2012 Appliance Turn-in Program

Impact and Process Evaluation Report

Prepared for the FirstEnergy Ohio Companies:

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Table of Contents

List of Figures

List of Tables

1. Executive Summary

For 2012, the Ohio operating companies The Cleveland Electric Illuminating Company (CEI), Ohio Edison (OE), and The Toledo Edison Company (TE) (collectively "Companies") offered the Appliance Turn-In Program. This program offered residential customers rebates for the recycling of refrigerators, freezers, and room air conditioners (RACs) during the 2012 program year. The goal of the program is to permanently remove from the system old appliances, which are generally inefficient. Units removed from customers' homes cannot enter the used appliance market, which in the absence of this program would be a likely alternate outcome.

A total of 9,427 households in the service territories of the Companies received appliance collection and recycling services through the Appliance Turn-In Program in 2012. Program design allows for an individual household to recycle up to two refrigerators or freezers and up to two RACs per year. The number of participating households within each utility is shown in Table 1-1.

Table 1-1: Program Participation by Utility

Utility	*Number of Participants*[1]
CEI	3,225
OE	5,644
TE	558
All Companies	9,427

Ex post gross electric savings were estimated through detailed analysis of program tracking data and participant survey data. ADM Associates, Inc. (ADM) conducted analyses of these data using statistical and engineering models that have been utilized to evaluate similar recycling programs.

Ex post verified electric savings was 10,293,613 kWh annually (a realization rate of 87 percent) and 5,404,673 kWh during the 2012 calendar year (first-year pro-rata savings). *Ex post* verified peak demand reduction was 1,723 kW. For detailed tables listing energy savings and demand reductions by measure type, please refer to Appendix A. *Ex post* gross energy savings (kWh) and peak demand reduction (kW) for the program in the three service territories are reported in Table 1-2.

[1] The number of participants was counted by identifying the number of unique customer IDs in the program tracking database. A number of participants recycled more than one appliance.

Table 1-2. Overall Evaluation Results

Utility	*Ex Ante Expected Gross Savings*		*Ex Post Verified Gross Savings*	
	Gross kWh	*Gross kW*	*Gross kWh*	*Gross kW*
CEI	4,064,178	725.26	3,525,012	590
OE	7,046,994	1,216	6,163,402	1,029
TE	686,833	132	605,199	103
All Companies	11,798,005	2,073	10,293,613	1,723

Key findings from the process evaluation of the 2012 Appliance Turn-In program include:

- **Participants of the Appliance Turn-In Program are highly satisfied.** Respondents to the participant survey reported very positive satisfaction ratings for numerous program elements including the scheduling process, the actual pick-up, communication with program staff, the incentive amount and the time to receive the rebate check. There were very few instances of dissatisfaction, and the majority of these were anecdotal in nature. These results suggest that the program continues to be a reliable entity that is capable of meeting customer expectations and goal targets.
- **The Companies' Appliance Turn-In program is continuing to operate smoothly.** The basic design of the program (i.e., measures, implementation, QA/QC, etc.) has not changed from the first program year so neither the Companies staff nor JACO staff reported any issues with program implementation in 2012.
- **Quality Assurance and Quality Control (QA/QC) procedures continues to effectively monitor the entire recycling process at the measure level.** The Companies program staff and the JACO staff described extensive QA/QC checks to monitor the appliance chain-of-custody, beginning with the scheduling of the pick-up to the actual recycling of the appliance at the facility.
- **JACO's dashboard continues to be an effective reporting mechanism for program staff.** The Companies have real time access to detailed levels of information needed to effectively manage and monitor program operations. The dashboard replaces the additional costs of generating time-consuming reports.
- **Program incentive levels are still appropriate.** Both the Companies staff and JACO staff report incentive levels as being effective and are similar to other appliance recycling programs across the country.

- **Program partnerships with retailers, such as Sears, have not seen significant results.** It is reported by program staff that less than 5 percent of the recycled appliances come from retailer assistance.
- **There is still large market potential for appliance recycling programs.** Program staff estimates in Ohio that less than 5 percent of disposed refrigerators are recycled through the program, whereas in more seasoned states, their program is recycling approximately 20 percent of disposed refrigerators.
- **There are no immediate challenges to implementing the program and reaching goals.** All program staff agreed that this program has no foreseeable challenges. The market potential is plentiful enough to reach targets, QA/QC is well grooved and consistent, and marketing efforts have been effective.

2. Introduction and Purpose of Study

Under contract with the Companies, ADM is performing measurement and verification (M&V) activities to confirm the energy savings and demand reduction being realized through the energy efficiency programs that the Companies are implementing in Ohio in 2012. The purpose of this report is to present the results of the impact evaluation effort undertaken by ADM to verify the energy savings and peak demand reductions that resulted from appliances collected and recycled through the Appliance Turn-In Program during 2012. Additionally, this report presents the results of the process evaluation of the program focusing on participant and program staff perspectives regarding the program's second year of implementation.

The impact evaluation component of this report estimates annual gross energy savings and peak demand reduction as framed by the following five research questions:

- How many eligible refrigerators, freezers, and room air conditioners were collected for recycling?
- What is the average annual kWh savings per collected appliance?
- What is the average kW reduction per collected appliance?
- What fraction of collected appliances were either not used, or used only part time over the past year?
- How many of the room air conditioners were replaced and how many represent a net removal from the grid?

The goal of the process evaluation component was to determine how effective the program is in terms of customer satisfaction, customer awareness, and stakeholder interaction. The process evaluation was framed, therefore, by the following four research questions.

- How effective were the marketing efforts for the program? Which marketing methods were most effective?
- How well did the Companies' staff and the implementation team work together?
- Were the program participants satisfied with their experience? What was the level of satisfaction with the incentive amount, the scheduling process, and the pickup process?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

3. Description of Program

First launched on May 2, 2011, the Appliance Turn-In program is designed to help customers reduce their energy consumption by removing old, working refrigerators, freezers, and room air conditioners (RACs) from their homes for recycling. There is a limit of two refrigerators or freezers per household per calendar year. A maximum of two room air conditioners can be picked up at the same time as the refrigerator and/or freezer. The Companies benefit because the old appliances, which are generally inefficient, are permanently removed from the system. The environment also benefits from the recycling process through safe disposal of environmentally harmful material.

The goal of the program is to reduce the number of old, inefficient refrigerators and freezers that customers have moved to their garages or other locations such as basements and patios. Many areas in which spare units are placed are not space conditioned and most refrigerators used in that environment operate under a heavy thermal load during the summer. This is exacerbated by the fact that the appliances are usually quite old and inefficient. Previous studies by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and other utilities have determined that removing these appliances, and properly recycling them, performs an energy saving service.

The Companies contract with JACO, Inc. (JACO) to implement the program. The program is designed as a turnkey, stand-alone energy efficiency initiative. The program targets existing multi- and single-family households, renters and homeowners who have old, inefficient refrigerators, freezers, or RACs. Marketing for the program consists of newspaper, radio, and TV ads; bill stuffers; and community events. There is an additional marketing channel for low-income participants, who may become aware of the program from auditors from other low-income specific energy efficiency programs. To be eligible for the program, appliances to be recycled must be in working condition, plugged in and cooling at the time of pick-up. The customer receives pick-up and removal service in addition to a $50 rebate per recycled refrigerator or freezer. Customers with inefficient, working RAC units receive a $25 rebate for each recycled unit.

Removing old, inefficient refrigerators, freezers and RACs prevents them from being resold or transferred to another utility customer. The program provides annual electric energy savings for the remaining life of the unit by permanently removing the appliance from service. As an added environmental benefit, 95% of the materials from these units are able to be recycled (metals, plastic, glass, oil, etc.) and disposed of in an environmentally responsible manner, thus preventing the materials from reaching landfills and contaminating the environment.

4. Methodology

This chapter provides a description of the methodology applied by ADM in the evaluation of the 2012 Appliance Turn-In Program. The chapter is divided into two sections: impact evaluation methodology and process evaluation methodology.

4.1 Impact Evaluation Methodology

The impact evaluation component of this report estimates annual gross energy savings (kWh) and peak demand reduction (kW) as framed by the following five research questions:

- How many eligible refrigerators, freezers, and room air conditioners were collected for recycling?
- What is the average annual kWh savings per collected appliance?
- What is the average kW reduction per collected appliance?
- What fraction of collected appliances were either not used, or used only part time over the past year?
- How many of the room air conditioners were replaced and how many represent a net removal from the grid?

The methodology used to address each of these questions is detailed in the following sections.

4.1.1 Verification of Units Recycled

A first aspect of conducting measurements of program activity is to verify the number of refrigerators, freezers, and RACs collected and recycled. ADM took several steps in the verification effort, which consisted of the following:

- Validating program tracking data provided by JACO by checking for duplicate or erroneous entries;
- Verifying that refrigerators, freezers, and RACs are recycled according to the agreed-upon process between JACO and the Companies; and
- Conducting verification surveys with a statistically valid sample of program participants. The focus of these verification surveys was to verify that customers listed in the program tracking database did indeed participate and that the number of appliances claimed to be recycled was accurate. Additionally, survey respondents were asked a series of questions to verify the working condition of their recycled appliances; it is a program requirement that collected units be in working condition at the time of pick-up.

As the first step toward verification, tracking data for the program provided by JACO were reviewed. The numbers of refrigerators, freezers, and RACs reported in the program tracking data that were recycled during 2012 are shown in Table 4-1.

Table 4-1: Appliances Recycled in 2012

Utility	*Number of Refrigerators Collected*	*Number of Freezers Collected*	*Number of RACs Collected*
CEI	2,844	568	237
OE	4,827	1,176	403
TE	499	92	60
All Companies	8,170	1,836	700

As the table above shows, the vast majority of program participation was represented by recycled refrigerators. Freezer units were a distant second while RACs represented the smallest portion of program participation. Refrigerators represent approximately 83% of the *ex ante* kWh savings claimed for the program; freezers represent approximately 17% while RACs represent less than 1%. ADM conducted telephone interviews with a sample of program participants to verify participation and obtain information with which to determine the percentage of units that were still operable when picked up by the recycler. A random sample, stratified by measure type and company, was selected to ensure that 90 percent confidence with ±10 percent relative precision (or better) would be achieved for each utility.

