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EVALUATION OF AMERENUE'S REFRIGERATOR RECYCLING AND REBATE PROGRAM

Prepared for

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Executive Summary

AmerenUE along with the Midwest Energy Efficiency Alliance (MEEA) offered a Refrigerator Recycling and Rebate Program in 2003 and again for two months at the end of 2005. The goal of these programs was to encourage the use of Energy Star refrigerators by offering an incentive to remove older refrigerators from the market. According to the AmerenUE program description, "The Refrigerator Rebate and Recycling Program was designed to increase market share of energy-efficient refrigerators in use within the markets served by AmerenUE. The program's energy savings are produced by accelerating the pace at which Energy Star® qualified models gain market share by offering a rebate on the purchase of a new Energy Star® refrigerator and by providing people who purchase an Energy Star unit an incentive to recycle through an environmentally sound process that permanently removes older, energy-inefficient units from the market well in advance of reaching their expected years of use." (A full description of the program can be found in Section II.)

Based on the findings from this evaluation, program accomplishments for 2003 and 2005 include:

- Increasing the number of refrigerators recycled by 2,438 units: 2,314 units recycled in 2003 and 124 units recycled in 2005
- Sales of 496 Energy Star units in conjunction with the program: 379 in 2003 and 117 in 2005
- The early retirement of some units
- Savings of 1,904 MWh

The 2003 and 2005 programs both attempted to influence customers to purchase new Energy Star refrigerators and recycle older refrigerators. Due to the nature of the implementation contracts, however, program intervention occurred at the customer level for only 22% of the units recycled (for the remaining units, program intervention occurred with the haul away contractor). However, most of the customers participating in the program appear to be satisfied with the program (86% of those who participated in 2005). Participants were most satisfied with the pick up and removal process with 92% stating they were very satisfied with this process, followed by 82% stating they are very satisfied with the sign up process. Participants were least satisfied with the amount of time it took to receive the incentive check however 71% still stated they were very satisfied. (See Section VI Table D-3 and Section VI Table D-19.)

Overall, program savings from these programs are relatively low (among the lowest in AmerenUE's portfolio during the 2003-2006 period), with the 2003 program being cost-effective while the 2005 program was not cost-effective due to the short implementation period. (See Section IV.)

No additional refrigerator recycling programs have been funded to date. However if AmerenUE and the Collaborative decide to run a similar program in the future, we recommend the following:

- Clearly state the goals of the program to focus the program approach, and consider extending the program to include customers who "only recycle" and/or customers who "only purchase an Energy Star refrigerator"
- Consider at what point in the process you want to reach potential program participants and expand promotions to reach those who were not already looking to purchase a new refrigerator
- Refocus the program to encourage early retirement of refrigerators through marketing outside of appliance stores
- Raise awareness of opportunities to recycle, and building the infrastructure for this effort, perhaps in lieu of providing customer incentives
- Extend planning time and the length of commitments from retailers and subcontractors
- Find ways to ensure that customer units are not switched during the recycling process
- Collect consistent data from both older models and new models (e.g., nameplate amperage for both).

Details on each of these recommendations are provided in Section V.

I. Introduction and Methodology

AmerenUE along with the Midwest Energy Efficiency Alliance (MEEA) offered a Refrigerator Recycling and Rebate Program in 2003 and again for two months at the end of 2005. According to the AmerenUE program description, "The Refrigerator Rebate and Recycling Program was designed to increase market share of energy-efficient refrigerators in use within the markets served by AmerenUE. The program's energy savings are produced by accelerating the pace at which Energy Star® qualified models gain market share by … providing people who purchase an Energy Star unit an incentive to recycle through an environmentally sound process that permanently removes older, energy-inefficient units from the market well in advance of reaching their expected years of use." AmerenUE partnered with the Midwest Energy Efficiency Alliance to administer this program. (A full program description is provided in Section II.)

This report provides a process and impact evaluation of the Refrigerator and Recycling Program, led by Opinion Dynamics Corp. in partnership with GDS Associates. This evaluation report is based on (1) an in-depth interview with the MEEA program administrator and program stakeholders, including MEEA and ARCA, (2) review of MEEA annual reports (3) our review of the 2003 and 2005 program databases, (5) our review of a MEEA survey of participants from 2003, (6) telephone interviews with participants in the 2005 program, and (7) telephone interviews with non-participants.

In March 2007, ODC conducted telephone surveys with 65 participants in the 2005 program; representing 54% recycled refrigerators and 56% new Energy Star refrigerators attributed to the program. The list of program participants and their contact information was provided to ODC by AmerenUE. Where possible, we combined this data with survey data collected by MEEA from 2003 program participants.

ODC also interviewed 100 AmerenUE customers who had not participated in the Refrigerator Rebate and Recycling program. AmerenUE provided ODC with a list of zip codes that fall within its service territory. Using this list, ODC obtained a random sample of phone numbers from these zip codes. We then removed program participants from our non-participant sample. These non participant interviews were conducted in April 2007. Of these non participants 32% purchased a new refrigerator within the past five years.

We do not provide all of the detailed tables in the body of the write-up for the purpose of keeping the write-up as succinct as possible. Key tables are provided in the body of the write-up, with additional detailed tables denoted by the letter "D" and provided in Section VI of this report.

II. Program Description

This section describes the history of the 2003 and 2005 programs including the incentive structures, costs, and recycling and sales goals for the 2003 and 2005 programs.

