objectives

2.1.1. Impact Questions

For PY7, the evaluation team sought to estimate gross and net energy savings attributable to the program. In particular, the study focused on the following research questions:

1. What are the estimated gross energy and demand impacts from this program?
2. What are the estimated net energy and demand impacts from this program?

2.1.2. Process Questions

In addition, the team explored process-related research questions as part of the PY7 evaluation. These questions focused on the impacts of changes made between PY6 and PY7 and on ways to increase program participation. Specifically, they included the following:

1. What are the standard practices of retailer haul-away programs?
2. Were the ARP operational and delivery processes adequately documented? Were program materials sufficiently up to date to reflect program changes in PY7?
3. Did the program implementation change since PY6? If so, how, why, and was this change advantageous?
4. Has program participation reached its maximum participation rate within AIC's territory? Were cost-effective marketing options available to increase participation, or should the program marketing goal transition to increasing savings rather than participation?

2.2. Evaluation Tasks

Table 2 summarizes the evaluation tasks conducted for PY7.

Table 2. Summary of Appliance Recycling Program Evaluation Activities for PY7

Activity	PY7 Impact	PY7 Process	Forward Looking	Details
Program Staff In-Depth Interviews		✓		Program staff interviews provided insights into program design and delivery as well as potential refinements or improvements to the current program. Stakeholders included staff from AIC, Leidos, and ARCA.
Review of Program Materials and Database	✓	✓		The evaluation team reviewed all program materials and data in the tracking database to ensure collection of appropriate data to inform the evaluation.
Retailer Interviews	✓	✓		Retailer interviews were conducted with smaller retailers to determine what happens to haul-away units collected outside of the ARP program. This information informed retailer-specific freeridership ratios to supplement research conducted by Itron for ComEd PY5 evaluation report[a] (focused on large retail chains).
Gross Savings Calculations	✓		✓	Referencing the Illinois Statewide Technical Reference Manual (TRM) Version 3.0 (February 2014), the evaluation team calculated estimates of annual unit energy consumption (UEC), using inputs from the PY7 program-tracking database, with per-unit savings adjusted for part-use (also specified in the Statewide TRM Version 3.0) to determine gross savings. Verification rates from the PY6 participant survey were also used.

[a] Refrigerator and Freezer Recycle Rewards Program PY5 Evaluation Report, April 15, 2014.

The following activities informed the ARP's PY7 evaluation.

2.2.1. Program Staff Interviews

Interviews with program staff sought to gain information about the program's design, implementation, and processes. The evaluation team also asked about data tracking and customer outreach related to the program. Part of this task included interviewing four members of ARCA's implementation team, Leidos' program manager, and AIC's program manager.

2.2.2. Review of Program Materials and Database

The evaluation team reviewed program data, including marketing materials and the program-tracking database.

2.2.3. Retailer Interviews

The team interviewed smaller, local appliance retailers to determine, in the program's absence, the likelihood that these retailers would have picked up these units for resale in the secondary market.

Table 3. Completed Retailer Interviews

Target	Completed	Response Rate
5	4	80%

2.2.4. Impact Analysis

Gross Impact Analysis Approach

The evaluation team determined gross ex post impacts by thoroughly reviewing the program database and applying the Statewide TRM Version 3.0 algorithms. The team then performed individual savings calculations for each measure type, using data provided in the PY7 program database and responses collected through the PY6 participant surveys (i.e., verification rates).

Net Impact Analysis Approach

To estimate PY7 net savings, the evaluation team applied values approved by the SAG: the PY4 net-to-gross ratio (NTGR) of 62% for freezers, the PY5 NTGR of 56% for refrigerators, and 50% for room air conditioners from the PY5 ComEd evaluation.

2.3. Sources and Mitigation of Error

Table 4 provides a summary of possible sources of error associated with research tasks conducted for the ARP. We discuss each item in detail below.

Table 4. Possible Sources of Error

Research Task	Survey Errors		Non-Survey Errors
	Sampling Errors	Non-Sampling Errors	
Used Appliance Retailer Interviews	• Yes	• Non-Response	• N/A
Impact Analysis	• N/A	• N/A	• Data processing errors

The evaluation team took a number of steps to mitigate potential sources of error throughout the planning and implementation of the PY7 evaluation.

