Nexus Market Research, Inc.

IMPACT, PROCESS, AND MARKET STUDY OF THE CONNECTICUT APPLIANCE RETIREMENT PROGRAM: OVERALL REPORT

FINAL

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Submitted to:
Northeast Utilities – Connecticut Light and Power
The United Illuminating Company

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Executive Summary

This overall report summarizes the impact, process, and market study of the Connecticut Appliance Retirement Program (ARP) conducted by Nexus Market Research, Inc. (NMR) and RLW Analytics, Inc. (RLW) for Northeast Utilities – Connecticut Light and Power (NU CL&P) and The United Illuminating Company (UI). In this report, we highlight the major conclusions of the evaluation activities and make recommendations based on the findings of the study.

Program Impact and Effectiveness

The two primary goals of the ARP are:

1. To remove older, secondary refrigerators (RF) and/or freezers (FZ) from customers' homes while preventing these appliances from entering the secondary market
2. To encourage customers to replace older room air conditioners (RAC) by providing point-of-purchase incentives for new ENERGY STAR®-qualified RAC

The ARP also seeks to reduce demand for electricity and increase electricity and bill savings for customers. The section on program impact and effectiveness assesses progress towards these goals. We also estimate energy savings resulting from the ARP and the cost-effectiveness of the program.

Number of Products Retired

A total of 7,467 RF, 2,895 FZ, and 5,875 RAC were retired through the ARP in 2004. (Table ES.1) Most of the RAC, (83%) were retired at turn-in events. Although not a focus of this evaluation, the program also resulted in the retirement of 274 dehumidifiers; only four were retired at turn-in events. The patterns of product retirement reflect the program's focus on the critical and constrained communities of Southwest Connecticut (SWCT). Just over two-thirds of RF and FZ (68%) and nearly three-fourths (72%) of RAC were retired by customers living in SWCT, Customers of UI retired 39% of all the units surrendered to the ARP, or about 37% of the RF and FZ and 42% of the RAC. Customers of CL&P surrendered the remaining 61% of units, or 63% of RF and FZ and 58% of the RAC.

Table ES.1: Number of Products Retired through the Program

		RF	FZ	RAC-PU	RAC-TI	Total
CL&P	SWCT	2,385	918	310	1,545	5,158
	Not SWCT	2,344	917	494	1,039	4,794
	Total CL&P	**4,729**	**1,835**	**804**	**2,584**	9,952
	% SWCT	**50%**	**50%**	**39%**	**60%**	**52%**
UI	SWCT	2,722	1,054	223	2,179	6,178
	Not SWCT	16	6	1	84	107
	Total CL&P	**2,738**	**1,060**	**224**	**2,263**	6,285
	% SWCT	**99%**	**99%**	**100%**	**96%**	**98%**
OVERALL	SWCT	5,107	1,972	533	3,724	11,336
	Not SWCT	2,360	923	495	1,123	4,901
	Total CL&P	**7,467**	**2,895**	**1,028**	**4,847**	16,237
	% SWCT	**68%**	**68%**	**52%**	**77%**	**70%**

The number of products actually retired exceeded program goals by 77% for RF and FZ and 411% for RAC. (Table ES.2) Product retirements were higher than expected for both CL&P and UI. Retirements by customers of CL&P exceeded goals by 62% for RF and FZ and 384% for RAC, while retirements by customers of UI retired 109% more RF and FZ and 453% more RAC than the stated goals.

Table ES.2: ARP Product Retirement Goals and Achievements

	Overall			CL&P			UI		
	Goal	Actual	% above Goal[b]	Goal	Actual	% above Goal[b]	Goal	Actual	% above Goal[b]
RF[a]	4,228	7,467	77%	2,916	4,729	62%	1,312	2,738	109%
FZ[a]	1,639	2,895	77%	1,131	1,835	62%	508	1,060	109%
RAC	1,150	5,875	411%	700	3,388	384%	450	2,487	453%

[a] In the RFP Table 2.2.2, Sponsors listed their goals for RF and FZ together. NMR has used the proportions of units actually retired in 2004 to estimate separate goals for RF an FZ
[b] Actual divided by Goal minus one, multiplied by 100%.

Diversions from Secondary Market

The NMR team estimates that the program diverted 4,670 RF, 1,791 FZ, and 3,292 RAC from the used market from June through December of 2004. We estimate that non-participants contributed approximately 67,812 RF, 12,536 FZ, and 64,031 RAC to the secondary appliance market during the same time period. If we assume that together these comprise the total number of appliances removed from customers' homes that would have entered the used market, the results indicate that the program diverted only 6% of RF, 13% of FZ, and 5% of RAC from the used market. However, we also believe that it is unlikely that all of the units retired by participants or disposed of by non-participants would have actually been sold at used appliance stores in Connecticut. An unknown number of them may instead have been transported out of Connecticut, stored in warehouses, or destroyed.

Replacement with ENERGY STAR-qualified RAC

Approximately 63% of respondents retiring RAC say they replaced the unit with an ENERGY STAR-qualified model. Another 13% say they bought a standard model to replace the unit retired through the ARP. However, only 40% of the units retired at turn-in events were replaced using the purchase incentive for ENERGY STAR-qualified RAC handed out only these events.

Energy Savings and Cost Effectiveness

The NMR team used three different techniques— the augmented comparison approach, weighted least squares regression, and a survey-based approach—to estimate the energy savings attributable to the ARP. These estimation methods largely confirmed the sponsors' deemed savings for FZ, but they led to estimates of achieved savings for RF that fell short of current assumptions. (Table ES.3) Furthermore, the survey approach also suggests that savings attributable to the retirement of RAC fell short of current deemed savings. Free ridership, replacements of RF and FZ, and infrequent product use prior to retirement limit achieved energy savings.

Table ES.3: Current Energy Savings Assumptions and Evaluation-Based Estimates of Energy Savings, in kWh

(per-unit estimates, except for the retirement of both RF and FZ, which are per account)

	Current Assumption	Augmented Comparison	Regression	Survey
Refrigerator	739	426	438	337
Freezer	450	506	475	433
Refrigerator & Freezer	na	549	na	na
Room air conditioner, no replacement	64	na	na	40
RAC, ENERGY STAR replacement	39	na	na	14

Considering the results of the various estimation methods and their relative strengths and weaknesses, NMR and RLW recommend the savings assumptions summarized in Table ES.4.[1]

Table ES.4: Recommended Savings Assumptions

Row	Component	RF	FZ	RAC No replacement	RAC Replacement
A	Gross Savings kWh per unit	1,383	1,181	191	53
B	Realization Rate	29.9%	38.1%	20.7%	26.0%
C	Net Savings kWh per unit *(Row A ×Row B)*	413	450	40	14

Based on the number of products retired in 2004, the recommended savings assumptions yield estimates of annual and lifetime energy savings for the program overall and for each sponsor as described in Table ES.5.

Table ES.5: Number of Products Retired and Estimated Savings, in MWh

		RF	FZ	RAC		Total Savings
				No replacement	Replacement	
	Net Savings, kWh	413	450	40	14	na

[1] These strengths and weaknesses are summarized in Section 2.4.2 and Appendix F. The survey-based approach takes free ridership and product replacement into account but is not based on actual metered energy use. The regression approach is based on actual energy use but does not adjust for free ridership or other behavioral factors that limit savings attributable to the program.

CL&P	N Products	4,729	1,835	541	2,847	9,952
	Annual Savings	1,953	826	22	40	2,840
	Lifetime Savings[a]	9,765	4,129	65	518	14,477
UI	N Products	2,738	1,060	827	1,660	6,285
	Annual Savings	1,131	4,77	33	23	1,664
	Lifetime Savings[a]	5,654	2,385	99	302	8,440
Overall	N Products	7,467	2,895	1,368	4,507	16,237
	Annual Savings	3,084	1,303	54	62	4,504
	Lifetime Savings[a]	15,419	6,514	164	820	22,918

[a] Lifetime based on sponsors' current assumptions measure life: five years for RF, five years for FZ, three years for non-replaced RAC, and 13 years for RAC replaced with ENERGY STAR-qualified model.

Due to the higher than expected number of product retirements, the program achieved its annual and peak demand savings goals; however, the program failed to achieve its lifetime savings goals. (Table ES.6) Furthermore, budget increases together with the limited achieved energy savings served to lower the cost effectiveness of the program. In fact, the amount of money spent per kWh hour of energy savings achieved was more than twice the stated program goal.

Table ES.6: ARP Energy Savings and Cost Effectiveness Goals & Achievements

	Goal	Actual	Difference[a]
Annual (MWh)	4,332	4,504	173
Lifetime (MWh)	23,958	22,918	-1,041
Demand (kW)	736	807	71
2004 Budget	$1,065,136	$2,314,326	$1,249,190
Annual Cost Rate ($/kWh)	0.246	0.514	0.268
Lifetime Cost Rate ($/kWh)	0.044	0.101	0.057

[a] Difference is computed by subtracting the actual savings by the savings goals.

Non-Electric Benefits

The NMR team quantified some of the non-electric benefits (NEBs) of the ARP, including:

- Reduction of carbon dioxide and sulfur oxides emissions
- Scrap metal recycled
- Refrigerants recovered
- Capacitors recovered
- Oil recovered
- Mercury recovered
- Batteries recovered

The NMR team recommends that the sponsors continue to use their current assumptions regarding carbon and sulfur oxides emissions. (Table ES.7) According to these assumptions, the ARP in 2004 reduced carbon dioxide emissions by nearly 4,000 tons and sulfur oxides emissions by 14 tons. To estimate other NEBs, NMR obtained ARCA's assumptions about the amount of materials recovered during the demanufacturing process. These assumptions, broken down by appliance, are summarized in Table ES.8. These same assumptions underlie the NEBs data available on ARCA's ATO on-line reporting system, but the NMR estimates include units also retired through turn-in events, which the on-line reporting system does not for 2004. Based on these assumptions, the ARP recovered 1,342 tons of scrap metal, nearly 4,000 pounds of refrigerants, just over 3,000 gallons of oil, nearly 8,000 pounds of capacitors, nine ounces of mercury, and 145 pounds of batteries. It is also worth noting that, when asked about NEBs, 44%

of participants indicated that retiring their appliance helped the environment, stopped global warming, or limited damage to the ozone layer. Very few participants named any drawbacks to ARP participation.

Table ES.7: Reduction in Carbon Dioxide and Sulfur Oxide Emissions, 2004 Program Year

Material	Savings	2004 Achievements	Lifetime Savings
Carbon dioxide	0.3485 lbs/kWh	22,917,539 kWh	3,993 tons
Sulfur oxides	0.001225 lbs/kWh		14 tons

Table ES.8: Per-Product Assumptions of Amount of Material Recovered during the Demanufacturing Process, ARCA

	Refrigerator	Freezer	Room Air Conditioner
Scrap Metal - tons	0.100	0.100	0.052
Refrigerants - lbs	0.369	0.375	0.015
Oil – gals	0.073	0.074	0.395
Capacitors - lbs	0.063	0.063	1.250
Mercury – oz	0.000	0.003	0.000
Batteries – lbs	0.000	0.800	0.000

Table ES.9: Amount of Material Recovered by the ARP, 2004 Program Year

	Refrigerator	Freezer	Room Air Conditioner	Program Total
N Retired through ARP	7,467	2,895	5,857	**16,219**
Scrap Metal - tons	747	290	306	**1,342**
Refrigerants - lbs	2758	1086	88	**3,932**
Oil – gals	545	215	2322	**3,082**
Capacitors - lbs	467	181	7344	**7,991**
Mercury – oz	0	9	0	**9**
Batteries – lbs	0	145	0	**145**

Program Processes

The ARP was developed to help utility customers in Connecticut overcome three perceived barriers to recycling secondary RF, FZ, and RAC: inconvenience, disposal costs, and unfamiliarity with the operating costs. The program addressed these barriers by having products picked up at customers' homes or holding turn-in events in convenient locations, paying participants to retire their units, and educating customers about the costs of running older appliances. In addition, the program also used purchase incentives to confront the initially higher cost of ENERGY STAR-qualified RAC units.

Marketing, Program Awareness, and Reasons for Participation

Initially, bill inserts served as the most effective way of alerting customers about the ARP pick-up mode. However, over time, bill inserts lost their effectiveness and had to be paired with other forms of marketing, such as television and radio advertisements, in order to achieve desired levels of participation.

Most customers participated in the ARP because it provided a convenient way to get rid of appliances they no longer wanted. At least some participants also expected to see savings on their electricity bills. Others named energy conservation, the incentive, and product recycling as additional reasons to participate. Unlike many other programs offering incentives, ARP pick-up participants placed only moderate importance on the financial incentive to retire their appliances. In contrast, the pairing of the surrender and purchase incentives for RAC appear to have been a key driver of participation at turn-in events.

Just over one-half of non-participants with eligible appliances in their homes are willing to give them up at current incentive levels. The respondents who would not surrender the appliances at current incentive levels are simply unwilling to give them up, primarily because the units are still in use. Based on the responses of non-participants with eligible units currently in their homes, NMR believes that current incentive levels will bring about optimal participation.

Strengths and Weaknesses

The evaluation of the ARP has uncovered clear strengths of the program. One of these strengths—especially from a program planning and implementation perspective—is the turnkey nature of the ARP. Because the program is essentially "ready made," it requires little utility administration, and the volume can be directly managed via marketing and advertising. Furthermore, staff members argue that the ARP promotes positive relationships and good will with customers. Finally, the program staff reports that all the key players—the sponsors, ARCA, and retailers participating in turn-in events, among others—have positive working relationships and have no problems with communication.

The program, however, suffers from two primary weaknesses. First, participation at turn-in events is unpredictable and largely dependent on the weather. The unpredictable participation not only affects the success of the program from the standpoint of the sponsors, but it also limits the benefits to retailers who allow events to be held in their parking lots, causing them to remain skeptical about hosting turn-in events. Second, the program cannot control customer behavior before or after the program nor influence motivations for participation. Yet, it is customer behavior and motivation that most influence achieved energy savings, leading to high levels of uncertainty regarding program impacts and effectiveness.

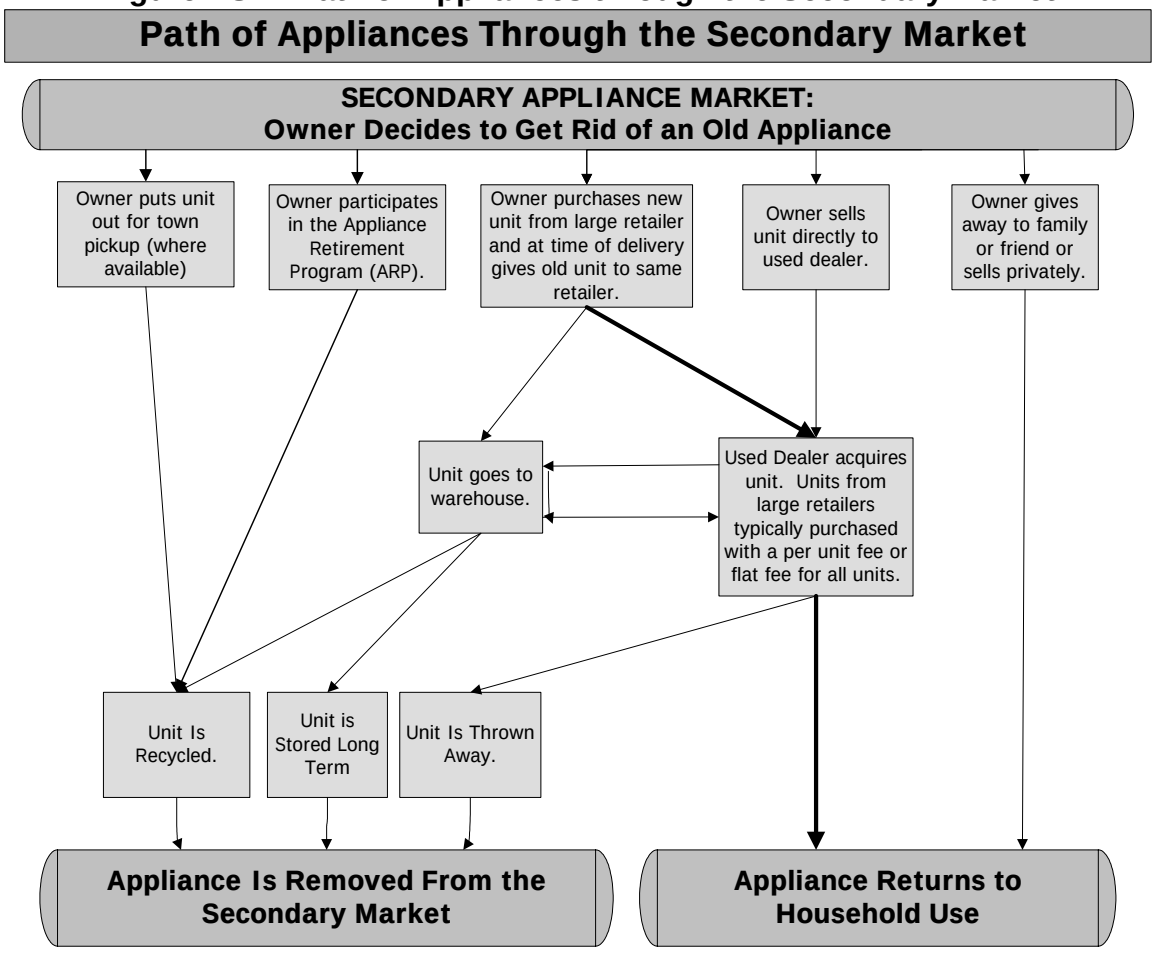
Secondary Market

Based on their investigation of the secondary appliance market, RLW estimates that 89 stores in Connecticut sell used RF, FZ, and/or RAC. RLW conducted mystery calls to 50 of these stores and visits to another 20. They identified 2,225 used RF, eight used FZ, and 223 used RAC that were available in late July and early August of 2005. Just as with new appliance stores, some of the used appliance dealers carried large numbers of appliances, while other carried just a few. Smaller stores most often received units from their own customers, through want ads, or by removing units from the homes of the recently deceased. The larger stores, in contrast, are more likely to obtain the units from retailers who had picked them up while delivering new units. Used appliance dealers generally pay very little for the units they purchase from retailers (e.g., $15-$20 each), but it appears their profit margins could be high. At the time of the mystery calls,

the average price of RF for sale at used appliance dealers was over $200, used FZ costs just over $150, and RAC were just under $100.

Based on the investigation into the structure of the secondary market, RLW developed the following flow chart of that structure. (Figure ES.1) Specifically, this figure illustrates how we believe appliances move into and/or are removed from the secondary market. The two leftmost paths illustrate how an appliance is removed from the secondary market either through the ARP or by a customer putting it out for municipal pickup and recycling. The dark lines illustrate the means by which a substantial number of secondary appliances make their way back into the marketplace via retailers. The most common way units (re)enter the used market is represented by the middle path. Customers buy a new appliance from a corporate retail store and give that store their old unit; the retailer then sells the old unit to a used appliance dealer.

Figure ES.1: Path of Appliances through the Secondary Market



Recommendations

The NMR team has developed a number of recommendations related to the future of the ARP. These are in addition to the recommendations presented above regarding assumed energy savings, non-electric benefits, and incentive levels.

Based on the lack of cost effectiveness regarding achieved energy savings and the minimal effect that the ARP has on diverting units from the secondary appliance market, NMR recommends that the sponsors consider discontinuing the program or substantially restructuring it to improve cost-effectiveness. The NMR team recognizes, however, that discontinuation of the ARP may not be desirable. For this reason, the remainder of our recommendations assume that the ARP will be revised but continue to operate in some fashion. Please note that we sometimes offer alternative possibilities for the future of the ARP.

Turn-in Events

The sponsors have informed NMR that the turn-in events will not be held in 2006. While we concur with this decision, we believe that it may be useful to offer some other type of incentive for the purchase of ENERGY STAR-qualified RAC. This belief is based on the fact that the substantial purchase incentive offered at turn-in events in 2004 succeeded in convincing at least some participants (though unfortunately not most of them) to remove units that were in active use from their homes and to replace these units with ENERGY STAR-qualified models. In contrast, the retirement incentive alone was more likely to capture the unwanted units sitting in customers' basements or attics. Furthermore, interviews we have completed in support of an assessment of the RAC market that NMR is conducting for CL&P and UI also make clear that retailers carry more ENERGY STAR-qualified RAC when purchase incentives are available than when they are not.

Based on this information, we make the following recommendations regarding turn-in events and the replacement of RAC with ENERGY STAR-qualified models:

- Discontinue the events as planned
- Pay no incentive for the surrender of RAC but instead distribute incentives to purchase ENERGY STAR-qualified models
- Alternatively, pay for the pick-up of RAC only after a customer has demonstrated the purchase of an ENERGY STAR-qualified model. Because the pick-up can occur at any time of the year, and not just the summer, the purchase could have occurred any time within the twelve months prior to pick-up or will occur in the summer immediately following the pick-up.
- Discontinue the connection between the ARP and the purchase of ENERGY STAR-qualified RAC and divert resources toward negotiated cooperative promotions (NCPs) with retailers or instant rebate programs offered at retail stores. Because the approach would be open to all the sponsors' customers, it would most likely increase the saturation of ENERGY STAR-qualified units in use in customers' homes. The approach would not, however, confront the methods of RAC disposal—including giving older, inefficient units away.

Pick-Up Mode

Based on participant responses to the telephone survey and surveys taken at the time of pick-up, we believe that two related factors are largely responsible for driving down achieved energy savings from the pick-up mode: the surrender of primary RF and the replacement of surrendered RF and FZ. Because NMR can identify no way to stop customers from retiring primary units or from replacing retired units, we that the sponsors focus on limiting their effects on energy savings using the following mitigation efforts:

- Provide additional literature to customers about the costs of running FZ or secondary RF in homes, including the costs associated with newer standard models and ENERGY STAR-qualified ones. Perhaps the literature will discourage at least a few replacements or increase the percentage of replacements that are ENERGY STAR qualified.
- If customers indicate during the ARCA screening process that they plan to retire primary units or to replace units (and, according to the ARCA database, some of them do indicate as much), the ARP may offer a purchase incentive for an ENERGY STAR-qualified model of the appliance(s) being retired. The incentive may help the sponsors recoup some of the savings that would have otherwise been lost through the replacement with a less efficient model.

We recognize that the second suggestion does not address the people who plan to replace their unit but do not divulge this intention to ARCA. Yet, we do not see how to prevent the loss of these savings without providing a purchase incentive for ENERGY STAR-qualified models for all RF and FZ surrendered through the program. NMR does not, however, believe that such a decision to give a purchase incentive to all participants will provide a cost-effective way to increase energy savings.

Also related to the pick-up mode, while it remains unclear whether *more* appliances would be recycled if the program were run continuously, the experiences of the 2004 program year—the first year of operation for the current ARP—make clear that the effectiveness of marketing declines over time. To compensate, the program has to increase the marketing budget to achieve savings goals, thereby reducing the cost-effectiveness of the program. Therefore, if the sponsors have to choose between periodic and continuous operation, NMR would recommend running the program periodically.

Secondary Appliance Market

As stated above, the ARP is currently making only a small dent in the secondary appliance market. Furthermore, participants in the ARP and non-participants who responded to the telephone survey are not buying units from the secondary market. However, the number of used appliance stores in Connecticut that carry RF and FZ make clear that some residents in the state are buying units from the secondary market. For reasons explained more fully in Section 9.3 of the Survey Results Report, our evaluation has not been able to identify who is purchasing used units nor the number of units purchased through the secondary market, although we strongly suspect it is primarily landlords and low-income customers.

Given the findings and remaining uncertainties regarding the secondary market, our first recommendation is for the sponsors to assess the degree to which diverting units from the secondary market is critical for reducing energy usage in Connecticut. A short random digit-dial

study of households in Connecticut—albeit with a fairly large sample—could be used to determine how many used appliances are purchased and in service in Connecticut, and who obtains appliances through the secondary market and why. Short of conducting an additional study, the sponsors could also add questions about used appliances to future Residential Appliance Saturation Studies.

If future research reveals that reducing the number of units obtained through the secondary market is critical to reducing energy usage in Connecticut, the following recommendations could be considered. Note that the recommendations regarding landlords and lower-income customers reflect the expectation that future studies will reveal these groups to be among the primary purchasers of used appliances.

- Work directly with retailers selling new appliances and picking up old units from customers' homes. Supply retailers with stickers that would be given to customers agreeing to have their product recycled through the program. The customer could receive an incentive after proving the appliance was picked up by mailing a delivery receipt to an implementation contractor hired by the sponsors. The store would receive incentives for each unit with a sticker delivered to ARCA. The use of the sticker would ideally limit the "switching" of units by the retailer delivery/pick-up staff.
- The evaluation also made clear that many unwanted RF and FZ were simply "put into the trash." For this reason, an alternative approach of diverting units from the secondary market involves working with local towns. Similar to the approach with the retailers, the customer would first obtain a sticker from their local government to be affixed to a unit. The sticker would be given for free, but the customer would *not* receive an incentive to do this based on the assumption that units destined for the trash have already been taken out of use, which may not be true of units picked up by retailers upon delivery of a new appliance. For each *working* unit picked up by ARCA, an incentive would be placed into a fund that the town could use to finance energy conservation programs.
- If further investigation into the secondary market finds that landlords or multi-family complexes are among the most common purchasers of used appliances, the sponsors could consider a program targeted at landlords. Landlords would surrender used or inefficient units to ARCA and then receive multi-product discounts or rebates on the purchase of ENERGY-STAR qualified units. However, any future program design should also recognize that many renters own their appliances. Therefore, programs targeted at rental housing should also take into account that at least some of the appliances may be owned by the renters and not the property owners. It is NMR's understanding that the sponsors already have a low-income program that includes the removal of inefficient RF from customers' homes.

1 Introduction

This overall report summarizes the impact, process, and market study of the Connecticut Appliance Retirement Program (ARP) conducted by Nexus Market Research, Inc. (NMR) and RLW Analytics, Inc. (RLW) for Northeast Utilities – Connecticut Light and Power (NU CL&P) and The United Illuminating Company (UI). In this overall report, we highlight the major conclusions of the evaluation activities and make recommendations based on the findings of the study. Throughout the document, we reference the individual evaluation reports that contain additional and more detailed information on each of the key findings. Each of these reports is provided as an appendix to this overall report (either in a separate MS-Word file or as appendices in the PDF of the full report).

The two primary goals of the ARP are:

1. To remove older, secondary refrigerators (RF) and/or freezers (FZ) from customers' homes while preventing these appliances from entering the secondary market
2. To encourage customers to replace older room air conditioners (RAC) by providing point-of-purchase incentives for new ENERGY STAR®-qualified RAC

The ARP also seeks to reduce demand for electricity and increase electricity and bill savings for customers. The evaluation of the ARP focused on determining progress towards these goals and on measuring the direct and indirect impacts of the ARP for the 2004 program year. The primary topics addressed in the overall evaluation and summarized in this report include:

- Program impacts and effectiveness, including the number of products retired, diversions from the secondary market, replacement of older RAC with ENERGY STAR-qualified models, estimated energy savings, cost-effectiveness, and non-electric benefits
- Assessment of program processes, including program logic, marketing, reasons for participation, quality control, and the strengths and weaknesses of the ARP
- Secondary appliances market, including the size and structure of the market and customer participation in it

In Table 1.1, we summarize the specific objectives of the evaluation and the methods and data sources employed to achieve these objectives.

Table 1.1: Evaluation Objectives, Methods, and Data Sources

Objective	Methods	Data Sources
Measure and verify achieved levels of energy and peak demand savings for program year 2004	Conduct billing analysis (refrigerators & freezers only)	Participant and non-participant billing data
		ARCA database
	Estimate savings from deemed savings and customer behavior (RAC, refrigerators, freezers)	Current deemed savings
		ARCA database
		Weather data from NOAA (RAC only)
		Participant telephone surveys
		Secondary data sources
Review planning assumptions, such as measure life and net realization rate	Review the existing literature on measure life	Blasnik for Massachusetts Utilities; KEMA-Xenergy for SCE; AHAM; NYSERDA
	Verify the age of the surrendered units	Participant survey (NB age data listed in pick-up database for 2004 are not reliable)
	Compute net realization rate	Results of energy savings analysis and current sponsor estimates of energy savings
Provide feedback and corrective guidance regarding program implementation through a process evaluation of program year 2004	Review program tracking	Tracking database
	Evaluate marketing materials	Copies of marketing materials, including press releases, newspaper advertisements, bill inserts
	Assess customer satisfaction	Participant telephone surveys
	Evaluate program processes and procedures	Depth interviews with NU and UI program personnel and implementation contractor personnel; tracking database, participant and non-participant telephone surveys
	Review retailer notification needs and influences on participation in turn-in events.	Depth interviews with retailers who participate in turn-in events
	Develop program logic model	Depth interviews with NU and UI program personnel, implementation contractor personnel; review of program documents
	Determine levels of customer awareness of the program and ways of finding out about program	Participant and non-participant telephone surveys
		Surveys taken at time of participation
Provide feedback on program effectiveness through market assessment and customer behavior analysis	Assess customer behavior before program participation	Participant telephone surveys
	Assess customer behavior after program participation	Participant telephone surveys
		Surveys taken at time of participation
	Assess perceived non-electric benefits of program participation	Participant survey
	Identify alternative disposal options	Participant and non-participant surveys
Determine if alternative program implementation is required for SWCT versus the remainder of the state.	Identify similarities and differences between SWCT and the remainder of the state that may affect program implementation	Participant and non-participant telephone surveys

Objective	Methods	Data Sources
Recommend optimal incentive structure and participation criteria	Identify the amount of incentive and participation criteria that lead to the optimal number of appliance surrenders in a cost-effective manner	Participant telephone survey
		Non-participant telephone survey
		Interviews with program personnel and implementation contractor personnel
	Assess relationship between ARP and Room AC rebate program	Participant telephone surveys
		Surveys taken at time of participation
Suggest whether program should be run continuously or periodically	Determine if program will result in the highest number of surrenders by offering continuously or periodically	Collective results of all evaluation activities
Identify structure of secondary market and impact of program on the market	Estimate the number, type, and distribution of used appliance outlets	Mystery calls to appliance stores listed as selling used appliances or repairing appliances
	Compare the incentive offered to the amount customers can expect to receive from secondary market	Mystery calls to used appliances stores
	Evaluate the relative convenience of secondary market vs ARP	Participant and non-participant telephone surveys
	Outline the path appliance takes over lifetime	Interviews with used appliance retailers
		Interviews with new appliance stores and ARCA
	Characterize perceived impact of ARP on secondary market, including product diversions from the secondary market	Interviews with used appliance retailers
		Interviews with ARCA
		Participant and non-participant surveys
	Identify past and current participation of customer in the used appliance market	Participant and non-participant telephone surveys
	Estimate charges for picking up unwanted used appliances	Non-participant telephone surveys
		Interviews with new and used appliance stores

2 Program Impacts and Effectiveness

NMR and RLW assessed program effectiveness through the following tasks:

- Verifying the number of products retired in 2004
- Projecting the number of products diverted from the used appliances market
- Determining the frequency with which participants report replacing retired RAC using the purchase incentive for ENERGY STAR-qualified model
- Estimating gross, net, and demand energy savings as well as realization rates and cost effectiveness
- Identifying and, when possible, quantifying non-electric benefits

In this section, we highlight the major findings regarding program impacts and effectiveness. Additional and more detailed information on the findings can be found in the appendices to this report. The energy savings estimates for each sponsor (as opposed to the ARP as a whole), demand savings, cost effectiveness, and the quantification of non-electric benefits are presented here for the first time.

2.1 Number of Products Retired

According to the tracking databases supplied by ARCA, 7,467 RF, 2,895 FZ, and 1,028 RAC were picked up at customers' homes during the 2004 program year. (Table 2.1) Another 4,847 RAC were turned in by customers at events held at local retail stores or other locations in the spring and summer of 2004. Although approximately one-half of the population of Connecticut lives in the targeted region of Southwest Connecticut (SWCT), two-thirds of the RF and FZ were retired from that region; this finding is consistent with the program's focus on that portion of the state.[2] Likewise, while UI accounts for approximately 20% of the residential utility customers in the state, its customers retired 37% of the RF and FZ.[3] Because all of UI's service territory is in SWCT, the disproportionately high percentage of products retired by UI customers is another indication of the marketing focus on that region of the state.

Table 2.1: Number of Products Retired through the Program, Tracking Databases

		RF	FZ	RAC-PU	RAC-TI	Total
CL&P	SWCT	2,385	918	310	1,545	5,158
	Not SWCT	2,344	917	494	1,039	4,794
	Total CL&P	**4,729**	**1,835**	**804**	**2,584**	9,952
	% SWCT	**50%**	**50%**	**39%**	**60%**	**52%**
UI	SWCT	2,722	1,054	223	2,179	6,178
	Not SWCT	16	6	1	84	107
	Total UI	**2,738**	**1,060**	**224**	**2,263**	6,285
	% SWCT	**99%**	**99%**	**100%**	**96%**	**98%**
OVERALL	SWCT	5,107	1,972	533	3,724	11,336
	Not SWCT	2,360	923	495	1,123	4,901
	Total Overall	**7,467**	**2,895**	**1,028**	**4,847**	16,237
	% SWCT	**68%**	**68%**	**52%**	**77%**	**70%**

The surrender of RAC followed somewhat different patterns than RF and FZ. Only 52% of the RAC picked up came from households in SWCT, but 77% of the units turned in came from that targeted region of the state. Likewise, CL&P customers retired 78% of the RAC picked up at customers' homes but only 53% of the RAC surrendered at turn-in events. We believe that the different patterns for RAC reflect the location of turn-in events. In particular, all turn-in events were held in SWCT, and customers of either sponsor could turn in units at any of the events. Given that all of UI customers are located in SWCT and that UI held eleven events within its service territory in 2004, it is likely that very few UI customers had to drive long distances to participate in turn-in events. In contrast, some customers of CL&P living outside of SWCT would have had to drive long distances to turn in RAC, likely explaining the smaller percentage of CL&P units surrendered in that manner.

[2] Please note that all of UI's service territory is in SWCT. We suspect that the few customers with addresses listed outside of the region use unofficial township names not included on the official list of critical and constrained towns.
[3] Note that this percentage, 37%, is consistent with UI's portion of the 2004 overall budget. See Section 2.5 below on cost-effectiveness.

The tracking databases indicate that the actual numbers of RF and FZ retired were 77% greater than the goals set by the sponsors (as reported in the *Request for Proposals* [RFP] to evaluate the ARP). Retirements of RAC were 411% above the stated goal. (Table 2.2) Retirements by customers of UI exceeded stated goals by larger margins than retirements by CL&P customers. While UI customers retired twice as many RF and FZ as expected and 453% more RAC than expected, CL&P customers exceeded the stated goals by 62% for RF and FZ and RAC by 384%. The degree to which each sponsor exceeded stated goals will be revisited in our discussion of achieved energy savings.

Table 2.2: ARP Product Retirement Goals and Achievements

	Overall			CL&P			UI		
	Goal	Actual	% above Goal[b]	Goal	Actual	% above Goal[b]	Goal	Actual	% above Goal[b]
RF[a]	4,228	7,467	77%	2,916	4,729	62%	1,312	2,738	109%
FZ[a]	1,639	2,895	77%	1,131	1,835	62%	508	1,060	109%
RAC	1,150	5,875	411%	700	3,388	384%	450	2,487	453%

[a] In the RFP Table 2.2.2, Sponsors listed their goals for RF and FZ together. NMR has used the proportions of units actually retired in 2004 to estimate separate goals for RF an FZ

[b] Actual divided by Goal minus one, multiplied by 100%.

2.2 Diversions from Secondary Market

As discussed in more detail below in Section 4 on the secondary market and Appendix B on the Secondary Appliance Market, there are numerous paths by which units enter the used appliances market. In order to estimate the number of products diverted from the secondary appliance market by the ARP, we asked participants what they would most likely have done with their appliance if they had not recycled it through the program.[4] (Table 2.3) The alternative disposition methods that potentially could have allowed units to enter the used market are shaded; the overall estimated percentage of units that would have gone to the used market is reported in the last row of the table. As the table shows, approximately 60% of all units retired may have found their way into the used market, most often by being "put out in the trash" or by having them hauled away either by a retail store or by someone hired by the customer.[5]

Table 2.3: What Would Have Done with Appliances if ARP Not Available[a]

(base = participants respondents to telephone survey retiring each product)

	RF	FZ	RAC
n	333	158	221
Put out in the trash	24%	19%	31%
Continued to use	17	12	24
Called someone to haul away	17	18	9
Given away/Donated	12	15	14
Had retail store come pick up	10	5	1
Stored unused	8	15	14
Recycled	6	4	4
Sold	1	5	2
Other	<1	0	0
Don't know	4	7	1
Overall Potentially to Used Market	**64%**	**61%**	**57%**

[a] Methods potentially contributing to the secondary market are shaded.

[4] We caution that the intention to do something is not the same as actually doing it.

[5] Units "put out in the trash" can find their way into the secondary market in two ways. First, trash companies and hauling companies hired by cities and towns may sell the units to junk yards or used appliance dealers, depending on the details of hauling contracts. Second, individuals may find the units on the curb and take them away for their own personal use or for resale.

Although participants may not have followed through on these alternative methods of disposition, non-participants actually did dispose of unwanted RF, FZ, and RAC in similar manners to those named by participants. (Table 2.4) Of the units disposed of by non-participant respondents to the telephone survey, approximately 80% could have found their way to the used market.

Table 2.4: Ways in which Non-Participants Disposed of Appliances
(base = non-participant respondents to telephone survey disposing of each product)

	RF	FZ	RAC
n	73	15[a]	52
Store took away when purchased new one	30%	2	13%
Called someone to haul it away	21	4	13
Gave it away/Donated it	16	4	30
Put out in trash	12	2	25
Recycled it	8	3	11
Sold it	4	0	<1
Took to dump	3	0	4
Other	1	0	0
Don't know	5	0	5
Overall Potentially to Used Market	85%	78%[b]	84%

[a] Number of responses due to small sample size.
[b] Here the weighted percentage is reported for the sake of comparison.

In order to estimate the number and percentage of units that the ARP diverted from the used market, we weighted the data from the participant survey back to the population of products retired through the program; data from the non-participant survey were weighted back to the populations of non-participating residential customers of each sponsor. This extrapolation from the survey data to the populations is summarized in Table 2.5 through Table 2.7.[6] The results suggest that the program diverted 4,670 RF, 1,791 FZ, and 3,292 RAC from the used market in 2004. Since May of 2004, non-participants contributed 145,312 RF, 26,862 FZ, and 137,209 RAC to the secondary appliance market. Adjusting this estimate to only the months the ARP operated in 2004 (i.e., June through December), we estimate that non-participants disposed of 67,812 RF, 12,536 FZ, and 64,031 RAC.[7]

If we assume that together the ARP retirements and non-participants disposals from June through December of 2004 comprise the total number of appliances removed from customers' homes that would have entered the used market, the results indicate that the program diverted only 6% of RF and 5% of RAC were diverted from the used market in the second half of 2004. A larger percentage (13%) of FZ was diverted from the used market. It is worth noting that the RLW investigation of the used market found the fewest number of FZ in secondary appliance stores.

[6] The "matched" and "unmatched" samples in these tables refer to the selection of half of the non-participant sample based on their similar energy usage to participants; that is, they were matched to non-participants on energy usage. The other half of the sample was not matched to participants.
[7] We did not limit our questions about non-participants appliance disposition to 2004 because our primary purpose was to learn about alternative methods of disposing of units. Furthermore, it is unlikely that appliances are disposed off consistently over the year. Instead, rates of disposal likely follow patterns of purchase, which are higher for RF and FZ at the very beginning and end of the calendar year and in the summer for ; RAC.

Table 2.5: Contributions to and Diversions from the Secondary RF Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	4,670	3,025	1,472	1,554	1,644	1,633	11
		Matched			Unmatched		
Non-participant contributions to[b]	145,312	3,065	1,651	1,413	142,247	54,349	87,898
Non-participants, 2004 only[c]	67,812	1,430	770	659	66,382	25,363	41,019
Total Potentially into Used Market, 2004	72,482						
% Program Diverted	6%						

[a] Weighted to the population of products retired
[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample. Units retired since May of 2004.
[c] Estimate of all non-participant contributions since May of 2004, divided by 15 (number of months from June 2004 through August of 2005). We then multiplied the monthly estimate by seven to develop an estimate of the total number of units disposed of from June 1 through December 31, 2004.

Table 2.6: Contributions to and Diversions from the Secondary FZ Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	1,791	1,125	450	676	665	662	3
		Matched			Unmatched		
Non-participant contributions to[b]	26,862	492	351	141	26,369	0[c]	26,389
Non-participants, 2004 only[d]	12,536	230	164	66	12,306	0	12,315
Total Potentially into Used Market, 2004	14,327						
% Program Diverted	13%						

[a] Weighted to the population of products retired
[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample. Units retired since May of 2004.
[c] Only 15 non-participants had disposed of a FZ; none of them were in the unmatched SWCT sub-sample. Therefore, we cannot provide a population projection of FZ diverted from this group, but it is likely that the true number is greater than zero.
[d] Estimate of all non-participant contributions since May of 2004, divided by 15 (number of months from June 2004 through August of 2005). We then multiplied the monthly estimate by seven to develop an estimate of the total number of units disposed of from June 1 through December 31, 2004.

Table 2.7: Contributions to and Diversions from the RAC Secondary Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	3,292	1,773	1,012	760	1,520	1,492	28
		Matched			Unmatched		
Non-participant contributions to[b]	137,209	1,490	642	848	135,719	65,401	70,319
Non-participants, 2004 only[c]	64,031	695	300	396	63,336	30,520	32,816
Total Potentially into Used Market, 2004	67,146						
% Program Diverted	5%						

[a] Weighted to the population of products retired
[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample. Units retired since May of 2004.
[c] Estimate of all non-participant contributions since May of 2004, divided by 15 (number of months from June 2004 through August of 2005). We then multiplied the monthly estimate by seven to develop an estimate of the total number of units disposed of from June 1 through December 31, 2004.

In light of RLW's investigation of the secondary appliance market, we do not believe that all of these units retired by participants or disposed of by non-participants would have actually ended up in used appliance stores in Connecticut. RLW found that only 2,225 RF were available in the 50 stores they surveyed in July and August of 2005. We can only account for all the RF entering the used market if, for example, we assume that all 89 used appliance stores RLW identified carried 5,000 RF per month and sold all of the units each month, which is unlikely. Such generous assumptions would yield an estimate of 60,000 used RF being purchased each year by Connecticut residents. Realistically, we do not believe that used appliance stores have in stock or sell 5,000 RF each month. Therefore, we conclude that at least some appliances disposed of by Connecticut residents are finding their way out of Connecticut, are stored in warehouses, or are being destroyed.

2.3 Replacement with ENERGY STAR-qualified RAC

In 2004 the sponsors offered turn-in participants an additional $25 incentive to purchase an ENERGY STAR-qualified RAC. This incentive likely contributed to the 75% replacement rate of RAC. (Table 2.8) More specifically, 63% of the units retired were replaced with ENERGY STAR-qualified models, while 13% were replaced with non-qualified models (including central air conditioning). The percentage of ENERGY STAR-qualified models seems high, but may be reasonable given the sizable purchase incentive and the lower price of RAC compared to RF and FZ. If we accept the responses reported by participants, the survey estimates that 3,700 of the 5,875 RAC retired through the program were replaced with ENERGY STAR-qualified models; this should be considered a high-end estimate.

Table 2.8: Replacement of Room Air Conditioners Retired through the ARP

	Replaced			Replaced with ENERGY STAR			Used Purchase Incentive[c]		
	Overall	Pick-up	Turn-in	Overall	Pick-up	Turn-in	Overall	Pick-up	Turn-in
n	221	62	159	221	62	159	221	62	159
Yes	75%	62%	78%	63%	55	65	36%	14%	40%
No[a]	25	38	22	37[b]	45	35	64	86	60

[a] Also includes don't know responses and those who replaced with central air conditioning.
[b] Includes the 13% of respondents who replaced with non-ENERGY STAR models or with central air conditioning.
[c] Because incentives were offered only at turn-in events, pick-up participants reporting the use of the purchase incentive are likely confusing the retirement and turn-in incentives.

In Section 3.6, we discuss the relationship between the ARP and the purchase incentive as well as the influence of the purchase incentive on ARP participation.

2.4 Energy Savings

Appendix C: Billing Analysis Results and Appendix F: Energy Savings Estimates addressed the methods by which we developed estimates of energy savings resulting from the ARP. The results of each method were compared to the current savings assumptions used by the sponsors. In this section, we summarize the estimated savings for the program overall and for each sponsor. We also estimate peak demand savings and compare achieved savings to the goals listed in the RFP.

2.4.1 Factors Limiting the Realized Energy Savings

The results presented in Table 2.2 above demonstrate that the number of products retired through the ARP exceed the goals set by the sponsors. While this fact clearly increases the energy saved as a result of the ARP, a number of factors worked to reduce realization rates, thereby limiting achieved energy savings. (Table 2.9)

Free Ridership. Free ridership is the first of these factors. As discussed in Appendix E: Survey Results (Appendix Section 7.1), NMR and the sponsors agreed to a definition of free ridership focused on the retirement of units that would neither yield energy savings nor divert units from the secondary market. In particular, this definition included the surrender of products that:

- Were not in working order
- Would have been stored unused
- Would have been recycled anyway
- Had not been used the year prior/were unlikely to be used, but whose owners later indicated the units would have continued to be used if the ARP had not been available

The last criterion was included largely because the customer's previous behavior suggested the unit would really had been stored unused instead of being used by the respondent.[8] This definition yielded free ridership rates of 16% for RF and 21% for FZ and RAC.

Table 2.9: Undesirable Surrenders or Post-Surrender Behavior[a]

	RF	FZ	RAC
n	333	158	221
Free Ridership	16%	21%	21%
Replacement	46%	34%	40%[b]
Unit not in use[c]	7%	16%	30%
Unit in periodic use[d]	27%	21%	40%

[a] Note that these groups are not mutually exclusive. Some respondents fall into more than one category.
[b] Limited to replacements that did not use the incentive to purchase ENERGY STAR-qualified RAC.
[c] For RF and FZ, respondent indicated the unit was never plugged in the year prior to surrender. For RAC respondent indicated s/he was extremely unlikely to use unit in Summer of 2004
[d] For RF and FZ, respondent indicated the unit was plugged in "most of the time" or "occasionally" the year prior to surrender. For RAC respondent indicated the likelihood to use RAC with a one through nine on a zero to ten scale.

Product Replacement. In addition to free ridership, product replacement can also limit achieved energy savings. Certainly, most replacement units obtained new—and most were obtained new—will be more efficient than those retired through the program, resulting in at least some savings. However, because the ARP seeks to reduce the number of FZ and secondary RF in customers' homes, any replacement will lower the realized energy savings. As we can see in Table 2.9, 46% of RF and 34% of the FZ retired were replaced. In contrast, the sponsors expected that RAC would be replaced, even though such replacements would reduce achieved energy savings. They hoped to increase the savings by offering turn-in participants a $25 purchase incentive for an ENERGY STAR-qualified RAC. In fact, only 40% of the RAC retired

[8] Note that our estimated realization rates exclude savings not only from free riders but also all respondents who report not using the appliance the year prior to surrender or who were extremely unlikely to use RAC during the summer of 2004. See the Energy Savings Memo.

at turn-in events (which account for 34% of those retired via both modes) were replaced using the purchase incentive.[9] Another 40% of units retired through both modes were replaced without using the incentive, although participants report that two-thirds of those models also qualified for the ENERGY STAR label.[10]

Infrequent Use of Retired Units. Finally, RF and FZ that were not in use prior to surrender or RAC that would not have been used the summer of 2004 would not yield any program-induced energy savings. Those only in periodic use would also not yield expected levels of energy savings. As shown in Table 2.9, an estimated 7% of RF, 16% of FZ, and 30% of RAC were not in use prior to surrender; another 27% of RF, 21% of FZ, and 40% of RAC were not in regular use prior to surrender.

All of these factors, then, served to reduce the energy savings actually achieved by the program. These downward pressures on energy savings are implicitly included in the estimates developed by the billing analysis, primarily because of the comparisons of actual energy usage of participants and non-participants. Furthermore, the billing analysis also accounts for energy savings resulting from the replacement of products with more efficient models. However, the billing analysis would still give energy savings credit to some free riders—for example those who would have stored the unit unused (but used it the year prior to surrender) or who would have recycled the unit anyway.

The survey-based approach, in contrast, took these situations into account explicitly in its development of realization rates. Although a full description of this method is included in the Appendix F: Energy Savings Estimates, here we believe it important to repeat that the survey-based realization rates do not include any energy savings resulting from the replacement of RF or FZ, or replacement of RAC without use of the ENERGY STAR purchase incentive. We reason that any replacements of RF and FZ and replacement of RAC with non-ENERGY STAR models are undesirable, and, therefore, the program should not take credit for any savings related to replacement. In addition, because we believe that respondents overstated the frequency of RF and FZ replacements with ENERGY STAR models and because we have no way of knowing the size and features of replacement models, we also could not estimate the achieved savings from replacement with more efficient units. Finally, while it may be desirable for participants to replace RAC with an ENERGY STAR model and *not* use the rebate to do so, we do not believe that the program can take direct credit for such purchases. Therefore, we also did not assume savings from this type of replacement.

[9] Nine pick-up participants reported using a purchase incentive to buy their new RAC. Because incentives were only distributed at turn-in events, these participants are most likely mistaken and may have confused the retirement and turn-in incentives.

[10] We address the issue of ENERGY STAR-qualified RAC replacements and use of the purchase incentive in Section 3.6 of this report.

Not surprisingly, the assumptions of the survey-based approach resulted in rather low realization rates. (Table 2.10) Because we recognize that these realization rates are conservative estimates, in the next section on estimated energy savings, we present recommended energy savings assumptions that take into account the strengths and weaknesses of the regression analysis and the survey-based approach.

Table 2.10: Realization Rates, as Determined by Participant Telephone Survey

			Room Air Conditioner	
	Refrigerator	Freezer	No replacement	ENERGY STAR Replacement using Rebate
Realization Rate	24.4%	36.7%	20.7%	26.0%

2.4.2 Estimated Energy Savings

Using three different techniques—the augmented comparison approach, weighted least squares regression, and a survey-based approach—NMR and RLW developed estimates of the average per-unit energy savings resulting from the ARP. The first two approaches used statistical models and billing data from both participants and non-participants to estimate energy savings resulting from the ARP. The third approach used gross savings derived from other evaluations of appliance retirement programs and computed net savings by adjusting gross savings based on customer responses to the participant survey (see discussion of factors limiting energy savings in Section 2.4.1 above). In addition to estimates of energy savings, the augmented comparison also produced estimates of the average savings from households retiring both a RF and a FZ. All these estimates of energy savings are presented in Table 2.11.

Each of the methods yielded an estimated net savings from the retirement of RF far below the current deemed savings used by the sponsors. In contrast, the augmented comparison and regression approaches point to slightly higher than assumed FZ savings, while the survey-based approach points to slighter lower savings for FZ. In addition, the augmented comparison approach suggests that savings from retiring both a FZ and RAC are not cumulative; only an additional 40 kWh of savings results from recycling both a RF and a FZ. This likely suggests that one of the products was not in use before retirement or that customers have replaced at least one of the two products. Finally, the survey-based approach also finds lower than assumed savings for both replaced and not replaced RAC.

Table 2.11: Current Energy Savings Assumptions and Evaluation-Based Estimates of Energy Savings, in kWh

(per-unit estimates, except for the retirement of both RF and FZ, which are per account)

	Current Assumption	Augmented Comparison	Regression	Survey
Refrigerator	739	426	438	337
Freezer	450	506	475	433
Refrigerator & Freezer	na	549	na	na
Room air conditioner, no replacement	64[a]	na	na	40
RAC, ENERGY STAR replacement	39	na	na	14

[a] This assumption was listed incorrectly in the RFP as 54 kWh; the savings assumptions and calculations provided by CL&P to NMR resulted in net savings assumption of 64 kWh.

We then developed estimates of energy savings based on the results of the regression and survey-based approaches and compared them to the energy savings predicted by the current deemed savings.[11] (Table 2.12) The survey-based approach yields an estimate of annual energy savings resulting from the retirement of units in 2004 that is 55% of the sponsors' current deemed savings; the regression approach yields estimates that are 68% of deemed savings.

Table 2.12: Comparison of Estimated Annual Energy Savings, in MWh

	NMR-Survey Based	Regression	Deemed Savings
Refrigerators	2,520	3,271	5,518
Freezers	1,255	1,375	1,303
Room AC no replacement	54	na	139
Room AC replacement	62	na	145
Overall Savings	3,891	4,646	7,105
% of Deemed Savings	55%	68%[a]	100%

[a] Based on RF and FZ savings only

Both the survey-based approach and the regression approach have relative strengths and weaknesses. The strengths of the survey-based approach include taking free ridership and product replacement into account, but its major weakness is that the estimates are not based on actual metered energy use. In contrast, the strength of the regression approach is its reliance on actual energy use, but it does not adjust for free ridership or other behavioral factors that limit savings attributable to the program. Based on these relative strengths and weaknesses and on assumptions regarding gross energy savings and realization rates, NMR and RLW recommend that the sponsors adopt the following assumptions of energy savings. (Table 2.13)

Table 2.13: Recommended Savings Assumptions

Row	Component	RF	FZ	RAC No replacement	RAC Replacement
A	Gross Savings kWh per unit	1,383	1,181	191	53
B	Realization Rate	29.9%	38.1%	20.7%	26.0%
C	Net Savings kWh per unit *(Row A ×Row B)*	413	450	40	14

[11] See Appendix F: Energy Savings Estimates for a detailed description of these estimates. We used the regression approach instead of the augmented-comparison approach because the former takes more information into account. As noted in Appendix C: Billing Analysis Results, the estimates from the regression approach fall within the confidence intervals for the augmented-comparison approach.

Based on the number of products retired in 2004, the recommended assumptions would yield estimates of annual and lifetime energy savings for the program overall and for each sponsor as described in Table 2.14. The annual savings are equal to net savings multiplied by the number of products retired; lifetime savings are equal to annual savings multiplied by the estimated measure life of each product, based on the sponsors' current assumptions.

Table 2.14: Number of Products Retired and Estimated Savings, in MWh

		RF	FZ	RAC		Total Savings
				No replacement	Replacement	
	Net Savings, kWh	413	450	40	14	na
CL&P	N Products	4,729	1,835	541	2,847	9,952
	Annual Savings	1,953	826	22	40	2,840
	Lifetime Savings[a]	9,765	4,129	65	518	14,477
UI	N Products	2,738	1,060	827	1,660	6,285
	Annual Savings	1,131	4,77	33	23	1,664
	Lifetime Savings[a]	5,654	2,385	99	302	8,440
Overall	N Products	7,467	2,895	1,368	4,507	16,237
	Annual Savings	3,084	1,303	54	62	4,504
	Lifetime Savings[a]	15,419	6,514	164	820	22,918

[a] Lifetime based on sponsors' current assumptions measure life: five years for RF, five years for FZ, three years for non-replaced RAC, and 13 years for RAC replaced with ENERGY STAR-qualified model.

Table 2.15 below compares the estimates of energy savings based on the recommended savings assumptions (Table 2.14) with the savings goals listed in or calculated from Table 2.2.3 of the RFP to evaluate the ARP. It also includes estimates of peak demand savings. Overall, the program achieved its annual energy and peak demand savings goals, but failed to achieve its lifetime savings goal. Looking at each sponsor, we find that UI achieved all of its savings goals, but CL&P achieved none of them. The differences in achieved savings largely reflect two circumstances. First, as shown in Table 2.2 above, the number of products retired by customers of both sponsors exceeded the 2004 program goals, but UI customers retired even more products than expected, thus boosting its overall savings. Second, and in contrast, the recommended net savings for each appliance result in smaller achieved savings estimates than do current assumptions. For UI, the relative increase due to the greater number of retirements outweighed the reductions in estimated energy savings; this was not the case for CL&P, resulting in lower than desired savings for this sponsor.

Table 2.15: ARP Energy Savings Goals and Achievements

	Overall			CL&P			UI		
	Goal	Actual	Difference[b]	Goal	Actual	Difference[b]	Goal	Actual	Difference[b]
Annual (MWh)	4,332	4,504	173	3,180	2,840	-340	1,151	1,664	513
Lifetime (MWh)	23,958	22,918	-1,041	17,806	14,477	-3,329	6,152	8,440	2,288
Demand (kW)[a]	736	807	71	545	488	-57	191	319	128

[a] Estimated by multiplying the savings for each appliance for each sponsor by the summer peak demand factors used by the sponsors, and then dividing by 1,000. The peak factor for RAC is 1.7572 and for RF and FZ is 0.1368. We then summed the individual demand savings reduction across the three appliances to develop the final estimate for each utility. The overall demand savings is the sum of the savings for the two sponsors.
[b] Difference is computed by subtracting the actual savings by the savings goals.

2.5 Cost effectiveness

Using the recommended savings assumptions described above as well as actual 2004 program budgets provided by the sponsors to NMR, we computed the overall and sponsor-specific cost effectiveness of the ARP. (Table 2.16) The annual cost rate, a measure of cost effectiveness, was just over $0.50 overall and for each sponsor; the lifetime cost rate overall and for each sponsor was approximately $0.10. These rates are more than twice as high as the program goals. For each sponsor, the low degree of cost effectiveness is largely a reflection of the increases in budget. This conclusion is verified by the fact that the cost effectiveness measures for both sponsors are nearly identical despite the fact that only UI achieved its annual and lifetime energy savings goals.

Table 2.16: ARP Cost Effectiveness Goals and Achievements

	Overall		CL&P		UI	
	Goal	Actual	Goal	Actual	Goal	Actual
2004 Budget[a]	$1,065,136	$2,314,326	$699,695	$1,446,900	$365,441	$867,426
Annual Cost Rate ($/kWh)	0.246	0.514	0.220	0.509	0.317	0.521
Lifetime Cost Rate ($/kWh)	0.044	0.101	.039	0.100	0.059	0.103

[a] NMR estimated the 2004 "goal" or projected budget based on the product of the annual or lifetime savings and cost rate goals listed in Table 2.2.3 of the Request for Proposals. Due to rounding error, the estimates of budget based on annual and lifetime savings differed slightly. We used the higher of the two estimated budgets; the estimated budget for CL&P was based on annual data and that for UI on the lifetime data.

2.6 Non-Electric Benefits

ARCA currently tracks certain non-electric benefits (NEBs), and the sponsors can access this information via an on-line reporting system available to ARCA clients. However, the ARCA database does not currently track reductions in carbon dioxide or sulfur oxides emissions, which are necessary to measure overall reductions in green-house gas emissions. ARCA's on-line reporting system also does not currently track NEBs for products retired through turn-in events. Finally, we also wanted to determine what participants perceived as the non-electric benefits of ARP participation.

In order to assess non-electric benefits, the NMR team used three different methods. First, we asked participant respondents to the telephone survey to identify any additional benefits of participation. On balance, we also asked them to name any potential drawbacks. These NEBs and drawbacks of participation are summarized in Table 2.17. Other environmental benefits served as the most frequently named NEBs of ARP participation. While about one-fourth of respondents said they did not know of any other benefits, another one-fourth of respondents indicated that participation gave them more space or reduced clutter. Finally, 14% reported that participation saved them money. In contrast, the vast majority of participants identified no drawbacks to participation in the ARP; the drawbacks that were named focused largely on the loss of storage space or the disposal of usable appliances.

Table 2.17: Non-Electric Benefits and Drawbacks of ARP Participation
(base = all participant respondents to the telephone survey, multiple response)

Non-Electric Benefits		Drawbacks	
n	600	n	600
Helps the environment/stops global warming/ozone layer	44%	Loss of food storage space	1%
Gives me more space	8	Loss of other storage space	1
Gets rid of junk/clutter	18	Usable appliances are thrown away	1
Saves me money	14	House no longer cool	<1
No other benefits/don't know	23	No drawbacks	85
Other[a]	5	Don't know	5
		Other[b]	5

[a] "Other" benefits focused on the proper disposal of the appliance or the benefits of recycling materials. Some participants, however, did mention that participation now allowed them get a new unit.
[b] "Other" drawbacks largely focused on complaints with the ARP, such as it being "intrusive" or "inconvenient." Others named the cost of product replacement. Most of the remaining responses indicated that the respondent misunderstood the question, such as naming concern about coolant disposal or the impact on electricity bills.

The second method involved estimating the reduction in carbon dioxide and sulfur oxides emissions attributable to the program. The sponsors provided NMR with their current assumptions of the amount of carbon dioxide and various sulfur oxides emissions reduced per kWh. We explored the possibility of using alternative assumptions, but those we found (e.g., by ENERGY STAR/EPA or ACEEE) were based on a national average. These national averages include the high carbon dioxide and sulfur oxides emissions from coal-fired electricity plants in the Midwest and Mountain West. The Northeastern states, in contrast, are more likely to rely on natural gas or nuclear power to generate electricity; both of these fuels have far fewer carbon dioxide and sulfur oxides emissions. Therefore, the NMR team recommends that the sponsors continue to use their current assumptions for carbon and sulfur oxides emissions. Based on the recommended lifetime savings, we estimate a reduction of 3,993 tons of carbon dioxide emissions and 14 tons of sulfur oxides emissions over the assumed measure life of products retired through the ARP in 2004. (Table 2.18)

Table 2.18: Averted Carbon Dioxide and Sulfur Oxides Emissions, in Tons

Row	Component	CO^2	SO^x
A	Lifetime energy savings (kWh)	22,917,539	22,917,539
B	Electricity emission factor (lbs per kWh)	0.3485	0.001225
C	Averted Emissions (lbs)(Row A × Row B)	7,986,762	28,074
D	Pounds per Ton	2,000	2,000
E	Averted Emissions (Tons)(Row C ÷ Row D)	3,993	14

The third method is based on ARCA's assumptions of NEBs. These assumptions underlie the estimates of NEBs that they have provided the sponsors via the ATO on-line reporting system, but the on-line system does not include all units retired at turn-in events. ARCA has provided their NEBs assumptions to NMR, and we applied them to all products retired through either the pick-up or turn-in program delivery modes. (Table 2.19 and Table 2.20) Based on these assumptions, the ARP recovered 1,342 tons of scrap metal, nearly 4,000 pounds of refrigerants, just over 3,000 gallons of oil, nearly 8,000 pounds of capacitors, nine ounces of mercury, and 145 pounds of batteries. NMR recommends that the sponsors continue to use ARCA's estimates of NEBs, but the sponsors must remember to include in their estimates any products retired through turn-in events in 2005 before the discontinuation of these events.