For the calculation of sample size, a coefficient of variation of 0.5 was assumed.[2] On this assumption, a minimum sample size of 68 participants per utility was required, as shown in the following formula:

[2] The coefficient of variation, cv(y), is a measure of variation for the variable to be estimated. Its value depends on the mean and standard deviation of the distribution of values for the variable (i.e., cv(y) = sd(y)/mean(y)). Essentially, cv is a metric of how wide the distribution of values for the variable of interest is.

As set out in the *Model Energy Efficiency Program Impact Evaluation Guide*:

> *"Until the actual mean and standard deviation of the population can be estimated from actual samples, 0.5 is often accepted as an initial estimate for cv. The more homogenous the population, the smaller the cv."*

Using a cv = 0.5 is also in accordance with California Evaluation Protocols for homogenous measures.

Minimum Sample Size Formula for 90 Percent Confidence Level

$$n_0 = \left(\frac{Z * CV}{RP}\right)^2 = \left(\frac{1.645 * 0.5}{0.10}\right)^2 = 68$$

Where:

n_0	=	minimum sample size
Z	=	Z-statistic value (1.645 for the 90% confidence level)
CV	=	Coefficient of Variation (assumed to be 0.5)
RP	=	Relative Precision (0.10)

ADM conducted phone surveys with 70 participants in each of the three service territories. The questionnaire that was the instrument for the survey interviews is provided in Appendix B. Survey respondents were asked a number of appliance specific questions. Based on the measure stratification scheme outlined above, appliance specific information was collected for the following: 44 refrigerators, 35 freezers and 37 RAC in the OE service territory; 53 refrigerators, 22 freezers and 28 RACs in the CEI service territory; and 53 refrigerators, 26 freezers and 27 RACs in the TE service territory. In total, 210 participants were surveyed representing 325 individual appliances. The number of appliances was significantly higher than the number of customers interviewed as a result of the program structure requiring a refrigerator or freezer to be recycled to be eligible for RAC recycling (i.e., no RACs are recycled on their own). The results of this survey effort were used to verify the number of program eligible appliances recycled in 2012.

4.1.2 Calculating Gross Annual kWh Savings per Appliance

Ex ante savings estimates for the Companies' Appliance Turn-In program were taken directly from the draft *State of Ohio Energy Efficiency Technical Reference Manual* (TRM)[3] for units recycled during January through May. These values are 1,376 kWh per refrigerator, 1,244 kWh per freezer, and 103.6 kWh per RAC recycled through the program. In June, the Companies' updated the ex ante savings estimates based on evaluation findings from the 2011 program year. The per-unit ex ante kWh estimates for units recycled June through December were: 1,075 per refrigerator, 890 per freezer, and 150 per RAC. For the impact evaluation effort, these savings estimates were assessed by developing separate gross unit energy consumption (UEC) estimates for refrigerators, freezers and RACs recycled through the program in 2012.

4.1.2.1 Refrigerators and Freezers

In evaluation research performed under contract for the California Public Utility Commission (CPUC), the Cadmus Group refined the use of linear multiple regression

[3] Vermont Energy Investment Corporation (VEIC), *State of Ohio Energy Efficiency Technical Reference Manual,* Prepared for Public Utilities Commission of Ohio, Draft of August 6, 2010.

methodology for estimating energy savings resulting from refrigerator recycling.[4] This research consisted of a dual metering study to determine energy savings associated with refrigerators recycled throughout California between 2006 and 2008. For its study, Cadmus used data on refrigerator energy use obtained through two in situ monitoring efforts:

- A dual monitoring study that ADM conducted in support of the evaluation of the California 2004-2005 Statewide Residential Appliance Recycling Program (RARP)[5]; and
- Additional in situ monitoring that Cadmus conducted as part of its study.

The product of these efforts was a database that contained energy use obtained through both Department of Energy (DOE) testing and in situ monitoring for a sample of 321 units, 184 of which were from the 2004-2005 evaluation and 137 from the 2006-2008 evaluation. Cadmus used the data from this dual monitoring sample to develop regression models that relate the annual unit energy consumption (UEC) of refrigerators - metered both *in situ* and according to DOE testing protocols – to various characteristics of the appliance and the household in which the appliance was used. The estimated coefficients from these models have been used in numerous subsequent studies to evaluate refrigerator degradation and to estimate appropriate UECs for appliances recycled through similar programs. As examples, the results of the Cadmus study were used by ADM in its evaluation of the 2010 and 2011 Nevada Energy Second Refrigerator Recycling Program[6,7], and by NMR Group, Inc., in its recent evaluation of the the 2009-2010 Massachusetts Appliance Turn-in Program.[8]

ADM used the DOE-based multiple regression model developed by Cadmus to estimate the UEC for refrigerators recycled through the Companies' program. Specifically, the average characteristics of refrigerators recycled through the program were multiplied by the associated coefficients from the Cadmus model and summed to produce an estimated average UEC for refrigerators recycled through the program. However, this UEC represents the annual energy consumption of the average refrigerator under conditions identical to the DOE testing procedure. To account for differences between the DOE testing environment and conditions in participants' homes, an adjustment for *in situ* conditions was necessary.

As part of its study, Cadmus compared the *in situ* and DOE based UEC's using an additional regression model which accounted for environmental factors that have the

[4] The Cadmus Group, Inc. "Residential Retrofit High Impact Measure Evaluation Report", prepared for the California Public Utilities Commission. February 7, 2010.
[5] ADM Associates, Inc., Athens Research, Hiner & Partners, Innovologie LLC, "Evaluation Study of the 2004-05 Statewide Residential Appliance Recycling Program" April 2008.
[6] ADM Associates, Inc., "2010 Second Refrigerator Recycling Program, NV Energy—Southern Nevada, Program Year 2009, Measurement & Verification Report." June, 2011
[7] ADM Associates, Inc., "2011 Second Refrigerator Recycling Program, NV Energy—Southern Nevada, Program Year 2010, Measurement & Verification Report." March, 2012
[8] NMR Group, Inc., "Massachusetts Appliance Turn-in Program Impact Evaluation" June 2011.

potential to affect refrigerator energy consumption. The results of this analysis indicated that there are three significant environmental factors affecting *in situ* refrigerator energy consumption that are not captured by DOE testing. Specifically, climate zone, household size, and whether the refrigerator is a primary or secondary unit. Cadmus used the dual monitoring data to develop a series of modification factors based on these three environmental variables. ADM used these modification factors, along with results from the participant survey, to determine appropriate adjustments to the DOE based refrigerator UEC estimate.

It is important to note that the Cadmus model only considers refrigerators. Accordingly, ADM used a refrigerator-to-freezer ratio factor to determine the average UEC for freezers. This refrigerator-to-freezer factor methodology is similar to that used by the NMR Group, Inc. in their recent evaluation of the Massachusetts Appliance Turn-in Program.[9] Using relevant secondary sources, ADM concluded that freezers on average use 15% less energy annually than refrigerators. This implies a refrigerator-to-freezer factor of 0.85. The analysis supporting this refrigerator-to-freezer factor is detailed in the previously mentioned Massachusetts Appliance Turn-In Program Evaluation performed by NMR Group, Inc.[10]

Finally, a partial use factor was developed for refrigerators and freezers to adjust UEC estimates to reflect the gross savings of appliances that were recycled through the program. The partial use factor is designed to account for the fact that not all refrigerators and freezers are plugged in year round. Secondary appliances are more likely to be unplugged for a portion of the year than primary appliances, and since there was a large presence of secondary appliances in the program, the partial use factor is an important consideration when developing gross savings estimates.

Based on the proceeding discussion, the procedure used by ADM to estimate gross energy savings (kWh) for the refrigerators and freezers recycled through the program can be summarized by the following steps:

1) The Cadmus DOE based model was used to predict the average UEC for participating refrigerators in 2012 based on the average refrigerator characteristics established from JACO records.
2) Freezer UEC was obtained by multiplying the estimated refrigerator UEC by the refrigerator-to-freezer factor of 0.85 to obtain estimates of the average freezer UECs.
3) The estimated UECs are adjusted to represent *in situ* operating conditions.
4) Partial use factors were applied to the UEC estimates to account for some of the appliances that were not being used throughout the entire year prior to being recycled.

[9] Ibid.
[10] Ibid.

5) The estimated average UECs for refrigerators and freezers were extrapolated to the population of program participating units to obtain a program level estimate of gross kWh savings resulting from refrigerator and freezer recycling.

4.1.2.2 Room Air Conditioners (RACs)

Calculating gross kWh savings for recycled room air conditioners was done in accordance with the algorithms in the Energy Star Room AC Calculator.[11] For the sake of consistency with the methodology outlined in the TRM, savings were adjusted for units that were replaced by new RACs after recycling. The percentage of units replaced by new RACs was assumed to be 76% based on assumptions presented in the TRM. As part of the participant survey, respondents were asked to identify whether they replaced the RACs they recycled. The survey results suggest that 46% of RACs were replaced directly with new RACs, while an additional 13% of recycled RACs were supplanted by new central AC systems. While these results suggest that the actual replacement rate may be less than the 76% stipulation in the TRM, it is possible that the timing of the survey was insufficient to capture replacements that will occur in preparation for the 2013 summer season. To be conservative, the stipulated 76% replacement value was used. The following formula was used to calculate kWh savings for the average RAC recycled through the program:

$$Annual\ kWh\ Savings = \frac{EFLH * \left(\frac{CAPY_{existing}}{EER_{existing}}\right)}{1000} - \left(\%replaced * \frac{EFLH * \left(\frac{CAPY_{newbase}}{EER_{newbase}}\right)}{1000}\right)$$

Where:

EFLH = Effective Full Load Cooling Hours

$CAPY_{existing}$ = Capacity of the average collected unit (in BtuH).

$CAPY_{newbase}$ = Capacity of the baseline replacement unit (in BtuH).

$EER_{existing}$ = The Energy Efficiency Ratio of the average collected unit.

$EER_{newbase}$ = The Energy Efficiency Ratio of the baseline replacement unit.