Survey Errors

- Sampling Errors
  - The sample of retailers is purely a convenience sample chosen based on PY6 survey responses when participants were asked from which retailer they purchased their replacement appliance. We completed surveys from 4 out of 5 retailers on our sample list.
- Non-Sampling Errors
  - Non-Response: While the response rate for the ARP interviews is high, with only one retailer refusing the interview, there is the potential for non-response bias. The team attempted to mitigate possible bias by making multiple calls on different days of the week, as well as at different times of the day.

Non-Survey Errors

- **Data Processing Errors**
  - **Gross Impact Calculations:** The evaluation team applied the Statewide TRM Version 3.0 calculations to participant data in the tracking database to calculate gross impacts. To minimize data processing errors, the team had all calculations reviewed by a separate team member to verify calculations were performed accurately.
  - **Net Impact Calculations:** The team applied the SAG-approved NTGR to estimate the program's net impacts. To minimize data processing errors, the team had all calculations reviewed by a separate team member to verify calculations were performed accurately.

3. Detailed Evaluation Findings

3.1. Program Description and Participation

During PY7, AIC's ARP offered a $50 incentive to customers who signed up to have a refrigerator or freezer recycled through the program. The program sought to achieve 4,010 MWh of net energy savings and to recycle 8,375 appliances—targets that were set slightly lower than PY6 goals. The program surpassed its energy savings and participation goals, achieving 4,693 MWh of net savings (117% of its goal) and recycling 9,014 units (116% of its goal). As discussed in more detail below, program staff attributed this success to a relatively mild winter and on the rebranded marketing campaign spearheaded by ARCA.

Figure 2 shows that overall participation has decreased significantly since the peak in PY4. However, , participation decreased by only 3% between PY6 and PY7 although, as can be seen in Table 5, the number of refrigerators and room air conditioners recycled through the program increased slightly from PY6 to PY7. The number of units recycled by year and appliance type is shown in Table 5.