2003 Program Description

The 2003 program "sought to increase the sales of Energy Star qualified refrigerators and link these sales to an accelerated retirement of old operational refrigerators. Therefore, the consumer incentive to purchase an Energy Star qualified unit was linked to recycling bounties. By linking these two activities at the consumer level the program would allow a high replacement rate and high cost effectiveness in terms of kWh reclamation."[1]

The 2003 program was run by the Midwest Energy Efficiency Alliance (MEEA), in coordination with Honeywell Utility Solutions; Sears; and the Sears local pick-up vendor in Missouri, S&S Recycling; and the Appliance Recycling Centers of America (ARCA), which recycled all units. Customers who purchased an Energy Star refrigerator from Sears received a 10% discount from Sears, and were then paid a $30 bounty if they recycled their old refrigerator through Sears using a program sticker from their new Energy Star refrigerator. In addition, if they recycled a second unit through the program (using the stickers from their new Energy Star refrigerator) they could receive another $50 bounty on their second recycled refrigerator or freezer. As part of the contract with Sears and their local pick-up vendor, S&S Recycling, AmerenUE and MEEA paid S&S Recycling a fee for any unit picked up from a customer who bought a refrigerator from Sears (even if they did not replace this refrigerator with an Energy Star refrigerator). As part of the program, S&S Recycling received $40 per unit recycled. MEEA (and AmerenUE) then paid ARCA to recycle the units. The program also spent $32,739 for six advertisements in the St. Louis newspaper.

The total program costs for the PY 2003 program were $378,382.

As documented in MEEA's PY2003 report, this program experienced difficulties because they were:

- Unable to work with manufacturers given the limited region covered by AmerenUE
- Unable to extend beyond certain parts of the AmerenUE territory given the lack of a centralized appliance delivery and haul away service outside of St. Louis
- Only able to work with eight Sears retailers since there were no opportunities for recycling beyond the Saint Louis area.

2005 Program Description

The 2005 program sought to improve upon the 2003 program. To do this MEEA amended the design of the program to link the purchase of an Energy Star qualified refrigerator to any bounty or rebate a consumer would receive in order to introduce a stronger market transformation aspect to the program (thus eliminating recycling without the purchase of an Energy Star refrigerator).

[1] MEEA 2003 Regional ENERGY STAR© Refrigerator Rebate & Recycling Program Final Report

The 2005 program was an improvement on the 2003 program, including the following changes:

- The geographic area was expanded to include St. Louis, Jefferson City and Cape Girardeau
- The retail locations were broadened to include all stores, not just Sears
- Energy Star units on sale were allowed
- All primary units were replaced by an Energy Star refrigerator

The 2005 program was also administered by MEEA, working directly with the Appliance Recycling Centers of America (ARCA). A $50 bounty was given for old units if the customer could provide a receipt for a new Energy Star refrigerator.

The 2005 program, however, experienced a very late program launch due to the approval process, and the difficulties of coordinating contractor selection and contract negotiations with a large committee. Although MEEA requested an extension, AmerenUE's tariff ended on December 31, 2005 and they were unable to extend the program without going back to the commission.

In 2005, ARCA was paid for units picked up. ARCA was paid $145 per unit (or $115 for the second unit), and the customer was given a $50 incentive, for a total of $195 per unit (or $165 per second unit). Notably, the costs per unit were much higher than in 2003.

Total program costs for 2005 were $66,257 (with incentives for recycling accounting for $17,980, and bounty payments to customers equaling $6,200).

III. Program Accomplishments

Program accomplishments during the program period include:

- Increasing the number of refrigerators recycled by 2,438 units: 2,314 units recycled in 2003 and 124 units recycled in 2005
- Sales of 496 Energy Star units in conjunction with the program: 379 in 2003 and 117 in 2005
- The early retirement of some units (77% of those recycled)
- Savings of 1,904 MWh

These accomplishments are described in more detail below.

Increasing the number of refrigerators recycled by 2,438 units: 2,314 units recycled in 2003 and 124 units recycled in 2005

Overall, the program recycled 2,438 units: 2,314 units in 2003 and 124 units in 2005.[2] While program participants reported that most refrigerators (96%) would have been replaced regardless of the program, almost none of them would have been recycled. (See Section VI Table D-9 and Section VI Table D-10.) As such, the majority of units that were still working could have remained in the secondary market.[3]

According to the PY2003 final report from MEEA, the program met its recycling goals. However, the recycling goals were ultimately met by collecting units that would have been picked up by S&S anyway; AmerenUE's program recycled these units (rather than returning them to the secondary market where possible). Many of these units, could have been replaced by new standard refrigerators (rather than Energy Star refrigerators) but information on the unit that replaced the recycled refrigerator was not available for most units. In all, the 2003 program paid for 2,373 units to be recycled through the program, but our analysis was only able to verify documentation for 2,314 units.

Table 1: Program Recycling Goals

	2003		2005	
	Goal	Actual	Goal	Actual
Primary Units Recycled	1,600	2,136	1,945	
Secondary Units Recycled	624	237		7[b]
Reported Total Units Recycled	2,225	2,373[a]	1,945	124[c]
Verified Units Through Impact Analysis		2,314		124

[a] Note that the number of units recycled in 2003 reflects all of the units that S&S Recycling picked up, including ones that would have been picked up even in the absence of the program.
[b] 5 refrigerators and 2 freezers
[c] 122 refrigerators and 2 freezers

[2] Note that the 2003 report indicates 2,373 units recycled, but program databases only allowed us to verify 2,314 units.
[3] Given the fact that S&S Recycling required AmerenUE to pay for all refrigerators that they picked up, it did not appear to be an established refrigerator recycling center/way to get it to ARCA. More than likely, units would have been picked up and refurbished or thrown away.