$\%replaced$ = The percentage of collected units replaced.

Furthermore, performance degradation of existing room air conditioners was accounted for using the methodology established by the National Renewable Energy Laboratory's

[11] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls?7e02-5075

2006 "*Building America Performance Analysis Procedures for Existing Homes*" booklet.[12] Specifically, the following equation was used to degrade the existing room air conditioners' at-manufacture EER value:

$$EER_{existing} = \left(EER_{At-manufacture}\right) * (1 - M)^{age}$$

Where:

$EER_{existing}$ = Estimated EER at time of collection.

$EER_{At-manufacture}$ = At-manufacture EER

M = Maintenance Factor (0.01)

Age = Age of unit at time of collection in years.

The program tracking database was not as detailed for RACs as it was for refrigerators and freezers. Information regarding the age of collected RACs was provided in the tracking database, but there was no information regarding capacity or EER. Additionally, the model numbers provided in the tracking database could not easily be used to find capacity and EER information in any systematic way. However, the Association of Home Appliance Manufacturers (AHAM) maintains sales weighted average capacity and EER data going back to 1972.[13] The most recent year that the data was available was 2010. Some interpolation was required for the years 1973 and 1979 and 1998.

Using this AHAM data, each RAC recycled through the program was assigned a proxy EER value based on the units age reported in the tracking system. For RACs whose reported age indicated a vintage before 1972, the sales weighted average EER for 1972 was used as a proxy. The EER values were then adjusted to account for equipment degradation as described above. The baseline replacement RAC was assumed to have an EER equal to the sales-weighted average RAC in 2010 from the AHAM data (EER = 10.18). Effective Full Load Hours (EFLH) were assumed to be 233 hours based on the assumptions in the TRM. The existing and new baseline capacity was assumed to be 10,000 BtuH based on the assumptions in the Energy Star Room Air Conditioner Savings Calculator. This 10,000 BtuH capacity assumption is greater than the 8,500 BtuH assumption in the TRM. However, it is in line with the AHAM average sales-weighted capacity of RACs recycled through the program in 2012 based on vintage.

[12] NREL (2006). "*Building America Performance Analysis Procedures for Existing Homes.*" http://www.nrel.gov/buildings/pdfs/38238.pdf

[13] This AHAM data was accessed from two sources:
1. http://www.nwcouncil.org/energy/rtf/meetings/2011/0301/LED_MF_RAC_supporting%20files.zip
2. http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=5.7.7

4.1.3 Calculating Gross Peak Demand (kW) Savings

Gross electric peak demand savings were calculated based on the algorithms and stipulations specified in the TRM. For refrigerators and freezers, the TRM stipulates that summer coincident peak demand savings are estimated by dividing verified gross per-unit kWh savings by 8,760, and multiplying by a temperature adjustment factor of 1.30[14] as well as a load shape adjustment factor of 1.074.[15] For room air conditioning units, the TRM stipulates that summer coincident peak demand savings are estimated using a summer peak coincidence factor of 0.3.[16] While the algorithm for calculating RAC peak kW reduction presented in the TRM is reasonable, there is an arithmetic error in the TRM that results in an over estimation of the actual per-unit reduction. ADM corrected this error in applying the TRM algorithm for RACs recycled through the program in 2012.

4.1.4 Calculating First-Year Pro-Rata and Lifetime kWh Savings

First-year pro-rata kWh savings are defined as gross kWh savings occurring during the 2012 calendar year. First-year pro-rata savings were calculated by determining the percentage of the 2012 year that was remaining from the date when each unit was picked-up for recycle. The remaining time that the unit could have potentially been in service was used along with the appropriate service territory verification rates for refrigerators, freezers, and room air conditioners in determining the share of annual kWh savings realized in the 2012 calendar year. After first-year pro-rata kWh savings was calculated for each unit individually, they were summed in order to determine program-level first-year pro-rata kWh savings.

Lifetime kWh savings were calculated by multiplying *ex post* verified annual gross kWh estimates by appropriate remaining useful life (RUL) values for each appliance type. The RUL values used were three years for RACs and eight years for refrigerators and freezers based on the assumptions in the TRM.

4.2 Process Evaluation Methodology

The process evaluation component of this report was designed to answer the following research questions:

[14] Temperature adjustment factor based on Blasnik, Michael, "Measurement and Verification of Residential Refrigerator Energy Use, Final Report, 2003-2004 Metering Study", July 29, 2004 (p. 47). It assumes 64% of Ohio homes have central air conditioning.

[15] Daily load shape adjustment factor also based on Blasnik, Michael, "Measurement and Verification of Residential Refrigerator Energy Use, Final Report, 2003-2004 Metering Study", July 29, 2004 (p. 48, using the average Existing Units Summer Profile for hours ending 16 through 18)

[16] Consistent with coincidence factors found in: RLW Report: Final Report Coincidence Factor Study Residential Room Air Conditioners, June 23, 2008 (http://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/National%20Grid/117_RLW_CF%20Res% 20RAC.pdf)

- How effective were the marketing efforts for the program? Which marketing methods were most effective?
- How well did the Companies' staff and the implementation team work together?
- How complete and how accurate was the program tracking database?
- Were the program participants satisfied with their experience? What was the level of satisfaction with the incentive amount, the scheduling process, and the pickup process?
- What changes can be made to the program's design or delivery to improve its effectiveness in future program years?

The methodologies used to answer these researchable questions are discussed in the following sections.

4.2.1 Participant Telephone Interviews

ADM completed a total of 210 participant telephone interviews that addressed a number of process related issues. Survey respondents were asked a series of questions that identified the marketing channels through which they became aware of the program. They were also asked a series of questions aimed at determining the reasons for disposing of the appliance. These questions were aimed at determining how effective the marketing materials are at inducing program participation. Customers were also asked to identify the main reason they chose to participate in the program as opposed to other disposal methods. The influence of the incentive amount on program participation was also explored.

The participant survey was also used to determine customer satisfaction with the Appliance Turn-In program. In particular, respondents were asked about their level of satisfaction with the scheduling process, pickup process, incentive amount, and interaction with program staff. Additionally, respondents were asked a number of demographic questions including those recommended by the Statewide Evaluator (SWE) for purposes of consistency across Ohio utilities, as relevant to the Appliance Turn-In program.

4.2.2 Program Staff Interviews

ADM conducted in-depth interviews with program staff from the Companies and JACO, Inc. The interviews were conducted during April of 2013. The objective of these interviews was to gather feedback from the Appliance Turn-In program and implementation staff to determine how the program is operating and to collect suggestions for program improvements.

5. Detailed Impact Evaluation Findings

This chapter presents the findings of the impact evaluation of the 2012 Appliance Turn-In Program.

5.1 Verification of Units Recycled

As a first step toward estimating program level kWh and kW impacts, ADM reviewed program tracking data provided by JACO for accuracy. No duplicate entries were discovered. To verify that the number of units claimed in the program tracking database was accurate, ADM administered a telephone survey with a sample of program participants.

All 210 respondents who completed the participant survey verified that they had in fact participated in the program during 2012. All except one of the survey respondents also indicated that the number of appliances recycled was identical to the claims in the JACO tracking database. One respondent stated that he turned in two RACs instead of one. However, in order for participating appliances to accrue energy savings by being taken out of service, the units must be in working condition at the time of pick-up. One respondent in the OE service territory and two respondents in the TE territory indicated that their appliance was not in working condition at the time of pick-up. One respondent was referencing a refrigerator that was recycled and two respondents were referencing an RAC that was recycled. All other survey respondents indicated that their units were in working condition at the time of pick-up. Based on these results, the verification rates shown in Table 5-1 for each utility and each appliance were determined:

Table 5-1: Verification Rates by Utility and Appliance Type

Utility	*Appliance Type*		
	Refrigerator	*Freezer*	*RAC*
CEI	100.0%	100.0%	100.0%
OE	100.0%	100.0%	97.3%
TE	98.1%	100.0%	96.3%

Based on these verification rates, Table 5-2 reports the numbers of refrigerators, freezers, and RACs recycled through the program during 2012 that were verified as being in working condition when recycled and therefore program-eligible.

Table 5-2. Recycled Appliances Verified to be in Working Condition

Utility	*Quantity Reported as Recycled*	*Verification Rate*	*Quantity of Recycled Units Verified as Program Eligible*
CEI			
Refrigerator	2,844	100%	2,844
Freezer	568	100%	568
RAC	237	100%	237
OE			
Refrigerator	4,827	100%	4,827
Freezer	1,176	100%	1,176
RAC	403	97.3%	392
TE			
Refrigerator	499	98.1%	490
Freezer	92	100%	92
RAC	60	96.3%	58

5.2 Gross Annual kWh Savings per Appliance

Gross annual kWh savings were calculated as described in chapter four of this report. The details and results of these calculations are reported in this section.

5.2.1 Refrigerators and Freezers

For refrigerators, Unit Energy Consumption (UEC) estimates were derived using the DOE-based regression model developed by Cadmus in the evaluation of the California Statewide Appliance Recycling Program. The model specification and estimated coefficients of the Cadmus model are shown in Table 5-3.

Table 5-3: Cadmus DOE based UEC Regression Details[17]
(Dependent Variable – DOE Estimated UEC, R^2=0.41)

Independent Variables	*Coefficient*	*t-Value*
Intercept	491.83	1.9
Dummy: Side-by-Side Configuration	98.96	0.5
Size (Cubic Feet)	35.3	2.9
Age (Years)	25.25	4.7
Interaction: Side-by-Side x Age	19.98	2.2
Dummy: 2006-2008 Metering Sample	-413.99	-6.3

The program tracking database included information regarding configuration, size, and age[18] for all but one of the 8,170 refrigerators collected in 2012. Of these 8,170 refrigerators, 22.3% were side-by-side models; the average size was 18.3 cubic feet and the average age was 24.3 years old. Table 5-4 shows all of the relevant refrigerator characteristics.