Table 2.19: Per-Product Assumptions of Amount of Material Recovered during the Demanufacturing Process, ARCA

	Refrigerator	Freezer	Room Air Conditioner
Scrap Metal - tons	0.100	0.100	0.052
Refrigerants - lbs	0.369	0.375	0.015
Oil – gals	0.073	0.074	0.395
Capacitors - lbs	0.063	0.063	1.250
Mercury – oz	0.000	0.003	0.000
Batteries – lbs	0.000	0.800	0.000

Table 2.20: Amount of Material Recovered by the ARP, 2004 Program Year

	Refrigerator	Freezer	Room Air Conditioner	Program Total
N Retired through ARP	7,467	2,895	5,857	**16,219**
Scrap Metal - tons	747	290	306	**1,342**
Refrigerants - lbs	2758	1086	88	**3,932**
Oil – gals	545	215	2322	**3,082**
Capacitors - lbs	467	181	7344	**7,991**
Mercury – oz	0	9	0	**9**
Batteries – lbs	0	145	0	**145**

3 Program Processes

Overall, the ARP is run well and requires relatively few staff resources. This assessment is particularly true of the pick-up mode of program delivery; furthermore, while the turn-in events suffered from unpredictable levels of participation, they too appear to have been well-run. In this section, we discuss the program processes, focusing primarily on program logic, marketing, reasons for participation, and quality control. We also summarize the strengths and weaknesses of the program and the connections between the ARP and the purchase incentive offered at turn-in events through the ENERGY STAR Appliances Program. Most of these issues are discussed in more detail in the Appendix D: Process Analysis while some are also addressed in Appendix E: Survey Results.

3.1 Program Logic

As mentioned earlier, the primary goals of the ARP are to remove older secondary RF and/or FZ from customers' homes and divert units from the secondary market; additionally, the program encourages customers to replace older RAC by providing point-of-purchase incentives for new ENERGY STAR-qualified RAC. Ultimately, these two goals will also increase demand savings as well as help customers save electricity and money. Staff members argue that three primary barriers—inconvenience, disposal costs, and ignorance of the operating costs—keep most appliance owners from recycling their older, secondary, and/or unwanted units. The results of the telephone surveys confirm that inconvenience and ignorance of operating costs are likely barriers to product recycling. However, very few non-participants actually paid to dispose of their unwanted appliances, mainly because they had retailers take the units away when delivering new ones, or because they simply put the unit into the trash. Those who were charged generally paid an average $15 to dispose of FZ and RAC and $25 to dispose of RF.

The perceived or actual existence of these barriers underlies the logic of the ARP, summarized in the Logic Model. (Table 3.1) The logic model outlines program activities and outputs as well as the anticipated short-term, mid-term, and long-term outcomes of the programs:

- Program Activities, including the five major components of the program
- Program Outputs, including measurable outputs of the five program activities
- Short-term Outcomes, which may be evident within the first one to three years of program operation
- Mid-term Outcomes, which may be evident within the first three to five years of program operation

- Long-term Outcomes, which may be evident after five years of program operation

Table 3.1: Logic Model

Program Activities	Program Outputs	Short-term outcomes (1-3 years)	Mid-Term Outcomes (3-5 years)	Long-term Outcomes (5+ years)
Marketing	Bill inserts Radio ads TV ads Print ads Press releases Banners on trucks	Increased customer awareness of program Customers participate in program Customers recognize high operating costs of older secondary units		
Turn-in events	Turn-in events held Stores participating RAC units turned in	Retailers demand improved disposal practices Customers purchase ENERGY STAR RAC Consumers value new models over used models	Improved disposal practices by contractors Increased penetration of ENERGY STAR RAC	
Pick-ups	Calls to ARCA RF units picked up FZ units picked up RAC units picked up DH units picked up	Customers do not replace secondary units		
Demanufacturing	RF units demanufactured FZ units demanufactured RAC units demanufactured DH units demanufactured	Proper disposal of units Secondary units removed from market leads to supply constraints Energy savings Demand savings	Improved disposal practices by contractors Reduced secondary market for appliances Energy savings persist Demand savings persist	 Energy savings persist Demand savings persist
Incentives	RF/FZ incentives issued RAC/DH incentives issued	Customers recommend program to relatives, friends, neighbors		

3.2 Marketing the ARP

Program marketing is necessary to make customers aware of the existence of the program. The pick-up mode of delivery was originally marketed primarily through bill inserts, while newspaper advertisements were used to market turn-in events. Additional marketing efforts included radio and television advertisements, press releases, flyers at stores holding turn-in events, and banners on trucks. Some participants found out about turn-in events by noticing the tents set up at retail stores.

Customer responses to surveys taken at the time of participation confirm the importance of bill inserts for alerting customers about the pick-up mode of delivery. Three-fourths of respondents to surveys taken at the time of appliance pick-up indicate that they heard about the program through a bill insert. (Table 3.2) The percentages are higher in SWCT and among UI customers. This is to be expected, given the emphasis of the program on SWCT; furthermore, all of UI's territory is in SWCT.

Table 3.2: How Pick-up Participants Heard About Program, Pick-up Survey
(Base = customers surveyed at time of pick-up)

	Total	SWCT	Other
n	9,446	6,179	3,267
Bill Insert	75%	80%	65%
Utility Representative	9	6	14
Friend/neighbor	8	7	9
Appliance Dealer	3	3	3
Television	2	1	5
Newspaper	1	2	<1
All Other	3	2	3

In contrast, no customers participating at the Norwalk or Waterbury Turn-in Events said they heard about the program through bill inserts. (Table 3.3) Instead, they typically heard about the program through newspaper advertisements. One-fifth of the participants at the Norwalk event had heard about the program through an in-store flyer.

Table 3.3: How Turn-in Participants Heard About Program, Turn-in Survey
(Base = customers surveyed at Norwalk and Waterbury Turn-in Events)

	Total	Norwalk	Waterbury
n	655	304	351
Newspaper	67%	55%	78%
Store flyer	10	20	1
Radio	8	9	7
Word of mouth	7	8	7
Drive by/noticed tent	5	7	4
Television	2	0	3
All other	1	2	1

The telephone surveys provide additional confirmation of the importance of bill inserts to pick-up participation and newspaper advertising to turn-in participation. (Table 3.4) About one in ten respondents heard about the program via word of mouth. In addition, 28% of non-participants were aware of the program, having learned about it primarily through bill inserts but also via word of mouth and newspapers, among other ways.

Table 3.4: How Participants Heard About Program, Telephone Survey
(base = participant respondents, multiple response)[a]

	Total	Pick-up	Turn-in[b]
n	600	441	159
Bill Insert	44%	54%	14%*
Newspaper	28	17	60*
Word of Mouth	11	12	7*
Television	3	4	1*
Store Flyer	2	2	2
Appliance Dealer	1	1	2
Radio	1	1	1
Salesperson	1	1	2
Internet	1	1	0*
Saw Tent	1	<1	2
Utility Web Site	<1	<1	1
Utility Representative	<1	<1	1
Advertisement on Truck	<1	<1	1
Don't Know	10	9	10

* Significantly different from pick-up participants with 90% confidence
[a] Total percentages may exceed 100% due to multiple responses.
[b] The seven respondents who participated in both modes have been collapsed with turn-in participants.

Requests for product pick-ups were at first closely tied to the mailing of bill inserts. However, program staff argues that bill inserts became less effective over time and had to be coupled with other forms of marketing. In fact, while the original mailing of bill inserts by UI in June of 2004 almost immediately brought about numerous calls for participation, in the fall of that year it took both a bill insert and newspaper advertising to boost calls to similar levels achieved at the start of the program.

3.3 Reasons for Participation

The surveys taken at the time of pick-up and the telephone surveys asked participants why they decided to take part in the ARP. Based on answers given to the surveys taken at the time of pick-up, over half of the participants took part in the ARP because it provided a free way to get rid of their appliances. (Table 3.5) This fact largely confirms the staff's impression that customers are using the program to dispose of their unwanted appliances. Other reasons for participation named in the pick-up surveys included savings on electric bills, energy conservation, the customer incentive, and the recycling of the appliance.

Table 3.5: Reasons for Participation, Pick-up Survey
(base = customers surveyed at the time of pick-up, multiple response)[a]

	Total	CL&P	UI
n accounts	9,619	6,066	3,553
Free Pick-up	54%	53%	55%
Savings on Electric Bill	35	34	36
Energy Conservation	31	31	31
Customer Incentive	31	31	30
Recycling of Appliance	22	20	25
No response	7	8	5

[a] Column percentages exceed 100% due to multiple responses

Respondents to the participant survey again validate the staff's expectation that participants retire units they no longer want. (Table 3.6) We have shaded those responses in the table. Overall, 56% of the RF, 58% of the FZ, and 40% of the RAC retired through the program were already considered "unwanted units." Those retiring a RAC were more likely to state that the incentive was behind their purchase, likely because of the additional purchase incentive.

Table 3.6: Why Decided to Participate, Telephone Survey
(Base = all respondents who surrendered each appliance, multiple response)

	Refrigerator	Freezer	Room AC
n	333	158	221
Didn't need it any more	22%*	35%*†	9%
Incentive to surrender	20*	14*	28
Old unit not working well	16	14	19
Bought a new unit	13	7†	11
Bought an energy efficient unit	8*	7*	19
Saves me money	7	7	7
Easy to turn in	6	7	8
Better for environment	4	6	6
Cost too much to have picked up	4*	2	1
No other way to get rid	3	6	3
Bought model that saves money	3	3	4
Moving soon	<1	4*†	0
Other	2	1	1
Don't know	3	1	2
Unwanted per participant	56%	58%	40%

* Significantly different from room air conditioners at the 90% confidence level
† Significantly different from refrigerators at the 90% confidence level

3.3.1 Importance of the Rebate and Current Rebate Structure

As shown in Table 3.5 and Table 3.6, the retirement incentive is only one of the reasons that customers choose to participate in the ARP; only for RAC does it appear to be the most important reason for participation. The results presented in Table 3.7 validate this conclusion. We asked respondents to the telephone survey to rate on a zero-to-ten scale the importance of the incentive to their decision to participate. For all appliances surrendered through the pick-up mode, respondents reported that the incentive moderately influenced (medians of 5, and means between five and six) their decision to participate. As expected, the rebate was of greater influence on the decision to take part in turn-in events, again leading us to suspect that customers were thinking of both the retirement and purchase incentives.

Table 3.7: Importance of the Incentive to Participation in ARP, Telephone Survey

(Base = Participants recalling receipt of incentive)

	RF	FZ	RAC-PU	RAC-TI
n	328	155	62	151
Not Important (0 – 3 rating)	23%	27%	33%	21%
Moderately Important (4 – 7 rating)	36	35	43	27
Very Important (8 – 10 rating)	39	36	23	51*
Mean	6.0	5.7	4.8	6.5*
Median	5.2	5.0	5.0	8.0

* Significantly different from pick-up mode at the 90% confidence level

We also determined that over half of the non-participants with eligible appliances currently in their homes would be willing to retire their appliances at current program incentive levels of $50 for RF and FZ and $25 for RAC. Those unwilling to give up RAC at $25 were further questioned about their willingness to give up the appliance with a total rebate of $35 for an ENERGY STAR-qualified model. (Table 3.8) We also examined the results by prior awareness of the ARP, with awareness being verified by both stating awareness of the program and voluntarily naming at least one of the four appliances (RF, FZ, RAC, or dehumidifiers) included in the 2004 program. There were no statistically significant differences between awareness and willingness to give up appliances at current incentive levels. Respondents not willing to give up appliances at current incentive levels most often state that they currently use the units or plan to do so in the future. They are unwilling to give the unit up unless the incentive would be equal to the price of a new appliance.

Table 3.8: Percentage of Non-Participants who would Retire Eligible Appliances at Current Incentive Levels

(base = Non-participant owning eligible units)

	Refrigerator		Freezer		Room AC $25		Room AC $35	
	n	%	n	%	n	%	n	%
Total	67	55%	82	56%	34	53%	34	61%
Aware of ARP[a]	17	60%	20	70%	9	40%	9	60%
Not Aware	50	54%	62	53%	25	58%	25	62%

[a] Definition of awareness used here necessitates correctly naming at least one of the appliances included in the ARP.

In light of these results, NMR believes that incentives are already set at optimal levels. Increasing participation in the future may instead depend on raising awareness or getting customers to follow through on their intentions to participate.

3.4 Program Eligibility and Quality Control

A number of quality control mechanisms are in place to insure adherence to the five program eligibility requirements. These requirements are that:

- The participant is a customer of CL&P or UI
- The unit is at least ten years old
- RF and FZ are at least seven cubic feet
- The unit is functional
- RF are secondary units
- The number of units allowed is not exceeded

Quality control mechanisms include:

- Verifying eligibility through customer account numbers
- Verifying age based on the experience of ARCA staff or nameplate information
- Plugging the unit in to make sure it operates
- Verifying that customers have not bought a new RF in the past year
- Allowing program staff members to accompany the truck on pick-ups and to visit the ARCA facility where demanufacturing occurs.

NMR has found that most of the eligibility requirements are being met; however, the violations to the requirements are serving to limit the energy savings and cost effectiveness achieved by the ARP. The first concern is the frequent retirement of primary RF. According to responses to the telephone survey, 28% of the RF retired through the ARP was primary units; of course, most of these units have been replaced, thereby limiting achieved energy savings. ARCA currently tries to screen out primary units by asking customers about recent purchases of RF, but it appears that another method of discouraging retirement of such units may be needed. Alternatively, as discussed in the Recommendations, the program may have to accept such undesirable retirements and focus instead of mitigating their impact on energy savings.

In addition to being concerned that eligibility criteria were not being met, staff members also feared that retailers were gaming the system by telling customers who purchase a new appliance to call the ARP for the pick up. NMR found that customers rarely found out about the ARP through retailers; therefore, we do not believe retailer gaming is a serious concern. We do, however, find evidence for another of the staff's concerns: that some units were not being used by participants prior to the surrender. As shown in Table 2.9 above, seven percent of RF and 16% of FZ were not plugged the year prior to surrender, and 30% of RAC were extremely unlikely to have been used in the summer of 2004. Additional units were used only periodically, again limiting energy savings and program cost effectiveness.

3.5 Strengths and Weaknesses of the ARP

The evaluation of the ARP has uncovered clear strengths of the program. One of these strengths—especially from a program planning and implementation perspective—is the turnkey nature of the ARP. Because the program is essentially "ready made," it requires little utility administration, and the volume can be directly managed via marketing and advertising. Furthermore, staff members argue that the ARP promotes positive relationships and good will with customers. Staff members also state that ARCA is a solid vendor who reflects well on the utilities. Retirements, additionally, have important NEBs, including the reduction of greenhouse gas emissions as well as recycling usable or safely disposing of harmful materials contained within the units. The survey responses confirm that respondents found the process of retiring the units to be easy and the location of the turn-in events to be convenient. Respondents also had few problems scheduling pick-ups, and most customers had their appliances picked up within two weeks of first contacting the program. Finally, the program staff reports that all the key players—the sponsors, ARCA, and retailers participating in turn-in events, among others—have positive working relationships and have no problems with communication.

The program, however, suffers from two primary weaknesses. First, participation at turn-in events is unpredictable and largely dependent on the weather. Events held on warm, sunny days often have high levels of participation while those held on cooler, rainier days draw few participants. The unpredictable participation not only affects the success of the program from the standpoint of the sponsors, but it also limits the benefits to retailers who allow events to be held in their parking lots. Although retailers have expressed willingness to host future events, they suggest holding them later in the cooling season. Retailers also admit that they will remain skeptical about the turn-in events unless a way can be found to insure that participation will lead to increased sales in their stores. Second, the program cannot control customer behavior before or after the program nor influence motivations for participation. As we have discussed above, many participants retire units that they already wanted to get rid of; many of these units had already been removed from service. Furthermore, customers also frequently replaced RF and FZ, even though such replacements are undesirable from the perspective of the ARP. These factors greatly limit the energy savings achieved by the program, which in turn limits its cost-effectiveness. As one staffer said, "The program acquires friends not resources."

3.6 Connections between the ARP and the ENERGY STAR-qualified RAC Rebate Program

As mentioned above, in 2004 the sponsors offered turn-in participants a $25 mail-in rebate for the purchase of an ENERGY STAR-qualified RAC. Survey results indicate that 37% of all respondents retiring RAC—including both the turn-in and pick-up modes—report using the purchase incentive. Of course, pick-up mode participants must be mistaken because they were not offered the purchase incentive; we believe that respondents were confused by the availability of both incentives, despite wording in the survey to help them understand the differences between the two. If we exclude pick-up participants, we find that 41% of the turn-in participants report using the ENERGY STAR purchase incentive to replace RAC. This is 9% higher than the preliminary estimate of 32% that the sponsors quoted in the RFP.

The turn-in participants most likely to use the purchase incentive were those who were actually replacing a unit they intended to use; 66% of those indicating with a six or higher on a one-to-ten

scale that they would have been likely to use the RAC they turned in purchased a new unit using the ENERGY STAR purchase incentive. However, such individuals comprise only 19% of all RAC retirements and 22% of all RAC turned in. All the other RAC retirements were either not replaced, were replaced without using the incentive, or were not likely to be used if the ARP had not been available.

The additional $25 purchase incentive appears to have been a key driver of participation in turn-in events. As reported in the Process Analysis, a statistically higher proportion of turn-in participants rated the *retirement* incentive as very important to their decision to participate in the ARP. Although we specifically stated that the incentive was for the retirement of the product, the greater influence of the incentive on this mode of participation—coupled with other results suggesting that turn-in participants did not cognitively separate the two incentives—strongly suggests that the purchase incentive boosted turn-in participation.

4 Secondary Market

The sponsors of the ARP requested that NMR and RLW conduct an investigation into the secondary, or used, appliance market for RF, FZ, and RAC. In particular, they wanted to understand the size of the market and its structure as well as the degree to which Connecticut residents are participating in the used appliance markets. The investigation relied largely on mystery calls (50 total) and visits (20 total) to used appliance dealers across the state and on customer responses to the participant and non-participant surveys. RLW also conducted brief and informal on-site interviews with randomly selected chain and independent new appliance dealers to further understand what happens to appliances that are removed from the homes of customers. More information on the secondary appliance market can be found in Appendix B: Secondary Appliance Market and Appendix E: Survey Results.

4.1 Size of the Secondary Appliance Market

In order to determine the number of stores selling used RF, FZ, and RAC in Connecticut, RLW first compiled a list of 242 businesses that, based on their name or standard industrial classification code, could have potentially sold used appliances. RLW then attempted to contact each of the 242 businesses to determine if they actually sold any of the three appliances. Based on this investigation, RLW estimates that there are 89 separate used appliance dealers in Connecticut selling RF, FZ, and/or RAC. These stores tend to concentrate in areas of higher population density, including SWCT.

4.2 Structure of the Secondary Appliance Market

Like new appliance stores, some used appliance dealers were noted to be particularly large while others were smaller. Specifically, two of the refrigerator dealers contacted reported that they can have up to 1,000 refrigerators available for purchase at times. The 50 used dealers contacted were far more likely to carry RF than FZ, having 2,225 used RF available for purchase at the time of the mystery calls compared to only eight FZ. (Table 4.1) We believe the lower number of RAC available (223) reflects the fact that calls were made at the end of the cooling season, so many stores had reduced their seasonal stock of RAC. However, as shown in the second row of Table 4.1, it is also the case that used appliance stores do not always have units in stock. The final row in the table presents the average price of each appliance type as reported by the used appliance dealers over the phone. Used refrigerators cost approximately $229 while freezers and room air conditioners are approximately $164 and $93, respectively.

Table 4.1: Average Number of Units and Average Price

Used Dealers (n=50)	Refrigerators	Freezers	Room A/C
# of stores selling	50	28	28
# of stores with at least one unit in stock	32	6	12
Total in stock	2,225	8	223
Avg. Price	$229	$164	$93

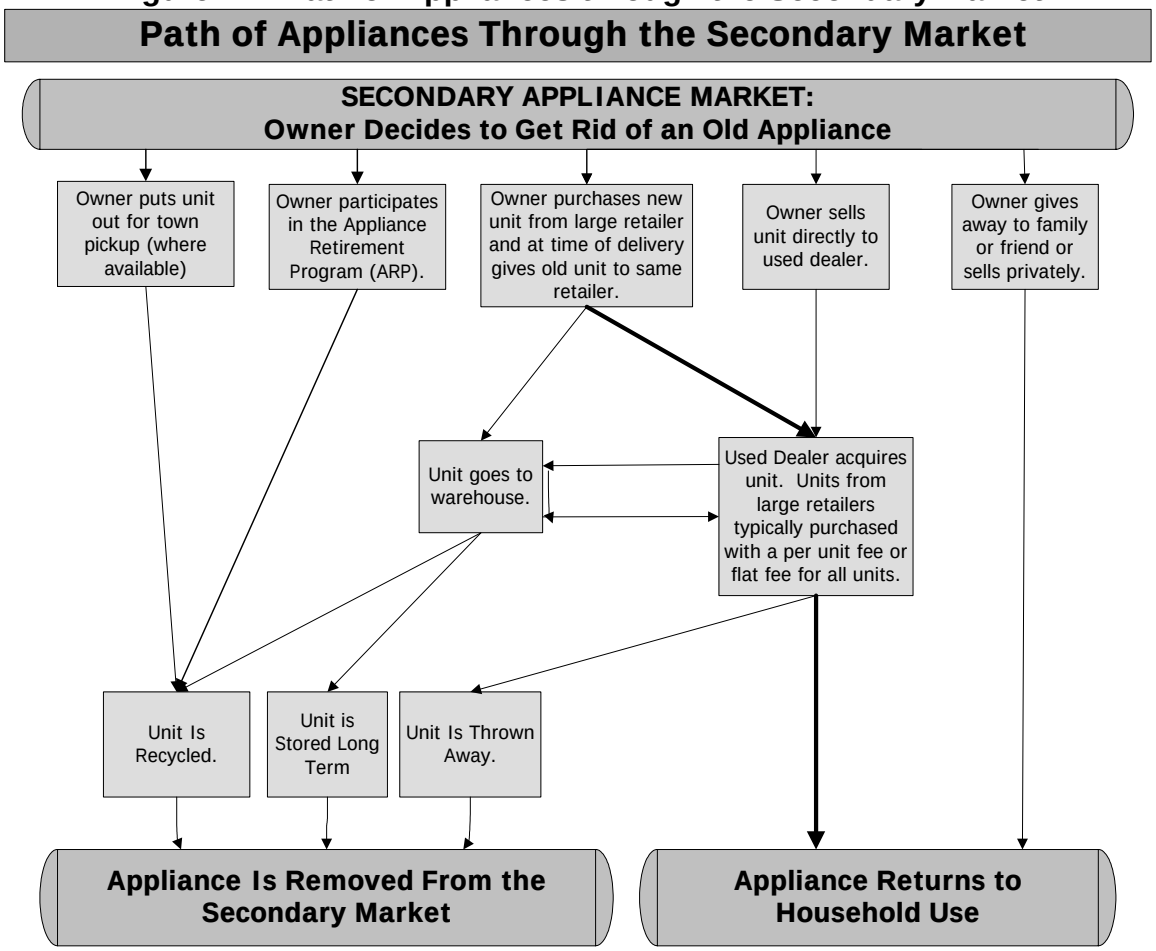
The investigation into the secondary market also clarified where used appliance dealers obtain the units they sell in their stores. As shown in Table 4.2, it is generally the case that dealers with fewer available refrigerators tend to receive their units from individual customers whereas dealers with more available refrigerators tend to acquire their units from large corporate new appliance dealers.

Table 4.2: Where Used Appliance Dealers Get their Refrigerators

Source of used refrigerators	# of Refrigerators Available At Time of Call					
	0 (n=16)	**1-5 (n=18)**	**6-10 (n=7)**	**11-20 (n=6)**	**21-50 (n=1)**	**50+ (n=2)**
Customers	87.5%	77.8%	28.6%	66.7%	0.0%	50.0%
Large corporate new appliance dealers or warehouse	12.5%	27.8%	42.9%	50.0%	100.0%	50.0%
Other used appliance dealers	6.3%	5.6%	14.3%	16.7%	0.0%	0.0%
A "supplier"	0.0%	11.1%	28.6%	0.0%	0.0%	0.0%
Don't know or would not say	0.0%	5.6%	0.0%	16.7%	0.0%	0.0%

Based on the investigation into the structure of the secondary market, RLW developed the following flow chart of that structure. (Figure 4.1) Specifically, this figure illustrates how we believe appliances move into and/or are removed from the secondary market. The two leftmost paths illustrate how an appliance is removed from the secondary market either through the ARP or by a customer putting it out for municipal pickup and recycling. The dark lines illustrate the means by which a substantial number of secondary appliances make their way back into the marketplace via retailers. The most common way units (re)enter the used market is represented by the middle path. Customers buy a new appliance from a corporate retail store and give that store their old unit; the retailer then sells the old unit to a used appliance dealer.

Figure 4.1: Path of Appliances through the Secondary Market



4.3 Customer Participation in the Secondary Appliance Market

The participant and non-participant surveys suggest that very few of the households surveyed had formerly or recently purchased units from the used market. A minority of respondents had used appliances in their homes, and, of the appliances obtained used, most of them either came with the residence or were given to the respondent by friends or family members. Yet, the number of stores selling used appliances and the results of the mystery calls and visits indicate strongly that Connecticut residents are purchasing quite a few used appliances. Unfortunately,

our study of the secondary appliance market has not been able to identify the segment of appliance purchasers who buy from the used market, although we strongly suspect that landlords and low-income householders may be among the more common purchasers of used appliances.

The results of this evaluation also strongly suggest that most of the units retired through the ARP were diverted from the secondary appliance market, thus helping the program achieve one of its primary goals. As discussed in Section 2.2, it is also the case, however, that the units retired through the ARP make up just a small portion—two to six percent—of all the units disposed of by Connecticut residents that may have found their way into the secondary market. While only some of these units would have actually been sold in used appliance stores in Connecticut—the exact number is unclear—we believe it is safe to say that the ARP is only making a small dent in the availability of older, less efficient, used appliances in Connecticut.

5 Recommendations[12]

Based on the lack of cost effectiveness regarding achieved energy savings and the minimal effect that the ARP has on diverting units from the secondary appliance market, NMR recommends that the sponsors consider discontinuing the program or substantially restructuring it to improve cost-effectiveness. Furthermore, our evaluation was based on the results of the 2004 program year, the time during which the program should have caught the "low hanging fruit," that is the customers who really wanted to retire their appliances and responded to the relatively cost-effective bill inserts. Therefore, it is likely that cost effectiveness may be even lower in 2005 and lower still in 2006, unless a switch in focus from SWCT to the remainder of the state brings in additional easy-to-capture retirements.

The NMR team recognizes, however, that discontinuation of the ARP may not be desirable. In particular, the ARP is a well designed program with a strong customer service orientation. Participants appreciate the program and express high levels of satisfaction with it. Likewise, for some participants, the ARP is the only conservation program in which they will participate and, therefore, the only way they will see a return on their contributions to the conservation funds financed through charges on electricity bills. The pick-up mode of the program, furthermore, requires little coordination or planning on the part of utility program staff; it is, to use their terminology, a turnkey program. For this reason, the remainder of our recommendations assume that the ARP will be revised but continue to operate in some fashion. Please note that we sometimes offer alternative possibilities for the future of the ARP.

5.1 Turn-in Events

The sponsors have already indicated to NMR that the turn-in events will be discontinued in 2006. While we concur with this decision, participant responses to the telephone surveys and to the surveys taken at the time of participation make clear that the substantial purchase incentive offered at turn-in events in 2004 succeeded in convincing at least some participants (though unfortunately not most of them) to remove units that were in active use from their homes and to replace these units with ENERGY STAR-qualified models. In contrast, the retirement incentive alone was more likely to capture the unwanted units sitting in customers' basements or attics.

[12] These recommendations relate solely to the future of the ARP. Other recommendations are made in throughout the body of this overall report.

Furthermore, interviews we have completed in support of an assessment of the RAC market that NMR is conducting for CL&P and UI also make clear that retailers carry more ENERGY STAR-qualified RAC when purchase incentives are available than when they are not. These retailers argue that, without rebates, they will sell substantially fewer ENERGY STAR-qualified models. While at least one of the retailers argued that the ARP turn-in event was a "bad plan [that had been] executed … very well," they both welcomed the rebates associated with the program. In fact, both indicated that they are currently ordering fewer ENERGY STAR-qualified RAC for the summer of 2006 based on the assumption that no purchase incentives will be offered.

Based on this information, we make the following recommendations regarding turn-in events and the replacement of RAC with ENERGY STAR-qualified models:

- Discontinue the events as planned
- Pay no incentive for the surrender of RAC but instead distribute incentives to purchase ENERGY STAR-qualified models
- Alternatively, pay for the pick-up of RAC only after a customer has demonstrated the purchase of an ENERGY STAR-qualified model. Because the pick-up can occur at any time of the year, and not just the summer, the purchase could have occurred any time within the twelve months prior to pick-up or will occur in the summer immediately following the pick-up.
- Discontinue the connection between the ARP and the purchase of ENERGY STAR-qualified RAC and divert resources toward negotiated cooperative promotions (NCPs) with retailers or instant rebate programs offered at retail stores. Because the approach would be open to all the sponsors' customers, it would most likely increase the saturation of ENERGY STAR-qualified units in use in customers' homes. The approach would not, however, confront the methods of RAC disposal—including giving older, inefficient units away.

5.2 Pick-Up Mode

Based on participant responses to the telephone survey and surveys taken at the time of pick-up, we believe that two related factors are largely responsible for driving down achieved energy savings: the surrender of primary RF and the replacement of surrendered RF and FZ. The surrender of units not in use or in use only occasionally also drives down energy savings, most dramatically for RAC.

In reality, NMR can identify no way to stop customers from retiring primary units or from replacing retired units. Some customers have already indicated a willingness to be less than truthful by falsely reporting that they had not purchased a new unit in the past year but then later admitting in the telephone survey that they did not need the unit they retired because they had already bought a new one. Therefore, we do not believe that limiting participation to those who pledge not to retire a primary RF or to replace RF or FZ will actually produce the desired results. While we believe the program should continue to discourage the retirement of primary RF and the replacement of RF and FZ, realistically the ARP should focus more effort on mitigating their effects on energy savings. We suggest the following mitigation efforts:

- Provide additional literature to customers about the costs of running FZ or secondary RF in homes, including the costs associated with newer standard models and ENERGY STAR-qualified ones. Perhaps the literature will discourage at least a few replacements or increase the percentage of replacements that are ENERGY STAR qualified.
- If customers indicate during the ARCA screening process that they plan to retire primary units or to replace units (and, according to the ARCA database, some of them do indicate as much), the ARP may offer a purchase incentive for an ENERGY STAR-qualified model of the appliance(s) being retired. The incentive may help the sponsors recoup some of the savings that would have otherwise been lost through the replacement with a less efficient model.

We recognize that the second suggestion does not address the people who plan to replace their unit but do not divulge this intention to ARCA. Yet, we do not see how to prevent the loss of these savings without providing a purchase incentive for ENERGY STAR-qualified models for all RF and FZ surrendered through the program. NMR does not, however, believe that such a decision to give a purchase incentive to all participants will provide a cost-effective way to increase energy savings.

Also related to the pick-up mode, while it remains unclear whether *more* appliances would be recycled if the program were run continuously, the experiences of the 2004 program year—the first year of operation for the current ARP—make clear that the effectiveness of marketing declines over time. To compensate, the program has to increase the marketing budget to achieve savings goals, thereby reducing the cost-effectiveness of the program. Therefore, if the sponsors have to choose between periodic and continuous operation, NMR would recommend running the program periodically.

5.3 Secondary Appliance Market

As stated above, the ARP is currently making only a small dent in the secondary appliance market. Furthermore, participants in the ARP and non-participants who responded to the telephone survey are not buying units from the secondary market. However, the number of used appliance stores in Connecticut that carry RF and FZ make clear that some residents in the state are buying units from the secondary market. For reasons explained more fully in Section 9.3 of the Survey Results Report, our evaluation has not been able to identify who is purchasing used units nor the number of units purchased through the secondary market, although we strongly suspect it is primarily landlords and low-income customers.[13]

Given the findings and remaining uncertainties regarding the secondary market, our first recommendation is for the sponsors to assess the degree to which diverting units from the secondary market is critical for reducing energy usage in Connecticut. A short random digit-dial study of households in Connecticut—albeit with a fairly large sample—could be used to determine:

- Whether RF and FZ were obtained new or used,
- Whether units were purchased, received for free, or came with a residence
- Where units were purchased
- How much, if anything, customers were charged to obtain new and used units
- Why some customers obtain used instead of new units
- If respondents have purchased new or used appliances for rental properties they may own, and why they decided to purchase a new or used unit

The study would also gather information such as owner/renter status, income level, and whether or not the respondent pays their own electricity bill. Because the goal will be to understand the secondary appliance market for RF and FZ, the study should *not* be limited to customers of CL&P and UI nor should it be limited to respondents who pay their own electricity bill. Once the information is gathered, the sponsors will have a better idea of how many used appliances are purchased and in service in Connecticut, and who obtains appliances through the secondary market and why. Short of conducting an additional study, the sponsors could also add questions about used appliances to future Residential Appliance Saturation Studies.

If future research reveals that reducing the number of units obtained through the secondary market is critical to reducing energy usage in Connecticut, the following recommendations could be considered. Note that the recommendations regarding landlords and lower-income customers reflect the expectation that future studies will reveal these groups to be among the primary purchasers of used appliances.

[13] In brief, both landlords and lower-income residents are under-represented in the telephone surveys. Landlords were not surveyed about their rental units because we needed to understand how the retired appliances had been used by residents of their properties prior to surrender. While the surveys did not explicitly exclude low-income residents, we screened non-participants based on their responsibility for paying their electricity bill. Furthermore, lower-income people are more likely to rely on cellular phones, which cannot be contacted for survey-type calls. Together these factors limited the number of low-income residents contacted for both surveys.

- It has been suggested by program staff members as well as by the NMR team that the ARP may want to work directly with new appliance retailers to divert products they pick up at customers' homes from the secondary market. However, ARCA staff members have pointed out that the drivers on the trucks contracted by retailers sometimes sell the units they pick up and replace the older but working units with truly junked ones. If this is the case, then working with retailers would do little to reduce energy usage or keep older units from being used in customers' homes. It may still be possible, however, to work with new appliance retailers to reduce the number of used units entering the secondary market. Perhaps the program could supply retailers with stickers that would be given to customers agreeing to have their product recycled through the program. The customer could receive an incentive after proving the appliance was picked up by mailing a delivery receipt to an implementation contractor hired by the sponsors. The store would receive incentives for each unit with a sticker delivered to ARCA. The use of the sticker would ideally limit the "switching" of units by the retailer delivery/pick-up staff. Of course, the system assumes that the retailers also "play fair" and do not let delivery staff gain access to the stickers.
- The evaluation also made clear that many unwanted RF and FZ were simply "put into the trash." For this reason, an alternative approach of diverting units from the secondary market involves working with local towns. Similar to the approach with the retailers, the customer would first obtain a sticker from their local government to be affixed to a unit. The sticker would be given for free, but the customer would *not* receive an incentive to do this based on the assumption that units destined for the trash have already been taken out of use, which may not be true of units picked up by retailers upon delivery of a new appliance. For each *working* unit picked up by ARCA, an incentive would be placed into a fund that the town could use to finance energy conservation programs.
- If further investigation into the secondary market finds that landlords or multi-family complexes are among the most common purchasers of used appliances, the sponsors could consider a program targeted at landlords. Landlords would surrender used or inefficient units to ARCA and then receive multi-product discounts or rebates on the purchase of ENERGY-STAR qualified units. However, any future program design should also recognize that many renters own their appliances. Therefore, programs targeted at rental housing should also take into account that at least some of the appliances may be owned by the renters and not the property owners. It is NMR's understanding that the sponsors already have a low-income program that includes the removal of inefficient RF from customers' homes.

Appendix A
Secondary Research: Review of the Literature

NMR
Nexus Market Research, Inc.

Secondary Research: Review of the Literature

This report summarizes the literature we have reviewed in support of our evaluation of the Connecticut Appliance Retirement Program (CT ARP), sponsored by Northeast Utilities/Connecticut Light and Power (NU/CL&P) and The United Illuminating Company (UI). The report focuses on four subject areas: measure life, energy consumption (primarily of refrigerators), appliance demographics, and the experiences of other retirement programs. When possible, we draw comparisons to Connecticut. In the final report, we will compare and contrast the NMR team's evaluation results to those discussed in the literature.

1 Measure Life

The subject of appliance life expectancy is somewhat controversial, and no universally accepted figures are available. The conditions under which studies are conducted tend to be program-specific and do not necessarily share all of the characteristics of units being recycled under the CT ARP. Studies also consider various aspects of measure life, including the age of units surrendered to a program, the average age of units currently in use, and the average length of ownership.

The Association of Home Appliance Manufacturer's (AHAM) *Home Appliance Saturation and Length of First-Ownership Study*[1] is based on a mailed survey that asked a representative sample of householders across the United States about the age of their primary refrigerator; it does not account for the ages of secondary refrigerators. AHAM estimates that the average length of ownership for refrigerators is 8.5 years. In that study, consumers estimated the age of replacement for units purchased new to be 13.8 years and 14.4 years for units purchased old; for both categories the age of replacement is younger than found in a similar AHAM survey conducted in 1996, indicating more frequent replacements are taking place.

A study conducted on behalf of a group of Massachusetts and Rhode Island utilities, including NSTAR Electric & Gas, National Grid, and Northeast Utilities[2] performed in situ metering of participants in a home energy assessment program (Blasnik 2004). The refrigerators that were logged were all eligible, based on program criteria, to be targeted for replacement by ENERGY STAR qualified units. The study found the average age of logged refrigerators to be 20 years.

[1] NFO World Group "Final Report: Home Appliance Saturation and Length of First Ownership Study." Prepared for Association of Home Appliance Manufacturers (AHAM), May 2001.

[2] Blasnik, Michael "Measurement and Verification of Residential Refrigerator Energy Use: Final Report 2003-2004 Metering Study." Submitted to NSTAR Electric, National Grid, and Northeast Utilities on July 29, 2004

Jim Mapp of the Wisconsin Department of Administration (DOA) developed another source of information, based on refrigerator and freezer data from a refrigerator retirement program.[3] The average age of refrigerators and freezers sent in for de-manufacturing in Wisconsin—all still functioning, according to program requirements—was about 30 years.

AHAM estimates that the average length of ownership for freezers is 11.7 years. In that study, consumers estimated the age of replacement for units purchased new to be 15.2 years and 16.9 years for units purchased old.

AHAM estimates that the average length of ownership for RAC is 6.5 years. In that study, consumers estimated the age of replacement for units purchased new to be 8.9 years and 10.7 years for units purchased old.

The NMR team had hoped to verify the age of appliances picked-up by ARCA; however, ARCA has informed NMR that the data on the age of appliances picked up in 2004 may not be reliable due to certain default values in the computer database program. ARCA has informed NMR that the error in the database has been corrected for more recent appliance pick-ups.

2 Energy Consumption

Studies that focus on energy consumption typically include only refrigerators and occasionally freezers. They rely on metered data, either conducted in a laboratory under controlled conditions or in situ under conditions assumed to reflect how the unit was operating prior to being removed through a program. Much of the literature explores the merits of metering techniques and the conditions under which metering should take place. As with studies of measure life, the resulting energy consumption data typically reflect the specific conditions under which the program was operating, making cross-program comparisons difficult.

A study for Southern California Edison (SCE) by KEMA[4] explored the merits of alternative metering approaches (laboratory or in situ metering, or a combination of both) in a review of nine refrigerator metering studies conducted from 1992 to 2003. The study could make no definitive conclusions about unit energy consumption (UEC) estimates from the review; some studies found laboratory metering overestimated actual energy consumption, and other studies were inconclusive.

The Massachusetts/Rhode Island study (Blasnik 2004) identified various reference sources for refrigerator energy usage and logged the energy use of two types of refrigerators—units that were eligible for a rebate through a home energy assessment program, and ENERGY STAR-qualified units purchased with rebates through the

[3] Mapp, Jim (2004) Personal Communication to Authors, August 9, 2004

[4] KEMA-XENERGY (2004a) "Final Report: Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program." Submitted to Southern California Edison on February 13, 2004.

program. Blasnik found that almost all of the units eligible for retirement used *more* energy than estimated by the energy labels but *less* than estimated by the Massachusetts and Rhode Island program installation vendors. It should be remembered that the units sampled had an average age of 20 years, so some were quite old. Furthermore, Blasnik over-sampled units that had been purchased through the secondary market.

The Blasnik study, furthermore, also found that the location of the refrigerators (basement v. kitchen) impacted energy consumption, with those in the basement using 9% less electricity than label-rated usage and those in the kitchen using 16% more than label-rated usage. The difference is attributed to cooler basement temperatures compared to temperatures found in living space; occupant loads also tend to be smaller in basements. In addition, about 8% of the existing refrigerators in the study had constant energy usage (ran all the time, instead of cycling on and off); these units tended to be those that were acquired second-hand, had low power factors and had gaps around the door seals.

The Massachusetts/Rhode Island study also modeled refrigerator usage based on unit age, household living characteristics, physical characteristics of the units, and whether the unit was purchased new or used in an attempt to create a model for a new audit approach. The resulting model includes the following factors: number of occupants (primary unit only), anti-sweat switch is "on," through-the-door icemaker, door seal with noticeable gaps, average room temperature, and base level usage. Interestingly, age of the unit was not found to be statistically significant; the study concludes that because all units in the study were relatively old, any early degradation already would have occurred.

Finally, the Blasnik study also examined refrigerator load shapes, calculating a ratio of hourly usage to average daily hourly usage. The study concluded that, despite using less energy overall, new replacement refrigerators have greater peak hour usage compared to existing units. The "peakiness" of the new units reflects higher occupancy in the homes with the new refrigerators together with the greater efficiency of the box.

As Function of Age

KEMA (2004a) addressed refrigerator consumption patterns by computing hazard functions and corresponding survival functions using a large database of lab-metered data and a metering study of 100 recovered units in 2003. From this data, a model was created to predict energy usage as a function of age and other physical unit characteristics. After fitting this model to the data, they found that unit energy consumption declined by about 10% between 1996 and 2002.

Another study for SCE by KEMA[5] verified the utilities claimed energy- and demand-savings, based on the number of units they claim from the program and the factors (kWh, kW, Net-to-Gross) used to calculate the savings. In the 2003 analysis, the utilities used the higher energy savings estimates that had been used in 1996. The same study also conducted a degradation analysis to determine the extent to which the UEC of

[5] KEMA (2004b) "2003 EM&V RARP Study: Verification, Degradation &Market Potential Analysis." Submitted to Southern California Edison on December 23, 2004.

refrigerators and freezers removed through the program changes over time. They compared manufacturer reported UEC for models (new UEC) to DOE laboratory test results of the same models (old UEC) and tested regression models to describe degradation as a function of age and other unit characteristics. Their comparison found that degradation occurs over the lifespan of the selected models, but, similar to Blasnik, they could not find a strong relationship between usage and age alone. They conclude that degradation is a function of age and other physical unit characteristics. It should be noted that due to the small sample sizes (136 models), their conclusions are tentative and restricted to only models included in the study, not all refrigerator and freezer models in the general population.

Net to Gross

The SCE studies (KEMA 2004a and 2004b) estimate net-to-gross (NTG) to credit the program with removals using an attribution factor and a part-use factor. The attribution factor adjusts for the proportion of units that would have been disposed of in the absence of the program and gives credit to the program for the proportion of units that were picked up and otherwise would have been transferred to another user. The part-use factor adjusts for the proportion of time that participants would have used a unit if they had kept it. The 2002 program evaluation (KEMA 2004a) used program participant and non-participant survey data for the NTG estimates. This study produced a NTG factor of 0.35 for refrigerators; the value is lower than that found in the previous (1996) and subsequent (KEMA 2004b) evaluations. The study attributes the 2002 values to increased shares of participants that year who surrendered a primary, rather than secondary unit, an increased percentage of participants that would have disposed of units in the absence of the program, and a lower proportion of participants that would have kept the unit in use if the program had not picked it up.

Table 1 summarizes the energy consumption estimates from the various sources. It should be noted that the usage estimates have not been adjusted for free ridership or spillover, although the load and net-to-gross estimates for SCE have been.

Table 1: Comparison of Energy and Demand Estimates

	Refrigerators			Freezers		
Study	**Usage (kWh)**	**Load (kW)**	**Net-to-Gross**	**Usage (kWh)**	**Load (kW)**	**Net-to-Gross**
SCE (KEMA 2004a)	1,946		0.35	1,662		0.54
SCE (KEMA 2004b)[1, 2]	2,148	0.33	0.53	2,058	0.31	0.57
MA (Blasnik 2004) Label-rated usage	1,244					
MA (Blasnik 2004) Program estimated usage	1,743					
MA (Blasnik 2004) Actual detailed metered usage	1,383					
MA (Blasnik 2004) New units label-rated	484					

[1]Represents factors for SCE and PG&E; load and net-to-gross factors for SDG&E varied slightly and were being revised.
[2]These factors were also used in 1996; the savings estimates developed for 1996 were higher than those derived for 2002.

The metered usage estimates for Massachusetts are similar to the engineering estimates developed for NU by Appliance Energy Group, Inc. in 1993 in their evaluation of the previous Appliance Pickup Program. As with the KEMA study for SCE, Appliance Energy Group found that engineering derived estimates of energy usage exceed those derived from regression models based on participant and non-participant surveys. More specifically, Applied Energy Group developed an engineering savings estimate of 1,370 annual kWh per retired unit. However, their estimate derived from the regression model was much lower, 560 annual kWh. Currently, NU/CL&P and UI estimate an average net annual kWh savings of 739 per refrigerator that is turned in by the program. This current estimate falls between the two estimates of net annual savings per unit developed by KEMA for SCE; adjusting the usage by the net-to-gross factor yields 681 kWh according to the regression-derived results in the first study and 1,138 kWh for the engineering results in the second study.

The freezer saving estimates developed by Applied Energy Group in 1993 were 1,062 kWh (engineering derived) and 432 kWh (model-derived). The CT sponsors currently use a net annual savings estimate 450 kWh. These are much lower than the gross and net annual estimates developed SCE; the net annual savings estimates for freezers in CA are 897 kWh for the first study and 1,173 for the second.

3 Appliance Demographics

Saturation

AHAM estimates that refrigerator saturation is 95.6%; 15.7% of households own or have access to multiple refrigerators. Similarly, RASS (CA) data estimate that 17% of California households have a second refrigerator. (KEMA 2004b). Based on the *2000*

Northeast Residential Dwelling and Appliance Saturation Survey[6] conducted for NU, Connecticut and Western Massachusetts households are much more likely to have a second refrigerator; the study found that 27% of respondents had more than one refrigerator.

AHAM estimates that RAC saturation is 25.8%, representing a decline since 1996 from 30.7%. About four in ten of these households (40.7%) have access to multiple RAC units. In the NU territory in Connecticut and Massachusetts, about 49% of households have at least one room air conditioner, with the mean number of units being two. The older housing stock and moderate climate of the Northeast limit the number of homes with central air conditioning, helping to explain the greater reliance on room air conditioners in Connecticut and Massachusetts than what AHAM found nationally.

AHAM estimates that freezer saturation is 41%; 10.7% of households have access to multiple units. RASS (CA) data estimate that 18% of California households have a stand-alone freezer. (KEMA 2004b). Thirty-one percent of households in Connecticut and Western Massachusetts reported having at least one stand alone freezer in 2000, making them less likely to have a freezer than households nationwide but more likely to have one than households in California.

New v. Used (Acquisition)

Refrigerators

AHAM estimates that 81% of refrigerators are purchased new and 25% are purchased used; in 1996, fewer refrigerators were purchased new (76%). The AHAM study found that when a refrigerator that had been purchased new is being replaced, the vast majority of units may continued to be used in some other way—15% of consumers keep the old unit, 23% moved and left it with the previous home, 24% sold or gave it away, 12% sent it to a recycling facility, 7% left it at the curb for disposal, and 19% say a retailer took it away for them. AHAM does not provide detail about secondary markets for the replaced refrigerators.

RAC

AHAM estimates that 77% of RAC are purchased new and 24% are purchased used; in 1996, fewer RACs were purchased new (71%). Similar to refrigerators, the AHAM study found that when a RAC unit that had been purchased new is being replaced, most units could have still be used—16% of consumers keep the old unit, 21% moved and left it with the previous home, 40% sold or gave it away, 9% sent it to a recycling facility, 9% left it at the curb for disposal, and 4% say a retailer took it away for them.

Freezers

AHAM estimates that 75% of freezers are purchased new and 27% are purchased used; in 1996 about the same number of freezers were purchased new (74%). Once again, the AHAM study found that when a freezer that had been purchased new is being replaced, the vast majority of units remain available for further use—14% of consumers keep the

[6] *2000 Northeast Residential Dwelling and Appliance Saturation Survey*. Northeast Utilities, C&LM, New Britain, CT.

old unit, 10% moved and left it with the previous home, 37% sold or gave it away, 15% sent it to a recycling facility, 8% left it at the curb for disposal, and 14% say a retailer took it away for them.

4 Other Programs

Incentive Structure

In Massachusetts and Rhode Island, the Residential Conservation Service (RCS) Program offered a $300 rebate for new refrigerators if the existing unit used more than 1,175 kWh per year.

Southern California Edison, Pacific Gas and Electric Company, and San Diego Gas and Electric Company's Residential Appliance Recycling Program (RARP) is designed to remove working, older, inefficient refrigerators and freezers from residential customer homes and to prevent the appliances from entering the secondary market. The 2003 program provided appliance removal and the choice of a $35 rebate or a 5-pack of compact fluorescent light bulbs. The CFLs are intended to provide the program with additional energy savings.

The Keep Cool program sponsored by the New York State Energy Research and Development Authority (NYSERDA) held room air conditioner turn-in events from 2000 to 2003. The turn-in incentive was $75 from 2000 to 2002, but NYSERDA lowered the incentive to $35 in 2003. The turn-in program was discontinued in 2004. NYSERDA also offered a storage fee to retailers who accepted recycled RAC. The fee has ranged from $15 to $25. The retailers held the units until they were picked up by recycling and de-manufacturing contractors.[7] Some appliance program sponsors in Massachusetts have also held room air conditioner turn-in events in 2003 and 2004. Customers were generally paid $25 to turn in an old unit. As in Connecticut, they could also take advantage of a rebate to purchase an ENERGY STAR qualified unit.

5 Conclusions

The diversity of research methods as well as differences between programs and the characteristics of retired appliances makes it difficult to draw definitive conclusions from the existing literature regarding measure life and the energy savings resulting from appliance retirement.

AHAM found that approximately a quarter of all refrigerators, room air conditioners, and freezers are purchased used. Not only are used appliances older, and, therefore, generally higher energy users than the new models on the market, Blasnik also found that refrigerators acquired second hand tended to be more likely to run continuously rather than cycle on and off, resulting in even greater energy usage. Furthermore, AHAM also reported that most units being replaced could still end up being used, either as second units within the same household or by being given, sold, donated to someone else or perhaps being refurbished for resale. The NMR team will be using the participant and

[7] Evaluation of the Keep Cool program is described in the *New York Energy $MART^{SM} Program Evaluation and Status Report*, May 2004

non-participant surveys as well as the analysis of the secondary appliance market to study the used appliance market in Connecticut. We will compare and contrasts our findings to those of the AHAM study in our final report.

Appendix B
Secondary Market Results

RLW ANALYTICS

To: Deb Sas, Northeast Utilities and Paul Gray, United Illuminating

From: Thomas Ledyard and Jeff Zynda, RLW Analytics, Inc.

Subject: Secondary Market Results

Date: November 29, 2005

We have recently completed the mystery shopper calls to used appliance dealers and 20 mystery shopper visits to both used appliance dealers and 6 visits to new appliance dealers. This memo serves to provide the results of these activities, including methodologies used and preliminary thoughts on program implications.

Objectives

The purpose of these data collection activities was to inform the following items of interest:

- Estimate quantity, type, and distribution of secondary appliance dealers in Connecticut.
- The types of appliances acquired and re-sold through these dealers.
- Amount paid for used appliances and how it compares to the program incentive.
- How non-functioning units are handled.
- The typical path of a used appliance available in a used appliance store.
- Criteria used by the secondary market to determine if a unit has met the end of its useful life.
- Impact of ARP on secondary market.
- Do new appliance retailers pick up old units when delivering new units? Is there a charge? What happens to them?

Methodology

To generate the secondary appliance dealer sample frame for the mystery calls and on-site mystery shopping, we performed an SIC query of InfoUSA, a searchable electronic phone book. The following SIC codes were used to generate the population:

1. 593208: Appliance-Household-Major-Used:
   This industry includes stores primarily engaged in the retail sale of used merchandise and secondhand goods.
2. 572219: Refrigerators & Freezers-Dealers:
3. 572212: A/C Equipment-Room Units:
4. 572207: Appliances-Household-Small-Dealers:
5. 572202: Household Appliance Stores:

Establishments primarily engaged in the retail sale of electric and gas refrigerators, stoves, and other household appliances.

This preliminary population was then supplemented by a list generated through both a hard copy and internet yellow pages search[1] for these business types. To refine the population estimate, we removed businesses that were duplicates, were known not to sell used appliances (Bernie's, Circuit City, etc.), or had the terms "service" or "repair" in the company name. These searches resulted in a preliminary sample frame of 242 unique businesses.

RLW then contacted this list of 242 potential secondary appliance dealers. As a result, out of the 242 businesses preliminarily compiled, 140 did not fit the sampling criteria because they either did not sell refrigerators, freezers, or room air conditioners, sold only new appliances, or were service/repair only businesses. From the remaining 102 businesses, 50 mystery shopper surveys were completed, 38 did not answer after multiple attempts, 13 had bad numbers, and 1 refused to share the information we were looking to gather. Assuming the 38 that were not able to be contacted and the one that refused are also used appliance dealers, we estimate that there are up to 89 used appliance dealers in Connecticut. Figure 1 shows where these stores are located within the state by county. The counties are shaded according to their population density, the circles represent cities, and the stars represent zip codes that have at least one store in them. As illustrated in the figure, used dealers tend to concentrate in areas with the largest populations, including SWCT, which is targeted by the program.

[1] www.smartpages.com.

Figure 1: Secondary Appliance Dealers in Connecticut

The 50 used appliance dealers that were successfully contacted for the mystery caller surveys represented the sample frame for the mystery shopper visits. Four stores were removed from the sample frame because they did not have a sales floor. To ensure equal representation across the state, the sample frame was divided by county. The number of sample points within each county was proportional to the size of the market within that county. Within each county, sample points were selected at random.

Table 1 presents the number of sample points selected within each county. It also shows, by county, the number of businesses from the original list, the number that matched the sampling criteria, and the number with which mystery caller surveys were completed. It is interesting to note that the counties with the largest quantities of used dealers (Fairfield, Hartford, and New Haven) are also those that contain the largest numbers of critical/constrained communities.

County	Total # in original list	# That Fit Sampling Criteria*	# of Mystery Phone Calls Completed	Mystery Shopper Sample
Fairfield	57	13	7	3
Hartford	72	24	12	4
Litchfield	17	9	5	2
Middlesex	10	2	2	2
New Haven	59	26	12	4
New London	17	9	8	3
Tolland	3	0	0	0
Windham	7	6	4	2
Total	**242**	**89**	**50**	**20**

* Includes businesses with whom surveys were completed and those who were not able to be contacted.

Table 1: Mystery Shopper Sampling

Table 2 shows the 20 used appliance stores that were randomly selected for mystery shopping. Note that only refrigerators and freezers (as opposed to room air conditioners) were mystery shopped for. Although included in the mystery calls, room air conditioners were not selected for these visits mainly due to their seasonality.

Refrigerators		Freezers	
Store Name and City	**County**	**Store Name and City**	**County**
Harral Used Appliance, Bridgeport	Fairfield	Demassa Appliance, Norwalk	Fairfield
Jeff Appliances Inc., Shelton	Fairfield	Davis Enterprises Showroom, Hartford	Hartford
H & E Appliance, Hartford	Hartford	Lugo Appliances, Hartford	Hartford
Wholesale Appliance, Hartford	Hartford	Crowley's Appliance, Torrington	Litchfield
Commercial Refrigeration, Terryville	Litchfield	Portland Electric, Portland	Middlesex
Appliance Discounters, Middletown	Middlesex	Marino's TV & Appliance Inc., Waterbury	New Haven
RTC Used Appliances, Wallingford	New Haven	Rico's Used Appliances & TVs, Waterbury	New Haven
Carroll Cut-Rate Furniture, W. Haven	New Haven	Johnny Kielbasa's Stuff Shop, Taftville	New London
Pequot Appliance Inc., Groton	New London	Bruno's Guarantee Rebuilt, New London	New London
La Bonte & Mercik App., Putnam	Windham	DV-TV & Appliances, Central Village	Windham

Table 2: Mystery Shopper Visit Sample

While in the field performing the mystery shopper visits RLW also performed brief and informal on-site interviews with randomly selected chain and independent new appliance dealers to further understand what happens to appliances that are removed from the homes of customers. The following stores were randomly visited as part of this effort.

National Chain: Home Depot, Shelton, CT
National Chain: Best Buy, Manchester, CT
Regional Chain: Bernie's, New London, CT
Independent: Shore TV & Appliance, Old Saybrook, CT
Independent: Midstate Maytag, Southington, CT
Independent: Dick Cooper TV & Appliance, Torrington, CT

Results

This section contains the results from the mystery calling and mystery shopping. If a store was mystery shopped at, all information gathered during the mystery call was verified during the mystery shopping visit.

Table 3 shows the number of used appliance stores selling each appliance type and the number with at least one unit in stock at the time of the mystery shopper call. It was apparent from the calls that used appliance stores do not always have units in stock. However, like new appliance stores, some used appliance dealers were noted to be particularly large while others are smaller. Specifically, two of the refrigerator dealers contacted reported that they can have up to 1,000 refrigerators available for purchase at times. Among the 50 used dealers contacted, we estimate that 2,225 used refrigerators were available for purchase at the time of the phone call.

The final row in the table presents the average price of each appliance type as reported by the used dealers over the phone. Used refrigerators cost approximately $229 to purchase while freezers and room air conditioners are approximately $164 and $93, respectively.

Used Dealers (n=50)	Refrigerators	Freezers	Room A/C
# of stores selling	50	28	28
# of stores with at least one unit in stock	32	6	12
Total in stock	2,225	8	223
Avg. Price	$229	$164	$93

Table 3: Average Number of Units and Average Price

It is interesting that only about 20% of the stores who sell chest freezers actually had any in stock. Room air conditioners, which were out of season at the time of the mystery calls, were stocked in twice as many stores. This suggests that the secondary market for chest freezers is not terribly active, perhaps because of the small price difference between new and used chest freezers. That is, the average price that used dealers charge for a chest freezer is $164. During the visits with some of these used dealers, the mystery shopper noted that the chest freezers being sold were typically 5 cubic feet in size. In the new appliance stores the least expensive 5 cubic foot units were priced at an average of approximately $210. For an additional $46 (less than the ARP rebate of $50) a customer can purchase a comparable unit that is brand new. In reviewing the cost of refrigerators at the new appliance dealers visited, it was apparent that new refrigerators cost nearly twice as much as used units, if not more. (Depending on the features and size the price of the new units can be much more.) This difference helps explain why we observed far more secondary refrigerators at the used appliance dealers than secondary chest freezers.

All of the used dealers that were contacted over the phone were asked how they receive their used appliances. Table 4 shows the proportion of respondents that reported getting at least some of their products through each source grouped by the number of refrigerators they had available at the time of the mystery call. The general trend observed in this table is that used dealers with fewer available refrigerators tend to

receive their units from individual customers whereas dealers with more available refrigerators tend to acquire their units from large corporate new appliance dealers.

Source of used refrigerators	# of Refrigerators Available At Time of Call					
	0 (n=16)	1-5 (n=18)	6-10 (n=7)	11-20 (n=6)	21-50 (n=1)	50+ (n=2)
Customers	87.5%	77.8%	28.6%	66.7%	0.0%	50.0%
Large corporate new appliance dealers or warehouse	12.5%	27.8%	42.9%	50.0%	100.0%	50.0%
Other used dealers	6.3%	5.6%	14.3%	16.7%	0.0%	0.0%
A "supplier"	0.0%	11.1%	14.3%	0.0%	0.0%	0.0%
Don't know or would not say	0.0%	5.6%	0.0%	16.7%	0.0%	0.0%
Appliance recycler	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%

Table 4: Where Used Dealers Get Their Refrigerators

As indicated above, dealers with fewer available refrigerators tend to receive them directly from customers. Some of the means of acquisition cited from the dealers for getting units from customers included getting them through “want-ads” in the newspaper, from elderly homes after people pass away, or from housing authorities that replace appliances before new tenants move in.

Used dealers with more refrigerators available tend to receive them from large corporate dealers who pick up old appliances when dropping off new ones. A couple of these used dealers reported that they have a contract with the large corporate dealers to receive these appliances. Another used dealer said that there are “warehouses full of them” and that he “picks and chooses the best.” This information was corroborated by the chain new appliance dealers visited by the mystery shopper. Two of the three dealers reported that appliances which are picked up at customers’ homes go back to a warehouse where they are picked up by used dealers. These two dealers estimated that they pick up approximately 3,500 refrigerators per year, many of which find their way back into the secondary market. The other chain dealer reported that the manufacturer delivers the new appliance and removes the old one; he was not sure what happened to the old unit beyond that point.

The entry of used appliances into the secondary market through large corporate dealers was also mentioned during an informal interview with a representative from the Appliance Recycling Centers of America (ARCA). This representative reported that some used dealers pay a monthly fee to the large dealers for access to all of the used appliances that are picked up in the homes of customers. This representative also said that other used dealers pay a small fee ($15-$20/unit) for units they are interested in. If used refrigerators are selling for approximately $229 each and the used dealer is picking up the units for $15-$20 each, the used dealer profit margin on each unit appears to be very lucrative.