The 2005 goal was to recycle 1,945 refrigerators in an environmentally sound manner. In all, 117 customers participated in the program, for a total of 124 units recycled (117 primary refrigerators, 5 secondary refrigerators and 2 freezers). As such, the 2005 program did not meet its goals. All of these units were documented by the program databases.

Sales of 496 Energy Star units in conjunction with the program: 379 in 2003 and 117 in 2005

The AmerenUE program supported the sale of 379 models in 2003 and 117 in 2005. While 75% of the 2005 participants who we interviewed stated that they would have purchased an Energy Star model if the program had not required it, one-quarter (25%) of participants either would not have purchased an Energy Star model or were unaware of the Energy Star label.

Notably, while the program was running, Sears sold 3,028 Energy Star refrigerators, but only a small fraction of those customers recycled a refrigerator through the program, so ultimately only 379 of the refrigerators sold by the participating stores are recorded in the program database (although the 10% discount by Sears, which was part of the program, could have encouraged some of the remaining sales). While the 2003 annual report does not report a sales goal, it appears that they would have hoped to have the ratio of newly purchased Energy Star to recycled units be a 1:1 ratio. As such, the program did not reach their sales goal.

Table 2: Program Energy Star Sales Goals

	2003		2005	
	Goal	**Actual**	**Goal**	**Actual**
Sales goal (Bounties paid)	[1,600]	379	1,880	117

[a] Note that the number of units recycled in 2003 reflects all of the units that S&S Recycling picked up, including ones that would have been recycled from Sears customers even in the absence of the program.

The 2005 goal was to support the purchase of 1,880 Energy Star qualified refrigerators. In all, only 117 customers participated in the program due to the short time frame of the program. As such, the 2005 program did not meet its goals. However, the program did achieve nearly a 1:1 ratio (i.e., 117 Energy Star units were purchased for 124 units recycled).

Enabled the Early Retirement of Some Units (77% of Those Recycled)

Based on program data, we estimate that the combined 2003 and 2005 programs are responsible for the early retirement of 77% of the units. This estimate is based on responses from retailers and consumers about what would have happened to the units without the program (e.g., the retail would have hauled away, the refrigerator would have been used as a second unit, etc.), as well as on the assumption that approximately 75% of refrigerators that are hauled away or thrown away are eventually refurbished. While this is an approximation (since no definitive data is available on the market), this assumption takes into account ARCA's extensive experience in the market, the evaluation teams experience, as well as the age of the refrigerators that were recycled through the program.

Table 3: Percent of Refrigerators Would Have Remained in Use

	Percent of all units recycled through the program (n=2,314) (column 1)	Assumed Percent That Would Remain in Use (column 2)	Percent of Total Remain in Use (col. 1 * col. 2)
Had the retailer haul it away (Still purchased a new unit)	87%	75%	65%
Kept it, and not purchased a new one	4%	100%	4%
Kept it as a second unit	3%	100%	3%
Sold or given it away	3%	100%	3%
Thrown it out or had someone else pick it up	3%	75%	2%
Paid to have it recycled	1%	0%	0%
		Total*	**77%**

* The parts do not equal the sum due to rounding.

Savings of 1,904 MWh

Gross savings per unit range from 912 kWh to 1,038 kWh. However, since only 77% would have remained in the market, net realized energy savings are as follows:

- 2003 are 1,816,346 kWh with a demand reduction of 0.2790 MW.
- 2005 are 87,904 kWh with a demand reduction of 0.0135 MW.

A detailed analysis of the impacts and cost-effectiveness of the 2003 and 2005 programs are reported below.

IV. Impacts and Cost Effectiveness Analysis

We conducted the impact evaluation of AmerenUE's 2003 and 2005 Energy Star Refrigerator Rebate and Recycling Program using information about the refrigerators that were picked up and recycled by MEEA, as well as energy use information of older existing refrigerators and new Energy Star qualifying refrigerators.[4]

Overview of Gross Savings Calculations

Because amp draw information in the program databases was connected load (actual operating) amperage versus nameplate amperage, and Energy Star only reports nameplate amperage for new units, we were not able to use the information in the program databases and it was necessary for us to calculate program impacts using another method. Information from a study completed by D&R International, Ltd., for DOE from the Directory of Certified Refrigerators, Freezers, and Refrigerator Freezers published by the California Energy Commission (CEC) from 1979 to 1992 shows average annual energy consumption by size of unit, style of unit, and age of unit. We sorted this information by unit size in order to develop a lookup table of annual energy use for side-by side style units and top freezer and other styles sized 9 cubic feet to 30 cubic feet (see Table 4).

Table 4: Lookup Table for Existing Refrigerators

Vol (cu ft)	Side-by-side (KWh)	Top Mount freezer and other (KWh)
9	850	770
10	880	800
11	900	850
12	950	870
13	1,000	930
14	1,050	975
15	1,100	1,005
16	1,200	1,030
17	1,260	1,070
18	1,300	1,100
19	1,330	1,130
20	1,350	1,150
21	1,375	1,170
22	1,400	1,190
23	1,425	1,215
24	1,440	1,240
25	1,465	1,260
26	1,475	1,280
27	1,480	1,300
28	1,495	1,300
29	1,550	1,370
30	1,650	1,430

[4] Information collected on the refrigerators that were recycled included amp draw of the removed units, size in cubic feet of the units, and the style of the units (side-by-side, top mounted freezer, bottom mounted freezer, single door refrigerator, etc.).