Figure 2. Total Units Recycled by Program Year

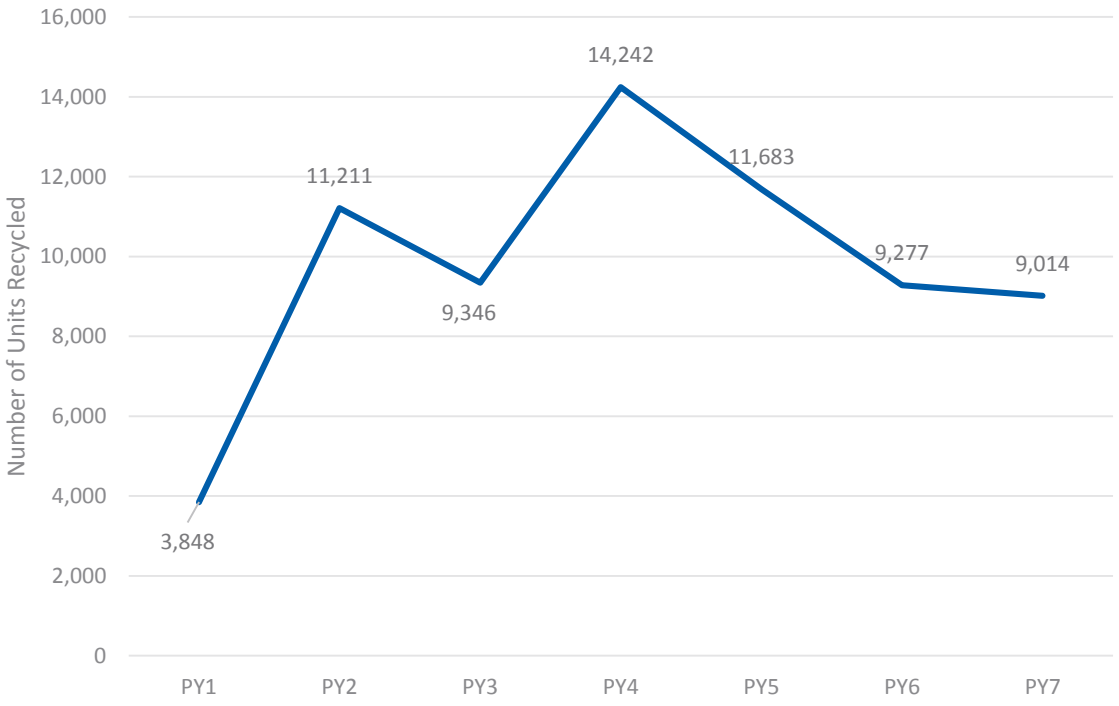


Table 5. AIC ARP Historical Participation

Year	Refrigerators	Freezers	Room A/Cs	Total
PY1	2,752	1,096	N/A	**3,848**
PY2	7,762	3,422	27	**11,211**
PY3	7,202	2,131	13	**9,346**
PY4	10,696	3,536	10	**14,242**
PY5	8,780	2,899	4	**11,683**
PY6	7,079	2,181	17	**9,277**
PY7	7,084	1,912	18	**9,014**

3.2. Process Assessment

3.2.1. Program Changes

For the process assessment, the evaluation team interviewed program staff from AIC, Leidos, and ARCA to understand how the program operated, to identify any changes made in PY7, and to identify any areas of concern or challenges faced by the program.

For PY7, program staff cited key changes regarding shifts in implementation and marketing responsibilities. Prior to PY7, Conservation Services Group (CSG) served as the primary ARP implementer. In PY7, Leidos, who historically implemented AIC's commercial and industrial programs, took over this role. Program staff reported the transition from CSG to Leidos proceeded smoothly..

In addition, ARCA assumed an expanded role in marketing the program. In PY6, ARCA and CSG shared marketing responsibilities. With the introduction of Leidos as the primary implementer in PY7, ARCA assumed responsibility for all program marketing. ARCA reported that handling all marketing for the program, rather than sharing this responsibility with another implementation contractor, allowed them to maintain a clear record of efforts deployed in the market and monitor responses from individual marketing efforts. This allowed ARCA to better track marketing effectiveness and to distribute marketing funds using the most effective tactics.

Program staff reported that completing the shift in marketing responsibilities from CSG to ARCA also proceeded smoothly. This transition started in PY6 which could have slowed the PY6 participation due to delays in preparing marketing materials. With PY7 maintaining similar participation levels to PY6, ARCA believes the rebranded marketing campaign helped maintain participation levels close to PY6.

Since room air conditioners historically have been a convenience service for AIC's program, AIC does not offer a customer incentive. Hence, they have never made up a large proportion of appliances recycled through the program (0.2% in PY7). In PY6, AIC staff reported that room air conditioners would no longer be picked up by the program, starting in PY7. However, the program continued to pick up a small number room air conditioners in PY7. The program implementer reported they may expand the program to include picking up dehumidifiers as a convenience service, providing free haul-away but not a monetary incentive—the same way the program treated room air conditioners.[2]

[2] At the time of the interview, the program implementer noted there were no firm plans to launch this effort in PY8.

The recycling center also moved from Springfield, Illinois, to Decatur, Illinois, a location more central to AIC's service territory. The move is expected to improve pick-up scheduling. In the past, ARCA used a shared recycling center in Springfield that processed appliances for both Ameren Illinois' and Ameren Missouri's programs. When ARCA built a new recycling center within its territory, Ameren Illinois moved its operation to Decatur. The Ameren program manager noted that the Decatur recycling center is smaller and more efficient. Based on feedback from program implementers, the location change did not significantly affect program participation.

Program staff did not report any other changes planned for PY8.

3.2.2. Communication and Program Delivery

AIC, Leidos, and ARCA frequently communicate regarding the program. Every two weeks, AIC, Leidos, and ARCA meet via telephone to discuss progress towards goals and program activity for the preceding couple of weeks. In addition, AIC and Leidos meet monthly to review the entire portfolio. This communication level proves sufficient for AIC, Leidos, and ARCA to successfully manage and implement the ARP.

Program staff reported that program delivery proceeded smoothly in PY7, with very few issues in the field. As such, program staff and implementers did not make suggestions for improvements to program processes or delivery. In early PY8,[3] however, ARCA implemented an update to the delivery processes, with customers receiving an e-mail before receiving their incentive check (pre-mail). The e-mail thanked them for their participation and informed them that their incentive was being processed. This addition sought to keep customers informed and to reduce the number of customers calling to check on their incentive's status.