Table 5-4: 2012 Program Refrigerator Characteristics

Appliance Characteristics	*Refrigerators*
Sample Size	8,170
Side-by-Side Percentage	22.3%
Average Size (Cubic Feet)	18.3
Average Age (Years)	24.3
Interaction: Side-by-Side x Age	4.2

The refrigerator characteristics shown in Table 5-4 were used in conjunction with the model coefficients in Table 5-3 to calculate annual energy consumption estimates for program participating refrigerators. The refrigerator-to-freezer factor of 0.85 was applied to develop annual energy consumption estimates for freezers. These calculations are shown below:

[17] Source: Cadmus et al. (2010). *Residential Retrofit High Impact Measure Evaluation Report..* February 8th, 2010.

[18] Model year is listed on refrigerator nameplates for many but not all units. As explained to ADM staff, when model year is not listed on the nameplate it is estimated based on appliance characteristics common to certain vintages.

Refrigerator UEC (kWh)

$$491.83 + 98.96 * 0.223\ (Side - by - Side) + 35.3 * 18.3\ (Size) + 25.25 * 24.3\ (Age) + 19.98 * 4.2\ (Interaction) - 413.99 = 1{,}441\ kWh$$

Freezer UEC (kWh)

$$1{,}441 * 0.85\ (refrigerator - to - freezer\ factor) = 1{,}225\ kWh$$

It is important to note that these UEC estimates are based on the DOE testing procedure, and therefore estimate the energy usage of units of appliances in the DOE testing environment. An adjustment is necessary to reflect in situ usage environments. ADM used the modification factors estimated by Cadmus as shown in Table 5-5 below.

Table 5-5. DOE to In Situ Adjustment Factors[19]

Primary	*Household Size*	*Climate Zone*	*N*	*% In Situ Delta*[20]
Yes	1-2	Cool	29	-30.8%
		Warm	18	-19.2%
	3+	Cool	50	-16.0%
		Warm	32	-6.4%
No	1-2	Cool	86	-21.3%
		Warm	42	-15.8%
	3+	Cool	59	-6.8%
		Warm	31	1.3%

For the purposes of this study, Ohio is treated as a Cool Climate. Estimates of primary vs. secondary appliances for refrigerators were derived from responses to the participant survey. These responses indicated that 52.7% of refrigerators collected in 2012 were primary appliances, while the other 47.3% were secondary appliances. All freezers were assumed to be secondary appliances. Estimates of household size were developed using data from the 2008-2010 American Community Survey for Ohio residents.[21] Based on this data, it was determined that 40.7% of Ohio households have one or two occupants, while 59.3% have three or more occupants. These values were used as proxies for program participating households. Using this information to weight the "% In Situ Delta" results in adjustment factors of:

[19] Source: Cadmus et al. (2010). *Residential Retrofit High Impact Measure Evaluation Report.*. February 8th, 2010.

[20] A negative in situ delta represents an *in situ* UEC that is lower than the DOE UEC.

[21] The American Community Survey Data can be accessed for free via the Integrated Public Use Microdata Series (IPUMS) website at: http://www.ipums.org/

Refrigerators: *[(0.407 * -0.308 + 0.593 * -0.16) * 0.527] + [(0. 407 * -0.213 + 0. 593 * -0.068) * 0.473] = -17.6%*

Freezers: *(0.407 * -0.213 + 0.593 * -0.068) = -12.7%*

Applying these adjustment factors to the DOE based UEC estimates above results in the following *in situ* UEC estimates for refrigerators and freezers:

- Refrigerators: 1,187 kWh
- Freezers: 1,069 kWh

One final adjustment was made to account for the fact that not all refrigerators and freezers are plugged in year round. This partial use adjustment assigns different "use factors" based on three categories into which recycled appliances fall:

1) Some units that were recycled were not being used at all before being sent for recycling. The use factor for such units therefore would be zero. That is, these units were not being used even before recycling and therefore had no baseline energy usage.

2) Other units were being used, but for only part of the year. For these units, the use factor is calculated by dividing the number of months in the past year that the unit had been plugged in and running by the number of months in the year (i.e., 12). Based on data collected through the survey of participants, the average number of months in use for a refrigerator that was being partly used was 4.83 months, implying a use factor of 0.403 (i.e., 4.83/12). For freezers in this category, the use factor was calculated to be 0.431, reflecting an average of 5.2 months in use for freezers being partly used.

3) Units used all of the time have a use factor of one (1).

The overall use factor and the corresponding overall Unit Energy Savings (UES) are calculated as a weighted average across the three categories, where the weights are determined by the percentages of units falling into the three categories. Table 5-6 shows the calculation of the overall UES for refrigerators and freezers when partial use is taken into account.

Table 5-6: Unit Energy Savings Adjusted for Partial Use

Operating Status of Unit	*Percentage of Recycled Units in Category*	*Use Factor*	*Calculation of UES to Adjust for Part Use*
	Refrigerators		
Not running	5.33%	0	0
Running part time	8.00%	0.403	478
Running all time	85.33%	1	1,187
Weighted Average UES for Refrigerators			1,051
	Freezers		
Not running	11.11%	0	0
Running part time	9.72%	0.431	460
Running all time	76.39%	1	1,069
Weighted Average UES for Freezers			861

Based on the findings detailed in this section, the *ex post* gross per-unit annual kWh savings for refrigerators recycled through the program is estimated to be 1,051 kWh; the *ex post* gross per-unit annual kWh savings for freezers recycled through the program is estimated to be 861 kWh.

5.2.2 Room Air Conditioners (RACs)

AHAM Sales-weighted average EER values were applied to each RAC recycled through the program in 2012 based on the reported vintage. The resulting average EER value was 7.99. Appliance degradation was taken into account using the methodology established by the National Renewable Energy Laboratory's 2006 "*Building America Performance Analysis Procedures for Existing Homes*" booklet.[22] After accounting for degradation, the average EER for recycled RACs dropped to 6.27. Based on the assumptions presented in the TRM, EFLH were assumed to be 233 and 76% of units were assumed to be replaced. Average capacity for the average existing and baseline replacement RAC was assumed to be 10,000 BtuH based on the assumptions in the Energy Star Room Air Conditioner Savings Calculator. This assumption is in line with the AHAM data implied average of 10,287 BtuH for RACs recycled in 2011, the most recent year for which data was available. The EER of replacement RACs was assumed to be 10.18 – the sales-weighted average RAC EER in 2010 according to AHAM data.

Based on these assumptions, gross per unit kWh savings for RACs recycled through the Appliance Turn-In Program in 2012 was calculated to be 197.7 kWh as follows:

[22] NREL (2006). "*Building America Performance Analysis Procedures for Existing Homes.*" http://www.nrel.gov/buildings/pdfs/38238.pdf

$$RAC\ Annual\ kWh\ Savings = (233 * (10{,}000/6.27))/1000 - (0.76 * (233 * (10{,}000/10.18))/1000) = 197.7\ kWh$$

5.2.3 Gross Peak Demand (kW) Savings per Appliance

The summer coincident peak demand savings formula, which incorporates a temperature adjustment factor and a load shape adjustment factor, was used to estimate the average kW reduction occurring during the PUCO defined on-peak period, for refrigerators and freezers. For RACs, the summer coincident peak demand savings formula from the TRM was used to calculate the average kW reduction occurring during the PUCO defined on-peak period.

Using the TRM methodology, ADM calculated an average on-peak demand reduction of 0.17 kW per recycled refrigerator, 0.14 kW per recycled freezer, and 0.15 kW per recycled RAC.

5.2.4 First-Year Pro-Rata and Lifetime kWh Savings per Appliance

First-year pro-rata savings were calculated by determining the percentage of the 2012 year that was remaining from the date when each unit was picked-up for recycle. To calculate this percentage, ADM determined the number of days left in the year following the collection of each appliance and then divided that number by 365 days. The remaining time that the unit could have potentially been in service was used along with appropriate service territory verification rates for refrigerators, freezers, and room air conditioners in determining the share of annual kWh savings realized in the 2012 calendar year. The average per-unit first-year pro-rata kWh savings value by utility and appliance type is shown in Table 5-.

Table 5-7: Average Per-Unit First-Year Pro-Rata Savings by Appliance Type and Utility

Utility	*Refrigerators*	*Freezers*	*RACs*
CEI	563.0	543.8	476.1
OE	479.8	468.6	433.2
TE	114.6	108.1	112.7

Lifetime kWh savings were calculated by multiplying the gross annual kWh savings by assumed RULs for each appliance type. Based on the assumptions in the TRM, RUL values of three years for RACs and eight years for refrigerators and freezers were used. Table 5-8 shows the resulting per-unit lifetime kWh savings estimates.

Table 5-8: Per-Unit Lifetime kWh Savings

Appliance Type	*Ex Post Per-Unit Annual kWh Savings*	*RUL (years)*	*Ex Post Per-Unit Lifetime kWh Savings*
Refrigerators	1,051	8	8,408
Freezers	861	8	6,888
RACs	197.7	3	593

6. Detailed Process Evaluation Findings

This chapter provides the findings of the process evaluation component of this report. This section is broken down into three subsections, representing the three data collection activities performed.

6.1 Participant Survey Findings

A telephone survey was conducted to collect data about customer decision-making, preferences, and opinions of the Appliance Turn-In Program. The survey focused on various aspects of the customer experience, including the program application process, the pickup process, and the program rebate. The customer survey was conducted in March of 2013 with customers who had participated in the 2012 program year. In total, 210 customers who had recycled at least one appliance through the program responded to the survey.

6.1.1 Customer Awareness of the Program

Participants were initially asked how they first learned about the Appliance Turn-In Program. As shown in Figure 6-, respondents most commonly reported that they heard about the program through a bill insert from the Companies. This was followed by learning of the program from a friend or relative with 23% of respondents citing this source. Another 10% of respondents indicated learning of the program from a retailer or store. These results are consistent with the findings obtained from multiple customer inquiries conducted by JACO, where program participants commonly cited bill inserts as their initial source of program information.

Eight percent of respondents reported hearing about the Appliance Turn-In Program from newspaper or magazine, which suggests that print media is still a relevant channel of communicating with participants. Furthermore, it is likely that the word of mouth element will continue to increase over the course of the program, and that eventually a higher percentage of customers will hear about the program from friends or relatives who have participated.