Consumption used in the lookup table was typical consumption seen for units of a particular size for units ten years old or less. We observed that increasing these consumption levels by 30% results consumption levels that are similar to those observed for units more than ten years old. This multiplier of 1.3 was applied if the age data for a recycled unit indicated that it was more than ten years old when picked up. Similarly, we developed typical energy consumptions of Energy Star qualifying models sized 9 cubic feet to 30 cubic feet to create a second lookup table (Table 5). The lookup tables provided an efficient method for assigning an estimated annual energy consumption level for all units recycled as part of the AmerenUE program. After a base consumption was determined for a unit, that consumption was multiplied by 1.3 to obtain an age-adjusted consumption if the unit was determined to be over ten years old at the time of removal. The anticipated annual energy use of an Energy Star qualifying replacement of the same size and type was subtracted from the age adjusted energy use of the removed unit to calculate annual energy saving resulting from the removal of that unit. Savings for all units removed through the program were then added to determine KWh savings for program years 2003 and 2005. In order to account for secondary refrigerators, the totaled savings were increased slightly by first deducting the number of secondary refrigerators removed multiplied by the average annual savings per unit and then adding back in the number of secondary refrigerators multiplied by average base consumption for the recycled refrigerators. This was done because secondary refrigerators would most likely not be replaced, while primary refrigerators would be. It is therefore fair to claim the entire base use consumption of secondary units as savings.

Because annual savings data were used to determine total program savings, it was not possible to independently calculate peak demand reduction; therefore, the ratio of demand reduction to energy savings (0.0001536 KW/KWh) derived from data in the Final Report Impact Evaluation of the Spare Refrigerator Recycling Program CEC Study #537 completed by Xenergy for Southern California Edison was used to compute peak demand reduction from calculated annual KWh savings.

Table 5: Lookup Table for ENERGY STAR Refrigerators

Vol (cu ft)	Side-by-side (KWh)	Top Mount freezer and other (KWh)
9	400	316
10	400	320
11	400	330
12	420	345
13	430	355
14	440	365
15	460	376
16	480	390
17	507	407
18	508	408
19	518	420
20	524	432
21	530	440
22	584	488
23	595	510
24	607	540

Vol (cu ft)	Side-by-side (KWh)	Top Mount freezer and other (KWh)
25	617	550
26	637	570
27	680	600
28	720	630
29	770	670
30	810	710

Overall, 94% of recycled refrigerators were plugged in and working at the time of the pickup.[5] Of the total number of refrigerators collected in 2003, over 1,800 were not replaced with Energy Star units directly through the program. It may be assumed that many were replaced with Energy Star units, and this was the assumption used in completing the impact analysis.
Finally, the average age of refrigerators recycled in 2003 was calculated to be 16.8 years. This is already beyond the expected life of 15 years for refrigerators. It is not known how many more years the refrigerators would have been in use, but many collected were 30, 40, or even 50 years old. Therefore, for the purposes of program cost effectiveness, we have used an expected measure life of 15 years in calculating lifetime program savings.

Program Year 2003 Gross Savings

The final invoice summary for 2003-2004 lists a total 2,314 units removed from Missouri customers. This differs from the total of 2,373 units shown in the MEEA 2003 Final Report. This invoice summary also lists a program total of 4,165 units compared with 4,546 units reported, indicating that a discrepancy in the unit totals exists. Based on the methodology described above, gross program savings were calculated to be 2,401,939 KWh with a peak demand reduction of 0.36796 MW.

The savings reported in the 2003 final report and the calculated gross savings are summarized in Table 6.

Table 6: 2003 Program Savings

	Units Removed	Gross Annual Savings (KWh)	Demand Reduction (MW)	Savings per unit (KWh)
ODC/GDS	2,314	2,401,939	0.36894	1,038
MEEA 2003 Final Report	*2,373*	*4,077,763*	*0.626472*	*1,718*
Difference	-59	-1,675,824	-0.25753	-680
Percent of reported	97.5%	58.9%	58.9%	60.4%

Prior program savings reported by MEEA were calculated based on per-unit savings from the Final Report Impact Evaluation of the Spare Refrigerator Recycling Program CEC Study #537 completed by Xenergy for Southern California Edison. Refrigerators were assigned an average annual consumption of 2,148 KWh and 0.33 KW; with a six-year estimate of remaining useful

[5] We collected additional details about the recycled refrigerators, but due to the available information, we did not incorporate these details since the program estimates are not as detailed as was expected given the level of data available for impacts.

life. A net to gross ratio of 0.8 was then applied, resulting in per unit annual savings of 1,718 KWh. This calculation appears not to have subtracted the expected energy use of the replacement unit if the recycled unit was a primary refrigerator. In reality, the majority of units recycled in the 2003 program (2,136 of 2,373 reported for Missouri) were primary units that would be expected to be replaced.