3.2.3. Marketing

After taking on responsibility for marketing, ARCA rebranded the ARP's marketing materials, shifting away from the Energy Hog mascot that had been used for several years in favor of a "Cool Savings are Hiding in Your Fridge" slogan. Figure 3 provides an example of the rebranded marketing materials. Program staff partly attributed the program's PY7 success to this refreshed marketing campaign.

[3] Summer 2015

Figure 3. Example of Rebranded PY7 Marketing Materials

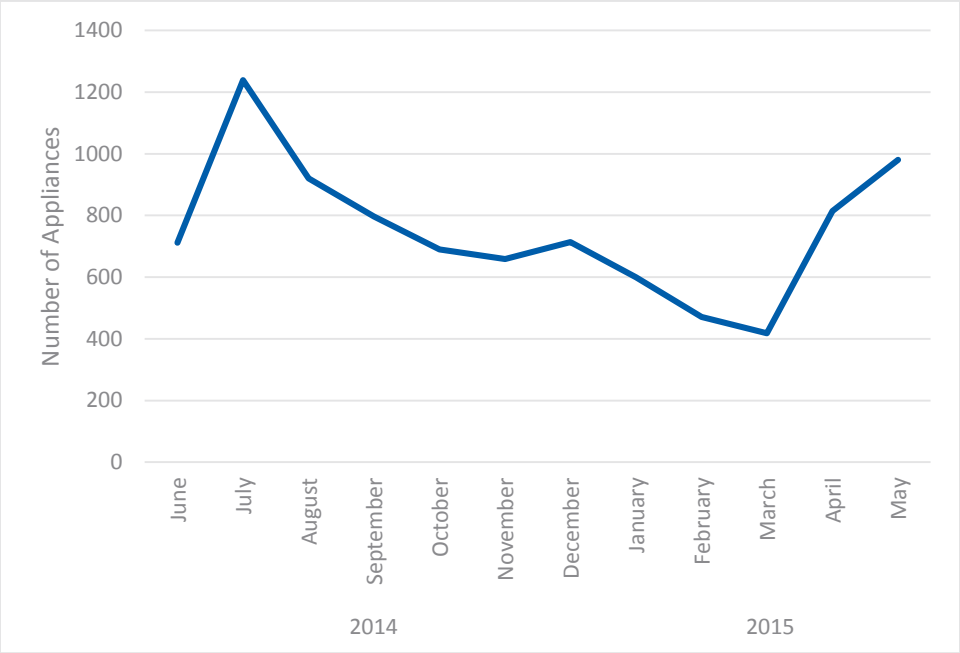
Program staff emphasized the importance of using consistent and persistent advertising. All ARP marketing materials now carry the same messaging and maintain a consistent look and feel (according to program staff; this was not the case in PY6). Program implementers noted that ARP programs generally face a marketing challenge in reaching customers at the right time. As customers do not replace refrigerators and freezers often, persistent advertising is important to build long-term program awareness and maintain high participation levels.

In terms of marketing channels, PY7 used much of the same program marketing methods as in prior years: bill inserts, e-mail blasts, billboards, mall banners, and a presence at home shows. The program pursued fewer digital marketing tactics than in the past, since the response rates for digital marketing tended to be lower than for physical tactics, such as bill inserts. AIC continued its retail partnership with Sears (where customers, purchasing a new appliance from Sears, could have Sears pick up their old appliance and recycle it through the ARP). AIC discontinued its nonprofit referral bonus due to a diminishing number of referrals in PY6.

Figure 4 shows participation by month during PY7. Participation peaked in July 2014—which is typical behavior between July and September for appliance recycling programs (likely due to better weather). The first half of PY7 experienced especially high participation, which program staff attributed to demand created by ARCA's revamped marketing campaign. Given this higher-than-expected participation, ARCA cut back on marketing activities for about five weeks in the beginning of 2015. While this marketing slowdown may be reflected in the participation dip occurring in February and March, appliance recycling programs also typically experience decreased participation in winter months, largely due to the difficulty in scheduling pick-ups. Following the

marketing slowdown, ARCA received approval from AIC to exceed the program's participation goals and resumed normal marketing activities. As a result, participation picked up again in April and May.