Table 5 shows the frequency with which the sampled used dealers remove old units from the homes of customers and how often they charge a fee to remove these units. Over 80% of the used dealers in the sample said that they remove old units when

delivering new ones, but less than 60% of these dealers reported that they charge a fee for this removal. For those that do charge a fee, the average cost was $30, regardless of the appliance type.

Appliance	# that sell (n=50)	# that remove old units...	...And charge a fee
Refrigerators	50	42	27
Freezers	28	23	13
Room A/C	28	23	11

Table 5: Used Dealers Who Remove Old Units

One issue of interest in assessing the used appliance market is determining what happens to used appliances that are picked up at the time of another used appliance delivery. Overall, 81% of used appliance dealers reported that if the unit can be fixed or refurbished, they will turn around and resell it again. If the unit can not be resold, most used dealers indicated they discard it; although some said they will simply keep it on the floor until it is sold. Several used dealers reported that they specifically recycle it after evacuating the refrigerant, although some simply indicate that they toss the units out, but did not elaborate any further. The primary discovery among these responses appears to be that once a unit gets into the used appliance market, its lifetime can be very long and it could conceivably be sold multiple times as it remains in the used appliance marketplace. An ARCA representative interviewed as part of this effort indicated that some units that cannot be sold are shipped to other countries en masse; although this was not noted in our mystery shopper phone calls or visits.

Based upon the information discussed above and the interview with the ARCA representative, we have drafted a flow chart of how we believe the secondary appliance market works in Connecticut. Specifically, Figure 2 illustrates how we believe appliances move into and are removed from the secondary market. The two leftmost paths illustrate how an appliance is removed from the secondary market either through the ARP or by a customer putting it out for municipal pickup and recycling.

The dark lines illustrate the means by which the majority of secondary appliances make their way back into the marketplace. That is, based upon the mystery calls, mystery visits and interview with ARCA, we believe the majority of used appliances get back into the market as a result of being picked up by a new appliance retailer upon delivery of a new appliance. These units are then picked up by large used appliance dealers based upon a per-unit fee or a flat fee for all units.

Based upon our interpretation of the market, we believe there is an opportunity for the program to intercept used appliances that are traded in to large corporate retailers and sold to smaller used appliance dealers. This opportunity is presented in the black “ARP” oval and is discussed further in the conclusions and recommendations section below.

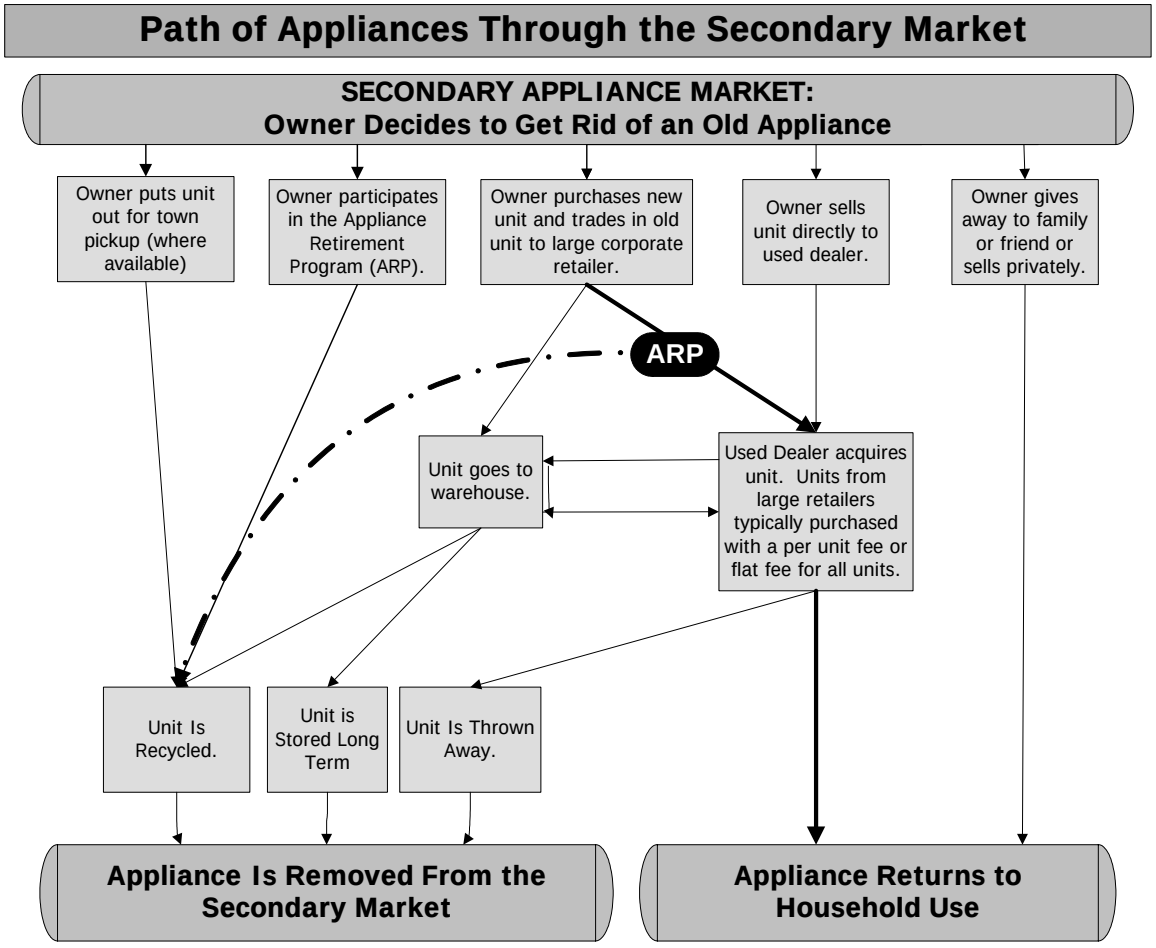


Figure 2: Secondary Appliance Market

Conclusions and Recommendations

The used appliance market appears to be large and well established. Within the market there are several secondary appliance channels that originate with individual customers selling their appliance to a used dealer. However, it appears that the largest used dealers receive their stock from new appliance retailers that sell back units that are picked up at the time of a new appliance delivery. These new appliance retailers do not appear to be getting a lot of money for these pickups; they are probably content to get modest revenues from the picked up/used appliances with the added benefit of having them regularly taken off their lot without having to comply with the regulations surrounding their proper recycling and discard.

Used appliances that get to a used appliance dealer appear likely to remain in the secondary market and not be removed unless the unit is absolutely unsalvageable. Based upon the approximate purchase and sale price of used units as understood from ARCA and the used dealer visits, profit margins on these units appear to be substantial. As a result, used dealers appear to refurbish the great majority of units they receive and resell them to lock in these profits. There does not appear to be a standard threshold upon which used dealers discard units they pick up. Essentially, regardless of age, if the

unit still operates it is reconditioned and put out for sale. Units are typically discarded only if they cannot be sold; although an ARCA employee indicated that some unsold units are packaged and sent overseas to other countries.

Based upon our understanding of the market at this time, we believe there are two potential areas of program change for the sponsors to consider in light of results from other evaluation activities as they are completed:

1. There appears to be an opportunity for the program to intervene in the market between new appliance dealers and used appliance dealers. At this point in the market, a used appliance that is picked up upon delivery of a new appliance is sold to a used appliance dealer. This exchange of used appliances is often performed in bulk according to an established financial arrangement. The program might consider offering new appliance dealers a per-unit or flat fee to pickup and de-commission the used appliances that are taken from customers homes.

   The benefits to this approach are that instead of picking up appliances in the disparate locations of customer homes, the appliances would already be in a central location and ready for pickup on a regular basis. In addition, resources dedicated to the broad marketing currently performed to get participants could be used to directly pay new appliance dealers for the used appliances they pickup. Finally, the program can still be geographically targeted through this mechanism by focusing on new appliance retailers in the locations of interest to the program under the assumption that the catchment area of these retailers will be their immediate surrounding area and local community. The two primary qualifications for refrigerators to be processed in the program should be generally adhered to under this program redesign; they will typically be able to run (assuming the customer is replacing a primary refrigerator) and it would likely have been a secondary refrigerator had it not been removed.

2. An alternative to the program change suggested above would be to partner with the large (and perhaps smaller) new appliance retailers and advertise the program in the appliance section of their store, akin to the provision of a rebate form in the clothes washer initiative. That is, at the point of sale of a new refrigerator the customer could be given a form with the pickup rebate levels listed, along with the phone numbers to call for a pickup. The form could encourage them to dispose of their current refrigerator immediately after delivery of their new unit. Although we do not believe this will remove as many units from the market as the suggestion above, this approach would be consistent with the current ARP approach in that it leaves the decision (and resulting benefit) directly with the customer on whether to remove their appliance from the market. Like the suggestion above, this suggestion can be geographically targeted, if desired.

Appendix B1
Used Appliance Dealer Census Mystery Call Interview Guide

Used Appliance Dealer Census Mystery Call Interview Guide, Connecticut Appliance Retirement Program

Note to caller: It is important to come across as a customer who wants to make sure they are getting a quality used appliance (question #3) and as a customer who is genuinely concerned for the environment (question #4).

Hi, I'm shopping around for a used refrigerator, freezer, and room air conditioner.

1. Do you sell any of these appliances?
   a. Refrigerators
   b. Freezers
   c. Room A/C

2. How many of each do you currently have in stock? And approximately how much are they?
   a. Refrigerators - _____ $_____
   b. Freezers - _____ $_____
   c. Room A/C - _____ $_____

3. Just out of curiosity, where do you usually get these things? _____
   _____
   _____

4. And what do you do if no one buys them…then where do they go?
   _____
   _____
   _____

5. Will you take my old appliances? (If yes) Is there a fee for this? (If so) How much?
   a. Refrigerators – Y / N Y / N $_____
   b. Freezers – Y / N Y / N $_____
   c. Room A/C – Y / N Y / N $_____

Ok great, maybe we'll stop in. What are you store hours? ____ to ____.

Appendix B2
Independent Used Appliance Dealer Mystery Shopper Guide

Independent Used Appliance Dealer Mystery Shopper Guide
Connecticut Appliance Retirement Program

Store Name: _____ Appliance Shopped (circle): Refrigerator/Freezer

Address: _____ Date: _____

Shopper: _____ Time of Visit: _____

Note to mystery shopper: It is important to establish a "buddy" relationship with the salesperson and to come across as a genuinely curious customer. DO NOT bring this guide into the store with you and you cannot be seen filling it out afterwards. Make this as conversational as possible. You may change the order in which you ask the questions if the conversation warrants it, but you should ask the questions as closely as possible to the manner in which they are provided here.

Premise:

a. You're an established homeowner and you're shopping for a replacement appliance.
b. The appliance you have now is about 15 years old and has gotten noisy with age and doesn't stay as cold as it used to.
c. You're ready to replace it with a used one because a new one is just too expensive for you right now.
d. It's an off-brand model (can't recall, but definitely not Whirlpool, GE, Kenmore, etc.).
e. You scheduled an appointment for your utility company to come and pick up your old unit.

1. I actually thought that was kind of interesting; the idea that my utility would pick up my old refrigerator and give me money for it. Have you ever heard of such a thing? _____
   _____

If the salesperson asks more about the utility company picking up your old unit, tell them that they are giving you $50 to pick it up from your house in about 2 weeks. You heard about it through a bill insert.

Anyway...

2. How many of these appliances do you have that I can look at and pick from? _____

3. How much are they? $_____ (write approximate avg. if there were many to choose from)

4. Just out of curiosity, where do you usually get them and how long can I expect it to last? _____

   _____

5. Do you repair and sell units that were:
   a. Not working at all or
   b. Only those were not running right?

6. How do you decide that a unit is not worth fixing; I mean how do I know that the system I buy will be of a decent quality? _____
   _____
7. And what happens to them if no one buys them or they aren't repairable? _____

Appendix C
Billing Analysis Results

RLW ANALYTICS

To: Deb Sas, Northeast Utilities and Paul Gray, United Illuminating

From: Thomas Ledyard and Tim Hennessy, RLW Analytics, Inc.

Subject: Billing Analysis Results

Date: November 30, 2005

We have recently completed the billing analysis of energy savings associated with the retirement of refrigerators and/or freezers. This memo serves to provide the results of these activities, including methodologies used and the calculated savings impact. The primary objective of this billing analysis was to quantify the savings for the 2004 program year for the refrigerators and freezer components.

Research Design

The research design chosen for the ARP billing analysis is a time-series comparison/cross sectional design. This research design essentially determines the program impacts by examining the change in participants' usage patterns over time. Comparing a representative control group's change in usage over a similar time period further refines the impact estimate. This experimental design helps to reduce any potential bias in the results.

The time series/cross sectional design achieves internal and external validity. Internal validity means the evaluation is conducted in a manner such that the results isolate the impact of the activity being studied. When other factors are not recognized, the changes attributed to the program may be the result of other phenomena. For example, if the experiment does not recognize the effect of a participant's demographic or end-use characteristics, the change in usage could be explained by the impact of the implementation of the program or, alternatively, by the change in lifestyle of the participant. A research design can help achieve external validity by ensuring that the results are representative of a larger population of interest, allowing for the findings to be generalized. For example, for the ARP Program, the information determined by the 2004 participants and the corresponding control group permits the evaluation to represent the total program impacts.

Evaluation Methodology Overview

The evaluation methodology used billing data to determine the impact of the program using the maximum number of 2004 participants and a representative group of non-participants. This study approach consisted of a variety of methods ranging from a simplistic comparison approach to more complex regression techniques.

Specifically, the evaluation consisted of the following four steps:

1) Development of the participant billing information,
2) Development of a representative control group,
3) Temperature normalization of billing information, and
4) The quantification of the energy impacts.

In each of the subsequent sections of this memo, the approach and the results of the analysis are presented.

The Participants

Billing analysis requires that sufficient billing information is available to establish consumption trends in both the pre-removal and post-removal periods. This section presents the general approach to the development of the participant group consumption analysis. For a more detailed discussion of the methodology to develop the participant group, see Appendix A.

From the program tracking records it was determined that there were 9,775 participants. Using the account numbers for participants, the sponsors (CLP & UI) gathered the appropriate billing data. This data spanned the period from May 2003 through the end of June, 2005. This window was selected as the ARP Program started June 2004; which ensured the data would provide at least 1 year of pre-data and 6-12 months of post-data. Billing information was provided for 8,498 customers.

The initial step in developing the participant information was to examine every individual read for each of the participants with billing records. During this process, when the information from a particular billing record appeared to be incongruent, that record was edited or eliminated from the analysis. The editing process included combining cycles to remove estimated reads, and correcting read dates. After the individual reads were examined, the participant data was split into pre- and post-removal periods according to the date of refrigerator or freezer pickup or turn-in. The next culling step checked the participant accounts to verify that there was enough data in each period to be accurately analyzed. At the end of the culling of the participant billing data, a total of 4,811[1] customers were available for the billing analysis.

Table 1 presents information about the participant population. As this table shows, the average CL&P customer uses more energy, and turned in more appliances per participating customer than the UI participants.

[1] There were 3,432 CLP and 1,370 UI customers available for the analysis. The majority of customers eliminated from the analysis were a result of insufficient pre- or post-program data.

	CL&P	UI	Total
Number of Participants	6,161	3,614	9,775
Pre-Annualized Usage (kWh)	10,217	8,757	9,677
Refrigerators			
Number of Participants	4,703	2,726	7,429
Total Units	4,729	2,738	7,467
Average/Participant	1.0	1.0	1.0
Freezers			
Number of Participants	1,830	1,053	2,883
Total Units	1835	1,060	2,895
Average/Participant	1.0	1.0	1.0

Table 1 - Participant Information

The Control Group

The primary purpose of the ARP Program billing analysis is to determine the program's effects on electricity consumption. One of the challenges in the analysis is that residential energy consumption can be significantly affected by a variety of variables such as changes in weather, activity, demographics, building shell, etc. One of the most efficient methods for controlling these confounding effects is the establishment of a representative "control" group of non-program participants.

For the ARP Program evaluation, a systematic method for determining a representative control group was used. A detailed presentation of the methodology used to develop the control group is presented in Appendix A. This section presents the results of the development of the control group.

For the ARP Program, CLP and UI provided a file with billing information for 49,356[2] customers. These customers were designated the "Control Group Pool". From this pool, all known participants were eliminated.

Next, the participant group was examined to establish matching criteria. The criteria used to partition the participant group into homogeneous groups were based on annualized usage, Company and rate code (the latter only for CL&P customers). The control group pool customers were then compared to the ARP Program participants based on annual usage within the group. Based on the above methodology, up to five control group members were selected for each participant.

At the end of the selection and culling process, the control group consisted of 24,000 customers. Table 2 shows a comparison of the pre-removal period, annualized usage between the participants and the control group. This table demonstrates how well the control group selection process worked. The control group closely matches the participant group in terms of average usage per day within the load factor strata. Based on this comparison, the control group was accepted and promoted to the later stages of the analysis.

[2] The pool provided by CL&P was 31,911 customers. The pool provided by UI was 17,445 customers.

Statistic	CL&P		UI		Total	
	Participants	Control Group	Participants	Control Group	Participants	Control Group
N	3,421	17,105	1,379	6,895	4,800	24,000
Minimum	22	21	141	120	66	58
25th Quartile	5,677	5,677	5,120	5,122	5,471	5,471
Median	8,735	8,736	7,383	7,384	8,234	8,234
Mean	10,217	10,216	8,757	8,757	9,675	9,675
75th Quartile	12,768	12,777	11,275	11,276	12,214	12,220
Maximum	48,783	49,760	47,841	49,504	48,434	49,665

Table 2 - Comparison of Pre-Removal Period Average Daily Usage (kWh)

Temperature Normalization of Billing Information

One of the most important steps in the assessment of the effect of the ARP Program is the pre-removal to the post-removal comparison of energy usage related to the program alone. By controlling for other non-program influences, such as weather, the program's effects can be isolated and quantified. A detailed description of this normalization methodology is presented in Appendix A. This section presents the results of the temperature normalization procedure.

The temperature normalization procedure described in Appendix A presented an enormous computing challenge. For the electric consumption models, heating degree-days based on reference temperatures from 50^0F to 75^0F, and cooling degree-days based on reference temperatures from 60^0F to 75^0F were examined. The wide variety of reference temperatures resulted in 1,248 models being considered for each customer to determine the optimal models.

To capture accurate temperatures, information from the Hartford and Bridgeport Connecticut weather stations were used. For CL&P, the daily mean Hartford temperature was used. For UI, the daily mean Bridgeport temperature was used.

To check the accuracy of the models, the actual usage was estimated using the optimal models. Table 3 shows the distribution of the actual to model predicted usage (i.e., using actual temperatures, rather than normal temperatures, for the period) for the most recent 12 months of data in each period. The participants' predicted mean usage is usually within 1% of the actual mean. This supports the conclusion that the models are performing well within each period. The comparison of annualized usage between groups for each period also supports the conclusion that the control group is well matched to the participant group.

Usage per Customer	Participants		Control Group	
	Pre	Post	Pre	Post
Actual	9,261	8,922	9,323	9,290
Predicted	9,185	8,817	9,273	9,183

Table 3 - Distribution of Actual and Predicted Electric Usage (kWh)

To estimate usage under normal weather, normal temperatures were used in the models. The normal temperatures used in this analysis were 20-year average daily temperatures. These average normal temperatures are presented in Table 4.

Month	Hartford	Bridgeport
January	27	31
February	30	33
March	38	40
April	49	49
May	60	59
June	69	69
July	74	74
August	72	74
September	64	66
October	52	55
November	42	45
December	32	35

Table 4 - Average Normal Daily Temperatures

Using normal temperatures, the Normalized Annual Consumption (NAC) was calculated for each period for each group. Table 5 shows the NAC for each period. The mean and median consumption is decreased for the participant group from the pre-removal to the post removal period. The Control group shows a modest decrease in the mean and median consumption for the pre to post period. The comparison of the NAC between groups, for each period does however demonstrate that the control group is well matched to the participant group.

Usage per Customer	Participants		Control Group	
	Pre	Post	Pre	Post
Average	8,946	8,413	8,937	8,886
Median	7,681	7,092	7,632	7,602

Table 5 - Distribution of Electric NACs

Evaluation Energy Impact Results

To fully investigate the effects of the program, several different analytical methods were used. These methods ranged from a simple comparison approach to a more complex regression technique. The estimates of savings were expected to remain relatively stable from method to method. The more complex methods were expected to produce "better" estimates.

In the evaluation of the ARP Program, the following two different methods were used. First, the energy impact was determined using an Augmented Comparison Method (PRISM). The second approach was a Regression Approach. Appendix A contains a detailed discussion of the Augmented Comparison Method, PRISM and the Regression methodology used to quantify the energy impacts.

One of CLP and UI's objectives was to establish savings estimates for subsets of the participant population, by participant type (i.e., refrigerator and freezer). To that end, the analysis approaches were adapted to address this objective.

The Augmented Comparison Approach Results

For the net savings, the average control group pre- and post removal usage were used. Table 6 shows the mean savings by program component.

Rebate Type	Participants	Pre NAC	Tracking	Gross	Net	Realization Rate
Freezer	2,346	8,929	452	590	506	112%
Refrigerator	6,892	8,938	743	517	426	57%
Ref and Freezer	537	8,766	1,195	664	549	46%
	9,775	8,926	698	543	452	65%

Table 6 - Comparison of the Net Savings, By Component

Table 6 shows an average savings per participant of 452 kWh/year. This is a 5% reduction from the pre-removal NAC. This table also shows that the freezer-only rebate customer evinced mean savings of 506 kWh/year, but the refrigerator-only rebate customers had a mean savings of 426 kWh/year.

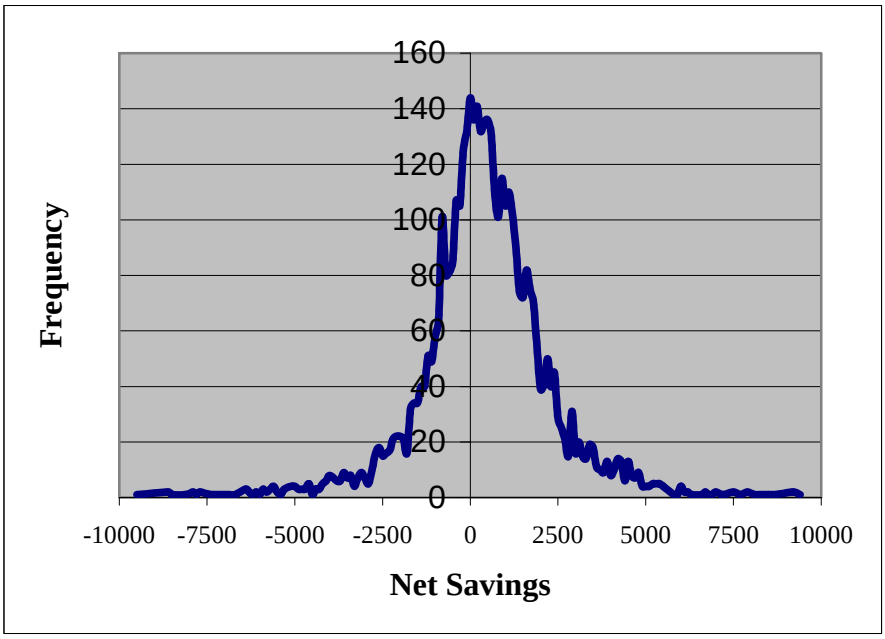


Figure 1 - Distribution of PRISM Savings

The confidence interval around the savings is 338 kWh/year to 567 kWh/year (+/- 115 kWh). This is a 25% confidence interval. Figure 1 shows the distribution of the PRISM savings estimates. This is typical of the distribution of savings generated by PRISM analysis. The distribution is essentially a normal (i.e., bell-shaped) curve, with most of the estimates falling around the center point or mean. The tails of the distribution are symmetrical. The large confidence intervals are exemplified by the large spread in

values shown in this figure. Interestingly, about 36% of the participants showed a predicted increase in usage from the pre-removal to the post-removal period.

Some conclusions can be drawn from the augmented comparison approach. Although the results can be refined, it is clear from this initial analysis that the ARP Program has affected the electric consumption of the participants.

The Regression Approach Analysis Results

The regression analysis was implemented using the four-step approach described in Appendix A. Estimated participant tracking savings were obtained by multiplying the expected savings (739 for a refrigerator and 450 for a freezer) by the number of surrenders. The initial analysis step was to build a simple regression model using total savings. However, based on the initial analyses, the number of rebates and the type of unit collected were incorporated explicitly as variables.

	Realization Rate	Participants	Units	Tracking Savings	Net Savings
Refrigerator	61%	7429	7,467	743	454
Freezer	107%	2883	2,895	452	483
Total	70%	9,775	10,362	698	487

Table 7 - Average Savings Estimates from Simple Model

Table 7 shows the average savings estimates from the simple model. The savings estimates shown in this table are virtually identical to the augmented comparison approach results. However, the regression approach reduced the variability associated with the estimate. The confidence interval around the average participant savings of 487 kWh/year is 425 kWh to 519 kWh (+/- 32 kWh). This is a 6% confidence interval.

	Realization Rate	Participants	Units	Tracking Savings	Net Savings
Refrigerator	59%	7429	7,467	743	438
Freezer	105%	2883	2,895	452	475
Total	68%	9,775	10,362	698	473

Table 8 - WLS Savings Estimates

To avoid violation of fundamental regression assumption, a second technique, weighted least squares (WLS) was applied. Based on the WLS regression technique, the average savings were estimated. Table 8 shows the average savings estimates from the WLS model. The savings estimates shown are consistent with the augmented comparison approach and the simple regression approach. The confidence interval around the savings estimate of 473 kWh/year is estimate is 366 kWh/year to 580/kWh/year (+/- 107 kWh). This is a 23% confidence interval. The confidence interval is larger than those estimated by the simple model. However, since the regression assumptions have been met, this confidence is more accurate. Interestingly, the confidence interval generated by the WLS regression approach is consistent with that developed through the augmented comparison approach.

Summary of Analysis Results

The augmented comparison and the regression approach yielded similar findings, with similar confidence intervals. Overall, the augmented comparison approach estimated that the net savings per participant was 452 kWh/year (+/- 115 kWh). Compared to the tracking system estimate of savings, this is a 65% realization rate. The regression approach estimated the savings at 473 kWh/year (+/- 107 kWh) per year. Compared to the tracking system estimate of savings, this is a 68% realization rate.

To determine the total annual impact of the program, the average savings were multiplied by the number of customers in that group. Based on this analysis, in total, the 2004 ARP Program will save 4,621 MWH/year. Of this, the refrigerator portion of the program will save 3,251 MWH/year and the freezer portion of the program will save 1,370 MWH/year.

Freezers

Participants who surrendered one or more freezers only (i.e., no refrigerator was retired) had a 112% realization rate (506 kWh). The savings estimate for the first freezer rebated in the tracking system was 450 kWh, a 112% realization rate. Participants that surrendered both a refrigerator and a freezer had a much lower realization rate, 46%, and the expected savings from these participants was only 549 kWh.

Refrigerators

Participants who surrendered one or more refrigerators only (i.e., they did not also retire a freezer) had a 57% realization rate (426 kWh). The low realization rate may be a result of higher anticipated savings. The tracking estimate of savings for refrigerators was based on assumptions regarding age (and thus use) of units, operation patterns, and the numbers of junk units surrendered. The average savings for first refrigerator surrendered was about 450 kWh - equivalent to that of the first freezer surrendered.

Detailed Methodology

Methodology to Develop the Participant Analysis Group

The first step in the analysis of the ARP Program was to identify all participants that could contribute to the analysis. To this end, CLP and UI constructed a data set of all known participants' electric usage history, not including those accounts that had been turned off. This data set contained information for 8,498 participants[3].

Once the billing data set was constructed it was examined, using the following three steps:

- Merge billing data with site-specific information.

- Eliminate records with unusually long or short number of days, bills with large or zero consumption, or any bill that was not within two years of the completion date.

- Eliminate records of customers that had insufficient information during the pre and post removal periods. Sufficient information is defined as records with at least 275 days in each period, which consisted of at least 9 billing periods of information, and having a minimum of 2 summer billing periods and 2 winter billing periods.

Methodology to Develop the Control Group

The Control Group for the ARP Program was developed following a four-step algorithm:

1. An appropriate pool of potential control group customers was established,
2. Criteria were developed to match control group pool customers to participants,
3. Known participants were eliminated from the control group pool, and
4. The control group pool customers were compared to each participant. Based on the established criteria, the best Control Group pool matches were selected.

Each of these steps is explained in detail below.

Step 1: The Establishment of a Control Group Pool

In order to develop a control group for the ARP Program, CLP and UI selected a large sample of non-participating customers. The customers in the Control Group Pool were examined and, if necessary, edited. This examination was consistent with the culling procedure applied to the participants.

Step 2: The Establishment of Control Group Matching Criteria

Based on the available information Control Group customers were matched to specific participants based on annualized usage, as defined by Equation 1, within Company.

[3] There was billing information provided for 6,107 NU participants and 2,391 UI participants.

$$AU = \frac{(\Sigma U_i)*365}{(\Sigma D_i)}$$

Where;

AU	=	Annualized Usage
U_i	=	Monthly Billed Consumption
D_i	=	Monthly Days in the Cycle

Equation 1 - The Calculation of Annualized Usage

Step 3: Eliminating Known Participants

After the initial edits, any known current ARP Program participants were eliminated from the control group pool. This was done by matching the current participants against the Control Group Pool database.

Step 4: The Establishment of the Control Group

During this step, each control group pool customer was compared to each participant. For each control group pool customer within a given strata, the relative deviation in annualized usage was calculated using Equation 2.

$$ARD = \left(\frac{|U_c - U_p|}{U_p} \right) *100$$

Where;

ARD	=	Absolute Relative Deviation
U_c	=	Annualized Usage for Potential Control Group Member
U_p	=	Annualized Usage for Participant

Equation 2 - The Determination of the Absolute Relative Deviation

For each participant, the five control group pool customers with the smallest absolute relative deviation in the annualized usage were chosen. These ten control group matches were then examined further. These customers were designated the Control Group.

Based on the matching of the program participants, each selected control group member was assigned a removal date. This information was used to split the customers in the control group into pre- and post removal periods that are consistent with that of their matched participant.

Next, each member of the control group was checked to confirm that they had enough pre-removal and post removal billing data to be analyzed. This culling process was consistent with that applied to the participant group.

The Control Group was chosen *with replacement*. Selecting a sample with replacement allows a customer to have the potential of being designated a Control Group member for more than one participant.

Temperature Normalization Methodology

The temperature normalization procedure used for this analysis is the *Princeton Scorekeeping Model* (PRISM) algorithm. Through years of experience, RLW has taken the fundamental concept of the PRISM methodology and refined it to produce more accurate estimates of normalized annual consumption (NAC).

The PRISM algorithm develops a mathematical model that represents the temperature to energy consumption relationship. The standard, Heating-Only version of this model is shown in Equation 3.

$$U_i = \alpha + \beta * DD_i(\tau) + e_i$$

Where;

U_i = average daily consumption in interval i.
$DD_i(\tau)$ = average degree days in interval i, based on reference temperature τ.
α,β = parameters to be estimated to minimize e.
e = a random error term.

Equation 3 - The PRISM Heating Only Model

The PRISM model reflects that a customer's energy usage is equal to some base level □, and a linear function between a reference temperature τ, and the outside temperature. The constant proportionality, β, represents a customer's effective heat-loss or heat-gain rate.

PRISM recognizes that each customer has unique space conditioning operating characteristics. To capture these unique space-conditioning characteristics, PRISM examines a range of heating and cooling reference temperatures. The model chosen to represent a customer's energy use is the model that best linearizes the relationship between usage and degree-days. For each customer, an optimal model based on a unique reference temperature (τ) is identified by the minimum mean squared error (MSE) of the regression.

Once the optimal parameters have been established, normalized annual consumption is estimated using Equation 4.

$$NAC = 365 * \alpha + \beta * DD_o(\tau)$$

Where:

DD_o is the number of degree days expected in a typical year.

Equation 4 - Determination of Normalized Annual Consumption (NAC) [4]

When this model is applied to a home's heating characteristics, it is referred to as the *heating only model* (HOM). When this model is applied to a home's cooling characteristics, it is referred to as the *cooling only model* (COM).

For the analysis of electric consumption data, it was not known whether or not the participants or control group members had significant space conditioning load. Therefore, the first adaptation of the PRISM methodology was to consider a *heating and cooling model* (HCM), along with the standard PRISM *heating only* or *cooling only models*. The expansion of the standard PRISM approach to consider heating and cooling loads is calculated using Equation 5.

$$U_i = \beta_0 + \beta_1 * HDD_i(\tau_1) + \beta_2 * CDD_i(\tau_2) + e_i$$

Where:

U_i	=	The electric usage during cycle i.
$HDD_i(\tau_1)$	=	The heating degree days based on reference temperature τ_1, during cycle i.
$CDD_i(\tau_2)$	=	The cooling degree days based on reference temperature τ_2, during cycle i.
β_i	=	The coefficients to be estimated to minimize the error term.
e_i	=	The error in predicting U.

Equation 5 - PRISM Heating and Cooling Model

As with the standard PRISM procedure, the optimal heating and cooling model is determined by calculating the regression models assuming various reference temperature values (τ_1 and τ_2). Expected annual degree-days are applied to the optimal model to calculate a normalized annual consumption (NAC). The results of the model can be interpreted as:

- β_o is an estimate of the average base load for a cycle;
- β_1 represents the heating slope, or the increase in electric usage for each incremental increase in heating degree days; and,
- β_2 represent the cooling slope, or the increase in electric usage for each incremental increase in cooling degree-days.

The standard PRISM approach uses usage and degree-day data on a billing cycle basis. However, the data has an inherent variability associated with the varying lengths of billing

[4] For a more comprehensive technical discussion of PRISM, see Impact Evaluation of Demand-Side Management Programs, Volume 1: A Guide to Current Practice, EPRI Report CU-7178,V1, pages 5-6.

cycles. For the estimation of the heating and cooling slopes (β_1, and β_2) the effects of the varying lengths of the billing cycle are mitigated. This is a result of the number of degree-days being directly correlated to the number of days in the cycle. However, the estimates of base load (β_o) reflects the average base load per cycle and does not account for the days in the cycle. In effect, this estimate infers the base load will be β_o, regardless of the length of the cycle. Since base load usage is a function of time, this result may introduce a slight bias into the calculation. To eliminate this bias, the augmented PRISM approach uses usage per day as the dependent variable, and expresses the degree days on a per day basis.

Alternative models, with different numbers of independent variables, introduce a challenge to choosing an optimal model. The standard PRISM approach relies on the maximization of R^2 to indicate the optimal model. However, in building mathematical regression models, the R^2 statistic has a tendency to increase as the number of independent variables increases. Therefore, when comparing models with different numbers of regressors, the maximum R^2 criteria may not lead to choosing the optimal model between alternative models. To avoid this possibility, an alternative method to determine the optimal model was used. The minimization of the mean squared error of the residuals (MS_E) is a good alternative. The MS_E accounts for the decrease in the degrees of freedom when an additional regressor is added to the equation. Therefore, the model that minimized the MS_E was chosen as the optimal model to represent the temperature versus usage relationship.

Lastly, in an effort to obtain the most accurate models possible, a system of re-analyzing poor performing models was developed. A "poor performing model" is defined as one that produced a low R^2 statistic.

The determination of the optimal model used a four-step approach. These steps are:

1) The optimal models are determined using all available data.
2) If the optimal model produced in Step 1 has a poor R^2, the usage data point with the largest prediction error was omitted. Using this trimmed and edited data set the models were re-estimated.
3) Choosing the optimal model for each customer from the first two steps, the customers with poor R^2 are again identified. For these customers, the usage data was limited to the most recent year of information. Using this trimmed data set, the models were re-estimated.
4) The models developed for each customer in each of the first three steps are compared. The optimal model (i.e., the model that minimizes RMSE) was chosen.

Normal temperatures were applied to the optimal models generated by this algorithm. The estimates produced are the Normalized Annual Consumption (NAC) for each period.

Energy Impact Analysis Methodology

In the evaluation of the ARP Program, the following two different methods were used. First, the energy impact was determined using an Augmented Comparison Method (PRISM). The second approach was a Regression Approach. This section discusses the methodology used to determine the energy impacts of the ARP Program.

The Augmented Comparison Approach

An augmented comparison approach controls for weather and other factors using a representative control group and simple equations. After the normalization of the participant and control group bills (see Temperature Normalization Methodology), the difference between the pre-program and post-program NACs were used to determine the raw energy savings that can be attributed to the program. The determination of energy savings is calculated using Equation 6.

$$S_{raw}=NAC_{Pre\text{-}Program} - NAC_{Post\text{-}Program}$$

Equation 6 - The Augmented Comparison Approach Determination of Gross Savings

To account for exogenous influences, the raw savings expressed can be adjusted by using a representative control group. If it is assumed that the same outside influences are affecting both the control and participant groups, then the adjustment will yield an estimate of energy savings that are isolated from all other influences. Determining the pre- and post-program NACs for both the participant and control groups makes this adjustment. The estimated savings are calculated by adjusting the participant results by the Control Group results. This adjustment is shown in Equation 7.

$$S_{adjusted} = NAC_{pre-program}(P_i) * \frac{NAC_{Post-Program}(C_i)}{NAC_{Pre-Program}(C_i)} - NAC_{post\,Program}(P_i)$$

Equation 7 - The Augmented Comparison Approach, Determination of Net Savings

Where:

C_i = The average of control group members associated with participant *i*.
P_i = Participant *i*.

While this method is simple, it can obscure real program effects and usually produces a high variability around the estimate.

The Regression Approach

The regression approach was performed using a comprehensive and systematic approach. This approach, presented below, has been applied with great success to the analysis of conservation programs.

The regression approach consisted of four steps that result in the selection of an optimal model that accurately quantifies the program impact. This sub-section describes the four steps of the regression approach.

Step 1: The Simple Model

During this step an initial regression model is developed using ordinary least squares ("OLS"). This simple model determined the effect of *one* important change variable

(i.e., the participation indicator variable status, or the participants engineering estimate of savings) on energy savings *while controlling for all other changes*. The basic form of this model is shown in Equation **8**.

$$NAC_{post,i} = \beta_0 + \beta_1 NAC_{Pre,i} + \beta_2 P_i + \varepsilon_i$$

Where:

$NAC_{post,i}$ = Post Installation Normalized Annualized Consumption for customer i
$NAC_{pre,i}$ = Pre Installation Normalized Annualized Consumption for customer i
P_i = Participation Indicator Variable or Engineering Estimate of Savings
ε_i = Prediction error

Equation 8 - The Simple Regression Model

Step 2: Regression Diagnostics

As a result of the residual standard deviation related to the size of the customer's energy usage, one regression assumption most often violated is that the standard deviation of the error terms, (or "residuals") is not constant across the range of predicted values. When the standard deviation residuals are related to the predicted values, the model is said to be "heteroscedastic." Heteroscedasticity is a violation of one of the basic regression assumptions and could result in the miss-specification of mathematical relationships. As a result of the residual standard deviation being related to the size of the customer's energy usage, heteroscedasticity is often detected in cross sectional models used to analyze program impact. During this step, verification that the regression assumptions are valid is performed. If the initial regression model is found to be heteroscedastic further regression analyses are performed. These analyses are performed using a weighted least squares (WLS) approach.

Step 3: Weighted Least Squares

As discussed above, one of the fundamental regression assumptions is that the standard deviation of the error terms (or residuals) has a constant variance across the range of predicted values. When heteroscedasticity is present, an ordinary least squares (OLS) approach to establishing the relationship between the dependent and independent variables may be inappropriate. An OLS approach that does not correct for the heteroscedastic relationship of its residuals will yield confidence intervals[5] that are misleading. More specifically, when heteroscedasticity is present, the OLS regression coefficients are unbiased estimates of the true parameters, but they are subject to greater

[5] Even though it is the best possible estimate given the data, it is unlikely that the point estimate will exactly equal the true, unknown parameter being estimated. Accordingly, instead of using a single value to estimate the true, unknown value, it is common to use a set of values or a *confidence interval*. A confidence interval is a range of values between which we can define a statistical probability, based on the estimate variability that the true value will fall. Generally, the higher the probability, the wider the confidence interval. Usually, the confidence interval is stated in terms of the probability that the true value will fall within plus or minus the interval around the point estimate. For example, given a 90% confidence level (the probability), the true mean will fall within $\pm$ 5% of the estimated mean.

statistical variation than the appropriate estimates. Moreover, the standard errors produced by the OLS regression analysis are biased estimates of the true standard deviations of the regression coefficients.

Weighted least squares (WLS) is one approach to correct for heteroscedasticity in regression analysis. According to econometric theory, the advantages of WLS are:

a) Under a properly specified heteroscedastic model, WLS yields the best linear unbiased estimates of the true parameters and,
b) WLS gives an unbiased estimate of the variance of the estimators, providing appropriate confidence intervals and p-values.

In other words, WLS provides the most reliable estimate of savings and an accurate measure of the resulting reliability. The theory of WLS depends on a correct specification of the heteroscedasticity. The theory assumes that a positive-valued variable can be specified, say *z*, such that the residual standard deviation is proportional to *z*. Usually, *z* is taken to be some measure of size (for example, the pre-retrofit NAC consumption).

The benefits of WLS depend on the correct choice of *z.* Therefore, it is useful to have a way of comparing alternative candidates for *z*. If it can be confirmed that heteroscedasticity is present, the following procedure[6] is employed:

1. Postulate a family of possible candidates for *z*. In the following analysis, the regression has been estimated assuming that the residual standard deviation is proportional to pre-retrofit NAC dampened by raising this variable to some power between 0 and 1. This variable will be termed $(NAC_{Pre})^{\gamma}$, where $\gamma \geq 0$. Here the exponent, gamma, is an unknown parameter that creates a family of candidate choices of *z*.

2. For each candidate of *z*, geometrically standardize *z* by dividing each value of *z* by the geometric mean of the *n* sample values of *z*. The geometric mean is the n^{th} root of the product of the *n* values of *z*.

3. Fit the regression model using WLS with each geometrically standardized *z*, and calculate the root mean square error (RMSE) of each regression model.

4. Minimize the RMSE to find the best choice of *z* and use this particular WLS regression to obtain the best estimate of savings.

During this step, a residual analysis is performed. If heteroscedasticity is suspected, the models are estimated using WLS.

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[6] The justification for this approach is from the statistical theory of maximum likelihood estimation. Although the WLS is different, the mathematical derivation of the methodology is the same as used by Box and Cox in their paper An Analysis of Transformations, (Journal of the Royal Statistical Society, Series B, 1964). A good summary of the approach is given in the text *Econometrics,* by G.S. Maddala, McGraw-Hill, 1977, pp. 315-317. J. Kmenta gives a similar methodology in Elements of Econometrics, to deal with autoregression in time series analysis.

Step 4: Calculation of Energy Savings

The final step in the analysis estimates the energy savings by using the resultant models.

Temperature Normalization Results Details

To obtain the most precise models, several models for each customer were developed. The models are based on the culling strategy are shown in Table 9. The distribution of model types is consistent within the period (i.e., pre-program and post program period) between the participant and control group. This supports the conclusion that the control group is well matched to the participants. The original simple model approach (i.e., Step 1, all available data) was chosen about a third of the time for the pre program period and about half the time during the post program period. Few of the 12 month models (Step 3) were chosen in the post period. This is a result of only about 12 months of data being available for this period.

	Pre-Program		Post-Program	
Model Type	Participants	Control Group	Participants	Control Group
Original	36%	34%	50%	53%
Outlier	45%	46%	50%	47%
12 Month	20%	19%	0%	0%

Table 9 Distribution of Model Types

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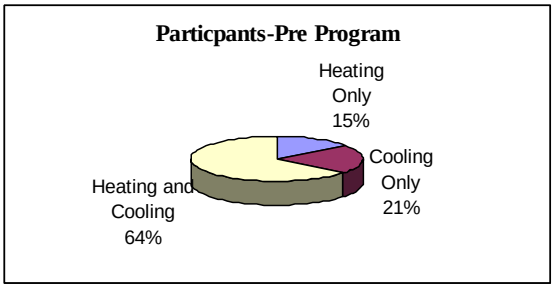
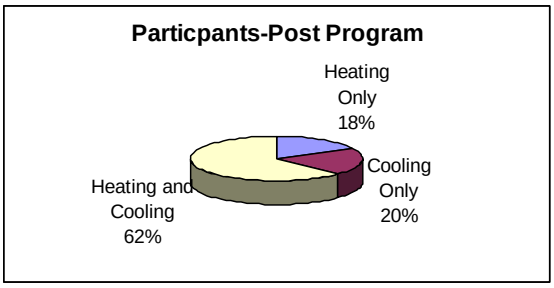
In the Temperature Normalization Methodology, two variables were considered for the electric models. Heating and cooling degree-days were considered. Figure 2 shows that for the participants, models that featured the heating and cooling PRISM models were chosen nearly two thirds of the time. The distribution of the type of models is fairly consistent from period to period and within customer groups. This suggests the models are stable across time and that the control group is well matched to the participant group.





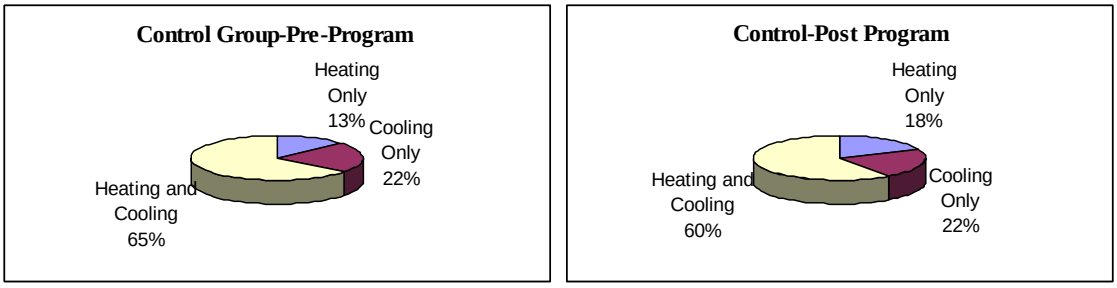


Figure 2 – Distribution of Model Specification

Table 10 compares the distribution of set points for the degree-day variables. For the participants, the median heating degree-day reference point was 55°F in the pre- and 57°F in the post-removal periods. For the control group, the median heating degree-day reference point was 55°F in the pre-and the post-removal periods. For the participants, the median cooling degree-day reference point was 66°F in the pre- and the post-removal periods. For the control group, the median cooling degree-day reference point was 66°F in the pre- and 65°F in the post-removal period. The distribution points of both groups are strikingly similar. This reinforces the conclusion that the models are stable across time and that the control group is well matched to the participant group.

	Heating Degree Day Reference Temperatures			
	Pre-Installation		Post Installation	
Statistics	Participants	Control Group	Participants	Control Group
Maximum	74	74	74	74
75th Percentile	65	64	65	65
Mean	58	58	59	58
Median	55	55	57	55
25th Percentile	50	50	50	50
Minimum	50	50	50	50
	Cooling Degree Day Reference Temperatures			
	Pre-Installation		Post Installation	
	Participants	Control Group	Participants	Control Group
Maximum	75	75	75	75
75th Percentile	72	72	73	73
Mean	67	66	67	67
Median	66	66	66	65
25th Percentile	60	60	60	60
Minimum	60	60	60	60

Table 10 – Distribution of Degree-Day Set Points

Table 11 shows the distribution of the R^2 statistics. For the participants and the control group, about half the models had R^2 over 80%. This supports the conclusion that the models are stable across time and that the control group is well matched to the participant group.

Statistics	Pre-Installation		Post Installation	
	Participants	Control Group	Participants	Control Group
Maximum	100%	100%	100%	100%
75th Percentile	89%	88%	93%	92%
Mean	73%	72%	78%	76%
Median	82%	81%	85%	84%
25th Percentile	63%	62%	73%	68%
Minimum	0%	0%	0%	0%

Table 11 – Distribution of R-Squared Statistics for the Electric Models

Appendix D
Process Evaluation

Nexus Market Research, Inc.

PROCESS EVALUATION OF THE CONNECTICUT APPLIANCE RETIREMENT PROGRAM

November 29, 2005

Submitted to:
Northeast Utilities – Connecticut Light and Power
The United Illuminating Company

Submitted by
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Executive Summary

This report summarizes the results of the process evaluation of the Connecticut Appliance Retirement Program (ARP) completed by Nexus Market Research, Inc. (NMR). Three different research methods were used to conduct the process evaluation—depth interviews, review and analysis of tracking databases including surveys taken at the time of participation, and telephone surveys of participants and non-participants. The major findings of the evaluation are reviewed in this executive summary.

Number of Products Retired

In 2004, the ARP succeeded in picking up 7,467 refrigerators (RF), 2,895 freezers (FZ), and 1,028 room air conditioners (RAC). Another 4,847 RAC were turned in at the 14 events held in either the Connecticut Light and Power (CL&P) service territory (three events) or the service territory of The United Illuminating Company (UI) (11 events).

Program Logic

The two primary goals of the ARP are:

1. To remove older, secondary RF and/or FZ from customers' homes while preventing these appliances from entering the secondary market
2. To encourage customers to replace older RAC by providing point-of-purchase incentives for new ENERGY STAR-qualified RAC

Program staff members have also identified two direct program effects:

3. Provide environmentally correct disposal of units
4. Reduce supply of secondary units and influence customers (primarily landlords) to purchase new units

While not specific program goals, the staff also expects that the ARP will have produce two indirect effects on the secondary appliances market:

5. Influence the manufacturers, retailers, and municipalities to improve disposal practices for secondary units
6. Improve the efficiency of the existing inventory of secondary appliances

Staff members argue that three primary barriers—inconvenience, disposal costs, and ignorance of the operating costs—keep most appliance owners from recycling their older, secondary, and/or unwanted units. The existence of these barriers underlies the logic of the ARP. The results of the telephone surveys confirm that inconvenience and ignorance of operating costs are likely barriers to product recycling. However, very few non-participants were actually charged to dispose of their unwanted appliances, mainly because they had retailers take the units away when delivering new ones, or because they simply put the unit into the trash. Those who were charged generally paid an average $15 to dispose of FZ and RAC and $25 to dispose of RF. It is more likely that those wishing to retire and not replace an appliance may be charged to dispose of it, but the evidence suggests that the charges are relatively minimal.

Program Implementation

The program delivery relies on two different modes: picking up appliances from customers' homes and turn-in events. In the pick-up mode, customers typically call a toll-free number to schedule a pick-up; within approximately two weeks the implementation contractor, ARCA, will send a truck to collect up to one RF, one FZ, and, in 2004, two RAC and one dehumidifier.[1] Customers of UI can no longer retire RAC and dehumidifiers through the program. ARCA staff verifies that the unit is in working condition and then cuts the cord, destroys the temperature gauge, and paints a red "X" on the unit. These last three steps insure that the product is not later sold in the secondary market. Dehumidifiers and RAC are accepted at turn-in events. To participate in these events, customers drive to the event and are greeted by ARCA, utility, and/or store staff members. The customer parks and exits their car. While filling out paperwork, the staff members verify both participant and product eligibility. The cord of the unit is then cut.

Nearly all pick-up participants called the toll-free number to schedule their product retirement. Over half of the products were picked up within two weeks, and 95% were picked up within six weeks. Pick-up participants generally found scheduling the pick-up and the process of retiring their products to be very easy. Turn-in participants reported that the events were conveniently located; they also said the process of retiring the RAC was very easy.

Program staff members view the ARP pick-up mode as a turnkey program—one that requires minimal planning and coordination on the part of the staff. They believe the program will succeed in reducing the number of secondary RF as well as FZ in customers' homes—at least temporarily. However, if the program is discontinued or operated intermittently, staff expects the saturation of secondary appliances to snap back to pre-program levels or higher. The staff members also fear that many customers are retiring appliances that they already wanted to get rid of, that were not working, or that had already been removed from use. If such appliances are retired in large numbers, energy savings will be lower than expected based on tracking estimates.

The telephone surveys and analysis of the tracking database provide evidence in support of both of these major concerns. Participants replaced just under one-half of the RF retired through the program, in part because 28% of the units retired were primary units, in violation of program requirements. Yet, some secondary units were also replaced, signifying that at least some snapback will occur in the homes of participants within a year of participation. Of course, product replacement also reduces the realized energy savings. In addition, when asked why they participated in the program, 58% of participants retiring RF, 65% retiring FZ, and 43% retiring RAC indicated in some way that they no longer wanted the unit. NMR, however, believes that not all of these participants can be fairly classified as free riders, because their participation in the ARP did limit the number of units entering the secondary market. The pick-up surveys indicated that the free pick-up was the key motivation for program participation.

Staff members also express concerns about the turn-in events. Participation in the events is unpredictable, and highly dependent on the weather. Furthermore, the events require considerable marketing and staff resources; low participation, therefore, lowers cost-

[1] Dehumidifiers have been included in both the turn-in and pick-up modes of program delivery. However, so few were surrendered to the program that the sponsors directed NMR not to include dehumidifiers in our evaluation of the ARP. According to the tracking databases, four dehumidifiers were turned in, and 270 were picked up.

effectiveness. Furthermore, retailers are wary of participation unless it can be demonstrated that the events will increase sales at the store; store managers agree that the weather is the main factor in both the success of the turn-in events and the impact of the events on store sales. They suggest holding any future events later in the cooling season when it is more likely to be hot and customers are more likely to be shopping for RAC.

The program uses a variety of methods to market the program. According to the surveys taken at the time of participation, bill inserts were by far the most common way that pick-up participants heard about the ARP, while turn-in participants heard about the program primarily through newspaper advertising. The telephone surveys confirm these findings. Requests for appliance pick-ups were generally tied to marketing efforts, with calls increasing after bill inserts were mailed. However, the effectiveness of bill inserts declined over time, leading to the increased use of other forms of advertising. For example, while bill inserts alone boosted calls among UI customers when the program began in June of 2004, by the fall of that year UI had to turn to both bill inserts and newspaper advertisements to produce similar call volume.

Program Processes

A number of quality control mechanisms are in place to insure adherence to the five program eligibility requirements. These requirements are that:

- The participant is a customer of CL&P or UI
- The unit is at least ten years old
- The RF or FZ is at least seven cubic feet
- The unit is functional
- RF are secondary units
- The number of units allowed is not exceeded

Quality control mechanisms include:

- Verifying eligibility through customer account numbers
- Verifying age based on the experience of ARCA staff or nameplate information
- Plugging the unit in to make sure it operates
- Verifying that customers have not bought a new RF in the past year
- Allowing program staff members to accompany the truck on pick-ups and to visit the ARCA facility where demanufacturing occurs.

Account number in the ARCA pick-up database all belonged to customers of UI or CL&P; the turn-in database did not include account numbers, so NMR was unable to verify that this requirement was being met. Furthermore ARCA informed NMR that the age field in the tracking database may include errors due to computer program default values. Customers reported that nearly all RF and FZ were over ten years old, although more RAC (about 25%) were reported to be younger the required ten years. Participants report that nearly all the units retired met the requirement that they work when plugged in; many of the units, however, were not working well, although this could imply that they were energy hogs. Over one-fourth (28%) of RF retired through the program were reported by telephone survey respondents to be primary units; of course, most of these units have been replaced. This frequent violation of one of the key program requirements suggests that some customers are less than honest during the

screening process. ARCA and the program may have to find another way of verifying that the unit was truly a secondary one. Finally, we found that product limits for RF and FZ were respected; participants were, however, often allowed to turn in or have more RAC picked up.

Staff members also had concerns that retailers were gaming the system by telling customers who purchase a new appliance to call the ARP for the pick up. NMR found that customers rarely found out about the ARP through retailers; therefore, we do not believe retailer gaming is a serious concern. We do however find evidence for another of the staff's concern: that some units were not being used by participants prior to the surrender. Seven percent of RF and 16% of FZ were not plugged the year prior to surrender, and 30% of RAC were extremely unlikely to have been used in the summer of 2004.

Program staff members believe that program staffing and budgetary resources are adequate. ARCA staff points out that a larger budget could increase accomplishments. No staff members reported difficulties in communications between the various program actors, including program staff, the implementation contractor, turn-in event retailers, or printers, among others.

Program Tracking

In general, current program tracking appears adequate to determine the impact of the ARP. Observed errors in both the pick-up and turn-in tracking databases are likely the result of data entry; automated range checks could help ARCA find and correct these errors. Tracking EER for RAC and additional information on non-energy benefits, among other items, would provide for an even greater accounting of program impacts, including energy savings and environmental benefits. Store managers also suggest finding a way to measure the impact of turn-in events on the sales at participating stores.

Key Conclusions

The process analysis has uncovered clear strengths of the ARP. One of these strengths—especially from a program planning and implementation perspective—is the turnkey nature of the ARP. Because the program is essentially "ready made," it requires little utility administration, and the volume can be directly managed via marketing and advertising. Furthermore, staff members argue that the ARP promotes positive relationships and good will with customers. Staff members also state that ARCA is a solid vendor who reflects well on the utilities. The survey responses confirm that respondents found the process of retiring the units to be easy and the location of the turn-in events to be convenient. Respondents also had few problems scheduling pick-ups, and most customers had their appliances picked up within two weeks of first contacting the program. Finally, the program staff reports that all the key players—the sponsors, ARCA, and retailers participating in turn-in events, among others—have positive working relationships and have no problems with communication.

The program, however, suffers from three primary weaknesses. First, participation at turn-in events is unpredictable and largely dependent on the weather. Events held on warm, sunny days often have high levels of participation while those held on cooler, rainier days draw few participants. The unpredictable participation not only affects the success of the program from the standpoint of the sponsors, but it also limits the benefits to retailers who allow events to be

held in their parking lots. Although retailers have expressed willingness to host future events, they suggest holding them later in the cooling season. Retailers also admit that they will remain skeptical about the turn-in events unless a way can be found to insure that participation will lead to increased sales in their stores. Second, the program cannot control customer behavior before or after the program nor influence motivations for participation. Many participants retire units that they already wanted to get rid of and/or replace those RF or FZ that they retired. Finally, the bill inserts bring in fewer retirements over time, forcing the sponsors to pursue less cost-effective marketing approaches, such as television and radio advertising. Together, these three weaknesses will limit the energy savings and cost-effectiveness achieved by the program.

1 Introduction

This report summarizes the results of the process evaluation of the Connecticut Appliance Retirement Program (ARP) completed by Nexus Market Research, Inc. (NMR). The process evaluation is part of larger impact, process, and market study that NMR and RLW Analytics, Inc., are conducting for Northeast Utilities – Connecticut Light and Power (NU CL&P) and The United Illuminating Company (UI).

The process evaluation focuses on the following topics:

- Program theory and logic, including a logic model
- Program design and development
- Program implementation, including delivery, steps to participation, and assessment of the program implementation
- Program processes
- Program tracking

We relied on three different methods to conduct the process evaluation. First, we conducted interviews with program planning and implementation staff, as well as staff of the implementation contractor (ARCA). Two shorter interviews were also conducted with managers of stores that participated in turn-in events. Second, we reviewed the tracking databases and analyzed the data contained within them. Finally, we conducted telephone surveys with both participants and non-participants; some of the questions included in the surveys are directly related to program processes.[2] The three methodological components were conducted separately, but in coordination with each other. Furthermore, the results obtained via each method inform those of the other two. Therefore, we organize this revised report based on evaluation topics, not on data source. To the extent possible, we will discuss the results of the three methods simultaneously, stressing the degree to which they display convergent validity—that is, point to similar outcomes or findings.

2 Program Logic

The goals of the ARP, as outlined in the *Request for Proposals* and discussed by program planning and implementation staff, are:

1. To remove older, secondary refrigerators (RF) as well as freezers (FZ) from customers' homes while preventing them from entering the secondary market
2. To encourage customers to replace older room air conditioners (RAC) by providing point-of-purchase incentives for new ENERGY STAR-qualified RAC

[2] In this report, we focus only on the questions most directly related to the process analysis. Other results, as well as more detail on some of the findings briefly summarized here, were included in a report delivered on October 31, 2005.

Staff members also perceive these additional goals:

3. Provide environmentally correct disposal of units
4. Influence the manufacturers, retailers, and municipalities to improve disposal practices for secondary units
5. Improve the efficiency of the existing inventory of secondary appliances
6. Reduce supply of secondary units and influence customers (primarily landlords) to purchase new units

The ARP staff identified three potential barriers that prevent many customers from retiring appliances on their own. These barriers include:

- Inconvenience: the hassle involved in finding a site that will receive the appliance and then actually moving and transporting the often heavy unit from the basement, garage, or other room in the home to the site.
- Disposal costs: Some towns or other entities (e.g., stores delivering new appliances, disposal companies, charities) may charge a fee to pick up or accept large appliances, or they many only occasionally accept the appliances.
- Ignorance of operating costs: Customers may not be aware that old appliances can be very inefficient and have long operating hours, contributing to high electricity bills.

The results from the telephone surveys of participants and non-participants provide mixed support for the "real world" prevalence of these barriers.[3] The results clearly indicate that customers are ignorant of the operating costs. Neither participants nor non-participants had any idea what it costs to run a 15-year old refrigerator for a year. Of course, as a reviewer of this document has pointed out, most people—including many in the energy-efficiency field—could not answer this question accurately. Yet, this fact only serves to emphasize the point—people are running extra refrigerators in their homes, and they have no idea how much it is costing them to do so.

The telephone survey results also suggest that disposing of an appliance that one is not replacing and doing so in a responsible manner can be inconvenient. In particular, very few respondents told us that they would have continued using their appliance if the ARP had not been available.[4] This finding leads to the conclusion that most participants had already wanted to dispose of their appliance before participation but had failed to do. We did not ask them why they had not gotten rid of the appliance prior to participation, but one may assume that the inconvenience—including taking steps to identify a way to get rid of the appliance—likely underlies the failure of many participants to dispose of these appliances outside of the program.

