



Final Report

THE
CADMUS
GROUP, INC.

Pacific Power 2009–2010 California Residential Home Energy Savings Evaluation

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Glossary of Terms

Analysis of Covariance (ANCOVA)

An ANCOVA model is an ANOVA model with a continuous variable added. An ANOVA model explains the variation in the independent variable, based on a series of characteristics (expressed as binary variables equaling either zero or one).

Evaluated Gross Savings

Evaluated gross savings represent the total savings of a program, based on validated savings and installations, before adjusting for behavioral effects such as freeridership or spillover. They are most often calculated for a given measure, i , as:

$$\text{Evaluated Gross Savings}_i = \text{Verified Installations}_i * \text{Unit Consumption}_i$$

Evaluated Net Savings

Evaluated net savings are the savings “net” of what would have occurred in the program’s absence. These savings are the observed impacts attributable to the program. Net savings are calculated as:

$$\text{Net Savings} = \text{Evaluated Gross Savings} * \text{NTG}$$

Freeridership

Freeridership in energy-efficiency programs is defined as participants who would have adopted the energy-efficient measure in the program’s absence. This is often expressed as the freeridership rate, or the proportion of evaluated gross savings that can be classified as freeridership.

Gross Realization Rate

The ratio of evaluated gross savings and the savings reported (or claimed) by the program administrator.

In-Service Rate (ISR)

The ISR (also called the installation rate) is the proportion of incented measures actually installed.

Net-to-Gross (NTG)

The NTG ratio is the ratio of net savings to evaluated gross savings. Analytically, NTG is defined as:

$$\text{NTG} = (1 - \text{Freeridership Rate}) + \text{Spillover Rate}$$

P-Value

A p-value indicates the probability that a statistical finding might be due to chance. A p-value less than 0.10 indicates one can say, with 90 percent confidence, that the finding was due to the intervention.

Spillover

Spillover is the adoption of an energy-efficiency measure induced by the program's presence, but not directly funded by the program. As with freeridership, this is expressed as a fraction of evaluated gross savings (or the *spillover rate*).

T-Test

In regression analysis, a t-test is applied to determine whether the estimated coefficient differs significantly from zero. A t-test with a p-value less than 0.10 indicates that there is a 90 percent probability that the estimated coefficient is different from zero.

Executive Summary

Pacific Power offers the Home Energy Savings (HES) Program in Northern California, Wyoming, Utah, Idaho, and Washington. In 2008, Pacific Power first offered the HES Program in California. The HES Program provides residential customers with incentives to help facilitate the purchase of energy-efficient products and services through upstream (manufacturer and retailer) and downstream (customer) incentive mechanisms. During the 2009 and 2010 program years, Pacific Power reported over 7,500 participants in the program and gross electricity savings of 2,995,175 kWh. The largest program in Pacific Power's residential portfolio in California, the HES Program contributed 87 percent of residential program savings, and 55 percent of all California portfolio savings in 2009 and 2010.

The HES Program offers energy-efficiency measures in four categories:

- **Lighting:** Upstream incentives for manufacturers to reduce retail prices on compact florescent lamps (CFLs), and incentives to customers for light fixtures and ceiling fans.
- **Appliances:** Customer incentives for clothes washers, dishwashers, refrigerators, room air conditioners, and high-efficiency electric storage water heaters.
- **Heating, ventilation, and air conditioning (HVAC):** Customer incentives for high-efficiency heating and cooling equipment and services, duct sealing, and evaporative cooling equipment.
- **Appliance Recycling:** Customer incentives for recycling working refrigerator and freezers. Participants also receive free energy-efficient kits as part of this program.

Pacific Power contracted with The Cadmus Group, Inc., (Cadmus) to conduct process and impact evaluations of the California HES Program for program years 2009 and 2010. The impact evaluation assessed energy impacts and program cost-effectiveness. The process evaluation assessed: program delivery and efficacy, bottlenecks, barriers, best practices, and opportunities for improvements. This document presents these evaluations' results.

Overview of Evaluation Activities

The HES Program evaluation consisted of primary and secondary data collection activities, informing the impact and process evaluation components. The impact evaluation estimated two key components: gross savings and the net-to-gross (NTG) ratio. The gross savings calculations included adjustments for the installation rate and verification of engineering calculations and assumptions. NTG—the combination of freeridership and spillover—discounted savings from units that would have been installed in the program's absence, and credited the program for unaccounted spillover savings achieved through the program's influence.

The process evaluation investigated topics such as: participant satisfaction; implementation and delivery processes; marketing methods; quality assurance; and other qualitative issues.

Key Findings

Launched in 2008 the HES Program provides incentives for 23 energy-saving measures. Cadmus' evaluation focused on the top 10 measures, which collectively contributed to over 99 percent of

the HES Program savings. Cadmus collected primary data on the top savings measures, and performed engineering reviews utilizing secondary data for the remaining measures. CFLs accounted for 50 percent of total HES Program savings, and, as a result, became a primary focus of the evaluation.

Key Impact Findings

Key impact evaluation findings include the following:

- The HES program in 2009 and 2010 resulted in evaluated gross savings of 2,790,489 kWh, and net savings of 2,583,763, representing 93 percent of the reported gross savings and 85 percent of the reported net savings, respectively.
- **Appliances:** Incented appliances experienced a 100 percent installation rate. Evaluated gross savings realization rates ranged from 29 percent (ceiling fans) to 377 (clothes washers). Savings realization rates above 100 percent resulted from changes in assumptions regarding efficiencies, electricity usage, and fuel type saturation. The HES Program's non-lighting measures achieved an 82 percent NTG ratio (see Table 1).
- **HVAC:** Incented HVAC equipment experienced a 100 percent installation rate. Evaluated gross savings realization rates ranged from 19 percent (heat pump upgrade) to well over 2,000 percent (duct sealing). The HES Program non-lighting measures had an 82 percent NTG ratio estimate (see Table 1).
- **Lighting:** Incented CFLs experienced a 71 percent installation rate, based on storage and removal practice behaviors, as reported through surveys. The HES lighting component experienced a 101 percent evaluated gross savings realization rate, and a NTG ratio of 50 percent (see Table 1).
- **Appliance Recycling:** Appliance recycling achieved gross savings realization rates of 93 percent for refrigerator recycling, 57 percent for freezer recycling, and 64 percent for energy-saving kits. Participants reported installing 87.5 percent of CFLs provided in the energy-saving kit. For recycled refrigerators and freezers, Cadmus estimated freeridership at 37 percent of evaluated gross savings, and spillover at 1 percent of savings, resulting in an overall 66 percent NTG (see Table 1).

Table 1. 2009 and 2010 HES Program Savings*

Measure Group	Units	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Evaluated Net Savings (kWh)	Evaluated NTG Ratio	Precision at 90% Confidence* * (+/-)
Upstream Lighting	58,382	1,501,621	1,521,662	101%	760,831	50%	12.97%
Appliances and HVAC	1,426	384,610	365,107	95%	299,388	82%	22.57%
Refrigerator and Freezer Recycling	866	1,108,944	903,720	81%	594,870	66%	11.17%
Totals	60,674	2,995,175	2,790,489	93%	1,655,089		

*Throughout the report, totals in tables may not add up due to rounding.

**Appendix B describes the methodology for calculating precision.

Table 2. 2009 HES Program Savings*

Measure Group	Units	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Evaluated Net Savings (kWh)
Upstream Lighting	24,071	693,193	621,007	90%	310,504
Appliances and HVAC	653	127,906	157,010	123%	128,749
Refrigerator and Freezer Recycling	264	339,465	277,729	82%	182,534
<i>Totals</i>	<i>24,988</i>	<i>1,160,564</i>	<i>1,055,746</i>	<i>91%</i>	<i>621,786</i>

*Throughout the report, totals in tables may not add up due to rounding.

Table 3. 2010 HES Program Savings*

Measure Group	Units	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Evaluated Net Savings (kWh)
Upstream Lighting	34,311	808,428	900,655	111%	450,328
Appliances and HVAC	773	256,704	208,096	81%	170,639
Refrigerator and Freezer Recycling	602	769,479	625,991	81%	412,336
<i>Totals</i>	<i>35,686</i>	<i>1,834,611</i>	<i>1,734,742</i>	<i>95%</i>	<i>1,033,303</i>

*Throughout the report, totals in tables may not add up due to rounding.

Key Process Evaluation Findings

Key process evaluation findings include the following:

- Of the 251 in-territory lighting customers surveyed, 85 percent recognized the terms “compact fluorescent bulb” or “CFL”; and 59 percent were familiar with light-emitting diode (LED) bulbs. These results indicate effective marketing and high customer energy efficient lighting knowledge.
- Appliance and HVAC participants reported being motivated by factors other than energy efficiency: more than one-third of surveyed customers purchased qualifying measures because their old equipment had failed or worked poorly.
- While recognizing the importance of the HES Program’s QC process, implementer staff reported it did not prove cost-effective to maintain full-time QC inspectors on staff in California. However, they questioned how to conduct QC inspections within 45 days of the equipment’s installation without such an arrangement.
- Program staff estimated 80 percent of California Pacific Power residential customers lived at or below the poverty level.
- HES Program satisfaction generally ran high. All surveyed customers reported high satisfaction levels regarding program incentives, purchased measures, and overall program experiences. Ninety-two percent of appliance and HVAC participants reported being “very” or “somewhat” satisfied with their overall HES Program experience.

Eighty-one percent of See Ya Later Refrigerator (SYLR) participants reported being very satisfied with the program; less than 2 percent reported dissatisfaction.

Cost-Effectiveness Results

Table 4 shows program cost-effectiveness for 2009–2010 combined, based on net evaluated savings. The HES Program proved cost-effective across the evaluation period for four of the five primary cost tests: the total resource cost test (TRC); the PacifiCorp total resource cost test (PTRC); the participant cost test (PCT); and the utility cost test (UCT). The program did not prove cost-effective from the rate impact measure (RIM) perspective, which measures impacts of programs on customer rates. Most programs do not pass the RIM test due to adverse impacts of lost revenue. Levelized cost per kWh, presented in Table 4, represents the present value of program life cycle costs, divided by total energy savings produced by the program over the lives of the measures: a useful metric for comparing energy costs for demand-side management programs with those of supply-side resources.

Table 4. 2009–2010 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.053	\$723,801	\$1,328,713	\$604,912	1.84
Total Resource No Adder (TRC)	\$0.053	\$723,801	\$1,207,921	\$484,120	1.67
Utility (UCT)	\$0.038	\$523,586	\$1,207,921	\$684,335	2.31
Ratepayer Impact (RIM)	\$0.147	\$2,002,024	\$1,207,921	(\$794,102)	0.60
Participant (PCT)	\$0.025	\$545,346	\$2,563,770	\$2,018,424	4.70

Table 5 and Table 6 show HES Program cost-effectiveness for the 2009 and 2010 program years, respectively, based on net evaluated program savings.

Table 5. 2009 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.054	\$319,328	\$542,427	\$223,098	1.70
Total Resource No Adder (TRC)	\$0.054	\$319,328	\$493,115	\$173,787	1.54
Utility (UCT)	\$0.041	\$241,879	\$493,115	\$251,236	2.04
Ratepayer Impact (RIM)	\$0.147	\$867,473	\$493,115	(\$374,358)	0.57
Participant (PCT)	\$0.024	\$228,015	\$1,087,885	\$859,870	4.77

Table 6. 2010 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net Benefits	Benefit / Cost Ratio
	\$ / kWh				
Total Resource + Conservation Adder (PTRC)	\$0.052	\$434,404	\$844,472	\$410,068	1.94
Total Resource No Adder (TRC)	\$0.052	\$434,404	\$767,702	\$333,298	1.77
Utility (UCT)	\$0.036	\$302,554	\$767,702	\$465,148	2.54
Ratepayer Impact (RIM)	\$0.146	\$1,218,507	\$767,702	(\$450,805)	0.63
Participant (PCT)	\$0.025	\$340,814	\$1,585,100	\$1,244,286	4.65

Summary and Recommendations

Pacific Power made several changes to the HES Program in 2010, such as adjusting program operations, delivery structures, and marketing approaches. These led to significant improvements in participation and savings. Conclusions and recommendations presented here have been drawn from process evaluation interviews, surveys, and other analyses conducted. While Cadmus' process evaluation found several HES Program operations and delivery aspects improved, the program may benefit from additional changes as it matures and continues to adapt to the California market. Based on this evaluation's findings, Cadmus offers the following observations and recommendations:

- ***EISA legislation and ingrained customer preferences could have wide-ranging impacts on utility lighting programs.***
 - ***Recommendation:*** Given the changes in the evolving lighting industry, explore which higher-efficiency lighting options (e.g., LEDs) will garner the most savings per unit to maintain savings. Align marketing messages with the preferred lighting option to heighten awareness using market transformation tactics.
- ***The EISA standard will impact Rocky Mountain Power savings analysis of CFLs.***
 - ***Recommendation:*** Baseline wattage assumptions will need to be updated to account for the new EISA standards. The EISA standard established an equivalent baseline by rated lamp lumens. If the actual baseline wattage replaced is not known (i.e. no surveys were conducted), the recommended approach uses the CFL rated lumens and equivalent lumens in EISA to determine baseline wattage. This approach can be used for program evaluations in 2012 and beyond.
- ***Rocky Mountain Power impact analysis of CFLs does not include a waste heat factor (WHF) in the planning estimates.***
 - ***Recommendation:*** Cadmus recommends using the approach outlined in Appendix L and including this adjustment for future planning estimates and evaluations.
- ***The need for new equipment most often motivates customers to purchase qualified appliance and HVAC measures.***

- **Recommendation:** Utilize marketing messages targeting the equipment replacement market. Trade allies should be trained to capture this market by promoting the HES Program when contacted to install new equipment in emergency replacement situations.
- ***QC inspections prove costly in California due to a dispersed customer community and low participation volume overall.***
 - **Recommendation:** Outsource the QC process to a locally-based QC firm. Subcontracting with a locally-based firm with existing work would lower travel costs, and eliminates the need for a full-time staff dedicated to installation inspections.
- ***Economic constraints may serve as a significant barrier to meeting forecasted savings and participation results.***
 - **Recommendation:** Consider reviewing measure incentive levels. Customers with less disposable income may need a higher financial motivator to purchase qualifying measures.
- ***Both HES and SYLR surveyed customers reported high satisfaction with program incentives, purchased measures, and overall program experiences.***

For more detail, please see the Summary and Recommendations in this report's Process Evaluation Findings section.

Introduction

Program Description

In 2008, Home Energy Savings (HES) was launched in California. Portland Energy Conservation, Inc. (PECI/program implementer) implemented the HES Program, which provided incentives to residential customers purchasing qualifying, high-efficiency equipment, appliances, and weatherization measures. JACO Environmental implemented the refrigerator and freezer recycling incentives. Prescriptive incentives offered included the following measures:

- Clothes washers;
- Dishwashers;
- Water heaters;
- Refrigerators;
- Room air conditioners;
- Evaporative coolers;
- Central air conditioning units;
- Heat pumps;
- Duct sealing
- Fluorescent fixtures;
- Ceiling fans; and
- Refrigerator and freezer recycling.

To encourage dealers to promote energy-efficient equipment incentives and to properly size, install, and maintain equipment, Pacific Power also offered dealer incentives for qualifying central air conditioning, evaporative coolers, duct sealing, and heat pump measures bought or installed through the HES Program.

The HES Program included an upstream lighting component, applying incentives for eligible compact fluorescent lamps (CFLs) at the manufacturer level, and discounting for end-use customers purchasing high-efficiency lighting options.

Table 7, below, lists HES Program measures and customer and dealer incentive amounts.

Table 7. HES Program Incentives by Measure

Measure	Energy-Efficient Standards	Unit	2009 Incentive Levels	2010 Incentive Levels	Dealer Spiff
Clothes Washer	Clothes Washer-Tier One (1.72 - 1.99 MEF)	Units	\$50		
	Clothes Washer-Tier Two (2.0 + MEF)	Units	\$75		
	Clothes Washer Recycling	Units	N/A		
	Qualified Models	Units		Up to \$75	
Dishwasher	EF 0.68 or higher	Units	\$20	\$20	
Electric Water Heater	40+ Gallons (EF 0.93 or higher)	Units	\$40	\$40	
Refrigerator	ENERGY STAR Refrigerator	Units	\$20	\$20	
	Refrigerator and Freezer Recycling	Units	\$35	\$35	
Evaporative Cooler	Permanently Installed (Minimum 2,500 CFM)	Units	\$150	\$150	\$25
	Portable (Minimum 2,500 CFM)	Units		\$50	
Room Air Conditioner	ENERGY STAR Room Air Conditioner	Units		\$30	
Central Air Conditioner	CAC Tune up	Projects	\$100	\$50	\$25
	HP Tune Up	Projects	\$100	\$75	\$25
	CAC (15 SEER)	Units	\$100	\$100	\$25
Duct Sealing	Program Qualified Contractor	Projects	\$150		\$50
Heat Pumps	Heat Pump Upgrade (8.5+ HSPF & TXV)	Projects		\$350	\$50
	Heat Pump Conversion (8.5+ HSPF & TXV)	Projects		\$450	\$50
	Single-head ductless heat pump	Units		\$550	\$50
	Multi-head ductless heat pump	Units		\$750	\$50
Ceiling Fans	ENERGY STAR Ceiling Fans	Units	\$20	\$20	
Fixtures	ENERGY STAR Fixtures	Units	\$20	\$20	
CFLs	CFLs-Spiral	Lamps			
New Homes	Gas heated homes	Projects	\$750		
	Electrically heated homes	Projects	\$900	\$1,500	
Refrigerator Recycling	Refrigerator and Freezer Recycling	\$35	\$35	\$35	

Evaluated Gross and Net Savings Methodology

This report presents two saving values: evaluated gross and net savings. To determine evaluated net savings, Cadmus applied four steps (as shown in Table 8). Reported gross savings have been defined as electricity savings (kWh) reported to Cadmus by Pacific Power.

Table 8. Impact Steps

Savings Estimate	Step	Action
Evaluated Gross Savings	1	Validate Accuracy of Data in Participant Database
	2	Perform Engineering Review to Validate Saving Calculations
	3	Adjust Gross Savings with Actual Installation Rate
Evaluated Net Savings	4	Apply Net-to-Gross (NTG) Adjustments

Step one (verify participant database) included a review of the program tracking database to ensure participants and reported savings matched 2009 and 2010 annual reports.

Step two (perform an engineering review) included a review of measure saving assumptions, equations, and inputs.

Step three (adjust gross savings with the actual installation rate) determined the number of measures program participants installed (and remaining in installation). This value was determined through a telephone survey, and using the installation and persistence rate (referred to as in-service rate or ISR) in calculating evaluated gross savings.

Together, the first three steps determined evaluated gross savings. A fourth step (applying net adjustments) determined evaluated net savings.