Figure 4. PY7 ARP Participation by Month



As the PY6 report discussed in detail, appliance recycling programs commonly experience declines as they mature. Program implementers, however, do not feel program participation has reached saturation within AIC's territory. Based on interview findings, cost-effective marketing options, such as targeted marketing, are still available to maintain participation.

In PY7, ARCA partnered with AIC to complete two rounds of targeted bill inserts. ARCA compared participation rates among zip codes and demographics and found that the zip codes with higher-than-average customer age and income levels also had higher historic participation rates. In addition, ARCA identified areas with historic participation rates below 2% where a higher concentration of appliances may be available for recycling. Participation rates over 2% suggest most eligible and interested customers have already done so. The program sent bill inserts to customers in areas where demographics indicated higher customer age and income levels and historical participation rates below 2%; ARCA thought these customers would exhibit the highest response rates. ARCA reported that this tactic, new for the program, greatly increased participation.

Program implementers also reported that they collected information on appliance ages in different regions which, the implementer reported, could be analyzed to target areas with older appliances.

As reported in PY6, a recent study[4] found marketing targeted specifically toward older homes, with accounts active for 10 years or more, yielded participants with older appliances. This effort increased the average appliance age by approximately 27% for the program and savings per unit by approximately 19%.

[4] Navigant Consulting Inc. *2012 EM&V Report for the Appliance Recycling Program*. October 2013. Accessed December 12, 2014. http://dms.psc.sc.gov/pdf/matters/EF1A5FFD-155D-141F-239A7CB4C326E7B7.pdf

3.1.1 Retailer Feedback

The evaluation team interviewed retailers to gather information on the standard practices of retailer haul-away programs. Additionally, the interviews included questions about awareness and promotion of the ARP.

All four retailers interviewed by the evaluation team knew of the ARP and display program information to inform customers shopping for new appliances in their stores of the option to recycle their old appliance. One retailer said the program provided customers with an incentive to move forward and replace their old refrigerator, rather than holding on to it for a few more years. Another reported that, as the incentive increased from $35 to $50, almost all of his customers participate in the ARP. However, one retailer noted that while the program provides a benefit to customers, some do not wish to wait for the program to haul away their old appliances, opting instead to have them removed by the retailer.

Three of the four interviewed retailers also sell used appliances, and the primary source of these appliances are customers who purchase a new unit and opt to have their old unit hauled away by the retailer. Two of the three retailers that sell used appliances reported that the ARP removes viable used units from the market that they could otherwise sell. One retailer also stated that AIC's program has severely impacted the used refrigerator business and significantly increased the price of used refrigerators as supply has dwindled.

Section 3.4 includes retailer feedback pertaining to freeridership.

3.3. Impact Assessment

As shown in Table 6, the evaluation team applied the verification rate determined in the PY6 participant survey. As the program only recycled 18 air conditioners in PY7 (accounting for 0.2% of total appliances), the team applied the PY4 verification rate of 100% for air conditioners.

Table 6. Summary of PY7 Participant Verification Results

Recycling Measure	Participants	Verification Rate	Verified Participants
Refrigerator	7,084	100%	7,084
Freezer	1,912	100%	1,912
Air Conditioner	18	100%[a]	18
Total	**9,014**	**100%**	**9,014**

[a] Applying PY4 verification rate for air conditioners.

3.3.1. Ex Post Gross Impact Results

Using PY7 tracking data, PY6 participant survey data, and algorithms specified in the Statewide TRM Version 3.0, the evaluation team calculated ex post gross savings. As participant surveys were not conducted in PY7, the team applied the PY6 survey-based verification rate of 100%.

Estimated Annual Consumption

The Statewide TRM Version 3.0 algorithm, basing its coefficients on a collaborative metering study conducted for ComEd, Consumers Energy, and DTE Energy in Michigan for PY4, generated PY7 savings estimates for refrigerators and freezers. The algorithm is identical to that used in PY6.

Holding all other variables constant, the coefficient of each independent variable indicated the influence of that variable on annual consumption:

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

The coefficient value indicated the marginal impact of a 1-point increase in the independent variable on the UEC. For instance, a 1-cubic-foot increase in refrigerator size resulted in a 19.42 kWh increase in average annual consumption.