MEEA's program results for Missouri customers in 2003 were reported as 2,373 units removed, for a total annual energy savings of 4,077,763 KWh and a peak demand reduction of 0.626472 MW. As discussed above, refrigerators were assigned an average annual consumption of 2,148 KWh and 0.33 KW; with a six-year estimate of remaining useful life. A net to gross ratio of 0.8 was then applied, resulting in per unit annual savings of 1,718 KWh, regardless of size or type.
Two factors appear to account for the majority of the difference between the gross savings claimed in the 2003 final report and the gross savings calculated as part of the impact evaluation. First, and probably most significant, claimed savings were determined to be the full expected annual consumption of the recycled units, modified by a net to gross ratio of 0.8. This did not account for the refrigerators that would replace the recycled units, even though 2,136 of the 2,373 recycled refrigerators in Missouri were primary refrigerators and would most likely have been replaced.

Second, the estimated consumption was an average value determined in the Final Report Impact Evaluation of the Spare Refrigerator Recycling Program CEC Study #537 completed by Xenergy for Southern California Edison. This consumption estimate appears similar to consumption data seen for older refrigerators (20 years old or older) that would be expected to be used as spare refrigerators. As mentioned above, the vast majority of recycled refrigerators were primary refrigerators, not spares, and a survey of Missouri customers indicated that only 45% of recycled refrigerators were over 16 years old. This indicates that the average consumption used in calculating reported savings was probably too high to represent the units recycled in this program.

Program Year 2005 Gross Savings

The final invoice summary for 2003-2004 lists a total 124 units removed from Missouri customers. Based on the methodology described above, gross program savings were calculated to be 116,245 KWh with a peak demand reduction of 0.0178 MW.
The savings reported in the 2005 final report and the calculated gross savings are summarized in Table 7.

Table 7: 2005 Program Savings

	Units Removed	Gross Annual Savings (KWh)	Demand Reduction (MW)	Savings per unit (KWh)
ODC/GDS	124	116,245	0.0178	937
MEEA 2003 Final Report	*124*	*212,888*	*0.030*	*1,718*
Difference	0	-96,643	-0.0122	-781
Percent of reported	100%	54.6%	59.3%	54.5%

Program results for Missouri customers in 2005 were reported as 124 units removed, for a total annual energy savings of 212,888 KWh and a peak demand reduction of 0.030 MW. As for the

2003 program year, refrigerators were assigned an average annual consumption of 2,148 KWh and 0.33 KW; with a six-year estimate of remaining useful life. A net to gross ratio of 0.8 was then applied, resulting in per unit annual savings of 1,718 KWh, regardless of size or type.

Two factors appear to account for the majority of the difference between the gross savings claimed in the final report and the gross savings calculated as part of the impact evaluation.

First, and probably most significant, claimed savings were determined to be the expected consumption of the recycled units, modified by a net to gross ratio of 0.8. This did not account for the refrigerators that would replace the recycled units, even though 122 of the 124 recycled refrigerators in Missouri were primary refrigerators and would most likely have been replaced. Second, the estimated consumption was an average value determined in the Final Report Impact Evaluation of the Spare Refrigerator Recycling Program CEC Study #537 completed by Xenergy for Southern California Edison. This consumption estimate appears similar to consumption data seen for older refrigerators (20 years old or older) that would be expected to be used as spare refrigerators. As mentioned above, the vast majority of recycled refrigerators were primary refrigerators, not spares, and a survey of Missouri customers indicated that only 45% of recycled refrigerators were over 16 years old. This indicates that the average consumption used in calculating reported savings was probably too high to represent the units recycled in this program.

Net Realized Savings

For the combined 2003 and 2005 programs, 77% of the refrigerators recycled through the program would have remained on the market if the program had not existed, meaning that 23% of them would likely have been thrown away or recycled even without the program. In addition, a factor of 1.06 was also applied to freeridership because 6% of recycled refrigerators were not functioning at the time of pickup. Spillover data are not available, therefore, estimating 24.4% free riders, net realized savings for 2003 is calculated to be 1,816,346 KWh, with a demand reduction of 0.2790 MW and for 2005 is calculated to be 87,904 KWh, with a demand reduction of 0.0135 MW.

Cost Effectiveness

Table 8 shows the cost effectiveness of AmerenUE's Refrigerator Recycling Program for 2003 and 2005. FEMP UPV Discount Factors for electricity for Census Region 2 (Including Missouri) were used for the benefit/cost analysis. The Department of Energy currently uses a 3% discount rate in determining discount factors. The expected life of refrigerators is 15 years, and this was the life used in determining the appropriate residential discount factors and in calculating lifetime savings. Clearly, the very few units collected in 2005 resulted in that program year having a poor benefit cost ratio. This is probably because any fixed administrative costs needed to be spread out over much fewer units in 2005 as compared with 2003.

Table 8: Refrigerator Program Cost Effectiveness

Year	Program Cost	First Year Program Savings	Effective Life of Recommendations	Lifetime Savings	Lifetime Benefit/Cost Ratio
2003	$378,000	$119,879	15.0	$827,164	2.2
2005	$66,000	$5,802	15.0	$40,031	0.6

Detailed spreadsheets on the savings and life cycle costs analyses were provided to AmerenUE along with this report.

V. Process Findings and Recommendations

Overall, most participants in the 2005 program were very satisfied the program (86%). (See Section VI Table D-3)[6] Participants were most satisfied with the pick up and removal process with 92% stating they were very satisfied with this process, followed by 82% stating they are very satisfied with the sign up process. Participants were least satisfied with the amount of time it took to receive the incentive check however 70% still stated they were very satisfied. (Section VI Table D-19) Participants that were not fully satisfied said they experienced delays in getting their refrigerators picked up or receiving their rebate checks.