Cadmus' evaluation included the following data collection activities:

- **Management Staff Interviews:** In October 2011, Cadmus conducted an in-depth interview with PacifiCorp's HES Program manager.
- **Program Partner Interviews:** In October and November 2011, Cadmus interviewed three program management staff from the program implementer, which provided information on program implementation, incentive processing, and verification services for the HES Program.
- **Participant Telephone Survey:** Cadmus conducted 172 interviews with customers receiving incentives from Pacific Power for clothes washers, refrigerators, dishwashers, fixtures, heat pumps, room air conditioners, ceiling fans, and electric water heaters.
- **Participant Retailer/ Contractor Surveys:** Cadmus conducted 11 interviews with trade allies supplying discounted CFLs, Heating, ventilation, and air conditioning (HVAC), and appliances through HES. Many trade allies answered questions about multiple measures, resulting in eight completed sections for lighting, and eight sections for appliances and HVAC.
- **In-territory Lighting Survey:** Cadmus performed 251 interviews with Pacific Power customers purchasing CFLs during the 2009 and 2010 program years.
- **Appliance Recycling Participant Survey:** In October and November 2011, Cadmus conducted 114 surveys with participants who recycled a refrigerator and/or freezer.
- **Appliance Recycling Nonparticipant Survey:** In October and November 2011, Cadmus conducted 56 surveys with customers who disposed of a refrigerator and/or freezer outside of the program.

- **Marketing Materials Review:** Cadmus reviewed marketing and communications developed to promote participation and to educate target audiences about HES Program details. The review addressed specific marketing elements, regarding: general look and feel; brand and message consistency; program accessibility; and online and interactive properties.

Appendix A provides data collection instruments for customer surveys.

Sample Design and Data Collection Methods

Cadmus developed samples, seeking to achieve precision of ± 10 percent at the 90 percent statistical confidence level for individual estimates at the measure level, with sample sizes determined assuming a coefficient of variation (CV) of 0.5.¹ For small population sizes, a finite population adjustment factor was applied. Table 9 shows the final sample disposition for various data collection activities. For nearly all data collection, Cadmus drew samples using either simple or stratified random sampling.²

Table 9. Sample Disposition for Various Data Collection Activity

Data Collection Activity	Population	Sample	Achieved Surveys
Management Staff Interviews	N/A	N/A	1
Program Partner Interviews	N/A	N/A	3
Participant Telephone Survey	1,469	1,403	172
Participant Retailer/Contractor Survey	26	26	11
In-Territory Lighting Survey	10,991	250	251
Appliance Recycling Participant Survey	866	140	114
Appliance Recycling Nonparticipant Survey	N/A	70	56

Management and Program Partner Interviews

Cadmus interviewed a census of the Pacific Power HES Program staff and program partners, provided by Pacific Power.

Participant Telephone Survey

Cadmus stratified the participant telephone survey (appliances and HVAC) by measure to ensure statistically representative results for each measure. Table 10 shows the number of contacts available, targets, and completed surveys. Completion targets were not reached for seven out of eight measures due to the small number of contacts available, despite multiple call-back attempts, calls at different times of day and week.

¹ The ratio of standard deviation (a measure of the dispersion of data points in a data series) to the series mean.

² Simple random samples are drawn from the entire population, whereas stratified random samples are drawn randomly from subpopulations (strata), and then weighted to extrapolate to the population.

Table 10. Participant Telephone Survey Sample Sizes

Measure	Population	Target Surveys	Achieved Surveys
Clothes Washer	749	70	78
Central AC	7	7	1
Refrigerator	393	70	56
Dishwasher	149	70	20
Fixtures	17	17	2
Heat Pump Upgrade	43	43	9
Ceiling Fans	4	4	1
Electric Water Heater	41	41	5
Excluded Measures	66	0	0
Total	1,469	322	172

Table 11 details the screening process for eligible participants, which randomly selected 172 participants from 1,281 unique participants with California mailing addresses, valid phone numbers, and valid Pacific Power customer numbers.

Table 11. Participant Telephone Survey Sample

	Total
Total Records	1,469
No Phone Number	129
Measure Quantity Equals Zero	53
Duplicate Records	6
Eligible for call list	1,281
Completed Surveys	172
Response Rate*	13%
Cooperation Rate**	24%

* Response rate: the number of customers completing a survey, divided by the number of eligible participants in call list.

** Cooperation rate: the number of customers completing a survey, divided by the number of customers reached by phone.

Retailer/Contractor Surveys

In nearly all cases, Cadmus drew random samples, with sampled units having equal probabilities of being chosen. For the survey's CFL section, however, the team weighted the probability of selecting a given retailer, based on their total CFL sales. This ensured capturing a sufficient number of large retailers in the sample, while retaining the desired statistical properties of a random sample.

Cadmus selected appliance and HVAC retailers and contractors for interviews based on their incented products, ensuring adequate representation of the greater program trade ally population. This approach, intended solely for qualitative analysis, offered an advantage over drawing random sample from groups too small to produce statistically valid estimates.

Table 12 details the screening process for eligible participants, which randomly selected 11 participants from 26 unique California retailers.

Table 12. Retailer Participant Survey Sample

	Total
Total Records	26
No Phone Number	0
Duplicate Records (by customer number and phone number)	2
Eligible participants in call list	26
Completed Surveys	11
Response Rate*	42%
Cooperation Rate**	42%

* Response rate: the number of customers completing a survey, divided by the number of eligible participants in call list.

** Cooperation rate: the number of customers completing a survey, divided by the number of customers reached by phone.

Table 13 shows responses by retailer or contractor, indicating sections answered by each.

Table 13. Retailer Participant Surveys

Company/ Store	Lighting	Appliances
Retailer 1	X	
Retailer 2	X	
Retailer 3	X	X
Retailer 4		X
Retailer 5		X
Retailer 6	X	X
Retailer 7	X	X
Retailer 8	X	X
Retailer 9		X
Retailer 10	X	
Retailer 11	X	X

As shown in Table 14, participating lighting or appliance retailers did not meet survey targets due to the small number of contacts available, despite survey best practices (e.g., multiple attempts, calls at different times of day, and scheduling call-backs). In addition, in the lighting strata, two contacts had duplicate contact information, and one survey was terminated because the retailer reported they did not sell CFLs.

Table 14. Retailer Survey Dispositions

	Contacts	Targets	Completes
Lighting	20	20	6
Appliance	6	6	5
<i>Total</i>	<i>26</i>	<i>26</i>	<i>11</i>

In-Territory Lighting Survey

Cadmus drew the in-territory lighting survey sample from a random list of California Pacific Power residential customers, provided by Pacific Power. Surveyors screened respondents to identify recent CFL purchasers for the survey.

Table 15 details the screening process for eligible participants, which randomly selected 251 participants from 8,592 unique customers with California mailing addresses, valid phone numbers, and valid Pacific Power customer numbers.

Table 15. In-Territory Lighting Survey Sample

	Total
Total Records	10,991
Duplicate Records	399
Held out for ARP nonparticipant survey	2,000
Eligible for call list	8,592
Completed Surveys	251
Response Rate*	3%
Cooperation Rate**	24%

* Response rate: the number of customers completing a survey, divided by the number of eligible participants in call list.

** Cooperation rate: the number of customers completing a survey, divided by the number of customers reached by phone.

Appliance Recycling Survey

Cadmus drew appliance recycling participant survey sample from the JACO Environmental's tracking database.

Table 16 details the screening process for eligible participants, which randomly selected 114 participants from 761 unique customers with California mailing addresses, valid phone numbers, and valid Pacific Power customer numbers.

Table 16. Appliance Recycling Participant Survey Sample

	Total
Total Records	866
Duplicate records (by customer number and phone number)	106
Eligible participants in call list	761
Completed Surveys	114
Response Rate*	15%
Cooperation Rate**	31%

* Response rate: the number of customers completing a survey, divided by the number of eligible participants in call list.

** Cooperation rate: the number of customers completing a survey, divided by the number of customers reached by phone.

Appliance Recycling Nonparticipant Survey

Cadmus drew the appliance recycling nonparticipant survey sample from a random list of California Pacific Power residential customers, provided by Pacific Power, and chose nonparticipants by screening respondents to identify those recently disposing of an operable refrigerator and/or freezer outside of the program.

Table 17 details the screening process, which randomly selected 56 candidates from 2,000 unique customers with California mailing addresses, valid phone numbers, and valid Pacific Power customer numbers.

Table 17. Appliance Recycling Nonparticipant Survey Sample

	Total
Total Records	2,000
Unusable records (invalid phone number)	0
Eligible participants in call list	2,000
Completed Surveys	56
Response Rate*	3%
Cooperation Rate**	3%

* Response rate: the number of customers completing a survey, divided by the number of eligible participants in call list.

** Cooperation rate: the number of customers completing a survey, divided by the number of customers reached by phone.

Marketing Materials Review

The process evaluation included Cadmus' review of marketing and communications developed to promote participation and educate target audiences regarding HES Program details. As appropriate, Cadmus also integrated findings from program staff interviews and customer surveys on marketing approaches and effectiveness into analysis.

Sources used for the marketing and messaging review included:

- Collateral (e.g., promotional material, advertising, and educational pieces);
- Presentation decks;
- Online promotional elements; and
- Marketing media mix and timing.

Where applicable, the review included specific comments regarding the following:

- General look and feel;
- Brand and message consistency;
- Program accessibility; and
- Stakeholder criteria, including:
 - Incentive forms
 - Web-based marketing and educational collateral

- Searchable retailer listings
- Online processes availability

The marketing review also included a qualitative evaluation of online resources available from Pacific Power, and comparisons with other interactive resources.³

³ The online review assumed Pacific Power.net as an initial entry point for HES Program participants.

Impact Evaluation

This section provides impact findings for the HES Program, based on analysis of data using the following methods:

- Participant and nonparticipant surveys;
- Billing analysis;
- Engineering reviews;
- Site visits; and
- Secondary research.

Each data element contributed to gross or net savings estimates. Table 18 summarizes evaluation activities and each effort's goals.

Table 18. Summary of Evaluation Approach

Action	Impact		Process
	Gross Savings	NTG	
Participant Surveys (Appliance, HVAC, and Weatherization Measures)	X	X	X
In-Territory Lighting Surveys	X		X
Participant Retailer/Contractor Surveys		X	X
Appliance Recycling Participant Survey	X	X	X
Appliance Recycling Nonparticipant Survey		X	X
Stakeholder Interviews (Management Staff and Implementers)			X
Secondary Research		X	
Secondary Data Analysis	X		

As noted, HES offered a large number of different products and measures, which required different evaluation methods. To address the complexities and details of each individual measure group, the impact findings have been organized into three sections:

1. Lighting
2. Appliances, HVAC, and Weatherization
3. Refrigerator and Freezer Recycling

Lighting

During the 2009–2010 program years, Pacific Power incented over 58,000 CFL bulbs through seven different retailers in 20 stores. The bulbs contributed to 50 percent of total HES savings, and, as shown in Table 19, included standard and specialty CFL bulbs.

Table 19. Incented CFL Bulbs by Type

Bulb Type	Incited Bulbs	Percent of Total
Spiral (Standard)	55,584	95.2%
A-Lamp	76	0.1%
Candelabra	34	0.1%
Daylight	1,509	2.6%
Reflector	911	1.6%
3-Way	8	0.0%
Globe	124	0.2%
Outdoor	57	0.1%
Dimmable	79	0.1%
<i>Total</i>	<i>58,382</i>	<i>100%</i>

Source: 2009–2010 CA HES PECL tracking data.

Generally, CFL buy-down programs offer an effective alternative to traditional mail-in incentives, given their ease of deployment, widespread accessibility, and low administrative costs. For such programs, utility incentives pass through manufacturers to retailers, which reduce bulb prices to the end consumer. The programs motivate retailer participation through reduced bulb prices without losses in their profits. At the customer level, participation may be so seamless that participants do not know they have purchased an incentivized bulb or have participated in a utility program.

Upstream programs, however, offer particular evaluation challenges. Calculating metrics, such as installation rates and attributions, traditionally relies on finding participants and incentivized products; in this instance, however, purchasers may not be aware of their participation in a utility-sponsored program.

Consequently, calculation of various CFL lighting component inputs required use of primary and secondary data collection activities, as shown in Table 20. Lighting trends reported in the in-territory lighting surveys of Pacific Power’s California residential customers served as a proxy for HES lighting participants, in lieu of verifiable participation data.

Table 20. California Lighting Activities

Activity	N	Metric	Result
Participant Retailer/Contractor Surveys	11	NTG, Willingness to Pay	Net Savings
In-Territory Lighting Surveys	251	Installation Rate, Installation Location, Hours-of-Use	Gross Savings
Secondary Research	N/A	NTG	Net Savings
Secondary Data Analysis	N/A	Hours-of-Use	Gross Savings

Evaluated Gross Savings Approach—Lighting

Three different parameters informed the calculation of gross savings for the lighting component: ISRs, delta watts, and hours-of-use (HOU). The following algorithm provided gross lighting savings:

$$\text{Evaluated Per Unit Savings (kWh per unit)} = \frac{\Delta \text{Watts} * \text{ISR} * \text{HOU} * 365}{1,000}$$

Where:

ΔWatts = Difference in wattage between baseline bulb and evaluated bulb

ISR = In-service rate, or percentage of incented units installed

HOU = Hours-of-use; daily lighting operating hours

The annual savings algorithm derived from industry-standard engineering practices, consistent with the methodology used by the Northwest Regional Technical Forum (RTF) for calculating energy use and savings for residential lighting. Each methodology component is discussed in detail below.

In-Service Rate

The ISR (also known as the installation rate) was determined using in-territory lighting surveys of 251 recent CFL purchasers. The survey asked those purchasing CFLs during 2009 or 2010 a series of questions to determine whether the purchased CFLs had been installed, and, if so, in which rooms. As shown in Table 21 and Table 22, respondents installed 71 percent of bulbs purchased in 2009 and 2010, with bulbs most commonly installed in living spaces (such as family and living rooms) and bedrooms. This evaluation did not include stored bulbs as part of the ISR input, as they had not been installed during the 2009–2010 program period and, as such, did not contribute to first-year program savings.

Table 21. CFL Installation Rate (n=251)

	Bulbs	Percent of Total
Installed	2,214	71%
In storage	647	21%
Discarded or given away	278	9%
<i>Total</i>	<i>3,139</i>	<i>100%</i>

Table 22. CFL Installation Locations (n=225)

	Percent of Total*
Living Space	35.6%
Kitchen	16.1%
Basement	0.7%
Outdoor	5.6%
Bedroom	21.4%
Bathroom	14.4%
Other	6.1%
<i>Total</i>	<i>100.0%</i>

* Percents may not add to 100 percent due to rounding.

This evaluation did not include stored bulbs as part of the ISR input, as they had not been installed during the 2009–2010 program period and, as such, did not contribute to first-year program savings. In 2012, the evaluation team plans to survey a statistically significant portion of respondents that reported in-storage CFLs during the 2009–2010 phone survey. These respondents will be asked a series of questions to determine if any of the stored CFLs were installed during the 2011–2012 program period. Any additional installations, if any, will be credited in the 2011–2012 evaluation.

Delta Watts

Delta Watts represent the wattage difference between a baseline bulb and an equivalent CFL. For the HES Program, specific CFL products may be sold by participating California retailers. Pacific Power provided 2009–2010 CFL sales data by Stock Keeping Unit (SKU)⁴ number (model number and bulb type) for the 109 products eligible at the five participating retail outlets. Sales data indicated sales of 58,382⁵ incandescent CFLs. Product sales data included CFL wattages, though lumen data or light outputs for bulbs were not available.

To determine per-bulb savings, Cadmus estimated the baseline incandescent wattage for each CFL bulb sold. Table 23 shows the baseline wattage, established using the comparable light output of the purchased CFL. Groups of lumen ranges (bins) were developed based on 2007's Energy Independence and Security Act (EISA).⁶ Analysis of listed eligible ENERGY STAR CFL products provided estimates of CFL Wattage bins for each associated lumen bin.

Table 23. Lumen Bins by Baseline Wattage and Estimated CFL Wattage

Lumens Bins	Baseline Wattage (W_{base})	Estimated CFL Wattage (W_{eff}) Bins
310–749	40	6–11
750–1,049	60	12–16
1,050–1,489	75	17–22
1,490–2,600	100	23–38

Fifteen models classified as reflector-type lamps did not follow the lumen bin classifications described above. Reflectors can be described as flood lights, providing a direct path of light, with the wattage of eligible products ranging from 11 to 26 watts. Incandescent reflectors (R20, R30, BR30, PAR38 type), shown in Table 24, have comparable baseline wattages, ranging from 45 to 90 watts, based on manufacturer literature.⁷

⁴ SKU represents the unique make and model indicator for a specific retailer.

⁵ Sales in the tracking database differed from those reported in annual reports, due to different reporting and tracking calendars. CFLs in the database were verified for this evaluation.

⁶ Congress signed EISA into law on December 19, 2007. The new law contains provisions for phasing in more-efficient incandescent lamps, based on rated lumens. For example, a 100-watt incandescent lamp with a rated lumen range of 1,490 to 2,600 will be required to have a minimum of 72 watts, effective January 1, 2012.

⁷ The wattage baseline was based on manufacturer specifications and product literature from GE, Philips, and Westinghouse.

Table 24. Reflector Baseline Wattage and CFL Wattage

CFL Wattage	Baseline Wattage
R11	45
R14	50
R15	65
R23	90
R26	90

Of the 109 eligible products included in the HES Program, 73 CFL SKU numbers (including reflectors) were verified online for each retailer, with each model's rated lumens recorded. For the remaining 36 CFL products, estimated lumens were based on analysis of eligible ENERGY STAR CFL products.

ENERGY STAR Analysis

This analysis used a downloaded list of ENERGY STAR-qualified CFL bulb products, last updated on May 24, 2011. The database consisted of 5,245 CFL products and their associated wattages and lumens. The list required data cleaning to remove or update database inconsistencies, missing values, decimal places, outliers, and incorrect entries. Cleaning removed or updated nine entries, resulting in a "cleaned" database of 5,243 CFL products.

The final database also included 117 three-way CFL bulb types. Analysis used mid-range wattage, as specified by manufacturers.

The analysis broke out the ENERGY STAR CFL product list into lumen bins, specified by the EISA lumen requirements, and extrapolated to the higher lumens bins. Table 25 shows the number of CFL products by lumen bin, per the ENERGY STAR database.

Table 25. ENERGY STAR Product Counts by Lumen Bin

Lumens Bins	ENERGY STAR Product Counts
Less than 310	75
310–749	925
750–1,049	1,980
1,050–1,489	865
1,490–2,600	1,328
Greater than 2600	70
<i>Total</i>	<i>5,243</i>

Lumens varied significantly for CFL wattages where multiple ENERGY STAR products existed. For example, 381 CFL products had 20 watts, with lighting outputs ranging from 850 to 2,150 lumens. Calculating the median lumens, instead of the mean, for bulb wattage addressed these variations.