For dummy variables, the coefficient value represented the difference in consumption if a given condition held true. For example, the coefficient for the variable indicating a refrigerator was used as a primary unit was 170.98; all else being equal, this meant a primary refrigerator consumed 170.98 kWh more annually than a secondary unit.

Table 7 lists the Statewide TRM Version 3.0 coefficients for refrigerators.

Table 7. UEC Refrigerator Regression Algorithm

Independent Variables	Estimate Coefficient
Intercept	116.84
Age (years)	10.90
Pre-1990 (= 1 if manufactured pre-1990)	431.79
Size (cubic feet)	19.42
Dummy: Single Door (= 1 if single door)	−795.37
Dummy: Side-by-Side (= 1 if side-by-side)	426.41
Dummy: Primary Usage Type (in absence of the program) (= 1 if primary unit)	170.98
Interaction: Located in Unconditioned Space x CDD/365.25	17.34
Interaction: Located in Unconditioned Space x HDD/365.25	−11.78

Table 8 lists the regression coefficients for freezers from the Statewide TRM Version 3.0.

Table 8. UEC Freezer Regression Algorithm

Independent Variables	Estimate Coefficient
Intercept	132.12
Age (years)	12.13
Pre-1990 (= 1 if manufactured pre-1990)	156.18
Size (cubic feet)	31.84
Chest Freezer Configuration (= 1 if chest freezer)	−19.71
Interaction: Located in Unconditioned Space x CDD/365.25	9.78
Interaction: Located in Unconditioned Space x HDD/365.25	−12.76

Extrapolation

Using the PY7 tracking database, the evaluation team calculated the corresponding characteristics (i.e., the independent variables) for participating appliances for input into the Statewide TRM Version 3.0 algorithm. Table 9 summarizes program averages or proportions for each independent variable.

Table 9. PY7 Mean Explanatory Variables

Appliance	Independent Variables	Participant Population Mean Value
Refrigerator	Age (years)	22.70
	Pre-1990 (= 1 if manufactured pre-1990)	0.37
	Size (cubic feet)	19.02
	Dummy: Single Door (= 1 if single door)	0.05
	Dummy: Side-by-Side (= 1 if side-by-side)	0.23
	Dummy: Primary Usage Type (in absence of the program) (= 1 if primary unit)	0.67
	Interaction: Located in Unconditioned Space x CDD/365.25	0.99
	Interaction: Located in Unconditioned Space x HDD/365.25	5.09
Freezer	Age (years)	27.65
	Pre-1990 (= 1 if manufactured pre-1990)	0.58
	Size (cubic feet)	15.68
	Chest Freezer Configuration (= 1 if chest freezer)	0.44
	Interaction: Located in Unconditioned Space x CDD/365.25	2.49
	Interaction: Located in Unconditioned Space x HDD/365.25	12.85

To determine annual and average daily per-unit energy consumption using the TRM algorithm and PY7 AIC tracking data, the evaluation team applied average participant refrigerator and freezer characteristics to regression model coefficients. This approach ensured the resulting UEC was based on specific units recycled through AIC's program in PY7, rather than a point estimate based on a secondary data source.

Table 10 provides the annual UEC for refrigerators and freezers AIC recycled in PY7. Additionally, Table 10 shows demand calculated by applying the following formula, included in the Statewide TRM Version 3.0 for refrigerators and freezers:

$$\text{Unit Demand Savings} = \Delta\text{kW} = \frac{\text{kWh}}{8{,}760} * Coincidence\ Factor$$

Where: coincidence factors are 1.081 for refrigerators and 1.028 for freezers.

Table 10. PY7 ARP Unit Energy Savings (without part-use)

Recycling Measure	Unit Energy Savings (kWh)	Unit Demand Savings (kW)
Refrigerator	1,023	0.13
Freezer	908	0.11
Air Conditioner	346	0.00

- Demand for air conditioners is calculated according to this formula, specified in the TRM:

$$\text{Unit Demand Savings} = \Delta\text{kW} = \left(\frac{\text{Btu}}{\text{hr}} * \left(\frac{1}{EERexisting}\right)\right) * Coincidence\ Factor$$

Where: coincidence factor equals 0.3.