However, the very few non-participants who disposed of RF, FZ, or RAC since May of 2004 told us that they generally found it was easy to do so. This fact initially seems to contradict the assumed program barrier regarding the inconvenience of disposing of an appliance. Further

[3] More detail on many of these findings, including sample sizes and data tables, are contained in the survey results report submitted on October 31, 2005.
[4] We must note that these intentions do not mean the participant would have actually followed through with the alternative method of disposal.

questioning, however, made clear that these non-participants largely found it easy to dispose of their appliances because many RF and FZ were picked up by retailers upon delivery of a replacement unit; RAC were simply put out in the trash. Based on the experiences of non-participants, it does not appear, however, that the cost of disposal is a substantial barrier. Of the handful of non-respondents charged to get rid of their appliance, the charges generally ran around $25 for RF and $15 for RAC and FZ.[5] It is more likely that those wishing to retire and not replace an appliance may be charged for the removal of the appliance, but the evidence suggests that the charges are relatively minimal.

In summary, the survey results suggest that inconvenience may be a real barrier to appliance disposal—and most likely recycling—particularly if the unit is not being replaced or put into the trash. This inconvenience, even if only perceived, may keep some customers from taking the steps necessary to dispose of a secondary RF or a FZ or RAC. Furthermore, even if customers do not really need or want the appliance anymore, they may continue to keep the units plugged in because of their ignorance of the true costs of running them. The cost of disposal, however, does not seem to be a major barrier.

The program seeks to reduce these actual or perceived barriers in three primary ways. First, the ARP provides convenient ways for customers to dispose of their secondary RF or their FZ and RAC, either by picking the product up at the customer's home or by hosting turn-in events. Second, the ARP pays customers to get rid of their appliances. Third, the program provides marketing materials that stress the fact that older appliances use substantial amounts of energy. The program logic reflects the program goals, the barriers that keep products from being recycled, and the ways in which the program seeks to reduce those barriers.

2.1 Logic Model

This section provides an overview of the various elements of the logic model, as summarized in Table 2.1. These include the program activities and outputs as well as the anticipated short-term, mid-term, and long-term outcomes of the programs.

Program Activities. These items include the five major components of the program: marketing, pick-up, turn-in events, demanufacturing, and payment of customer incentives.

Program Outputs. These items include measurable outputs of the five program activities, including bill inserts, stores participating in turn-in events, calls to ARCA, RF demanufactured, and incentives issued to customers.

Short-term Outcomes. These outcomes may be evident within the first one to three years of program operation. Such outcomes include increased awareness of the program, customer recognition of high operating costs of older secondary units, purchase of ENERGY STAR-qualified RAC, reduced supply of used appliances, energy savings, demand savings, and participant recommendation of the program to other customers.

[5] Of course, non-participants may have shopped around for a free or cheap way to dispose of their appliance; however, one would assume that, had they shopped around, non-participants would have said it was more difficult to find a way to get rid of their unwanted appliances.

Mid-term Outcomes. These outcomes, which may be evident within the first three to five years of program operation, include increased penetration of ENERGY STAR-qualified RAC, improved disposal practices, reduction in the secondary market for appliances, persistence of achieved energy savings and demand savings.

Long-term Outcomes. These outcomes may be evident after five years of program operation. Several of the mid-term outcomes should extend into a longer timeframe; otherwise there are no targeted long-term outcomes for the program beyond the persistence of achieved energy savings and demand savings. Unless the program continues to operate (either on an intermittent basis or a continual basis), the market is eventually expected to "snap back" to its original condition, with updated RF and FZ models replacing the older models that have been removed.

Table 2.1: Logic Model

Program Activities	Program Outputs	Short-term outcomes (1-3 years)	Mid-Term Outcomes (3-5 years)	Long-term Outcomes (5+ years)
Marketing	Bill inserts Radio ads TV ads Print ads Press releases Banners on trucks	Increased customer awareness of program Customers participate in program Customers recognize high operating costs of older secondary units		
Turn-in events	Turn-in events held Stores participating RAC units turned in	Retailers demand improved disposal practices Customers purchase ENERGY STAR RAC Consumers value new models over used models	Improved disposal practices by contractors Increased penetration of ENERGY STAR RAC	
Pick-ups	Calls to ARCA RF units picked up FZ units picked up RAC units picked up DH units picked up	Customers do not replace secondary units		
Demanufacturing	RF units demanufactured FZ units demanufactured RAC units demanufactured DH units demanufactured	Proper disposal of units Secondary units removed from market leads to supply constraints Energy savings Demand savings	Improved disposal practices by contractors Reduced secondary market for appliances Energy savings persist Demand savings persist	Energy savings persist Demand savings persist
Incentives	RF/FZ incentives issued RAC/DH incentives issued	Customers recommend program to relatives, friends, neighbors		

3 Program Design and Development

The Appliance Retirement Program was first conceived by DPUC staff in order to reduce kW demand in southwestern Connecticut (SWCT). It was originally designed by utility staff as a program to collect used appliances directly from retailers who had picked the units up from customers' homes when delivering new units[6]. However, DPUC staff preferred that the program work directly with customers; thus the program was redesigned to pick up units directly from customers' homes and host turn-in events at retail stores.

Incentive levels were established to be sufficient to encourage participation, but also justified by the estimated level of energy savings. Incentive levels or RF and FZ were set at $50. In 2004, retirement incentives of $25 for RAC were offered; however, each participant at turn-in events was also eligible to receive an additional $25 toward a new ENERGY STAR model. In 2005, the RAC retirement incentive remained at $25, but turn-in participants could instead opt for a $35 rebate towards the purchase of a new ENERGY STAR model instead of taking the $25 retirement incentive.

In addition, in 2004, the program provided for pickup of dehumidifiers in both the CL&P and United Illuminating UI service territories.[7] In 2005, UI elected to discontinue the pickup of dehumidifiers in homes due to the cost structure of the contract, although CL&P still allows customers to do so if a RF or FZ is being picked up.

3.1 Staff Assessments of the Program

Most staff members believe that the ARP will succeed in reducing the number of secondary RF in customers' homes. However, they also expect that the market will "snap back" to its original condition in the absence of the program, with more modern secondary appliances replacing the older models.

Staff also believes that the program is both known and well-respected in the market, leading to positive relationships with retailers and customers. In addition, the pick-up program is perceived as a solid, turnkey design that operates smoothly. However, as one staff member noted, while the program is well-designed, there are concerns about whether the removed units were actually being used in the homes prior to their surrender. This concern underlies certain quality control features, which are discussed below. We will also address the degree to which these concerns have merit, at least as determined by responses to the participant survey.

Utility staff believes that the greatest strengths of the program are its turnkey nature, which requires little utility administration and whose volume can be directly managed via marketing

[6] Note that one staff member thought that such a direct intervention approach with retailers would only obtain older, broken down units. This is based on the assumption that the working units picked up would get sold by the individuals actually hauling the appliances and exchanged for broken down models before the units arrived at the retail store. The weak link in the process is the appliance delivery team, as they can earn more money selling old units than they actually get paid to pick up and deliver new ones.

[7] Only 274 dehumidifiers were retired through the program. Due to their small numbers, the sponsors directed NMR not to include dehumidifiers in their evaluation of the ARP.

and advertising. In addition, staff members cite the development of positive customer relationships and good will, and that ARCA is a solid vendor who reflects well on the utilities.

In terms of weaknesses, program staff mentions the large number of uncertainties involving expected energy savings, thus making the impact of the program questionable. As one staffer said, "The program acquires friends not resources." In addition, staff notes that the program is expensive to operate, particularly the turn-in events that also have had inconsistent participation levels. In fact, after these interviews were conducted, the sponsors and the DPUC decided to discontinue turn-in events. Lastly, generating a consistent volume of pick-up calls in order to maintain a solid work force is challenging for ARCA management, as the peaks and valleys can be difficult to manage.

4 Program Implementation

This section describes program delivery, particularly from the perspective of the program staff. We then describe the steps that customers must take to become ARP participants and provide further detail about staff, participant, and non-participant opinions in relation to those steps.

4.1 Program Delivery

There are two major program tracks: the pick-up portion and the turn-in events. These two tracks will be discussed separately as they operate in different manners.

4.1.1 Appliance Pick-up

In the pick-up mode of delivery, customers become aware of the program through any of the marketing channels discussed below. In order to schedule pick-ups, customers primarily call the program's toll-free phone number (94% of those retiring RF and 95% of those retiring FZ, according to the telephone survey of participants), although some customers also schedule via the sponsors' 1-800 phone numbers or websites or the ARCA website. The customers are asked some screening questions, including their utility and if they have purchased a new appliance within the last year. The latter question attempts to discourage the retirement of primary units that are being replaced.

Once their appliance is approved as eligible for the program, the customer selects an appropriate pick-up time usually two or three weeks ahead. Customers select from the available time slots, within a four-hour window during which the ARCA team will arrive. Most customers accept this type of "window" scheduling due to past experience with cable and telephone service, although some customers dislike taking time off from work to wait at home.

After arriving at the home, ARCA staff will cut the cord for the unit before it is moved out of the house. Once the unit is inside the truck, they smash the temperature control. Both of these tasks are done in order to ensure that the unit is properly disposed of, and not re-sold on the secondary market. An "X" is painted on the unit and then tagged with an ARCA work order number. The units are driven to the ARCA facility where they are demanufactured. Customers typically receive their $50 checks within four to six weeks.

4.1.2 Turn-in Events

Turn-in events are designed to make it easy for customers to retire older RAC and to provide incentives for them to purchase ENERGY STAR-qualified units. CL&P sponsored three turn-in events in 2004 and four in 2005; UI sponsored eleven in 2004. Planning for these events begins with the scheduling of the event date with the sponsoring retail store several months in advance of the event.

At the event, a traffic flow plan utilizing a drive-through model is put in place. This allows the program staff to greet customers and unload RAC units from customers' vehicles. Then the customers park and exit their cars to complete necessary paperwork. Customers are also asked if they are a CL&P or UI customer and the town in which they live. Eligibility is checked by comparing information on driver's licenses with addresses tied to account numbers. While the customer completes the paperwork, a staff member plugs the unit into a generator to ensure that it is operational. In addition, the staff member "eyeballs" the unit to determine whether it is at least ten years old; he or she also records the unit's nameplate data. Once the customer and the unit are approved, the staff member cuts the cord on the unit and loads it onto the truck. In 2005, if the customer has opted for the rebate coupon, he or she immediately receives the form. Alternatively, customers receive their $25 check in the mail a few weeks later if they choose only the surrender incentive.

4.2 Steps to Participate

There are four major steps that customers must take to participate in the ARP. They must:

1. Become aware of the ARP through program marketing, primarily bill inserts for the pick-up mode and advertising for the turn-in events.
2. Be persuaded to participate in the program, either because of the convenience, the incentives, or the energy savings.
3. Decide to participate: The customer takes action by calling the toll-free phone number, ordering a pick-up on-line at the program website, or by planning to attend the turn-in event.
4. Dispose of appliance by staying home during the scheduled pick-up time or traveling to a turn-in event with the unit.

This section of the report addresses the major aspects of program implementation that seek to ensure that some customers actually participate.

4.2.1 Marketing and Recruitment: Becoming Aware of the Program

The program uses a variety of methods to recruit customers, including the following:

- Bill inserts
- Radio advertising
- Print advertising
- Press releases
- Banners on trucks
- TV advertising

According to staff, the primary method for recruiting customers is the utility bill insert, which staff members agree is the most cost-effective option. However, as the effectiveness of bill inserts has declined over time, other marketing approaches have been tried, including TV and radio advertising. This is particularly true for UI, which has ramped up marketing levels this year in order to meet the volume goals. In addition, press releases were typically issued for turn-in events, and the events utilized cooperative advertising with sponsoring stores in order to promote the events. Lastly, UI's Smartliving Center is an avenue for promoting the ARP to customers. Overall, staff believes that the program is strongly marketed and that the marketing strategy is balanced and effective.

Customer responses to surveys taken at the time of participation confirm the importance of bill inserts for alerting customers about the pick-up mode of delivery.[8] Three-fourths of respondents to surveys taken at the time of appliance pick-up indicate that they heard about the program through a bill insert. (Table 4.1) The percentages are higher in SWCT and among UI customers. This is to be expected, given the emphasis of the program on SWCT; furthermore, all of UI's territory is in SWCT.

Table 4.1: How Pick-up Participants Heard About Program, Pick-up Survey
(Base = customers surveyed at time of pick-up)

	Total			CL&P			UI		
	Total	SWCT	Other	Total	SWCT	Other	Total	SWCT	Other
n	9,446	6,179	3,267	5,942	3,032	2,910	3,504	3,147	357
Bill Insert	75%	80%	65%	68%	73%	63%	86%	86%	86%
Utility Representative	9	6	14	13	11	16	1	1	1
Friend/neighbor	8	7	9	9	8	10	5	5	4
Appliance Dealer	3	3	3	3	3	3	3	2	4
Television	2	1	5	3	1	5	0	<1	0
Newspaper	1	2	<1	0	0	0	3	3	4
All Other	3	2	3	3	3	4	2	2	2

[8] Because they are based on population data, we do not conduct tests of statistical significance for the surveys taken at the time of participation. The sponsors supplied turn-in survey data only for the events held at Norwalk and Waterbury, so the results are only indicative of participants in these two events.

In contrast, no customers participating at the Norwalk or Waterbury Turn-in Events said they heard about the program through bill inserts. (Table 4.2) Instead, they typically heard about the program through newspaper advertisements. A fifth of the participants at the Norwalk event had heard about the program through an in-store flyer.

Table 4.2: How Turn-in Participants Heard About Program, Turn-in Survey

(Base = customers surveyed at Norwalk and Waterbury Turn-in Events)

	Total	Norwalk	Waterbury
n	655	304	351
Newspaper	67%	55%	78%
Store flyer	10	20	1
Radio	8	9	7
Word of mouth	7	8	7
Drive by/noticed tent	5	7	4
Television	2	0	3
All other	1	2	1

While the surveys taken at the time of participation limited customers to one response, the telephone survey allowed respondents to name more than one way that they heard about the program. The telephone surveys confirm, albeit at smaller percentages, that pick-up participants typically heard about the program through bill inserts. (Table 4.3) Many also heard about the program through the newspaper or through word-of-mouth. Likewise, the telephone survey respondents who had participated in turn-in events reported hearing about the program through newspaper advertisements, again confirming the findings from the surveys taken at the time of participation. Although the telephone survey points to similar findings, there are differences in the relative importance of the methods of hearing about the program. It must be remembered that the telephone surveys were conducted at least eight and as long as fourteen months after customers had participated in the program. Therefore, respondents may no longer accurately recall how they heard about the ARP.

Table 4.3: How Participants Heard About Program, Telephone Survey
(Base = participant respondents, multiple response)[a]

	Total	Pick-up	Turn-in[b]
n	600	441	159
Bill Insert	44%	54%	14%*
Newspaper	28	17	60*
Word-of-Mouth	11	12	7*
Television	3	4	1*
Store Flyer	2	2	2
Appliance Dealer	1	1	2
Radio	1	1	1
Salesperson	1	1	2
Internet	1	1	0*
Saw Tent	1	<1	2
Utility Web Site	<1	<1	1
Utility Representative	<1	<1	1
Advertisement on Truck	<1	<1	1
Don't Know	10	9	10

* Significantly different from pick-up participants with 90% confidence
[a] Total percentages may exceed 100% due to multiple responses.
[b] The seven respondents who participated in both modes have been collapsed with turn-in participants.

We also asked non-participants if they were aware of the program. Of the 505 non-participants surveyed, 28% were aware of the program. (Table 4.4) There were no statistically significant differences in awareness among non-participants.

Table 4.4: Awareness of Program among Non-Participants, Telephone Survey
(Base = non-participant respondents)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	505	252	177	75	253	177	76
Aware	28%	25%	30%	22%	30%	33%	27%

Like participants, bill inserts served as the main avenue through which non-participants learned about the program. (Table 4.5) Respondents from the sample not matched to participants on energy use (i.e., the unmatched sample) were significantly more likely to report having heard about the program via word of mouth than were those from the unmatched sample.

Table 4.5: How Non-participants Heard About the Program, Telephone Survey

(Base = non-participant respondents aware of the program, multiple response)[a]

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	143	68	52	16	75	55	20
Bill Insert	48%	53%	55%	50%	47%	48%	45%
Newspaper	9	7	8	6	10	10	10
Word-of-Mouth	14	4*	3	6	19†	20	19
Television	7	9	7	13	5	2	10
Store Flyer	1	2	3	0	0	0	0
Appliance Dealer	4	6	0$	13∞	3	2	5
Radio	4	5	9	0	4	7	0$∞
Utility Representative	0	1	1	0	0	0	0
Advertisement on Truck	<1	0	0	0	1	1	0
Other	2	6	6	6	0*†	0	0
Don't Know	10	10	14	6	11	12	10

* Significantly different from total at the 90% confidence level
† Significantly different from CL&P at the 90% confidence level
$ Significantly different from Overall within group at the 90% confidence level
∞ Significantly different from SWCT within group at the 90% confidence level
[a] Total percentages may exceed 100% due to multiple responses.

Understanding the connection between marketing and product pick-ups—i.e., flow management—is important because the program must balance the competing concerns of keeping ARCA staff occupied while still cost-effectively generating leads and maintaining reasonable wait times for customers. Staff members believe that program activity is very closely tied to marketing; for example, they argue that the volume of pick-up calls increases after bill inserts are mailed out.

The pick-up tracking database allows for an assessment of the connection between marketing and requests for pick-ups. As shown in Table 4.6, in 2004 the greatest number of requests for pick-ups of products from the CL&P service territory occurred in October, with the greatest number of pick-ups occurring the next month, in November. The requests for pick-ups in the UI territory generally occurred in June, with the greatest number of pick-ups occurring in August. Although we do not have comparable information for CL&P, UI sent bill inserts in June and again in September and advertised the program in two area newspapers at the end of October. The June bill inserts in particular seemed to stimulate requests for pick-ups, while the combination of the September bill insert and October newspaper advertisement may account for the jump in requests in October.

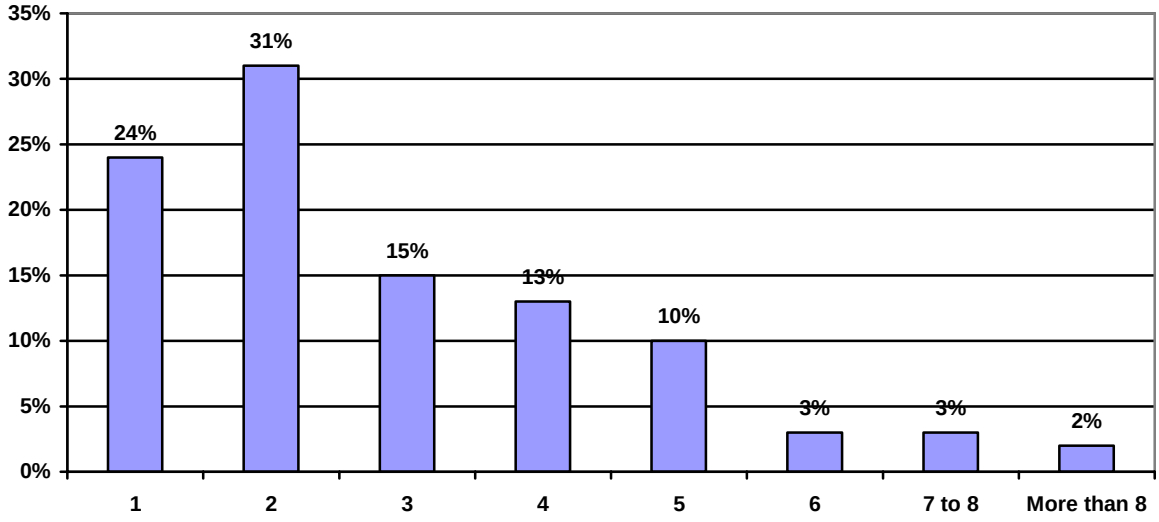
Table 4.6: Dates of Request for and Actual Pick-Up of Appliances, 2004

(Base = products picked up)

	Request	Pick-Up
CL&P # products	7,367	7,367
June	11%	1%
July	10%	9%
August	19%	19%
September	14%	22%
October	29%	17%
November	12%	23%
December	4%	9%
UI # products	4,022	4,022
June	22%	2%
July	19%	18%
August	17%	29%
September	14%	17%
October	19%	18%
November	7%	11%
December	2%	5%
Total # products	11,389	11,389
June	15%	1%
July	13%	12%
August	18%	23%
September	14%	20%
October	26%	18%
November	11%	19%
December	3%	7%

After contacting the program, participants generally did not have to wait long to have their appliance(s) picked up. As Figure 4.1 shows, over half of the appliances (55%) were picked up within two weeks after the initial request occurred. Within six weeks, 95% of appliances had been picked up by ARCA.

Figure 4.1: Elapsed Time between Request and Pick-up



The median length of time between the request for pick up and the actual pick up are summarized by utility and targeted areas of the state in Table 4.7.[9] Appliances in the non-targeted towns in the CL&P area were generally picked up the fastest, while those in targeted UI area took the longest to be picked up. It took two days longer to have appliances picked up in the CL&P territory than in the UI territory.

Table 4.7: Median Elapsed Number of Days between Request and Pick-Up
(Base = products)

	Total		CL&P		UI	
	n	Median	n	Median	n	Median
All products	11,389	13.0	4,022	15.0	7,367	13.0
Targeted	7,612	16.0	3,613	16.0	3,999	15.0
Not Targeted	3,777	11.0	3,754	11.0	23	14.0

In 2005, the sponsors, particularly UI, had to increase their marketing efforts to achieve volume goals. The ARP staff members anticipate that recruitment efforts will be more challenging in 2006. In order to measure the market transformation-oriented goals, staff suggest that declining participation may serve as an indicator that the program has reached most of the individuals who are most likely to participate—the "low-hanging fruit." Given the slow-down in requests for pick-ups and the expectation that the market will "snap back," meaning that secondary appliances will again build up in customers' homes, some staff have suggested that the program should be offered on a periodic, high-volume basis (every few years) rather than on a continual, low-volume basis. In contrast, ARCA staff members suggest that the market is large and has

[9] We use the median here instead of the mean because the distribution is right skewed, meaning that most pickups occurred soon after the request, but a few people had to wait a long time. When a distribution is skewed, the median is a better measure of "central tendency" (i.e., the middle) than is the mean, because a few values at the tail can have a strong impact on the mean. For example, the mean wait time was 17 days, but the median was 13. This is because a few products took quite a long time (up to 153 days) to get picked up.

been only lightly penetrated by the ARP. However, the ARCA staff members seem to agree that the program should aggressively pursue secondary appliances for a few years then scale back operation, otherwise the program risks becoming a waste management service for towns or a sales support service for retailers.

4.2.2 Reasons for Participation

Staff members believe that customers choose to participate in the program because they get paid to have the program remove their "old junk" and essentially help clean out their basement or garage. The staff also says that some customers participate because of the incentive, because they believe in the environmental benefits, or because it is the right thing to do.

Based on answers given to the surveys taken at the time of pick-up, over half of the participants took part in the ARP because it provided a free way to get rid of their appliances. (Table 4.8) This fact—and others to be discussed below—largely confirm the staff's impression that customers are using the program to dispose of their unwanted appliances. However, this fact does not necessarily mean that these respondents were free riders; by choosing to take part in the program rather than use some other method of disposing of their appliances, participants are keeping their appliances out of the secondary market.

Table 4.8: Reasons for Participation, Pick-up Survey

(Base = customers surveyed at the time of pick-up, multiple response)[a]

	Total	CL&P	UI
n accounts	9,619	6,066	3,553
Free Pick-up	54%	53%	55%
Savings on Electric Bill	35	34	36
Energy Conservation	31	31	31
Customer Incentive	31	31	30
Recycling of Appliance	22	20	25
No response	7	8	5

[a] Column percentages exceed 100% due to multiple responses

The information in Table 4.8 also shows additional reasons that participants took part in the ARP. About one-third of participants also cited the savings on their electric bill, energy conservation, and the customer incentive. About one-fifth named the actual recycling of the appliance. These five responses were the only ones included in the ARCA tracking database; we are not certain whether the ARCA survey allowed only these responses, or if the customer-service representatives fit all responses into one of these five categories.

Respondents to the participant survey were asked an open-ended question about why they decided to retire each product through the ARP. The open-ended nature of the question produced a wider range of reasons for participation. (Table 4.9) Overall, the responses again confirm the staff's expectation that participants retire units they no longer want. We have shaded those responses in the table.[10] Overall, 56% of those RF retired, 58% of the FZ, and 40% of the RAC retired through the program were already considered "unwanted units." Please note that we do not include the purchase of energy-efficient models or those that save money because these could imply the purchase of an ENERGY STAR-qualified appliance. Counting the units replaced for these reasons would increase the percentage of "unwanted" units.

Table 4.9: Why Decided to Participate, Telephone Survey

(Base = all respondents who surrendered each appliance, multiple response)

	Refrigerator	Freezer	Room AC
n	333	158	221
Didn't need it any more	22%*	35%*†	9%
Incentive to surrender	20*	14*	28
Old unit not working well	16	14	19
Bought a new unit	13	7†	11
Bought an energy efficient unit	8*	7*	19
Saves me money	7	7	7
Easy to turn in	6	7	8
Better for environment	4	6	6
Cost too much to have picked up	4*	2	1
No other way to get rid	3	6	3
Bought model that saves money	3	3	4
Moving soon	<1	4*†	0
Other	2	1	1
Don't know	3	1	2
Unwanted per participant[a]	56%	58%	40%

[a] Counted if customer named any one of the responses indicating the unit was no longer wanted.
* Significantly different from room air conditioners at the 90% confidence level
† Significantly different from refrigerators at the 90% confidence level

Those retiring a RAC were more likely to state that the incentive was behind their purchase. Given that another 19% said they purchased a new unit, we believe it is safe to assume that the greater importance of the incentive for RAC reflects the combination of the retirement and purchase incentives.

[10] Here we believe it is worth taking a moment to discuss the response that the unit was not working well. "Not working well" is different than "not working at all." A unit that is not working well may still be in use and running nearly all the time in order to keep the appliance at desired levels of coolness. The program would certainly want to remove these units from use.

Although not always the most important driver, the results presented above suggest that customer incentives play a role in increasing participation in the ARP. The data summarized in Table 4.10 confirm that the incentive only had moderate influences on participation. About one-third of the respondents retiring RF and FZ who also recall receiving the incentive rated it as very important to their decision to participate, the means hovered at six on the zero to ten scale. While the incentive was less important to those retiring RAC through the pick-up mode, it was rated as important to those who took part in the turn-in mode. The differences between RAC surrender modes are statistically significant. Although we stressed in the interviews that the incentive was only for the product retirement, the difference in the importance of the rebate between those participating in each surrender mode suggests that the turn-in participants may not have cognitively separated the $25 retirement incentive from the $25 purchase incentive.

Table 4.10: Importance of the Incentive to Participation in ARP, Telephone Survey

(Base = Participants recalling receipt of incentive)

	RF	FZ	RAC-PU	RAC-TI
n	328	155	62	151
Not Important (0 – 3 rating)	23%	27%	33%	21%
Moderately Important (4 – 7 rating)	36	35	43	27
Very Important (8 – 10 rating)	39	36	23	51*
Mean	6.0	5.7	4.8	6.5*
Median	5.2	5.0	5.0	8.0

* Significantly different from pick-up mode at the 90% confidence level

We also asked the handful of non-participants who both retired products and were aware of the program why they elected not to participate. (Table 4.11) The primary reason was being unaware of the program at the time, followed by appliance stores removing refrigerators, suggesting that they had disposed of the appliances when buying new ones. Only one person said that the program did not pay enough money.

Table 4.11: Why Non-Participants Decided Not to Participate, Telephone Survey

(Base = non-participants aware of program who disposed of appliance outside of program, multiple response, number of responses)

	RF	FZ	RAC
N	21	4	9
Didn't know about program at time	8	2	4
Appliance store removed	5	0	0
Didn't know took particular appliance	1	0	2
Turn-in event not convenient	0	0	1
Not enough money	1	0	0
Told not eligible	0	0	1
Other	0	1	0
Don't Know	6	1	2

4.2.3 The Act of Participation

According to the tracking databases, 9,793 participants (counted by their account number) retired 7,467 RF, 2,895 FZ, and 1,028 RAC through the pick-up mode of delivery in 2004. (Table 4.12)[11] An additional 4,847 RAC were surrendered by customers at turn-in events held in 2004. About a third of RF (37%) and FZ (37%) were picked up from UI customers. Customers of UI surrendered 22% of the RAC picked up and 47% of those turned in. These percentages seem reasonable given that customers of UI make up 21% of the combined UI and CL&P customer base, and that all of the UI territory is either critical or constrained. Furthermore, UI held a greater number of turn-in events than CL&P in 2004, and all turn-in events sponsored by both utilities were held in targeted towns.

Table 4.12: Number of Products Retired through the Program, Tracking Databases

		RF	FZ	RAC-PU	RAC-TI	Total
CL&P	Targeted	2,385	918	310	1,545	5,158
	Not Targeted	2,344	917	494	1,039	4,794
	Total CL&P	**4,729**	**1,835**	**804**	**2,584**	9,952
	% Targeted	**50%**	**50%**	**39%**	**60%**	**52%**
UI	Targeted	2,722	1,054	223	2,179	6,178
	Not Targeted	16	6	1	84	107
	Total UI	**2,738**	**1,060**	**224**	**2,263**	6,285
	% Targeted	**99%**	**99%**	**100%**	**96%**	**98%**
OVERALL	Targeted	5,107	1,972	533	3,724	11,336
	Not Targeted	2,360	923	495	1,123	4,901
	Total Overall	**7,467**	**2,895**	**1,028**	**4,847**	16,237
	% Targeted	**68%**	**68%**	**52%**	**77%**	**70%**

Furthermore, program participation reflects the focus on critical and constrained towns in SWCT in other ways. Although about 36% of the CL&P territory is in targeted areas,[12] one-half of all RF and FZ surrendered by CL&P customers and 60% of air conditioners turned in came from targeted areas. Likewise, at least 96% of all units surrendered from the UI territory were from SWCT.[13] Only the percentage of RAC picked up from CL&P targeted areas seems low. However, as there were no turn-in events outside of SWCT, these CL&P customers had the option of driving somewhat longer distances or of having RAC picked up along with RF or FZ if they wanted to participate in the program. The lack of turn-in events in much of CL&P's service

[11] Note that NMR requested data based on participation date, not on the date that ARCA billed CL&P or UI. Therefore, our totals differ from those reported in the RFP.

[12] We base the 36% on the proportion of CL&P customers living in critical and constrained communities as counted using the U.S. Census Bureau numbers. Source: Census of Population and Housing 2002, as reported on the American Factfinder and State and County Quickfacts websites of the U.S. Census Bureau.

[13] In reality, the fact that the entire UI territory is targeted should mean that 100% of units retired were from critical or constrained communities. We believe that the few that were not identified as being from targeted towns may in fact have been. It is possible that customers listed an informal community name not on the list in their address, even though that community may officially be within the boundaries of the targeted town. Alternatively, ARCA or the customer may have incorrectly identified the participant's community or utility.

territory may also explain why over one-half of the RAC picked up were surrendered by non-targeted customers.

4.3 Assessing Program Implementation

Program staff, turn-in event partners, and participants were asked to assess program implementation. In particular, program staff and turn-in event partners were asked to discuss the strengths and weaknesses of the program implementation, while participants were asked to rate the ease and convenience of participation and to describe any difficulties they encountered.

4.3.1 Assessing the Pick-up Mode

Program staff indicates that the ARP had to work through some issues during the first six to eight months of program operation, primarily regarding scheduling and routing. After this period, the program established smooth operations. Staff members report few problems with the process and note that there were only a handful of customer complaints, usually about being rejected through the screening process, scheduling difficulties (due to customers' schedules), or because the program will not pick up RAC and dehumidifiers alone. Overall, program staff believes the pick-up program is turnkey—a ready-made program requiring little support from utility staff. In addition, the pick-up program generates good public recognition and good will for the utilities.

In support of the staff assessments, the telephone survey results show that customers find it very easy to schedule the pick-up of their appliances. (Table 4.13) The 442 participants who recall having at least one appliance picked up gave an average rating of 9.3 on a zero-to-ten scale regarding the ease of scheduling the pick-up of their appliances. The median of ten indicates that over half of the respondents rated the ease with a ten, or extremely easy.

Table 4.13: Ease of Scheduling Pick-up[a]

	Overall	CL&P	UI
n	442	280	162
Difficult (0 – 3 rating)	2%	2%	2%
Moderately Easy (4 – 7 rating)	6	5	8
Very Easy (8 – 10 rating)	90	92	88
Mean	9.3	9.3	9.2
Median	10.0	10.0	10.0

[a] "Don't know" responses removed from mean and median

There were 16 pick-up participants (4% of all pick-up respondents) who indicated that scheduling the pick-up was not easy (i.e., they gave a rating of five or lower on a zero-to-ten scale). (Table 4.14) Because they could name more than one reason, these participants collectively gave a total of 21 responses as to why scheduling the pick up was not easy. Actual scheduling difficulties included having to make repeated calls, having to reschedule, and taking a long time to schedule the pick-up. Three customers also stated that they were not given a specific time at which the pick-up would take place. Two customers think that ARCA was disorganized, with one accusing it of damaging property, and one saying the company was not flexible. Finally, two customers seemed to be unhappy with program requirements. One named as a difficulty the fact that the products had to be running. The other stated the difficulty was that only one unit was picked up, implying that others were rejected due to the limit of recycling only one each of RF and FZ.

Table 4.14: Difficulties Encountered in Scheduling the Pick-Up

(Base = Participants rating scheduling of pick-up as difficult, number or responses)

	# of Responses
n	21
Not on time/no specific time given	3
Long time to schedule	3
Pick-up company disorganized	2
Required repeated calls	2
Rescheduled	1
Damaged property	1
Required unit still running	1
Would pick up only one unit	1
Pick-up company not flexible	1
Don't know/None given	6

Overall, customers said it was very easy to retire appliances through the pick-up mode, giving an average rate of 8.9 (for RAC) or higher. (Table 4.15) The medians are all 10.0. Importantly, these high levels of satisfaction are based on participation during 2004, which coincides with the earlier months of the program implementation, when staff members indicate that ARCA experienced more difficulties with scheduling and routing. One can only assume, then, that current satisfaction would be at least as high.

Table 4.15: Ease of Retiring Appliance through Pick-Up Mode[a]

	RF	FZ	RAC-PU
n	333	158	62
Difficult (0 – 3 rating)	1%	1%	5%
Moderately Easy (4 – 7 rating)	8	4	8
Very Easy (8 – 10 rating)	93	95	87
Mean	9.2	9.5	8.9
Median	10.0	10.0	10.0

[a] "Don't know" responses removed from mean and median

4.3.2 Assessing the Turn-in Mode

Program staff members tend to have greater reservations about turn-in events than about the pick-up mode. The turn-in events are considered to be expensive to operate; they consume a

substantial amount of marketing and staff resources, and the benefits are very dependent on uncontrollable variables, primarily the weather. In 2005, most of the turn-in events yielded poor participation due to the wet, cold spring. Both of the retail store managers who were interviewed also mentioned the weather-related difficulties with holding the events in the spring and early summer. They each suggested that the turn-in events should be held later in the cooling season when customers are more interested in buying RAC.

Program staff also believes that the lead time for turn-in events (usually eight weeks minimum) is probably not sufficient for most retailers to coordinate cooperative advertising, which staff says strongly influences participation. In addition, sometimes the retailers have not stocked enough ENERGY STAR units; according to ARP staff, many retailers purchase their RAC units for the spring season in October or November of the previous year. The retail store managers could not comment on issues related to cooperative advertising, but they did state that the timing of events was largely coordinated through their regional corporate offices. Both managers thought that they received enough lead time for the event, although the regional office had chosen the dates. In addition, one retailer indicated that he believed the corporate office would have been flexible on the date of the turn-in event if the manager had a compelling reason for changing it.

Skepticism is one of the primary barriers to retailer participation, according to program staff; retailers reasonably expect that the turn-in events should increase foot traffic in the stores and subsequently improve sales of RAC as well as other items. Furthermore, the events consume a substantial portion of parking lot space, which presents an issue for downtown retailers who have limited parking available. The two retail store managers who were interviewed (from Home Depot and Lowe's) reported that their stores did not observe increased sales from the turn-in events; they blamed the lack of increased sales on the inclement weather that resulted in poor participation at the events. In addition to holding events later in the cooling season, one retailer suggested that the program should identify a method for quantifying the impact of the events on sales. Until the benefits of participation are demonstrated, managers will tend to remain skeptical about participating in turn-in events, even though one indicated his willingness to hold future events at his store.

Program staff members also believe that retailers are reluctant to participate because of the structure of the RAC market. In 2004, one retailer provided substantial matching rebates and product demonstrations outside the store during the turn-in event; the weather was also good. This event led to record sales that weekend. However, retailers were more reluctant to provide matching rebates in 2005, and combined with the inclement weather, the turn-in events were less successful than in 2004. Staff members believe that retailer profits from RAC are being squeezed by cheap international manufacturers and thus they are less willing to provide rebates. In addition, one retailer elected to offer only ENERGY STAR models in 2005 and thus it was unnecessary to provide matching ENERGY STAR rebates.

Despite reservations about the overall success of turn-in events, the ARP staff members generally believe that, apart from the weather, there have been very few problems with them. Specifically, they note that there was little difficulty in the transition from the $25 check *and* $25 rebate coupon in 2004 to the introduction of the $25 check *or* $35 coupon option in 2005.

Although there were few problems with this transition, one staff member recommends maintaining current rebate levels to avoid complaints about reductions in incentives. Of course, the rebate level will not be an issue unless the sponsors again decide to hold turn-in events.

Customers overall found it to be convenient to take part in turn-in events. (Table 4.16) On a zero to ten scale, customers rate the location of turn-in events with an eight, or very convenient. The median was also eight. CL&P turn-in participants give similar ratings to the locations of events as UI participants do, even through UI held more events in 2004.[14] Turn-in participants also said it was very easy to recycle their RAC at the events, giving an overall rating of nine on the same scale. The median was ten, indicating that over half of the participants said it was extremely easy to recycle their RAC.

Table 4.16: Convenience of Turn-in Events[a]

	Overall	CL&P	UI
	158	93	65
Inconvenient (0 – 3 rating)	5%	6%	3%
Moderately Convenient (4 – 7 rating)	28	26	30
Very Convenient (8 – 10 rating)	67	68	67
Mean	7.9	7.9	8.0
Median	8.0	8.0	8.0

[a] "Don't know" responses removed from mean and median

5 Program Processes

The ARP limits program eligibility largely to customers of CL&P and UI. Furthermore, the retired products must be of a certain age and in working order. RF must not be the primary unit in use in the house. A number of quality control measures are in place to ensure that these eligibility criteria are met. In this section, we discuss the eligibility requirements, quality control, and the degree of adherence to the requirements. We also touch upon other program processes including program responsibilities, communication between the sponsors, ARCA, and participating stores, and the adequacy of program resources.

5.1 Quality Control

The ARP has a number of quality control processes in place. (Table 5.1) Program staff generally feels that the quality control processes are adequate. Customer eligibility is determined by verification of utility account numbers, the age of the unit is "eyeballed" by ARCA staff members to screen out obviously new models, and units are tested to verify functionality. Customers can have one RF unit and one FZ unit picked up per account, and will receive checks for up to two RAC per account, although this criterion was often relaxed. Furthermore, customers were allowed to turn-in or have picked up more than two RAC, but the extra units were not rebated. Staff members believe that the most challenging requirement to implement, but also probably the least important, is verifying that the unit is at least ten years old.
To illustrate quality assurance to the sponsors, ARCA invites utility staff to ride-along or follow the ARCA truck along its scheduled routes. Utility staff can visit the ARCA facility in order to check on the demanufacturing process. In addition, at least one utility staff member attends each

[14] It should be noted that customers of either utility could turn-in appliances at events held in the other's service territory.

of the turn-in events. ARCA provides paperwork to serve as documentation of program operations and utility staff can audit ARCA records at any time.

Table 5.1: Summary of Quality Control Processes

Requirement	Pick-Up	Turn-In
CL&P or UI Customer	Confirm utility account number	Confirm utility account number
Unit 10 years old	Staff estimate Age	Staff estimate Age
Unit is at least 7 cubic feet	Confirm size at pick-up	Not Applicable
Unit functional	Unit plugged in and operational	Unit tested with generator
Secondary Unit	Screening questions to confirm primary RF more than 1 year old	Not Applicable
Maximum Number of Units	1 RF and 1 FZ per account	2 units per account

An analysis of the data in the telephone surveys and tracking database helps assess adherence to these quality control criteria.[15] Taking each of the criteria in turn, we find that most of the products being retired do meet eligibility requirements.

CL&P or UI Customer. All of the products picked up were found to be surrendered by customers of CL&P or UI. Because the turn-in tracking database lacks account numbers, we cannot confirm that turn-in participants were customers of the two sponsors, but the database indicated that they were.

Age of Unit. ARCA has informed NMR that the age of units retired may not be entirely reliable due to database value defaults. They have assured NMR that this difficulty has been fixed for more recent pick-up records. Unfortunately, the unreliable age values in the database of pick-ups completed in 2004 means that we are unable to use the tracking database to verify age. Telephone survey respondents generally estimated that the products they retired were at least ten years old. A total of 95% of RF and 93% of FZ were at least eleven years of age, although a greater proportion of RAC were younger than eleven years old (about 25%) according to respondents.

[15] Please note that the findings from the telephone survey are discussed in more detail in the survey report delivered on October 31, 2005.

Size of Unit. The average size of RF and FZ picked up was about 15 cubic feet—well above the limit set by the program, but smaller than most units currently on the market, but reasonable considering the smaller size of older models. (Table 5.2**Error! Reference source not found.**) Although there were no limits on the minimum size of RAC surrendered, the average size of RAC turned in was approximately 7,000 BTUs; note that, until 2005, the ARCA pick-up database could not accept RAC sizes less than 10, thus these data are not presented. While the database contains information on the age of units, ARCA staff report that the data are not reliable estimates.

Table 5.2: Average Size of Products Surrendered

	N	Size
Refrigerator	7,467	15.3
Freezer	2,895	15.2
RAC-Pick Up	1,028	n/a[b]
RAC-Turn In	4,836	6.8

[a] Cubic feet for RF and FZ; kBTU for RAC
[b] Not available for RAC that were picked up

Unit is Functional. The third criterion—that the unit is operation and plugged in—is one about which program staff are particularly apprehensive. They also have corollary concerns:

- Retailers may be "gaming" the program by telling customers who purchase a new appliance to call the ARP to have it picked up
- If retired units are not plugged in (or rarely operated), then estimated energy savings are inflated, and cost-effectiveness may be significantly reduced
- Customers would have disposed of the appliance in the absence of the program.

The survey results provide evidence to alleviate some of these concerns. ARCA determines that an appliance is in working order if it actually runs when the unit is plugged in. Thus, it is likely that nearly all the products retired meet this very basic definition of "working." If participants who responded to the telephone surveys are to be believed—and we have no indication to the contrary—very few of the products retired were not in working condition. In particular, only one percent of RF and FZ and two percent of RAC were reported by respondents not to be in working order at the time of surrender. Respondents did, however, tell us that five percent of RF, three percent of FZ, and 13% of RAC were not working that well at the time of surrender. As mentioned earlier, the fact that products were not working well does not make them ineligible for the program; in actuality, these units may be the precise energy hogs the program wishes to capture. In short, based on the participant survey, NMR believes that the units being retired meet the minimal definition of "working": they turn on when plugged in.

Furthermore, only three percent of participants at the time of pick-up, one percent of participants to the telephone survey, and four percent of non-participants report hearing about the program from an appliance dealer. Therefore, we do not find evidence that many retailers are "gaming" the system.

Unfortunately the results also provide evidence to support the other two concerns regarding prior use of the unit and previous desire to dispose of the appliance. Seven percent of RF and 16% of

FZ surrendered had not been plugged in during the year prior to surrender. In addition, when asked to rate the likelihood that they would have used the RAC in the summer of 2004 if they had not recycled it, 30% of those retiring RAC rated the likelihood with a zero, indicating that they were extremely unlikely to have used the unit. While only some of these individuals will be considered free riders—only if they would not have put the unit into the secondary market in addition to not using it themselves—their participation in the ARP had has not directly increased energy savings. NMR will take their responses into account when computing our estimates of overall energy savings.

In addition, staff members are correct in their assumption that customers generally had wanted to dispose of the products that they retired through the ARP. In the telephone survey, participants suggested that 69% of RF, 64% of FZ, and 59% of RAC would have been disposed of if the program had not existed. These percentages come with the caveat that stated intentions may not be actualized; after all, the products had not been disposed of prior to the program, implying at least some degree of inertia on the part of their owners. Furthermore, again NMR believes it is unfair to classify all of these individuals as free riders in light of the goal of diverting units from the secondary market. Still, it cannot be denied that many participants had already wanted to get rid of the appliances they retired through the program. The ARP simply gave them a convenient—and lucrative—way of doing so. Unfortunately, this also means that expected energy savings are not fully realized and the cost-effectiveness of the program is reduced.

Secondary Refrigerator. We also find cause for concern regarding the fourth criterion. Twenty-eight percent of participants self-reported that they had retired their primary RF through the ARP. Most of these units have been replaced. One possibility is that such respondents were less than honest during the screening process about how long it had been since they had purchased a new unit. Alternatively, the respondents may have bought a new unit more than a year before participation, and kept the older one around until the program offered to pick it up. Customers may not have thought of this unit as "secondary"; they just had not gotten around to getting rid of it yet.

Finally, only about one-half of one percent (0.5%) of the participants (counted by their account number) retiring each product through the pick-up mode surrendered more than the allowed number. Such a small number could be explained entirely by data entry error (e.g., the product count or account number could have been incorrectly entered). Customers who participated in the turn-in events were more likely to surrender more than two RAC—two percent of them turned in three or more RAC. While the additional turn-ins were allowed, the tracking database indicated that all of the units were rebated. This coincides with reports from the program staff that the limit on two RAC rebates was often relaxed.

5.2 Responsibilities, Communication, and Resources

The program managers for UI and CL&P each spend about 20% to 25% of their time on the ARP. The program managers were responsible for designing the ARP and developing the initial request for proposals, as well as managing program startup. Currently, they are involved in day-to-day management of all aspects of the program including planning, administration, marketing, and tracking, as well as coordination and monitoring of ARCA.

Each of the planning staff members interviewed spends less than five percent of their time on the ARP. They are primarily involved in program planning regarding energy savings goals, benefits, and budgets, among other duties.

As the vendor, ARCA is responsible for staffing the phone line, maintaining the program website, and scheduling pick-up appointments. In addition, they are responsible for the actual pick up and demanufacturing of appliances as well as the processing and distribution of rebates. Regarding turn-in events, ARCA provides coordination, staffing and transportation of units to the demanufacturing facility.

Both UI and CL&P jointly administer the ARP, which requires regular communication between staff at both utilities in order to coordinate the program. In addition, utility staff members deal with several people at ARCA regarding day-to-day issues on the program. Program managers generally only interact with customers when someone has a complaint, which occurs relatively rarely. In addition, program managers work with marketing agencies to develop marketing materials, with printers for advertising, and with retailers regarding the turn-in events. Staff members did not identify any difficulties in the distribution of responsibility or in the communication between all the relevant parties.

Program staff maintains that current staffing levels are adequate at this time as the turnkey nature of the program requires minimal time commitment by utility staff. ARCA adjusts its staffing levels to meet program needs, though consistent volume is critical to maintaining a steady, productive workforce as ARCA tends to lay off workers when volume slows down too much.

There are differing opinions among program staff about funding levels for the program. Utility program staff members believe the program had more budget than necessary; they cite the fact that budget from 2004 was carried over to 2005. However, ARCA staff points out that the program could achieve more with a larger budget.

6 Program Tracking[16]

The ARP staff members track program progress based the number and characteristics of units as described in databases maintained by ARCA. Energy savings assumptions are applied to these data. In addition, internal ARP tracking databases include the number and type of appliances retired, estimated kW and kWh savings, and budgets. In this section, we share both staff and NMR assessments of the current tracking methods and suggestions for other possible information that may be tracked in the future.

6.1 Assessments of the Pick-up Tracking Database[17]

Program staff members believe that the pick-up tracking database is sufficient for program purposes. The pick-up database includes all relevant customer data, such as name, address, phone number, and account number as well as unit-specific information regarding the manufacturer, type, size, age, and amperage of the unit. In general, NMR concurs with the

[16] Appendix A summarizes the results of analyses from the tracking databases that were not pertinent to other sections of this report. We also compare, when applicable, to data from the telephone surveys.
[17] Appendix B summarizes the difficulties we encountered with the original data set provided by ARCA to NMR.

assessment of the staff. However, as mentioned above, ARCA recently informed NMR (on October 7, 2005) that the information on age for earlier units picked up was not always accurate, due to the use of default values in the database. Likewise, the decision to include the pick-up mode for RAC was made after the database had been compiled. The "size" field did not allow for values below ten, although many RAC are less than 10.0 kBTU. Therefore, the recorded size of many RAC picked up in 2004 are incorrectly high. According to ARCA the problems have been fixed, although we are uncertain when the improvements to the database were made.

Apart from the errors regarding the age of units and RAC size, most of the observed errors in the file can generally be attributed to mistakes made during data entry. We observed some spelling errors, a degree of inconsistent data entry format (e.g., inconsistent use of all capital letters, telephone numbers with and without parentheses, etc.), and some unlikely values (e.g., units picked up in 1943). Clearly, such errors are not substantial and fall within the reasonable realm of expected error during data entry. Of course, ARCA should take every step necessary to reduce data entry errors and to conduct periodic checks of the data to identify such errors; some tasks, such as range checks, could be automated.

6.2 Assessment of the Turn-in Tracking Database

The turn-in database shares many characteristics with the pick-up database. It includes the customers' names and contact information, what product they turned in, and some of the characteristics of that product including the model, BTU size, and amperage. It also notes the date and location/name of the specific event at which the product was surrendered. However, the program staff members note that the turn-in database is not quite as rich as the pick-up database. In particular, it lacks information on how the customer found out about the program and why they chose to participate. Furthermore, additional information, including plans to replace products, was not included, even though such information was collected at least at the Norwalk and Waterbury events, provided to NMR by CL&P. The turn-in database lacks customer account numbers and also contains slightly more data entry errors than the pick-up database.

The reasons for failing to include some data in the turn-in database as well as its greater number of data-entry errors both stem from the nature of the turn-in events themselves. The events were designed for customer convenience, and this includes not taking too much of their time. Therefore, customers fill out required information and answer any additional survey questions on data cards while the program and ARCA staff members unload and then verify the eligibility of the units being retired. Only later does ARCA staff enter the information from the cards into a database. The lack of familiarity with the names of communities in Connecticut or the difficulties associated with reading handwriting likely account for many of the data-entry errors.

Overall, we believe it is neither reasonable nor necessary to ask turn-in participants to fill out more detailed surveys such as those given to pick-up participants. Most of the information that could be collected would only provide richness to evaluations, but has little bearing on tracking program successes. However, we do believe that ARCA should include a field about how the customer found out about the program, as this information is necessary for tracking the impacts of the various marketing approaches used by the sponsors.

6.3 Suggestions for Tracking Measures

In order to estimate energy savings, it would be helpful for ARCA to track the Energy Efficiency Rating (EER) of RAC surrendered through the program. However, the EER is not always displayed on model nameplates. It can be calculated by dividing BTUs-per-hour produced by the number of watts used to produce that heat. Both of these pieces of information are on the nameplate and could be noted in lieu of the EER.

Staff members note that a number of non-energy outcomes could be tracked; these include further details on product recycling such as the pounds of metal, mercury switches, PCBs, and refrigerant recycled. However, it is NMR's understanding that ARCA does currently keep track of many non-energy benefits for each sponsor overall, although not for each product retired. In fact, the *Request for Proposals* to evaluate the ARP includes an accounting of quantifiable non-energy benefits for CL&P for 2004, presumably taken from ARCA's predefined web-based reports (See Section 2.2.11 of the RFP). ARCA does not currently track the reduction in carbon dioxide emissions resulting from the program. We believe that the ARP should track such reductions in the future.

Other suggestions made by program staff for measuring market transformation include tracking the efficiency of the existing stock at secondary dealers, assuming that it should increase as the program influences the market. In addition, tracking the market share of ENERGY STAR appliances—particularly of RAC—sold in Connecticut might provide another, though less direct, measure. Such percentages would have to be compared from a baseline year before program implementation to years during the program's operation; however, other factors—including the overall increase in ENERGY STAR market share nationwide—must be taken into account before attributing increases in penetration of qualified products to the program. Finally, results of Residential Appliance Saturation Surveys will also provide data on the incidence of secondary appliances in homes, and serve as another measure of program impacts.

APPENDIX A: Analysis of Data from the Tracking Databases

Appendix A summarizes the results of analyses from the tracking databases that were not pertinent to other sections of this report. We also compare, when applicable, to data from the telephone surveys. Note that we do not test the statistical significance of the analyses of data from the tracking databases. The results of the tracking databases and the surveys taken at the Norwalk and Waterbury turn-in events are based on the full population of customers; statistical significance tests are only valid for random samples. In addition, the pick-up surveys were not given to all participants or to a random sample of them; thus, they are not necessarily reflective of the population of participants overall.

Characteristics of Units Picked Up

Because of differing energy uses, the door and defrost configuration of RF and FZ surrendered affects the energy savings that result from the program. In general, RF with manual defrost use the least amount of energy while side-by-side units with automatic defrost use the most; likewise, chest FZ with manual defrost use the least amount of energy while upright FZ with automatic defrost use the most. As summarized in Table A.1 below, 71% of the FZ being picked up are upright models, which are among the highest energy users; yet most FZ (72%) surrendered through the program also have manual defrost, a lower-energy use design. Most of the RF recycled have a top FZ (70%), and many have manual defrost (37%). These characteristics, however, are to be expected due to the age of the units surrendered (i.e., older models are more likely to have manual defrost) and the prevalence of top-mount FZ models. In contrast, side-by-side models are among the more recent additions to the RF market; therefore, models are too young to be eligible for surrender through the program.

Table A.1: Door and Defrost Configuration of Refrigerators and Freezers

	Refrigerators
N	7,467
Top Freezer-Frost Free	48%
Top Freezer-Manual	22
Single Door-Frost Free	4
Single Door-Manual	12
Side-by-Side-Frost Free	8
Side-by-Side-Manual	1
Bottom Freezer-Frost Free	3
Bottom Freezer-Manual	2
Other/No response	1
	Freezers
n	2,895
Upright-Manual	52%
Upright-Frost Free	19
Chest-Manual	20
Chest-Frost Free	8
All Other/No response	2

Plans to Replace Surrendered Appliances

Some participants in both the pick-up and turn-in modes were asked about their plans for replacing the appliance they surrendered through the program. Norwalk and Waterbury turn-in participants who were not planning to replace their air conditioner were also asked why they would not do so. As reported in Table A.2, pick-up participants plan to replace just under 40% of the surrendered RF and RAC and slightly more than 30% of the FZ. The RF and FZ rates are comparable to the actual replacement rates as reported in the participant telephone survey (46% and 34% respectively), but lower than those for RAC surrendered via pick-up (62%). The relatively high levels of planned replacement, especially for RF and FZ, are troubling from an energy savings perspective. Although replacement units may use less energy (i.e., assuming they are purchased new or were at least manufactured after stricter efficiency standards were in place), they will still draw energy from the grid, thus limiting the savings that could have resulted from the program. It is worth noting that the telephone survey respondents reported that 73% of the replacement RF, 79% of the replacement FZ, and 94% of the replacement RAC (from the pick-up mode) were ENERGY STAR-qualified; we believe these estimates are high, but they still point to substantial proportions of replacement with more efficient models.

Table A.2: Plan to Replace Surrendered Appliance – Pick-Up

(Base = products surrendered by surveyed customers)

	Refrigerator		Freezer		Room Air Conditioner	
	n	**% Yes**	**n**	**% Yes**	**n**	**% Yes**
CL&P						
Targeted	358	42%	161	31%	82	56%
Not Targeted	387	36%	209	33%	129	29%
Total	745	39%	370	32%	211	39%
UI						
Targeted	387	40%	174	31%	81	40%
Not Targeted	47	40%	13	31%	10	20%
Total	434	40%	187	31%	91	37%
Overall						
Targeted	745	41%	335	31%	163	48%
Not Targeted	434	36%	222	32%	139	28%
Total	1,179	39%	557	32%	302	39%

The surveys taken at the Norwalk and Waterbury turn-in events asked respondents a few more questions about their plans to replace the air conditioners they were surrendering. First, respondents were asked if they planned to replace the unit they were surrendering. Those who were replacing were then asked if they planned to buy an ENERGY STAR-qualified unit, while those who were not planning to replace were asked why. Of the 654 respondents asked if they would replace the unit, 446 (68%) indicated that they would. This is somewhat smaller than the 78% of telephone respondents who had turned in a RAC who actually did replace the unit. Based on the Norwalk and Waterbury turn-in events, ninety percent of those planning to replace indicated that they would buy an ENERGY STAR-qualified model, comparable to the 86% of turn-in participants who say they actually did purchase an ENERGY STAR-qualified model. While customers were not asked if they planned to use the $25 coupon provided at the turn-in

event, the telephone survey suggests that 62% of the units reported as ENERGY STAR qualified had been purchased with the rebate.

Finally, Table A.3 summarizes the reasons why respondents were not replacing the unit they turned in. Over half (52%) indicated that they had already purchased a new RAC to replace the one they were turning in, while another 33% say they now have or were getting central air conditioning. Only 6% indicate that they are no longer using air conditioning. Again, while it is likely that many replacement units—not just the ENERGY STAR-qualified ones—will use less energy than older models, the prevalence of existing or future replacement units and of the use of central air conditioning will limit the expected energy savings resulting from the program but may keep some older units out of the secondary market.

Table A.3: Reasons for not Replacing Turned-In Room Air Conditioner

(Base = Norwalk and Waterbury Turn-in Event participants not planning on replacing)

n respondents	208
Already purchased new one	52%
Have/getting Central AC	33%
Do not use AC anymore	6%
Other/No response	9%

Participation in Other Energy Conservation Program

The pick-up and telephone surveys asked participants if they had ever taken part in other energy conservation programs offered by the program sponsors. (Table A.4 and Table A.5) The survey taken at the time of pick-up suggests that only 17% of participants had taken part in other energy conservation programs. The telephone survey, which actually named various programs, places the percentage somewhat higher, at 32%.

Table A.4: Participation in Other Energy Conservation Programs, Pick-Up Survey

(Base = aggregated accounts surveyed)

	Overall		CL&P		UI	
	n	% Yes	n	% Yes	n	% Yes
Targeted	818	17%	391	16%	427	19%
Not Targeted	468	18%	415	18%	53	15%
Total	1286	17%	806	17%	480	18%

Table A.5: Participation in Other Energy Conservation Programs Telephone Survey

(Base = participant respondents)

	Total	CL&P			UI		
		Overall	**SWCT**	**Other**	**Overall**	**SWCT**	**Other**
n	600	376	189	187	224	187	37
Purchased products through the Smart Living catalog	8%	7%	8%	6%	10%	10%	3%
Purchased lighting products with utility rebates	9	6	6	6	12†	12	16
Purchased other appliances using utility rebates	4	5	4	6	3	3	2
CL&P WRAP	2	3	4	2	n/a	n/a	n/a
CL&P CIP Program	<1	1	1	0*	n/a	n/a	n/a
CL&P ENERGY STAR Homes	<1	1	1	2	n/a	n/a	n/a
UI TOU rate program	<1	n/a	n/a	n/a	1	1	0
UI Electric hot water tank lease	<1	n/a	n/a	n/a	1	1	0
Others	2	2	1	2	3	3	0*∞
Don't Know	10	13	12	13	7†	7	0*∞
No Other program	68	69	70	67	66	65	82∞

* Significantly different from Overall within utility at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

Appendix B: Summary of Difficulties with Initial Pick-up Tracking Database

During the last week of August, NMR first became aware of a large discrepancy between the ARCA-reported number of products surrendered and customer self-reported number of products. After verifying that we had not made a mistake in our data cleaning efforts that would have resulted in the error, NMR worked with ARCA to locate the source of the problem. It was discovered that the data ARCA had sent to NMR contained duplicated files. The source of the error had to do with how ARCA pulled the data. NMR requested both the actual data on the units picked up as well as the data from the pick-up surveys. ARCA pulled both sets of data into one file. For some reason, this resulted in the duplication of records. ARCA resolved the problem by pulling the product retirement data separately from the survey data. Because the sponsors may some day wish to conduct their own analyses of data in the pick-up surveys, we strongly urge them to request that the survey data be delivered separately from product data. As long as both fields include an account number or other unique identifier, the sponsors should be able to match responses to the products retired.

Apart from the need to reanalyze the billing data, the only important implication of the initial error in the dataset involves a tendency for respondents to the telephone survey to have slightly over-estimated the number of units they had picked up when compared to the counts in the revised, corrected ARCA database (Table B.1). This stands in contrast to the table included in the second progress report in which we showed that customers had greatly underestimated their product counts—when compared to the original, flawed ARCA data. In fact, these customers were making largely accurate corrections to what were the incorrect numbers from the original ARCA database. It should be noted that NMR has confirmed that the remaining small amount by which customers now overestimate their product counts is an artifact of the original error in the database. These customers either "confirmed" a falsely high number or named a number somewhere between the actual number (based on the new ARCA data) and the original, incorrect number. Finally, Table B.2 shows the number by which the self-reported count differs from the new ARCA data. As the data make clear, most customers reported retiring the same number of products as included in the ARCA database.