As shown in Figure 1, the calculated trend line exhibited a relatively linear pattern: as CFL wattages increased, comparable baseline wattages also increased. Reported baseline wattages and delta wattages were based on a Pacific Power HES 2009–2010 savings analysis. Based on the

trend of median lumens and the specified lumen bins, lumens for the 36 remaining CFLs products could be estimated. For each incanted CFL, a baseline wattage was established using purchased CFLs' comparable light output.

Figure 1. Median Lumens of CFL Wattage

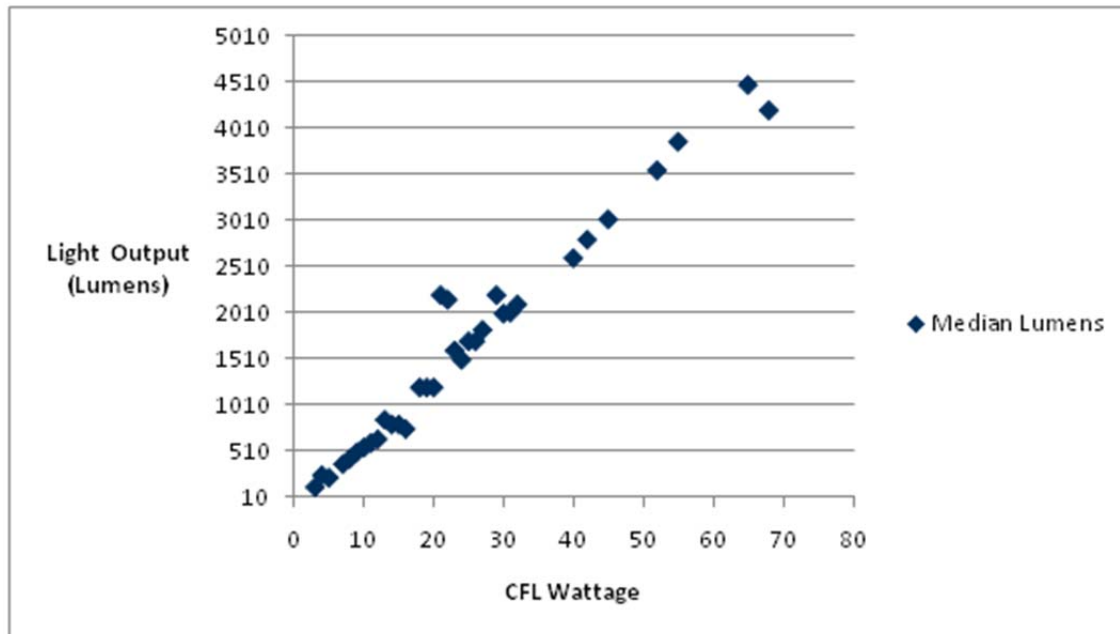


Table 26 represents all eligible 2009–2010 CFL products purchased through the HES Program (and their associated wattages). Evaluated and reported delta wattages show differences in assumptions by eligible CFL products. Documentation provided by PECO supplied reported baseline incandescent wattages. Analysis, as described in this report, determined the evaluated baseline wattage.

Table 26. Evaluated and Reported Delta Wattage of 2009–2010 CFLs and Baseline Wattages

Eligible 2009–2010 CFL Wattages	Evaluated Baseline Wattage (W_{base})	Evaluated Delta Watts (ΔW)	Reported Baseline Wattage (W_{base})	Reported Delta Watts (ΔW)
9	40	31	40	31
10	40	30	40	30
11	40	29	50	39
13	60	47	50	37
14	60	46	60	46
15	60	45	60	45
16	60	44	60	44
18	75	57	75	57
19	75	56	85	66
20	75	55	75	55
23	100	77	100	77
26	100	74	100	74
27	100	73	100	73
42	150	108	150	108
R11	45	34	50	39
R14	50	36	60	46
R15	65	50	60	45
R23	90	67	100	77
R26	90	64	100	74

Cadmus used this approach to determine an equivalent baseline by equivalent lumens of each lamp, as this remained consistent with the 2007 EISA. Cadmus recommends using the lamp lumen methodology to determine baseline wattage for program evaluations in 2012 and beyond; the 2007 EISA has established an equivalent baseline by rated lamp lumens. This approach does not necessarily apply to specialty bulbs, as the 2007 EISA excludes certain types of bulbs (such as three-way lamps, plant light lamps, shatter-resistant lamps, and others).

.Hours-of-Use

To estimate hours of use (HOU) for CFLs purchased through the HES program, Cadmus used data from a 2006–2008 CPUC Upstream Lighting Evaluation.⁸ This evaluation estimated the statewide mean HOU by room type, using data from 7,299 meters across 1,223 California households. Using the room type distribution from the phone survey, Cadmus estimated a weighted average HOU using these data, as shown in Table 27.

⁸ KEMA, Inc. “Final Evaluation Report: Upstream Lighting Program.” CPUC. February 8, 2010.

Table 27.

Room	Proportion	HOU	Precision at 90% Confidence
Exterior	6%	3.9	±9%
Bathroom	15%	1.4	±8%
Bedroom	22%	1.7	±6%
Dining Room	6%	1.9	±16%
Garage	4%	1.2	±29%
Hall	3%	1.2	±13%
Kitchen	16%	2.5	±8%
Living	24%	2.3	±8%
Office	2%	1.6	±13%
Other	3%	1.4	±12%
<i>Overall</i>		<i>2.0</i>	<i>±11%</i>

Lighting Findings

Table 28 presents resulting evaluated gross savings, by bulb wattage. Evaluated per-unit savings included HOU, delta Watts, and ISRs, as discussed above. Pacific Power's reported per-unit savings, based on program analysis documentation, included a 80 percent installation service rate and additional 80 percent NTG and leakage adjustment factor.⁹ For comparison purposes, the additional 80 percent factor is not included in Table 28.

⁹ The program analysis documentation included an additional factor that includes NTG and/or leakage rate.

Table 28. Evaluated and Reported Per Unit CFL Savings by Bulb Wattage for 2009–2010

Eligible 2009–2010 CFL Wattages	Evaluated Per Unit Gross Savings (kWh)	Reported Per Unit Savings (kWh)
9	16.13	27.20
10	15.61	26.40
11	15.09	34.40
13	24.46	32.80
14	23.94	40.00
15	23.42	39.20
16	22.90	38.40
18	29.67	49.60
19	29.15	57.60
20	28.63	48.16
23	40.08	67.20
26	38.52	64.80
27	37.99	63.92
42	56.21	95.04
R11	17.70	34.40
R14	18.74	40.00
R15	26.02	39.20
R23	34.87	67.20
R26	33.31	64.80

As shown in Table 29, the HES Program realized evaluated gross savings of 1,521,662 kWh annually. The evaluated per unit gross savings is 26.06 kWh, weighted by the number of each CFL type sold. A review of Pacific Power’s documentation indicated 1,501,621 kWh annual filed reported savings.

Table 29. Evaluated and Reported Program CFL Savings for 2009–2010

Reported Number CFLs Purchased*	Reported Program Gross Savings (kWh)	Evaluated Program Gross Savings (kWh)	Gross Savings Realization Rate
58,382	1,501,621	1,521,662	101%

* Total CFLs reported in the 2009 and 2010 Pacific Power database.

Estimating Net Savings—Lighting

Upstream energy-efficiency programs, such as the HES Program’s lighting component, present several evaluation challenges. By design, such programs remain largely invisible to consumers, and many customers may be unaware they took part in the program. Evaluations of upstream programs implemented elsewhere have indicated the majority of customer participants did not know of their participation status.

Light bulbs’ relatively low cost further complicates NTG analysis of upstream lighting programs. Consumers may recall details about buying light bulbs (e.g., how many individual light bulbs

and packages purchased, when the purchase occurred) for only a short time after the purchase. However, the memory becomes less reliable over time. This applies not only to incandescent bulbs, but also as well as CFLs, as consumers become familiar with CFLs and no longer view them as novelty items.

In addition to sales of program-discounted CFLs, utility marketing and outreach efforts often lead to higher sales of non-program CFLs. This spillover effect especially occurs when retailers reduce non-program CFL prices to keep them competitive with incented lamps. Non-program CFL sales (i.e., sales of non-discounted CFLs during program promotions, and CFL sales outside of program promotional periods) can occur at participating and nonparticipating retailers. Limiting NTG analysis to the few consumers who recall purchasing a program-discounted CFL can significantly underestimate program impacts.

Three different approaches provided CFL NTG:

- First, interviews with participating retailers and contractors sought to obtain their estimates of net program impacts.
- Second, the secondary literature was searched for estimates.
- Third, willingness-to-pay research was conducted to estimate a demand curve for CFLs, from which a freerider rate was inferred.

Participant Retailer/Contractor Surveys

The HES Program lamps' NTG was estimated using responses from in-depth participating retailer interviews. Of 11 participating retailers interviewed across various distribution channels, six addressed the HES Program's lighting component, with all six retailers answering the required battery of NTG questions. These six respondents represented 75 percent of 2009–2010 HES incented lamp sales, and 30 percent of participating stores and contractors in California.

A series of questions asked of store representatives sought to estimate percentages of all CFLs they would have sold in the HES Program's absence as well as percentages of total CFL sales incented through the HES Program during 2009 and 2010. The participant retailer/contractor survey accounted for freeridership and spillover, with questions addressing participating retailers' lift in total CFL sales resulting from the HES Program (i.e., CFLs attributable to the HES Program, including non-program CFLs). Appendix D provides interview guides for each of these groups.

NTG questions included:

1. *“If the HES incentives were not available during 2009 and 2010, do you think your sales of standard ENERGY STAR CFL bulbs would have been about the same, lower, or higher?”*
2. *“By what percent would your [store's] sales of standard ENERGY STAR CFLs have been [lower/higher] without the Home Energy Savings program?”*
3. *“During 2009 & 2010, what percent of your [store's] total CFL sales would you estimate are CFLs purchased through the HES Lighting Program?”*

In assessing responses to the above questions, NTG was estimated as follows:

1. For question 2 and 3 responses recorded in percentile ranges, calculations used midpoints of each range.
2. The HES Program tracking database provided program lamp sales data by store. This included estimated numbers of CFLs sold through the HES Program per retailer.
3. The following equation provided estimated total CFL sales by retailer:

$$\text{Total CFL Sales} = \frac{\text{Number of CFLs Sold Through the Program}}{\% \text{ Program CFLs sold over past two years (Q \#3)}}$$

4. The following equation provided estimated sales, by retailer, in the HES Program's absence:

$$\begin{aligned} & \text{Sales without Program} \\ & = \text{Total CFL Sales} \times (1 - \% \text{ Lower Sales without program(Q \#2)}) \end{aligned}$$

5. The following equation provided estimated lift or CFL sales attributable to the HES Program by retailer:

$$\text{Lift} = \text{Total CFL Sales} - \text{Sales w/out Program}$$

6. The following equation estimated NTG by retailer:

$$\text{NTG} = \frac{\text{Lift in CFL Sales for Each Retailer}}{\text{CFLs Sold Through the Program (Tracking Database)}}$$

To ensure accuracy and reliability to question 1 and 2 responses, survey administrators confirmed question responses by asking: “*Just to confirm, your sales of standard ENERGY STAR CFLs would have been [insert % from D7] [lower/higher] in 2009 and 2010 if the [Pacific Power/Rocky Mountain Power] program was not available?*”

Individual NTG ratios were weighted by distributions of program lamps sold by each of the six retailers providing useable NTG responses. For example, Retailer 1 NTG ratios were weighted by the percentage of program lamps they sold through the HES Program. This weighting approach ensured the final NTG estimate reflected distributions of program CFLs, with high-volume retailers more heavily weighted in the final NTG calculation. To calculate weights for each store, each store's program lamp sales were calculated as a percentage of total lamps sold by all retailers, then divided by the sum percentage of all six stores' lamp sales, relative to the program lamp total. Table 30 presents resulting lamp sales and weights.

Table 30. Interviewed Retailer Program Lamp Sales and Weights

Retailer Contributing to NTG	Total Program Lamp Sales	Weight
Retailer 1	7,199	0.161
Retailer 2	28,088	0.629
Retailer 3	6,558	0.147
Retailer 4	1,410	0.032
Retailer 5	1,326	0.030
Retailer 6	49	0.001
<i>Total</i>	<i>44,630</i>	<i>1.00</i>

Source: Questions D14 and D15 of the retailer participant survey.

As shown in Table 31, a 0.33 mean store-weighted NTG estimate resulted.

Table 31. Responses to NTG Questions and Weighted NTG Estimate

Retailer	Response of Whether CFL Sales Would be lower/higher or the Same Without HES Program	Estimated Program Lamps Sales as a Percent of Total Lamp Sales	Lift	NTG
Retailer 1	Lower	65%	4,984	0.69
Retailer 2	Same	25%	0	0.00
Retailer 3	Lower	85%	4,243	0.65
Retailer 4	Higher	5%	4,230	3.00
Retailer 5	Lower	65%	1,326	1.00
Retailer 6	Lower	25%	29	0.60
<i>Weighted NTG</i>				<i>0.33</i>

Source: Questions D5 and D7 of the retailer participant survey.

Potential Bias and Uncertainty

Potential bias sources contributing to uncertainty around the store-weighted NTG estimate included the following:

- The small sample of market actor responses resulted in a wide range of NTG estimates (as shown in Table 31). Responses from this small sample may not sufficiently represent all stores of the same name or all stores within each retail distribution channel.
- Program lamp sales for the six retailers contributing to NTG represented 75 percent of total lamps sold through the HES Program in California (59,308).

Secondary Data Review

For a second NTG estimate, Cadmus reviewed the literature on upstream lighting programs comparable to Pacific Power's. We found through this review that utilities across the United States have employed a number of different methodologies to derive NTG ratios; some utilities even combine methodologies to derive NTGs. These methodologies include:

- ***Participant and nonparticipant retailer interviews.*** Interviews with corporate- and store-level retailers include questions regarding retailers' total monthly or annual CFLs sales,

monthly or annual program sales, and changes observed in CFL sales and buying patterns resulting from the program. Retailer interviews also often ask about changes in customer awareness and CFL stocking patterns.

- **Consumer telephone surveys.** Consumer telephone surveys query a random sample of a sponsoring utility's customers about their recent light bulb purchases. Surveys may include questions about: quantities of CFLs recently purchased; quantities of incandescent and other light bulbs recently purchased; consumers' awareness of and experience with different types of energy-efficient lighting; and consumers' recollection of sponsoring utilities' identification.
- **Revealed preference intercept surveys.** Revealed preference intercept surveys—administered in stores, at the time of light bulb purchases—query consumers about their lighting product preferences, based on their actual purchasing behaviors.
- **Willingness to pay (WTP) assessments.** WTP assessments describe lighting product features to survey respondents, and then ask respondents how much they would be willing to pay for products with various feature combinations. These assessments are more theoretical than revealed preferences in that they rely on respondents' *hypothetical* purchasing decisions (rather than in-store, time-of-purchase decisions captured by revealed preference intercept surveys).
- **Conjoint/price elasticity analysis.** In conjoint analysis, survey respondents choose between different light bulbs (e.g., A-line, flood, incandescent), characterized by six or fewer distinct attributes (e.g., bulb type, price, lifetime, price promotion, brand, light color, recommendation). A conjoint software program (e.g., Sawtooth) determines price elasticity by simulating participants' willingness-to-pay for CFLs with different attribute configurations at various price points. To estimate an NTG ratio from such a model, evaluators calculate elasticity associated with CFLs using estimated market shares at the average, non-discounted price, on average, fully-discounted price. Both price points are estimated using a regression. The ratio between these market shares provides the freeridership value. The NTG ratio then equals one minus the freeridership value.
- **Multistate regression analysis.** This approach pools data from customer telephone and in-home audit lighting surveys, administered in multiple program and non-program areas across the U.S., into a single regression model. Pooled data are used in an equation predicting CFL purchases and NTG ratios by controlling for factors affecting CFL sales, such as income, education, homeownership status, home size, electricity rates, and concentrations of big-box stores.
- **Secondary research.** Secondary research studies NTG estimates derived by residential lighting programs elsewhere in the U.S., selecting the most appropriate NTG ratio for the utility being examined. Secondary research activities include: reviewing applicable past evaluations and conference papers; contacting utilities currently offering programs; and searching industry evaluation databases.

Table 32, below, summarizes secondary research findings from other recent, upstream, residential lighting programs across the U.S. For utilities using multiple NTG approaches, the

table shows NTG for each approach as well as the final NTG the utility selected for the overall program.

Table 32. Summary of Secondary Research Results

Program Sponsor	State	Program Years Evaluated	Year of Program	Overall NTG	NTG Ratio by Methodology						
					Customer Telephone Survey	Supplier Telephone Interview	Secondary Research	WTP Assessment	Revealed Preference	Conjoint/ Price Elasticity Analysis	Multistate Regression
Ameren Illinois	IL	2010	PY2	0.83			0.83				
Efficiency Maine	ME	2003-2006	PY1–PY4	0.94	0.94						
Massachusetts ENERGY STAR	MA	2010-2011	PY9–PY10	All CFLs: 0.47 Spiral: 0.43 Specialty: 0.60		All CFLs: 0.41 Spiral: 0.39 Specialty: 0.49		All CFLs: 0.45 Spiral: 0.49 Specialty: 0.31	All CFLs: 0.36 Spiral: 0.37 Specialty: 0.31	Specialty: 0.59	0.45
PG&E	CA	2006-2008	PY3–PY5	0.49	X*				0.49		
PPL Electric (PA)	PA	2010-2011	PY2	0.85	0.85						
Rocky Mountain Power–UT	UT	2006-2008	PY1–PY3	PY1 = 0.840 PY2 = 0.822 PY3 = 0.868	PY1 = 0.840 PY2 = 0.822 PY3 = 0.868	X*	X*				
Rocky Mountain Power–WA	WA	2006-2008	PY1–PY3	PY1 = 0.919 PY2 = 0.894 PY3 = 0.807	PY1 = 0.919 PY2 = 0.894 PY3 = 0.807	X*	X*				
SCE	CA	2006-2008	PY3–PY5	0.64	X*				0.64		
SDG&E	CA	2006-2008	PY3–PY5	0.48	X*				0.48		
Southwestern Public Service Company	NM	2009	PY1	0.81	0.81						
Wisconsin Focus on Energy	WI	2007-2010	PY1-PY3	PY1 = 0.75 PY2 = 0.67 PY3 = 0.62							PY1 = 0.75 PY2 = 0.67 PY3 = 0.62
Xcel Energy	CO	2008-2009	PY3–PY4	1.0	0.738	0.601	0.54-1.97				1.65
Unspecified mid-Atlantic utility	N/A	2009–2010	PY1–PY2	0.80			0.80				
Unspecified Midwest Utility	MO	2010	PY2	0.96							0.96
Unspecified Southwest utility	N/A	2009–2010	PY1	0.75	0.75						
Unspecified Southwest utility	N/A	2010-2011	PY2	0.79							0.79

* Secondary approach; NTG value not available.

Secondary sources show overall NTG ratios for other upstream residential lighting programs range from 0.47 to 1.0.