Part-Use

The part-use factor accounted for appliances not plugged in year-round prior to participation. For PY7, the team applied a part-use factor of 0.93 for refrigerators and 0.85 for freezers, as specified in the Statewide TRM Version 3.0.

Applying the part-use factors to modeled annual consumption from Table 10 yielded AIC's average per-unit gross energy savings for PY7. As shown in Table 11, the verified per-unit values for refrigerators and freezers were 951 kWh and 971 kWh, respectively.

Table 11. PY7 Evaluated Gross Energy Savings (Per-Unit)

Recycling Measure	Ex Ante Unit Energy Savings (kWh)	Ex Post Unit Energy Savings (kWh)	Percent Change
Refrigerator	907	951	+5%
Freezer	935	772	-17%
Air Conditioner	188	346	+84%

Table 11 also compares ex ante and ex post gross savings. Refrigerator savings increased by 5% largely due to an increase in the part use factor (0.88 in PY6 increased to 0.93 for refrigerators). Freezer savings decreased by 17% from PY6. The decrease is primarily due to a correction in the TRM Version 3.0 where HDD and CDD coefficients in the regression algorithm were transposed in the freezer algorithm.[5] Ex ante savings are based on the PY6 mix of units. Air conditioner savings increased due to the size, or cooling capacity, of the units increasing in PY7 relative to PY6.

3.3.2. Net Impacts

The program's NTGR, as calculated in PY5 (PY4 for freezers), drew on the self-report approach methodology, established in the Uniform Methods Project protocol for evaluation of appliance recycling programs.[6] The PY5 NTGR offered the most recent analysis performed that met the Illinois NTGR framework.

The evaluation team used the following formula to estimate net savings for recycled refrigerators:

$$Net\ savings = Gross\ Savings - Freeridership\ and\ Secondary\ Market\ Impacts - Induced\ Replacement + Spillover$$

[5] Cadmus memo, July 30, 2014; "Illinois Statewide Technical Reference Manual – Refrigerator and Freezer Recycling Work Paper Revision."

[6] National Renewable Energy Laboratory. "Chapter 7: Refrigerator Recycling Evaluation Protocol" Last modified April, 2013. Accessed September 17, 2015. http://energy.gov/sites/prod/files/2013/11/f5/53827-7.pdf

Where:

Gross Savings	=	The evaluated *in situ* UEC for the recycled unit, adjusted for part-use;
Freeridership and Secondary Market Impacts	=	Program savings that would have occurred in the program's absence;
Induced Replacement	=	Average additional energy consumed by replacement units purchased due to the program;
Spillover	=	Savings attributable to measures installed absent any program incentives that were greatly influenced by participation in the appliance recycling program.

The team applied the SAG-approved NTGR for PY7, as shown in Table 12.

Table 12. Ex Post Per-Unit Net Savings

Recycling Measure	Ex Post Gross Per-Unit Savings (kWh)	NTGR	Ex Post Net Per-Unit Savings (kWh)
Refrigerator	951	56%	533
Freezer	772	62%	479
Room Air Conditioner	346	50%	173

3.4. Future Inputs

3.4.1. Retailer Research—Freeridership

The evaluation team interviewed small retailers to assess haul-away and resell practices of retail channels where ARP participants would likely purchase new appliances. Based on this analysis, we determined that no change to the freeridership assumptions around the secondary appliance market approach is necessary. We provide further details of the research in Appendix A.

4. Conclusions and Recommendations

- **Conclusion 1:** In addition to general awareness marketing campaigns, AIC could consider increasing targeted marketing strategies to target households with long-term active accounts to try to identify homes with older units (on average) than other program units. Older units produce higher-than-average savings, especially if manufactured before the early 1990s appliance efficiency standards. Combined with program implementers' information on appliance ages in different regions of the service territory, such targeted marketing strategy could yield higher per-unit savings by increasing the proportion of older appliances recycled through the program.