No additional refrigerator recycling programs have been funded to date. However if AmerenUE and the Collaborative decide to run a similar program in the future, we recommend the following:

- **Clearly state the goals of the program to focus the program approach, and extend the program to include customers who "only recycle" and/or customers who "only purchase an Energy Star refrigerator"**

  It is unclear what the main goals of the programs were: To recycle older units instead of keep using them or putting them into the secondary market? Early retirement? To increase the sale of Energy Star units? If the goal was on increasing sales of Energy Star units, the 2003 program did not require the linking of recycled appliances to new Energy Star appliances. While the 2005 program did require this, the 2005 program also mentions early replacement of older operational units as a goal, although then fails to encourage early retirement since many of the 2005 participants (83%) were planning to replace their refrigerators prior to hearing about the recycling program and incentive (See Section VI Table D-9b.) Additionally, many participants stated that they would have purchased an Energy Star model without the program. (See Section VI Table D-17.)

  By design (but not implementation in 2003), the AmerenUE refrigerator programs focused on the nexus of people who were both purchasing Energy Star units, and willing to recycle their old unit. As described by ARCA, if one thinks of it in terms of two intersecting circles (one representing those who purchase Energy Star units and one for those who are getting rid of units) the AmerenUE program sought only to capture those who met both requirements, or the intersection of the two circles. Expanding the program in a way to incorporate all customers either purchasing and/or getting rid of refrigerators would help to increase the number of customers affected through the program. (Notably, however, this expansion would have to occur in a cost-effective way, which might assume just education and not incentives for all units). According to interviews with ARCA, uncoupling the recycling with efforts to promote and sell Energy Star units could also reduce the program costs per unit. Increasing the volume of units could also bring down the cost per unit.

  Any future programs should more clearly state the goals (and/or the balance of the three goals mentioned above) in order to focus the program more.

[6] No satisfaction questions were asked in the MEEA survey of 2003 participants.

- **Consider at what point in the process you want to reach potential program participants and consider expanding promotions to reach those that were not already looking to purchase a new refrigerator**

  Most participants (71%) found out about the program in the store either from in-store displays or stickers on appliances (see Section VI Table D-1). This is consistent with the finding that most (96% of all or 83% of the 2005 participants) were also planning on purchasing a new refrigerator prior to hearing about the program (see Section VI Table D-9). While in-store advertising is getting customers to participate in the program and getting refrigerators recycled that otherwise would not be, it is not encouraging customers to replace their refrigerators earlier than they normally would since these customers who find out about the program through in-store advertising are likely to be shopping for a new unit already.

  AmerenUE should look to promote the program to customers who are not currently looking to purchase a new refrigerator. This could possibly include targeting low to middle income customers or neighborhoods where the housing stock is older.

- **Refocus the program to encourage early retirement of refrigerators through marketing outside of appliance stores**

  Based on non-participant survey data, over 25% of non-participant refrigerators are over 11 years old (See Section VI Table D-5.). Yet based on non-participant comments, only 5% of non-participants are in the market to purchase a refrigerator over the next year, so there may be opportunities to encourage the early retirement of additional older energy hogs.

  Most of the participants in the program were replacing refrigerators that were at the end of their useful life. As the age of the refrigerator replaced through the program increases to its useful lifetime the savings that can be claimed by the program decreases. Forty-five percent of participants replaced a refrigerator that was over 16 years old with another 22% replacing a unit that was 11-15 years old. According to the Association of Home Appliance Manufactures (AHAM) the average useful life of a refrigerator ranges from 14 years to 17 years.

  Future programs should focus on getting customers that own high use units but are likely to wait until the refrigerator stops working to replace it. Thus, additional marketing outside of the stores would be required.

- **Raise the awareness of opportunities to recycle, and building the infrastructure for this effort, perhaps in lieu of providing customer incentives**

  None of the non-participants who purchased a refrigerator in the past five years said they paid to have their old unit recycled, and only 4% of participants said they would have done this if the program had not been offered (representing 1% of all units in the program). However, when all non-participants were specifically asked if they would look for someone to recycle their old refrigerator when the time came to get rid it, 52% said

"yes" and 20% would be willing to pay $50 for the service. (See Section VI Table D-11.) This is similar to participants: 49% said they would have looked for someone to recycle their old refrigerator if the program had not been available, and 20% would be willing to pay $50 for it. Notably, therefore, just raising awareness of the possibility of recycling the refrigerator appears to generate interest. Future programs should consider this, and whether the customer incentive is needed.

- **Extend planning time and the length of commitments from retailers and subcontractors**

  Based on information gathered through our in-depth interview with the program administrator, the 2005 was launched late due to the amount of time required for planning and approval. The time it took to get feedback from AmerenUE and the Collaborative on the RFP process, and then the time to sign the contracts and coordinate with the contractor, was much longer than anticipated. As a result, the program did not launch until a few months before the tariff ended, and it appears as though AmerenUE was unable to extend the tariff and thus the program period.

  In addition, the contract time frame and volume did not allow for a recycling center to be established within the Missouri market. Due to the limited commitment from the program, ARCA recycled the units through neighboring states, thus not allowing for the transformation of the market. As such, the program was limited to the existing infrastructure (e.g., only being able to haul away from the St. Louis area). A commitment to a longer timeframe and higher volume of units would allow for additional infrastructure to be established.