When studying these programs to identify NTG ratios most applicable to Pacific Power's program, it is important to note that Pacific Power's evaluated program years (2009 and 2010) represented the second and third years of the program's operation. Newer upstream lighting programs typically have higher NTG ratios than more mature programs. Therefore, Cadmus focused on NTG ratios from comparison programs' typically in their second and third years. Averaging the PY2 and PY3 values from comparison utilities resulted in a 0.81 NTG ratio derived for Pacific Power's upstream residential lighting program.

Lighting Customer WTP (In-Territory Lighting Surveys)

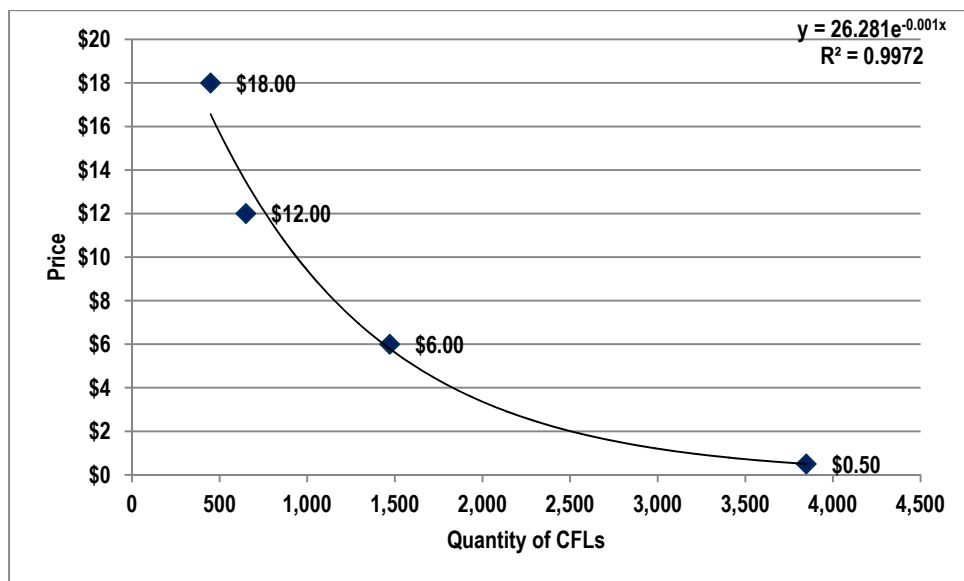
In August 2011, 251 in-territory lighting surveys were conducted, randomly drawn from a Pacific Power list of 10,991 California residential customers. The survey asked respondents a battery of questions designed to determine their WTP for CFLs in the absence of HES Program markdowns. After determining how many CFLs participants purchased in 2009 and 2010, participants were asked:

1. Whether they would generally purchase more CFLs, fewer CFLs, or the same number of CFLs at various un-incented hypothetical price levels.
2. What quantity of CFLs they would hypothetically purchase at various un-incented prices.

Specifically, questions asked respondents to indicate how many lamps they would purchase at four hypothetical per-CFL prices: \$18.00, \$12.00, \$6.00, and \$0.50. One hundred and ninety-one respondents answered for all four price levels.

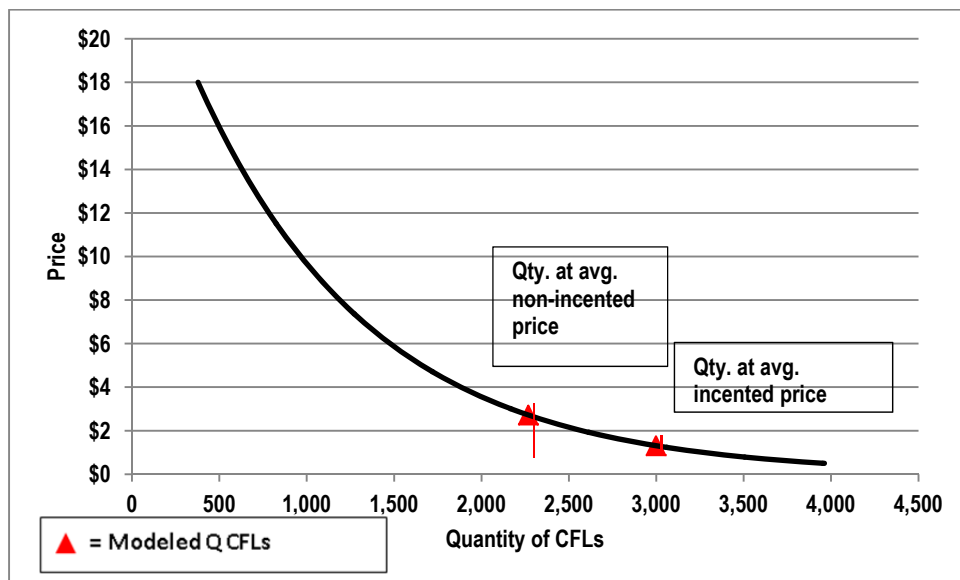
CFL demand was assumed to relate inversely to price, indicating participants would purchase more CFLs at lower prices. To estimate participant willingness to pay for un-incented lamps, we estimated a demand curve for survey participants which related hypothetical prices and quantities. Figure 2 illustrates the program lamp demand function, based on responses from in-territory lighting surveys. The Y-axis shows prices, and the X-axis shows quantities of lamps purchased at each price. The figure also shows an equation describing the relationship between price and quantity.

Figure 2. Demand Schedule for Hypothetical Lamp Purchases



To estimate the number of lamps purchased at the average program price per lamp (net lamps) and the number of lamps purchased without the program incentive (freeridership), estimates addressed the quantities of lamps that would be purchased at the average incented price of \$1.31 and at the average un-incented price of \$2.72. As shown in Figure 3, 2,999 would be purchased at the average incented price of \$1.31, and 2,268 would be purchased at the average un-incented price of \$2.72.

Figure 3. Modeled CFL Quantities for FR Estimation



Lamps to the left of the vertical line from the un-incented price (\$2.72)—in this case 2,268 lamps—represent freerider (FR) lamps, which would have been purchased without the incentive.

Only lamps to the right of this value and to the left of the incited lamp price represent program effects. This results in the following equation for FR:

$$FR = 1 - \frac{(Q_{cfl_{avg_incited}} - Q_{cfl_{avg_unincited}})}{Q_{cfl_{avg_incited}}}$$

Where:

$Q_{cfl_{avg_incited}}$ = 2,999; quantity of CFLs purchased at the average price of incited lamps (\$1.31)

$Q_{cfl_{avg_unincited}}$ = 2,268; quantity of CFLs purchased at the average price of un-incited lamps (\$2.72)

Responses to the in-territory lighting survey produced a 76 percent FR estimate, and, therefore, a 24 percent NTG estimate.

This approach produced the overall program effect minus freeridership, but the approach does not account for potential program spillover; which upstream lighting programs could produce. Upstream programs primarily produce spillover by reducing prices of lamps sold without incentives. CFL incentives' wide availability has reduced the price of un-incited and incited lamps. Thus, the observed un-incited CFL price of \$2.72 runs substantially below recent prices in other markets. For instance, recent research in Maryland indicates an un-incited CFL price of \$4.53. Other research indicates un-incited prices between \$3.37 and \$3.50.

A recent lighting shelf survey of lighting retailers in Maryland indicates un-incited prices as high as \$6.10 per lamp. These higher prices better reflect CFL costs in the absence of program incentives. As the un-incited price estimate rises, the FR rate declines, as fewer lamps would have been purchased in the program's absence. An un-incited lamp at \$3.37 would have an FR rate of 68 percent. A \$4.53 price produces an FR rate of 59 percent. A \$6.10 price per lamp produces an FR rate of 49 percent. Program impacts of un-incited lamps cannot be quantified with the data available, though \$4.00 represents a reasonable value. This cost results in an FR estimated rate from WTP data of 63 percent, for a 0.37 NTG value.

Statistical Significance and Uncertainty

Random digit dial phone surveys avoid bias through the very randomness of the selection process. With every sample, however, random error occurs, reflecting those selected to participate in the study. This is the error due to sampling, for which we can estimate a margin of error within a given degree of confidence. For instance, this study's sample reported a willingness to purchase 1,471 CFLs in aggregate at a price of \$6.00 per CFL.

A 90 percent confidence interval was constructed for random error around the sum of CFLs purchased at each hypothetical price level. Table 33 shows error due to sampling for the sum of purchased CFLs at each price. The estimates' relative precision ranged from 11.2 to 42.3 percent, indicating the NTG estimate from this approach did not have a high degree of stability. However,

a NTG value of 0.25 for the observed prices and 0.40 at the hypothetical \$4.00 spillover price, would be within the 90 percent confidence interval of the observed data.¹⁰

**Table 33. 90 Percent Confidence Interval and Summary Statistics
for the CFL WTP Study (n = 191)**

Price	Sum of CFLs Purchased	Precision at 90% Confidence
\$18.00 per CFL	449	±42.3%
\$12.00 per CFL	650	±20.9%
\$6.00 per CFL	1,471	±16.7%
\$0.50 per CFL	3,848	±11.2%

Source: Questions F1-F6 of the out-of-territory lighting survey.

Random error reported in Table 33 did not include systematic measurement errors associated with this WTP methodology. For instance, if some respondents experienced social pressures to report their CFL purchases, they could report making more purchases at higher prices than they actually would.

NTG Findings

Identifying NTG for the HES lighting program produced three values:

- Retailer/contractor surveys: 0.33
- Secondary literature review: 0.81
- WTP research: 0.37

Each approach faced limitations. Few retailer surveys, for example, were fielded, and respondents had difficulty responding to questions related to NTG, with just more than half providing useful information. The secondary literature review also provided a wide range of estimates, underscoring the inherent difficulty in estimating NTG. WTP research required respondents to answer difficult, hypothetical questions. Again, only 76 percent of respondents provided useful information. Moreover, research from around the country indicates WTP estimates of NTG often run lower than estimates derived from other methodologies.

Given the inherent uncertainty in estimating NTG, an approach triangulating the methods reduces each method's effect of unknown error. In principle, the three estimates could be combined weighted by some measure of each estimate's certainty, such as its variance. This would decrease the retailer survey's power in the overall NTG estimate due to wide disagreement among retailers. As Cadmus could not directly estimate variance for the WTP estimate, it could not be brought into this scheme. In such a case, equal weighting would prove a reasonable approach. Assigning equal weights to each of the three estimates resulted in a blended NTG value of 0.50.

¹⁰ These values were determined by assuming the estimate of quantities purchased at \$6.00 and \$0.50 were off at the limit of the confidence intervals, in opposite directions (i.e., at the lower limit at \$6.00 and at the upper limit at \$0.50). The study then re-estimated NTG for observed and hypothetical unincented prices, based on a curve through these points. This ignored the joint probability of the estimate, being at the limit in opposite directions at both prices, at less than 10 percent; however, this would only bring the limit NTG estimate closer to the mean estimate; so this can be considered a conservative value.

CFL Leakage

Background

Before selecting stores for participation, the program implementer contracted with Buxton, a market research firm, to identify likely CFL customers for retailers within Pacific Power's service area. The program implementer used Buxton's proprietary tool, Micro Analyzer, to identify stores with high proportions of likely CFL purchasers.¹¹ This tool defined profiles for each store, including a drive-time based polygon of likely customers around each retailer and its respective mix of 66 consumer segments. The program implementer then mapped these profiles to the California Pacific Power service areas to determine proportions of likely customers belonging to each area utility. The program implementer targets participant retailers where 90 percent of customers within a 10-minute drive time inside the Pacific Power service territory. The final analysis dataset contained the proportion of likely customers by utility for each retailer in Pacific Power's service area.

Methodology

To quantify impacts of CFL leakage, defined as the proportion of incented CFLs purchased by non-Pacific Power customers, an analysis was conducted using the market research data and primary out-of-territory lighting survey data. Combining market data and sales data received from the program implementer, likely leakage values were estimated by mapping the proportion of total sales by store to the estimated proportion of likely CFL purchasers not served by Pacific Power. Likely leakage by store was then defined as the product of the proportion of total incented CFL sales, and the proportion of non-Pacific Power likely purchasers for each store. That is, for each store, 'i':

$$\begin{aligned} \text{Potential Leakage}_i &= \left(\frac{\text{Incented CFLs}_i}{\sum_i \text{Incented CFLs}_i} \right) \\ & * \left(\frac{\text{Non - Rocky Mountain Power Likely CFL Purchasers}_i}{\text{Likely CFL Purchasers}_i} \right) \end{aligned}$$

Once likely leakage had been calculated for each store, leakage was aggregated to the ZIP code level. For ZIP codes with likely leakage, the out-of-territory lighting survey was conducted: a random digit dial survey of non-Pacific Power customers purchasing CFLs in the past two years. Table 34 summarizes these data.

¹¹ A brief overview of Buxton's database and analytics was found on its Website:
http://www.buxtonco.com/pdf/product/Retail_MKSolutions_brochure.pdf

Table 34. Likely CFL Leakage by Store

Store ID	Percent of Likely Shoppers that Are Pacific Power Customers	Percent of Incented Bulb Sales	Potential Leakage	Potential Leakage with Imputation
852452	100%	47.4%	0.00%	0.00%
163019	Missing	12.1%	N/A	0.00%
191090	Missing	11.6%	N/A	0.00%
746484	Missing	11.1%	N/A	0.00%
170	Missing	4.3%	N/A	0.00%
412	Missing	3.8%	N/A	0.00%
452330	Missing	2.4%	N/A	0.84%
820772	100%	2.2%	0.00%	0.00%
4691	Missing	0.8%	N/A	0.00%
3062	100%	0.7%	0.00%	0.00%
113432	99%	0.6%	0.01%	0.00%
2416	100%	0.5%	0.00%	0.00%
2611	100%	0.5%	0.00%	0.00%
1530	100%	0.5%	0.00%	0.00%
2317	100%	0.5%	0.00%	0.00%
3112	100%	0.5%	0.00%	0.00%
4995	Missing	0.3%	N/A	0.00%
210	Missing	0.1%	N/A	0.00%
10241	Missing	0.1%	N/A	0.00%
2512	Missing	0.1%	N/A	0.00%
Total		100%	0.0%	0.84%

**"Missing" indicates that the Buxton analysis was not run on that particular store

For a small number of participating stores, the Buxton dataset did not contain data on likely customers¹². In these cases, Cadmus used data from stores within the same ZIP code. If there was not data for other store with a matching ZIP code, Cadmus used the proportion of that ZIP code within Pacific Power's service area.¹³ This is reflected in the rightmost column of Table 34 (Potential Leakage with Imputation). This imputation increased the potential leakage from 0.0% to 0.84% (Table 34). Based on Cadmus' imputation, the HES program has potential leakage of 1 percent, well below the program implementer's 10 percent target.

Appliances, HVAC, and Weatherization

As the HES Program contains several measures, this section addresses evaluated gross and net savings estimates for the following:

¹² The implementer has reported that stores without Buxton data have since been removed from the program

¹³ This imputation likely overstates leakage to a degree, as it assumes all customers would be equally distributed across the given ZIP code. Therefore, leakage values should be viewed as conservative estimates.

- Clothes washers;
- Dishwashers;
- Water heaters;
- Refrigerators;
- Refrigerator and freezer recycling;
- Room air conditioners;
- Evaporative coolers;
- Central air conditioning units;
- Heat pumps;
- Duct sealing;
- Fluorescent light fixtures; and
- Ceiling fans.

As these measures greatly differ, Cadmus utilized the most effective evaluation techniques for specific measures incented, as shown in Table 35.

Table 35. Gross Savings Evaluation Methodology, by Measure

Measure	Methodology
Clothes Washers	Engineering Review
Dishwashers	Engineering Review
Water Heaters	Engineering Review
Refrigerators	Engineering Review
Room Air Conditioners	Engineering Review
Ceiling Fans	Engineering Review
Light Fixtures	Engineering Review
Heat Pumps	Engineering Review
CAC/HP Tune-Up	Engineering Review
Duct Sealing	Engineering Review
Ductless Split Heat Pumps	Whole House Model

The following sections discuss each methodology and evaluated savings in depth.

Calculation of Gross Savings

Calculation of gross savings for these measures involved two steps for each measure group: determination of installation rates; and an engineering review or whole house model. Cadmus enhanced the insulation savings estimates through site visits and billing analyses, described in detail below.

Installation Rate

For each measure group, participant telephone surveys asked participants a simple series of questions to determine whether or not they installed incentivized products. For products with multiple measurement units, such as fixtures, participants could be awarded credit for partially

installing incented units. This proved unnecessary as survey results indicated complete installation of each measure surveyed, resulting in 100 percent installation rates. The evaluation assigned low savings measure groups not surveyed (such as duct sealing and permanently installed evaporative coolers) the average installation rate of surveyed measures.

See Ya Later Refrigerator (SYLR) CFL installation rates ran quite high. Participants initially installed, on average, 1.75 of the two bulbs received, resulting in an 87.5 percent installation rate.

Review Tracking Database

Cadmus reviewed the program implementer's lighting and HES participant databases to check for duplicate records and ineligible participants. Table 36 shows the tracking database review's outcome, while Table 37 shows validation of the measure-level tracking database.

Table 36. Tracking Database Review

	Number of Records	Action
Database Records	1,469	
2008 Reporting Year	9	Dropped
Measure Quantity or Total Gross Savings Equals Zero	53	Dropped
Verified Participation	1,407	

Table 37. Measure Level Tracking Database Validation*

Measure	Filed Units	Database Units	Filed Savings (kWh)	Database Savings (kWh)	Explanation
Ceiling Fans	4	4	420	420	
Clothes Washer	746	746	177,111	177,392	Instances where filing incorrectly reflects pre-tariff unit savings. Database is correct.
Dishwasher	147	147	10,907	10,929	Instances where filing incorrectly reflects pre-tariff unit savings. Database is correct.
Electric Water Heater	41	41	6,063	6,063	
Refrigerator	389	389	33,329	35,157	Instances where filing incorrectly reflects pre-tariff unit savings. Database is correct.
Fixtures	36	36	3,312	3,312	
Room AC	10	10	830	830	
CAC Tune up	2	2	164	164	
CAC/HP Tune up	7	7	574	574	
Duct Sealing	3	3	153	153	
Heat Pump Conversion	7	6	25,494	25,494	Duplicate record. Database is correct.
Heat Pump Upgrade	17	15	32,685	32,685	Duplicate records. Database is correct.
Ductless Heat Pump, Single Head	17	16	69,568	69,568	Duplicate record. Database is correct.
Ductless Heat Pump, Multi Head	4	4	24,000	24,000	
Total	1,430	1,426	384,610	386,742	

* Gray shading indicates filed and tracking database units or savings do not match.

Cadmus dropped nine records as they did not belong in the 2009 or 2010 reporting year. Cadmus also dropped 53 records as the measure quantity or total gross savings equaled zero.

As shown in Table 37, Cadmus and the program implementer identified six measures where reported units and/or savings did not match filed numbers. For clothes washers, dishwashers, and refrigerators, the program implementer found records where pre-April 2010 tariff per unit savings had been incorrectly applied. For heat pump conversion, heat pump upgrade, and single head ductless heat pumps, the program implementer identified instances where contractor applications had been incorrectly counted.