Table B.1: Discrepancy between New ARCA Database and Participant Telephone Survey Self-Reported Product Counts

		Overall	Refrigerator			Freezer			Room Air Conditioner					
									Pick Up			Turn-In		
		n	n			n			n			n		
Sponsor	Targeted	respond-ents[a]	respond-ents[b]	New ARCA[c]	Self-report[d]	respond-ents[b]	New ARCA[c]	Self-report[d]	respond-ents[b]	New ARCA[c]	Self-report[d]	respond-ents[b]	ARCA[c]	Self-report[d]
CL&P	Yes	189	109	109	132	51	51	61	26	35	38	48	71	71
	No	187	106	108	126	61	61	65	36	44	54	46	69	70
	Overall	376	215	217	258	112	112	126	62	79	92	94	140	141
UI	Yes	187	100	102	114	45	44	46	11	14	16	62	90	91
	No	37	25	25	26	9	9	9	0	0	0	3	5	5
	Overall	224	125	127	140	54	53	55	11	14	16	65	95	96
Total	Yes	376	209	211	246	96	95	107	37	49	54	110	161	162
	No	224	131	133	152	70	70	74	36	44	54	49	74	75
	Overall	600	340	344	398	166	165	181	73	93	108	159	235	237

[a] Number of respondents
[b] Number of respondents who retired each appliance, as reported in the *original* ARCA database
[c] Number of products retired as reported in the *revised* ARCA
[d] Number of products self-reported as retired from respondent's own home

Table B.2: Difference between Self-Report and Corrected ARCA

(Difference = Self-Report – ARCA)

Refrigerator			Freezer			Room AC – Pick-up			Room AC – Turn In		
Difference	**n**	**%**	**Difference**	**n**	**%**	**Difference**	**n**	**%**	**Difference**	**n**	**%**
-1	6	2%	-1	6	4%	-2	1	1%	0	157	99%
0	281	83	0	140	84	-1	7	10	1	2	1
1	46	14	1	18	11	0	49	67	Total	159	100
2	7	2	2	2	1	1	12	16			
Total	340	100	Total	166	100	2	2	3			
						4	2	3			
						Total	73	100			

Appendix D1
Staff Interview Guide

STAFF INTERVIEW GUIDE NMR 1114
CONNECTICUT APPLIANCE RETIREMENT PROGRAM

Interviewer: _____

Date of Interview: _____

Time Begun_____ Time Ended _____

Respondent Name: _____

Respondent Title: _____

Work Location (Store Name; Street Address; ZIP Code):

_____

_____

_____

_____

Other Contact Information:

Phone Number(s): _____

Fax Number: _____

E-mail Address: _____

Interview was: ☐ By phone ☐ At respondent's Office

☐ Elsewhere (Please specify); _____

[NOTE: NOT MEANT AS VERBATIM QUESTIONS BUT AS ROUGH GUIDE]

I'm here to talk with you about the Appliance Retirement Program. As you know, I am part of the evaluation team, and part of our job is to determine how people involved in the program think it is operating, what is working well, and what needs to be improved. Please be aware that the information you provide will be treated as confidential.

INDIVIDUAL'S ROLE

First I'd like you tell me about your role.

1. What are your responsibilities for the Appliance Retirement Program?

2. How long have you held that position?

3. About what percentage of your time do you spend on this program?

4. How do you interact with other people with respect to this program?

    a. At CL&P?
    b. At UI?
    c. At ARCA?
    d. Customers?
    e. Others?

PROGRAM DESIGN

5. How would you describe the goals of the program?

6. What are the major components and activities of the program, and what are they intended to accomplish? In the short term? Intermediate term? Long term?

7. How do you expect to measure the extent to which program goals have been accomplished—that is, what are the indicators for the outcomes you expect to achieve? Short term? Intermediate term? Long term?

8. What has changed about program design since the beginning, and why?

9. Are there other aspects of program design that may not be working as planned?

10. Please describe the rationale for incentive levels. Are current incentive levels appropriate?

11. How does the Appliance Retirement Program interact with other programs offered by the utilities?

12. How could manufacturers and retailers become more involved and invested in the program?

13. What do you think is particularly good about program design? How could program design be improved?

MARKETING

14. How do potential customers find out about the program? What works well for reaching customers and what doesn't work so well? By CCR vs. other areas of the state?

15. Why do you think customers choose to participate? What benefits do they see from participating? What are the barriers to participation? By CCR vs. other areas of the state?

16. How are relationships developed with retail stores for turn-in events?

17. What do you think is particularly good about program marketing? How could program marketing be improved?

DELIVERY

18. Pickups: Let's walk through the process of participating in the pick-up program (800 phone #, scheduling, pick-up, de-manufacturing, incentive processing). What is involved for the customer? What is going on behind the scenes at ARCA and the utilities at each of these steps?

19. Are there problems with scheduling pickups? Are there any unnecessary delays in any step in the process?

20. Do you find a lot of people who are surrendering appliances that don't actually meet program criteria (e.g., they are primary units or they aren't in working order), or who are surrendering more appliances than the program allows? Are they getting rebates for these? [PROBE: IN OUR REVIEW OF THE ARCA DATA BASE, WE'VE NOTICED THAT THE SAME PHONE NUMBER MAY BE ASSOCIATED WITH MORE THAN ONE ACCOUNT NUMBER OR ADDRESS. FURTHERMORE, SOME ACCOUNT NUMBERS ARE ASSOCIATED WITH MULTIPLE ADDRESSES. FINALLY, THERE ARE PEOPLE WHO ORDERED A PICK UP AT AN ADDRESS OTHER THAN THEIR OWN. CAN WE DESCRIBE WHY THESE SITUATIONS MAY OCCUR? ARE THEY FREQUENT?]

21. Do you find a lot of landlords who are having appliances picked up from places they rent out? How frequently do you think this happens? Other than landlords, what other types of situations have you found in which people are surrendering appliances that weren't used in their own homes?

22. Turn-ins: Let's walk through the process of participating in the turn-in event program (unload unit, customer paperwork, distribute incentive). What is involved for the customer? What is going on behind the scenes at ARCA and the utilities at each of these steps? Are there any unnecessary delays in any step in the process?

23. Do you think that customers have found ways to turn-in and get rebates on more than the allotted number of appliances? How do they do this? Do you think it happens frequently? [PROBE: IN OUR REVIEW OF THE ARCA DATA BASE, WE'VE SEEN THE SAME PHONE NUMBER LISTED UNDER MULTIPLE NAMES, ADDRESSES, AND/OR AT MULTIPLE EVENTS]

24. What benefits do retailers receive from participating in the turn-in program? What are the barriers? Are the lead times sufficient for participating retailers?

25. Why do customers drop out? When does this typically occur?

26. How do current project volume and flow compare with what you expected? If not what was expected, how could it be changed in the future?

27. How appropriate are the resources available for this program compared to the demands of the program?

28. What do you think is particularly good about program delivery? How could program delivery be improved?

TRACKING & QUALITY CONTROL

29. Explain what data is currently being tracked by ARCA. Are there other data that should be recorded? How else could program tracking be improved?

30. Explain the quality control process (verification of CL&P or UI customers; unit functioning and 10 years old; demanufacturing; customer receipt of incentive). Is this sufficient? How could quality control be improved?

CONCLUSION

31. What do you think are the greatest strengths of the program?

32. What are the weaknesses of the program?

33. What could be done to address these weaknesses?

34. Do you believe that the program will still bring in large numbers of appliances, or do you feel it has run its course?

35. Is there anything else you would like to tell me about the program?

Appendix D2
Interview Guide for Turn-in Event Store Managers

Interview Guide for Turn-in Event Store Managers
Connecticut Appliance Retirement Program NMR 1114

Interviewer: _____

Date of Interview: _____

Time Begun_____ Time Ended _____

Respondent Name: _____

Respondent Title: _____

Work Location (Store Name; Street Address; ZIP Code):

_____

_____

_____

_____

Other Contact Information:

Phone Number(s): _____

Fax Number: _____

E-mail Address: _____

Interview was: ☐ By phone ☐ At respondent's Office

☐ Elsewhere (Please specify); _____

A. Introduction (Adapt for use in recruiting or initiating interview, as appropriate.):

Good morning/afternoon. My name is _____ and I work for Nexus Market Research. We're conducting a study of the Connecticut Appliance Retirement Program for Connecticut Light and Power (CL&P) and the United Illuminating Company (UI). In 2004 and/or in 2005, your store partnered with CL&P and UI to hold a room air conditioner and dehumidifier turn-in event. Part of our job it to obtain feedback on the strengths and weaknesses of the turn-in events and to learn ways in which the program could better meet the needs of its retail partners. I'd like to talk with you for about 30 minutes to learn about your experience and get your comments and suggestions. I am interviewing several people about the program and will report a summary of the issues and recommendations, but will not identify where different ideas come from—so, in that sense, whatever you tell me will be held in strictest confidence.

B. Background

1. When did you begin working for [INSERT NAME OF STORE]?

_____

2. During that time, have you always worked at this particular [INSERT NAME OF STORE]?

☐ Yes
☐ No

3. [IF NO TO #3] How long have you worked at this particular [INSERT NAME OF STORE]? _____

4. What are your duties at the store?

5. Do you work with CL&P and UI on other energy efficiency programs or just on the room air conditioner and dehumidifier turn-in event? If other programs, which ones? [IF THEY DO NOT MENTION THE ENERGY STAR ROOM AIR CONDITIONER REBATE PROGRAM, SPECIFICALLY PROBE FOR IT.]

C. Turn-in Event Participation

Now I'm going to ask you some specific questions about planning for the turn-in events? Just to be clear, the promotion I'm talking about is the one where customers dropped off an old room air conditioner or dehumidifier at an event held in the parking lot of your store.

6. Why did your store decide to partner with [INSERT SPONSOR] and hold a turn-in event at your store?

7. In addition to the space in the parking lot, did you provide other materials, staff, or services or the turn-in event?

8. Did you participation in the turn-in event increase, decrease, or have no effect on the number of people who shopped at your store that day?

9. What do you see as the benefits of sponsoring a turn-in event?

10. What do you see as any costs or drawbacks of sponsoring a turn-in event?

11. Would you be likely to hold another room air conditioner/dehumidifier turn-in event at your store in the future? Why or why not?

D. Turn-in Event Notification

12. When did [INSERT SPONSOR] first contact you about potentially holding a turn-in event in your store?

13. Did [INSERT SPONSOR] have some specific dates in mind to hold the turn-in event, or did they leave it up to you to suggest a date?

- ☐ They suggested dates
- ☐ Left it up to the store

14. If they chose the date, do you believe they gave you enough time to plan for the event before it was held? If no, please explain why there wasn't enough time.

15. If you chose the date, what factors did you consider in choosing the date? [PROBE IF NECESSARY, holidays, vacation schedules, in-store sales events, timing of other promotions]

16. What could the sponsors of the Appliance Retirement Program do differently to help you prepare for future turn-in events that may be held at your store?

E. ENERGY STAR

17. Are you aware of the ENERGY STAR label on some room air conditioners and dehumidifiers?

- ☐ Yes
- ☐ No
- ☐ Don't Know

18. Do you believe that customers who participate in the turn-in event are more or less likely than other customers to purchase an ENERGY STAR-labeled replacement room air conditioner or dehumidifier?

19. Is it you belief that participating in the turn-in event increased your sales of ENERGY STAR-labeled room air conditioners or dehumidifiers one the day of the event or in the days just after it?

- ☐ Yes
- ☐ No
- ☐ Don't Know

20. Overall, what do estimate to be the percentage of room air conditioners sold at your store that are labeled with the ENERGY STAR?

21. What would you estimate to be the percentage of ENERGY STAR models purchased by people who also turned in a room air conditioner?

22. Participants at turn-in events were offered an in-store coupon for the purchase of an ENERGY STAR-labeled room air conditioner. In your experience, did participants typically use the in-store coupon to buy an ENERGY STAR-labeled room air conditioner?

23. What percentage of customers buying ENERGY STAR-labeled room air conditioners in general tends to use in-store coupons to make their purchase?

F. Wrap Up

24. Do you have other comments or suggestions that you would like to make regarding the turn-in events?

Appendix E:
Results of the Telephone Surveys of Participants and Non-Participants

Nexus Market Research, Inc.

CONNECTICUT APPLIANCE RETIREMENT PROGRAM: RESULTS OF TELEPHONE SURVEYS OF PARTICIPANTS AND NON-PARTICIPANTS AND ENERGY SAVINGS ESTIMATES

November 29,2005

Submitted To:
Northeast Utilities – Connecticut Light and Power
The United Illuminating Company

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Executive Summary

This report summarizes the majority of results of the participant and non-participant telephone surveys conducted by Nexus Market Research, Inc., in support of the evaluation of the Connecticut Appliance Retirement Program (ARP).

The survey results presented here address eight main topics:

1. Characteristics of respondents
2. Characteristics of the units that were retired
3. Pre-surrender use of appliances
4. Disposition options
5. Replacement of retired units
6. Free ridership and spillover
7. Benefits and drawbacks of program participation.
8. Respondent purchases from and contributions to secondary appliance market

Description of Respondents

A total of 600 participants and 505 non-participants were surveyed. (Table ES-1) Of the 600 participants surveyed, 376 (63%) were customers of Connecticut Light and Power (CL&P); 376—including both UI and CL&P customers—lived in Southwest Connecticut (SWCT). Three-quarters of the participants who were surveyed (441) had participated only in the pick-up mode. Another 159 respondents had turned in room air conditioners (RAC); of the 159, seven had also had products picked up. Among the participants, 335 had retired refrigerators (RF), 159 had retired freezers (FZ), and 224 had retired RAC.

Table ES-1: Final Sample Counts by Major Categories of Interest

	n	% of Total n
Participant Survey	**600**	**100%**
CL&P	376	63%
UI	224	37%
SWCT	376	63%
Other	224	37%
Pick-up only	441	75%
Turn-in (including both modes)	159	25%
Refrigerators	335	56%
Freezers	159	27%
Room AC	224	37%
Non-Participant Survey	**505**	**100%**
CL&P	354	70%
UI	151	30%
SWCT	354	70%
Other	151	30%
Matched	253	50%
Not Matched	252	50%

Of the 505 non-participants surveyed, 30% were from the United Illuminating Company's (UI) territory, and 30% lived outside of SWCT. We also matched half of the sample to participants based on energy usage; we refer to this as the matched sample.

Sampling errors were small; the error for the participant survey was 3.7% assuming a 50%/50% break in responses with a 90% level of confidence, while the error for the non-participant survey was 4.3%.

Characteristics of Respondents

Participants were more likely to be male, over 65, and to have lower (albeit moderate) incomes than non-participants and most Connecticut residents. Furthermore, participants were more likely than non-participants to live in detached, single family homes that they owned. Non-participants from the matched sample were older and had higher incomes than unmatched non-participants. The matched sample was also more likely to live in a detached, single family home that they owned. Homes of matched non-participants were larger than those of the unmatched sample. All three samples overall were, for the most part, older and better educated than Connecticut residents as a whole. Those surveyed were also more likely to live in single family homes that they owned.

Over two-thirds of participants say they have not participated in any other conservation programs.

Together, the demographic, housing, and participation data provide a reasonable profile of participants. They are older residents, many on moderate fixed incomes, who nevertheless were able to purchase moderately sized homes at a time when housing prices were lower and/or their incomes were higher relative to costs. These older residents are the most likely to have the older and extra appliances targeted by the program. However, perhaps due to their age and income, many have chosen not to participate in other conservation programs. They may assume they would not live to realize energy savings from purchasing new appliances or weatherizing their homes, and their income levels may be too high to qualify for low-income assistance programs.

Characteristics of Surrendered Units

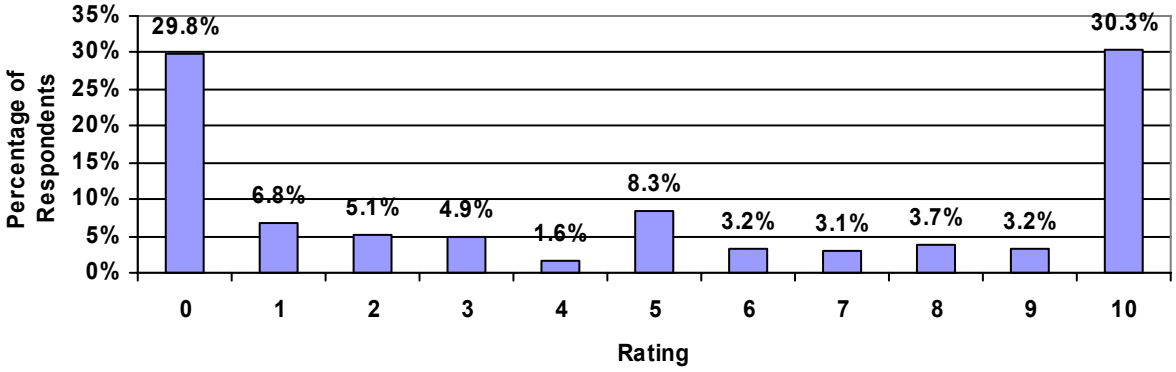
Respondents self-reported that most of the units they retired met eligibility standards. Nearly all RF and FZ were at least ten years old, although as many as 20% of RAC were younger than ten years of age. Nearly all units were in working order when they were retired. However, 28% of participants retiring RF surrendered their primary unit, violating one of the key eligibility requirements. Not surprisingly, most of these customers replaced the unit they retired through the program. In fact, it may be that these participants first bought a new unit and then called the program to pick up what then became a "second" unit that they had no intention of using. Because ARCA screens for recent purchases, this would mean that some participants were less than truthful during the screening process. Still, it should be remembered that these formerly primary units were most likely going to be sent to the basement to become secondary units or they were going to find their way to the secondary market. Therefore, although the relatively high rate of retirement of primary RF is less than ideal, these surrenders are still contributing in a positive way to the goals of the ARP.

Use in Year Prior to Surrender and Intention to use Summer of 2004

Most RF (65%) and FZ (63%) had been plugged in all the time in the year prior to the surrender. While only 7% of RF were never plugged in, 16% of FZ had not been plugged in at any time during the year prior to surrender. When RF and FZ were plugged in, they were typically being used to cool or freeze foods and beverages; no respondents with RF plugged in all or most of the time and only five percent of those with FZ plugged in all the time said that they had never used the appliance to cool foods.

Because RAC are not used year round and because the turn-in events typically occurred before or early in the cooling season, we asked participants who turned in RAC how likely they would have been to use the appliance in the summer of 2004. Their responses indicate that, on a zero to ten scale, 30% of participants indicated that they were extremely unlikely to use the RAC and 30% indicated that they were extremely likely to use the RAC.

Figure ES-1: Likelihood of Using RAC if not Recycled



Further investigation revealed that those least likely to use the RAC had participated through the pick-up mode in disproportionate percentages. In addition, those most likely to have used the RAC were also more likely to replace the unit and to use the purchase rebate for ENERGY STAR-labeled RAC; rebates were only given out at turn-in events.

We believe that the findings regarding RAC suggest the following: pick-up participants are most interested in having their RF and FZ removed; they are more than happy, therefore, to have the program pay them to remove their unwanted RAC. In contrast, the incentive to buy a more efficient RAC appears to be a primary motivation for giving up a unit at a turn-in event. We do not know, however, if they were already planning on upgrading to an ENERGY STAR-qualified model or if the incentive actually convinced them to do so.

Location and Time of Use

As discussed in the secondary literature review, RF and FZ kept in the basement or other cooler spaces tend to use less energy than those kept in warmer areas of the house. Participants reported that just about half (51%) of RF and 80% of FZ were kept in the basement. However, about 56% of the basements holding RF and 61% holding FZ were heated in the winter, likely limiting some of the energy savings typically associated with units located in basements.

Another 17% of RF and 13% of FZ were located in garages, most of which were not heated or cooled. These units would use less energy in the winter, but more during the peak summer months. Of the 83 participants (29% of those retiring RF) who kept their RF in the kitchen, 92% had retired their primary unit.

RAC were most often located in bedrooms (57%) and used at night, signifying that participants mainly used them to get a comfortable night's sleep. The average participant used the RAC over the course of two and a half months in the summer; they typically turned on the unit when the temperature was 84 degrees or higher. When developing estimates of ENERGY SAVINGS from RAC, NMR will adjust cooling degree days as reported by the National Atmospheric and Oceanic Administration (NOAA), which were 565 in 2004, by the temperature at which respondents typically turn on RAC.

Frequency of Appliance Disposal by Non-Participants

Very few of the 505 non-participants interviewed had disposed of any RF, FZ, or RAC from May 2004 through September of 2005 when the survey was conducted. Specifically, only 15% had disposed of a RF, 3% a FZ, or 11% a RAC over that time period. Population projections for all residential customers of the two ARP sponsors, adjusted for the number of participants, suggest that approximately 157,353 RF, 30,930 FZ, and 162,377 RAC had been disposed of by non-participants.

Contrary to our expectations, non-participants report that it was actually easy to dispose of RF and RAC, the former because they were picked up by appliance stores when new units were delivered, and the latter because respondents simply placed them in the trash. In contrast, it was only moderately easy to dispose of FZ, in large part because they were less likely to be picked up by retail stores, implying that non-participants were not replacing them. Not surprisingly, FZ were also rarely put out with the trash.

A dozen non-participants disposing of appliances had to pay for the removal. These non-participants paid just under $25, on average, for the disposal of their RF. The six people charged to dispose of FZ paid about $15 on average for the removal. We are not certain why it would cost more to dispose of RF than FZ. In reality, the very small sample sizes may do more to explain the variation than actual differences in charges paid to pick up the two appliances. In contrast, due to the smaller size of the appliance, it does make sense that the three non-participants charged to dispose of RAC paid about $15 on average for the removal.

Options for Disposition

Units not recycled through the program would most likely have been picked up by appliance dealers or hauling companies, given away to friends or family members, or put out with the trash. Notably, it is highly likely that most of these appliances would have found (for participants) or did find (for non-participants) their way into the used appliance market. Only about 24% of RAC, 12% of FZ, and 17% of RF retired through the program would have continued to be used by respondents. Another 8% of RF, 15% of FZ, and 14% of RAC would have been stored unused by respondents. Finally, between 3% and 11% of participants and non-participants named recycling the unit as a viable option to program participation.

Very few participants considered selling their appliances, and very few non-participants actually did. Specifically, only 1% of participants retiring RF, 5% retiring FZ, and 2% retiring RAC considered selling the units. Similarly, only 4% of RF and less than 1% of RAC were actually sold by non-participants; no non-participants sold FZ.

Replacement of Retired Appliances

The logic of the ARP assumes that participants will not replace the RF or FZ retired through the program. Unfortunately, about 46% of RF retired through the program have been replaced, as have 34% of FZ. These high rates of replacement serve to lower the overall energy savings achieved by the program. The good news is that three quarters of the replacement RF and 93% of the replacement FZ were purchased new; therefore, they most likely use less energy than the older units they replaced. Furthermore, among those customers who recognize the ENERGY STAR label, 73% of the replacement RF and 79% of the replacement FZ were reported to be ENERGY STAR qualified. While we believe these percentages are somewhat exaggerated, it appears that the replacement units still allow for net energy savings.

It is, in contrast, assumed that many RAC will be replaced; this assumption underlies the pairing of turn-in events with incentives to purchase ENERGY STAR-labeled RAC. As expected, respondents replaced 75% of the RAC; nearly all of the replacement RAC were new. Most of the replacement units purchased by those aware of the ENERGY STAR label were qualified units (87%). Of the qualified units, 57% were purchased using the incentive provided at turn-in events. However, a quarter of the participants at pick-up events also said they used a purchase incentive; this indicates that at least some respondents confused the two types of incentives despite the fact that the survey explicitly drew distinctions between them.

Free Ridership and Spillover

The ARP challenged the NMR team and the sponsors to develop a definition of free ridership that adequately suited the program's goals and objectives. We needed a definition that takes into account the dual purpose of achieving energy savings and diverting units from the secondary market. The final definition agreed upon included the following participants as free riders:

- Those who surrendered a non-working appliance
- Those who would have recycled the appliance anyway
- Those who would have stored the appliance unused
- Those who indicate that they would have "continued using" an appliance that they previously indicated had been unplugged for the year prior to surrender or who had said they were extremely unlikely to use the unit in the summer of 2004

Based on this definition, free ridership rates range from 16% for RF to 21% for FZ and RAC. In contrast, spillover rates for those who retired any additional RF, FZ, or RAC after participating were estimated to be about 7%; if we include the retirement of any additional appliances, the rate increases to about 9%. In addition, of those participants who are aware of the ENERGY STAR label, 78% said they had purchased some type of ENERGY STAR-labeled product after participating in the program. Our experience indicates that this rate is very high, so we believe that the self-reported purchase of ENERGY STAR products should be considered the higher bound of estimate range. We believe the true percentage falls somewhere between 39% (a 50% discount rate) and 78%. The overall percentage of participants who report that their participation

in the ARP influenced their purchase of an ENERGY STAR-qualified appliance was 13%; applying the 50% discount rate produces an estimation range of 7% to 13%.

Benefits and Drawbacks of Participation

Approximately 40% of ARP participants say their energy usage has decreased since participating in the program; another 33% say their usage has remained about the same. These participants are satisfied with the perceived energy savings, giving an average satisfaction rating of 6.9 on a 0-10 scale.

Environmental benefits were the most commonly named non-energy benefits (44%), although some respondents also mentioned freeing up space (8%), removing junk (18%) and saving money (14%). About 23% of respondents saw no other benefits.

Most people saw no drawbacks to participation (85%) and another 5% said they did not know if there were any drawbacks. The remaining ten percent of respondents named such drawbacks as the loss of food or other storage space, that usable appliances are thrown away, or that the house is no longer cool.

Secondary Market

Very few participants had purchased either the units they retired or their replacement units from the used appliance market. Likewise, very few of the units currently in the homes of non-participants had been purchased used. Instead, most of the used units in respondents' homes had been given to the respondents by friends or family members.

In contrast, non-participants who actually disposed of appliances are contributing thousands of units to the used market. When weighted back to the population and limited to disposals from June through December of 2004, we estimate that non-participants potentially contributed 67,812 RF, 12,536 FZ, and 64,031 RAC to the secondary appliance market. Given these large contributions and the relatively small number of participants, we further estimate that only 6% of RF, 13% of FZ, and 5% of RAC were diverted from the used market by the ARP.

Even though we believe that some of the people most likely to purchase used appliances were excluded or under-represented in the sample, we still find it difficult to believe that this many used appliances are actually being purchased in Connecticut each year. Based on survey results and the findings from the secondary market investigation, we believe that four things can happen to used appliances. Some are purchased or given away within Connecticut, some are actually decommissioned altogether, some sit in warehouses, and the rest are shipped to other states or countries. Unfortunately, we have no way of estimating the numbers of units following each of these alternative paths.

Key Conclusions

Because they will draw from the numerous tasks that have been—or are in the process of being—completed for this evaluation, we will save most of our recommendations for the ARP for the overall final report. However, we highlight some of the most important findings from the analyses of the two surveys and briefly discuss their implications for the program.

First, the sponsors have decided to discontinue turn-in events. Participation in the events is unpredictable and largely dependent on the weather; furthermore, a recent audit found that they were not cost effective. However, the survey results indicate that participants in turn-in events were more likely than pick-up participants to have actually used their RAC prior to its surrender through the program. These participants appear to have been motivated to participate by the pairing of the $25 retirement incentive with a $25 incentive to purchase an ENERGY STAR-qualified RAC. For this reason, we believe that the sponsors will increase the rate at which less efficient, older RAC are replaced with more efficient ENERGY STAR-qualified models if they continue to offer some type of purchase incentive. This may take the form of a customer rebate or a negotiated cooperative promotion with retailers as was held in 2005. We caution, however, that the rebate may have to be substantial if the ENERGY STAR-qualified units are to compete with the less expensive—and less efficient—models on the market. Therefore, the sponsors will have to consider if purchase incentives will bring about desired results in a cost effective manner.

Second, despite the fact that nearly every unit retired through the program was diverted from either the formal secondary market (i.e., used appliance dealers) or the informal one (e.g., being given away, sold at garage sales, or found on the curb), the ARP is making only a small dent in the number and percentage of appliances entering the secondary market. This finding confirms a similar one reached in RLW's investigation of the used appliance market. Together these two very different research methods are pointing to the same recommendation: if the program is to make substantial diversions from the used appliance market, it would be better to target new appliance dealers and, possibly, trash hauling companies. In order to keep used appliances from being given away, the program may offer a small incentive to customers purchasing new units to insure that they actually give them to appliance dealers who will recycle the RF and FZ.

Third, very few non-participants sold any of the appliances they had disposed of since May of 2004. And while only a handful paid to have their unwanted appliances removed, it remains more likely that customers would have to pay for the removal rather than making money from it. Furthermore, the charges for product removal are $25 or less, on average. Therefore, we believe that the current incentives to remove unwanted appliances are adequate, and perhaps even generous. We will provide further clarification after analyzing the data on untapped potential, to be included with the energy savings report.

Finally, and most importantly, the results of the survey point to substantial barriers to the achievement of desired energy savings. Of course, we will not be able to draw final conclusions about actual energy savings until the billing analysis and energy savings estimates have been completed. The results from the surveys make clear, however, that customers replaced many of the products that were retired. Luckily most of the replacement units were purchased new, making it likely that they were more efficient than the models retired, and quite a few of them—especially for RAC—were reported as being labeled with the ENERGY STAR. Still, the frequency of replacements will lower net energy savings. Estimates of energy savings will be further degraded by relatively high free ridership rates and typical spillover rates.

1 Introduction

This report summarizes the majority of results of the participant and non-participant telephone surveys conducted by Nexus Market Research, Inc., in support of the evaluation of the Connecticut Appliance Retirement Program (ARP). Results related to the process analysis have been summarized in that report.[1]

The survey results presented here address eight main topics:

1. Characteristics of respondents
2. Characteristics of the units that were retired
3. Pre-surrender use of appliances
4. Disposition options
5. Replacement of retired units
6. Free ridership and spillover
7. Benefits and drawbacks of program participation
8. Respondent purchases from and contributions to secondary appliance market

The report also includes population estimates of the number of products replaced by participants, the number of appliances disposed of by non-participants, and the number of units entering and diverted from the secondary appliance market.

Originally, we had expected to include estimates of the per-unit and total energy savings resulting from the program as well as the potential energy savings (i.e. "untapped potential"). However, due to the need to reanalyze billing data, we will instead include these estimates in an overall report addressing energy savings. In the energy savings report, we will make necessary adjustments to estimates based on the implications of free ridership, spillover, and the replacement of retired units.

[1] Topics addressed in the process analysis include: verification of the products recycled through the program, awareness of the program among non-participants, how respondents heard about the program, satisfaction with the program, awareness of costs of running a second refrigerator and what happens to units once they are surrendered, and reasons for participation, including the influence of the financial incentive, and non-participation.

1.1 Final Sample Designs and Sampling Error

The participant survey was conducted from August 8 through August 19; the interviews took an average of 13 minutes to complete. The final sample design is presented in Table 1-1. The design reflects the desire to survey a wide range of participants. Therefore, we stratified by sponsor, whether the respondent lived in SWCT (i.e., the targeted area), and the combination of appliances surrendered by each participant as reported in the initial ARCA data file. The shaded cells indicate where the actual, completed sample size differed from the desired size. The differences were slight, never exceeding five respondents. The final sampling error was 3.7%.

Table 1-1: Final Participant Survey Sample Design by Strata

Sponsor	Target	Appliance Mix	Population	Desired Sample	Actual Sample
CL&P	Yes	One RF, No FZ, No RAC	1,827	60	62
	Yes	More than one RF, No FZ, No RAC	56	8	8
	Yes	No RF, One FZ, No RAC	625	25	26
	Yes	No RF, More than one FZ, No RAC	18	1	1
	Yes	No RF, No FZ, One RAC	509	25	25
	Yes	No RF, No FZ, More than one RAC	428	23	23
	Yes	More than one RF, More than one FZ, No RAC	143	20	18
	Yes	One RF, No FZ, One RAC	17	1	1
	Yes	More than one RF, No FZ, More than one RAC	152	20	19
	Yes	More than one RF, More than one FZ, More than one RAC	19	1	1
	Yes	No RF, More than one FZ, More than one RAC	43	5	5
	No	One RF, No FZ, No RAC	1,644	50	50
	No	More than one RF, No FZ, No RAC	63	8	8
	No	No RF, One FZ, No RAC	566	25	25
	No	No RF, More than one FZ, No RAC	23	1	1
	No	No RF, No FZ, One RAC	315	23	23
	No	No RF, No FZ, More than one RAC	312	23	23
	No	More than one RF, More than one FZ, No RAC	135	20	21
	No	More than one RF, No FZ, More than one RAC	240	22	22
	No	More than one RF, More than one FZ, More than one RAC	35	5	5
	No	No RF, More than one FZ, More than one RAC	71	9	9
UI	Yes	One RF, No FZ, No RAC	1,961	65	66
	Yes	More than one RF, No FZ, No RAC	34	5	5
	Yes	No RF, One FZ, No RAC	707	30	30
	Yes	No RF, More than one FZ, No RAC	15	1	0
	Yes	No RF, No FZ, One RAC	738	30	31
	Yes	No RF, No FZ, More than one RAC	563	25	25
	Yes	More than one RF, More than one FZ, No RAC	125	19	14
	Yes	One RF, No FZ, One RAC	36	5	5
	Yes	One RF, No FZ, More than one RAC	15	1	0
	Yes	More than one RF, No FZ, More than one RAC	90	10	10
	Yes	No RF, More than one FZ, More than one RAC	22	1	1
	No	One RF, No FZ, No RAC	228	22	25
	No	No RF, One FZ, No RAC	78	9	9
	No	No RF, No FZ, One RAC	27	1	1
	No	No RF, No FZ, More than one RAC	23	1	2
Total			11903	600	600

The non-participant survey was fielded from September 8 through September 12. It took an average of six minutes to complete. Table 1-2 summarizes the completed sample design and sampling error for the non-participant telephone survey. The final design took into account three pieces of information. First, we stratified by sponsor. Second, we stratified by region. Third, as described in the final work plan, half of the non-participants surveyed had similar patterns of energy usage as participants prior to taking part in the program. The population size was based on the non-participant billing records we received from the sponsors. We were able to fill all desired strata quotas, and even surveyed five additional people. The overall sampling error for the design is 4.3% at the 90% confidence interval, assuming a 50%/50% break in responses. This error also matches that included in the approved sampling plan. Because the samples represent different populations, we almost always separate data for the matched respondents from the unmatched respondents. The only exceptions occur when the sample sizes are small.

Table 1-2: Non-Participant Survey Sample Design and Sampling Error

Sponsor	Matched Energy Use	Region	Population	Desired Sample	Actual Sample
CL&P	Yes	SWCT	3,494	100	102
		Other	10,601	75	75
	No	SWCT	5,006	100	101
		Other	16,044	75	76
UI	Yes	SWCT	5,453	75	75
	No	SWCT	12,036	75	76
Total			**52,634**	**500**	**505**

The two designs are further summarized in Table 1-3. The percentage of participant respondents who are customers of CL&P and the percentage from SWCT are both 63%. The overlap of these percentages is coincidental, based largely on the proportions in the population of participants, with only some adjustments to reduce overall sampling error. Furthermore, a comparison of the "total" percentages and the "in-depth" percentages for each appliance type makes clear that nearly all the customers who had recycled each appliance (the "total" number) were later asked in-depth questions about that appliance.

Turning to the non-participant survey, we find that 70% of respondents were from the CL&P territory and as well as from SWCT. While the percentages are again coincidental, the 70% for each was achieved through intentional design. We attempted to keep the percentage of CL&P customers roughly similar to the population while still making sure to survey a large enough sample of UI customers. Furthermore, we over sampled respondents from SWCT in order to gain a greater understanding about program awareness and untapped potential in the area most targeted for reductions in energy use.

Table 1-3: Final Sample Counts by Major Categories of Interest

	n	% of Total n
Participant Survey	**600**	**100%**
CL&P	376	63%
UI	224	37%
SWCT	376	63%
Other	224	37%
Pick-up only	441	75%
Turn-in (including both modes)	159	25%
Refrigerators (total)[a]	335	56%
Freezers (total)[a]	159	27%
Room AC (total)[a]	224	37%
Refrigerators (in-depth)[a]	333	56%
Freezers (in-depth)[a]	158	26%
Room AC (in-depth)[a]	221	37%
Non-Participant Survey	**505**	**100%**
CL&P	354	70%
UI	151	30%
SWCT	354	70%
Other	151	30%
Matched	253	50%
Not Matched	252	50%

[a] "Total" refers to all respondents in the sample who recalled surrendering at least one of the appliances. "In-depth" refers to those respondents who were asked detailed survey questions about the particular appliance. The sum of the percentages in these categories will exceed 100% as some respondents retired more than one type of product.

Table 1-4 summarizes sampling errors between various groups of participants and non-participants. All errors are below 10% at the 90% confidence interval, assuming a 50%/50% break in responses. The highest errors (9.3%) are associated with the non-SWCT portion, or "other," region of the state and with UI, due to its smaller size in the population and sample. The lowest error (5.7%) is that between the participants and non-participant samples.

Table 1-4: Sampling Errors – Participant v. Non-Participant Surveys

Comparison	Sampling Error
Participants to Non-participants	5.7%
SWCT Participants to Non-Participants	6.9%
Other Region Participants to Non-Participants	9.3%
CL&P Participants to Non-Participants	7.1%
UI Participants to Non-Participants	9.3%

There were nine non-participants (beyond the 505 who responded) who were not eligible for the survey because they told us they had either turned in an air conditioner or dehumidifier (three) or had an appliance picked up by the program (six). There were 49 participants (beyond the 600 who responded) who were not eligible for the survey because they told us that they did not recall participating in the program (37 respondents), or they did not recycle any units from their own home (12 respondents).

Please note that throughout this report, the sample sizes are unweighted while the survey responses are weighted back to their proportions in the population. Usually the population is program participants or non-participants, although sometimes it is actually the number of products or all households in the state.

2 Characteristics of Respondents

This section describes the demographic and housing characteristics of survey respondents. It also discusses whether or not they are aware of the ENERGY STAR label and if participants recall having previously participated in other utility-sponsored conservation programs.

2.1 Demographic and Housing Characteristics

The demographic and housing characteristics of participants, non-participants, and Connecticut residents and households are presented in Table 2-1 and Table 2-2. This information helps us understand how these three groups compare to each other and provides insight into factors that may influence participation. We have compared the characteristics of respondents to the entire state, based on the 2004 *American Community Survey* (ACS) and the *2000 Census of Population and Housing* (U.S. Bureau of the Census 2005a, 2005b). [2] Due to their different methodologies and population bases, we have not conducted statistical comparisons between the statewide data and the telephone survey data. Furthermore, the percentages associated with the "refusal" or "don't know" responses are based on all respondents that were surveyed (i.e., 600 for the participant sample, 253 for the matched non-participant sample, and 252 for the unmatched non-participant sample). However, for ease of comparison across samples and to the population of Connecticut, the percentages associated with categorical responses are based on the number of people actually answering the question with something over than "refused" or "don't know."

The participants we surveyed are slightly more likely to have been male; they are significantly more likely than the matched non-participants to have been male. (Table 2-1)

Both participants and non-participants are more likely to have college degrees than are Connecticut residents overall. Unmatched non-participants are significantly more likely to have college degrees than are participants. Both groups of non-participants are significantly less likely to have attained trade or associates degrees, while matched non-participants are slightly more likely than participants to have stopped their education after attending college but not completing their degree. Both participants and matched non-participants are also more likely than unmatched non-participants to have less than a high school education.

Participants are significantly more likely than unmatched non-participants and also more likely than matched non-participants and the state population overall to be of retirement age.[3] In contrast, unmatched non-participants are significantly younger than both participants and matched non-participants. Matched non-participants are more likely to fall into the 44-54 year age category than are participants and unmatched non-participants.

Many respondents to both surveys chose not to respond to the income question. We should note that we have found this refusal rate to be high in other studies we have conducted in the past or

[2] U.S. Bureau of the Census (2005a): *American Community Survey, 2004* U.S. Bureau of the Census (2005b) *Census of Population and Housing, 2000*. Both are found at http://factfinder.census.gov, accessed on October 2, 2005.

[3] Although the percentage of matched non-participants who are of retirement age is lower than unmatched participants, statistical tests are sensitive to the weighted sample size. The weighted sample sizes for the matched non-participants are smaller than that for the unmatched non-participants, explaining the lack of statistical significance for the respondents who are of retirement age and others throughout the survey.

are conducting now. Thus, we caution that the income findings are based on fewer than two-thirds of respondents to either survey. Still, it is worth noting that participants tend to have lower incomes than either group of non-participants. In particular they are more likely to fall in to the moderate—by Northeast US standards—income category of $50,000 to $74,999, and less likely to have incomes over $100,000.

These demographic and socioeconomic characteristics together paint a reasonable portrait of participants. Because they are older, they grew up at a time when fewer people attended college, and quite a few never finished high school but could still find good paying jobs despite the lack of a higher education. Now many of these respondents are on fixed incomes, explaining their more moderate income levels. In contrast, the younger age of non-participants explains their higher education levels; furthermore, more non-participants are likely still in the workforce, resulting in higher incomes than participants.

Table 2-1: Demographic Characteristics of Respondents[a]

	Participants[b]	Non-Participants[b]		Connecticut[c]
		Matched	Unmatched	
Gender	600	253	252	3,389,483[d]
Female	47%	53%	48%	49%
Male	54	47*	52	52
Education Level	560	241	238	2,298,043[e]
Less than high school	4%	5%	1%*†	11%
High school	23	23	26	30
Technical or trade/ Associate Degree	7	2*	2*	7
Some college	15	21*	17	18
College graduate	32	34	38*	20
Some grad school	4	2	2*	na
Graduate degree	15	13	13	15
Don't Know/Refused	*6%*	*6%*	*6%*	*na*
Age	550	230	229	2,556,258[f]
18-24	<1%	1%	2%*	10%
25-34	4	5	7*	16
35-44	13	15	21*†	22
45-54	22	29*	19†	20
55-64	22	25	24	15
65 and older	40	27	28*	17
Don't Know/Refused	*8%*	*10%*	*7%*	*na*
Income	360	161	163	1,329,950[g]
Less than $35,000	19%	18%	22%	28%
$35,000-$49,999	17	17	15	13
$50,000-$74,999	27	22	15*	19
$75,000-$99,999	21	13*	21†	14
$100,000 or more	17	32*	28*	25
Don't Know/Refused	*41%*	*36%*	*35*%*	*na*

* Significantly different from participants at the 90% confidence level.
† Significantly different from matched sample at the 90% confident level.
[a] Results are subject to rounding error.
[b] Actual responses based on all who answered each question; refusals based on total number of respondents (i.e. 600 for participants, 253 for matched non-participants, and 252 for unmatched non-participants).
[c] Connecticut Data based on results of the 2004 American Community Survey http://factfinder.census.gov.
[d] Population
[e] Population 25 years and older
[f] Population 18 years and older
[g] Households

Turning to housing characteristics (Table 2-2), one important issue stands out. Although there are some significant differences between participants and matched non-participants, in general, the housing characteristics of matched non-participants are relatively similar to those of participants. This fact verifies that the matching procedure worked as desired—the matched non-participant sample was drawn from similar housing stock as participants, thus providing a strong comparison group for both the survey and the billing analysis.

Other notable findings include the following. Program participants are significantly more likely than non-participants in both groups to live in detached single family homes and to own their homes. This pattern makes sense; homeowners own their appliances and can, therefore, make decisions about disposing of them. This is likely less true for renters. Furthermore, the home type and ownership patterns also fit well with the demographic data: older residents have had a greater opportunity to purchase homes either when they were wage earners and/or when purchase prices were both absolutely and relatively lower. Older residents are also more likely to have older, and therefore qualifying, appliances in their home.

Not surprisingly, given the fact that they are more likely to dwell in multi-unit buildings, unmatched non-participants have significantly smaller home sizes than do either participants or matched non-participants. Unmatched participants are also more likely to live alone, again in keeping with their younger age, renter status, and housing type and size. Matched non-participants are less likely than participants to live in two-family houses, perhaps suggesting that fewer of them are "empty nesters" than is the case among participants. The fact that many of the participants have only two people living in their homes increases the chance that they have little use for extra appliances that were once needed when children lived at home. Somewhat counter-intuitively, since participating, the percentage of participants with one person in their house has decreased while those with three occupants have increased. We cannot speculate on the numerous possibilities that could explain this finding, but it will be noted in the section on energy savings.

Table 2-2: Housing Characteristics of Respondents[a]

	Participants[b]	Non-Participants[b]		Connecticut[c]
		Matched	Unmatched	
Type of House	589	251	248	1,414,433[d]
Detached Single Family	89%	84%*	76%*[∞]	59%
Townhouse or duplex-full separating wall and separate utilities	5	7	9*	5
2-4 units no full separating wall and at least one shared utility	5	4	10*[∞]	18
5+ unit building	1	5*	4*	16
Other	<1	0	1[∞]	1
Don't Know/Refused	*2%*	*1%*	*3%*[∞]	na
Tenure	588	249	248	1,329,950[e]
Own	96%	90%*	84%*[∞]	70%
Rent	4	10*	16*[∞]	30
Don't Know/Refused	*1%*	*2%*	*3%**	na
Square Footage	585	249	245	1,414,433[d]
Less than 1,500	18%	15%	26%*[∞]	28%
1,500-1,999	34	33	29	38
2,000-2,999 (Census 2,000-2,499)	32	32	27	24
3,000 or more (Census 2,500 or more)	17	21	19	10
Don't Know/Refused	*2%*	*2%*	*3%*	na
How many people lived in home now	572	242	239	1,301,670[f]
1	12%	16%	19%*	26%
2	44	37*	44	33
3	19	18	14*	17
4	16	16	16	15
5	5	7	6	6
6 or more	3	5	2	3
Don't Know/Refused	*4%*	*5%*	*6%*	na
How many people lived in home at time of participation	571	na	na	na
1	17%[†]			
2	46			
3	15[†]			
4	14			
5	5			
6 or more	2			
Don't Know/Refused	5%			

* Significantly different from participants at the 90% confidence level
† Significantly different from present number of occupants at the 90% confidence level
∞ Significantly different from matched sample at the 90% confident level.
[a] Results are subject to rounding error.
[b] Actual responses based on all who answered each question; refusals based on total number of respondents (i.e. 600 for participants, 253 for matched non-participants, and 252 for unmatched non-participants).
[c] Connecticut Data are based on results of the 2004 American Community Survey, with the exception of the number of people currently living in the home, which was taken from the 2000 Census of Population and Housing http://factfinder.census.gov.
[d] All housing units
[e] Occupied housing units
[f] Occupied housing units, 2000 Census.

2.2 ENERGY STAR Awareness and Other Program Participation

We asked respondents to both surveys if they were aware of the ENERGY STAR label. (Table 2-3 and Table 2-4) A large percentage of respondents to both surveys (89% to the participant survey and 86% to the non-participant survey) demonstrated either unaided or aided awareness of the label. That is, they either said they were aware of the label after being asked if they knew what the label was (i.e., unaided awareness) or after having the label described to them (i.e. aided awareness). The percentages are somewhat high compared to the 74% aided awareness reported for active ENERGY STAR regions in a survey of national awareness conducted by CEE.[4] It is likely that Connecticut residents are more likely to be aware of the label; the population of the state tends to be more affluent and to have higher educations levels, both characteristics associated with greater awareness of the ENERGY STAR label.

Table 2-3: Participants Aware of the ENERGY STAR Label

(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	600	376	189	187	224	187	37
% Aware	89%	89%	92%	86%[∞]	90%	90%	94%

[∞] Significantly different from SWCT within utility at the 90% confidence level

Table 2-4: Non-Participants Aware of the ENERGY STAR Label

(base = non-participant respondents)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	505	252	177	75	253	177	76
% Aware	86%	87%	84%	89%	86%	86%	86%

[4] Consortium for Energy Efficiency (2005) *National Awareness of ENERGY STAR® FOR 2004: ANALYSIS OF CEE HOUSEHOLD SURVEY*. http://www.cee1.org/eval/2004_ES-Survey.php3. Accessed October 19, 2005.

Roughly one-third of participants have participated in some other utility-sponsored energy efficiency program, mostly through purchases via the Smart Living catalog or lighting rebates. (Table 2-5) UI participants were significantly more likely to have purchased lighting products with utility rebates than were CL&P participants.

Table 2-5: Participation in Other Programs

(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	600	376	189	187	224	187	37
Purchased products through the Smart Living catalog	8%	7%	8%	6%	10%	10%	3%
Purchased lighting products with utility rebates	9	6	6	6	12†	12	16
Purchased other appliances using utility rebates	4	5	4	6	3	3	2
CL&P WRAP	2	3	4	2	n/a	n/a	n/a
CL&P CIP Program	<1	1	1	0*	n/a	n/a	n/a
CL&P ENERGY STAR Homes	<1	1	1	2	n/a	n/a	n/a
UI TOU rate program	<1	n/a	n/a	n/a	1	1	0
UI Electric hot water tank lease	<1	n/a	n/a	n/a	1	1	0
Others	2	2	1	2	3	3	0*∞
Don't Know	10	13	12	13	7†	7	0*∞
No Other program	68	69	70	67	66	65	82∞

* Significantly different from Overall within utility at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

3 Characteristics of Surrendered Units

Table 3-1 summarizes the number and percentage of products that customers recall retiring through the program. Due to its larger customer base, CL&P customers retired a greater number of products. Furthermore, while approximately 36% of CL&P's customers are in SWCT, half of the utility's retired units came from that portion of the state. The one exception is that nearly 60% of RAC picked up from CL&P customers came from outside of SWCT. In contrast, because virtually all of its customers live in SWCT, most of the UI units retired came from that portion of the state. In fact, we suspect that UI customers identified as living in "other" parts of the state may actually live in the targeted communities, but they use an unofficial town name not included on the "critical and constrained" list.

Table 3-1: Products Retired by Respondents

(base = ARCA product count for participant respondents)

	RF		FZ		RAC-PU		RAC-TI	
Sponsor	**CL&P**	**UI**	**CL&P**	**UI**	**CL&P**	**UI**	**CL&P**	**UI**
# products	258	140	126	55	92	16	141	96
SWCT	51%	81%	48%	84%	41%	100%	50%	95%
Other	49	19	52	16	59	0	50	5

For reasons discussed in more detail in the process analysis, we believe that the estimates respondents gave for the number of products picked up are slightly high. In short, pick-up respondents were asked if they recalled surrendering a specific number of products. This number was taken from an ARCA database that contained duplicated records. Luckily, the survey also gave respondents the opportunity to correct the number "from our records," and many did exactly that. The original total number of products quoted, the actual number based on the revised ARCA database, the numbers customers self-reported, and errors in those numbers are presented in Table 3-2. The upshot of the table is this: respondents were quoted product numbers that, overall, were between 46% and 155% higher than the actual number of products retired. These respondents corrected the data to within 10% to 16% of the actual numbers. Thus, we believe that respondents showed a great deal of care in providing largely accurate self-reported estimates to the products they retired.

Table 3-2: Product Counts: Self-Report and Revised ARCA

Row		RF	FZ	RAC-PU
A	Original ARCA	504	259	237
B	Revised ARCA	344	165	93
C	% over Actual *([A ÷ B]-1 x 100)*	46%	57%	155%
D	Difference *(A – B)*	160	94	144
E	Self-Report	398	181	108
F	% of Self Report *([E ÷ B]-1 x 100)*	16%	10%	16%
G	Difference	-54	-16	-15

3.1 Program Eligibility

The program has three primary eligibility standards, apart from participants being customers of either CL&P or UI. First, the appliances must be at least ten years old. Second, they must be in working condition, and, therefore, able to pull power from the electricity grid. A third criterion applies only to RF: that the unit has to be a secondary refrigerator. In this section, we discuss the eligibility of the units retired, as reported by participants.

3.1.1 Participant-Reported Age of Units Surrendered

In order to verify that the units being recycled were of the appropriate age, we asked customers whether the age of the product fell into age categories. Only in retrospect did we realize that one of the categories, six to ten years, included an eligible age, namely ten years. The other categories include either all eligible or ineligible years.

Based on these categories, it appears that all the RF (Table 3-3) and FZ (Table 3-4) being retired are most likely of eligible ages. No one reported retiring a unit less than six years of age, and very few were surrendered that were in the six-to-ten year category. In fact, the percentages in that category are small enough that all the units may well have been ten years old at the time of retirement. Most of the RF retired were over 16 years of age, and most of the FZ retired were over 20 years old. Refrigerators from the non-SWCT portion of CL&P's territory were more likely to be in the 16-20 year range, and their freezers to be in the 11-15 year range.

Table 3-3: Age of Refrigerators by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
6-10 years	5%	4%	3%	6%	7%	7%	8%
11-15 years	21	22	28	16$^{\infty}$	18	18	17
16-20	24	26	17*	34$^{\infty}$	22	21	33
more than 20 years	46	46	47	44	46	47	33
Don't know	4	2	5	0$^{\$\infty}$	7†	7	8

† Significantly different from CL&P overall at the 90% confidence level
$^{\$}$ Significantly different from Overall within utility at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within utility at the 90% confidence level

Table 3-4: Age of Freezers by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
6-10 years	7%	7%	7%	8%	4%
11-15 years	15	12	5	20$^{\infty}$	19
16-20	13	11	12	10	19
more than 20 years	64	70	76	63	53†
Don't know	2	0	0	0	4

† Significantly different from CL&P overall at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within utility at the 90% confidence level
[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

In contrast, it appears that some RAC being recycled are younger than the required ten years. (Table 3-5 and Table 3-6) A few units were reported as being less than six years old, particularly in the non-SWCT portions of CL&P's territory, and the percentages within the six to ten year category are high enough to suspect that at least some of the units were younger than ten years of age. However, most of the RAC being retired are older than ten years of age. Approximately 65% of RAC picked-up and 72% of RAC turned in clearly fall into eligible age ranges.

Table 3-5: Age of RAC by Surrender Mode

(base = participant respondents retiring RAC)

	Total	Pick-up	Turn-in[a]
n	221	62	159
0-5 years	2%	3%	1%
6-10 years	23	21	24
11-15 years	27	24	28
more than 15 years	43	41	44
Don't know	6	10	5

[a] Respondents who participated in both modes are included with the turn-in, as we instructed such respondents to tell us about the RAC they turned in.

Table 3-6: Age of RAC by Sponsor and Region of State

(base = participant respondents retiring RAC)

	CL&P			UI[a]
	Overall	SWCT	Other	
n	149	71	78	72
0-5 years	3%	0%[$]	6%[∞]	0%*[†]
6-10 years	19	21	17	27
11-15 years	26	26	26	28
more than 15 years	46	46	47	40
Don't know	6	7	4	5

[*] Significantly different from all RAC at the 90% confidence level
[†] Significantly different from CL&P overall at the 90% confidence level
[$] Significantly different from Overall within utility at the 90% confidence level
[∞] Significantly different from SWCT within utility at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

3.1.2 Condition of Appliance upon Retirement

According to respondents, nearly all the RF and FZ and most of the RAC turned in were in working order when retired. Fewer than two percent of the appliances that were recycled were not working when they were retired through the program. (Table 3-7 to Table 3-9) As discussed later, we will count the few units not working well as "free rider" units. Five percent of RF, three percent of FZ, and 13% of RAC were not working well. The appliances that were not working that well may have met the criteria that, when plugged in, they ran. This is not to say, however, that these units were not energy hogs; it is likely that some units ran all the time in the attempt to keep food or rooms cooled. Others may have been leaking CFCs. A significantly smaller percentage of RF retired from the UI territory than from the CL&P territory were in working condition when recycled.

Table 3-7: Refrigerator in Working Condition by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Yes	94%	96%	96%	96%	91%†	91%	91%
Yes, but not well	5	4	4	4	7	7	9
No	1	1	1	0	2	2	0

† Significantly different from CL&P Overall at the 90% confidence level

Table 3-8: Freezer in Working Condition by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
Yes	95%	95%	98%	93%	98%
Yes, but not well	3	4	0[$]	7[∞]	2
No	1	1	2	0	0
Don't know	<1	0	0	0	<1

[$] Significantly different from Overall within utility at the 90% confidence level
[∞] Significantly different from SWCT within utility at the 90% confidence level
[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Table 3-9: RAC in Working Condition by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Yes	82%	83%	81%	85%	81%
Yes, but not well	13	14	18	10	11
No	2	1	0	2	3
Don't know	3	2	2	2	5

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

3.1.3 Primary or Secondary Refrigerator

Because most homes have a RF, the program targeted the approximately 27% of homes with more than one.[5] Only non-primary RF were eligible for surrender. As we can see from Table 3-10, 28% of respondents found a way around this eligibility requirement and recycled their primary unit. CL&P participants from outside of SWCT were significantly more likely to surrender primary units than those in SWCT. It may be that participants who surrendered their primary unit first bought a new RF and then called the program to pick up what then became a "second" unit that they had no intention of using. Because ARCA screens for recent purchases, this could mean that some participants were less than truthful during the screening process. Still, it should be remembered that these formerly primary units were most likely going to be sent to the basement to become secondary units or they were going to find their way to the secondary market. Therefore, although the relatively high rate of retirement of primary RF is less than ideal, these surrenders are still contributing in a positive way to the goals of the ARP.

UI customers overall were less likely to say that the RF was not being used at all. Not surprisingly, 79% of the 88 respondents who say they retired their primary refrigerator bought a replacement unit; only 35% of the 228 people retiring a secondary unit and 13% of the sixteen respondents retiring a unit not in use replaced their RF.

Table 3-10: Primary or Secondary Refrigerator by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Primary	28%	26%	19%	32%$	32%	31%	42%
Secondary	67	69	77	60$	66	67	50
Not being used	5	6	5	8	2*†	2	8
Don't know	<1	0	0	0	<1	<1	0

* Significantly different from all RF at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
$ Significantly different from SWCT within utility at the 90% confidence level

[5] NU Market Research (2001) *2000 Residential Dwelling and Appliance Saturation Survey*. Northeast Utilities System.

3.1.4 Type of RAC Unit

We asked respondents in what kind of space their RAC was typically installed. We wanted to verify whether or not the type of installation had an influence on the how many months the unit was used. As show in Table 3-11, nearly all of the RAC retired had been used in a window, as opposed to being used in a cutout space in the wall. Only one percent of units were portable. Due to the small frequencies in all but the "window" category, we do not show any breakdowns by the categories of interest for this variable. Furthermore, we determined that there was no difference in the months the units were used based on whether they were installed in windows or wall cutouts. This characteristic, then, will not be used in our RAC energy savings estimates.

Table 3-11: Type of RAC Installation
(base = participant respondents retiring RAC)

	Total
n	221
Window	94%
Cutout	5
Portable	1
Don't know	<1

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

4 Prior Usage of Appliances

In order to determine factors that may influence actual energy savings, we asked respondents questions about their use the appliances surrendered through the program. The questions centered on where and how often the appliances were used.

4.1 Location

As discussed in the Secondary Literature Review report, the location of a RF affects the amount of energy it uses, mainly due to the ambient temperature of the room.[6] Basements tend to be cooler, and RF and FZ located there often use less energy, all other things being equal. Approximately half of all the RF surrendered through the ARP had been located in the basement. (Table 4-1) Another 21% to 42% had been located in the kitchen. Units surrendered from CL&P customers living outside of SWCT were significantly more likely than those from within SWCT to surrender a unit from the kitchen. Of the 83 people who surrendered a unit from their kitchen, 92% reported that it was a primary unit; likewise, 92% of the 165 units located in basements were secondary units. Most of the RF not located in basements or kitchens were in the garage.

Table 4-1: Where Refrigerator Located by Sponsor and Region of State[a]

(base = participant respondents having RF plugged in the year prior to surrender)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	304	190	100	90	114	89	25
Basement	51%	48%	53%	43%	55%	55%	50%
Kitchen	29	28	21	37$	31	30	42
Garage	17	19	23	15	15	15	8
Family room	2	2	1	3	0*†	0	0
Storage/Pantry/Laundry	1	2	3	1	<1*†	0	<1
Porch	<1	0	0	0	0	0	0
Shed	<1	1	0	1	0	0	0
Hall	<1	0	0	0	<1	0	<1

* Significantly different from all RF at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
$ Significantly different from SWCT within group at the 90% confidence level
[a] Those who indicated that the RF was not plugged in over the year prior to the surrender or did not know if the unit was plugged in were not asked this question.

[6] Delivered August 1, 2005

Overall, 80% of FZ were located in the basement, with another 13% being located in the garage. (Table 4-2) UI customers were significantly less like than CL&P customers to use their FZ in the garage. We are uncertain why this may be; perhaps fewer residents in the UI territory have garages. The few remaining units were located on porches, in storage areas, or in kitchens.

Table 4-2: Where Freezer Located by Sponsor and Region of State[a]

(base = participant respondents having FZ plugged in the year prior to surrender)

	Total	CL&P			UI[b]
		Overall	SWCT	Other	
n	131	89	41	48	42
Basement	80%	79%	77%	82%	87%
Garage	13	16	20	12	5†
Porch	3	2	0	3	5
Storage/Laundry	3	3	3	3	3
Kitchen	1	0	0	0	0

† Significantly different from CL&P Overall at the 90% confidence level

[a] Those who indicated that the FZ was not plugged in over the year prior to the surrender or did not know if the unit was plugged in were not asked this question.

[b] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

More than half of the RAC surrendered through the program had been used in respondents' bedrooms. (Table 4-3) Another 19% to 26% were used in respondents' living or family rooms. The rest of the units were spread throughout the house or even in the garage. There were no significant differences between groups regarding where RAC were used. As discussed again in Section 4.3.2, the prevalence of RAC in bedrooms indicates that respondents were using the units mainly to cool rooms for sleeping. This suggests that the units were likely on for at least eight hours a day, but they were drawing most heavily from the electricity grid at non-peak hours.

Table 4-3: Where RAC Used by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Bedroom	57%	56%	60%	51%	58%
Living/family room	22	22	19	26	22
Kitchen	7	10	10	9	3
Office/Study	7	6	5	6	10
Dining Room	5	6	5	6	6
Garage	1	0	0	0	1
Didn't use	1	0	0	0	1
Hall	<1	1	0	2	0
Don't know	<1	<1	0	<1	0

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

The tendency for RF and FZ located in the basement to use less energy is largely dependent on the fact that basements are often not heated. However, this is not always the case, especially with the prevalence of conditioned basements. One could also argue that RF located in spaces that are cooled may also use less energy than those in unheated spaces—although the air conditioning likely cancels out any energy savings. Because of the importance of room temperature to energy savings for RF and FZ, we asked respondents if the space in which they kept their RF and FZ was cooled in the summer or heated in the winter. (Table 4-4 and Table 4-5) Sixty percent of RF were located in heated spaces, as were 57% of FZ. Likewise, 50% of RF and 55% of FZ were located in cooled spaces. RF retired by UI customers living outside of SWCT were significantly more likely to have their RF in a heated and cooled space. UI customers overall were more likely to have their FZ in a cooled space and they were more likely than CL&P customers to have their RF in a cooled space.