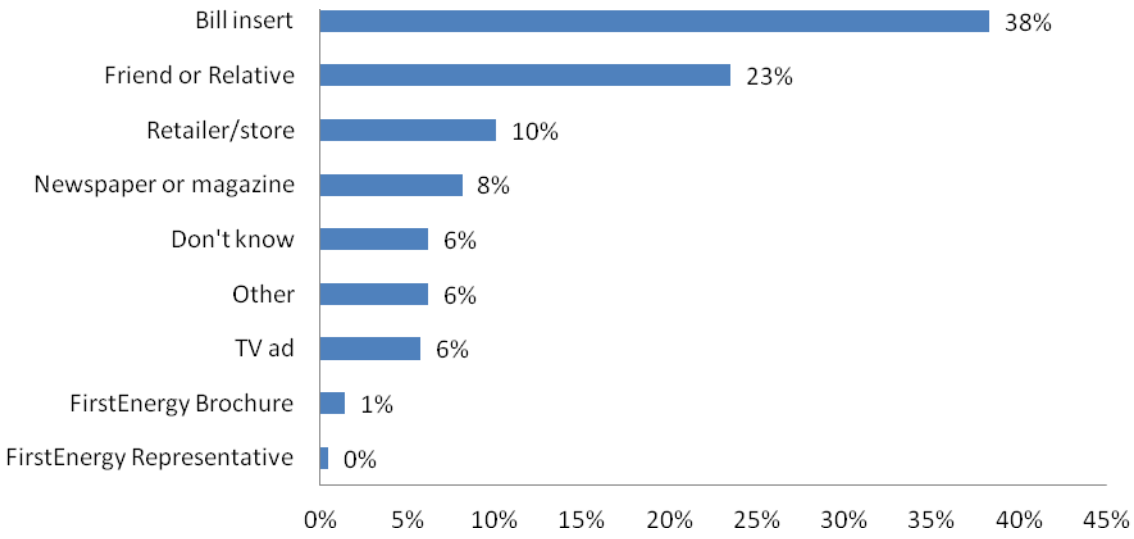


Figure 6-1: How Customers Learned about the Program

6.1.2 Customer Decision Making Characteristics

In order to understand customer values and potential motivations for participating in the program, survey respondents were asked why they chose to participate in the Appliance Turn-In program over other disposal methods. As shown in Figure 6-, over half of customers reported that they chose the program over other disposal methods because of the cash incentive offered. Another 33% indicated that convenience or no additional cost pick-up service was the reason they chose the program. Additionally, environmentally safe disposal of the old appliances was a main consideration for almost 12% of respondents.

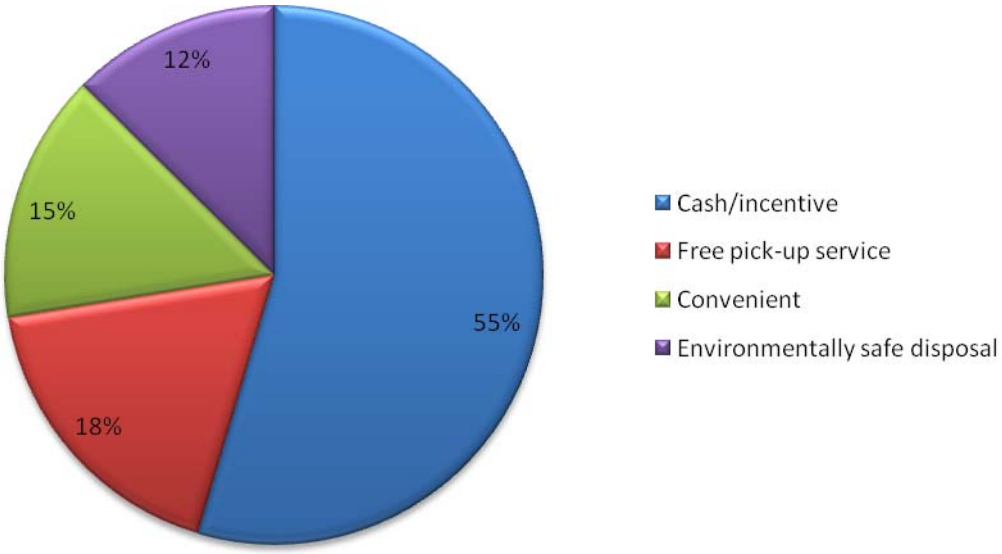


Figure 6-2: Reason for Program Participation over other Disposal Methods

The rebate incentive and the convenience of haul away are typically the two most common motivations for customers to participate in appliance recycling programs such as the Appliance Turn-In Program, and it is often unclear whether some customers would be interested in participating in the absence of a rebate. To further investigate the importance of the rebate in the customer's decision to participate, respondents were asked if they would have still participated in the program if the incentive amount had been less. As shown in Figure 6-, only 19% of respondents indicated that a lower incentive amount would have discouraged them from participating.

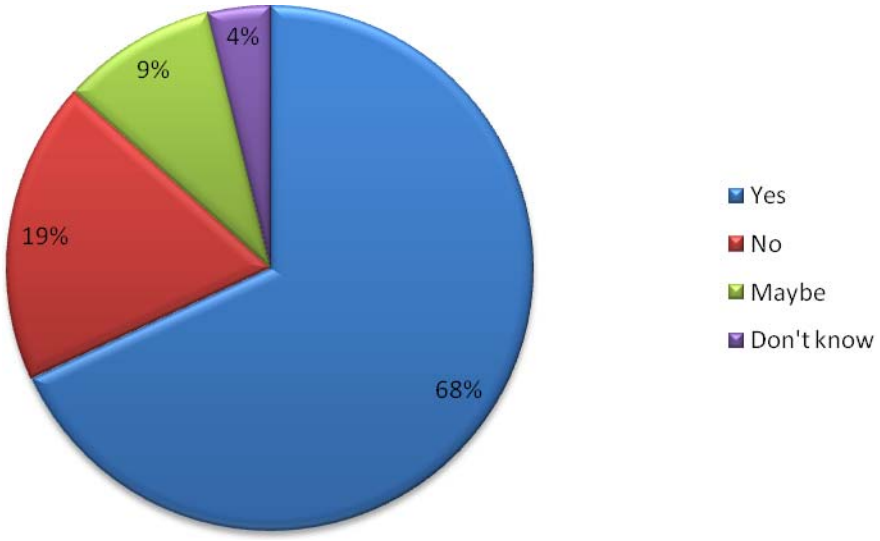


Figure 6-3. Willingness to Participate at Lower Incentive Level

Respondents who indicated they would/might still participate in the program with a lower incentive level (n=171) were then asked a follow up question: would you have participated in the program with no rebate check at all? As shown in Figure 6-1, approximately 25% of these respondents would not participate if the rebate were removed entirely from the program. Taking these results together, approximately 38% of the 210 survey respondents indicated that they would not have participated in the program if a rebate was not offered. It is worth noting that while approximately half of the respondents indicated that the cash rebate was the main reason they participated in the program over other disposal methods, approximately 50% of all respondents indicate that they would have participated even without the rebate. This highlights the fact that the convenience of the no additional cost pick-up service provided through the program is highly valued by respondents.

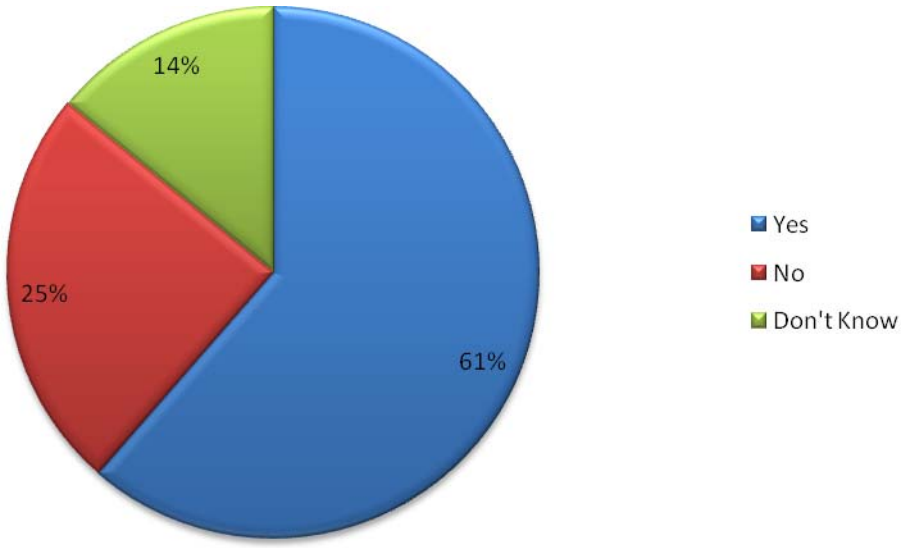


Figure 6-1. Willingness to Participate without Incentive

6.1.3 Customer Satisfaction with the Appliance Turn-In Program

The participant survey also asked customers about their satisfaction with several elements of the program. These elements included:

- Satisfaction with the program scheduling process;
- Satisfaction with the actual pick-up appointments;
- Satisfaction with the rebate amount received;
- Satisfaction with the time it took to receive the rebate after participating;
- Satisfaction with communication with program staff; and
- Satisfaction with the program overall.

Respondents were asked about their levels of satisfaction with these program elements, with the response options of “very satisfied”, “somewhat satisfied”, “neither satisfied nor dissatisfied”, “somewhat dissatisfied”, and “very dissatisfied”. Figure 6-2 displays the distribution of participant satisfaction ratings for these aspects of the program. Overall, satisfaction ratings were very high, with few low scores reported by respondents.

Customer satisfaction with program scheduling process: Overall respondents were highly satisfied with the scheduling process. Ninety percent of respondents indicated that they were at least somewhat satisfied with this element of the program. Only five percent of respondents expressed dissatisfaction with the scheduling process. The

open-ended explanations for dissatisfaction provided by this minority were mostly related to the length of time before pick-up or rescheduling needs.