Cadmus also reviewed the program implementer's tracking of 2009 and 2010 upstream lighting measures. As shown in Table 38, the total number of CFLs in the program implementer's database exceeded the filing's quantity by 3,752 bulbs.

Table 38. Lighting Database Review

Measure	Filed Units	Database Units	Difference
CFL (bulbs)	54,630	58,382	3,752

To calculate evaluated gross and net savings, Cadmus used measure quantities that could be verified with documentation, either through a database or an invoice

Engineering Review—Appliances

The engineering review used data from the participant phone surveys and secondary data to evaluate gross savings for clothes washers, refrigerators, dishwashers, ceiling fans, and light fixtures. As shown in Table 39, realization rates ranged between 29 percent and 377 percent. Appendix J provides a more detailed analysis.

Table 39. Engineering Review Summary—Appliances

Year	Measure	Standard	Gross Reported Savings (kWh/unit)	Gross Evaluated Savings (kWh/unit)	Realization Rate
2009–April 11, 2010	Clothes Washers	Clothes Washer–Tier One (1.72 – 1.99 MEF)	276	225	82%
	Clothes Washers	Clothes Washer–Tier Two (2.0 + MEF)	293	393	134%
April 12–December 31, 2010	Clothes Washers	Clothes Washer–Tier One (2.0–2.19 MEF)	115	434	377%
	Clothes Washers	Clothes Washer–Tier Two (2.2–2.45 MEF)	160	376	235%
	Clothes Washers	Clothes Washer–Tier Three (2.46 + MEF)	184	304	165%
2009–April 11, 2010	Refrigerator	ENERGY STAR Refrigerator	58	65.5	113%
April 12–December 31, 2010	Refrigerator	ENERGY STAR Refrigerator	141	65.5	46%
2009–2010	Dishwasher	ENERGY STAR Dishwasher (weighted average)	74	37	50%
2009–2010	Ceiling Fans	Ceiling Fans	105	31	29%
2009–2010	Fixtures	Fixtures	92	50	54%

Engineering Review—Systems

The engineering review used data from the participant phone surveys and secondary data to evaluate gross savings for water heating and HVAC related measures. As shown in Table 40, realization rates ranged between 19 percent and 2,710 percent. Appendix J provides a more detailed analysis.

Table 40. Engineering Review Summary—Systems

Year	Measure	Baseline	Gross Reported Savings (kWh/unit)	Gross Evaluated Savings (kWh/unit)	Realization Rate
2009–2010	Water Heaters	Federal Standard	125–179	149	
	Heat Pump Water Heaters	Federal Standard	125	903	722%
2009–2010	Heat Pump System Conversion	Electric Furnace	4,249	3,840	90%
2009–2010	Heat Pump Upgrade	HSPF 7.7	2,179	422	19%
2009–2010	Heat Pump Tune-Up	Operating Heat Pump System	266	266	100%
2009–2010	CAC Tune-Up	Operating CAC System	27	27	100%
2009–2010	Room AC New Purchase	Standard Efficiency Room AC	83	83	100%
2009–2010	Duct Sealing	Leaky Ducts, per RTF definition	51	1,382	2,710%

Whole-House Energy Modeling

Ductless Split Heat Pumps

Cadmus modified whole-house simulation models developed by the implementer to match the average participant record for the two ductless, split heat pump measure categories—single head and multi-head—and to match input assumptions used by the Regional Technical Forum for heat pump measure analysis. Final input adjustments were performed to calibrate savings to evaluated gross savings for a whole-house air source heat pump conversion. As shown in Table 41, the two measures had realization rates of 21 and 66 percent. Appendix J provides a more detailed analysis.

Table 41. Evaluated Gross Savings, Ductless Split Heat Pumps

Measure	Reported Savings (kWh/year)	Evaluated Gross Savings, (kWh/year)	Realization Rate
Single-head ductless heat pump	4,348	923	21%
Multi-head ductless heat pump	6,000	3,935	66%

Net Savings Approach

Cadmus implemented a NTG methodology addressing the HES Program in 2009 and 2010. Freeridership and spillover comprised NTG's two components. Freeriders—customers who would have purchased a measure without a program's influence—reduced savings attributable to Pacific Power's programs. Spillover—additional savings obtained by the customer's decision to invest in additional efficiency measures or activities due to their program participation—

increased savings attributable to the program, and improved program cost-effectiveness. The following formula provided final NTG ratios for each program category:

$$\text{Net-to-gross ratio} = (1 - \text{Freeridership}) + \text{Spillover}$$

The freeridership component drew from a previously developed approach, which ascertained freeridership using patterns or responses of a series of six simple questions. The questions—allowing “yes,” “no,” or “don’t know” responses—asked whether participants would have installed the same equipment in the program’s absence, at the same time, at the same amount, and at the same efficiency. Question response patterns were assigned freerider scores, and the confidence and precision estimates were calculated on score distributions.¹⁴

Cadmus estimated participant spillover by estimating: savings attributable to additional measures installed; and whether respondents credited Pacific Power with influencing their decisions. Measures counted if eligible for program incentives, but incentives were not requested. NTG ratios then accounted for freeridership and spillover.

Appendix C provides a detailed explanation of Cadmus’ NTG methodology, including:

- A description of how Cadmus categorized Pacific Power’s HES Program into similar measures;
- An explanation of survey designs; and
- Descriptions of Cadmus’ freeridership and spillover evaluation methodologies.

It also provides:

- Full-text versions of NTG survey questions administered to participants;
- The freeridership scoring matrix, showing all possible combinations of responses to the freeridership survey questions; and
- Scores Cadmus assigned each combination.

Though this methodology could be used for evaluating NTG for appliances, HVAC, and lighting fixtures, it did not apply for CFLs, insulation, or windows. As the HES Program incented CFLs at the retailer level, participants did not know they participated in a program or purchased an incented CFL. Therefore, estimating freeridership and spillover by surveying participants did not provide a viable option. To determine the CFL NTG estimate, Cadmus triangulated results of the participant retailer surveys, the customer’s willingness to pay for analysis, and the secondary data review. Insulation billing analysis results included effects from freeridership and spillover due to the methodology’s nature. Specifically, as participant billing data were compared with nonparticipants’, the resulting estimates included what would happen in the program’s absence. As the billing analysis results were used for both insulation and windows savings estimates, additional NTG ratios were not applied to those measures.

¹⁴ This approach follows methods outlined in: Schiller, Steven et. al. “National Action Plan for Energy Efficiency.” Model Energy Efficiency Program Impact Evaluation Guide. 2007. www.epa.gov/eeactionplan.

Summary of Results

Table 42 summarizes HES Program freeridership, spillover, and NTG percentages for appliances and HVAC. Appendix C explains in detail why measures were separated into categories for NTG analysis.

Table 42. HES NTG Ratio

Program Category	Responses (N)	FR %	Spillover %	NTG Ratio	Precision at 90% Confidence
Appliances/HVAC	172	43%	25%	82%	±16.4%

Participants purchasing appliances and HVAC measures indicated an 82 percent NTG ratio, meaning 82 percent of gross savings for appliance and HVAC measures could be attributed to the HES Program.

Freeridership Analysis

After conducting participant surveys, Cadmus converted resulting responses into a freeridership score for each participant, using the Excel-based matrix approach described in Appendix C's freeridership methodology section. Each participant's freerider score derived from translating responses into a matrix value, and then using a rules-based calculation to obtain the final score.

Table 43 shows freeridership estimation results for appliance and HVAC measures. Sections following the table discuss in-depth freeridership analysis by measure category.

Table 43. HES Freeridership Results By Measure

Program Category	n	Freeridership Score	Precision at 90% Confidence
Clothes Washer	78	45%	± 0.05
Dishwasher	20	44%	± 0.11
Fixture	2	100%	± 0.00
Single-Head Ductless Heat Pump	3	0%	± 0.00
Multi-Head Ductless Heat Pump	1	50%	NA
Heat Pump System Conversion	1	50%	NA
Heat Pump Upgrade	4	50%	± 0.26
Room AC New Purchase	1	25%	NA
Electric Water Heater	5	50%	± 0.35
Ceiling Fans	1	0%	NA
Refrigerator	56	40%	± 0.07
<i>Appliances/HVAC</i>	<i>172</i>	<i>43%</i>	<i>± 0.04</i>

The 11 measures grouped together had a 43 percent overall freeridership score, with an absolute precision of 4 percentage points. Table 44 shows unique response combinations resulting from the HES appliance and HVAC measures participant survey, freeridership scores assigned to each combination, and numbers of responses for each combination. As the table indicates, participant responses tend to group around subsets of common response patterns.

Table 44. Frequency of Freeridership Scoring Combinations—HES Appliances and HVAC

Already planning to purchase?	Already purchased or installed?	Installed same measure without incentive?	Installed something without incentive?	Installed same efficiency?	Installed same quantity?	Installed at the same time?	Would not have installed measure?	Installed lower efficiency?	Installed lower quantity?	Installed at the same time?	Freeridership Score	Response Frequency
Yes	No	Yes	x	Yes	Partial	Yes	x	x	x	x	50%	64
Yes	Yes	x	x	x	x	x	x	x	x	x	100%	24
Yes	No	Yes	x	Yes	Partial	Partial	x	x	x	x	25%	18
No	No	Yes	x	Yes	Partial	Yes	x	x	x	x	25%	17
No	No	Yes	x	Yes	Partial	Partial	x	x	x	x	13%	11
No	Yes	x	x	x	x	x	x	x	x	x	100%	5
Yes	No	No	Yes	No	Partial	Yes	x	x	x	x	0%	3
Yes	No	Yes	x	No	Partial	Yes	x	x	x	x	0%	3
No	No	No	No	x	x	x	Yes	x	x	x	0%	3
Yes	No	No	Yes	Yes	Partial	Partial	x	x	x	x	25%	3
Yes	No	No	No	x	x	x	Yes	x	x	x	0%	3
Yes	No	Yes	x	Yes	Partial	No	x	x	x	x	0%	2
No	No	No	Yes	Partial	Partial	No	x	x	x	x	0%	2
No	No	Yes	x	No	Partial	Partial	x	x	x	x	0%	2
Yes	No	No	No	x	x	x	No	No	Partial	Yes	25%	2
Yes	No	No	Yes	Yes	Partial	Yes	x	x	x	x	50%	2
Yes	No	Yes	x	No	Partial	Partial	x	x	x	x	0%	2
Yes	No	Yes	x	Partial	Partial	Yes	x	x	x	x	25%	1
No	No	Yes	x	Yes	Partial	No	x	x	x	x	0%	1
Yes	No	No	No	x	x	x	No	Yes	Partial	Yes	0%	1
No	No	Yes	x	Partial	Partial	Yes	x	x	x	x	13%	1
No	No	Yes	x	Partial	Partial	Partial	x	x	x	x	0%	1
Yes	No	No	Yes	Yes	Partial	No	x	x	x	x	0%	1

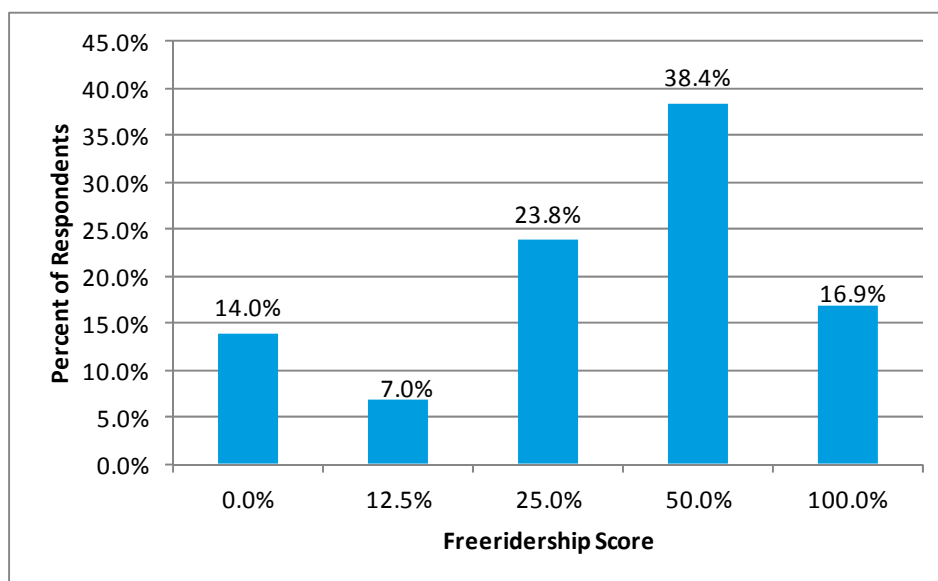
Four common patterns appeared in respondents' answers to freeridership questions, representing 72 percent (123 out of the 172) of total appliance participants interviewed:

- Sixty-four respondents planned to purchase measures before hearing about incentives. They indicated they would have purchased a measure of the same efficiency at the same time without the incentive, but, as they had not already purchased the measure when hearing about the incentive, they were considered 50 percent freeriders.
- Twenty-four respondents had already purchased the measure when they heard about the incentive, and therefore were considered 100 percent freeriders.

- Eighteen respondents planned to purchase measures before hearing about incentives. They indicated they would have purchased a measure of the same efficiency, but they would have purchased the measure later the same year and not at the same time. Due to the uncertainty regarding when they would have purchased the measure the same year, they were considered 25 percent freeriders.

Seventeen respondents said they had not already purchased nor were planning to purchase the measure when they heard about the incentive. However, they were scored as 25 percent freeriders, as they said they would have purchased the same measure at the same time without the incentive, and it would have been just as energy efficient. Freeridership for appliance and HVAC participants can also be examined by looking at the respondents' distribution by the freeridership score each one has been assigned. Figure 4 shows freeridership score distributions for appliances and HVAC participants.

Figure 4. Distribution of Freeridership Scores—HES Appliances



Approximately 14 percent of respondents installing appliances showed no freeridership. Conversely, over 55 percent of respondents installing an appliance were defined as 50 or 100 percent freeriders.

The investigation asked respondents to explain, in their own words, the HES incentive's influences on their decisions to purchase the equipment. A few responses follow below for those scoring as 100 percent freeriders (measures indicated in parentheses):

- *"It came after the fact so it did not influence my decision to buy it." (Refrigerator)*
- *"No, didn't have any. I bought the one I wanted." (Clothes Washer)*
- *"Didn't have any. Was going to purchase anyway." (Dishwasher)*
- *"It really didn't have any influence, we were going to get one anyway." (Dishwasher)*
- *"My old one blew up so I needed a new one." (Electric Water Heater)*

Spillover Analysis

This section presents a detailed analysis of additional, energy-efficient measures customers installed after participating in the HES Program. While many participants subsequently installed more energy-efficient measures after receiving incentives from Pacific Power, the analysis indicated only 17 percent of additional purchases were reported as significantly influenced by HES Program participation; therefore, the 83 percent not significantly influenced could not be considered spillover. Additionally, some participants significantly influenced by the HES Program applied for incentives for additional measures they installed, and could not be included in the spillover analysis.

As detailed in Appendix C's spillover methodology section, Cadmus used adjusted savings values from the deemed savings analysis to estimate spillover measure savings.

Cadmus estimated the spillover percentage for a program category by dividing the sum of additional spillover savings, reported by participants for a given program category, by total incentivized gross savings achieved by all respondents in the program category.

Table 45 shows spillover analysis results for all HES appliance and HVAC measures.

Table 45. HES Spillover Savings Analysis

Program Category	Spillover Savings (kWh)	Participant Program Savings (kWh)	Spillover %
Appliances/HVAC	11,928	47,575	25.1%

Though indicating higher potential spillover savings, most residential participants installing additional energy-efficient equipment reported the HES Program did not greatly influence their purchasing decisions. Further, some applied for incentives for additional measures purchased.

Table 46 summarizes numbers of participants excluded from the spillover analysis due to receiving incentives.

Table 46. Effects of Program Influence and Incentives on HES Spillover

Program Category	Spillover Measures Installed Attributable to High Program Influence	Spillover Measures Installed Not Receiving Incentive
Appliances/HVAC	26	19

Overall, surveyed HES Program participants highly influenced by the HES Program installed 26 additional measures. Participants received incentives for seven of these measures, leaving 19 measures qualifying for spillover savings. Table 47 displays 19 additional measures installed by HES appliance, and HVAC participants qualifying as spillover. Of this 19, insulation installed outside the HES Program accounted for the largest proportion of spillover savings (54 percent).

Table 47. HES Appliances Spillover Measures

Spillover Measure Installed	Quantity	Per Unit Electric Savings (kWh)	Total Savings (kWh)
Ceiling Fans	1	31	31
CFLs	5	26	130
Dishwasher	1	37	37
Electric Water Heater	1	277	277
Fixture	2	50	100
Heat Pumps	1	3840	3840
Insulation	4	1624	6496
Refrigerator	2	66	131
Windows	2	443	886

NTG Findings

NTG analysis results showed predictable trends. Appliance and HVAC participants showed freeridership levels consistent with Cadmus’ previous estimates in previous years for Pacific Power (and with similar programs and measures at other utilities). The HES Program evidences a significant amount of participant spillover, which develops slowly, depending on increased familiarity with energy efficiency and experiences with program-incented measures. Because customers interviewed in 2011 participated in the HES Program during the 2009 and 2010 program years, adequate time had elapsed following program participation to yield purchases potentially qualifying as HES Program spillover. If Pacific Power interviewed 2011 HES Program participants about the program’s influence on their additional energy-efficiency purchases, lower spillover estimation levels would likely emerge.

Freeridership is More than a Ratio

Response distributions used for estimating average freeridership ratios contain information that can help program managers more effectively manage their programs. In reviewing these distributions, two notable issues emerged.

First, it appears HES Program’s appliance components could become more efficient through tightened eligibility requirements or different marketing. This survey asked respondents whether they had installed equipment *before* hearing about the HES incentive, with the 29 answering “yes” classified as freeriders. As shown in Table 48, removing the “already installed” responses from analysis significantly lowered the freerider ratio for appliances, falling from 43 percent to 30 percent.