Table 4-4: Location of RF Heated or Cooled[a]

(base = participant respondents having RF plugged in the year prior to surrender)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	304	190	100	90	114	89	25
Heated in Winter	60%	57%	57%	57%	63%	61%	82%$^{\$\infty}$
Cooled in Summer	50%	46%	45%	46%	56%†	54%	73%$^{\$\infty}$

† Significantly different from CL&P Overall at the 90% confidence level
$^{\$}$ Significantly different from Overall within utility at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within utility at the 90% confidence level
[a] Those who indicated that the RF was not plugged in over the year prior to the surrender or did not know if the unit was plugged in were not asked this question.

Table 4-5: Location of FZ Heated or Cooled[a]

(base = participant respondents having FZ plugged in the year prior to surrender)

	Total	CL&P			UI[b]
		Overall	SWCT	Other	
n	131	89	41	48	42
Heated in Winter	57%	54%	56%	53%	58%
Cooled in Summer	55%	45%	41%	50%	73%*

* Significantly different from all FZ at the 90% confidence level
[a] Those who indicated that the FZ was not plugged in over the year prior to the surrender or did not know if the unit was plugged in were not asked this question.
[b] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

We also cross tabulated the heating and cooling information by location of the unit. (Table 4-6 and Table 4-7) The percentages are based on room totals. Fifty-six percent of basements that held refrigerators were heated in the winter, and 53% of them were cooled in the summer. Not surprisingly, nearly all of the kitchens with RF were heated, and about two-thirds of them were cooled. Very few garages had heating or cooling. Most of the "other" spaces holding RF were heated but not cooled.

Table 4-6: Location of Refrigerator by Heated/Cooled Space

(base = room in which RF had been located)

	n	Heated in Winter	Cooled in Summer
All RF	304	60%	50%
Basement	165	56%	53%
Kitchen	83	91%*	66%*
Garage	45	17%*	17%*
Other	11	70%	40%

* Significantly different from all RF at the 90% confidence level

Heating and cooling patterns of the spaces holding FZ are similar to those for RF. Sixty-one percent of the basements were heated, and 64% were cooled. Most of the other spaces were also heated but not cooled. Finally, very few of the garages were heated or cooled.

Table 4-7: Location of Freezer by Heated/Cooled Space

(base = room in which FZ had been located)

	n	Heated in Winter	Cooled in Summer
All FZ	131	57%	55%
Basement	104	61%	64%
Garage	16	14%*	14%*
Other	11	88%*	29%

* Significantly different from all FZ at the 90% confidence level

4.2 Refrigerator and Freezer Use Behavior

The survey also asked respondents who had turned in RF and FZ two different questions about their use of the retired units. The first question determined how often the units had actually been drawing power from the electricity grid. The second question ascertained how often respondents had actually used the units to cool/freeze foods or beverages. Each question asked respondents to think about their use over the year prior to surrendering the unit.

The first question is summarized in Table 4-8 and Table 4-9. Overall, 65% of the RF retired through the program had been plugged in "all the time" according to respondents. This includes all the units that respondents had designated as "primary" RF. Another 20% had the units plugged in occasionally. Only seven percent of respondents said they plugged the units in "most of the time" or "never." Customers of CL&P living outside of SWCT were less likely to use the units all the time, but were more likely to use them occasionally.

Table 4-8: How Often RF Plugged In by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
All the time	65%	64%	70%	57%∞	68%	67%	75%
Most of time	7	7	7	8	6	6	0†∞
Occasionally	20	20	15	26∞	19	19	25
Never	7	7	6	8	7	8	0†∞
Don't know	1	1	1	2	0*	0	0

* Significantly different from all RF at the 90% confidence level
† Significantly different from Overall within utility at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

Turning to FZ (Table 4-9), we find that a similar percentage of FZ (63%) were plugged in "all the time." However, somewhat more FZ than RF were never plugged in.

Table 4-9: How Often FZ Plugged In by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
All the time	63%	64%	65%	63%	57%
Most of time	10	11	7	15	11
Occasionally	11	8	14	2∞	15
Never	16	17	14	20	17
Don't know	1	0	0	<1	<1

∞ Significantly different from SWCT within utility at the 90% confidence level
[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Based on these self-reported results, we can conclude that the majority of the units recycled had been plugged in most or all of the time. However, over a quarter of all the RF and FZ surrendered had been used only occasionally or never. The seven percent of respondents surrendering RF that they had never used and the 16% surrendering FZ that they had never used

may be considered as free riders, if they also indicate that they would have "continued using the appliance." That is, these individuals essentially are saying they would either have left the unit sitting in their house unplugged or would have begun using it, resulting in either no net change or even an increase in energy usage.

Roughly two-third of respondents who had the refrigerator plugged in at least occasionally also report that they had used the refrigerator "all the time" to cool food. Most of the remaining units had been used to cool food occasionally. (Table 4-10)

Table 4-10: How Often RF Used to Cool Food by Sponsor and Region of State

(base = participant respondents having RF plugged in the year prior to surrender)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	304	190	100	90	114	89	25
All the time	68%	66%	70%	62%	72%	71%	73%
Most of time	7	9	9	8	4[†]	5	0[$∞]
Occasionally	22	21	19	22	23	24	18
Never	3	5	2	7[∞]	1[†]	0	9

[†] Significantly different from CL&P overall at the 90% confidence level
[$] Significantly different from Overall within utility at the 90% confidence level
[∞] Significantly different from SWCT within utility at the 90% confidence level

Sixty-five percent of those retiring FZ say they had used the appliance all the time to cool/freeze food. (Table 4-11) Another 12% had used the appliance most of the time, and 17% occasionally. Only 6% of those who had the unit plugged in at least some time during the year indicate that they had never used the FZ to freeze food or beverages.

Table 4-11: How Often FZ Used to Freeze Food by Sponsor and Region of State

(base = participant respondents having FZ plugged in the year prior to surrender)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	131	89	41	48	42
All the time	65%	70%	73%	67%	57%
Most of time	12	10	5	15	16
Occasionally	17	17	16	18	16
Never	6	3	5	0	11

[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

As Table 4-12 and Table 4-13 show, in general, when people had their units plugged in, they were using them to cool food or beverages. For example, of the 219 respondents who had their RF plugged in all the time, 95% said they had used the RF to cool food all the time. However, a handful of people who retired RF and FZ reported having used the unit "all the time" to cool food, even though they said it was plugged in "most of the time." We are uncertain why this group—and not those saying they had the appliance plugged in occasionally—would have been more likely to be confused by the question. Therefore, we suspect that these few respondents answered the question literally. Perhaps they had the unit unplugged for defrosting or for some other reason, but still used it for cooling their food at that time.

Table 4-12: How Often RF Plugged in by How Often Used to Cool Food
(base = all participants having RF plugged in the year prior to surrender)

	Plugged In			
	Total	All the time	Most of Time	Occasionally
Used to Cool Food	n=304	n=219	n=21	n=64
All the time	68%	95%	18%	0%
Most of time	7	4	59	0
Occasionally	22	2	23	87
Never	3	0	0	13

Table 4-13: How Often FZ Plugged in by How Often Used to Cool Food
(base = participant respondents having FZ plugged in the year prior to surrender)

	Plugged In			
	Total	All the time	Most of Time	Occasionally
Used to Cool Food	n=131	n=102	n=15	n=14
All the time	65%	82%	29%	0%
Most of time	12	9	50	0
Occasionally	17	5	21	85
Never	6	5	0	15

4.3 RAC Use Behavior

Because RAC serve a difference purpose than RF and FZ, it was necessary to ask participants different and more detailed questions about their use of the appliance. In particular, RAC are not used all year long or even for much of the summer. Furthermore, their small size makes it much easier to have numerous unwanted units sitting around the house. Therefore, we asked a series of questions to determine, first, the likelihood that RAC would have been used if the surrender had not occurred and, second, how often RAC typically had been used prior to surrender.

4.3.1 Likelihood to Use in 2004

Respondents who retired an RAC were asked to rate the likelihood that they would have used the unit in the summer of 2004 had they not recycled it. The scale ranged from zero, meaning "extremely unlikely," to ten, meaning "extremely likely." Their ratings, summarized in Figure 4-1, show an unexpected pattern. About one-third of the participants had no intention of using the RAC in 2004, while another one-third had every intention of using the RAC in 2004. Of the remaining one-third, more respondents fell on the "less likely to use" side of the scale. In all, 42% of respondents rated their likelihood of use with a "two" or lower, while 37% rated the likelihood with an eight or higher. Clearly, this finding has implications for projected energy savings. If 42% of the units were most likely not going to be used, the expected energy savings is much lower than if every unit recycled had been expected to stay on the grid.

Figure 4-1: Likelihood of Using RAC if not Recycled

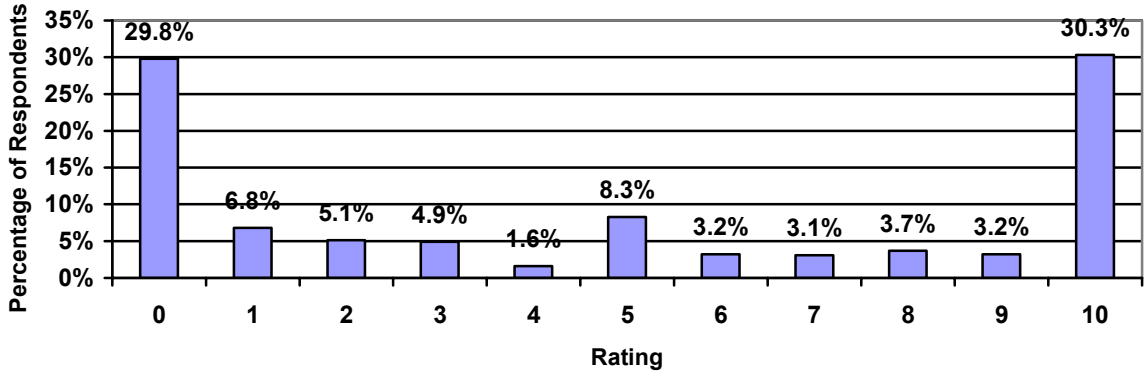


Table 4-14 breaks the ratings down by sponsor and region of the state. The key finding involves the fact that a much larger percentage of pick-up participants were unlikely to use their RAC in 2004. It is likely that these individuals were most interested in having their RF or FZ picked up but took advantage of the opportunity to dispose of an unwanted RAC as well.

Table 4-14: Likelihood of Using RAC if not Recycled

(base = respondents retiring RAC, don't know responses removed)

	Total	Pick-Up	Turn-In	CL&P			UI[a]
				Overall	SWCT	Other	
	214	62	152	145	70	75	69
Extremely Unlikely: 0 rating	30%	45%	25%[†]	26%	29%	22%	36%
Unlikely 1 – 3 rating	17	17	17	17	18	16	17
Moderately Likely 4 – 6 rating	13	7	14	10	9	11	16
Likely 7 – 9 rating	10	10	10	14	14	13	4*[$]
Extremely Likely 10 rating	30	21	34	34	30	38	26

* Significantly different from all RAC at the 90% confidence level
† Significantly different from Pick-Up participants at the 90% confidence level
$ Significantly different from CL&P Overall at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

A comparison of perceived options for disposition and product replacement for respondents most and least likely to use their air conditioner help explain the rather unusual "u-shaped" distribution shown in Figure 4-1. The results presented in Table 4-15 suggest that, in general, those who were unlikely to use their RAC in the summer of 2004 would have disposed of it in some manner (e.g., throwing or giving it away) or would have stored it. In contrast, over half of those who said they were likely to use the RAC in 2004 confirm this; some, however, say they would have thrown or given it away, showing some inconsistency in responses across questions. Such inconsistencies are not uncommon in survey research and have many sources, including the wording of questions and the order in which they are asked.

Table 4-15: Likelihood of Using RAC by Most Likely Alternative Disposition
(base = participant respondents most unlikely and most likely to use RAC in Summer of 2004)

Would have…	Unlikely (0-2)	Likely (8-10)
n	91	79
Continued to use it	3%	52%*
Stored it	18	6*
Given it to Retail Store	0	2
Had Hauled Away	7	11
Thrown Away	44	13*
Given it Away/Donated it	18	13
Sold it	4	2
Had coolants removed/recycled elsewhere	6	3

* Significantly different from unlikely at 90% confidence level

As shown in Table 4-14, those who participated in turn-in events were most likely to have used the RAC in the summer of 2004. We tested the hypothesis that the participation of these individuals was driven by the additional $25 incentive to purchase a new ENERGY STAR-qualified RAC that was available only to participants at turn-in events. The findings in Table 4-16 support this hypothesis.[7] Those who indicated that they were likely to have used their RAC in 2004 were also more likely to purchase a replacement RAC and to do so using the purchase incentive offered by the sponsors. We will look at the replacement of models and use of RAC rebates in more detail in Section 6.

Table 4-16: Likelihood of Using RAC by New Purchases and Use of RAC Rebate
(base = participant respondents most unlikely and most likely to use RAC in Summer of 2004)

		New RAC	Used Purchase Rebate
	n	% Yes	% Yes
Unlikely	91	60%	17%
Likely	79	84%*	45%*

* Significantly different from unlikely at 90% confidence level

[7] We stress that we did not ask if participants were already planning to upgrade to an ENERGY STAR-qualified model before ARP participation; therefore, the findings support, but by no means prove, the hypothesis.

The sponsors have informed NMR that the program will not be holding turn-in events in 2006. Given this decision and the information presented in Table 4-16, the sponsors may still want to offer some type of RAC purchase incentive. This may take the form of additional negotiated cooperative promotions such as that held in 2005 or rebates offered to all customers, not just those who participated in turn-in events.

4.3.2 When RAC Used

We also asked respondents in what month they had typically started using their RAC for the season and when they stopped using it. (Table 4-17 and Table 4-18) About 80% of respondents began using their RAC in either June or July.

Table 4-17: Month Began Using RAC by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
March	1%	1%	2%	0%	0%
May	10	11	14	9	7
June	39	43	40	47	33
July	39	36	36	36	43
August	6	2*	2	2	11†
Did not use	1	0	0	0	1
Don't Know	6	7	7	6	6

* Significantly different from all RAC at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

Most respondents stopped using their RAC in September, although about 20% stopped using the units in August, and just under 10% in October. CL&P customers living outside of SWCT were the most likely to stop using their units in September.

Table 4-18: Month Stopped Using RAC by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
August	19%	18%	23%	13%	19%
September	67	66	58	75*	66
October	8	9	9	8	8
November	1	1	2	0	0
Did not use	1	0	0	0	1
Don't Know	6	7	9	4	5

* Significantly different from SWCT within group at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

CL&P customers were significantly more likely to use RAC for three months than were UI customers; in contrast, UI customers were significantly more likely to report they had used their RAC only in August. (Table 4-19) We were not able to identify any demographic differences between customers of the two sponsors; therefore, we believe that the moderating effect the ocean has on temperature may contribute to the slightly shorter length of use among UI customers, who are more concentrated near the coast.[8] The overall average length of time used per year was about 2.5 months.

Table 4-19: Number and Average Months RAC Used by Sponsor and Region of State

(base = participant respondents retiring RAC, didn't use and don't know responses removed)

	Total	CL&P			UI[b]
		Overall	SWCT	Other	
n	203	138	65	73	65
.5[a]	2%	0%*	0%	0%	4%†
1	15	15	19	9	16
2	32	27	21	34	38
3	39	47	48	46	28*†
4	9	8	6	11	12
5	2	2	4	0	2
8	1	1	2	0	0
Average	2.5	2.6	2.6	2.6	2.3

* Significantly different from all RAC at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
[a] Those with ½ month said they only used the unit during the month of August.
[b] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

[8] NOAA says that Bridgeport, its monitoring station in UI's territory, has an average 40 more cooling days per year than Hartford, the station in CL&P's territory, or 789 v. 759 respectively. However, NOAA uses 65 degrees as its base for a cooling degree day. This is much lower than both the average and minimum temperatures at which respondents turned on their units (See Table 4-22 in this report). NOAA (2005) *Normal Cooling Degree Days (Jan. – Dec.) Base 65 Degrees F* http://www.ncdc.noaa.gov/oa/climate/online/ccd/nrmcdd.txt. Accessed October 15, 2005.

During the months they were using the RAC, customers most often used the units on weeknights followed by weekend nights. (Table 4-20) This was especially true of customers of UI who were significantly less likely than the sample overall and less likely than customers of CL&P to use RAC during the weekend days; UI customers were also less likely than those of CL&P to use the units on weekdays. This implies that UI customers are less likely to be at home during the day and/or that the temperatures during the day are milder than in CL&P's territory. Furthermore, the more frequent use of RAC at night for both sponsors and regions of the state, paired with the information that most were located in bedrooms (Table 4-3), leads to the conclusion that the recycled units had been helping customers get a comfortable night's sleep. If we assume that a customer used RAC every day during a week according to their stated times of use, the average customer would use the RAC 82 hours per week.

Table 4-20: Times of Day and Week when RAC Used by Sponsor and Region of State

(Base = participant respondents retiring RAC, multiple response)

	Total	CL&P			UI[b]
		Overall	SWCT	Other	
n	221	149	71	78	72
Weekdays	37%	42%	42%	42%	28%†
Weeknights	73	70	71	69	79
Weekend days	30	37	36	38	20*†
Weekend nights	49	51	50	53	46
When it's hot	2	2	1	4	2
Varies	1	2	2	1	0
Don't know	5	5	5	4	5

* Significantly different from all RAC at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level

Of course, most RAC were not used all week long according to the patterns described in Table 4-20. Most specifically, it is doubtful that many were used for 82 hours per week all summer long. Instead, respondents more often use RAC when they deem it to be "hot outside." For this reason, we asked respondents if they let the RAC turn itself on and off automatically or if they turned it on and off manually. About, 80% of customers turned the unit on and off manually. (Table 4-21)

Table 4-21: Manually Turned RAC On and Off by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Manually	80%	78%	79%	77%	82%
Automatically	16	20	20	21	11*
Don't Know	4	2	2	2	7

*Significantly different from CL&P overall at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

Finally, we asked those who operated the RAC manually at what temperature they turned the unit on. Typically, respondents turn RAC on when the temperature reaches about 84 degrees. (Table 4-22) There were no significant differences between sponsors or the region of the state. The lowest temperature named was 70 degrees by 4% of respondents and the highest was 95 degrees, also by 4% of respondents. When developing estimates of ENERGY SAVINGS from RAC, NMR will take into account both the cooling degree days as reported by NOAA (565 in 2004) as well as the average temperature at which respondents typically turn on RAC.[9]

Table 4-22: Average Temperature at which RAC Turned On by Sponsor and Region of State[a]

(base = participant respondents operating RAC manually
outliers and don't know responses removed)

	Total	CL&P			UI[b]
		Overall	SWCT	Other	
n	150	92	44	48	58
Average Temperature	83.6	83.3	84.0	82.5	83.9

[a] Outliers included two data entry errors of 0 and 5 degrees.
[b] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

[9] NOAA (2005) *Cooling Degree Days: January 2004 through May 2005.* http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hcs.html. Accessed October 19, 2005.

5 Options for Disposition

The sponsors asked the NMR team to assess what disposition options other than the ARP are available to their customers. Such information provides insight into the "competition" faced by the program as well as how many appliances are entering the secondary market and how many the ARP has diverted from that market. In this section, we only briefly touch on the implications of the results for the secondary market; we will discuss the implications more fully in Section 9, which is devoted entirely to the secondary market.

5.1 Ways in which Non-Participants Disposed of Appliances

One of the main objectives of the non-participant survey was to ascertain how individuals who do not use the ARP are disposing of appliances. We want to stress at the beginning that a very small number of non-participants surveyed had actually disposed of an appliance "since May of 2004." (Table 5-1) In fact, the percentage of people disposing of each appliance type is so small that we will limit the breakdowns by which we summarize the results. Still, the results provide useful insight into the options for disposition and the difficulty of disposing of unwanted appliances.

Table 5-1: Percentage of Non-Participants who Disposed of the Appliances

(base = non-participant respondents)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	505	252	177	75	253	177	76
Refrigerator	15%	21%*	19%	23%	12%†	11%	13%
Freezer	3%	4%	4%	4%	2%	0%$	4%∞
Room AC	11%	9%	9%	9%	13%	12%	13%

* Significantly different from all non-participant respondents at the 90% confidence level
† Significantly different from overall Matched at the 90% confidence level
$ Significantly different from Overall within sub-sample at the 90% confidence level
∞ Significantly different from SWCT within sub-sample at the 90% confidence level

Table 5-2: Population Estimate of Units Disposed of by Non-Participants

(base = non-participant respondents weighted to residential customers and subsample)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
# in Population	1,334,484	19,548	8,947	10,601	1,314,936	646,910	668,026
Refrigerator	157,353	4,054	1,651	2,403	153,299	65,401	87,898
Freezer	30,930	775	351	424	30,154	3,785	26,369
Room AC	162,377	1,810	821	989	160,566	72,668	87,898

As shown in Table 5-3 through Table 5-5, the three appliances are generally disposed of in somewhat different ways. Of the disposed RF, roughly 30% are picked up by the store when a new unit is delivered. Another one in five is hauled away by someone the respondent contacted. About 16% of RF are given away, and another 12% are put out in the trash. In contrast, only 13% percent of RAC that are disposed are picked up by the store or a hauling company. Instead, 30% of RAC are given away and another one in four is simply put out in the trash. Due to small sample sizes, we show the actual number of responses for FZ instead of percentages. Four of the fifteen respondents disposed of FZ called someone to haul it away and another four gave their unit away. Eight percent of those disposed of RF, 11% of those disposed of RAC, and three people disposing of FZ said that they recycled the unit. Finally, non-participants are not selling the appliances they disposed of. Only three respondents sold RF and only one sold an RAC; no respondents sold FZ.

Table 5-3: How Non-Participants Disposed of Refrigerators

(base = non-participants who disposed of RF)

	Total	Matched	Unmatched
n	73	45	28
Store took away when purchased new one	30%	26%	34%
Called someone to haul it away	21	24	18
Gave it away/Donated it	16	11	21
Put out in trash	12	13	11
Recycled it	8	11	5
Sold it	4	3	5
Took to dump	3	0	5
Other	1	3	0
Don't know	5	11	0*†

* Significantly different from all non-participant respondents at the 90% confidence level
† Significantly different from Matched Overall at the 90% confidence level

Table 5-4: How Non-Participants Disposed of Freezers[a]

(base = number of non-participant respondents who disposed of FZ; number of respondents shown)

	Total	Matched	Unmatched
n	15	11	4
Called someone to haul it away	4	4	0
Gave it away/Donated it	4	3	1
Recycled it	3	2	1
Store took away when purchased new one	2	2	0
Put out in trash	2	0	2

[a] No statistical tests performed due to small sample size

Table 5-5: How Non-Participants Disposed of Room Air Conditioners
(base = non-participant respondents who disposed of RAC)

	Total	Matched	Unmatched
n	52	22	30
Gave it away/Donated it	30%	31%	30%
Put out in trash	25	13	30
Store took away when purchased new one	13	6	15
Called someone to haul it away	13	31	5†
Recycled it	11	13	10
Took to dump	4	0	5
Sold it	<1	<1	0
Don't know	5	6	5

† Significantly different from Matched Overall at the 90% confidence level

Although we will discuss the implications more fully in Section 9, it is worth stressing here that nearly all the units that non-participants disposed of could have easily ended up in the secondary market. [10] Based on information collected by RLW, most of the units picked up by the stores or hauled away by a company most certainly made their way into the secondary market. Of course, the units that were sold or given away became a "used" appliance in the new owner's home. It is even possible that the units put out in the trash could also have found their way back into someone's home, as trash services must find some way of disposing of them outside of landfills. We have every reason to believe that these companies would also find a way to make some money by selling the units to used appliance dealers. In short, when customers do not use the ARP nor have the units recycled, the appliances are probably going to the used market.

[10] We will provide estimates of the population of appliances that end up in the secondary market in Section 9.

Most non-participants disposing of appliances generally rated the ease of doing so with a nine or ten on a zero-to-ten scale. (Table 5-6 through Table 5-8) The mean rating for RF and RAC was nearly nine, but the mean rating for the ease of disposing of FZ was only about seven. However, nine percent of non-participants disposing of RF and eight percent disposing of RAC found it to be difficult to do so (i.e., ratings three or less).

Table 5-6: Ease of Disposing of Refrigerators

(base = non-participants disposing of RF, don't know responses removed from mean)

	Total	Matched	Unmatched
n	73	45	28
Difficult: 0 – 3 rating	9%	8%	10%
Moderately easy: 4 – 7 rating	11	10	13
Easy: 8 – 10 rating	76	75	77
Don't know	4	8	0*$
Mean	8.7	8.8	8.6

* Significantly different from all non-participant respondents at the 90% confidence level
$ Significantly different from Matched Overall at the 90% confidence level

Table 5-7: Ease of Disposing of Freezers[a]

(base = number non-participant respondents disposing of FZ; number of respondents shown; means are weighted and don't know responses removed)

	Total	Matched	Unmatched
n	15	11	4
Difficult: 0 – 3 rating	1	1	0
Moderately easy: 4 – 7 rating	4	2	2
Easy: 8 – 10 rating	10	8	2
Mean	6.9	6.9	6.8

[a] No statistical tests performed on number of individual responses; statistical tests were performed on means, but no differences were found to be significant.

Table 5-8: Ease of Disposing of Room Air Conditioners

(base = non-participant respondents who disposing of RAC; don't know responses removed from mean)

	Total	Matched	Unmatched
n	52	22	30
Difficult: 0 – 3 rating	8%	6%	10%
Moderately easy: 4 – 7 rating	9	17	5
Easy: 8 – 10 rating	75	72	76
Don't know	9	5	9
Mean	8.6	8.7	8.5

In order to provide clarification on why the rating for FZ differs from that for RF and RAC, we also computed the mean rating of ease of disposal by the five most common ways means. (Table 5-9) We present the results for each appliance overall due to extremely small sample sizes when breaking the data down further. Disposing of an old RF or FZ is very easy when purchasing a new one because the store hauls away the old one; however, it is harder to convince a store to haul away your old room air conditioner. Of course, putting an RAC into the trash is also very easy. Other than having the store haul it away, it is generally harder to dispose of a FZ, no matter the method. We are uncertain whether FZ are more difficult to unload into the used market, or if respondents were reacting to the physical difficulty of disposing of FZ.

Table 5-9: Ease of Disposing of Appliance by Way of Disposing of Appliance

(base = non-participant respondents disposing of each appliance by manner of doing so)

	Refrigerator		Freezer		Room AC	
	n	mean	n	mean	n	mean
Overall	73	8.7	15	6.9	52	8.6
Store took away when purchased new one	26	9.1	2	10.0	5	5.9*
Called someone to haul it away	13	8.3	4	6.5	8	9.1
Gave it away/Donated it	10	8.4	4	7.2	15	8.8
Put out in trash	9	8.2	2	7.5	13	9.4*
Recycled it	5	7.9	3	5.2	6	8.2

* Significantly different than overall within appliance at the 90% confidence level.

Most of the appliances given away or sold went to friends or family members, as shown in Table 5-10. Respondents sold one RF and one RAC at garage or yard sales while the other two, both RF, were sold to used appliance stores. Based on the information presented here, we do not believe that many people sell their unwanted appliances. Given that so many used appliances are available at very low costs from hauling companies and new appliance stores, dealers of used appliances have little incentive to pay customers directly for buying an appliance. Customers likely do not want the hassle, given the small price they would likely receive for the appliance.

Table 5-10: To Whom Appliance Given or Sold

(base = number of non-participant respondents who gave away or sold appliances; number of respondents shown)

	Refrigerators	Freezers	Room AC
Friend/Family Member	7	3	15
Garage/Yard Sale	1*	0	1*
Used Appliance Store	2*	0	0
Don't know	1	0	0

* Indicates an appliance that was sold

While only four units were sold by non-participants who disposed of appliances, respondents had to pay to have 24 appliances hauled away. In fact, one in five non-participants giving up a RF and one in ten giving up an RAC were charged to have it removed from their home. (Table 5-11) Of the very few people who disposed of a FZ, nearly half of them paid to have it hauled from their home. Table 5-11 also shows how much non-participants paid for the removal of the appliance. It must be stressed that these sample sizes are very small due to the relatively few people who paid and who remembered what they paid. With this caveat in mind, the analysis suggest that it costs about $23 to have a RF removed, $15 to have a FZ removed, and $14 to have RAC removed.

Table 5-11: Paying to Have Appliance Removed
(base = non-participant respondents who did not sell their appliance;
don't know responses removed from means)

	Refrigerators	Freezers	Room AC
n	70	15	51
Charged	21%	48%	11%
n	12	6	3
Average Charge	$23.48	$14.93	$13.86

Given the fact that very few people sell their appliances and that some are even charged to have the appliances removed, we believe the incentive paid by the program for recycling the unit is considered generous by most utility customers who would like to dispose of their appliances.

5.2 Likely Alternative Disposition of Retired Units

We also asked participants what they would most likely have done with their appliance if they had not recycled it through the program. We caution that the intention to do something is not the same as actually doing it. However, we believe it is important to understand what participants perceive as their options for disposing of unwanted appliances. Those respondents who say they would have stored their unit unused or had it recycled comprise part of the group we will consider as free riders, which will be discussed in more detail in Section 7. Likewise, in Section 9, we will estimate the number of units that the ARP diverted from the secondary market.

When asked what they would have done with the appliance if the program had not been available, most respondents say they would not have continued to use the appliance. (Table 5-12 through Table 5-14) The relatively small percentages for all three appliances strongly suggest that most participants really wanted to dispose of the appliances that they retired through the program; the program offered them an easy—and financially attractive—way to do so. Only 17% of those retiring RF and 12% of those retiring FZ indicated that they would have continued using their appliances. Those retiring RAC were most likely to say they would have continued using the appliance (24%). UI customers were significantly more likely than CL&P customers to say they would have continued using their RF; CL&P customers from outside of SWCT were less likely than those inside SWCT to use their FZ but more likely to continue using their RAC.

Putting appliances out in the trash is the most commonly named alternative disposition for all three appliances. CL&P respondents from outside of SWCT were significantly less likely to say they would have put their RF out in the trash. Other perceived alternative methods of disposition include having a retail store or some other company come and pick it up and giving it away or donating it. UI customers disposing of RF were significantly less likely to say they would have a retail store come pick it up. CL&P customers from outside of SWCT were more likely to say they would have called someone to pick up their FZ. Very few people thought about selling the units they retired.

Table 5-12: What Would Have Done with Refrigerator if Program Not Available by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Put out in the trash	24%	26%	32%	19%$^{\infty}$	21%	20%	36%
Continued to use	17	14	19	9$^{\infty}$	22†	24	9
Called someone to haul away	17	14	11	17	21	21	27
Given away/Donated	12	11	10	12	13	14	9
Had retail store come pick up	10	13	11	15	5*†	5	0$^{\$\infty}$
Stored unused	8	9	7	10	7	7	9
Recycled	6	9	8	9	2*†	2	9
Sold	1	1	0	3$^{\infty}$	2	2	0
Other	<1	0	0	0	<1	0	<1
Don't know	4	3	2	5	6	6	0$^{\$\infty}$

* Significantly different than all RF at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
$ Significantly different from Overall within utility at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

Table 5-13: What Would Have Done with Freezer if Program Not Available by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
Put out in the trash	19%	18%	19%	17%	21%
Called someone to haul away	18	16	7	24[∞]	21
Given away/Donated	15	16	14	17	12
Stored unused	15	16	21	10	17
Continued to use	12	10	17	2[$∞]	14
Had retail store come pick up	5	7	5	10	2
Sold	5	6	2	10	2
Recycled	4	5	5	5	2
Don't know	7	7	10	5	7

[$] Significantly different from Overall within utility at the 90% confidence level
[∞] Significantly different from SWCT within utility at the 90% confidence level
[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Table 5-14: What Would Have Done with Room Air Conditioner if Program Not Available by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Put out in trash	31%	27%	23%	31%	37%
Continued to use	24	25	18	33[∞]	23
Given away/Donated	14	13	16	8	16
Stored unused	14	17	21	13	11
Called someone to haul away	9	11	13	8	6
Recycled/Had coolants removed	4	4	4	4	4
Sold	2	2	2	2	1
Had retail store come pick up	1	1	2	0	1
Don't know	1	1	2	0	0

[∞] Significantly different from SWCT within utility at the 90% confidence level
[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

6 Product Replacement and Use of RAC Rebate

In order to reap the desired energy savings, ideally customers will not replace the RF and FZ they retire through the program. If they do replace the RF and FZ, the hope is that the new units are more efficient than the ones retired; ideally, replacement units would be qualified for the ENERGY STAR label. The logic for RAC is a somewhat different. While it may be ideal that customers will not replace RAC, the ARP sponsors recognize that this is unlikely. Therefore, in 2004, they offered $25 rebate coupons at turn-in events toward the purchase of new ENERGY STAR-qualified RAC. In this section, we address the question of product replacement, including providing projections of the number of products replaced and the number that is ENERGY STAR qualified. These projections will be taken into account when we develop the final estimates of energy savings. We also look at the relationship between RAC replacement and the use of the ENERGY STAR purchase incentive.

6.1 Rates of Product Replacement

The rate of product replacement is summarized in Table 6-1 through Table 6-4. The replacement rates for RF and FZ are fairly high. About half of those retiring a RF reported purchasing a replacement unit, and one-third of those retiring FZ replaced them. There were no significant differences between groups regarding RF and FZ replacement.

Table 6-1: Purchased a Replacement RF
(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Yes	46%	46%	51%	40%	46%	46%	50%
No	54	54	49	60	54	54	50

Table 6-2: Purchased a Replacement FZ
(base = participant respondents retiring FZ)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	158	106	49	57	52
Yes	34%	33%	31%	35%	36%
No	66	67	69	65	64
Don't Know	0	0	0	0	0

As expected, RAC were very likely to be replaced, with about three-quarters of respondents purchasing a replacement RAC. Seventy-eight percent of turn-in participants replaced an RAC, while 62% of pick-up participants did; note that the percentages are not statistically different. A significantly higher proportion of CL&P customers replaced their RAC. Only 3% of respondents replaced their recycled RAC with central air conditioning.

Table 6-3: Purchased a Replacement RAC
(base = participant respondents retiring RAC)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	221	149	71	78	72
Purchased RAC	75%	81%	81%	81%	68%†
Purchased CAC	3	3	2	4	1
Neither	23	16	18	15	31†

† Significantly different from CL&P Overall at the 90% confidence level

Table 6-4: Purchased a replacement RAC by Mode
(base = participant respondents retiring RAC)

	Total	Pick-up	Turn-in
n	221	62	159
Purchased RAC	75%	62%	78%
Purchased CAC	3	7	1
Neither	23	31	21

The relatively high rate of product replacement limits the amount of energy savings the program has achieved. Yet, not all replacement units have equally detrimental effects on energy savings. In particular, brand new appliances are almost certainly more energy efficient than those retired through the program, all other characteristics being equal. Thus, it is promising to learn that most of the replacement appliances were purchased new. (Table 6-5 through Table 6-7) It is not very surprising that 96% of the replacement RAC were new, given both the availability of lower cost models as well as the purchase incentive given at turn-in events. Most (93%) of all replacement FZ were new; this coincides with information from the Secondary Appliance Market report that there is less availability of FZ in the used market compared to RF.[11] Finally, 75% of replacement RF were new.

Table 6-5: Purchased new or used replacement RF unit

(base = participant respondents replacing RF)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	157	103	57	46	54
New	76%	75%	70%	81%	77%
Used	24	25	30	19	23

Table 6-6: Purchased new or used replacement FZ unit

(base = participant respondents replacing FZ)

	Total	CL&P	UI
		Overall	Overall
n	54	37	17
New	93%	93%	100%*
Used	7	7	0*
Don't Know	0	0	0

* Significantly different from all FZ at the 90% confidence level

Table 6-7: Purchased new or used replacement RAC unit

(base = participant respondents replacing RAC)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	163	117	55	62	46
New	96%	93%	89%	97%	100%*†
Used	4	6	11$∞	0	0*†
Don't Know	1	1	0	3	0

* Significantly different from all RAC at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
$ Significantly different from Overall within utility at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

[11] Delivered September 15.

Just under one-third of all replacement RF and FZ were purchased at Sears. (Table 6-8) Another 20% of RF were obtained used from friends or family members; in fact, every replacement RF, FZ, or RAC obtained from a friend or family member was used. Almost all other replacement RF were purchased from national or regional retailers. However, 16% of replacement FZ were obtained from local appliance stores. The locations where RAC were purchased differed from those where RF and FZ were purchased. Only 11% of RAC were purchased from Sears; greater percentages were purchased from Lowe's, Home Depot, and Bernie's. Notably, turn-in events were held in the parking lots of each of these three stores in the late spring and early summer of 2004, strongly suggesting that participants were using the rebates to purchase the units at these stores, a hypothesis we address below. Furthermore, the stores where RAC were purchased highlight the different structure of the RAC market. In particular, six percent of RAC were purchased at warehouse stores (e.g., Sam's, BJ's) and another 6% were purchased at discount stores (e.g., Wal-mart). A few were even bought at drugstores. Only one RF was purchased at any of these types of stores.

Table 6-8: Where Obtained Replacement Units

(base = participant respondents replacing each appliance)

	RF	FZ	RAC
n	157	54	163
Sears	32%	30%	11%
Friend/Family	20	4	3
Bernie's*	9	7	12
Home Depot*	8	18	21
Lowe's*	6	0	24
Best Buy	2	6	4
Appliance Store	2	16	0
Warehouse Store	1	0	6
Internet	1	0	0
Discount Store	0	0	6
Drugstore	0	0	2
Other	9	10	3
Don't Know	10	7	8

* At least one turn-in event held at least one location of these national and regional retailers

It is worth emphasizing that, of the replacement appliances obtained used, nearly all of them were given to participants by friends or family, while a couple of RF were purchased at yard or garage sales. Only one unit—a FZ—was obtained from a used appliance dealer. However, one respondent purchasing a used RF and one a used RAC said they bought them at Sears and Wal-mart, respectively. These respondents have most certainly mistakenly identified the store or that their appliance was used.

6.2 ENERGY STAR Status of Replacement RF and FZ

As mentioned above, the purchase of new units will lower the detrimental effect of product replacement on energy savings. The detrimental effect can be limited even further if the replacement appliance is ENERGY STAR qualified. As shown in Table 6-9, about three-quarters of respondents who replaced their RF and who were aware of the label believe the new unit was ENERGY STAR qualified.[12] About eight-tenths of those aware of the label identified their replacement FZ as ENERGY STAR qualified. (Table 6-10) Based on our experience, these figures appear inflated. It is likely that many of these respondents are confusing the Energy Guide label with the ENERGY STAR label. Alternatively, respondents could be giving what they perceive to be the socially desirable response. There were no significant differences between groups in the stated ENERGY STAR status of replacement appliances.

Table 6-9: Replacement RF has the ENERGY STAR Label
(base = participant respondents replacing RF and are aware of label)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	142	96	54	42	46
Yes	73%	69%	68%	71%	81%
No	14	15	18	11	11
Don't Know	13	16	14	18	9

Table 6-10: Replacement FZ has the ENERGY STAR Label
(base = participant respondents replacing FZ and are aware of label)

	Total	CL&P	UI
		Overall	Overall
n	45	30	15
Yes	79%	74%	87%
No	8	9	7
Don't Know	13	17	7

[12] The ENERGY STAR status of all appliances was based only on customer response. We did not ask respondents to find model numbers, so we cannot verify the status of the units.

6.3 ENERGY STAR Status of Replacement RAC and Use of Rebate

Nearly 90% of participants who obtained a new RAC unit and were aware of the label believe the new unit was ENERGY STAR qualified. (Table 6-11) While participants may be more likely to purchase ENERGY STAR models than the typical customer due to the availability of the ENERGY STAR rebate, we believe the figures are still likely inflated.

Table 6-11: Replacement RAC has the ENERGY STAR Label
(base = participant respondents replacing RAC and are aware of label)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	158	112	53	59	46
Yes	87%	88%	80%	97%$^{\$\infty}$	86%
No	7	6	9	3	10
Don't Know	6	6	11	0$^{\$\infty}$	4

$ Significantly different from Overall within utility at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

Of those customers who believe they purchased an ENERGY STAR-qualified RAC, slightly over one-half thought they received the additional $25 ENERGY STAR rebate. (Table 6-12) UI customers were significantly more likely than the sample overall and than CL&P customers to report that they had received the rebate. This is to be expected since most of the UI participants retiring RAC did so at turn-in events, and, therefore, could receive the rebates.

Table 6-12: Received $25 rebate for ENERGY STAR RAC
(base = participant respondents replacing RAC with ENERGY STAR model)

	Total	CL&P			UI
		Overall	SWCT	Other	Overall
n	141	101	43	58	40
Yes	57%	47%	33%	60%$^{\infty}$	76%*†
No	35	47	56	37	17*†
Don't Know	8	7	11	3	7

* Significantly different from all RAC at the 90% confidence level
† Significantly different from CL&P Overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

Because rebates were available only at turn-in events, the 25% of pick-up participants who say they purchased an ENERGY STAR-qualified RAC using the purchase rebate are probably mistaken. (Table 6-13) Although we specifically told them that the purchase incentive was in addition to anything they received for retiring the RAC, customers could still have confused the two rebates. Thirty percent of the turn-in participants who say they purchased an ENERGY STAR-labeled RAC failed to use the rebate. Because we did not ask why they failed to use the rebate, we can only speculate on potential reasons. However, our previous experience suggests that many of these participants lost the coupon, forgot they had it, or failed to send in the coupon.

Table 6-13: Received $25 rebate for ENERGY STAR RAC by Mode

(base = participant respondents replacing RAC with ENERGY STAR model)

	Total	Pick-up	Turn-in
n	141	34	107
Yes	57%	25%*	62%†
No	35	69*	30†
Don't Know	8	6	8

* Significantly different from all RAC at the 90% confidence level
† Significantly different from Pick-up at the 90% confidence level

It is important to note that the RAC purchase rebate could be used on a qualifying unit bought at any store, even over the internet. However, respondents most often used the rebates offered by the three stores that held turn-in events. (Table 6-14) Forty-two percent of all the rebates used were applied to replacement RAC purchased at Lowe's. Another 23% were applied to those at Home Depot, and 12% at Bernie's. The only other store approaching these percentages was Sears, with 8% of the rebates used.

Table 6-14: Received $25 rebate by Store Hosting Turn-in Events

(base = participant respondents using rebate to replace RAC)

	Received Rebate
n	77
Lowe's	42%
Home Depot	23
Bernie's	12

Finally, of those customers who believe they used the $25 ENERGY STAR rebate to purchase an ENERGY STAR-qualified RAC, the majority, nearly 70% said that the rebate strongly influenced their purchase decision (Table 6-15). Furthermore, as discussed in Section 4.3.1, it is likely that the additional incentive also influenced their participation in the ARP. Yet, the possibility remains that these participants already planned to upgrade to an ENERGY STAR-qualified RAC but made use of the incentives anyway; in other words, some of those using the purchase incentive may have been free riders.

Table 6-15: Importance of rebate on decision to purchase ENERGY STAR RAC

(base = participant respondents using rebate to replace RAC)

	Total	CL&P	UI
n	77	46	31
Little Influence: 0 – 3 rating	9%	9%	9%
Moderate Influence: 4 – 7 rating	23	15	30
Strong Influence: 8 – 10 rating	68	76	61

6.4 Population Projections of Replacement Units

Based on the information presented earlier in this section, we developed the following estimates of the number of replacement units obtained, the number obtained new and used, and the number that were ENERGY STAR-qualified. These population projections will be factored into our forthcoming energy savings estimates.

Table 6-16: Population Estimates of Replacement RF[a]

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
Replaced	3,489	2,338	1,271	1,067	1,151	1,143	8
New	2,673	1,795	937	858	878	871	7
Used	816	543	334	209	273	272	1
ENERGY STAR	2,306	1,566	847	719	739	735	4

[a] Weighted to the population of products

Table 6-17: Population Estimates of Replacement FZ[a]

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
Replaced	956	635	281	354	322	319	3
New	873	552	262	290	321	319	2
Used	84	83	19	64	1	0	1
ENERGY STAR	620	372	131	241	247	245	2

[a] Weighted to the population of products

Table 6-18: Population Estimates of Replacement RAC[a]

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
Replaced	4,344	2,744	1,508	1,236	1,600	1,543	57
New	4,150	2,551	1,353	1,198	1,600	1,543	57
Used	171	171	156	23	0	0	0
ENERGY STAR	3,708	2,320	1,160	1,160	1,389	1,332	57

[a] Weighted to the population of products

7 Free Ridership and Spillover

When we began fielding the survey, NMR and the sponsors agreed to a definition of free ridership that included all participants who would have recycled, trashed, or otherwise decommissioned the product they retired, as well as those who retired a non-working unit. We chose this definition because we assumed that these retired units would not result in net energy savings. However, as RLW's investigation makes clear, most of the units included in the original definition of free ridership would have ended up in the secondary market if participants had not used the program. Because their participation furthered one of the primary goals of the program, these participants should not be considered as free riders. For this reason, NMR suggested to the sponsors that we use an alternative definition of free ridership.

We suggested and the sponsors agreed to the following definition: Any participant who reports a surrender of a non-working appliance, who would have continued to store the unit unused, or who would have recycled the appliance anyway will be considered a free rider. We also summarize the percentage of people who say they would have continued using the unit if the program had not been available by their reported use the year prior to the surrender. Among those indicating they would have continued to use the appliance if the program had not been available, anyone who had no intention of using an RAC in the summer of 2004 or who did not have the RF or FZ plugged in the year prior to surrender will also be considered free riders.[13]

The NMR team will continue to use the definition of spillover that the sponsors approved before the fielding of the survey. This definition focuses on the influence of participation in the ARP on post-participation retirement of other appliances and purchases of energy-efficient products.

In this section, we will present the summary counts and percentages of free ridership and spillover by sponsor, region of the state, and other pertinent comparisons. We also compare what the estimate of free ridership would have been under the rejected definition and what it is under the definition that more accurately suits the goals of the ARP. In the forthcoming report on energy savings, we will make adjustments to estimates of energy savings based on the free ridership and spillover estimates discussed here.

[13] Those who had at least some intention of using their RAC or who had the unit plugged in at least occasionally the year prior to surrender will not be considered free riders, but we will adjust energy savings estimates for their uncertain or intermittent use. These adjustments will be addressed in detail in the report on energy savings.

7.1 Free Ridership

As stated above, NMR suggested that we redefine free ridership primarily because of the connection between the most common alternative methods of appliance disposal and the secondary market. The old definition considered any participant to be a free rider who was already going to dispose of an appliance, along with those who surrendered a used appliance. In contrast, the new definition limits free ridership to participants who surrendered a non-working appliance, who would have stored the unit unused, or who would have recycled it anyway. It also includes those people who had not used the appliance in the previous year or had no intention of using it and yet said they would have continued using it if the program had not been available. This last criterion is specially included so as to avoid counting their energy savings. The new definition had the unintended consequence of greatly reducing the percentage of participants who would be considered free riders. Specifically, if we had used the original definition, between 60% and 70% of respondents who retired each appliance would have been considered free riders. (Table 7-1) The new definition lowers the percentage to between 16% and 21%, largely accounted for by those who would have stored their units unused.

Table 7-1: Comparison of Free Ridership by Old and New Definition

(base = participant respondents retiring each appliance)

	RF	FZ	RAC
n	333	158	221
OLD DEFINITION			
Had retail store come pick up	10%	5%	1%
Called someone to haul away	16	18	8
Put out in the trash	24	19	30
Given away/Donated	12	14	14
Sold	1	5	2
Recycled	6	4	4
Not in working order	1	1	2
Total %	70%	65%	61%
NEW DEFINITION			
Not used year prior/no intention to use	0%	0%	1%
Stored unused	8	15	14
Recycled	6	4	4
Not in worker order	1	1	2
Total %	16%	21%	21%

The next three tables (Table 7-2 through Table 7-4) break free ridership down by sponsor and region of the state. We find that CL&P participants who retired RF were significantly more likely than UI participants who retired RF to have been free riders. In addition, CL&P participants from outside SWCT were less likely to free ride on the surrender of their RF than were those from within SWCT. In both cases, the differences are largely explained by more free riders saying they would store the RF or FZ unused. We are uncertain of any differences that could explain the varying responses, although it may relate to the storage space available. There are no significant differences in RAC free ridership rates by sponsor, region of the state, or mode of participation.

Table 7-2: Refrigerator Free Ridership by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Free Rider	16%	19%	17%	20%	11%[$]	9%	18%

[$] Significantly different from CL&P Overall at the 90% confidence level

Table 7-3: Freezer Free Ridership by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
Free Rider	21%	21%	29%	13%[∞]	20%

[∞] Significantly different from SWCT within utility at the 90% confidence level

[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Table 7-4: Room Air Conditioner Free Ridership by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Free Rider	21%	22%	25%	19%	20%

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

Table 7-5: Room Air Conditioner Free Ridership by Participation Mode

(base = participant respondents retiring RAC)

	Total	Pick-up	Turn-in
n	221	62	159
Free Rider	21%	17%	22%

By applying product weights, we can project the number of free rider units retired through the program.

Table 7-6: Projected Free Rider Population Counts[a]

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
Refrigerator N	7,467	4,729	2,386	2,343	2,738	2,722	16
# Free Rider	1,126	796	401	394	330	327	3
Freezer N	2,895	1,835	918	917	1,060	1,054	6
# Free Rider	586	388	244	145	197	196	1
Room AC N	5,875	3,388	1,855	1,533	2,487	2,402	85
# Free Rider	1,272	755	467	288	517	489	28

[a] Weighted to the population of products

Table 7-7: Room Air Conditioner Free Ridership by Participation Mode[a]

	Total	Pick-up	Turn-in
N	5,560	1,027	4,533
# Free Rider	1,203	174	1,028

[a] Weighted to the population of products

7.2 Spillover

As mentioned above, we considered spillover to occur when program participation led respondents to stop using other appliances in their homes and/or to purchase ENERGY STAR-labeled appliances. In the energy savings report, we will use the retirement of additional RF, FZ, and RAC that are attributable to the program to adjust the estimates of energy savings. We also take into account any replacements of these three products, particular those that are ENERGY STAR qualified.

Overall, about 30% of participants have recycled, removed, or discontinued use of an appliance since participating in the ARP program. RAC were the most frequently retired item, followed by dehumidifiers, FZ, and second RF (Table 7-8). UI participants were significantly more likely to recycle, remove, or discontinue use of a second refrigerator than were CL&P participants, although the few UI participants from outside of SWCT were significantly less likely than those from SWCT to do so. If we look only at the three appliances of greatest interest to the program, we still find a fairly substantial 20% post-participation rate of retirement.[14]

Table 7-8: Recycled, Removed, or Discontinued Use of Other Appliances since ARP Participation

(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	600	376	189	187	224	187	37
Second refrigerator	6%	4%	5%	2%	9%†	10%	0%*∞
Freezer	7	7	9	5	6	7	6
Room air conditioners	10	9	9	9	11	11	6
Central air conditioner	2	2	2	1	3	3	6
Dehumidifier[a]	8	7	6	9	9	8	11
Any other appliances	8	9	9	8	6	6	0*∞
All Appliances	**29**	**27**	**29**	**25**	**33**	**33**	**33**
Program Appliances	**20**	**18**	**21**	**15**	**21**	**22**	**11**

* Significantly different from Overall within utility at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level
[a] Dehumidifiers are included in the program. However, few have actually been retired through the program, and the units result in very little energy savings. As specified by the sponsors, dehumidifiers were not included in the surveys or the forthcoming energy savings estimates.

[14] Dehumidifiers are included in the program. However, few have actually been retired through the program, and the units result in very little energy savings. As specified by the sponsors, dehumidifiers were not included in the surveys or the forthcoming energy savings estimates.

In order to determine whether the additional product retirements were attributable to the program, we asked respondents if the program influenced their decision to recycle, remove, or discontinue using another appliance since participating in the program. Only in these cases would additional retirements be considered "program-induced spillover." These final spillover estimates for additional product retirements are presented in Table 7-9. The overall spillover rate is nine percent—that is, nine percent of all respondents had both retired other products and attributed that retirement to their participation in the program. At 13%, the spillover rate is significantly higher among UI participants. The spillover rate limited to post-participation retirement of RF, FZ, and/or RAC was seven percent. There were no significant differences between groups.

Table 7-9: ARP Influenced Recycling or Discontinued Use of Other Appliances
(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall[a]	SWCT	Other
n	600	376	189	187	224	187	37
Any Appliance	9%	7%	7%	7%	13%[†]	13%	11%
Program Appliances	7%	6%	7%	5%	9%	10%	6%

[†] Significantly different from CL&P overall at the 90% confidence level

Over three-quarters of participants who recognize the ENERGY STAR label report that they purchased an ENERGY STAR product since participating in the program.[15] (Table 7-10) Based on our experience, we believe this to be an overestimate. Likewise, it is our opinion that customers also overestimated their ENERGY STAR purchases of each type of product. For this reason, we have presented the estimates as ranges, with the higher bound being the self-reported ENERGY STAR purchases and the lower bound as 50% of that estimate. Thus, the range of likely ENERGY STAR purchases since the program is 39% to 78%.

Based on these ranges, respondents were most likely to purchase ENERGY STAR-qualified appliances and lighting products. They were least likely to purchase qualified heating systems.

Table 7-10: Purchased ENERGY STAR products since ARP participation
(base = participant respondents aware of ENERGY STAR label)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	537	335	164	171	202	167	35
Appliances	30-60%	30-60%	29-57%	33-65%	30-60%	30-60%	27-53%
Heating system	3-6%	4-7%	4-7%	4-8%	3-5%	3-5%	3-6%
Windows	6-12%	6-12%	6-11%	7-14%	6-12%	6-11%	9-18%
Lighting products	19-38%	19-37%	18-35%	19-38%	20-40%	21-42%	9-18%[$∞]
Home electronics	6-11%	5-10%	5-10%	5-10%	7-13%	7-14%	0%[$∞]
All Products	**39-78%**	**40-79%**	**38-75%**	**42-84%[∞]**	**38-76%**	**39-77%**	**28-56%**

[$] Higher bound significantly different from overall within utility at the 90% confidence level
[∞] Higher bound significantly different from SWCT within utility at the 90% confidence level

[15] The questions on ENERGY STAR purchases since program participation were asked only to those who recognized the label. However, some people who do not recognize the label may still have purchased ENERGY STAR-qualified products, but they would not know it was labeled. For this reason, we have based these percentages on just those who recognize the label, rather than the entire population.

Respondents who had purchased an ENERGY STAR product were asked, on a scale of zero to ten, where zero equals "No influence at all" and ten equals "A great deal of influence," how much their ARP participation influenced their purchase. Those who rated the influence with an eight or higher were considered to have exhibited program-induced spillover on purchases of ENERGY STAR-labeled products. (Table 7-11) The overall percentage of participants who report that their participation in the ARP influenced their purchase of an ENERGY STAR qualified was 13%; applying the 50% discount rate produces an estimation range of 7% to 13%.

Table 7-11: Influence of ARP on purchase of ENERGY STAR products

(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
N	600	376	189	187	224	187	37
Strong Influence: 8 – 10 rating	7-13%	7-13%	6-11%	8-15%	7-14%	7-14%	6-11%

8 Benefits and Drawbacks of Program Participation

Participants were asked about their perceptions of both energy and non-energy benefits of retiring appliances through the ARP. We also asked them if they perceived any drawbacks to participation. In this section, we summarize the results of these questions.

8.1 Changes in Energy Usage

We asked respondents to report if their energy usage had decreased, increased, or stayed about the same since program participation. A few points are worth noting about this question. The results are based on respondents' "gut" impressions; we did not ask them to verify by looking at energy bills, nor have we here compared to their actual energy usage. Furthermore, customers likely did not take the time when answering the survey to assess what other changes may have occurred in their household that could have had an effect on energy use. Therefore, the billing analysis will tell us if customers really saw increases or decreased in energy usage. The questions on perceived changes in energy usage are a helpful way to gauge what customers understand as the impact of their participation and how satisfied they are with it.

About 40% of all respondents reported that, since their participation, their energy usage had decreased either by a lot (8%) or a little (32%). (Table 8-1) Another one-third of respondents reported that their energy usage had "stayed about the same." UI participants were significantly more likely than CL&P participants to report that their energy usage "decreased a lot." If we group the responses into "decreased" or "increased", we find no statistically significant differences between the groups.

Table 8-1: Change in Energy Use since ARP participation

(base = participant respondents)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	600	376	189	187	224	187	37
Decreased a lot	8%	6%	6%	6%	11%†	11%	11%
Decreased a little	32	32	32	32	32	32	22
Stayed about the same	33	32	32	32	35	35	39
Increased a little	10	12	12	12	7†	7	6
Increased a lot	7	6	5	7	8	9	0*∞
Don't know	10	12	13	11	8	7	22

* Significantly different from Overall within utility at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

The high percentage of respondents who perceived only small or no change to their savings could have been due to the high number of product replacements. For this reason, we cross-tabulated the perceived changes in energy savings by whether or not the respondent had replaced each product retired and, if so, whether the replacement was labeled with the ENERGY STAR. (Table 8-2) The results do not suggest that there are many statistically significant differences between product replacement and ENERGY STAR status by energy savings. The only substantive difference involves a greater tendency for those not replacing RF or RAC to say that their energy usage had remained about the same.

Table 8-2: Perceived Change in Energy Use by Product Replacement

(base = participant respondents replacing each appliance)

	RF			FZ			RAC		
Replaced	Yes		No	Yes		No	Yes		No
	All	ES[a]		All	ES[a]		All	ES[a]	
n	157	103	176	54	35	104	163	141	50
Decreased a lot	8%	11%	8%	9%	3%	9%	6%	7%	10%
Decreased a little	33	40	32	33	37	27	36	35	20*
Stayed about the same	27	19	37*	36	30	48	26	25	46*
Increased a little	10	8	10	7	0*	6	12	13	10
Increased a lot	10	12	6	5	7	3	8	7	2*
Don't know	12	11	8	21	23	12	12	12	12

* Significantly different from all replacements within appliance at the 90% confidence level

[a] Denotes replacement was an ENERGY STAR model. Those asked about ENERGY STAR replacements are subsets of those who replaced each appliance. The questions about the ENERGY STAR status of replacement products were asked only to those who were aware of the label.

We asked those respondents who thought that their energy usage had decreased or stayed about the same to rate their satisfaction with their perceived energy savings on a zero to ten scale. The average rating of 6.9 indicates a moderately high level of satisfaction with energy savings. (Table 8-3) There is a significant tendency for UI participants to be more strongly satisfied with their perceived energy savings.

Table 8-3: Satisfaction with Energy Savings

(base = participant respondents with similar or decreased energy usage)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	436	164	129	135	172	144	28
Dissatisfied 0 – 3 rating	5%	6%	5%	6%	5%	5%	8%
Moderately Satisfied 4 – 7 rating	42	46	46	47	36†	38	17∞
Satisfied 8 – 10	43	37	38	37	52*†	51	67
Don't know	10	11	11	11	7	7	8
Mean[a]	6.9	6.6	6.7	6.6	7.3*†	7.2	7.6

* Significantly different from all respondents at the 90% confidence level
† Significantly different from CL&P overall at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level
[a] Don't know responses have been removed from the computations of mean.

8.2 Non-energy Benefits and Drawbacks of Participation

When asked about the non-energy benefits of ARP participation, over 40% of respondents cited the environment, global warming, or the ozone layer. (Table 8-4) Another 18% mentioned reduced clutter and 14% said it saved money. About one-quarter of respondents could not identify any other benefits.

Table 8-4: Non-Energy Benefits of ARP Participation

(base = participant respondents, multiple response)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
N	600	376	189	187	224	187	37
Helps the environment/stops global warming/ozone layer	44%	42%	41%	44%	46%	47%	41%
Gives me more space	8	8	8	8	9	9	5
Gets rid of junk/clutter	18	17	16	19	18	19	13
Saves me money	14	13	14	11	15	15	15
No other benefits/don't know	23	24	25	24	21	20	26
Other	5	5	4	6	5	5	3

Over 80% of respondents reported that there were no drawbacks to participating in the ARP. (Table 8-5) A handful of respondents cited loss of storage space for food or other items, throwing away useable appliances, or having a house that was not as cool.

Table 8-5: Drawbacks of ARP participation

(base = participant respondents, multiple response)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
N	600	376	189	187	224	187	37
Loss of food storage space	1%	2%	1%	4%	0%†	0%	0%∞
Loss of other storage space	1	1	1	1	1	1	0
Usable appliances are thrown away	1	1	2	0$	2	2	3∞
House no longer cool	0	0	1	0	1	1	0
No drawbacks	85	83	83	83	88†	87	92
Don't know	5	7	5	10	2†	2	2∞
Other	5	6	9	4	6	7	3∞

† Significantly different from CL&P overall at the 90% confidence level
$ Significantly different from Overall within utility at the 90% confidence level
∞ Significantly different from SWCT within utility at the 90% confidence level

9 Secondary Market

One of the objectives of the ARP is to reduce the number of appliances entering and then being resold through the secondary (used) appliance market. The sponsors requested that the NMR team learn more about the structure of this market and the frequency with which Connecticut residents were making use of it, both in terms of buying from and contributing units to it. This section summarizes the results of numerous questions asked of program participants and non-participants regarding their use of the secondary appliance market. We view this section as supplemental to the Secondary Market memorandum delivered on September 15, and we discuss relevant connections between the results presented here and those discussed in the memo.

For the purposes of this section, we will discuss, but draw distinctions between, used units obtained in the following ways:

- Purchased used from a store
- Purchased used from another source (e.g., garage/yard sales, acquaintances)
- Given used
- Came with home

Regarding the last question, we will assume that all units that came with homes were used. We recognize that this over-estimates the number of appliances obtained used by some unknown proportion. Yet, in the absence of other data, we believed it was best to make this assumption. Unlike dishwashers, newly constructed homes generally do not come with these three appliances, and typically, if a previous owner leaves RF and especially FZ and RAC, they are used units.