Some respondents commented that the appliance was not picked up at the agreed upon scheduled pick-up. Another commented that "it took three weeks to make an appointment to pick up the old unit." Another participant said that "it wasn't an easy scheduling service." These findings reflect some of the challenges that exist with coordinating the haul away service for customers with busy schedules or uncertain availability. While these customers represent a small percentage of respondents, their concerns emphasize the importance of communicating with customers and ensuring that the pickup process is as straightforward as possible.

Customer satisfaction with the actual pick-up: Eighty-four percent of respondents reported being very satisfied with their actual pick-up appointment, and another 10% reported being somewhat satisfied. Only two percent of respondents indicated that they were somewhat dissatisfied with the pickup; the open-ended explanations for their dissatisfaction were "they were almost five, ten minutes late" and "they never left a note on the door to say they were there."

For programs that require entering customer homes for installation or removal of equipment, some customers typically view the process as burdensome or uncomfortable. However, the full set of participant responses strongly suggests a high level of satisfaction with the JACO pickup team.

Customer satisfaction with rebate amount: When asked how satisfied they were with rebate amount they received for participating in the program, 69% of respondents reported that they were very satisfied, while another 26% reported they were somewhat satisfied. Less than 1% of respondents indicated that they were dissatisfied with the rebate amount. This result indicates that the program incentive is set at a level that is attractive and agreeable to program participants. This result is consistent with reports from the Companies and JACO staff that the current incentive levels are appropriately set based on experience with similar programs in Ohio and other states.

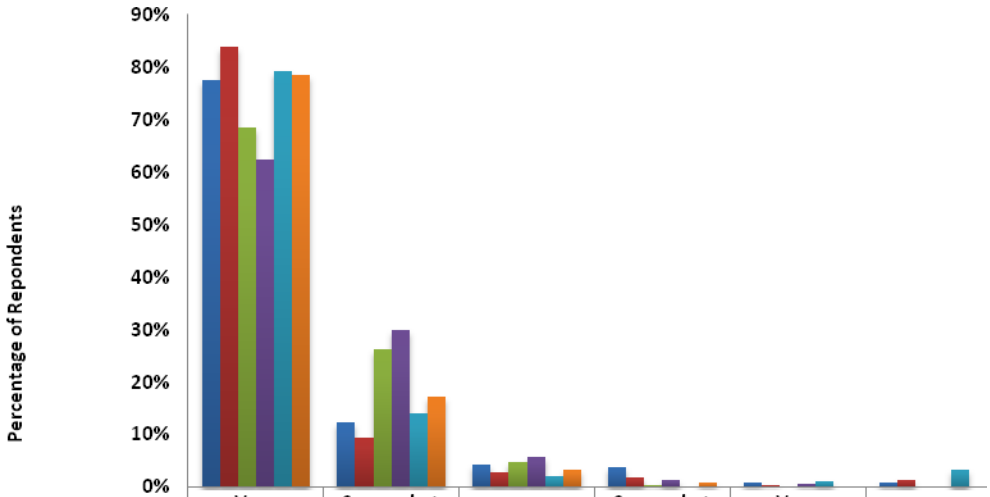
Customer satisfaction with time to receive program rebate: Sixty-two percent of respondents reported being very satisfied with the time it took to receive their rebate, while 30% of respondents indicated that they were somewhat satisfied with this aspect. These ratings reflect very high satisfaction levels for customers. One percent of respondents rated the time to receive the rebate with a 'somewhat dissatisfied' response. Survey respondents were also asked to self-report how long it took to receive the rebate check after the pick-up. Out of 210 respondents, only four responded that the check took longer than the program goal of 4-6 weeks (all four of these responses were between 6 and 16 weeks). Conversely, 78 respondents indicated that the check arrived in 3 weeks or less.

Customer satisfaction regarding communications with program staff: Survey respondents were asked to indicate how many times they contacted program staff with questions about the program. Fifty-six percent of respondents said they did not need to contact program staff with questions. This high percentage is likely a result of the automated online scheduling system operated by JACO. Another one percent of respondents did not know if they contacted program staff with questions, while the remaining 43% contacted program staff at least once. Of the 89 respondents who did contact program staff at least once, 96% reported being at least 'somewhat satisfied' with the communication.

Only one respondent reported dissatisfaction with their interactions with program staff. When asked to explain the reason for dissatisfaction, this respondent stated, "I was dissatisfied because no one seemed to know about the program. They kept on giving me different numbers to call and no one would call me back." Overall, survey responses indicate that the vast majority of participants are satisfied with their interactions with program staff.

Customer satisfaction with overall process of program experience: Seventy-nine percent of respondents were very satisfied with the overall process of having their appliance recycled, from the time they called for a pickup to the time they received their rebate. Another 17% were somewhat satisfied. Only one of the 210 respondents indicated they were somewhat dissatisfied. When explaining the reasons for dissatisfaction, this respondent stated, "I had such a hard time getting through to the right person to set up a pickup."

The few issues discussed in the previous sections may be related to managing customer expectations, where some customers may anticipate very flexible appointment times or instant rebates. While these details are generally addressed within the customer-facing program documentation, unfulfilled expectations would likely be minimized by ensuring that participants understand the estimated timeframes of both the scheduling process and rebate delivery. As the previous sections demonstrate, customers are for the most part satisfied with all program elements.



	Very satisifed	Somewhat satisfied	Neither	Somewhat dissatisfied	Very dissatisfied	Don't know
Scheduled	78%	12%	4%	4%	1%	1%
Pick-up process	84%	10%	3%	2%	0.5%	1%
Rebate amount	69%	26%	5%	0.5%	0%	0%
Time to receive rebate	62%	30%	6%	1%	1%	0%
Communication w/ programm staff	79%	14%	2%	0%	1%	3%
Overall	79%	17%	3%	1%	0%	0%

Figure 6-2 Customer Satisfaction with Selected Program Elements

In addition to satisfaction levels for specific program elements, survey respondents were asked whether they had any suggestions for program improvements. Seventy-nine percent of respondents did not have any suggestions. The remaining 21% offered a number of positive suggestions such as: “Keep up the good job” and “it could be advertised better.” Others suggested reducing the time between scheduling and pick up, increasing the incentive amount, and increasing the frequency of pickups, and including more appliance types in the program.

There were also a few suggestions that illustrate that some customers may not fully understand the purpose of the program. For example, one respondent reported, “I would like to know if the program could pick up my old water heater.” Another respondent state, “I want to know why the program requires the unit to be plugged in… when being picked up… I think they should pick them up regardless of if they run or not.” These responses indicate that there may be some misunderstandings amongst customers as to the nature of the program.

6.2 Company and JACO Staff Interview Findings

ADM conducted in-depth interviews with program staff from the Companies and JACO, Inc. The interviews were conducted during April 2013. The following sections describe the findings from these interviews regarding a number of topics.

6.2.1 Company Program Staff Administration and Oversight

The Companies' program manager works directly with a senior program manager at JACO. JACO's program manager provides input on the design of the program, the development of the contract, marketing strategies and efforts, along with administrative activities and trouble-shooting issues.

JACO uses a dashboard to provide the Companies with an online comprehensive and detailed tracking tool that provides near-real time information. The online tool provides information and data such as: the number of calls and orders received by day; the daily pickup schedule; historical trends; projected call, unit, and schedule volumes; customer level data; and unit specific data.

6.2.2 Program Incentive Levels

All program staff believes the current incentive levels are appropriate for Ohio's utility service territory. The Companies program staff believes that the incentive levels are about right for each of the three appliances included in the program. JACO staff indicated that the current incentive levels are comparable to those offered by other utilities in other states.

6.2.3 Program Operations, Implementation Improvements, and Lessons Learned

Day-to-day operations appear to be running smoothly from both the Companies and JACO program staff perspectives. JACO has been in the recycling business for more than a dozen years and administers appliance turn-in programs for utilities in nearly 30 states. Both parties agree things are operating like a "well-oiled machine".

JACO has been managing a retail partnership with Sears as part of the program. Sears has agreed to advertise and encourage appliance recycling through the program when customers purchase a new appliance. JACO provides training to all store employees who will be involved in the process. This training includes an explanation of the program criteria, the benefits to both the retailer and the customer, the customer enrollment process (customers are able to enroll in the program during the purchase transaction or at home), and what happens with the unit once it is collected. Sears provides its personnel with an online refresher course that is available at all times. JACO also provides Sears stores with signage and other marketing materials. JACO staff indicated the signage in the store as being a key element of this collaboration as that is a more

efficient way to inform customers of the program other than relying on Sears employees. Sears has now begun encouraging employees to have customers apply for a pick-up right there in the store. This is a convenient way to coordinate the drop off and pick up of the new and old appliance, making it more convenient for the customer.

To maintain the chain-of-custody, customers recycling through a retail store are provided with an identification sticker to affix to the unit to be recycled. This sticker includes the customer name and a confirmation number. The retailer picks up the unit to be recycled and takes it to the Sears collection center where appliances that have the Companies Appliance Turn-In program sticker are segregated. The JACO collection team collects the appliances with the Companies sticker, scans the program stickers and verifies program eligibility, and the units are then tracked in the JACO tracking system.

A quick review of the JACO dashboard also revealed that the ratio of units scheduled for pick-up to the number of units that ultimately are collected for recycling was quite high. In total, 10,845 units were scheduled during 2012 and 10,706 were collected – a ratio of 98.7%. This is an important metric as it shows that JACO's screening procedures are largely effective at screening non-eligible units before valuable time and resources are used sending drivers to customer's homes.

6.2.4 Marketing

JACO uses a combination of earned media (press releases and public relations events), paid media (television, newspaper, radio, web banners, and optimized Google search), and utility channels (bill inserts). JACO staff stated bill inserts as being the most effective marketing tool. According to one JACO staff member, "Thirty-five to fifty percent of customers are hearing about the program from the bill inserts". Television was also mentioned by JACO staff as an effective marketing tool.

JACO uses an outside marketing firm to track the effectiveness of the marketing campaigns. Data is collected from each customer pick-up that describes how the customer first heard about the program and annual reports are developed that report on the effectiveness of each channel used to inform future marketing campaigns.