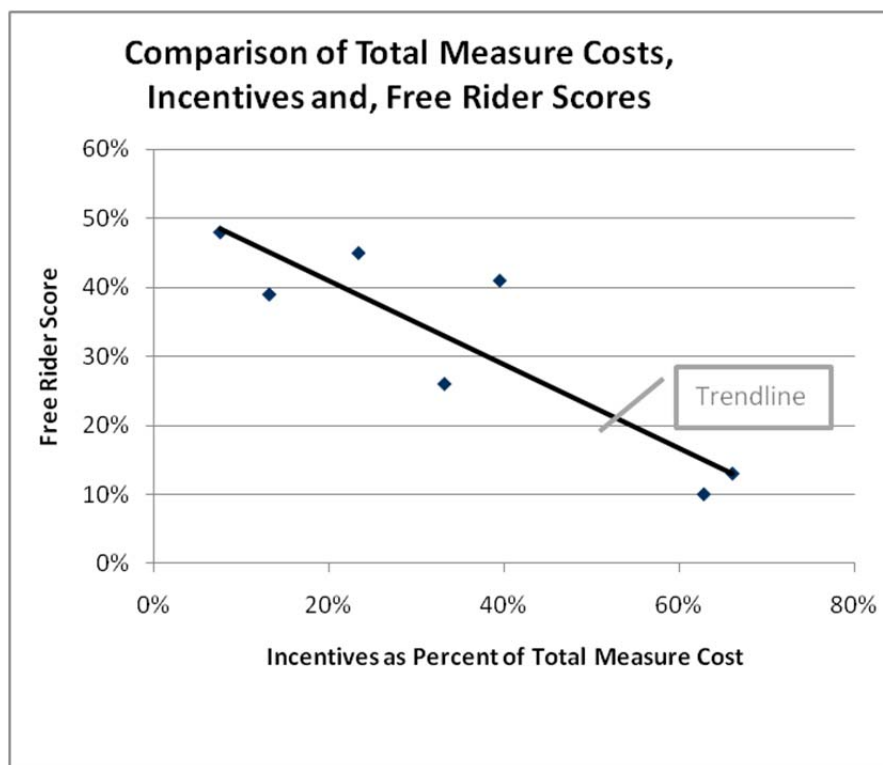
Table 48. Effect on Freeridership of Removing “Already Installed” Responses

Program Category	With “Already Installed”		Without “Already Installed”	
	Responses	Freeridership Score	Responses	Freeridership Score
Appliances/HVAC	172	43%	143	30%

The appliance measures' high freeridership levels may relate to a relationship between an appliance's retail cost and the incentive's size. A recent study Cadmus conducted for a Pacific Northwest utility tested the hypothesis that incentive levels affect freeridership. The study graphed the proportion of total measure costs covered by the incentive with the freeridership ratio found in the analysis.

As shown in Figure 5, a strong inverse relationship occurred between the proportion of the total measure cost covered by the incentive and the freeridership ratio. The graph's upper left side represents residential appliances, which typically offer small incentives relative to appliance costs. Where incentive amounts do not affect purchasing decisions, high freeridership can be expected. The trend line's right-hand end represents nonresidential prescriptive and grocer programs, which evidence low freeridership rates and incentives covering 60 percent of total costs, per program records.

Figure 5. Proportion of Measure Cost Incented and Freeridership Ratio



Refrigerator and Freezer Recycling

This section summarizes the approach used to determine gross and net savings for refrigerator and freezer recycling. Appendices G provides details on both impact and process evaluations for refrigerator and freezer recycling.

Evaluated Gross Savings Approach

Regression Analysis

Cadmus developed a multivariate regression model to estimate gross unit energy consumption (UEC) for retired refrigerators and freezers. Cadmus estimated model coefficients using an aggregated *in situ* metering¹⁵ dataset, composed of over 400 appliances, metered as part of four California and Michigan evaluations conducted between May 2009 and April 2011.¹⁶ Collectively, these evaluations offered a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions. The dataset's diverse nature provided an effective secondary data source for estimating energy savings when California-specific metering could not be conducted.

Cadmus used regression models to estimate consumption for refrigerators (Table 49) and freezers (Table 50). Each independent variable's coefficient indicated that variable's influence on daily consumption, holding all other variables constant. A positive coefficient indicated an upward influence on consumption; a negative coefficient indicated a downward effect.

**Table 49. Refrigerator UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, $R^2 = 0.26$)**

Independent Variables	Coefficient	p-Value	VIF
Intercept	0.662	0.001	0.0
Age (years)	0.005	0.169	2.1
Dummy: Manufactured Pre-1980	1.372	<.0001	2.8
Dummy: Manufactured in 1980s	0.960	<.0001	4.7
Dummy: Manufactured in 1990s	0.199	0.042	4.8
Size (ft. ³)	0.081	<.0001	1.9
Dummy: Single Door	-1.172	<.0001	1.3
Dummy: Side-by-Side	0.823	<.0001	1.6
Dummy: Primary	0.633	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.031	<.0001	1.2

¹⁵ *In situ* metering involves metering units in the environment where they are typically used. This contrasts with lab testing, where units are metered under controlled conditions.

¹⁶ Southern California Edison, Pacific Gas & Electric, San Diego Gas & Electric, DTE Energy, and Consumers Energy.

**Table 50. Freezer UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, $R^2 = 0.36$)**

Independent Variables	Coefficient	p-Value	VIF
Intercept	-0.590	0.003	0.0
Age (years)	0.040	<.0001	1.9
Dummy: Unit Manufactured Pre-1990	0.566	<.0001	2.1
Size (ft. ³)	0.109	<.0001	1.2
Dummy: Chest Freezer	-0.265	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.059	<.0001	1.1

After estimating the final regression models, Cadmus analyzed the corresponding characteristics (the independent variables) for participating appliances (as captured in the program administrator program database). Table 51 summarizes program averages or proportions for each independent variable.

Table 51. 2009–2010 Participant Mean Explanatory Variables*

Appliance	Independent Variables	Participant Population Mean Value
Refrigerator	Age (years)	25.29
	Dummy: Manufactured Pre-1980	0.29
	Dummy: Manufactured in 1980s	0.37
	Dummy: Manufactured in 1990s	0.29
	Size (ft. ³)	17.62
	Dummy: Single Door	0.10
	Dummy: Side-by-Side	0.13
	Dummy: Primary	0.53
Interaction: Unconditioned Space x CDDs	0.28	
Freezer	Age (years)	30.54
	Dummy: Unit Manufactured Pre-1990	0.85
	Size (ft. ³)	17.11
	Dummy: Chest Freezer	0.21
	Interaction: Unconditioned Space x CDDs	0.59

*CDDs are the weighted average CDDs from TMY3 data for weather stations mapped to participating appliance ZIP codes. TMY3 is a typical meteorological year, using median daily values for a variety of weather data collected from 1991–2005.

For example, using values from Table 49 and Table 50, the estimated annual UEC for freezers was calculated as:¹⁷

$$\begin{aligned}
 \text{Freezer UEC} &= 365 \text{ days} \\
 &\quad * (-0.590 + 0.040 * [30.54 \text{ years old}] + 0.566 \\
 &\quad * [85\% \text{ units manufactured pre - 1990}] + 0.109 * [17.11 \text{ ft.}^3] - 0.265 \\
 &\quad * [21\% \text{ units that are chest freezers}] + 0.059 \\
 &\quad * [0.59 \text{ unconditioned CDDs}] \approx 1,056 \text{ kWh}
 \end{aligned}$$

Kit Savings

Table 52 shows final inputs and gross savings estimated for CFLs distributed in the SYLR energy-saving kits.

Table 52. SYLR Unadjusted Energy-Saving Kit CFL Savings (Not Including Adjustment for In-Service Rate)

Incandescent Watts	CFL Watts	HOU	Installation Rate	Annual Unadjusted Gross Savings(kWh per bulb)	Annual Unadjusted Gross Savings (kWh per kit)
60	13	1.96	0.87	33.6	67.3

UEC Summary

Table 53 presents evaluated per-unit average annual energy consumption for refrigerators and freezers recycled by the HES during the 2009–2010 program period. The following section describes adjustments to these estimates used to determine gross per-unit saving estimates for participant refrigerators and freezers. The results indicated an evaluated freezer value 534 kWh lower than the reported value, with refrigerators values 80 kWh higher.

Table 53. Estimates of Per-Unit Annual Energy Consumption

Appliance	Reported Annual UEC (kWh/year)	Evaluated Annual UEC (kWh/year)	Relative Precision(90% Confidence)
Refrigerators	1,149	1,229	±3.3%
Freezers	1,590	1,056	±4.1%
Energy Savings Kits	81	67	±11.1%

¹⁷ This equation illustrates the inputs, but Cadmus' analysis took a slightly different approach to calculating average UECs. The analysis used the regression coefficients to predict an average daily UEC for each unit in the implementer tracking database. The annualized average of these predictions represented the average UEC for the participant population during program period. This approach ensured the resulting UEC would be based on specific units recycled through Pacific Power's program. The two approaches would be mathematically identical if the tracking database was 100 percent complete. Due to rare instances of missing data, results of the two approaches differ very slightly.

Appliance Part-Use Factor

SYLR Participants used some refrigerators and freezers recycled through the program for part of the year. Cadmus calculated a weighted average part-use factor, representing the three participant usage categories, as defined by the appliance's operational status during the year before it was recycled. For example, participants not using their appliance at all received a part-use factor of zero, as no immediate savings were generated by their appliance's retirement

Table 54 shows participants using their appliances part of the year had average part-use factors of 0.40 for refrigerators and 0.34 for freezers. Thus, the average freezer recycler, using a freezer for part of the year, used it for approximately 4.1 months.

Table 54. Part-Use Factors and Evaluated Energy Savings by Appliance Type

Operational Status	Refrigerators			Freezers		
	Percent of Total Recycled Refrigerator	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)	Percent of Total Recycled Freezers	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)
Not Running	7%	0	0	11%	0	0
Running Part Time	13%	0.40	495	11%	0.34	361
Running All Time	79%	1.00	1,229	79%	1.00	1,056
<i>Total</i>	<i>100%</i>	<i>0.85</i>	<i>1,039</i>	<i>100%</i>	<i>0.82</i>	<i>869</i>

"Not Running" refers to units that were simply not plugged in, as inoperable units were excluded from the program.

Evaluated Gross Savings

Table 55 provides estimates of per-unit evaluated gross energy savings. Cadmus determined estimated energy consumption of units through the *in situ* metering study, adjusting it by part-use factors determined from the participant survey.

Table 55. Part-Use Adjusted Per-Unit Evaluated Gross Energy Savings by Measure

Appliance	Gross Energy Savings (kWh/Year)	Relative Precision(90% Confidence)
Refrigerators	1,039	±8.5%
Freezers	869	±9.7%
Energy-Saving Kits	59	±11.1%

Net Savings Approach

Freeridership

Assessing freeridership for appliance recycling programs can be challenging, as the programs not only seek to remove inefficient appliances from the customers' homes, but seek to remove them from the utility grid. Thus, freeridership must be estimated based on participants' reports of what would have happened to the appliance in the program's absence. This invites the risk of biased responses from participants, as participants must assess what they would have done hypothetically. Such assessments very often suffer from social desirability bias, which results

from the respondents' tendency to answer questions in a manner that will be viewed favorably by others. To counteract this potential bias, Cadmus collected additional data from nonparticipants¹⁸ about how they actually disposed of their appliances. Table 56 presents four possible scenarios, assuming participating refrigerators or freezers had not been recycled through the program. As Scenarios 1 and 3 indicate freeridership, the report addresses those scenarios in further detail.

Table 56. Potential Freeridership Scenarios

Scenarios Independent of Program	Scenario	Indicative of Freeridership	Percent of Refrigerator Participants (n=51)	Percent of Freezer Participants (n=39)
Unit Kept But Not Used	1	Yes	2%	0%
Unit Kept And Used	2	No	24%	26%
Unit Discarded and Destroyed	3	Yes	35%	38%
Unit Discarded, Transferred, Used	4	No	39%	36%

The outlined freeridership calculations yielded the appliance-specific freeridership ratios presented in Table 57.

Table 57. Participant and Nonparticipant Freeridership Responses

Respondent Group	Measure Stratum	Respondents being factored into Freerider Score*	Identified # of Freeriders	Freerider Ratio	Absolute Precision at 90% Confidence**
Participant	Refrigerator	52	20	38%	±10.2%
Participant	Freezer	40	16	40%	±10.1%
Nonparticipant	Refrigerator	43	16	37%	±12.4%
Nonparticipant	Freezer	10	2	20%	±23.2%

* The number of respondents factored into the freerider score differs from total number of participants and nonparticipants surveyed, because some respondents gave a response of "Don't know" to one or more essential questions.

**For ease of interpretation, this report uses absolute precision for proportion estimates.

Cadmus averaged freeridership ratio estimates for participating and nonparticipating appliances to arrive at final, measure-level freeridership ratios. Calculating the average using inverse variance weights ensured placing greater weight on values with a higher degree of certainty.

Table 58. SYLR Freeridership Ratios

Participants/Nonparticipants Combined	FR Ratio Weighted Average	Absolute Precision at 90% Confidence
Refrigerator	38%	±8.2%
Freezer	35%	±11.0%
Combined	37%	±7.1%

¹⁸ Nonparticipants were defined as Pacific Power customers disposing of a working refrigerator or freezer outside of the HES program during 2009 or 2010.

Spillover

Table 59 summarizes participant spillover responses. Appliance per-unit savings were derived from 2009 and 2010 gross evaluated values from the rebate program. Cadmus assumed CFL savings equaled those calculated for energy-efficiency kits. Total spillover savings represented 1.51 percent of total program savings.

Table 59. SYLR Spillover Results

Sample Spillover kWh	Sample SYLR kWh	Spillover Ratio	Absolute Precision (90% Confidence)
1, 668	110,453	1.51%	±0.96%

Final Net-to-Gross

As summarized in Table 60, the evaluation determined final net savings (and, subsequently, the NTG ratio) as gross savings, adjusted for freeridership and spillover, less induced replacement consumption.

Table 60. Final SYLR NTG Ratios

Participants/Nonparticipants Combined	FR Ratio	Spillover Ratio	NTG Ratio	Absolute Precision (90% Confidence)
Refrigerator	37.9%	1.51%	63.6%	±8.3%
Freezer	34.5%		67.0%	±11.1%

Process Evaluation Findings

This section provides detailed process evaluation findings for the HES Program. Findings resulted from Cadmus' data collection activities, including retailer/contractor surveys, program staff and market actor interviews, participant surveys, and secondary research.

Program Implementation and Delivery

Program Status

The HES Program provided cash incentives to residential customers for purchases of energy-efficient products, home improvements, and heating and cooling equipment and services. In California, the HES Program also included an appliance recycling component. Appendix L provides detailed findings from Cadmus' evaluation of the SYLR Program. According to implementation staff, the HES Program offered an à la carte energy-efficiency program, allowing customers to install multiple measures to create customized efficiency portfolios. HES Program operations "allow customers to pick what they need and apply for an incentive." Accessible to all customers (even those who are not homeowners), the HES Program provided energy-saving opportunities for Pacific Power's entire customer community. According to the program implementer, due to poor forecasting, the California HES Program did not meet its goals for the 2009 and 2010 program years.

Delivery Structure and Processes

The program implementer delivered the HES Program. For most qualifying program measures, customers received incentives through a mail-in process. However, because the HES Program's lighting component uses an upstream mechanism, the program implementer paid incentives directly to manufacturers of qualifying light bulbs. Local retailers and contractors supported the program by: upselling their customers to higher-efficiency equipment measures; installing equipment and service measures; and promoting available incentives. As part of the HES Program, Pacific Power also offered incentives to contractors for quality installation, sizing, and tune-ups of qualified HVAC measures.

According to implementer staff, the program implementer primarily used an allocation system to target lighting retailers. For each retail partner location, program implementer staff analyzed the customer base, assigning stores an allocation ranking, determined by the percentage of Pacific Power customers in that location. Targeted potential participating retailers needed a Pacific Power customer base of 90 percent or higher. The allocation ranking sought to minimize leakage of incented bulbs to customers outside Pacific Power's service territory.

Program stakeholders noted program implementer staff working on Pacific Power's HES Programs originally had not been assigned to specific states; rather, implementation staff constantly focused on all five states' programs. In 2010, the program implementer began assigning staff to specific service territories, with state management positions created to streamline the program's implementation within each individual state. Additionally, the program implementer created a two-channel structure to better manage relationships with participating retailers and contractors (trade allies) in each state. Implementer staff divided into two channels that focused entirely on either retailers or contractors. These teams were assigned a channel

manager who was responsible for all relationships and activities tied to their respective delivery channel.

The contractor channel is segmented, based on types of contractors working with the HES Program. Table 61 defines different types of contractors participating in the program, and the requirements for each category.

Table 61. Types of HES Contractors

Contractor Type	Participation	Requirements	Incentive
Participating weatherization contractor	Install eligible weatherization measures	Must attend program training and meet Pacific Power's installation quality standards	Access to program promotional materials
Nonparticipating weatherization contractor	Install eligible weatherization measures	Must meet Pacific Power's installation quality standards	N/A
Participating HVAC contractor	Sell qualified HVAC products to customers, but do not install the purchased measures	Meet standard participation requirements (these are outlined in the text list below)	N/A
Qualified HVAC contractor	Offer installation services to customers in addition to selling qualified HVAC measures	Must successfully complete program approved training in addition to meeting the standard participation requirements (outlined in list below)	Eligible for program dealer incentives

In addition, all HVAC contractors are held to the following participation requirements:

- Read and agree to abide by terms outlined in the Contractor Program Manual;
- Submit a completed participation agreement;
- Submit a completed W-9 form;
- Hold a valid state business and contractor license;
- Hold general liability insurance and worker's compensation in amounts required by the state;
- Supply three satisfactory customer references and three satisfactory trade references to the program;
- Have no unresolved claims with the Better Business Bureau; and
- Agree to participate in the program's quality control process.

In California, select HVAC measures qualified for split incentives, with split incentives paid to both installation contractors and customers. The contractor could receive a portion (no more than half) of the incentive for installing the measure, and the customer received the remaining portion upon installing qualifying measures.

As noted in the Evaluated Gross and Net Savings Methodology, Cadmus conducted telephone surveys with retailers and contractors as well as appliance, HVAC, and lighting customers. For the process evaluation, Cadmus will refer to these groups as shown in Table 62, below:

Table 62. Survey Respondents Reference Guide

Respondent Type	Reference
Participant Retailer/Contractor Survey respondents	Trade allies
Participant Retailer/Contractor Survey respondents who indicated they sold lighting products	Lighting retailers
Participant Telephone Survey respondents	Appliance and HVAC participants
In-territory Lighting Survey respondents	Lighting customers

Tariff Approach

A tariff represents the rules of engagement for a conservation program. Tariffs are very detailed, specifying:

- Exactly which measures are offered;
- Eligibility specifications for each measure; incentives offered; and
- The market eligible to participate.

These strict guidelines must be adhered to during the time frame established by the tariff.

In 2010, Pacific Power changed its tariff approach. Rather than filing a tariff with specific qualifications listed for each measure, revised language allowed specifications to flexibly align with ever-changing ENERGY STAR specifications. This allowed implementer staff to change qualifications for eligible measures without making formal tariff changes every time ENERGY STAR specifications changed (at times, a time consuming process).

This proactive tariff approach allowed program staff to take advantage of increasing federal efficiency standards without having to refile measure specifications with each technology improvement. According to implementer staff, the change has succeeded for the HES program, allowing program stakeholders to anticipate and adjust to changes.