9.1 How Units Are Obtained

In order to determine how frequently Connecticut residents obtain units from the secondary market, we asked participants how they had come to own the units they retired through the program. We also asked them if any replacements had been purchased new or used, as well as where the units had been obtained. Finally, we asked non-participants where they had purchased RF, FZ, and RAC that were currently in their homes.

9.1.1 How Participants Obtained Units that were Retired

Respondents had most commonly purchased the appliances that they recycled through the program. (Table 9-1 through Table 9-3) While very few RAC and FZ came with respondents' houses, as many as 39% of the RF that were retired had. A statistically higher percentage of UI customers had obtained the RF when they moved to their home. Approximately one-fifth (22%) of all RF had been given to respondents, along with 29% of RAC and 32% of freezers. There were no statistically significant differences in the patterns of obtaining FZ or RAC.

Table 9-1: How Obtained Refrigerator by Sponsor and Region of State

(base = participant respondents retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
Bought it	47%	50%	47%	54%	42%	40%	55%
Given to me	22	24	25	24	18	19	9
Came with house	28	22	25	19	38*$	39	36
Other	<1	1	0	2	0	0	0
Don't know	2	2	3	2	2	2	0

* Significantly different from all RF at the 90% confidence level
$ Significantly different from CL&P Overall at the 90% confidence level

Table 9-2: How Obtained Freezer by Sponsor and Region of State

(base = participant respondents retiring FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	158	106	49	57	52
Bought it	59%	61%	64%	59%	57%
Given to me	32	30	29	32	35
Came with house	9	8	7	10	9
Don't know	<1	0	0	0	<1

[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Table 9-3: How Obtained RAC by Sponsor and Region of State

(base = participant respondents retiring RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
n	221	149	71	78	72
Bought it	57%	56%	53%	60%	60%
Given to me	29	28	30	26	30
Came with house	11	13	12	13	8
Don't know	4	4	5	2	3

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.

Among those appliances purchased, 84% of RF and RAC and 81% of FZ were purchased new from a store or dealer. (Table 9-4 through Table 9-6) The few products purchased used were most often purchased from friends or family members. Customers of UI were significantly more likely than those retiring RF overall and than CL&P customers to have purchased the unit new from a store. CL&P customers from outside of SWCT were significantly more likely than CL&P customers overall and in the targeted area of the state to have purchased an RAC new from a store. Few participants bought their retired products from used appliance stores. Not surprisingly, most appliances given to respondents were used. CL&P customers from SWCT were significantly more likely to be given a used RF.

Table 9-4: Bought or Given RF Used by Sponsor and Region of State

(base = participant respondents purchasing or being given RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
Bought n	160	107	53	54	53	40	13
New from store/dealer	84%	80%	77%	82%	93%*$	92%	100%
Used from store	5	7	4	11	0*$	0	0
Used from friend/family	6	7	8	7	4	4	0
Used from garage/yard/classifieds	3	3	6	0†	4	4	0
Don't know	2	3	6	0†	0*$	0	0
Given n	75	52	26	26	23[a]		
New	12%	12%	0%$	23%†	13%		
Used	88	89	100$	77†	87		

* Significantly different from all RF at the 90% confidence level
$ Significantly different from CL&P Overall at the 90% confidence level
† Significantly different from SWCT within utility at the 90% confidence level
[a] Only three UI customers from outside SWCT were given RF, so we only report the overall result.

Table 9-5: Bought or Given FZ Used by Sponsor and Region of State

(base = participant respondents purchasing or being given FZ)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
Bought n	95	66	33	33	29
New from store	81%	86%	89%	83%	76%
Used from store	3	2	0	4	0
Used from friend/family	13	12	12	13	16
Used from garage/yard	4	<1	<1	0	8
Don't know	<1	<1	0	<1	0
Given n	47	32	13	19	15
New	3%	4%	8%	0%	0%
Used	97	96	92	100	100

[a] Only nine UI customers in "other" areas were asked detailed questions about the FZ they retired.

Table 9-6: Bought or Given RAC Used by Sponsor and Region of State

(base = participant respondents purchasing or being given RAC)

	Total	CL&P			UI[a]
		Overall	SWCT	Other	
Bought n	126	83	40	43	43
New from store	84%	81%	70%	93%[$†]	91%
Used from store	3	2	3	0	2
Used from friend/family	9	12	20	4[†]	5
Used from garage/yard	4	4	3	4	2
Don't know	1	2	3	0	0
Given n	62	41	19	22	21
New	5%	3%	6%	0%	9%
Used	95	97	94	100	91

[a] Only three UI customers in "other" areas were asked detailed questions about the RAC they retired.
[$] Significantly different from CL&P Overall at the 90% confidence level
[†] Significantly different from SWCT within utility at the 90% confidence level

Of the RF retired through the program that had been obtained used, most had come with the respondents' homes. In contrast, most of the FZ and RAC obtained used had been given to respondents. FZ and RAC were purchased used about 20% of the time, while RF were purchased used 12% of the time.

Table 9-7: How Used Units were Obtained

(base = participant respondents retiring used appliances)

	RF	FZ	RAC
n	178	76	102
Bought used	12%	22%	19%
Given used	36	61	57
Came with home	52	17	24

Overall, about half of all appliances retired through the program were used when the participant came to own them. (Table 9-8 through Table 9-10) The program, then, is not only diverting units from the secondary market, it is also getting older, used units out of homes. The percentage is somewhat higher for RF (54%), due to the frequency with which RF are included in the purchase of a home. The percentage is smallest for RAC (47%), which are the least expensive of the three appliances. There were no statistically significant differences in percentages between groups for any of the three appliances.

Table 9-8: Estimated Number of RF Obtained Used by Program Participants

(base = participant respondent retiring RF)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	333	208	107	101	125	100	25
% Obtained Used[a]	54%	52%	58%	47%	57%	58%	50%
N	7,467	4,729	2,386	2,343	2,738	2,722	16
# Obtained Used[b]	4,033	2,474	1,360	1,114	1,559	1,552	8

[a] Weighted to the population of participants
[b] Weighted to the population of products

Table 9-9: Estimated Number of FZ Obtained Used by Program Participants
(base = participant respondents retiring FZ)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	158	106	49	57	52		
% Obtained Used[a]	50%	48%	43%	53%	55%		
N	2,895	1,835	918	917	1,060	1,054	6
# Obtained Used[b]	1,408	841	375	467	566	564	3

[a] Weighted to the population of participants
[b] Weighted to the population of products

Table 9-10: Estimated Number of RAC Obtained Used by Program Participants
(base = participant respondents retiring RAC)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
n	221	149	71	78	72		
% Obtained Used[a]	47%	50%	53%	46%	42%		
N	5,875	3,388	1,855	1,533	2,487	2,402	85
# Obtained Used[b]	2,700	1,690	990	700	1009	1009	0

[a] Weighted to the population of participants
[b] Weighted to the population of products

9.1.2 Number of Replacement Units Obtained Used

In Section 6.1, we explained that, of those participants who replaced the appliances retired through the program, very few had obtained used replacement units. Nearly all of the replacement units obtained used had been received from friends or family members. Only one FZ had been obtained from a used appliance store, while two RF had been purchased at garage or yard sales. In Table 9-11 below, we repeat the population estimates of the number of used replacement units obtained by participants.

Table 9-11: Population Estimates of Replacement Appliances Obtained Used[a] (Participants)

	Total	CL&P			UI		
		Overall	SWCT	Other	Overall	SWCT	Other
# Used Replacement RF	816	543	334	209	273	272	1
# Used Replacement FZ	84	83	19	64	1	0	1
# Used Replacement RAC	164	163	148	15	0	0	0

[a] Weighted to the population of products

9.2 How Non-participants Obtained Units Currently in Home

In order to determine the "untapped potential" of the program, we asked non-participants and participants about the number and eligibility of appliances currently in their home (i.e.., post-participation for participants). As these results pertain directly to potential energy savings, they will be discussed in more detail in that report. However, when asking non-participants about the units in their home, we also found out how they had obtained those units. Here we summarize the results of this series of questions as they pertain to the used appliance market. We will not make explicit comparisons with how units retired or replacement units were obtained. The reasons for ownership likely differ, limiting the information that can be gained by comparing how units were obtained.

Because the questions focused on untapped potential and program eligibility, our information on RF is limited to non-primary units in the home. Based on the non-participant survey, approximately 37% of homes have more than one RF. (Table 9-12) Respondents in the unmatched sample from outside of SWCT were significantly more likely to have more than one RF than were those from SWCT. About 46% of homes have FZ, and 57% have RAC. These percentages are all substantially higher than the percentages found in the NU Residential Saturation Study—27% for secondary RAC, 31% for FZ, and 47% for RAC. [16] The differences in the percentages may be due to two factors. First, UI customers may have different saturation patterns than NU customers. Second, low-income individuals and renters are under-represented compared to the state population; these groups may be less likely to have room for secondary RF and FZ and may not be able to afford the costs of running RAC.

Table 9-12: Non-Participant Households with Targeted Appliances

(base = non-participant respondents)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	505	252	177	75	253	177	76
More than one RF	37%	37%	32%	41%	36%	31%	42%$^{\infty}$
Freezers	46%	46%	41%	51%	45%	37%$^{\$}$	53%$^{\infty}$
Room AC	57%	47%*	49%	45%	62%†	53%$^{\$}$	71%$^{\$\infty}$
Mean # RF	1.4	1.4	1.4	1.5	1.4	1.4	1.5
Mean # FZ	.5	.5	.4	.6$^{\infty}$	.5	.4$^{\$}$	.6$^{\infty}$
Mean # RAC	1.4	1.5	1.5	1.5	1.3	1.3	1.6$^{\$\infty}$

* Significantly different from all respondents at the 90% confidence level
† Significantly different from overall Matched sample at the 90% confidence level
$ Significantly different from Overall within group at the 90% confidence level
∞ Significantly different from SWCT within group at the 90% confidence level

[16] NU Market Research (2001).

The mean number of RF in non-participant homes was 1.4; there were no statistically significant differences between groups in terms of the number of RF in homes.[17] There was approximately one FZ per two households in the sample (or a half a FZ per home); non-participants outside of SWCT were significantly more likely to have FZ, likely due to having more space available to store unit. Finally, non-participant households had about 1.4 RAC each, with a significantly higher number among the unmatched sample outside of SWCT.

Most non-participants purchased their own extra RF or their FZ or RAC. (Table 9-13 through Table 9-15) In contrast, very few of the appliances were given to non-participants, and only five to eleven percent came with the respondents' homes.[18] Unmatched respondents from outside of SWCT were significantly more likely to have been given FZ than were those from SWCT.

Table 9-13: How Secondary RF Obtained by Non-Participants

(base = non-participant respondents with secondary RF)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	190	98	67	31	92	60	32
Bought it	74%	80%	76%	83%	70%	75%	66%
Given to me	14	10	14	7	17	16	19
Came with house	10	10	10	10	10	10	9
Don't know	2	0*	0	0	3†	0$	6∞

* Significantly different from total at the 90% confidence level
† Significantly different from overall matched at the 90% confidence level
$ Significantly different from overall within group at the 90% confidence level
∞ Significantly different from SWCT within group at the 90% confidence level

Table 9-14: How Freezer Obtained by Non-Participants

(base = non-participant respondents with FZ)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	224	110	72	38	114	74	40
Bought it	69%	72%	67%	77%	67%	73%	63%
Given to me	17	18	19	18	16	10	20∞
Came with house	11	8	11	6	13	17	10
Other	1	0	0	0	1	0	3
Don't know	2	1	3	0	3	0	5

∞ Significantly different from SWCT within group at the 90% confidence level

[17] We present these results only to demonstrate the proportion of homes that contain targeted appliances and were, therefore, asked further questions about how they obtained the units. All other analyses of the saturation of secondary units, including the overall number of eligible appliances and respondents' willingness to give them up, will be discussed in the untapped potential portion of the energy savings report.

[18] For RF, this likely reflects the focus on extra units. Please recall that, while the ARP limits participation to secondary units, participants often reported that they actually surrendered their primary RF.

Table 9-15: How Room Air Conditioner Obtained by Non-Participants

(base = non-participant respondents with RAC)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	263	118	84	34	145	90	54
Bought it	84%	77%	83%	72%	87%†	76%$	96%$∞
Given to me	11	13	7	17	10	17	4$∞
Came with house	5	8	7	9	3	7	0$∞
Don't know	1	2	2	2	0*	0	0

* Significantly different from total at the 90% confidence level
† Significantly different from overall matched at the 90% confidence level
$ Significantly different from overall within group at the 90% confidence level
∞ Significantly different from SWCT within group at the 90% confidence level

Not only were non-respondents likely to purchase their appliances, they usually purchased them new. (Table 9-16 through Table 9-18) In contrast to the units purchased, ninety-one percent of the 24 RF given to respondents was used, 75% of the 35 FZ, and 61% of 29 RAC.[19]

Table 9-16: How Non-Participants Bought Refrigerators

(base = non-participant respondents purchasing RF)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	143	78	52	26	65	44	21
New from store/dealer	93%	95%	95%	94%	92%	82%	100%$^{\$\infty}$
Used from store	4	4	5	3	5	10	0
Used from friend/family	0	0	0	0	0	0	0
Used from garage/yard/classifieds	2	2	0	3	1	3	0
Don't know	1	0	0	0	2	5	0

$^{\$}$ Significantly different from overall within group at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within group at the 90% confidence level

Table 9-17: How Non-Participants Bought Freezers

(base = non-participant respondents purchasing FZ)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	159	80	51	29	79	54	25
New from store/dealer	90%	91%	96%	87%	90%	87%	92%
Used from store	4	3	4	3	4	9	0$^{\$\infty}$
Used from friend/family	4	5	0$^{\$}$	8$^{\infty}$	2	0	4
Used from garage/yard/classifieds	1	2	0	3	0	0	0
Other	1	0	0	0	2	0	4
Don't know	1	0	0	0	2	4	0

$^{\$}$ Significantly different from overall within group at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within group at the 90% confidence level

Table 9-18: How Non-Participants Bought Room Air Conditioners

(base = non-participant respondent purchasing RAC)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	217	94	70	24	123	71	52
New from store/dealer	97%	99%	97%	100%	95%†	91%	98%$^{\infty}$
Used from store	1	0	0	0	1	3	0
Used from friend/family	1	2	3	0	1	0	2
Used from garage/yard/classifieds	1	0	0	0	1	3	0
Don't know	1	0	0	0	1	3	0

† Significantly different from matched overall at the 90% confidence level
$^{\infty}$ Significantly different from SWCT within group at the 90% confidence level

[19] Due to these small sample sizes, we do not break the data down further.

Of the targeted appliances in non-participants' homes that were obtained used, just under one-half had been given to the respondents used; another one-third or so had come with their house, and the remainder had been purchased used. (Table 9-19) It should be noted, however, that the sample sizes are very small.

Table 9-19: Summary of How Non-Participants Obtained Used Units

(base = non-participant sample obtaining used appliances)

	RF	FZ	RAC
n	52	63	36
Bought used	16%	18%	18%
Given used	48	44	49
Came with home	36	38	33

Table 9-20 through Table 9-22 summarize the data on the number of targeted appliances currently in the homes of non-participants that had been obtained used. In all, 27% of RF, 29% of FZ, and 14% of RAC had been obtained used. Those from the unmatched sample in SWCT were significantly more likely than the unmatched sample overall or than those from outside SWCT to have purchased a used RAC.

Table 9-20: Estimated Number of RF Obtained Used by Non- Participants

(base = non-participant respondents with secondary RF)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	190	98	67	31	92	60	32
% Obtained Used[a]	27%	23%	25%	21%	29%	34%	25%
N[b]	509,306	7,292	2,910	4,382	502,014	220,740	281,274
# Obtained Used[c]	149,414	1,730	740	989	147,684	77,365	70,319

[a] Weighted to the population of non-participants
[b] Estimated number of homes with more than one RF. Total slightly underestimated because respondent directed to give information on only one unit.
[c] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample.

Table 9-21: Estimated Number of FZ Obtained Used by Non-Participants

(base = non-participant respondent with FZ)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	224	110	72	38	114	74	40
% Obtained Used[a]	29%	30%	31%	29%	28%	33%	25%
N[b]	633,219	9,106	3,735	5,371	624,112	356,964	351,593
# Obtained Used[c]	174,893	2,667	112	1,555	172,226	89,453	87,898

[a] Weighted to the population of non-participants
[b] Estimated number of homes with FZ. Total slightly underestimated because respondent directed to give information on only one unit.
[c] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample.

Table 9-22: Estimated Number of RAC Obtained Used by Non-Participants

(base = non-participant respondents with RAC)

	Total	Matched			Unmatched		
		Overall	SWCT	Other	Overall	SWCT	Other
n	263	118	84	34	145	90	54
% Obtained Used[a]	14%	17%	14%	20%	12%	22%[$]	4%[$∞]
N[b]	815,612	9,260	4,454	4,806	806,352	331,702	474,650
# Obtained Used[c]	76,398	1,597	608	989	74,801	57,222	17,580

[$] Significantly different from overall within group at the 90% confidence level
[∞] Significantly different from SWCT within group at the 90% confidence level
[a] Weighted to the population of non-participants
[b] Estimated number of homes with RAC. Total slightly underestimated because respondent directed to give information on only one unit.
[c] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample.

Projecting to the population of non-participating customers of CL&P and UI, we find that approximately 149,414 secondary RF in respondents' homes are used, 174,893 FZ are used, and 76,398 RAC are used. As stated in the footnotes, these are slight underestimates because we only asked non-participants to give detailed information about one of their potentially eligible appliances. Still, given that there are about 1,347,200 residential customers between the two sponsors, we are confident in concluding that there are relatively few used appliances in the homes of customers that match the profile of the non-participants we surveyed.

9.3 Purchase of Used Appliances: An Aside

The information in Sections 9.1 and 9.2 strongly suggests that CL&P and UI customers are not buying products from the secondary appliance market. Instead, they most commonly obtain units new, and those that are used come from friends or family members or with their home. On the surface, this conclusion conflicts with the information gathered by RLW in their investigation of the secondary appliance market. That investigation found that there were 89 outlets selling used appliances in Connecticut. Obviously, someone is buying these appliances in Connecticut. It is our belief that the people most likely to buy used appliances in Connecticut were under-represented in our participant and non-participants samples. In particular, landlords were excluded from the sample and renters and lower-income residents were under-represented. The reasons for this are discussed below.

In preparing the sample, we excluded the five percent of units retired in which the address from which the unit was surrendered differed from the billing address associated with the account; most of these were landlord/renter situations. Likewise, we directed participants to talk only about the appliances they recycled from their own homes; only twelve of the potential participants were excluded because they had not retired any products from their own home. We made these decisions—with the approval of the sponsors—because we needed to talk with individuals who were both knowledgeable about pre-retirement use of the appliance as well as why the decision was made to retire the unit. Neither renters nor landlords could have answered all the necessary questions. In addition, among non-participants, we surveyed only those who were responsible for the electricity bill; this criterion excluded only 13 potential respondents. While collectively these decisions had little effect on how representative the resulting samples were of the population of participants and non-participants, they perhaps had the unintended consequence of undercounting the people who buy from the used appliance market.

The demographic data also make clear that, not only are renters under-represented in two surveys, but so are lower-income residents. Certainly, these two factors are related; in general, lower-income residents are more likely to be renters and vice versa. Thus, the decisions that led to the exclusion of many renters also help explain why lower-income residents were under-represented among respondents. While we have not been able to identify the full range of reasons why lower-income residents may be under-represented, we also believe that the increased reliance on cellular phones as the main contact number for individuals may have contributed to the finding. Lower-income and younger people are more likely to rely exclusively on cellular phones.

We want to stress that the under-representation of these groups *has very little effect on the results related to participation and disposal options or the forthcoming estimates of untapped potential*

and energy savings. In reality, the participant survey is a very close representation of the population of participants. Furthermore, the matched non-participant sample should resemble the participant sample because of the match on electricity usage. Of course, there is little we can do about increased reliance on cellular phones, if that is behind the under-representation of certain demographic groups from the unmatched sample. Instead, the only major implication of the exclusion of landlords and the under-representation of renters and lower-income residents is the underestimation of units originally obtained from the secondary appliance market. In contrast, the surveys have done exemplary jobs at identifying non-participant contributions to and participant diversions of units from the used appliance market. This diversion is a key program goal, and its identification and that of alternative methods of disposal were among the major purposes of this evaluation. In order to learn more about who buys from the used appliance market, a study would have to target landlords, renters, and lower-income residents specifically.

9.4 Population Estimates of Units Entering the Secondary Market

This section draws on results first presented in Section 5 on Options for Disposition. Here, we use the data from that section to project the total population of appliances that would have entered the used market after May of 2004 if the program had not been available. The results suggest that the program diverted 4,670 RF, 1,791 FZ, and 3,115 RAC from the used market. Since May of 2004, non-participants contributed approximately 145,312 RF, 26,862 FZ, and 137,209 RAC to the secondary appliance market.[20] (Table 9-23 through Table 9-25) We estimate that approximately 67,812 of the RF, 12,536 of the FZ, and 64 ,031 of the RAC were disposed of from June through December of 2004, the time period that coincides with the operation of the ARP in 2004. If we assume that together the retirements by participants and disposals by non-participants comprise the total number of appliances removed from customers' homes in 2004 that would have entered the used market, the results indicate that the program diverted only 6% of RF and 5% of RAC from the used market. In contrast, while the diversions of RF and RAC may have had little affect on the used market, the diversion of the 13% of FZ may have indeed caused a noticeable decline in the availability of FZ in used appliance stores.[21]

Table 9-23: Contributions to and Diversions from the Secondary RF Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	4,670	3,025	1,472	1,554	1,644	1,633	11
		Matched			Unmatched		
Non-participant contributions to[b]	145,312	3,065	1,651	1,413	142,247	54,349	87,898
Non-participants, 2004 only[c]	67,812	1,430	770	659	66,382	25,363	41,019
Total Potentially into Used Market, 2004	72,482						
% Program Diverted	6%						

[a] Weighted to the population of products retired

[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample. Units retired since May of 2004.

[c] Estimate of all non-participant contributions since May of 2004, divided by 15 (number of months from June 2004 through August of 2005). We then multiplied the monthly estimate by seven to develop an estimate of the total number of units disposed of from June 1 through December 31, 2004.

[20] It is worth noting that the relatively close estimates of the number of units matched non-participants contributed to and participants diverted from the used market is further evidence that the matched non-participant sample is very similar energy usage and other behavior to participants. In short, the matching worked as desired and expected.

[21] In fact, in July and August of 2005, RLW found only eight FZ for sale by used appliance dealers in Connecticut, compared to 2,225 RF and 223 RAC. We have not way of determining whether the ARP was responsible for the limited number of FZ for sale in used appliance stores at that time.

Table 9-24: Contributions to and Diversions from the Secondary FZ Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	1,791	1,125	450	676	665	662	3
		Matched			Unmatched		
Non-participant contributions to[b]	26,862	492	351	141	26,369	0[c]	26,389
Non-participants, 2004 only[d]	12,536	230	164	66	12,306	0	12,315
Total Potentially into Used Market, 2004	14,327						
% Program Diverted	13%						

[a] Weighted to the population of products retired
[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample
[c] Only 15 non-participants had disposed of a FZ; none of them were in the unmatched SWCT sub-sample. Therefore, we cannot provide a population projection of FZ diverted from this group, but it is likely that the true number is greater than zero.
[d] Estimate of all non-participant contributions since May of 2004, divided by 15 (number of months from June 2004 through August of 2005). We then multiplied the monthly estimate by seven to develop an estimate of the total number of units disposed of from June 1 through December 31, 2004.

Table 9-25: Contributions to and Diversions from the RAC Secondary Market

	Total	Overall	SWCT	Other	Overall	SWCT	Other
		CL&P			UI		
Participant diversions from[a]	3,292	1,773	1,012	760	1,520	1,492	28
		Matched			Unmatched		
Non-participant contributions to[b]	137,209	1,490	642	848	135,719	65,401	70,319
Non-participants, 2004 only[c]	64,031	695	300	396	63,336	30,520	32,816
Total Potentially into Used Market	67,146						
% Program Diverted	5%						

[a] Weighted to the population of products retired
[b] Weighted to residential customers of sponsors, minus participants, by matched and unmatched sample

Even though we believe that some of the people most likely to purchase used appliances were excluded or under-represented in the sample, we still find it difficult to believe that this many used appliances are actually being purchased in Connecticut each year. Based on survey results and the findings from the secondary market investigation, we believe that three things can happen to used appliances picked up by appliance stores or hauling companies. Some are purchased in Connecticut, some are actually decommissioned altogether, and some are shipped to other states or countries. Unfortunately, we have no way of estimating the numbers of units following these alternative paths.

Appendix E1
Participant Survey Questionnaire

Participant Survey
2004 CL&P and UI Appliance Retirement Program

FINAL 08-08-05

RESPONDENT INFORMATION [FROM SAMPLE DATABASE]

Mode
- Pick-up (1)
- Turn-in (2)
- Both (3)

Utility
- Connecticut Light and Power (CL&P) (2)
- The United Illuminating Company (UI) (3)

FirstName
LastName
Address
Town

Status
- Targeted (1)
- Not Targeted (3)

Account (if available)

Phone

Products Retired
- Refrigerator = RF
- Freezer = FZ
- Room air conditioner: pick-up = RACpi
- Room air conditioner: turn-in = RACti
- Dehumidifer = DH
- Room air conditioner total = RACtot
- Total products = Totprod

SCREENING QUESTIONS

Could I speak with [INSERT NAME]?

1. Yes [GO TO INTRODUCTION]
2. No [SAY "Perhaps you can help me anyway." GO TO INTRODUCTION]

Hello, my name is _____ from Nexus Market Research. I am calling on behalf of Connecticut Light and Power (CL&P) and The United Illuminating Company (UI) as part of a study of their appliance retirement programs. I'm not selling anything; we are trying to get feedback from customers about the utilities' appliance retirement programs so we can make these programs better. Your responses will be kept strictly confidential—that is, your name will not be associated with any of your responses. [IF RESPONDENT EXPRESSES INTEREST OR VOICES CONCERN, READ] If you have questions or concerns please contact [IF UTILITY = CL&P INSERT "(860) 832-4754"; IF UTILITY = UI INSERT "(203) 499-3686"

This survey will take about 15 minutes of your time. Would that be okay?

[IF REFUSE, ASK] "Can we schedule a more convenient time for you to conduct this survey?"

[SCHEDULED, IF NECESSARY, FOR: _____]

[INTERVIEWER: AFTER THIS INTRODUCTION, YOU CAN USE CL&P OR UI TO REFER TO THE UTILITIES INSTEAD OF THE FULL NAMES.]

VERIFICATION OF PARTICIPATION AND THE NUMBER RETIRED
Turn-in mode (RAC only)
[IF SAMPLE INDICATES PICK-UP ONLY GOTO Q#V4.]

V1. Our records indicate that you dropped off [INSERT NUMBER FROM RACti] room air conditioner[s] at a retail store or another location such as the SmartLiving Center in the Spring or Summer of 2004? Is this correct?

1. Yes [RECORD NUMBER FROM RACti IN Q#V2 AND GO TO Q#V3].

[IF NO, PROBE WHY. CODE AS FOLLOWS]

2. No, count not correct [GO TO Q#V2]
3. No, does not recall participating [PROBE: 'ARE YOU CERTAIN? THE EVENT WAS HELD IN THE SPRING OR SUMMER OF 2004 AT HOME DEPOT, BERNIE'S, LOWE'S OR OTHER STORE. THERE MAY HAVE BEEN A TENT SET UP AND YOU MAY HAVE RECEIVED A REBATE OR BOUNTY PAYMENT FOR TURNING IT IN.']
4. (Don't know) [PROBE: 'ARE YOU CERTAIN? THE EVENT WAS HELD IN THE SPRING OR SUMMER OF 2004. AT HOME DEPOT, BERNIE'S, LOWE'S OR OTHER STORE. THERE MAY HAVE BEEN A TENT SET UP AND YOU MAY HAVE RECEIVED A REBATE OR BOUNTY PAYMENT FOR TURNING IT IN.']

V2. [IF Q#V1 = 1 (Yes) RECORD NUMBER FROM RACti FOR Q#V2; IF Q#V1=2 (No, count not correct)] How many room air conditioners do you recall turning in? [RECORD NUMBER, 99 Don't know]

[IF Q#V2 = 0, THANK AND TERMINATE IF MODE = 2 (Turn-in Only); IF Q#V2 = 0 AND MODE = 3 (BOTH), GO TO Q#V4; IF Q#V2 GE 1 GO TO V3.]

V3. [IF Q#V2 > 1 READ] "Were these room air conditioner(s) from the home where you live, or were you dropping them off for someone who lives at a different address or at a home or apartment that you rent out?" [IF Q#V2 = 1 READ] "Was this room air conditioner from the home where you live, or were you dropping it off for someone who lives at a different address or at a home or apartment that you rent out?"

1. Yes, these units/this unit for own home [GO TO Q#V4]
2. [DO NOT ALLOW IF Q#V2 = 1] Some units for own home, some for another home [GO BACK TO Q#V2 AND REVISE NUMBER TO REPRESENT UNITS TURNED-IN FOR OWN HOME. TELL RESPONDENT 'For purposes of this survey, let's just talk about the unit(s) that you dropped off from your own home.' GO TO Q#V4]
3. No, (none of units)/(this unit not) for own home [THANK AND TERMINATE IF MODE = 2 (Turn-in Only) OTHERWISE GO TO V4.]
4. (Don't know) [THANK AND TERMINATE IF MODE = 2 (Turn-in Only). OTHERWISE GO TO Q#V4.]

V4. [IF MODE = 2 (Turn-in Only), GO TO Q#P1]
Our records indicate that [INSERT UTILITY NAME] sent someone to your home to remove at least one refrigerator or freezer and maybe a room air conditioner or dehumidifier. Is this correct?

1. Yes [GO TO Q#V5]
2. No, does not recall participating [PROBE: ARE YOU CERTAIN? SOMEONE WOULD HAVE COME TO YOUR HOME AND PICKED UP YOUR OLD APPLIANCE TO RECYCLE IT. AND YOU MAY HAVE RECEIVED A REBATE OR BOUNTY PAYMENT FOR REMOVING IT.]
3. (Don't know) [PROBE: ARE YOU CERTAIN? SOMEONE WOULD HAVE COME TO YOUR HOME AND PICKED UP YOUR OLD APPLIANCE TO RECYCLE IT. AND YOU MAY HAVE RECEIVED A REBATE OR BOUNTY PAYMENT FOR REMOVING IT.]

[IF RESPONDENT PERSISTS IN SAYING 2 (No, Don't recall participating) OR 3 (Don't Know) TO Q#V4 AND IF MODE = 1 (Pick up only); OR IF MODE = 3 (Both) AND Q#V1 = 3 (No, doesn't recall participating) OR 4 (Don't know); OR IF MODE = 3 (Both) AND Q#V3 = 3 (None used at own home) OR 4 (Don't know), THEN THANK AND TERMINATE.]

V5. [IF RF > 0 AND IF Q#V4 = 1 (Yes) Our records indicate that you had [INSERT NUMBER FROM RF] refrigerators picked up. Is this correct?

1. Yes [RECORD RF IN Q#V5b; GO TO Q#V6].
2. No

[IF RF = 0, RECORD 0 IN Q#V5b; IF Q#V5 = 1 (Yes), RECORD RF IN Q#V5b]

V5b. [IF Q#V5 = 2 (No) ASK] How many refrigerators do you recall having picked up? [RECORD NUMBER, 99 Don't Know]

[IF Q#V5b = 0, GO TO Q#V6]

V5c. [IF Q#V5b > 1 READ] Were these refrigerator(s) from the home where you live, or were you having them picked up from a different address? [IF Q#V5b = 1 READ] "Was this refrigerator from the home where you live, or were you having it picked up from a different address?"

1. Yes, (these units)/(this unit) for own home [GO TO Q#V6]
2. [DO NOT ALLOW IF Q#V5b = 1] Some units for own home, some for another home [GO BACK TO Q#V5b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. TELL RESPONDENT 'For purposes of this survey, let's just talk about the unit(s) that you had picked up from your own home.' GO TO Q#V6]
3. No, (none of units)/(this unit not) [GO BACK TO Q#V5b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. GO TO Q#V6]
4. (Don't know) [RECORD 0 IN Q#V5b; GO TO Q#V6.]

V6. [IF FZ > 0 AND IF Q#V4 = 1 (Yes) Our records indicate that you had [INSERT NUMBER FROM FZ] freezers picked up. Is this correct?
1. Yes [RECORD FZ IN Q#V6b; GO TO Q#V7].
2. No

[IF FZ = 0, RECORD 0 IN Q#V6b; IF Q#V6 = 1 (Yes), RECORD FZ IN Q#V6b]

V6b. [IF Q#V6 = 1 (Yes), RECORD FZ; IF Q#V6 = 2 (No) ASK] How many freezers do you recall having picked up? [RECORD NUMBER, 99 Don't Know]

[IF Q#V6b = 0, GO TO Q#V7]

V6c. [IF Q#V6b > 1 READ] "Were these freezers(s) from the home where you live, or were you having them picked up from a different address?" [IF Q#V6b = 1 READ] "Was this freezer from the home where you live, or were you having it picked up from a different address?"
1. Yes, (these units)/(this unit) for own home [GO TO Q#V7]
2. [DO NOT ALLOW IF Q#V6b = 1] Some units for own home, some for another home [GO BACK TO Q#V6b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. TELL RESPONDENT 'For purposes of this survey, let's just talk about the unit(s) that you had picked up from your own home.' GO TO Q#V7]
3. No, (none of units)/(this unit not) for own home [GO BACK TO Q#V6b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. GO TO Q#V7]
4. (Don't know) [RECORD 0 IN Q#V6b; GO TO Q#V7.]

V7. [IF RACpi > 0 AND IF Q#V4 = 1 (Yes) Our records indicate that you had [INSERT INSERT NUMBER FROM RACpi] room air conditioners picked up. Is this correct?
1. Yes [RECORD RACpi IN Q#V7b; GO TO Q#P1].
2. No

[IF RACpi = 0, RECORD 0 IN Q#V7b; IF Q#V7 = 1 (Yes), RECORD RACpi IN Q#V5b]

V7b. [IF Q#V7 = 1 (Yes), RECORD RACpi; IF Q#V7 = 2 (No) ASK] How many room air conditioners do you recall having picked up? [RECORD NUMBER, 99 Don't Know]

[IF Q#V7b = 0 GO TO Q#P1]

V7c. [IF Q#V7b > 1 READ] "Were these room air conditioners(s) from the home where you live, or were you having them picked up from a different address?" [IF Q#V7b = 1 READ] "Was this room air conditioner from the home where you live, or were you having it picked up from a different address?"

1. Yes, (these units)/(this unit) for own home [GO TO Q#V7]
2. Some units for own home, some for another home [GO BACK TO Q#V7b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. TELL RESPONDENT 'For purposes of this survey, let's just talk about the unit(s) that you had picked up from your own home.' GO TO Q#P1]
3. No, (none of units)/(this unit not) for own home [GO BACK TO Q#V7b AND REVISE NUMBER TO REPRESENT UNITS PICKED UP FROM OWN HOME. GO TO Q#P1]
4. (Don't know) [RECORD 0 IN Q#V7b; GO TO Q#P1.]

[PROGAMMER: IF SUM OF Q#V2, Q#5b, Q#6b, and Q#7b = 0, THANK AND TERMINATE. OTHERWISE, CONTINUE.]

FINDING OUT ABOUT THE PROGRAM [P series]

P1. How did you find out about this program? (DON'T READ; MULTIPLE RESPONSE)
1. (Bill insert/mailing from utility)
2. (Newspaper)
3. (Radio)
4. (TV)
5. (Advertisement on truck)
6. (Appliance dealer)
7. (At retailer/saw tent)
8. (Store flyer)
9. (Salesperson)
10. (Co-worker, family, or friend)
11. (Utility representative)
12. (Utility web site)
13. (Internet—unspecified)
14. (Other [SPECIFY_____])
15. (Don't know/Refused)

P2. After you give your appliance to [INSERT UTILITY NAME], what do you think happens to it? [DON'T READ; MULTIPLE RESPONSE]
1. (It gets recycled)
2. (They get rid of the CFCs, refrigerants, freon)
3. (They trash/get rid of it)
4. (They sell it to be reused)
5. (Other [SPECIFY _____])
6. (Don't know)

[READ: As you may know, after you give your appliance to [INSERT UTILITY NAME], they take it to a facility and remove all environmentally hazardous materials, such as capacitors, mercury switches and refrigerants. The remaining materials—mostly steel, along with smaller amounts of other metals, and rubber and plastic—are recycled.]

P3. [IF Q#V2 > 0] How convenient was the location of the turn-in event where you dropped off your room air conditioner? Please use a scale from 0 to 10, where 0 is "extremely inconvenient" and 10 is "extremely convenient." [RECORD NUMBER, 99 DON'T KNOW].

P4. [IF ANY Q#V5b, Q#V6b, or Q#V7b > 0] How easy was it to schedule the pick-up of your appliance(s) from your home? Please use a scale from 0 to 10, where 0 is "extremely inconvenient" and 10 is "extremely convenient." [RECORD NUMBER, 99 DON'T KNOW].

P5. [IF Q#P4 < 5] Please describe any difficulties you had in scheduling the pick-up of your appliance(s). [MULTIPLE RESPONSE]

P6. [IF V5b = 0 READ], "I know you didn't recycle a refrigerator. But, I want you to think a moment about how much it cost to run a refrigerator." [THEN READ TO ALL] About how much do you think it costs to run a 15 year old refrigerator for a year? Does it cost (READ):

1. $50 or less
2. $51 to $100
3. $101 to $150
4. $151 to $200
5. More than $200
6. (Don't know)

ENERGY STAR AWARENESS (E SERIES)

E1. Have you ever seen or heard of the ENERGY STAR label?

1. Yes [GO TO RANDOMIZED APPLIANCE SERIES]
2. No
3. (Don't know)

E2. The ENERGY STAR label has the word "energy" followed by a star under a half-circle. Some labels also show the continents and the oceans of the earth in the half circle. ENERGY STAR labels are used by the Environmental Protection Agency—the EPA—and the Department of Energy to identify and label highly energy-efficient products for consumers. Had you seen or heard of a label such as this before now?

1. Yes
2. No
3. (Not sure/don't know)

[ALL RESPONDENTS GO TO RANDOMIZED APPLIANCE SERIES]

[PROGRAMMER: EACH RESPONDENT WILL BE ASKED ABOUT ONE OR TWO APPLIANCES. NO RESPONDENT WILL BE ASKED ABOUT TWO OF A THE SAME APPLIANCE (E.G., NOT TWO REFRIGERATORS).

IF MODE = 2, ASK AC SERIES ONCE.

IF MODE = 1 ASK ABOUT UP TO TWO OF THE THREE APPLIANCE SERIES (AC SERIES, R SERIES, F SERIES) BASED ON PRODUCTS IN THE SAMPLE. RANDOMIZE WHICH SERIES IS ASKED FIRST BUT ALSO PAY ATTENTION THAT ALL QUOTAS BEING MET.

IF MODE = 3 ASK ABOUT AC SERIES AND ABOUT EITHER R SERIES OR F SERIES BASED ON PRODUCTS IN THE SAMPLE. AGAIN, RANDOMIZE WHICH SERIES IS ASKED FIRST.]

ROOM AIR CONDITIONERS [AC SERIES]

[IF MODE = 1 (Pick-up only) AND Q#V7b = 1; IF MODE = 2 (Turn-in only) AND Q#V2 = 1; OR IF MODE = 3 (Both) AND Q#V2 + Q#V7b = 1 SAY "Now, I'd like you to think about the room air conditioner you recycled."]

[IF MODE = 1 (Pick-up only) AND Q#V7b ≥ 2; IF MODE = 2 (Turn-in only) AND Q#V2 ≥ 2; SAY 'I know you recycled more than one room air conditioner. For purposes of this survey, can you focus on just one of the units you recycled?']

[IF MODE = 3 (Both) AND Q#V2 = 1 AND Q#V7b ≥ 1, SAY 'I know you recycled more than one room air conditioner. For the purposes of this survey, can you focus on just the room air conditioner that you recycled through the turn-in program at a local retailer or other location in the area?']

[IF MODE = 3 (Both) AND Q#V2 ≥ 2 AND Q#V7b ≥ 1, SAY 'I know you recycled more than one room air conditioner. For purposes of this survey, can you focus on just one of the units you recycled through the turn-in program at a local retailer or other location in the area?']

AC1. Approximately how old was the air conditioner you recycled through the program? Was it:
1. 0-5 years old
2. 6-10 years old
3. 11 to 15 years old
4. More than 15 years old
5. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

AC2. How did you come to own the room air conditioner that you recycled through the program? Did: [READ]
1. You buy it?
2. Someone give it to you? [GO TO Q#AC4]
3. It come with your house or apartment? [GO TO Q#AC5]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#AC5]
5. (Don't know/don't remember) [GO TO Q#AC5]

AC3. [IF 1 (Bought it) TO Q#AC2] Did you buy it: [RANDOMIZE AND READ 1-4, THEN 5]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Other [SPECIFY_____])
6. (Don't know/don't remember)

[IF Q#AC2=2, GO TO Q#AC4, OTHERWISE GO TO Q#AC5]

AC4. [IF 2 (Given to you) TO Q#AC2] When the air conditioner was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

AC5. Was the room air conditioner in working condition when you decided to recycle it with the program?
1. Yes
2. Yes, but not that well
3. No [GO TO Q#AC7]
4. (Don't know)

AC6. If you had not recycled the room air conditioner, how likely would you have been to use it last summer (that is, the summer of 2004)? Please use a scale from 0 to 10 where 0 is 'extremely unlikely' and 10 is 'extremely likely.' [RECORD NUMBER, 99 Don't know]

AC7. In what room of the house did you typically use the room air conditioner? [RANDOMIZE AND READ 1-5, THEN 6]
1. Living/family room
2. Bedroom
3. Kitchen
4. Dining room
5. Office/Study
6. Some other place [SPECIFY_____]
7. (Don't know)

AC8. Again thinking about just that one room air conditioner, why did you decide to recycle the room air conditioner through the [INSERT UTILITY NAME] sponsored program? [DON'T READ; MULTIPLE RESPONSE]
1. (Old unit was not working well)
2. (Bought a new room air conditioner)
3. (Bought a more energy efficient air conditioner)
4. (Bought a model that would save me money)
5. (Rebate/bounty to turn in/they paid me money)
6. (Easy to turn it in)
7. (They would pick it up)
8. (Moving soon/just moved)
9. (Better for the environment)
10. (Recycling it saves me money)
11. (No other way to get rid of it/trash collection would not accept)
12. (Cost too much money to get rid of it/have someone pick it up)
13. (Didn't need it any more)
14. (Installed central air conditioning)
15. (Other [SPECIFY_____])
16. (Don't know)

AC9. If the [INSERT UTILITY NAME] recycling program had not been available to you, what would you have done with the room air conditioner? Most likely, would you have: [RANDOMIZE AND READ 1-9, THEN 10; CHECK ONE]
1. Continued to use it
2. Stored it unused
3. Gave it to a retail store
4. Called someone to come and haul it away
5. Threw it way
6. Given it away
7. Donated it to a charity/church
8. Sold it
9. Took it to have the coolant removed
10. Or would you have done something else? [SPECIFY]_____
11. (Don't know)

AC10. [IF Q#AC9=6 (Given away) OR 7 (Donated) OR 8 (Sold)] Which of the following best describes how you would have [INSERT GIVEN AWAY, DONATED, OR SOLD] the room air conditioner? Would it have gone: [RANDOMIZE AND READ 1-5, THEN 6; CHECK ONE]
1. To a friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. At a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

Now I'm going to ask you to think back to how you actually used the room air conditioner before you recycled it through the program. We are still talking about just the one same air conditioner as in the previous questions.

AC11. Was the room air conditioner designed to be installed in a window or a cut out space in the wall, or was it a stand-alone or portable unit?
1. Window
2. Cut out in the wall
3. Stand alone or portable
4. (Other [SPECIFY _____])
5. (Don't know)

AC12. In which month did you typically use the room air conditioner for the first time during the season? [IF RESPONDENT ANSWERS THAT IT DEPENDS ON THE WEATHER/TEMPERATURE, ASK THEM TO THINK ABOUT WHEN IT GENERALLY OCCURRED]
1. May
2. June
3. July
4. August
5. Or some other month? [SPECIFY_____]
6. (Don't know)

AC13. In which month did you typically stop using use the room air conditioner for the season? [IF RESPONDENT ANSWERS THAT IT DEPENDS ON THE WEATHER/TEMPERATURE, ASK THEM TO THINK ABOUT WHEN IT GENERALLY OCCURRED]
1. August
2. September
3. October
4. Or some other month? [SPECIFY_____]
5. (Don't know)

AC14. Did you let your room air conditioner turn off and on automatically or did you turn it off and on manually?
1. Turn off and on automatically [GO TO Q#AC20]
2. Turn off and on manually
3. (Don't know)

AC15. You say you turned your room air conditioner off and on manually. What was the outdoor temperature when you typically turned the room air conditioner on [RECORD TEMPERATURE____[RECORD SINGLE NUMBER; IF RESPONDENT GIVES RANGE, RECORD AVERAGE. 999 Don't know]

AC16. During which of these times would you typically use the air conditioner? [READ, MULTIPLE RESPONSE]
1. Weekdays
2. Weeknights
3. Weekend days
4. Weekend nights
5. Or other times? [SPECIFY_____]
6. (Don't know)

Room AC Bounty Questions (ACB Series)

I'm now going to ask you some questions about any financial incentives you received for recycling this same room air conditioner.

ACB1. When you recycled your room air conditioner, did you qualify to receive a $25 check in the mail for recycling it? This is a separate payment from any you may have received for buying a new room air conditioner.
1. Yes
2. No [GO TO Q#ACB3]
3. Still waiting to receive check
4. (Don't know) [GO TO Q#ACB3]

ACB2. [IF Q#ACB1=1 OR 3] How important was the money in your decision to recycle the room air conditioner? Please use a scale from 0 to 10, where 0 is 'not at all important' and 10 is 'extremely important.' [RECORD NUMBER, 99 Don't know]

ACB3. How easy did you find the process of recycling your room air conditioner? Please use a scale of 0 to 10, where 0 is 'extremely difficult' and 10 is 'extremely easy.' [RECORD NUMBER, 99 Don't know]

ACB4. [IF ACB3≤4, OTHERWISE GO TO Q#ACE1] What problems did you encounter while recycling your room air conditioner? [PROBE; MULTIPLE RESPONSE]

ENERGY STAR Room AC Questions (ACE Series)

ACE1. Did you get another room air conditioner to replace the one that you recycled through the [INSERT UTILITY NAME] sponsored program?
1. Yes, got a new room air conditioner
2. Yes, installed central air conditioning [GO TO NEXT SERIES OR TO Q#B1]
3. No [GO TO NEXT SERIES OR TO Q#B1]
4. (Don't know) [GO TO NEXT SERIES OR TO Q#B1]

ACE2. Was the replacement air conditioner new or used when you got it?
1. New
2. Used
3. (Don't know)

ACE3. Where did you get the replacement air conditioner? [DON'T READ]
1. (Sears)
2. (Home Depot)
3. (Best Buy)
4. (Lowe's)
5. (Bernie's)
6. (Wal-Mart)
7. (Target)
8. (CVS)
9. (Brooks Drug)
10. (Walgreens)
11. (Stop n Shop)
12. (Shop Rite)
13. (Sam's Club)
14. (Costco)
15. (BJ's)
16. (Christmas Tree Shop)
17. (Yard/garage sale)
18. (Friend/relative)
19. (Internet [SPECIFY site name/address_____])
20. (Other [SPECIFY_____])
21. (Don't know)

[IF 2 (No) OR 3 (Don't know) TO Q#E2, GO TO NEXT SERIES OR TO Q#B1]

ACE4. [IF 1 (Yes) TO Q#E1 OR IF 1 (Yes) TO Q#E2] Does your replacement room air conditioner have the ENERGY STAR label?
1. Yes
2. No [GO TO NEXT SERIES OR TO Q#B1)
3. (Don't know) [GO TO NEXT SERIES OR TO Q#B1]

ACE5. Did you receive a $25 rebate from [INSERT UTILITY NAME] for purchasing your new ENERGY STAR room air conditioner? This would have been in addition to any payment you received for recycling the old room air conditioner.
1. Yes
2. No [GO TO NEXT SERIES OR TO Q#B1]
3. (Don't know) [GO TO NEXT SERIES OR TO Q#B1]

ACE6. How important was the utility rebate in your decision to purchase an ENERGY STAR room air conditioner? Please use a scale from 0 to 10, where 0 is 'not at all important' and 10 is 'extremely important.' [RECORD NUMBER, 99 Don't know]

[ALL GO TO NEXT SERIES OR TO Q#B1 DEPENDING ON PRODUCTS AND RANDOMIZATION]

REFRIGERATORS [R SERIES]

[IF Q#V5b > 0 SAY Now, I'd like you to think about the refrigerator you had removed through the program.

[IF Q#V5b > 1 SAY 'I know you recycled more than one refrigerator. For purposes of this survey, can you focus on just one of the units you recycled?']

R1. Approximately how old was the refrigerator you removed through the program? Was it [READ, CHECK ONE]:
1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
6. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

R2. How did you come to own the refrigerator that you removed through the program? Did [READ]
1. You buy it?
2. Someone give it to you? [GO TO Q#R4]
3. It come with your house or apartment? [GO TO Q#R5]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#R5]
5. (Don't know/don't remember) [GO TO Q#R5]

R3. [IF 1 (Bought it) TO Q#R2] Did you buy it [RANDOMIZE AND READ 1-5, THEN 6]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Or somewhere else? [SPECIFY_____])
6. (Don't know/don't remember)

[IF Q#R2≠2, GO TO Q#R5]

R4. [IF 2 (Given to you) TO #R2] When the refrigerator was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

R5. Was the refrigerator in working condition when you decided to recycle it with the program?
1. Yes
2. Yes, but not that well
3. No
4. (Don't know)

R6. Was the refrigerator the primary one used in the home, a second refrigerator, or was it not being used at all?
1. Primary [GO TO Q#R8a]
2. Secondary
3. Not being used
4. (Don't know)

R7a. [IF Q#R6 ≠ 1 (Primary)] In the year prior to getting rid of the refrigerator, how often did you have the refrigerator plugged in? Was it plugged in [READ, CHECK ONLY ONE]:
1. All the time
2. Most of time
3. Occasionally
4. Never [GO TO Q#R9]
5. (Don't know) [GO TO Q#R9]

R7b. [IF Q#R7a ≤ 3 (Occasionally, most, all the time)] In the year prior to getting rid of the refrigerator, how often did you actually use the refrigerator for cooling food, beverages, or other items? Was it used [READ, CHECK ONLY ONE]:
1. All the time
2. Most of time
3. Occasionally
4. Never
5. (Don't know)

R8a. Where in the house was the refrigerator located? [RANDOMIZE AND READ 1-4, THEN 5]
1. Basement
2. Kitchen
3. Garage
4. Porch
5. Some other place [SPECIFY_____]
6. (Don't know)

R8b. Is the space where the refrigerator was located heated in the winter?
1. Yes
2. No
3. (Don't know)

R8c. Is the space where the refrigerator was located cooled in the summer?
1. Yes
2. No
3. (Don't know)

R9. Why did you decide to recycle the refrigerator through the [INSERT UTILITY NAME]-sponsored program? [DO NOT READ; MULTIPLE RESPONSE]
1. (Old unit was not working well)
2. (Bought new refrigerator/remodeling)
3. (Bought a more energy efficient model)
4. (Bought a model that would save me money)
5. (Rebate/bounty to turn in/they paid me money)
6. (Easy to turn it in)
7. (They would pick it up)
8. (Moving soon/just moved)
9. (Better for the environment)
10. (Recycling it saves me money)
11. (No other way to get rid of it/trash collection would not accept)
12. (Cost too much to have it picked up)
13. (Didn't need it any more)
14. (Other) [SPECIFY_____])
15. (Don't know)

R10. If the [INSERT UTILITY NAME] recycling program had not been available to you, what would you have done with the refrigerator? Most likely, would you have: [RANDOMIZE AND READ 1-9, THEN 10]
1. Continued to use it
2. Stored it unused
3. Had a retail store come and pick it up
4. Called someone come and haul it away
5. Put it out in the trash
6. Given it away
7. Donated it to a charity/church
8. Sold it
9. Recycled it
10. Or would you have done something else? [SPECIFY]_____
11. (Don't know)

[IF Q#R10=6 (Given away) OR 7 (Donated) OR 8 (Sold), OTHERWISE GO TO Q#RB1]

R11. Which of the following best describes how you would have [INSERT GIVEN AWAY, DONATED, OR SOLD] the refrigerator? Would it have gone: [RANDOMIZE AND READ 1-5, THEN 6]
1. To friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. To someone who bought it at a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

Refrigerator Bounty Questions [RB Series]
I am now going to ask you some questions about any financial incentives you received for recycling your refrigerator.

RB1. When you recycled your refrigerator, did you qualify to receive a $50 check in the mail from [INSERT UTILITY NAME] for recycling it?
1. Yes
2. No [GO TO Q#RB3]
3. Still waiting to receive check
4. (Don't know) [GO TO Q#RB3]

RB2. [IF Q#RB1=1 OR 3] How important was the money in your decision to recycle the refrigerator? Please use a scale from 0 to 10, where 0 is 'it was not at all important' and 10 is 'it was extremely important.' [RECORD NUMBER, 99 Don't know]

RB3. Did you arrange for the refrigerator pick-up by calling a toll-free telephone number or on the utility web site?
1. Toll-free telephone number
2. Web site/Internet
3. (Don't know)

RB4. How easy did you find the process of recycling your refrigerator? Please use a scale of 0 to 10, where 0 is 'extremely difficult' and 10 is 'extremely easy.' [RECORD NUMBER, 99 Don't know]

RB5. [IF Q#RB4≤4, OTHERWISE GOTO Q#RE1] What problems did you encounter while recycling your refrigerator? [PROBE; MULTIPLE RESPONSE]

ENERGY STAR Refrigerator Questions (RE Series)

RE1. Did you get another refrigerator to replace the one you recycled through the [INSERT UTILITY NAME] sponsored program?
1. Yes
2. No [GO TO NEXT SERIES OR TO Q#B1]
3. (Don't know) [GO TO NEXT SERIES OR TO Q#B1]

RE2. Was the replacement refrigerator new or used when you got it?
1. New
2. Used
3. (Don't know)

RE3. Where did you get the replacement refrigerator? (DON'T READ)
1. (Sears)
2. (Home Depot)
3. (Best Buy)
4. (Lowe's)
5. (Bernie's)
6. (Wal-Mart)
7. (Target)
8. (Sam's Club)
9. (Costco)
10. (BJ's)
11. (Yard/garage sale)
12. (Friend/relative)
13. Internet [SPECIFY site name/address_____]
14. (Other [SPECIFY_____])
15. (Don't know)

[IF 2 (No) OR 3 (Don't know) TO Q#E2, GO TO NEXT SERIES OR TO Q#B1]

RE4. [IF 1 (Yes) TO Q#E1 OR IF 1 (Yes) TO Q#E2].Does your replacement refrigerator have the ENERGY STAR label?
1. Yes
2. No
3. (Don't know)

[ALL GO TO NEXT SERIES OR TO Q#B1, DEPENDING ON PRODUCTS AND RANDOMIZATION]

FREEZER [F SERIES]
[IF Q#V6b > 0 ASK F SERIES, OTHERWISE SKIP TO B1 Remaining Appliances]

Now, I'd like you to think about the freezer you had removed through the program.

[IF Q#V6b > 1 SAY 'I know you recycled more than one freezer. For purposes of this survey, can you focus on just one of the units you recycled?']

F1. Approximately how old was the freezer you removed through the program? Was it [READ, CHECK ONE]:
1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
6. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

F2. How did you come to own the freezer that you removed through the program? Did [READ]
1. You buy it
2. Someone give it to you [GO TO Q#F4]
3. It come with your house or apartment [GO TO Q#F5]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#F5]
5. (Don't know/don't remember) [GO TO Q#F5]

F3. [IF Q#F2=1 (Bought it)] Did you buy it [RANDOMIZE AND READ 1-4, THEN 5]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Other [SPECIFY_____])
6. (Don't know/don't remember)

[IF Q#F2≠2, GO TO Q#F5]

F4. [IF 2 (Given to you) TO Q#F2] When the freezer was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

F5. Was the freezer in working condition when you decided to recycle it with the program?
1. Yes
2. Yes, but not that well
3. No
4. (Don't know)

F7. In the year prior to getting rid of the freezer, how often did you have the freezer plugged? Was it plugged in [READ, CHECK ONLY ONE]:
1. All the time
2. Most of time
3. Occasionally
4. Never [GO TO Q#F9]
5. (Don't know) [GO TO Q#F9]

F7b. [IF Q#F7a ≤ 3 (Occasionally, most, all the time),] In the year prior to getting rid of the freezer, how often did you actually use it for freezing food, ice, or other items? Was it used [READ, CHECK ONLY ONE]:
1. All the time
2. Most of time
3. Occasionally
4. Never
5. (Don't know)

F8a. Where in the house was the freezer located? [RANDOMIZE AND READ 1-4, THEN 5]
1. Basement
2. Kitchen
3. Garage
4. Porch
5. Some other place [SPECIFY_____]
6. (Don't know)

F8b. Is the space where the freezer was located heated in the winter?
1. Yes
2. No
3. (Don't know)

F8c. Is the space where the freezer was located cooled in the summer?
1. Yes
2. No
3. (Don't know)

F9. Why did you decide to recycle the freezer through the [INSERT UTILITY NAME]-sponsored program? [DO NOT READ; MULTIPLE RESPONSE]
1. (Old unit was not working well)
2. (Bought new freezer/remodeling)
3. (Bought a more energy efficient model)
4. (Bought a model that would save me money)
5. (Rebate/bounty to turn in/they paid me money)
6. (Easy to turn it in)
7. (They would pick it up)
8. (Moving soon/just moved)
9. (Better for the environment)
10. (Recycling it saves me money)
11. (No other way to get rid of it/trash collection would not accept)
12. (Cost too much to have it picked up)
13. (Didn't need it any more)
14. (Other [SPECIFY_____])
15. (Don't know)

F10. If the [INSERT UTILITY NAME] recycling program had not been available to you, what would you have done with the freezer? Most likely, would you have: [RANDOMIZE AND READ 1-9, THEN 10]
1. Continued to use it
2. Stored it unused
3. Had a retail store come and pick it up
4. Called someone come and haul it away
5. Put it out in the trash
6. Given it away
7. Donated it to a charity/church
8. Sold it
9. Recycled it
10. Or would you have done something else? [SPECIFY]_____
11. (Don't know)

[IF Q#F10=6 (Given away) OR 7 (Donated) OR 8 (Sold), OTHERWISE GO TO Q#FB1]

F11. Which of the following best describes how you would have [INSERT GIVEN AWAY, DONATED, OR SOLD] the freezer? Would it have gone: [RANDOMIZE AND READ 1-5, THEN 6]

1. To friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. To someone who bought it at a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

Freezer Bounty Questions [FB Series]

I am now going to ask you some questions about any financial incentives you may have received for recycling your freezer.

FB1. When you recycled your freezer, did you qualify to receive a $50 check in the mail from [INSERT UTILITY NAME] for recycling it?

1. Yes
2. No [GO TO Q#FB3]
3. Still waiting to receive check
4. (Don't know) [GO TO Q#FB3]

FB2. [IF Q#FB1=1 OR 3] How important was the money in your decision to recycle the freezer? Please use a scale from 0 to 10, where 0 is 'not at all important' and 10 is 'extremely important.' [RECORD NUMBER, 99 Don't know]

FB3. Did you arrange for the freezer pick-up by calling a toll-free telephone number or on the utility web site?

1. Toll-free telephone number
2. Web site/Internet
3. (Don't know)

FB4. How easy did you find the process of recycling your freezer? Please use a scale of 0 to 10, where 0 is 'extremely difficult' and 10 is 'extremely easy.' [RECORD NUMBER, 99 Don't know]

FB5. [IF FB4≤4, OTHERWISE GOTO Q#FE1] What problems did you encounter while recycling your freezer? [PROBE; MULTIPLE RESPONSE]

ENERGY STAR Freezer Questions (FE Series)

FE1. Did you get another freezer to replace the one you recycled through the [INSERT UTILITY NAME] sponsored program?

1. Yes
2. No [GO TO NEXT SERIES OR TO Q#B1]
3. (Don't know) [GO TO NEXT SERIES OR TO Q#B1]

FE2. Was the replacement freezer new or used when you got it?
1. New
2. Used
3. (Don't know)

FE3. Where did you get the replacement freezer? [DON'T READ]
1. (Sears)
2. (Home Depot)
3. (Best Buy)
4. (Lowe's)
5. (Bernie's)
6. (Wal-Mart)
7. (Target)
8. (Sam's Club)
9. (Costco)
10. (BJ's)
11. (Yard/garage sale)
12. (Friend/relative)
13. Internet [SPECIFY site name/address_____]
14. (Other [SPECIFY_____])
15. (Don't know)

[IF 2 (No) OR 3 (Don't know) TO Q#E2, GO TO NEXT SERIES OR TO Q#B1]

FE4. [IF 1 (Yes) TO Q#E1 OR IF 1 (Yes) TO Q#E2] Does your replacement freezer have the ENERGY STAR label?
1. Yes
2. No
3. (Don't know)

[ALL GO TO NEXT SERIES OR TO Q#B1 DEPENDING ON PRODUCTS AND RANDOMIZATION]

REMAINING APPLIANCES (B SERIES)

B1. How many refrigerators are currently in use in your home? [IF Q#R1=1,2,3,4,5, OR 6 (Refrigerator Series was asked), ADD 'since you recycled a refrigerator through the program.']
[RECORD NUMBER]_____ [RECORD NUMBER, 99 Don't know] [IF 0 GO TO Q#B3].