6.2.5 Quality Assurance and Quality Control

JACO employs extensive QA/QC procedures to ensure the entire process is documented. This information is tracked on a dashboard where managers anywhere can access and retrieve information on every appliance recycled. The quality assurance and quality control procedures implemented by JACO include, but are not limited to:

- Calls to the call center operations are monitored by coordinators who listen in.

- Management monitors and tracks drivers' schedule adherence track record (appliances collected within the 4-hour window customers are given) and customer complaints.
- Drivers use cell phones and GPS devices to communicate with and locate customers.
- Chain-of-custody procedure ensures pickup-to-recycling process integrity and consists of:
  - Appliance data and digital pictures of all the units are collected.
  - After verification of a working unit, the pickup crew renders the appliance inoperable at the home – the power cord is cut, the seal is removed from the door, and the temperature control is broken. This activity often occurs in front of the customer so they can verify the unit is going out of service.
  - The customer's signature is collected electronically to verify that there was no damage done to the customer's property during appliance pickup.
  - A bar-coding system tracks the units from pickup to the recycling facility and links all data collected on the unit along with the photo.
- Routine quality checks are performed on all drivers' vehicles and on day-to-day work.

6.2.6 Current and Future Challenges

The Companies and JACO staff do not foresee any challenges for the program in the coming program year.

7. Conclusions and Recommendations

This chapter reports the conclusions and recommendations resulting from the impact and process evaluation of the 2012 Appliance Turn-In Program.

7.1 Energy Impacts

A total of 9,427 households in the service territories of the three Companies received appliance recycling services through the Appliance Turn-In Program in 2012. The numbers of participants for each service territory is shown in Table 7-1.

Table 7-1: Number of Participants by Company

Utility	*Number of Participants*
CEI	3,225
OE	5,644
TE	558
All Companies	9,427

Estimated Ex Post electric impacts were 10,293,613 kWh saved annually, which represents a realization rate of 87.3 percent; 5,404,673 kWh were saved during the 2012 calendar year (first-year pro-rata savings). Average on-peak Ex Post demand reduction was estimated to be 1,723 kW. For detailed tables listing energy savings and demand reductions by measure type, please refer to Appendix A. Estimates of annual gross energy savings (kWh) and on-peak demand reductions (kW) for the program in the three Companies are reported in Table 7-2.

Table 7-2: Overall Evaluation Results for Gross kWh and kW Savings

Utility	*Ex Ante Expected Gross Savings*		*Ex Post Verified Gross Savings*	
	Gross kWh	*Gross kW*	*Gross kWh*	*Gross kW*
CEI	4,064,178	725.26	3,525,012	590
OE	7,046,994	1,216	6,163,403	1,029
TE	686,833	132	605,199	103
All Companies	11,798,005	2,073	10,293,613	1,723

7.2 Process Findings

- **Participants of the Appliance Turn-In Program are highly satisfied.** Respondents to the participant survey reported very positive satisfaction ratings for numerous program elements including the scheduling process, the actual pick-up, communication with program staff, the incentive amount and the time to receive the rebate check. There were very few instances of dissatisfaction, and the majority of these were anecdotal in nature. These results suggest that the program continues to be a reliable entity that is capable of meeting customer expectations and goal targets.
- **The Companies' Appliance Turn-In program is continuing to operate smoothly.** The basic design of the program (i.e., measures, implementation, QA/QC, etc.) has not changed from the first program year so neither the Companies staff nor JACO staff reported any issues with program implementation in 2012.
- **Quality Assurance and Quality Control (QA/QC) procedures continues to effectively monitor the entire recycling process at the measure level.** The Companies program staff and the JACO staff described extensive QA/QC checks to monitor the appliance chain-of-custody, beginning with the scheduling of the pick-up to the actual recycling of the appliance at the facility.
- **JACO's dashboard continues to be an effective reporting mechanism for program staff.** The Companies have real time access to detailed levels of information needed to effectively manage and monitor program operations. The dashboard replaces the additional costs of generating time-consuming reports.
- **Program incentive levels are still appropriate.** Both the Companies staff and JACO staff report incentive levels as being effective and are similar to other appliance recycling programs across the country.
- **Program partnerships with retailers, such as Sears, have not seen significant results.** It is reported by program staff that less than 5 percent of the recycled appliances come from retailer assistance.
- **There is still large market potential for appliance recycling programs.** Program staff estimates in Ohio that less than 5 percent of disposed refrigerators are recycled through the program, whereas in more seasoned states, their program is recycling approximately 20 percent of disposed refrigerators.
- **There are no immediate challenges to implementing the program and reaching goals.** All program staff agreed that this program has no foreseeable challenges. The market potential is plentiful enough to reach targets, QA/QC is well grooved and consistent, and marketing efforts have been effective.

7.3 Recommendations

Overall, the program is running smoothly in its second year of implementation. The Companies and JACO staff are confident with their implementation procedures and data, and do not foresee any challenges for the program in the coming program year. JACO has been in the recycling business for more than a dozen years and administers appliance turn-in programs for utilities in nearly 30 states. The evaluation team currently has the following recommendation for program improvement consideration.

- **Continue to develop the retail partnership with Sears and establish goals for them.** Continue to work with Sears corporate to establish goals for their program participation, such as aiming for a certain percentage of their appliance sales resulting in recycling of the old appliance through the program. The Companies and JACO staff should continue their regular follow-ups with Sears to ensure they have enough, and appropriate, program material and training.
- **Continue to coordinate with other programs to promote the Appliance Turn-In program.** Work with other rebate or home audit programs implemented by the Companies to market the Appliance Turn-In program. For appliance rebate programs, the Appliance Turn-In program is a great add-on to promote participation in both programs. Home energy audit programs identify ways for a homeowner to reduce energy usage. If an old appliance exists in the home, this would be an opportunity to mention the Appliance Turn-In program.

8. Appendix A: Required Savings Tables

Tables showing measure-level participation counts and savings for the Appliance Turn-In Program were provided various locations throughout this report. This appendix provides additional tables summarizing savings results.

- Table 8-1 reports the annual Ex Post kWh savings by utility and measure.
- Table 8-2 reports the average annual Ex Post on-peak kW reductions by utility and measure.
- Table 8-3 reports the first-year pro-rata Ex Post kWh savings by utility and measure.
- Table 8-4 reports the lifetime Ex Post kWh savings by utility and measure.

Table 8-1. Annual Ex Post Energy Savings (kWh)

Appliance Type	*CEI*	*OE*	*TE*	*All Companies*
Refrigerators	2,988,937	5,072,996	514,535	8,576,469
Freezers	489,210	1,012,872	79,239	1,581,320
RACs	46,864	77,535	11,425	135,824
Total	3,525,012	6,163,403	605,199	10,293,613

Table 8-2: Annual Ex Post On-Peak Demand Reductions (kW)

Appliance Type	*CEI*	*OE*	*TE*	*All Companies*
Refrigerators	476.4	808.6	82.0	1,366.9
Freezers	78.0	161.4	12.6	252.0
RACs	35.9	59.3	8.7	104.0
Total	590.2	1,029.3	103.4	1,722.9

Table 8-3. First-Year Pro-Rata (2012) Ex Post Energy Savings (kWh)

Appliance Type	*CEI*	*OE*	*TE*	*All Companies*
Refrigerators	1,601,281	2,624,861	237,595	4,463,737
Freezers	272,501	551,100	39,855	863,456
RACs	27,158	43,560	6,762	77,480
Total	1,900,941	3,219,521	284,212	5,404,673

Table 8-4. Lifetime Ex Post Energy Savings (kWh)

Appliance Type	*CEI*	*OE*	*TE*	*All Companies*
Refrigerators	23,911,499	40,583,968	1,543,606	66,039,074
Freezers	3,913,681	8,102,974	237,715	12,254,370
RACs	374,912	620,279	34,275	1,029,466
Total	28,200,093	49,307,221	1,815,596	79,322,910

9. Appendix B: Participant Survey Instrument

The Illuminating Company, Ohio Edison Company, The Toledo Edison Company

Appliance Turn-In Program

Participant Telephone Survey

Interviewer: _____ Date of Interview: _____/_____/_____

Respondent: _____ Address: _____

May I please speak with **[CONTACT NAME]**: _____)?

*Hello. My name is _____ and I am calling on behalf of **[UTILITY]** about the Appliance Turn-In Program that your household participated in back in ___ **[Month/Year of Participation]**. Are you the person who is most familiar with having a refrigerator, freezer, and/or room air conditioner picked up for recycling through **[UTILITY]**'s program*?

(IF NOT RIGHT PERSON) *May I please speak to the person who would know the most about the appliance that was picked up for recycling?*

REPEAT INTRODUCTION AND CONTINUE

(IF RIGHT PERSON) *We are conducting a study to evaluate **[UTILITY]**'s Appliance Turn-In Program. **[UTILITY]** will use the results of this evaluation to determine the effectiveness of the program and to make improvements. We would like to include your opinions about the program in our evaluation. The interview will take approximately 15 minutes. May I ask you a few questions?*

IF REFUSAL: THANK AND TERMINATE

VERIFICATION

1. Our program records indicate that you had __ **(quantity of refrigerators, freezers, and/or room air conditioners)** picked up for recycling through the Appliance Turn-In program around **(date of pickup)**. Is that correct?

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

[ASK IF Q1=2]

2. How many refrigerators, freezers, and/or room air conditioners did you have recycled through the Appliance Turn-In program?

1. _____ **[Record Quantity of Each Appliance]**
98. Don't know
99. Refused

AWARENESS

3. How did you first learn about **[UTILITY]**'s appliance pick-up and recycling program? **[Do not read, prompt if necessary. Choose One.]**

1. Newspaper/magazine/print media
2. Bill insert
3. Friend or Relative (word-of-mouth)
4. TV ad
5. FirstEnergy Representative
6. FirstEnergy Brochure
7. Retailer/store
8. Other **[Specify]**_____.

98. Don't know
99. Refused

4. Did you hear about the program from any other sources? If so, which sources? [Check all that apply.]

1. No other sources
2. Newspaper/magazine/print media
3. Bill insert
4. Friend or Relative (word-of-mouth)
5. TV ad
6. FirstEnergy Representative
7. FirstEnergy Brochure
8. Retailer/store
9. Other **[Specify]**_____.