Implementation

According to program staff, California’s unique retail structure presented a large implementation obstacle. Pacific Power’s California territory has a much smaller national retailer presence than Pacific Power’s other service territories; so local retailers played a larger role in California’s HES Program. In states with more prevalent national retailers, program staff noted the program implementer only had to contact one representative at a retail chain’s corporate office, and the corporate representative communicated with all of the chain’s locations within Pacific Power’s service territory. In California, however, none of the trade allies surveyed learned of the program through a corporate office (see Figure 11, below).

The contractor channel in California also proved to be an obstacle for implementer staff. There were very few contractors in the territory, and none of them provided specialized services. This made it difficult for implementer staff to recruit contractors by demonstrating the program could create a competitive edge for their businesses, as they did not face competition in the market. Contractors were not motivated to participate in the program; so implementer staff spent additional time building relationships with contractors, training them on participation’s benefits.

California also face a specific barrier in its geographically dispersed population in Pacific Power's territory. The program implementer's field staff drove many miles between the territory's main population centers, making in-person meetings and training with contractors time-consuming and expensive, although, according to program stakeholders, such meetings proved essential for building relationships with local retailers and contractors.

Additionally, Pacific Power's has a very small territory in California; and its target market is rural, with limited income. Program staff estimated 80 percent of Pacific Power customers in California lived at or below the poverty level.

These barriers led Pacific Power and the program implementer to realize they had to increase field staff to raise their local presence and delivery capacity in California. The program implementer added locally based staff to increase program outreach to individual retailers. The program implementer's field staff visits retailers regularly, recruiting new participants, and expanding relationships with participating trade allies.

Given California's lack of a deep national chain presence and its widely distributed population centers, the program implementer required greater time and budget for field staff to visit individual stores to promote the HES Program. Program and implementer staff quickly realized this proved crucial in addressing California's unique market barriers and ensuring the program's success.

Energy Independence and Security Act

EISA, an omnibus energy policy law requiring 25 percent greater efficiency for light bulbs, with new standards phased in from 2012 through 2014,¹⁹ effectively phases out 100-, 75-, 60-, and 40-watt incandescent light bulbs currently in the market. In 2007, California's government passed the Huffman Bill which mandated reducing lighting energy usage in indoor residences and state facilities by no less than 50 percent by 2018, and requires a 25 percent reduction in commercial facilities' usage.²⁰ To achieve these efficiency levels, incandescent bulbs were already being phased out in California during the 2009–2010 HES program year, consequently phasing out the previous lighting savings baseline in the DSM market.

Program staff noted Pacific Power has been working to diversify its lighting portfolio in response to EISA legislation and the Huffman Bill, offering program incentives for all energy-efficient lighting options, including an expanded selection of specialty CFLs. Program staff have also planned to move away from the Database for Energy Efficiency Resources (DEER) savings assumptions they have used in the past, as these have not been updated to account for the Huffman Bill. Starting in 2012, the lighting savings for the HES program in California will be based on the regional technical forum (RTF), as in other Pacific Power territories.

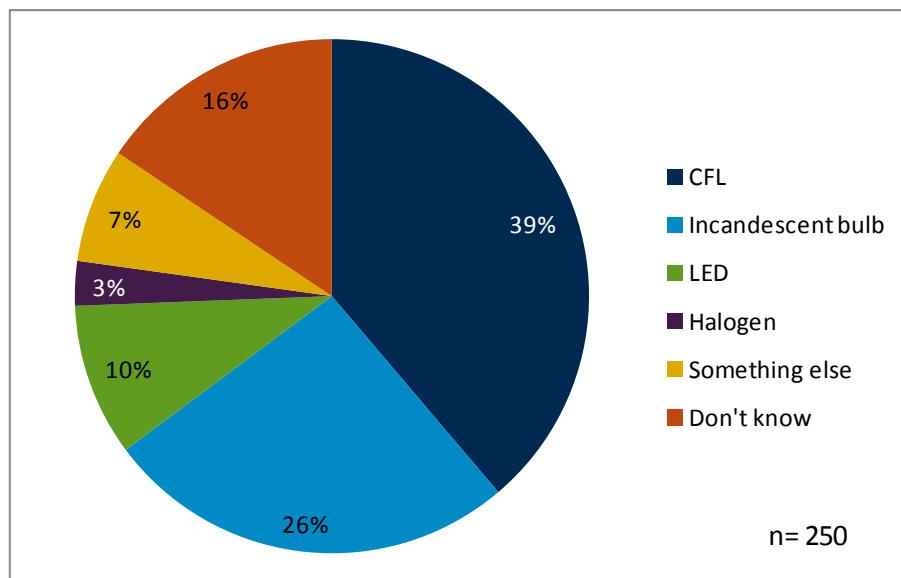
In-territory lighting survey responses indicated lighting customers preferred CFLs to other energy-efficient lighting options. When presented with a choice of purchasing a more efficient incandescent bulb or a CFL, LED, or halogen bulb, 39 percent of lighting customers chose CFLs. Figure 6 illustrates the full distribution of choices lighting customers made regarding energy-

¹⁹ <http://www.epa.gov/cfl/>

²⁰ http://www.cawrecycles.org/issues/current_legislation/ab1109_07

efficient lighting technologies. “Something else” responses included: “the most efficient,” “depending on what I use it for,” and “the cheapest one.”

Figure 6. Energy-Efficient Technologies Lighting Customers are Most Likely to Purchase*



Pacific Power CA HES Residential Lighting Survey Question J2.
*“Refused” responses were removed.

*EISA Awareness*²¹

Per participant retailer/contractor surveys, six of seven lighting retailers knew of EISA legislation. Of the six, almost all (83 percent) indicated having changed their stocking practices to prepare for EISA, including phasing out incandescent inventories, and increasing stocks of energy-efficient bulbs. Two retailers noted they did this under direction from their corporate offices. Two-thirds (67 percent) of lighting retailers familiar with EISA indicated they planned to educate customers about the new requirements using marketing materials, such as in-store displays, brochures, and flyers.

Forty-five percent of surveyed lighting customers knew of impending EISA changes (per the in-territory lighting survey). Among lighting retailers familiar with EISA, half (50 percent) reported customers not liking the upcoming changes. Another 33 percent indicated customer feedback had been mixed, and mentioned customers’ dislike of energy-efficient bulbs in general and the bulbs’ mercury content.

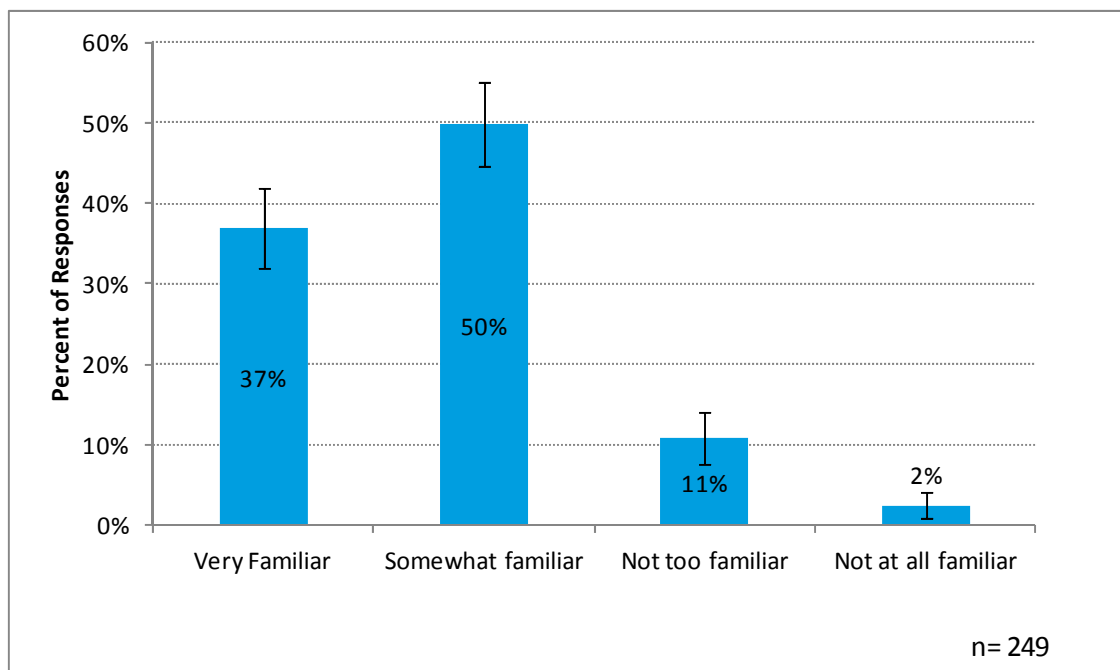
Familiarity with Energy-Efficient Lighting Options

Of 251 in-territory lighting customers responding to familiarity questions, 85 percent recognized the terms “compact fluorescent bulb” or “CFL” before hearing a description of the bulb’s twisted

²¹ Trade allies were asked a battery of questions pertaining to EISA legislation as part of the participant retailer/contractor survey effort. Responses to EISA questions may be skewed due to lighting efficiency standards already in place in California. Confusion may also arise between EISA and the Huffman Bill already enacted. Please read more about the Huffman Bill in “Energy Independence and Security Act” Section.

shape. Surveyed lighting customers primarily reported being “somewhat familiar” with CFLs (50 percent). Figure 7 illustrates familiarity with CFLs reported by surveyed lighting customers.

**Figure 7. Familiarity of CFLs Among Lighting Customers*
(with 90% Confidence Intervals)****



Pacific Power CA HES Residential Light Survey Question C3.

* “Don’t know” responses removed from this figure.

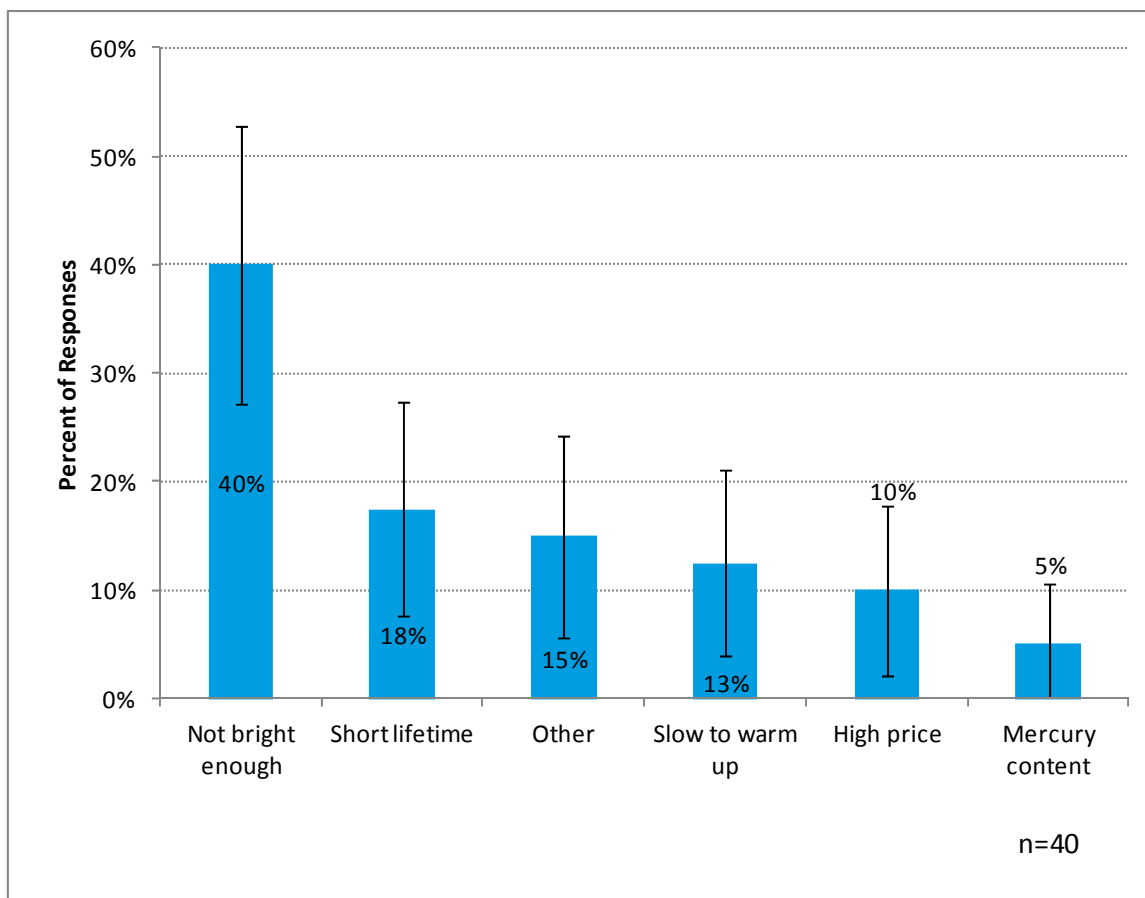
**Nearly all reported values fell within a ± 10 percent interval with 90 percent confidence. To ensure an apparent uncertainty level for this analysis, the report provides confidence intervals (represented by the black line) around summary results, where appropriate. Appendix C provides a more detailed discussion of this methodology.

More than half of lighting customers (59 percent) knew of LED bulbs, though only 7 percent actually purchased LEDs for standard lighting sockets in 2009 and 2010. Seventy-eight percent of lighting customers reported replacing incandescent bulbs in their homes with CFLs. Participating retailers recognized customers’ awareness of CFL bulbs: one third (33 percent) of retailers selling light bulbs in addition to other energy-efficient products reported customers most commonly knew of standard CFLs, and were likely to purchase them without requiring additional advertising.

CFL Concerns

Although lighting customers and retailers reported a high awareness of CFLs, Cadmus’ lighting survey indicated lighting customers expressed concern about CFL lighting quality and performance. As shown in Figure 8, when unsatisfied lighting customers were asked why they were “not very satisfied” or “not at all satisfied” with CFLs in their homes, 40 percent stated the bulbs were not bright enough.

**Figure 8. Reasons Lighting Customers are Dissatisfied with CFLs
(with 90% Confidence Intervals)**



Pacific Power CA HES Residential Lighting Survey Question G3.

Cadmus' in-territory lighting survey also found lighting customers did not utilize proper disposal methods for CFLs. Of lighting customers having a CFL burn out in their home within the past 12 months, 65 percent threw the bulb in the trash. Only 29 percent recycled the bulb appropriately. Further, lighting customers did not utilize online educational material; only three surveyed lighting customers reporting visiting the Pacific Power CFL disposal Webpage to learn about proper CFL disposal.

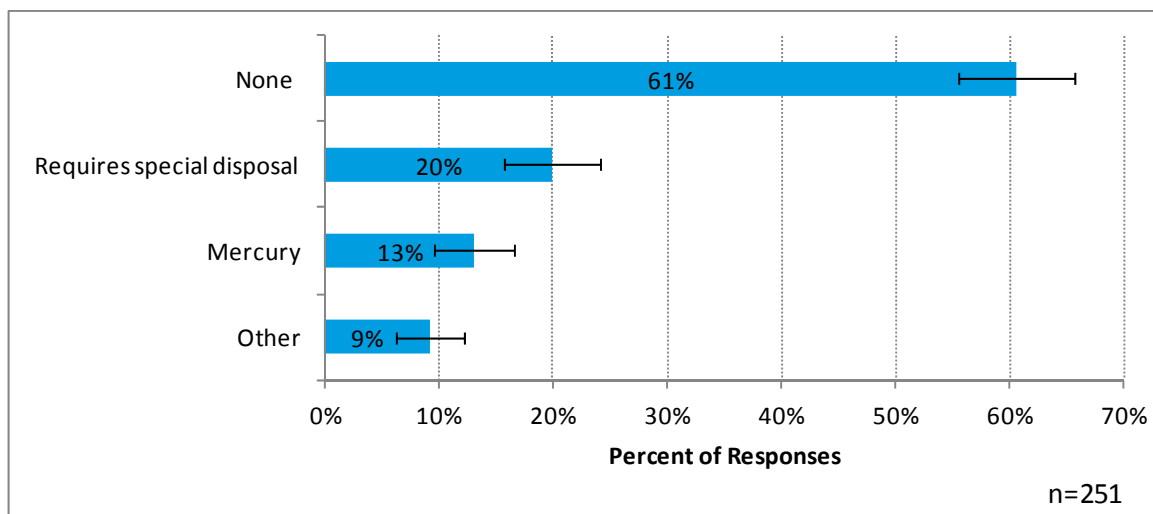
Sixty-one percent²² of lighting customers did not express concerns about CFL disposal; however, of customers reporting having concerns, 20 percent²³ mentioned special disposal requirements, and another 13 percent²⁴ mentioned mercury content. Figure 9 illustrates the distribution of lighting customers' disposal concerns.

²² Multiple responses allowed.

²³ Multiple responses allowed.

²⁴ Multiple responses allowed.

**Figure 9. Concerns with CFL Disposal among Lighting Customers
(with 90% Confidence Intervals)**



Pacific Power CA HES Residential Lighting Survey Question K6.

Marketing

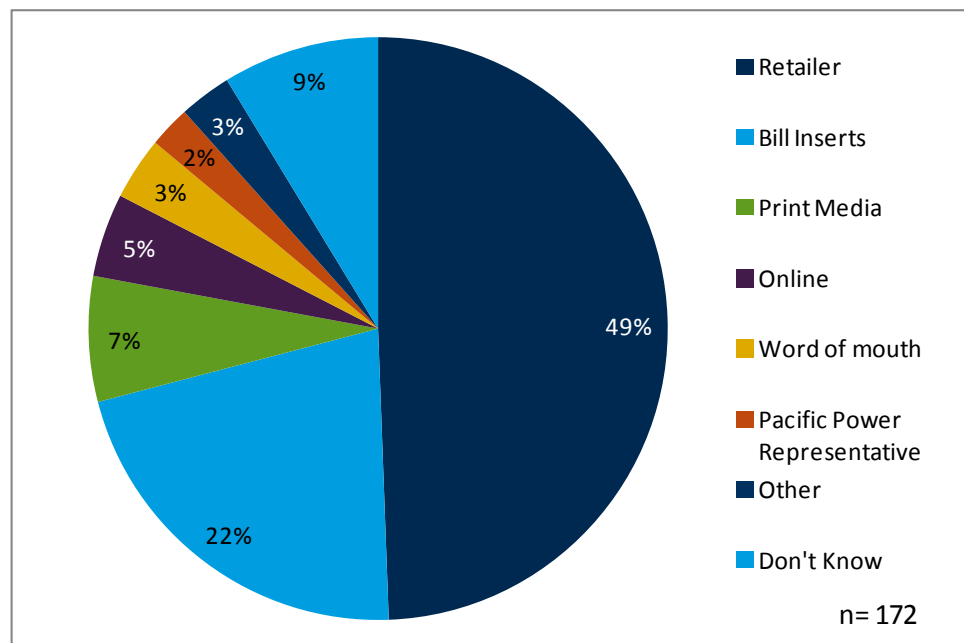
Approach

Program marketing materials initially drew on the HES Program materials from other territories. Implementer staff, quickly realizing custom marketing messages might prove more effective, developed key messages to resonate with local customers in various territories. The tone, language, and colors of marketing materials adopted a California focus. Implementer staff estimated the multi-purchase HES Program customer market in all five states increased by 50 percent from 2008 to 2009, and another 30 percent from 2009 to 2010, due to this marketing change.