B2a through B2c. [FOR EACH REFRIGERATOR, ASK "Approximately how old is your refrigerator." [IF MORE THAN ONE REFRIGERATOR, ASK ABOUT UP TO THREE REFRIGERATORS INSERTING "first", "second," or "third" BEFORE "refrigerator" AS APPROPRIATE.]
1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
6. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

B3. How many room air conditioners are currently in use in your home [IF Q#AC1=1,2,3,4, OR 5 (Room Air Conditioner Series was asked), ADD 'since you recycled a room air conditioner through the program.']?
[RECORD NUMBER]_____ [RECORD NUMBER, 99 Don't know] [IF 0 GO TO Q#B5]

B4a through B4c. [FOR EACH ROOM AIR CONDITIONER, ASK "Approximately how old is your room air conditioner." [IF MORE THAN ONE ROOM AIR CONDITIONER, ASK ABOUT UP TO THREE ROOM AIR CONDITIONERS INSERTING "first", "second," or "third" BEFORE "room air conditioner" AS APPROPRIATE.]
1. 0-5 years old
2. 6-10 years old
3. 11 to 15 years old
4. More than 15 years old
5. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

B5. How many stand-alone freezers that are not a part of your refrigerator are currently in use in your home [IF Q#F1=1,2,3,4,5 OR 6 (Freezer Series was asked), ADD 'since you recycled a freezer through the program.']?
[RECORD NUMBER]_____ [RECORD NUMBER, 99 Don't know] [IF 0 GO TO Q#B7]

B6a through B6c. [FOR EACH FREEZER, ASK "Approximately how old is your freezer." [IF MORE THAN ONE freezer, ASK ABOUT UP TO THREE FREEZERS INSERTING "first", "second," or "third" BEFORE "freezer" AS APPROPRIATE.]

1. 0 to 5 years old
2. 6 to 10 years old
3. 11 to 15 years old
4. 16 to 20 years old
5. More than 20 years old
6. (Don't know) [PROBE: 'CAN YOU GIVE AN APPROXIMATE AGE?']

B7. While living at this address, have you participated in any other energy efficiency programs sponsored by [INSERT NAME OF ELECTRIC UTILITY] such as: [RANDOMIZE AND READ 1-8, THEN 9, RECORD ALL THAT APPLY]

1. Purchasing energy efficient lighting products or ceiling fans through the Smart Living mail order or on-line catalog
2. Purchasing lighting products with utility-sponsored rebates at local retailers
3. Purchasing other appliances using utility-sponsored rebates
4. [FOR CL&P CUSTOMERS ONLY] WRAP weatherization program
5. [FOR CL&P CUSTOMERS ONLY] Customer Initiated Project (CIP) Program
6. [FOR CL&P CUSTOMERS ONLY] ENERGY STAR Homes—for new construction
7. [FOR UI CUSTOMERS ONLY] Rate RT—time-of-use rate program
8. [FOR UI CUSTOMERS ONLY] Electric hot water tank lease program
9. Any others I have not named? [SPECIFY]_____
10. (Don't know)
11. (Respondent did not participate in any programs)

[RANDOMIZE ORDER IN WHICH Q# B8a through Q# Bf ARE ASKED]

[INTRO TO B8 SERIES; READ] "Since participating in the [INSERT UTILITY NAME] recycling program, have you removed, recycled, or stopped using any additional major appliances in your home? Have you removed, recycled, or stopped using a …

a. Second refrigerator
    1. Yes
    2. No
    3. (Don't know)

b. Stand alone or upright freezer
    1. Yes
    2. No
    3. (Don't know)

c. Room air conditioners
    1. Yes
    2. No
    3. (Don't know)

d. Central air conditioner
    1. Yes
    2. No
    3. (Don't know)

e. Dehumidifier
    1. Yes
    2. No
    3. (Don't know)

f. Any other appliances? [SPECIFY]_____
    1. Yes
    2. No
    3. (Don't know)

B9. [IF ANY Q#B8=YES, OTHERWISE GO TO Q#B10] Did your participation in the [INSERT UTILITY NAME] recycling program influence your decision to remove, recycle, or stop using any of these appliances?
1. Yes – probably so
2. No – probably not
3. (Not sure)

[ASK Q# B10a through Q# B10e IF 1 (Yes) TO Q#E1 OR IF 1 (Yes) TO Q#E2 (aided or unaided awareness of ENERGY STAR label); RANDOMIZE ORDER IN WHICH Q# B10a through Q# B10e ARE ASKED]

[INTRO TO Q# B10 SERIES; READ "Since participating in the [INSERT UTILITY NAME] recycling program, have you purchased any of the following ENERGY STAR qualifying products for your home? Have you purchased ….

B10a: any ENERGY STAR appliances?
1. Yes
2. No
3. (Don't know)

B10b. an ENERGY STAR heating system?
1. Yes
2. No
3. (Don't know)

B10c. any ENERGY STAR windows?
1. Yes
2. No
3. (Don't know)

B10d. any ENERGY STAR lighting products?
1. Yes
2. No
3. (Don't know)

B10e. any ENERGY STAR home electronics?
1. Yes
2. No
3. (Don't know)

B11. [IF ANY Q#B10 SERIES=YES, OTHERWISE GO TO Q#B12] Did your participation in the [INSERT UTILITY NAME] recycling program influence your decision to replace or purchase any of these ENERGY STAR-qualified products? Please use a scale from 0 to 10 where 0 is "no influence at all" and 10 is "a great deal of influence."

B12. Would you say that your energy usage has decreased or increased since participating in the program? Has it:
1. Decreased a lot
2. Decreased a little
3. Stayed about the same
4. Increased a little
5. Increased a lot

6. (Don't know)

[IF Q#B12 ≥ 3 GO TO Q#B14]

B13. [IF Q#B14 < 5] How satisfied are you with the energy savings you have seen since participating in the program? Please use a scale from 0 to 10 where 0 is "extremely dissatisfied" and 10 is "extremely satisfied."

B14. In addition to saving energy or money, what are some other benefits that you believe result from removing and recycling appliances through the program? (DON'T READ; PROBE; MULTIPLE RESPONSE)

1. (Helps the environment/stops global warming/ozone layer)
2. (Gives me more space)
3. (Gets rid of junk/clutter)
4. (Saves me money)
5. (Other SPECIFY _____)
6. (No other benefits/don't know)

B15. What do you see as potential drawbacks of removing and recycling appliances through the program? [DON'T READ, PROBE; MULTIPLE RESPONSE]

1. (Loss of food storage space)
2. (Loss of other storage space)
3. (House no longer cool)
4. (Usable appliances are thrown away)
5. (Other SPECIFY _____)
6. (No drawbacks)
7. (Don't know)

DEMOGRAPHICS

D1. What type of building is your home? [READ RESPONSES] ?
1. Detached single-family home
2. Townhouse or duplex, with a wall separating the units from basement to roof, and with separate utilities for each unit
3. Two, three, or four family building—with no basement walls separating the units, or with one water and sewer bill for the whole building
4. Part of a building with 5 or more units
5. Other [SPECIFY: _____]
6. (Don't know/refused)

D2. Do you own or rent your home?
1. Own
2. Rent
3. (Refused)

D3. Approximately how many square feet is your home?
1. Less than 1,500
2. 1,500 – 1,999
3. 2,000 – 2,999
4. 3,000 – 3,999
5. 4,000 – 4,999
6. 5,000 – 5,999
7. 6,000 or more
8. (Don't know/Refused) [ASK Q#D4]

D4. [IF Q#D3=8] How many rooms are in your home, not counting bathrooms?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10 or more
11. (Don't know/refused)

D5. What is the highest level of education that you have completed? [READ CATEGORIES]
1. Less than high school
2. High school graduate
3. Technical or trade school graduate
4. Some college
5. College graduate

6. Some graduate school
7. Graduate degree
8. (Refused)

D6. How many people live in your home now?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6 or more
7. (Refused)

D7. How many people lived in your home at the time you participated in the program?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6 or more
7. (Refused)

D8. What is your age?
1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 or over
7. (Refused)

D9. What category best describes your total household income in 2004, before taxes?
1. Less than $35,000
2. $35,000 to $49,999
3. $50,000 to $74,999
4. $75,000 to $99,999
5. $100,000 or more
6. (Refused)

D10. [RECORD SEX]
1. Male
2. Female

[IF RESPONDENT EXPRESSES INTEREST OR VOICES CONCERN, READ] If you have questions or concerns please contact [IF UTILITY = CL&P INSERT "(860) 832-4754"; IF UTILITY = UI INSERT "(203) 499-3686"

Appendix E2
Non-Participant Survey Questionnaire

Non-Participant Survey
2004 CL&P and UI Appliance Retirement Program

DRAFT 09-06-05

RESPONDENT INFORMATION [FROM SAMPLE DATABASE]
Account
Account2
Sponsor

Name
Address
Address2
City
Zip
Phone

Status
Sample
Match
Strata

SECTION 1: SCREENING

> Hello, my name is _____ from Nexus Market Research. I am calling on behalf of Connecticut Light and Power (CL&P) and The United Illuminating Company (UI) to get feedback from customers about some of the utilities' programs and services. Your responses will be kept strictly confidential—that is your name will not be associated with any of your responses. If you have questions or concerns please contact [IF UTILITY = CL&P INSERT "(860) 832-4754"; IF UTILITY = UI INSERT "(203) 499-3686"

This survey will take about 15 minutes of your time. Would that be okay?
[IF REFUSE, ASK "Can we schedule a more convenient time for you to conduct this survey?"
[SCHEDULED, IF NECESSARY, FOR: _____]

SC1. Are you one of the people responsible for paying the electricity bill in your household?

1. Yes [GO TO Q#A1]
2. No [GO TO Q#SC2]
3. (Don't know) [GO TO Q#SC2]

SC2. Could I speak to the person responsible for paying the electricity bill?

1. Yes [REPEAT INTRODUCTION WITH NEW RESPONDENT AND GO TO Q#A1]
2. No
3. (Don't know) [THANK AND TERMINATE]

[IF Q#SC2=2 (No)] ASK "Is there a better time to reach this person?"
[SCHEDULED, IF NECESSARY, FOR: _____]

SECTION 2: AWARENESS AND REPORTED PARTICIPATION

A1. Do you know if [INSERT UTILITY NAME] has a program through which you can remove certain appliances that you may have in your home?
1. Yes [GO TO Q#A2]
2. No [GO TO Q#A6]
3. (Don't know) [GO TO Q#A6]

A2. What appliances can be removed through the program? [DO NOT READ, MULTIPLE RESPONSE]
1. (Refrigerator)
2. (Freezer)
3. (Room air conditioner)
4. (Dehumidifier)
5. (Other [SPECIFY_____])
6. (Don't know)

A3. How did you find out about this program? [DO NOT READ, MULTIPLE RESPONSE]
1. (Bill insert/mailing from utility)
2. (Newspaper)
3. (Radio)
4. (TV)
5. (Advertisement on truck)
6. (Appliance dealer)
7. (At retailer/saw tent)
8. (Store flyer)
9. (Salesperson)
10. (Co-worker, family, or friend)
11. (Utility representative)
12. (Utility web site)
13. (Internet—unspecified)
14. (Other [SPECIFY_____])
15. (Don't know/Refused)

A4. Have you ever participated in this program?
1. Yes
2. No [GO TO Q#A6]
3. (Don't know) [GO TO Q#A6]

A5. Did you [READ, MULTIPLE RESPONSE]

A5a. Turn in at least one room air conditioner or dehumidifier at an event held over the past year or so at a retail store or another location such as the SmartLiving Center?
1. Yes [THANK AND TERMINATE]
2. No
3. (Don't know)

A5b. Call [INSERT UTILITY NAME] and have them send someone to your house to pick up a refrigerator, freezer, dehumidifier, or room air conditioner over the past year or so?
1. Yes [THANK AND TERMINATE]
2. No
3. (Don't know)

A6. About how much do you think it costs to run a 15 year old refrigerator for a year? Does it cost (READ):
1. $50 or less
2. $51 to $100
3. $101 to $150
4. $151 to $200
5. More than $200
6. (Don't know)

[READ TO ALL "In this survey, we will sometimes be talking about recycling an appliance. By this, we mean that an appliance is taken to a facility where they remove all environmentally hazardous materials, such as capacitors, mercury switches and refrigerants. The remaining materials—mostly steel, along with smaller amounts of other metals, and rubber and plastic—are recycled.]

SECTION 3: EXISTENCE AND DISPOSITION OF ELIGIBLE UNITS

D1. Since May of 2004, have you gotten rid of any of the following items?

D1a. A refrigerator
1. Yes
2. No
3. (Don't know)

D1b. A stand alone chest or upright freezer that was not part of your refrigerator
1. Yes
2. No
3. (Don't know)

D1c. A room or window air conditioner
1. Yes
2. No
3. (Don't know)

D2. [IF Q#D1a (Yes), OTHERWISE GO TO Q#D3] How did you get rid of the refrigerator? Did you [RANDOMIZE AND READ 1-7, THEN 8; IF RESPONDENT SAYS THEY GOT RID OF MORE THAN ONE, PROMPT TO THINK ABOUT JUST ONE.]
1. Have a store take it away when you bought a new one
2. Call someone to haul it away
3. Put it out in the trash
4. Give it away
5. Donate it to charity/church
6. Sell it
7. Recycle it
8. Or did you do something else with it [SPECIFY_____])
9. (Don't know)

D2a. [IF Q#D2 = 6 (Sell It) GO TO Q#D2c] Were you charged money to get rid of the refrigerator?
1. Yes
2. No
3. (Don't know)

D2b. [IF Q#D2a (Yes)] About how much were you charged to have the refrigerator picked up? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE; 999 Don't know]

D2c. [IF Q#D2 = 4 (Gave it away), 6 (Sold it)] Which of the following best describes how you [INSERT GAVE AWAY, DONATED, OR SOLD] the refrigerator? [RANDOMIZE AND READ 1-5, THEN 6]
1. To a friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. At a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

D2d. One a scale from 0 to 10 where 1 is "very difficult" and ten is "very easy," how easy was it to find a way to get rid of your refrigerator? [RECORD_____, 99 Don't know]

D2e. [IF Q#A1=1(Aware of program) AND Q#D2 ≠ 7 (Recycle)] Why did you not have the refrigerator removed and recycled through the program sponsored by [INSERT UTILITY NAME]? [DON'T READ, MULTIPLE RESPONSE]

1. (Didn't know about it at the time)
2. (Didn't know they took refrigerators)
3. (Told I wasn't eligible)
4. (Program didn't pay enough money)
5. (Couldn't schedule a convenient pick up time)
6. (Other SPECIFY_____)
7. (Don't know)

D3. [IF Q#D1b=1 (Yes), OTHERWISE GO TO Q#D4] How did you get rid of the freezer? Did you [RANDOMIZE AND READ 1-7, THEN 8; IF RESPONDENT SAYS THEY GOT RID OF MORE THAN ONE, PROMPT TO THINK ABOUT JUST ONE.]

1. Have a store take it away when you bought a new one
2. Call someone to haul it away
3. Put it out in the trash
4. Give it away
5. Donate it to charity/church
6. Sell it
7. Recycle it
8. Or did you do something else with it [SPECIFY_____])
9. (Don't know)

D3a. [IF Q#D3 = 6 (Sell it) GO TO Q#D3c] Where you charged money to get rid of the freezer?

1. Yes
2. No
3. (Don't know)

D3b. [IF Q#D3a=1 (Yes)] About how much were you charged to have the freezer picked up? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 999 Don't know]

D3c. [IF Q#D3 = 4 (Gave it away), 6 (Sold it)] Which of the following best describes how you [INSERT GAVE AWAY, DONATED, OR SOLD] the freezer? [RANDOMIZE AND READ 1-5, THEN 6]

1. To a friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. At a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

D3d. One a scale from 0 to 10 where 0 is "very difficult" and 10 is "very easy," how easy was it to find a way to get rid of your freezer? [RECORD_____, 99 Don't know]

D3e. [IF Q#A1=1 (Aware of program) AND Q#D3≠7 (Recycle)] Why did you not have the freezer removed and recycled through the program sponsored by [INSERT UTILITY NAME]? [DON'T READ, MULTIPLE RESPONSE]

1. (Didn't know about it at the time)
2. (Didn't know they took freezers)
3. (Told I wasn't eligible)
4. (Program didn't pay enough money)
5. (Couldn't schedule a convenient pick up time)
6. (Other SPECIFY_____)
7. (Don't know)

D4. [IF Q#D1c=1 (Yes), OTHERWISE, GO TO Q#D5] How did you get rid of the room air conditioner? Did you [RANDOMIZE AND READ 1-7, THEN 8 IF RESPONDENT SAYS THEY GOT RID OF MORE THAN ONE, PROMPT TO THINK ABOUT JUST ONE.]

1. Have a store take it away when you bought a new one
2. Call someone to haul it away
3. Put it out in the trash
4. Give it away
5. Donate it to charity/church
6. Sell it
7. Recycle it
8. Or did you do something else with it [SPECIFY_____])
9. (Don't know)

D4a. [IF Q#D4 = 6 (Sell it) GO TO Q#D4c] Where you charged money to get rid of the room air conditioner?

1. Yes
2. No
3. (Don't know)

D4b. [IF Q#D4a=1 (Yes)] About how much were you charged to have the room air conditioner picked up? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 999 Don't know]

D4c. IF Q#D4 = 4 (Gave it away), 6 (Sold it] Which of the following best describes how you [INSERT GAVE AWAY, DONATED, OR SOLD] the room air conditioner? [RANDOMIZE AND READ 1-5, THEN 6]

1. To a friend or family member
2. To someone who answered a newspaper ad
3. To someone who answered an ad you posted on the Internet
4. At a garage/yard sale
5. To a used appliance dealer or appliance repair person
6. Some other way [SPECIFY_____]
7. (Don't know)

D4d. One a scale from 0 to 10 where 0 is "very difficult" and 10 is "very easy," how easy was it to find a way to get rid of your room air conditioner? [MULTIPLE RESPONSE]

D4e. [IF Q#A1=1 (Aware of program) AND Q#D4≠7 (Recycle)] Why did you not recycle the room air conditioner through the program sponsored by [INSERT UTILITY NAME]? [DON'T READ, MULTIPLE RESPONSE]

1. (Didn't know about it at the time)
2. (Didn't know they took room air conditioners)
3. (Told I wasn't eligible)
4. (Program didn't pay enough money)
5. (Couldn't schedule a convenient pick up time)
6. (Turn-in events were not at convenient times)
7. (Turn-in events were not at convenient locations)
8. (You had to recycle a refrigerator or freezer to have an air conditioner picked up)
9. (Other SPECIFY_____)
10. (Don't know)

D5. How many refrigerators do you have in the home? Include both those that are working and not working [RECORD NUMBER _____, 99 Don't know] [IF Q#D5 = 0 OR 99, GO TO Q#D6].

[PROGRAMMER, MAKE SURE THAT SUM OF Q#D5a AND Q#D5d = Q#D5. OTHERWISE, ASK RESPONDENT TO ACCOUNT FOR ALL REFRIGERATORS. SUM OF Q#D5b AND Q#D5c = Q#D5a. DO NOT INCLUDE DON'T KNOW RESPONSES (99) IN THESE CALCULATIONS]

D5a. [IF Q#D5 = 1 READ] "Is this refrigerator in working condition?"
[IF Q#D5 > 1 READ] "How many of these refrigerators are in working condition?"
[RECORD NUMBER _____, 99 Don't know; IF Q#D5a = 0 OR 99, GO TO Q#D5d]

D5b. [IF Q#D5a = 1] "Is this working refrigerator plugged in or turned on all or nearly all the time?"
[IF Q#D5a > 1] "How many of the working refrigerators are plugged in or turned on all or nearly all the time?"
[RECORD NUMBER _____, 99 Don't know]

[IF Q#D5a – Q#D5b = 0, GO TO Q#D5d]

D5c. [ASK IF Q#D5a – Q#D5b > 0]
[IF Q#D5a = 1] "Is this working refrigerator used occasionally?"
[IF Q#D5a > 1] "How many of the working refrigerators are used occasionally?"
[RECORD NUMBER _____, 99 Don't know]

D5d. [IF Q#D5 – Q#D5a = 0 GO TO Q#D6; CONTINUE IF Q#D5 – Q#D5a > 0]
[IF Q#D5 = 1] "Does the refrigerator not work at all?"
[IF Q#D5 > 1] "How many of these refrigerators do not work at all."
[RECORD NUMBER _____, 99 Don't know]

D6. How many freezers do you have in the home? Include both those that are working and not working [RECORD NUMBER _____, 99 Don't know] [IF Q#D6 = 0 OR 99, GO TO Q#D7].

[PROGRAMMER, MAKE SURE THAT SUM OF Q#D6a AND Q#D6d = Q#D6. OTHERWISE, ASK RESPONDENT TO ACCOUNT FOR ALL FREEZERS. SUM OF Q#D6b AND Q#D6c = Q#D6a. DO NOT INCLUDE DON'T KNOW RESPONSES (99) IN THESE CALCULATIONS]

D6a. [IF Q#D6 = 1 READ] "Is this freezer in working condition?"
[IF Q#D6 > 1 READ] "How many of these freezers are in working condition?"
[RECORD NUMBER _____, 99 Don't know; IF Q#D6a = 0 OR 99, GO TO Q#D6d]

D6b. [IF Q#D6a = 1] "Is this working freezer plugged in or turned on all or nearly all the time?"
[IF Q#D6a > 1] "How many of the working freezers are plugged in or turned on all or nearly all the time?"
[RECORD NUMBER _____, 99 Don't know]

[IF Q#D6a – Q#D6b = 0, GO TO Q#D6d]

D6c. [ASK IF Q#D6a – Q#D6b > 0]
[IF Q#D6a = 1] "Is this working freezer used occasionally?"
[IF Q#D6a > 1] "How many of the working freezers are used occasionally?"
[RECORD NUMBER _____, 99 Don't know]

D6d. [IF Q#D6 – Q#D6a = 0 GO TO Q#D7; CONTINUE IF Q#D6 – Q#D6a > 0]
[IF Q#D6 = 1] "Does the freezer not work at all?"
[IF Q#D6 > 1] "How many of these freezers do not work at all."
[RECORD NUMBER _____, 99 Don't know]

D7. How many room air conditioners do you have in the home? Include both those that are working and not working [RECORD NUMBER _____, 99 Don't know] [IF Q#D7 = 0 OR 99, GO TO Q#D8].

[PROGRAMMER, MAKE SURE THAT SUM OF Q#D7a AND Q#D7d = Q#D7. OTHERWISE, ASK RESPONDENT TO ACCOUNT FOR ALL ROOM AIR CONDITIONERS. SUM OF Q#D7b AND Q#D7c = Q#D7a. DO NOT INCLUDE DON'T KNOW RESPONSES (99) IN THESE CALCULATIONS]

D7a. [IF Q#D7 = 1 READ] "Is this room air conditioner in working condition?"
[IF Q#D7 > 1 READ] "How many of these room air conditioners are in working condition?"
[RECORD NUMBER _____, 99 Don't know; IF Q#D7a = 0 OR 99, GO TO Q#D7d]

D7b. [IF Q#D7a = 1] "Is this working room air conditioner plugged in or turned on all or nearly all the time?"
[IF Q#D7a > 1] "How many of the working room air conditioners are plugged in or turned on all or nearly all the time?"
[RECORD NUMBER _____, 99 Don't know]

[IF Q#D7a – Q#D7b = 0, GO TO Q#D7d]

D7c. [ASK IF Q#D7a – Q#D7b > 0]
[IF Q#D7a = 1] "Is this working room air conditioner used occasionally?"
[IF Q#D7a > 1] "How many of the working room air conditioners are used occasionally?" [RECORD NUMBER _____, 99 Don't know]

D7d. [IF Q#D7 – Q#D7a = 0 GO TO Q#D8; CONTINUE IF Q#D7 – Q#D7a > 0]
[IF Q#D7 = 1] "Does the room air conditioner not work at all?"
[IF Q#D7 > 1] "How many of these room air conditioners do not work at all."
[RECORD NUMBER _____, 99 Don't know]

D8. [IF Q#D5 > 1] If you knew that [INSERT UTILITY NAME] would pay you $50 to remove and recycle each older refrigerator you have in your home, would you be willing to give it up?
1. Yes [GO TO Q#D9]
2. No
3. (Don't know) [GO TO Q#D8b]

D8a. [IF Q#D8=2 (No)] Why would you not give up the older refrigerator? [DON'T READ, MULTIPLE RESPONSE]
1. (We need it/we use it)
2. (Not enough money)
3. (Plan on using it in the future)
4. (Plan on giving it away)
5. (Plan on selling it)
6. (Other [SPECIFY_____])
7. (Don't know)

D8b. Approximately how much money would [INSERT UTILITY NAME] have to pay you to give up an older refrigerator? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 998 No amount/would not give it up, 999 Don't know]

D8c. [IF Q#D8a=5 (Plan on selling it)] How much money do you expect to receive for selling your older working refrigerator? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 999 Don't know]

D9. [IF Q#D6 > 0] If you knew that [INSERT UTILITY NAME] would pay you $50 to remove and recycle each older freezer you have in your home, would you be willing to give it up?
1. Yes [GO TO Q#D10]
2. No
3. (Don't know) [GO TO Q#D9b]

D9a. [IF Q#D9 = 2 (No)] Why would you not give up the freezer? [DON'T READ, MULTIPLE RESPONSE]
1. (We need it/we use it)
2. (Not enough money)
3. (Plan on using it in the future)
4. (Plan on giving it away)
5. (Plan on selling it)
6. (Other [SPECIFY_____])
7. (Don't know)

D9b. Approximately how much money would [INSERT UTILITY NAME] have to pay you to give up your freezer? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 998, No amount/would not give it up, 999 Don't know]

D9c. [IF Q#D9a = 5 (Plan on selling it)] How much money do you expect to receive for selling your freezer? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 999 Don't know]

D10. [IF Q#D7 > 0] If you knew that [INSERT UTILITY NAME] would pay you $25 to remove and recycle each older room air conditioner in your home, would you be willing to give it up?
1. Yes [GO TO Q#P1]
2. No
3. (Don't know) [GO TO Q#10b]

D10a. [IF Q#D10 = 2 (No)] Why would you not give up the room air conditioner? [DON'T READ, MULTIPLE RESPONSE]
1. (We need it/we use it)
2. (Not enough money)
3. (Plan on using it in the future)
4. (Plan on giving it away)
5. (Plan on selling it)
6. (Other [SPECIFY_____])
7. (Don't know)

D10b. If [INSERT UTILITY NAME] was also willing to pay you $10 towards the purchase of a new, energy efficient room air conditioner, for a total rebate of $35, would you be willing to give up your room air conditioner?

1. Yes [IF D10a = 5 (Plan on selling it) GO TO Q#D10d; OTHERWISE, GO TO Q#P1]
2. No
3. (Don't know)

D10c. Approximately how much money would [INSERT UTILITY NAME] have to pay you to give up your room air conditioner? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 998 No amount/Would not give it up, 999 Don't know]

D10d. [IF Q#D10a = 5 (Plan on selling it)] How much money do you expect to receive for selling your room air conditioner? _____ [RECORD A SINGLE DOLLAR AMOUNT, NOT A RANGE; IF RESPONDENT GIVES RANGE, RECORD AVERAGE, 999 Don't know]

SECTION 4: AGE, PURCHASED NEW/USED

Now I'm going to ask you a few questions about where you got some of the appliances currently in your home.

P1. [IF Q#D5 > 1] Please think about [INSERT "YOUR" IF Q#D5 = 2 OR "ONE OF YOUR" IF Q#D5 > 2] extra refrigerator(s). Approximately how old is this refrigerator? [RECORD AGE____, 99 Don't know].

P2. How did you come to own this refrigerator? Did [READ]
1. You buy it
2. Someone give it to you [GO TO Q#P4]
3. It come with your house or apartment [GO TO Q#P5]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#P5]
5. (Don't know/don't remember) [GO TO Q#P5]

P3. [IF Q#P2=1 (Bought it)] Did you buy it [RANDOMIZE AND READ 1-4, THEN 5]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Or somewhere else? [SPECIFY_____])
6. (Don't know/don't remember)

P4. [IF Q#P2 = 2 (Given)] When the refrigerator was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

P5. [IF Q#D6 > 0] Please think about [INSERT "YOUR" IF Q#D6 = 1 OR "ONE OF YOUR" IF Q#D6 > 1] freezer(s). Approximately how old is this freezer? [RECORD AGE_____, 99 Don't know].

P6. How did you come to own this freezer ? Did [READ]
1. You buy it
2. Someone give it to you [GO TO Q# P8]
3. It come with your house or apartment [GO TO Q#P9]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#P9]
5. (Don't know/don't remember) [GO TO Q#P9]

P7. [IF Q#P6=1 (Bought it)] Did you buy it [RANDOMIZE AND READ 1-4, THEN 5]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Other [SPECIFY_____])
6. (Don't know/don't remember)

P8. [IF Q#P6 = 2 (Given)] When the freezer was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

P9. [IF Q#D7 > 0] Please think about [INSERT "YOUR" IF Q#D7 =1 OR "ONE OF YOUR" IF Q#D7 > 1] room air conditioner(s). Approximately how old is this room air conditioner? [RECORD AGE_____, 99 Don't know].

P10. How did you come to own this room air conditioner? Did [READ]
1. You buy it
2. Someone give it to you [GO TO Q#P12]
3. It come with your house or apartment [GO TO Q#P13]
4. Or did you get it another way? [SPECIFY_____]) [GO TO Q#P13]
5. (Don't know/don't remember) [GO TO Q#P13]

P11. [IF Q#P10=1 (Bought it)] Did you buy it [RANDOMIZE AND READ 1-4, THEN 5]
1. New from a store
2. Used from a store
3. Used from a friend or family member
4. Used from a garage or yard sale
5. Other [SPECIFY_____])
6. (Don't know/don't remember)

P12. [IF Q#P10 = 2 (Given)] When the room air conditioner was given to you, was it new or used?
1. New
2. Used
3. (Don't know/don't remember)

P13. Have you ever seen or heard of the ENERGY STAR label?
1. Yes [GO TO Q#W1]
2. No
3. (Don't know)

P14. The ENERGY STAR label has the word "energy" followed by a star under a half-circle. Some labels also show the continents and the oceans of the earth in the half circle. ENERGY STAR labels are used by the Environmental Protection Agency—the EPA—and the Department of Energy to identify and label highly energy-efficient appliances for consumers. Had you seen or heard of a label such as this before now?
1. Yes
2. No
3. (Don't know)

SECTION 5: WRAP UP, DEMOGRAPHIC QUESTIONS

Finally, I'd just like to ask you a few questions for reporting purposes. I remind you that your responses will be kept confidential and will be in no way tied to you.

W1. What type of building is your home? [READ RESPONSES] ?
1. Detached single-family home
2. Townhouse or duplex, with a wall separating the units from basement to roof, and with separate utilities for each unit
3. Two, three, or four family building—with no basement walls separating the units, or with one water and sewer bill for the whole building
4. Part of a building with 5 or more units
5. Other [SPECIFY: _____]
6. (Don't know/refused)

W2. Do you own or rent your home?
1. Own
2. Rent
3. (Refused)

W3. Approximately how many square feet is your home?
1. Less than 1,500
2. 1,500 – 1,999
3. 2,000 – 2,999
4. 3,000 – 3,999
5. 4,000 – 4,999
6. 5,000 – 5,999
7. 6,000 or more
8. (Don't know/Refused) [ASK Q#D3]

W4. [IF Q#W3=8] How many rooms are in your home, not counting bathrooms?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10 or more
11. (Don't know/refused)

W5. What is the highest level of education that you have completed? [READ CATEGORIES]
1. Less than high school
2. High school graduate
3. Technical or trade school graduate
4. Some college
5. College graduate
6. Some graduate school
7. Graduate degree
8. (Refused)

W6. How many people live in your home now?
1. 1
2. 2
3. 3
4. 4
5. 5
6. 6 or more
7. (Refused)

W7. What is your age?
1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 or over
7. (Refused)

W8. What category best describes your total household income in 2004, before taxes?
1. Less than $35,000
2. $35,000 to $49,999
3. $50,000 to $74,999
4. $75,000 to $99,999
5. $100,000 or more
6. (Refused)

W9. [RECORD SEX]
1. Male
2. Female

[IF RESPONDENT EXPRESSES INTEREST, READ:
"Certain appliances are eligible for the Appliance Retirement Program. For more information please call 1-800-664-2722."

Appendix F
Survey-Based Energy Savings Estimates and Untapped Potential of the ARP

Nexus Market Research, Inc.

MEMORANDUM

Date: November 29, 2005

To: Northeast Utilities – Connecticut Light and Power, The United Illuminating Company

From: Nexus Market Research, Inc.

Re: Survey-Based Energy Savings Estimates and Untapped Potential of the ARP

As described in the Final Work Plan for the Impact, Process, and Market Study of the Connecticut Appliance Retirement Program (ARP), Nexus Market Research, Inc. (NMR) and RLW Analytics, Inc. (RLW) outlined two different methods that we would use to estimate energy savings attributable to the program. RLW has completed one of the two methods, the billing analysis (delivered on October 31, 2005). In this memorandum, NMR describes findings based on the second method, which relies on the results of the telephone surveys of participants and also draws on information from secondary sources, including studies by Blasnik (2004) and KEMA- Xenergy (2004).[1] In this memorandum, we also compare the results of the two different estimation methods and revise the current gross and net savings estimates used by the sponsors as well as their current assumed realization rates. Finally, this memorandum also includes a discussion of the untapped potential of the program. NMR will provide estimates of demand savings and cost-effectiveness in the overall final report of our evaluation of the ARP.

[1] Blasnik, Michael "Measurement and Verification of Residential Refrigerator Energy Use: Final Report 2003-2004 Metering Study." Submitted to NSTAR Electric, National Grid, and Northeast Utilities on July 29, 2004. KEMA-Xenergy (2004) "Final Report: Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program." Submitted to Southern California Edison on February 13, 2004.

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1 Summary of Major Findings

The survey-based approach for estimating energy savings resulting from the ARP suggests that approximately 3,891 MWh annual energy savings resulted from program activity in 2004. (Table 1.1) Based on the sponsors' assumed measure life for each appliance, lifetime savings were estimated to be 19,842 MWh, or 55% of the savings from the sponsors' current deemed savings. Taking the information from the billing analysis into account, NMR recommends net savings of 413 kWh per refrigerator (RF), 450 kWh per freezer (FZ), and 40 kWh for each room air conditioner (RAC) that is not replaced, and 14 kWh for each RAC that is replaced with an ENERGY STAR-qualified model. These net saving assumptions would result in annual energy savings of 4,503 MWh and lifetime savings of 22,918 MWh, or 63% of the sponsors current deemed savings.

Table 1.1: Overall Program Savings Estimates, 2004 Retirements

	NMR- Survey Based	NMR - Recommended	Current Assumption
Refrigerator (MWh)	2,520	3,084	5,518
Freezer (MWh)	1,255	1,303	1,303
Room Air Conditioner (MWh)	116	116	284
Annual Overall (MWh)	3,891	4,503	7,105
Lifetime Overall (MWh)[a]	19,842	22,918	36,402
% of Currently Assumed	55%	63%	100%

[a] Lifetime based on sponsors current assumptions measure life: five years for RF, five years for FZ, three years for non-replaced RAC, 13 years for RAC replaced with ENERGY STAR-qualified model.

In order to estimate untapped potential, NMR asked participants and non-participants how many eligible appliances they currently had in their homes. Extrapolating to all residential customers of CL&P and UI, we estimate that there are approximately 182,300 eligible RF, 309,000 eligible FZ, and 180,000 eligible RAC currently in homes in Connecticut. A disproportionate number and percentage of appliances are located outside of SWCT. This suggests both that the program has succeeded in reducing the number of energy hogs currently in customers' homes in SWCT and that increased marketing outside of SWCT may produce more surrenders than continuing to focus marketing solely on SWCT.

Table 1.2: Population-Weighted Estimates of Number of Eligible Appliances

	Total	SWCT	Other
N	1,347,185	664,800	682,385
>1 RF	182,289	73,010	109,279
FZ	309,067	103,415	205,651
RAC	180,044	72,187	107,858

About one-half of the non-participants would be willing to retire their eligible appliances at current incentive levels. Those not willing to give up their appliances at current incentive levels are simply unwilling to give the products up, primarily because they need the unit now or plan on using it in the future.

2 Data Sources

We relied on four different sources to develop the survey-based estimates of energy savings and the untapped potential of the program. First, we turned to telephone surveys of both participants and non-participants. The participant survey contained questions to help estimate energy savings. These questions included the following:[2]

- Working condition of the product prior to surrender
- Use of RF and FZ the year prior to participation
- Likely use of RAC in the summer of 2004
- Likely disposition if program had not been available
- Frequency of use, including for RAC the temperature and times of the day at which products were used
- Rates of product replacement
- Replacement of RAC with the purchase incentive for ENERGY STAR-qualified models

Questions used to estimate untapped potential focused on counting the number of qualifying appliances currently in customer homes and non-participants' willingness to retire appliances based on 2005 incentive levels.

The remaining three sources were all used in the development of alternative assumptions regarding gross energy savings for the three major appliances of interest. The second source, Blasnik's (2004) metering study of RF eligible for replacement through the Massachusetts and Rhode Island home energy assessment programs, provided the value of our assumed gross savings attributable to the retirement of RF. Information from Blasnik's study was combined with data from the third source, KEMA-Xenergy's (2004) metering study of RF and FZ surrendered through an appliance retirement program sponsored by the California investor-owned utilities (IOUs), to develop the gross energy savings assumptions for FZ. Finally, we used hourly temperature data for the months of May through September of 2004 as reported by the National Oceanic and Atmospheric Administration (NOAA) to estimate the average hours customers used RAC in the summer of 2004.[3]

3 Energy-Savings Assumptions

As mentioned above, NMR developed alternative assumptions regarding gross energy savings. In this section, we outline our reasons for using different assumptions than those currently employed by the sponsors. We also discuss our choice and/or development of the new estimates of gross energy savings. Finally, we describe other assumptions that factored into our estimates of net energy savings attributable to the ARP.

3.1 Gross Energy Savings Assumptions

NMR elected not to use the ARP sponsors' current assumption of RF gross energy savings (1,232 kWh) because the savings are based on energy usage of units retired through a low-

[2] The Survey Results Report submitted on October 31, 2004 includes a more detailed discussion of these results.
[3] NOAA (2005) "Unedited Local Climatological Data – Hourly Observations." Available at http://cdo.ncdc.noaa.gov/ulcd/ULCD. Accessed November 7, 2005.

income program. We believe that units retired through a low-income program would, on average, use less energy than those retired through the ARP because the former are probably smaller and more likely to rely on manual defrost. We drew our alternative estimate of gross energy savings from Blasnik (2004).[4] We reasoned that ARP participants probably surrendered units similar to those eligible for retirement by participants of the home energy assessment programs from which Blasnik drew his sample of metered RF. Blasnik found that these RF used, on average, 1,383 kWh of electricity annually. Furthermore, Blasnik's estimate is very similar to the engineering estimate of 1,370 kWh found by Applied Energy Group (1993) in their evaluation of a previous ARP in Connecticut.

The Connecticut sponsors' current estimate of gross FZ usage (750 kWh) is based on the results of an evaluation of a previous ARP in Connecticut. However, this estimate is far below that reported in the 1993 evaluation (1,062 kWh).[5] Furthermore, we have found that the current assumption of gross energy usage is actually similar to the average energy usage of certain non-ENERGY STAR-qualifying units currently available on the market.[6] For these reasons, we believed it was necessary to develop an alternative estimate of gross energy savings for FZ. To do so, we turned to a study completed by KEMA-Xenergy (2004) for the California IOUs.[7] This is the only other metering study of FZ of which we are aware. Yet, based on the results of the Blasnik study and on Applied Energy Group's evaluation of the earlier Connecticut ARP, we believe KEMA-Xenergy over-estimated both RF and FZ usage. Rather than use their high estimate of FZ savings, we instead computed the ratio of their estimated energy usage of RF and FZ and then applied that ratio to the RF estimate developed by Blasnik.[8] (Table 3.1) Our estimate of FZ gross energy savings, then, is 1,181 kWh per year.

Table 3.1: Estimating Freezer Gross Energy Savings

Appliance and Source	Estimated Annual Energy Use, in kWh
FZ – KEMA-Xenergy	1,662
RF – KEMA-Xenergy	1,946
Ratio of KEMA-Xenergy FZ to RF	0.854
RF – Blasnik	1,383
Gross Savings for FZ (NMR)	**1,181**

Finally, we identified a number of potential difficulties with the sponsors' current assumptions about RAC energy savings. The difficulties resulted in four different adjustments. First, we recognized the need to adjust the estimated 500 hours of annual use by the usage patterns reported by participants in the telephone surveys. In particular, although it is typically hottest during the day, most participants reported using the RAC more frequently at night. This self-reported time of use was validated by the tendency to locate RAC in bedrooms over all other

[4] Blasnik 2004.
[5] Applied Energy Group, Inc. (1993) "Impact Evaluation of Northeast Utilities' Appliance Pickup Program." Prepared for Northeast Utilities.
[6] D&R International (2005) "Life Cycle Cost Estimates for One ENERGY STAR-Qualified Residential Freezer." Available at http://www.energystar.gov/index.cfm?c=refrig.pr_refrigerators. Accessed on November 12, 2005.
[7] KEMA-Xenergy (2004).
[8] We used the ratio from the KEMA-Xenergy study because it was conducted more recently than the study by Applied Energy Group.

rooms. Therefore, we collected hourly temperature data for the months of May through September for Hartford (to represent CL&P) and Bridgeport (to represent UI).[9] It so happens that the average temperatures in the summer of 2004 were virtually equal to the so-called "thirty-year normal" used by NOAA. Using these data and assuming that customers used RAC when it was 80 degrees or higher, we estimated that there were 484 population-adjusted cooling hours in the summer of 2004—very close to the estimated 500 used by the sponsors.[10] However, after adjusting for the self-reported times of the week and day that customers used RAC, the average customer actually operated RAC for only 210 hours over the summer of 2004.[11] Clearly, our revised estimate of the hours of use will reduce the realized energy savings.

Our second and third adjustments, however, recouped all of the gross savings lost to the hours of use and even increased the gross savings over the sponsors' current assumptions. When developing their estimates of gross energy savings for RAC, the sponsors assumed that every RAC surrendered through the program would have been replaced, either with an ENERGY STAR-qualified RAC or a non-qualified model. In fact, respondents reported replacing only 75% of RAC retired through the program. Therefore, we have developed two alternative estimates of gross energy savings. The first is based on a no-replacement scenario, while the second assumes replacement with an ENERGY STAR-qualified model. Furthermore, in the replacement with ENERGY STAR scenario, we use the assumed energy efficiency ratio (EER) of units retired in the equation for gross savings instead of the federal minimum EER for new units, as the sponsors assumed.

The last adjustment was to use the average BTUs of RAC as reported by ARCA in the turn-in database: 7,000 BTUs versus the 8,000 BTUs currently assumed by the sponsors. As reported in the process analysis, the 2004 pick-up database did not include reliable information for the size of RAC. It is possible that these units were somewhat larger than those taken to turn-in events. If this is found to be the case, then the BTU size may need to be revised upward, especially in light of the fact that turn-in events will no longer be held.

[9] NOAA (2005).

[10] The average temperature that participants reported turning on units was 84 degrees. We believed they may have overestimated the temperature slightly, so we rounded it down to 80 degrees. If the temperature was 80 degrees at anytime from 7:00 pm through 10:00 pm or if the temperature reached 80 degrees by 9:00 am the next day after having reached 80 in the late afternoon the preceding day, we assumed that customers would have used the units all night long.

[11] This estimate assumes the daytime runs from 8:00 am to 6:00 pm and the evening/night runs from 7:00 pm to 7 am the following day. Only one official temperature reading is taken per hour, usually at the same "minute past the hour" in each hour. For this reason, although the readings for both Hartford and Bridgeport are taken at approximately 50 minutes past the hour, they are included as the readings for that hour.

The final equations we have used to estimate gross energy savings attributable to RAC were:

(Hours of use ÷ 1,000) × BTU × ([1 ÷ EER old units] – [1 ÷ EER new units])

With the values filled in, the final equations were:

(210 ÷ 1,000) × 7,000 × (1 ÷ 7.7) for the "no replacement" scenario and

(210 ÷ 1,000) × 7,000 × ([1 ÷ 7.7]-[1 ÷ 10.7]) for the "ENERGY STAR replacement" scenario.

The resulting gross savings assumptions for all appliances are summarized in Table 3.2.

Table 3.2: Gross Energy Savings Assumptions, All Appliances

Appliance and Scenario	**Annual Gross Savings (kWh)**	
	NMR	Current ARP
Refrigerator	1,383	1,232
Freezer	1,181	750
Room Air Conditioner, no replacement	191	107
Room Air Conditioner, ENERGY STAR replacement	53	39

3.2 Assumptions Underlying Realization Rates

We developed realization rates based on information collected through the participant telephone survey. This step largely involved computing a realization rate for each unit retired by each participant and then finding the average realization rate across all units for each product.

For all three appliances, we assumed a realization rate of zero for the following participants; those who:[12]

- Retired a non-working unit
- Would have stored the unit unused
- Would have recycled the unit anyway
- Had not had RF or FZ plugged in the year prior to surrender
- Said they were extremely unlikely to use a RAC in the summer of 2004
- Had retired a primary RF
- Replaced a RF or FZ
- Replaced a RAC without using the purchase incentive for ENERGY STAR-qualified replacement RAC

The inclusion of the last two categories of participants among those with no realized energy savings requires further explanation. The ARP clearly does not want customers to replace secondary RF or the FZ surrendered through the program. Therefore, any replacement—even if the model was qualified for the ENERGY STAR—is not desirable. While it is likely that most replacement models are more efficient than those retired, we have no way of estimating the size, door configuration, defrost type, and other features that factor into the energy use of replacement models. Furthermore, as discussed in the Survey Report, we believe customers overstated the frequency with which they bought ENERGY STAR-qualified replacement RF and FZ as well as ENERGY STAR products overall. We have, therefore, taken the conservative approach and assumed that no energy savings resulted from the replacement of any RF and FZ.

In contrast, through the use of the purchase incentive, the program encouraged the replacement of RAC with ENERGY STAR-qualified models. Yet, if customers did not use the rebate to purchase their replacement—whether the unit was ENERGY STAR qualified or not—we cannot claim that the purchase was induced by the program. Therefore, only the energy savings resulting from the purchase of ENERGY STAR-qualified units using the rebate will be attributable to the program. All other RAC replacements are assumed to have zero energy savings for the same reasons as described above for RF and FZ.

We then made further adjustments to the realization rate for each unit retired per customer. If customers reported having their RF or FZ plugged in "occasionally," they were assumed to have a 33% realization rate; if the unit had been plugged in "most of the time," the rate was assumed to be 67%. Of course, those who had the product plugged in all the time—and are not excluded for other reasons—were deemed to have 100% realization rates. For RAC, we asked participants to rate the likelihood that they would have used the unit in the summer of 2004 had the product

[12] Note that this list includes all free riders, as described in the Survey Results Report (October 31, 2005).

not been retired through the ARP. Those who responded with a zero, extremely unlikely, were given a realization rate of zero, those with a one 10%, those with a two 20% and so forth. Those extremely likely to use the unit (ten on the zero-to-ten scale) were assumed to have 100% realization rates.

As discussed in the Survey Report and Process Analysis (delivered November 10, 2005), free ridership and replacement rates were both quite high. Free ridership for RF stood at approximately 16% while that for FZ and RAC was 21%; in addition, 46% of RF, 34% of FZ, and 75% of RAC were replaced. While replacement was expected for RAC, only an estimated 37% of those retiring RAC used the purchase incentive to buy an ENERGY STAR-qualified replacement unit. Given these less than desirable outcomes, it is not surprising that our assumptions led to rather low realization rates. (Table 3.3)

Table 3.3: Realization Rates, as Determined by Participant Telephone Survey

			Room Air Conditioner	
	Refrigerator	**Freezer**	No replacement	ENERGY STAR Replacement using Rebate
Realization Rate	24.4%	36.7%	20.7%	26.0%

3.3 Net Energy Savings

In order to develop the survey-based estimates of net energy savings, we multiplied our assumed gross energy savings by the realization rate as determined by the participant telephone survey. These results are compared with the average *per product* results of the billing analysis and the gross and net savings currently assumed by the ARP.[13] Based on these comparisons, and the relative strengths and weaknesses of the approaches, we also recommend the savings estimates we believe the sponsors should use to measure the net energy savings attributable to the ARP. The strengths of the survey-based approach include taking free ridership and product replacement into account, but its major weakness is that the estimates are not based on actual metered energy use. In contrast, the strength of the regression approach is its reliance on actual energy use, but it does not adjust for free ridership or other behavioral factors that limit savings attributable to the program. We believe that its reliance on actual energy usage increases the reliability of estimates developed from the regression-based approach. For this reason, the recommendations will favor this approach over the survey-based approach.

The net savings estimates developed through both the survey-based approach and the billing analysis fell far short of the net savings currently assumed for the ARP. (Table 3.4) In particular, the billing analysis suggested that only 59% (3,271 MWh) of the currently assumed net savings (5,518 MWh) had been realized in 2004, while the survey approach found the figure to be 46% (2,520 MWh). It appears that an over-estimated realization rate set the standard for net energy savings higher than the program could reasonably achieve. This conclusion is further supported by the evaluation of a prior ARP conducted by Applied Energy Group.[14] Based on gross savings estimates of 1,370 kWh per unit, the previous evaluation suggested a realization rate of only 41% and a net savings of 560 kWh per unit.

Table 3.4: Net Energy Savings Attributable to Refrigerator Retirement[a]

Row	Component	NMR – Survey Based	Billing Analysis	Current ARP	NMR – Final Recommendation
A	Gross Savings kWh per unit	1,383	na	1,232	1,383
B	Realization Rate	24.4%	na	60.0%	29.9%
C	Net Savings kWh per unit *(Row A ×Row B)*	337	438	739	413
D	Units Retired in 2004	7,467	7,467	7,467	7,467
E	2004 Total Savings, kWh *(Row C × Row E)*	2,519,754	3,270,546	5,518,113	3,083,871
F	% of Current ARP Assumed Savings	46%	59%	100%	56%

[a] Results subject to rounding error

[13] Although the final estimates of savings described in the billing analysis and those presented here both rely on the Weighted Least Squares approach (Table 8 and "Summary of the Analysis" in the Billing Analysis Memo), the estimates of program savings described in the billing analysis are slightly lower than those presented in Tables 2.4 and 2.5. This is largely due to rounding error, but also because the overall savings estimates reported in the billing analysis take into account the diminished returns from multiple surrenders that are discussed in that report. Here we have reported only the per-product savings described in Table 8 of the billing analysis and did not include any adjustments for multiple surrenders.

[14] Applied Energy Group (1993)

It is also the case that the billing analysis arrived at a higher per-unit net savings than did the survey-based approach: 438 kWh versus 337 kWh, respectively. The two methods may be producing different estimates because the billing analysis incorporates savings resulting from the use of more efficient replacements. In contrast, because such replacements are not desired, NMR assumed no energy savings for any RF replacements. Given the differences between the two estimates and the fact that each approach has its strengths and weaknesses, we suggest a final estimate of net savings that prioritizes the more precise nature of the billing analysis, but still recognizes its inability to distinguish savings due to undesirable replacements. We therefore recommend that the sponsors use a net savings rate of 413 kWh per unit, which is 25% less than the estimate developed from the billing analysis and 75% more than that from the survey approach. The estimated energy savings resulting from this recommendation would be 3,084 MWh for units picked up in 2004.

In contrast to RF, both the survey-based approach and the billing analysis produced net savings estimates for FZ that are very similar to those currently assumed by the program. (Table 3.5) Under current assumptions, the program estimates that 1,303 MWh are attributable to the retirement of FZ. The survey approach found the figure to be 1,255 MWh (96% of the currently assumed savings), and the billing analysis estimated savings of 1,375 MWh (106% of the currently assumed savings). Given that the billing analysis found a slightly higher estimate of net savings than current assumptions while the survey approach points to slightly lower net savings, we recommend that the sponsors continue to use their current estimate of net savings. However, we also recommend that they raise their assumed gross savings to 1,181 kWh per unit, which is equal to our estimate based on the Blasnik and KEMA-Xenergy studies. This would require a reduction of the realization rate to approximately 38%.

Table 3.5: Net Energy Savings Attributable to Freezer Retirement[a]

Row	Component	NMR – Survey Based	Billing Analysis	Current ARP	NMR – Final Recommendation
A	Gross Savings kWh per unit	1,181	na	750	1,181
B	Realization Rate	36.7%	na	60.0%	38.1%
C	Net Savings kWh per unit *(Row A ×Row B)*	433	475	450	450
D	Units Retired in 2004	2,895	2,895	2,895	2,895
E	2004 Total Savings, kWh *(Row C × Row E)*	1,254,771	1,375,125	1,302,750	1,302,750
F	% of Current ARP Assumed Savings	96%	106%	100%	100%

[a] Results subject to rounding error

The sponsors have always assumed that the savings attributable to the retirement of RAC would be small. This assumption partly explains their decision not to include RAC in the billing analysis. The lack of a billing analysis for RAC, however, means that current assumptions regarding RAC energy savings will only be compared to the estimates developed from the participant survey. As discussed earlier, our realization rates fell far short of the 60% and 100% for the replacement with non-qualifying and ENERGY STAR-qualifying RAC, respectively, currently assumed by the sponsors. The implication of the lower realization rate is that NMR estimates a total of 116 MWh savings attributable to the program, or 41% of the sponsors' assumed savings of 284 MWh. (Table 3.6)

Table 3.6: Net Energy Savings Attributable to Room Air Conditioner Retirement[a]

Row	Component	NMR – Survey Based		Current ARP	
		No replacement	ENERGY STAR Replacement using Rebate	Replaced with Non-ES	Replaced with ENERGY STAR
A	Gross Savings kWh per unit	191	53	107	39
B	Realization Rate	20.7%	26.0%	60.0%	100%
C	Net Savings kWh per unit *(Row A ×Row B)*	40	14	64	39
D	Units Retired in 2004	1,368[b]	4,507[c]	2,167[d]	3,708[e]
E	2004 Savings by scenario, kWh *(Row C × Row E)*	54,087	62,106	139,121	144,612
F	2004 Overall Savings, Both Replacement Scenarios	116,193		283,733	
G	% of Current ARP Assumed Savings	41%		100%	

[a] Results subject to rounding error
[b] No RAC replaced
[c] All RAC replaced, but savings are attributed only to those using the purchase incentive
[d] Number of units not replaced with ENERGY STAR-qualified model
[e] Number of units replaced with ENERGY STAR-qualified model, regardless of use of incentive

In light of our information regarding replacement patterns, NMR recommends using our survey-based estimates of gross and net savings to determine the overall energy savings resulting from the ARP in 2004 and 2005. The only potential adjustments would be to account for any changes in the hours of use based on the temperatures observed in 2005 over 2004 as well as any changes in the average BTUs of retired units based on improved reporting in the ARCA pick-up database. However, given the fact that the turn-in events have now been discontinued, unless the sponsors distribute purchase incentives or other inducements to pick-up participants to purchase ENERGY STAR-qualified RAC, we do not believe that the ARP will be able to take credit for any additional savings realized through such purchases. Instead, the appliance program should be given credit for these savings.

The estimated and recommended overall program savings for 2004 across appliances are presented in Table 3.7 We have not included the results of the billing analysis, as that approach did not estimate savings attributable to the surrender of RAC.[15] The survey-based approach estimates a total annual savings of 3,891 MWh or 55% of the 7,105 MWh currently assumed by the program. If the sponsors utilize our recommended savings assumptions, the annual overall savings attributable to the 2004 program would increase to 4,503 MWh, or 65% of currently assumed savings. Expanding the energy savings estimates to the assumed measure life of each product retired and/or replaced yields a survey-based estimate of 19,842 lifetime MWh saved due to retirements in 2004 compared to 36,402 lifetime MWh based on current deemed savings. If adopted, the recommended net energy savings would yield a lifetime savings of 22,918 MWh.

Table 3.7: Overall Program Savings Estimates, 2004

	NMR- Survey Based	NMR - Recommended	Current Assumption
Refrigerator (MWh)	2,520	3,084	5,518
Freezer (MWh)	1,255	1,303	1,303
Room Air Conditioner (MWh)	116	116	284
Annual Overall (MWh)	3,891	4,504	7,105
Lifetime Overall (MWh)[a]	19,842	22,918	36,402
% of Currently Assumed	55%	63%	100%

[a] Lifetime based on sponsors current assumptions measure life: five years for RF, five years for FZ, three years for non-replaced RAC, 13 years for RAC replaced with ENERGY STAR-qualified model.

Table 3.8 summarizes the saving estimates for each individual sponsor. CL&P customers retired about 61% of the products surrendered to the program and were responsible for 63% of the annual and lifetime savings. Despite the smaller service area, UI customers exceeded CL&P customers in achieved savings attributable to the RAC that were not replaced.

Table 3.8: Number of Products Retired and Estimated Savings, in MWh

		RF	FZ	RAC		Total Savings
				No replacement	Replacement	
	Net Savings, kWh	413	450	40	14	na
CL&P	N Products	4,729	1,835	541	2,847	9,952
	Annual Savings	1,953	826	22	40	2,840
	Lifetime Savings[a]	9,765	4,129	65	518	14,477
UI	N Products	2,738	1,060	827	1,660	6,285
	Annual Savings	1,131	4,77	33	23	1,664
	Lifetime Savings[a]	5,654	2,385	99	302	8,440
Overall	N Products	7,467	2,895	1,368	4,507	16,237
	Annual Savings	3,084	1,303	54	62	4,504
	Lifetime Savings[a]	15,419	6,514	164	820	22,918

[a] Lifetime based on sponsors' current assumptions measure life: five years for RF, five years for FZ, three years for non-replaced RAC, and 13 years for RAC replaced with ENERGY STAR-qualified model.

[15] Such surrenders for pick-up participants would be embedded within the RF and FZ results from the billing-analysis. However, most participant surrendered RAC through turn-in events and were not also participants in the pick-up mode of delivery.

4. Untapped Potential of the ARP

The telephone surveys of both participants and non-participants included questions to estimate untapped program potential. The questions focused on the number of RAC, FZ, and secondary RF currently in customers' homes (both participants and non-participants) as well as the eligibility of the appliances as determined by their age (i.e., at least ten years old) and their current use in homes. It is worth emphasizing the importance of the age requirement. For example, while 35% of participants and 37% of non-participants have more than one RF in the home, only 18% of participants and 13% of non-participants have units at least ten years old.[16] In addition, it is our understanding that past program participants can surrender additional appliances, but the additional surrenders must be in future program years. As all of the participants we surveyed surrendered appliances in 2004, they would now be eligible to participant again.

We next weighted the data from the two individual surveys back to the number of residential customers of CL&P and UI in Connecticut overall. (Table 4.1) The data estimate that customers own approximately 182,300 eligible RF, 309,100 eligible FZ, and 180,000 eligible RAC. The greater number of eligible FZ is due to their higher concentration in the homes of non-participants. This also suggests that customers are more likely to keep an aging FZ running in their homes than they are RF or RAC. A disproportionate number and percentage of appliances are located outside of SWCT. This suggests both that the program has succeeded in reducing the number of energy hogs currently in customers' homes in SWCT and that increased marketing outside of SWCT may produce more surrenders than continuing to focus marketing solely on SWCT.

Table 4.1: Population-Weighted Estimates of Number of Eligible Appliances

	Total	SWCT	Non-Participants
N	1,347,185	664,800	682,385
>1 RF	182,289	73,010	109,279
FZ	309,067	103,415	205,651
RAC	180,044	72,187	107,858

[16] As we will see in reference to the data in Table 4.1, the ARP appears to have been successful in lowering the percentage of older secondary RF in customers' homes. However, the fact that the percentage of participant and non-participant homes with secondary RF is virtually similar only validates the finding that many of the RF retired through the ARP are being replaced, albeit with younger units.

Of course, customers must also be willing to give up the appliances if they are to be considered as untapped program potential. Therefore, we asked non-participants if they would be willing to retire their appliances at current program incentive levels of $50 for RF and FZ and $25 for RAC. Those unwilling to give up RAC at $25 were further questioned about their willingness to give up the appliance with a total rebate of $35 for an ENERGY STAR-qualified model. A nearly consistent 55% of non-participants with eligible RF, 56% with eligible FZ, and 54% with eligible RAC reported that they would be willing to retire their appliance at current levels. (Table 4.2) A total of 61% of those with eligible RAC would give the unit up for the $35 purchase rebate. We also examined the results by prior awareness of the ARP, with awareness being verified by customers voluntarily naming at least one of the four appliances (RF, FZ, RAC, or dehumidifiers) included in the 2004 program. There were no statistically significant differences between awareness and willingness to give up appliances at current incentive levels. This may suggest that some non-participants who were aware of the program had not previously known the amount of incentive offered; alternatively, they may simply have not gotten around to participating yet.

Table 4.2: Percentage of Non-Participants who would Retire Eligible Appliances at Current Incentive Levels

(base = Respondents owning eligible units)

	Refrigerator		Freezer		Room AC $25		Room AC $35	
	n	%	n	%	n	%	n	%
Total	67	55%	82	56%	34	53%	34	61%
Aware of ARP[a]	17	60%	20	70%	9	40%	9	60%
Not Aware	50	54%	62	53%	25	58%	25	62%

[a] Definition of awareness used here necessitates correctly naming at least one of the appliances included in the ARP.

Most of those not willing to retire appliances at current incentive levels report they are still using their appliances or plan on using them in the future. (Table 4.3) Only a few people report that the incentive level was not high enough. We asked all respondents unwilling to give up appliances at current incentive levels how much the program would have to pay them to retire the unit; respondents typically stated that they did not know or they named an amount perceived as the cost of buying a new unit. Therefore, it appears that the program has potential to reach about half of the remaining appliances in customer homes. However, as discussed in the process analysis, current marketing has led to diminished returns, suggesting that the expenditure of resources needed to capture these appliances may not be cost-effective.

Table 4.3: Reasons why Non-Participants would not Retire Appliances at Current Incentive Levels

(number of responses shown due to small sample size, multiple response)

	Refrigerator	Freezer	Room AC
n	25	28	9
Currently need/use it	12	22	7
Plan on using it in future	6	4	0
Not enough money	5	3	2
Plan on giving it away	1	0	0
Other	2	1	0