  For future efforts, AmerenUE should allow for a planning period, work to streamline the approval processes, and seek a longer-term commitment. Notably, in the first program year, MEEA found that since they covered only a limited regional area, manufacturers did not want to participate because the rebated conflicted with nationwide rebates. They also found that certain areas of the state were not able to participate because they lacked a centralized appliance delivery and haul away service (which is why ARCA stepped in for the 2005 program). In future efforts, additional planning time and longer-term commitments could help build the infrastructure needed.

- **Find ways to ensure that customer units are not switched during the recycling process**

  The assumption within the refrigerator market is that if the unit is working, someone will use it; and if the unit looks good but is not working, someone will fix it and use it.[7] Because of this, throughout the country, there are problems with policing units to ensure that the units that are retired early are not switched with older units that would have been thrown away. Some policing of this should occur with any program. Suggestions include but are not limited to destroying the unit at the time of pick-up (for example, by piercing the wall of the unit), and/or tracking serial numbers or make/models. Any future

[7] Paraphrased from discussion with Bruce Wall, ARCA, 05/30/07.

programs should require the implementer to ensure how the market will be "policed" to ensure that units are not being switched.

- **Collect consistent data from both older models and new models (e.g., nameplate amperage for both)**

  In the program databases, the amperage information collected from the recycled refrigerators was generally lower than the nameplate wattage for Energy Star qualifying refrigerators of the same size. This implies that the amperage for the recycled units was probably a running amperage rather than nameplate amperage. Collecting the nameplate amperage would allow for a direct comparison to the nameplate amperage of Energy Star units of the same size and would result in more accurate baseline data. For future efforts, the program should collect consistent data from both older models and new models.

VI. Detailed Tables

Section VI Table D-1: Where Customers Heard About Program

	Participants (n=65)
In the store (in store display or stickers on appliances)	71%
Friend/family/neighbor	8%
TV advertisement	6%
At work-Ameren employees	5%
Advertisement in cable bill	2%
Newspaper	2%
Bill inserts	2%
Don't know	6%

Section VI Table D-2: Why Customers Participate (multiple response)

	Participants (n=65)
Rebate	55%
Needed to have old refrigerator removed	23%
Energy savings	17%
Needed a new refrigerator	17%
Other	6%

Section VI Table D-3: Satisfaction with Program

	Participants (n=65)
Very satisfied	86%
Somewhat satisfied	11%
Somewhat dissatisfied	2%
Very dissatisfied	-
Don't know	2%

Section VI Table D-4: Non Participant Refrigerator Purchases

	Non Participant (n=100)
Yes, I purchased fridge that is in use in my home	79%
Purchased New	*75%*
Purchased Used	*4%*
No, I did not purchase the fridge that is in use in my home	21%

Section VI Table D-5: Age of Non Participant Refrigerators

	Non Participant (n=100)
Less than 1 year	5%
1-5 years	38%
6-10 years	25%
11-15 years	14%
Over 16 years	11%
Don't know	7%

Section VI Table D-6: Age of Refrigerator at Time of Replacement (according to 2005 survey, not database)

	Participant			Non Participant (n=32)
	Participant Refrigerators (n=67)	Primary Refrigerators (n=51)	Secondary Refrigerators (n=16)	
Less than 1 year	1%	2%	-	-
1-5 years	1%	2%	-	6%
6-10 years	22%	24%	19%	9%
11-15 years	22%	29%	-	25%
Over 16 years	45%	37%	69%*	38%
Don't know	7%	6%	13%	22%

*significantly higher than primary refrigerators at the 90% level

Section VI Table D-7: Plugged In and Working (valid percentages)

Was the fridge plugged in and working?	Participant			Non Participant (n=32)
	Total Participant Refrigerators (n=64)	Primary Refrigerators (n=48)	Secondary Refrigerators (n=16)	
Yes	92%*	92%	94%	72%
Some of the time	2%	-	6%	-
No	6%	8%	-	25%^

*significantly higher than non participants at the 90% level
^significantly higher than participants at the 90% level

Section VI Table D-8: Refrigerator in a Room with Heating/Cooling

Q5 & Q14: Was the fridge in a room that has heat, ac or both?	Total Refrigerators (n=67)	Primary Refrigerators (n=51)	Secondary Refrigerators (n=16)
Heat only	4%	2%	13%*
AC only	-	-	-
Both heat and AC	85%	96%*	50%
Don't know	10%	2%	38%*

Section VI Table D-9a: Planning on Replacing Prior to Hearing About Program (all units, valid percentages)

MEEA Program Data & ODC Survey Q6 & Q16: Were you planning on replacing this refrigerator prior to hearing about the program?	Inferred Total Refrigerators (n=2,314)
Yes	96%*
No	4%

*Based on the 2005 ODC survey data which shows that 83% of refrigerators would have been replaced regardless of the program. This assumes that 83% of the 496, and 100% of the remaining 1,935 in 2003 would have been replaced anyway. (See below.)

Section VI Table D-9b: Planning on Replacing Prior to Hearing about Program (2005 survey responses only, valid percentages)

Q6 & Q16: Were you planning on replacing this refrigerator prior to hearing about the program?	Total Refrigerators (n=64)	Primary Refrigerators (n=49)	Secondary Refrigerators (n=15)
Yes	83%	86%	63%
No	17%	14%	37%

Section VI Table D-10: Fate of Old Refrigerator

	Participants (what would you have done if program did not exist)[1]			Non Participants	
	Total Refrigerators (all units)	Primary Units (n=200)	Secondary Units (n=45)	Purchased new unit within last 5 years (n=32)	Plan for old unit when buying an new unit (n=68)
Thrown it out or had someone else pick it up	3%	19%	18%	13%	9%
Had the retailer haul it away (Still purchased a new unit)	87%	50%	16%	41%^	19%
Sold or given it away	3%	12%	36%	22%	21%
Kept it as a second unit	3%	15%	29%	9%	4%
Paid to have it recycled	1%	5%	2%	-	6%
Kept it, and not purchased new one	4%				
Other	-	-	-	3%	4%
Don't know	-	-	-	-	12%

[1] Combined MEEA survey of PY 2003 participants and ODC survey of PY 2005 participants. Notably, the primarly and secondary unit columns are much smaller since these only include customers surveyed, not the 1,935 units recyled without customer intervention.