  - **Recommendation 1:** In addition to general awareness marketing campaigns, AIC could consider increasing targeted marketing strategies, such as the targeted bill inserts discussed in the Marketing section, to maintain current participation levels. As suggested in PY6, targeting households with long-term, active accounts could potentially identify homes with units older, on average, than other program units. Older units produce higher-than-average savings, especially if manufactured prior to the appliance efficiency standards of the early 1990s. Combined with information program implementers have on appliance age in different regions of the service territory, this targeted marketing strategy could yield higher per-unit savings by increasing the proportion of older appliances recycled through the program. For example, a recent ARP study found that by targeting homes with accounts active for 10 years or more, the average age of appliances recycled through the program increased by 27% and gross per-unit savings increased by 19%.

- **Conclusion 2:** The assumption that appliances younger than 10-years are re-sellable and those older are not is still the most applicable criteria for application in freeridership calculations. Smaller, local retailers that sell used appliances indicated that some non-working units and many units older than 10 years may be sellable on the used appliance market but also noted that some working units younger than 10 years may not be sellable. Retailers suggested that overall condition and potential repair costs also determine secondary market salability. However, these criteria prove much more challenging to assess at pickup than using an "age" criteria..

  - **Recommendation 2**: Given the challenge in identifying alternative criteria for identifying appliances that would sell in the secondary market, continue using the 10-year age cutoff as a reasonable estimate of an appliance's secondary market viability.

Appendix A. Retailer Research

Research Objective

In PY5, an evaluation of ComEd's ARP program utilized retailer research to determine the haul-away practices of retail channels where ARP participants would likely purchase new appliances. The research sought to determine what would have happened to appliances that participants indicate would have been picked up by a retailer, in the program's absence. As part of this research, ComEd's evaluation team interviewed several large, national retail chains.

The purposes of this research was to determine, for units that would have been hauled away by a retailer absent the program, what proportion would the retailers have resold versus removed from service, thereby establishing retailer-specific freeridership ratios. The evaluation team supplemented the research conducted for ComEd for two reasons.

First, Ameren Illinois' service territory includes more rural areas and the retailers operating in that area differ somewhat from those in ComEd's territory. Second, in the PY6 AIC participant survey responses there were several retailers mentioned by participants that were not covered in the ComEd research, which were local appliance retailers rather than big box chains. In particular, the evaluation team investigated whether practices differed between smaller retailers and larger chains—specifically whether smaller retailers are more likely to repair and resell used appliances and therefore would have different freeridership rates.

Sample

The evaluation team identified possible retailers to interview by reviewing names of retailers provided by customers through the PY6 participant survey. We focused our effort on smaller retailers that were not included in ComEd's research.

Haul-Away Practices

All retailers the evaluation team interviewed offered haul-away service with the purchase of a new unit. Three retailers offered the service for free and one charged $10. Two retailers said a small number of customers prefer to have their units picked up by the retailer rather than having to wait for the program to come by.

All four retailers indicated that most units they picked up were destroyed. However, they said this primarily results from the fact that working appliances are eligible for AIC's program and most customers opt for the program because of the incentive. One retailer said that because of the program there is a lack of available used units, and said he formerly had many used appliances and now they are "few and far between anymore."

One retailer only sold new appliances; others sold used appliances, provided they are in good shape. However, the one retailer who sold only new units had a contact that runs a used appliance business that picks up the haul-away units.

In every case, retailers said they primarily used age and condition to determine whether a unit was viable as a used appliance. None of the retailers had hard criteria but working condition was not a determining factor. For units not working, if the unit is repairable and in reasonably good condition, it will be resold.

One retailer said repairable units would likely resell, unless they were 30-40 years old. Another said old units are not worth the money to repair but did not provide a specific range.

Impact on Freeridership

The evaluation team's interview results suggest the behavior of smaller retailers differs from large retail chains. While smaller retailers did not discuss policies, some of the larger retailers indicated that they try to remove 100% of haul-aways from service (as found in the ComEd research). Absent the program, units that would be picked up by small retailers likely end up on the used market, except for old units or those in very poor condition.

Though the interviews did not yield specific age cutoffs, the team recommends maintaining the 10 year viability cutoff used in prior evaluations. For units that would have gone to smaller retailers, assume any units 10 years or younger would be likely to remain in service, rather than a specifying a freeridership score, as any change in the cutoff would be arbitrary.

Appendix B. Data Collection Instruments

AIC PY7 ARP Interview Guide.doc

AIC PY7 ARP Retailer Interview Guide_FIN

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