98. Don't know
99. Refused

APPLIANCE DESCRIPTION AND RECYCLING DECISION

5. IF [TOT_QTY] = 1: Now I'm going to ask you some specific questions about the [**refrigerator, freezer]** that was picked up and recycled by **<UTILITY>.**

IF [TOT_QTY] > 1 AND [RAC]=0: I'd like to focus on just one of the appliances you recycled through **<UTILITY>**'s program. It does not matter which appliance you choose, just that you respond with only that appliance in mind. Can you tell me which appliance you've selected to tell me about?

1. ____ Refrigerator
2. ____ Freezer

IF [TOT_QTY] > 1 AND [RAC]>0: I'd like to focus on just one of the appliances you recycled through **<UTILITY>**'s program. Specifically, I'd like to ask you about the room air conditioner you recycled.

6. How old was your **[refrigerator, freezer, room air conditioner]**? **[Record response in years, enter "00" if less than one year]**?
1. _____ **[Record years]**
98. Don't know
99. Refused

7. Was the old **[refrigerator, freezer, room air conditioner]** your primary or secondary (spare, auxiliary) unit?
1. Primary
2. Secondary
98. Don't know
99. Refused

[If refrigerator or freezer, skip to question 12]

8. [If room air conditioner] Before recycling the unit, how many room air conditioners were in operation in your home?
1. _____Record number of units
98. Don't know
99. Refused

9. [If room air conditioner] How many room air conditioners are currently in operation in your home?
1. _____Record number of units
98. Don't know
99. Refused

10. [If room air conditioner] Before recycling the unit, did your home have a central air conditioning system?
1. Yes
2. No
98. Don't know
99. Refused

11. [If room air conditioner] Does your home currently have a central air conditioning system?
1. Yes
2. No
98. Don't know
99. Refused

12. Did you replace the old **[refrigerator, freezer, room air conditioner]** with a new unit?
1. Yes
2. No
98. Don't know

99. Refused

13. For the majority of 2011, where within your home was the **[refrigerator, freezer, room air conditioner]** located?
1. Kitchen
2. Garage
3. Porch/patio
4. Basement
5. Living room
6. Family room
7. Bedroom
8. Hallway
9. Other **[Specify]** _____
98. Don't know
99. Refused

14. Thinking about the year prior to recycling the [**refrigerator, freezer, room air conditioner],** was it plugged in and running … **[Read all]**
1. . All the time **[Go to Q16]**
2. . For special occasions only
3. . During certain months of the year only, or
4. . Never plugged in or running **[Go to Q16]**
98. Don't know
99. Refused

15. If you were to add up the total amount of time it was running in the year prior to being picked up, how many months would that be? Your best estimate is okay. **[Get nearest month]**
1. . _____ **[Record number of months 1-11]**
2. . All the time
98. Don't know
99. Refused

16. Was the **[refrigerator, freezer, room air conditioner]** still in working condition when it was picked up? By working condition I mean did the unit turn on and produce cold air?
1. . Yes **[Skip to Q18]**
2. . No
3. . It worked but had some problems
98. Don't know **[Skip to Q18]**
99. Refused **[Skip to Q18]**

17. What was wrong with the unit? (If respondent is unsure, ask "would it turn on and produce cold air?")
1. Wouldn't turn on
2. Wouldn't keep food/room cold ENOUGH
3. Wouldn't keep food/room cold at all

4. Too loud
5. Don't know, but would produce cold air
6. Don't know, but would NOT produce cold air
7. Other **[Specify]** _____
98. Don't know
99. Refused

18. Had you already considered disposing of the **[refrigerator, freezer, room air conditioner]** before you heard about **[UTILITY]**'s appliance recycling program? By dispose of, I mean getting the appliance out of 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

19. What would you have most likely done with the **[refrigerator, freezer, room air conditioner]** had you not disposed of it through **[UTILITY]'**s program?

[Read list unless respondent indicates choice without reading the list]

1. . Sold it to a private party
2. . Sold it to a used appliance dealer
3. . Kept it and continued to use it
4. . Kept it and stored it unplugged
5. . Given it away to a private party, such as a friend or a neighbor
6. . Given it away to a charity organization, such as Goodwill Industries or a church
7. . Put it on a curb with a "Free" sign on it
8. . Had it removed by the dealer you got your new or replacement refrigerator from
9. . Taken it to a dump or recycling center
10. Hired someone to take it to a dump or recycling center
11. Gotten rid of it some other way [**Specify**]_____
98. Don't know
99. Refused

20. What is the MAIN reason you chose to get rid of your **[refrigerator, freezer, room air conditioner]** through **[UTILITY]**'s program over other methods of disposing of your appliance?

[If multiple are mentioned, ask: "Of those, which is the main reason?" Do not read, accept one answer only.]

[If respondent says: "I didn't need or want the refrigerator/freezer," respond "Yes, but why did you choose to discard it through [UTILITY]'s program rather than through another method?"]

1. . Cash/incentive payment
2. . Free pick-up service/others don't pick up/don't have to take it myself
3. . Environmentally safe disposal/recycled/good for environment
4. . Recommendation of a friend/relative
5. . Recommendation of retailer/dealer
6. . Utility sponsorship of the program
7. . Easy way/convenient
8. . Never heard of any others/only one I know of
9. . Other **[Specify]**
98. Don't know
99. Refused

21. Did you receive your rebate for participation in this program?

a. Yes
b. No

22. Would you have participated in the program if the amount of the rebate had been less, but appliance pick-up was still provided at no cost?

1. Yes
2. No **[Go to Q24]**
3. Maybe
98. Don't know
99. Refused

23. Would you have participated in the program with no rebate check altogether, but appliance pick-up was still provided at no cost?

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

PROGRAM SATISFACTION

"Now I have some questions about your satisfaction with your participation in the program."

24. How satisfied were you with the rebate amount? Would you say you were: Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied??

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied

98. Don't know
99. Refused

25. From the time you had the appliance(s) picked up, about how many weeks did it take to receive your rebate?**]**
1. Record # of weeks_____
98. Don't know [**Skip to Q27]**
99. Refused [**Skip to Q27]**

26. How satisfied were you with how long it took to receive the rebate? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

27. How satisfied were you with the scheduling of the pick-up of your old appliance(s)?
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

28. How satisfied were you with the actual pick up of your old appliance(s)??
1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

29. [IF UNSATISFIED FOR Q26, Q27 or Q28] Why were you dissatisfied?
1. Record Verbatim_____
98. Don't know
99. Refused

30. In the course of participating in **[UTILITY]'s** program, how often did you contact **[UTILITY]** or program staff with questions?

1. Never **[Skip to Q34]**
2. Once
3. 2 or 3 times
4. 4 times or more
98. Don't know
99. Refused

31. How did you contact them? **[CHECK ALL THAT APPLY]**

1. Phone
2. Email or fax
3. Letter
4. In person
98. Don't know
99. Refused

32. And how satisfied were you with your communications with **[UTILITY]** and program staff? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1. Very satisfied **[Skip to Q34]**
2. Somewhat satisfied **[Skip to Q34]**
3. Neither satisfied nor dissatisfied **[Skip to Q34]**
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know **[Skip to Q34]**
99. Refused **[Skip to Q34]**

33. Why were you dissatisfied?

1. Record Verbatim_____
98. Don't know
99. Refused

34. Have you noticed any savings on your electric bill since removing your old appliance(s)?

1. Yes
2. No **[Skip to Q36]**
3. Not sure **[Skip to Q36]**
98. Don't know **[Skip to Q36]**
99. Refused **[Skip to Q36]**

35. [IF NOTICED SAVINGS]. How satisfied are you with any savings you noticed on your electric bill since removing your old appliance(s)? Would you say you were: Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied??

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied

4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

36. Finally, if you were rating your overall satisfaction with the **[UTILITY]** Rebate Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1. Very satisfied
2. Somewhat satisfied
3. Neither satisfied nor dissatisfied
4. Somewhat dissatisfied
5. Very dissatisfied
98. Don't know
99. Refused

37. Why do you give it that rating?

1. Record Verbatim_____
98. Don't know
99. Refused

38. Do you have any suggestions to improve **[UTILITY]'s** Appliance Turn-In Program?

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

DEMOGRAPHICS

"Now I have just a few final questions about your home and energy use."

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

01. Single-family home, detached construction **[NOT A DUPLEX, TOWNHOME, OR APARTMENT; ATTACHED GARAGE IS OK]**
02. Single family home, factory manufactured/modular
03. Single family, mobile home
04. Row House
05. Two or Three family attached residence—traditional structure
06. Apartment (4 + families)---traditional structure
07. Condominium---traditional structure
08. Other: **[Specify]**_____
98. Don't know
99. Refused

40. Do you own or rent this residence?
1. Own
2. Rent
98. Don't know
99. Refused

41. Approximately when was your home constructed? **[DO NOT READ]**
1. Before 1960
2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2005
7. 2006 or later
98. Don't know
99. Refused

42. How many square feet is the above-ground living space (IF NECESSARY, THIS EXCLUDES WALK-OUT BASEMENTS)?
1. Numerical open end [Range 0-99,999]_____
98. Don't know
99. Refused

43. [IF Q41=98,99] Would you estimate the above-ground living space is about:

1. Less than 1,000 sqft
2. 1,001-2,000 sqft
3. 2,001-3,000 sqft
4. 3,001-4,000 sqft
5. 4,001-5,000 sqft
6. Greater than 5,000 sqft
98. Don't know
99. Refused

44. How many square feet of conditioned living space is below- ground (IF NECESSARY, THIS INCLUDES WALK-OUT BASEMENTS)?
1. Numerical open end [Range 0-99,999]_____
98. Don't know
99. Refused

45. [IF 43=98,99] Would you estimate the below-ground living space is about:?
1. Less than 1,000 sqft
2. 1,001-2,000 sqft
3. 2,001-3,000 sqft
4. 3,001-4,000 sqft
5. 4,001-5,000 sqft

6. Greater than 5,000 sqft
98. Don't know
99. Refused

This completes the survey. [UTILITY] appreciates your participation. Thanks for your time. Have a good day/evening.