*significantly higher than non participants that purchased a unit within 5 years and those that have not at the 90% level

^significantly higher than participants at the 90% level

Section VI Table D-11: Would Have Looked For Someone to Recycle Refrigerator

Would you look for someone to recycle your refrigerator if the program had not been available/when you get rid of an old refrigerator?	Participants			Non Participants (n=100)
	Total Participants (n=63)	Participants with Primary Refrigerators (n=50)	Participants with Secondary Refrigerators (n=13)	
Yes	46%	52%*	23%	52%
No	46%	38%	77%*	31%
Don't know	8%	10%	-	17%

*significantly higher than the comparison group at the 90% level

- 20% of participants and non participants would pay someone $50 to recycle their old refrigerator.

Section VI Table D-12: Why Would You Not Look for Someone to Recycle Your Fridge?

Q11b	Participants (n=29)	Non Participants (n=31)
Would have let retailer take it	28%	6%
Would have donated/given it away/sold it	17%	29%
Didn't know you could recycle it	14%	-
Would have kept it and used it	14%	-
Didn't think of recycling it	10%	-
Just wanted to get rid of it	3%	-
It's too much trouble	-	3%
Other	-	6%
Don't know/refused	14%	54%*

*significantly higher than the comparison group at the 90% level

Section VI Table D-13: Plan to Purchased in Next 12 Months

	Non Participants (n=100)
Yes	5%
No	92%
Don't know	3%

- Only 2% of non participants plan on purchasing an Energy Star refrigerator within the next 12 months

Section VI Table D-14: Energy Star Awareness

	Participants (n=65)	Non Participants (n=100)
Aware	89%*	54%
Unaided	*74%**	*40%*
Aided	*15%*	*14%*
Not Aware	9%	45%*
Don't know	2%	1%

Section VI Table D-15: What Energy Star Label Means (multiple response)

	Participants (n=58)	Non Participants (n=54)
Uses less energy	71%	56%
Lower utility bills	22%	35%
High quality	7%	4%
Good for the environment	5%	11%
Government endorsed	3%	2%
Product is tested	2%	7%
Less pollution	2%	7%
Haven't thought about it	-	6%
Other	10%	-
Haven't thought about it	2%	6%

Section VI Table D-16: Energy Star Refrigerators Among Non Participants

	Participants (n=100)
Yes, current refrigerator is Energy Star	25%
No, current refrigerator is not Energy Star	14%
Haven't heard of Energy Star	46%
Don't know	15%

Section VI Table D-17: Would Have Purchased of an Energy Star Unit Without the Program

Q27: Would you have purchased an Energy Star refrigerator if the program did not require it?	Participants (n=65)
Yes	75%
No/Haven't heard of Energy Star/Don't know	25%

Section VI Table D-18: Signing Up for the Program

Q29: Did you sign up for the program through the website or by calling the toll- number?	Participants (n=65)
Phone	63%
Website	8%
Don't know	29%

Section VI Table D-19: Satisfaction

Q30, Q32 & Q34: Were you satisfied or dissatisfied with…	Sign Up (n=65)	Pick Up and Removal (n=65)	Amount of Time to Receive Check (n=65)
Very satisfied	82%	92%	71%
Somewhat satisfied	9%	8%	12%
Neither satisfied nor dissatisfied	-	-	3%
Somewhat dissatisfied	2%	-	6%
Very dissatisfied	2%	-	-
Don't know	6%	-	8%

Section VI Table D-20: Refrigerator Participant Demographics

Demographics	Participants (n=65)	Non Participants (n=100)
Own/Rent		
Own	95%	84%
Rent	3%	13%
Don't know	2%	3%
Household Type		
Single family	91%	83%
Duplex or 2 family	3%	4%
Apartment 2-4 units	5%	5%
Apartment >4 units	2%	5%
Mobile home	-	1%
Townhouse	-	2%
Number of People		
1	8%	27%*
2	38%	45%
3	18%	10%
4	11%	11%
5	12%	4%
6	3%	1%
7 or more	2%	1%
Refused	8%	1%

Demographics	Participants (n=65)	Non Participants (n=100)
Low Income		
Non Low Income	80%	69%
Low Income	2%	16%
Don't know/refused	18%	15%
Year Built		
Built in 2006	-	-
2004-2005	-	1%
2001-2003	-	7%
1990-2000	22%	15%
1980-1989	15%	5%
1970-1979	17%	12%
1960-1969	26%	13%
1950-1959	5%	10%
1940-1949	3%	5%
Prior to 1939	5%	12%
Don't know	8%	20%
Education		
Less than 9th grade	2%	2%
9th to 12th grade	-	4%
High school graduate	15%	33%
Some college, no degree	15%	21%
Associates degree	6%	8%
Bachelors degree	40%	18%
Graduate or professional degree	11%	10%
Don't know/refused	11%	4%