Pacific Power and the program implementer created and distributed program marketing materials using bill inserts, radio ads, print ads, newspaper ads, and other print media. The program implementer provided point-of-purchase displays, aisle violators, incentive applications, brochures, Pacific Power-branded CFL price tags, and cling-on advertisements (product clings), aiding the program's trade allies in promoting the program.

Effectiveness

According to surveyed appliance and HVAC participants, retailers provided the most effective program promotion avenue. Almost half of appliance and HVAC participants (49 percent) first heard about the HES Program through retailers. As shown in Figure 10, customers reported bill inserts (22 percent) and print media (7 percent) as other common sources of program awareness.

Figure 10. How Appliance and HVAC Participants First Heard About the Program

Pacific Power CA HES Participant Telephone Survey Question M1

The majority (83 percent) of surveyed lighting retailers (and 73 percent of trade allies overall) mentioned receiving point-of-purchase marketing materials from program staff, including: applications to hand out to customers, posters, product clings, lists of qualified products, and end caps. One lighting retailer even noted receiving a scanning bar, which allowed incentive processing at check-out rather than requiring a customer to send in an incentive form. This retailer predicted the “new scanning bar will result in [a] huge jump [in] sales” and noted this suggestion had been put forth by the retailer itself, and then implemented by HES program staff. Despite lighting retailers’ reported use of point-of-purchase materials to garner program participation, only 14 percent of lighting customers knew Pacific Power discounted CFLs through the HES Program.

Surveys found participants rarely accessed HES Program information online: only 12 percent of appliance and HVAC participants and 6 percent of lighting customers had visited the HES Website.

Trade Ally and Market Partner Promotion

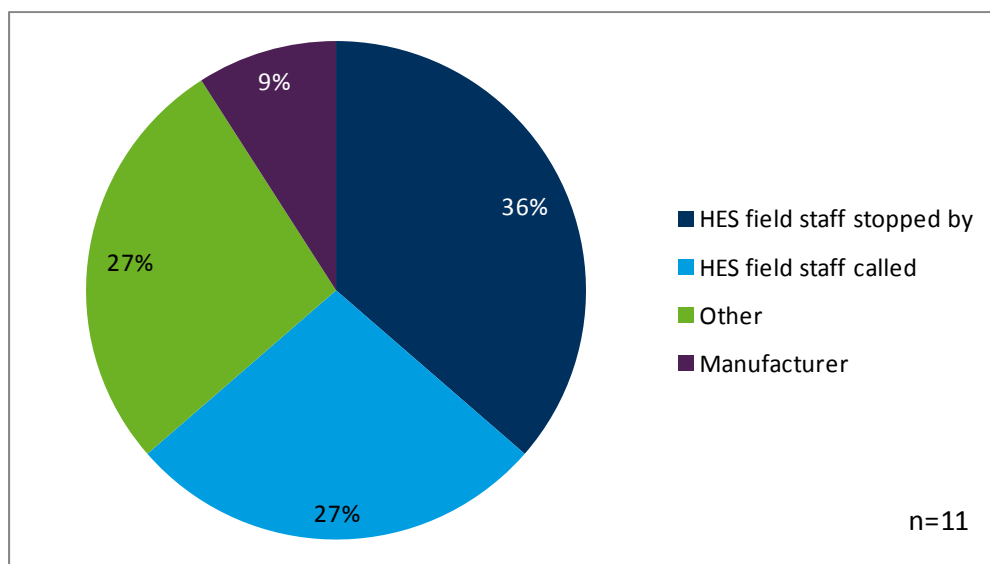
According to program stakeholders, trade allies proved key to creating program awareness among customers. The program implementer worked directly with retailers and contractors to make sure they knew of the program and its incentives, providing them with promotional materials. Retailers and contractors, in turn, promoted the program to customers to increase sales of high-efficiency equipment and products.

Because California’s retail structure relied heavily on local retailers, implementer staff shifted their outreach focus from national retail chains to smaller, independent retailers. According to the implementer, retailer staff served as a key source of information for customers. The program implementer specifically pointed to independent retailers as the reason the HES program

achieved its savings, noting, independent retailers allowed implementer staff to train store employees on how to explain the program at the customer level. In addition, independent retailers allowed implementer staff to hold contests to motivate sales associates to sell more energy-efficient products and to generate participation; national chains do not allow such activities due to corporate policies.

Participant retailer/contractor surveys indicated 63 percent of trade allies learned of the HES Program through calls or visits from HES field staff. Further, of 10 retailers reporting interactions with HES staff, eight found HES field staff “very helpful” at addressing their needs. Trade allies reported learning of the program through the methods illustrated in Figure 11.

Figure 11. How Trade Allies Learned About the HES Program



Pacific Power CA HES Retailer Participant Survey Question C1.

More than half of surveyed trade allies (55 percent)²⁵ cited product clings and posters as the most effective marketing materials. Other materials deemed effective included end caps and direct mail. Two retailers cited speaking directly with customers as the most effective marketing tactic.

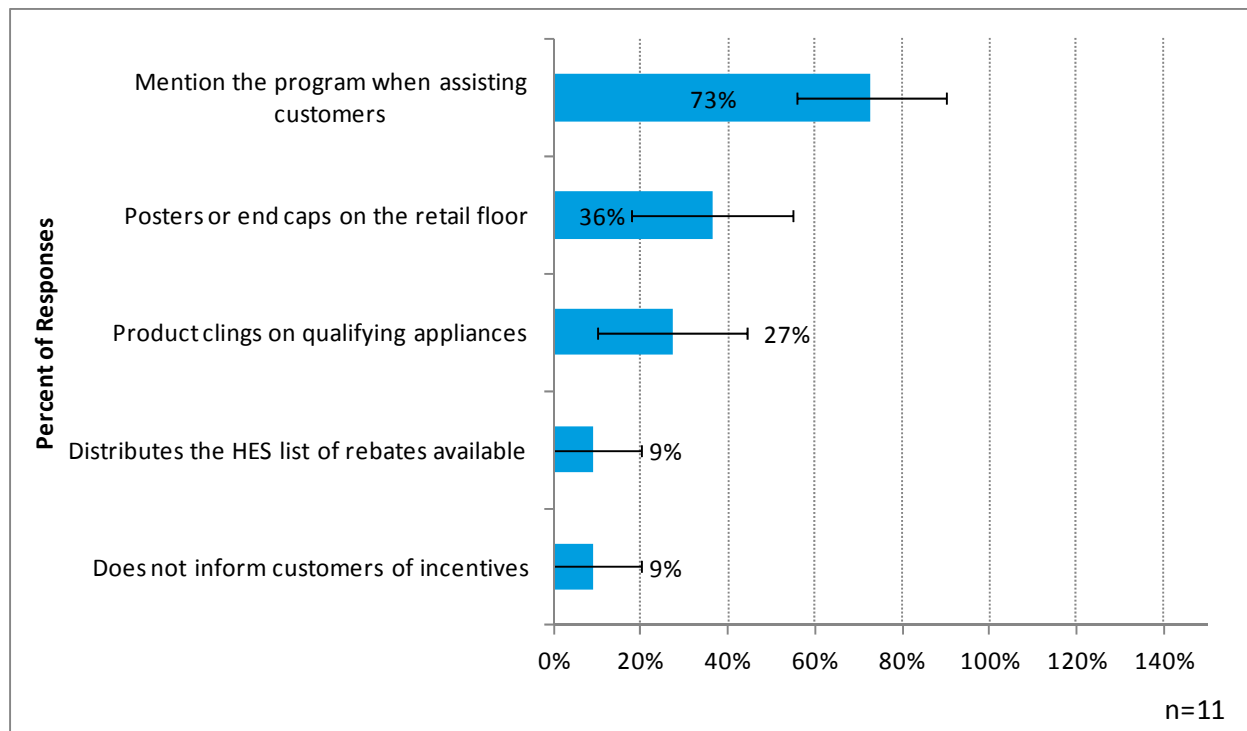
While almost three-quarters of trade allies (73 percent)²⁶ surveyed reported mentioning the program when assisting customers, they found the promotional materials provided by Pacific Power useful in reinforcing their messages. Sixty-four percent²⁷ of trade allies cited posters on the retail floor and product clings on qualifying appliances as their primary means of informing customers about available incentives. Other reported methods included providing customers with lists of available HES incentives and setting up end caps. Figure 12 depicts the ways trade allies informed customers of available incentives for energy-efficient products.

²⁵ Multiple responses allowed.

²⁶ Multiple responses allowed.

²⁷ Multiple responses allowed.

Figure 12. Trade Allies' Methods of Informing Customers of Incentives Available for Qualifying Energy-Efficient Products (with 90% Confidence Intervals)



Pacific Power CA HES Retailer Participant Survey Question E1.

Materials Review

Cadmus review of program promotional material for HES produced the following high-level findings:

- ***Pacific Power uses a well-constructed HES strategic marketing plan:*** The 2010 plan includes best practice tactics, providing the appropriate media ranges and retail channels to drive participation.
- ***WattSmart branding allows greater flexibility:*** The global WattSmart brand provides opportunities for cross-marketing between and within HES programs, and for greater customer awareness.
- ***California territory characteristics make HES program marketing more challenging:*** The California territory includes low-density customer and unspecialized contractor populations. Each of these factors results in a higher costs per contact to promote HES.
- ***HES Program marketing collateral presents a consistent look and feel:*** Point-of-purchase, bill inserts, and other collateral consistently include uncluttered and clear designs, bold colors, and large typefaces.
- ***HES Program marketing collateral provides consistent messaging:*** Marketing content for retailers and end-user customers includes basic calls-to-action and motivating

messages, helping all stakeholders choose program measures and easily share information with friends, family, and colleagues.

- ***Strong relationships drive retail-level and contractor marketing support:*** The program implementer trains retail and contractor allies to promote multiple measures during HES participation.
- ***Online marketing information, as described by program staff, does not include state segmented messaging:*** HES program information online is the same for every state.
- ***The Website does not offer marketing collateral materials available for download:*** The marketing plan includes creating this resource, but it is not immediately accessible via clear navigation.
- ***Marketing metrics and tracking appear unavailable:*** Source code tracking tactics identified in the marketing plan, along with associated results, were not available for review.

Table 63 and Table 64 compare elements in the current HES marketing plan to best practice elements in energy-efficiency program marketing. Findings indicate Pacific Power currently utilizes a significant majority of best practice marketing channels (Table 63), and the program Website largely uses common efficiency program online marketing best practices.

Table 63. HES Program Use of Best Practice Marketing Channels

Best Practice Marketing Channels	HES
Direct Mail	√
Newspaper Ads /articles	√
Radio/TV Ads	√
Online Advertising	√
Website	√
Customer Information Sheets	√
Contractor Information Sheets	√
Telemarketing	
Bill Inserts	√
Brochures	√
Newsletters	√
Presentations/Meetings	√
Events	√
Referrals	√
Point of Purchase	√
Branded Promo Items	√
Tests/Demonstrations	√
Social Media Outreach *	Generally Via Pacific Power

*Social media (e.g., Twitter, Flickr, YouTube, Facebook) offers channels for utilities to connect with customers. Most utilities leverage one or more social media platform(s) in their communication efforts.

Table 64. HES Program Use of Website Best Practices

Website Best Practice Element	HES
Program highlighted on Pacific Power home page	Yes
Number of Clicks from Pacific Power home page	2 or 3
Description leads with benefits (i.e., What's in it for the participant?)	WattSmart Programs and Incentives or Save Energy
Message consistency from Pacific Power home to subpage	Yes
Clear call to action	Strong and active
Many access points	Yes
Contact capture	No
Description of each individual program offered	Yes
Participant eligibility requirements	Yes
Contractor participation and eligibility requirements	Available via phone inquiry
Contractor Listing	Yes
Contractor Search Engine	No
Online Contractor Application Process	No
Downloadable Incentive Forms	Yes
Online Incentive Application Process	No
Downloadable program information in print format for contractors to share with customers	No
HES Social Media elements included (e.g. Facebook, Twitter, etc.)	No

Quality Assurance

The program implementer conducted on-site quality control (QC) inspections on 5 percent of all HVAC installations, ensuring “service measure” installations were conducted to HES Program standards. The pass rates for these inspections served as a component in determining the program’s overall effectiveness. However, conducting these inspections proved costly in a territory such as California’s. In territories with dispersed population centers and less volume, it has not been cost-effective for implementers to have staff ready for QC at all times. Implementer staff recognized it was not cost-effective to maintain staff inspectors in every state; though they questioned, without doing so, how to conduct QC inspections within 45 days of the equipment’s installation.

The program implementer also performed quality inspections at all participating retail locations. The program implementer’s quality assurance (QA) protocol, held participating retailers responsible for correctly displaying all provided promotional materials. The program implementer visited each store to ensure marketing materials were up to date, took pictures of all displayed promotions, and confirmed appropriate marketing materials were on display. The program implementer also checked prices and Pacific Power’s logo were correctly displayed, and verified products on display are actual qualified measures.

In 2010, the quality control process for verifying program data changed. Implementer staff began using a business rules engine to validate program data (in the past, data entry staff had conducted visual checks). As data came in through incentive applications, implementer staff entered data into a tracking system. The business rules engine then verified all data entered were consistent

those eligible for incentives. If data fell outside tariff parameters, the application was rejected. Most commonly, data were rejected if information was missing or the application data did not meet incentive qualifications.

Implementer staff estimated 20 percent of the business engines' rejections resulted from missing information. Implementer staff tried to resolve these rejections by redesigning the incentive applications. If information was missing, the implementer sent the customer a letter, explaining the missing material. If there no response arrived within two weeks, another letter was sent. If there no response followed the second letter, a third and final attempt for resolution was to send the application back to the customer with an explanation of information missing. Implementer staff approximated 70 percent of missing information issues were resolved after the first letter, and 95 percent were resolved after the second letter. An additional 3 percent of missing information issues were resolved after the third attempt for resolution from implementer staff.

If measure data specified on an application did not qualify for an incentive, implementer staff sent a letter to the customer, explaining specific reasons their applications were not approved for an incentive, and offered solutions regarding how the customer could quickly resolve the issue.

Pacific Power's call center handled customer complaints, with call center agents attempting to resolve issues on the first call. If customers had more serious complaints, the call agent contacted program managers at Pacific Power or the program implementer. The agent directed all customer complaint correspondence to Pacific Power's regulatory group for recording. The program implementer program staff personally called customers to resolve their issues. Customer complaints regarding participating trade allies were taken very seriously. If several customers complained about a trade ally, the program implementer informed Pacific Power, which usually removed the retailer or contractor as a promotional partner. In extreme cases, Pacific Power may take legal action against the trade ally in question.

A customer may also complain to the public utilities commission. In such cases, Pacific Power took a more formal approach. The program implementer provided all customer correspondence data to Pacific Power's regulatory group. Correspondence data included any e-mails, phone conversations, meeting dates, and meeting summaries involving any party in the complaint. Pacific Power's regulatory group then coordinated the customer complaint with the commission until the issue could be fully resolved.

Customer Response

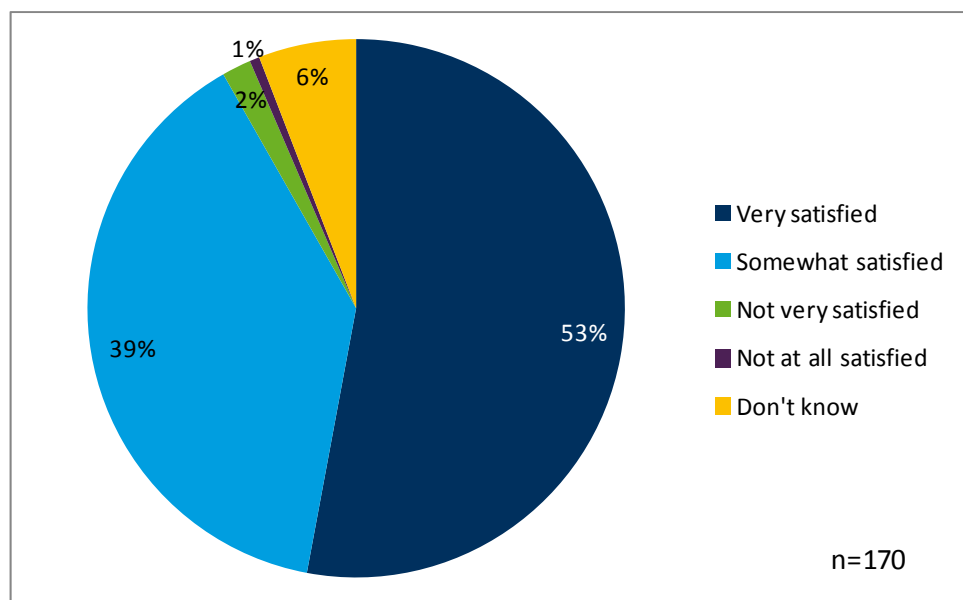
Satisfaction

Appliance and HVAC participants expressed strong satisfaction with incentive timing and amounts (as drawn from participant telephone surveys). Thirty-nine percent of appliance and HVAC participants received incentive payments within four to six weeks of submitting their incentive applications, and an additional 22 percent received payments in less than four weeks. At the same time, almost one-quarter (23 percent) of appliance and HVAC participants said they did not know how long it took to get their incentive checks. Among the group that could estimate the period, almost all (95 percent) reported satisfaction with time required to get their incentive checks in the mail. Overall, 94 percent expressed some level of satisfaction with the incentive amounts, with 61 percent "very" satisfied and 33 percent "somewhat" satisfied.

Customers also expressed strong satisfaction with measures purchased through the HES Program. Ninety-eight percent of appliance and HVAC participants reported being “very” (83 percent) or “somewhat” (15 percent) satisfied with measures they purchased through the HES Program. Eighty-two percent of lighting customers were “very” (47 percent) or “somewhat” (35 percent) satisfied with CFLs currently installed in their homes. Eighty-eight percent of lighting customers were “very” (44 percent) or “somewhat” (44 percent) satisfied with LED bulbs they purchased in 2009 and 2010.

As shown in Figure 13, 92 percent of appliance and HVAC participants were “very” (53 percent) or “somewhat” (39 percent) satisfied with their overall HES Program experience.

Figure 13. Appliance and HVAC Participant Satisfaction with HES Incentive Program*



Pacific Power CA HES Participant Telephone Survey Question F9

*Refused responses were removed.

Cadmus compared the California HES Program’s overall satisfaction rating to appliance and HVAC customer satisfaction of the HES program and similar programs in other service territories. As shown in Table 65, satisfaction results generally ran high for prescriptive rebate programs. All programs compared, including California’s, reported satisfaction between 80% to 100%, with California’s HES program at the midrange of satisfaction levels.

Table 65. Benchmarking of Satisfaction Results

Program	Overall Satisfaction (%)
California HES	92%
Idaho HES	94%
Utah HES	94%
Washington HES	93%
A Northwest Utility Rebate Program	97%
A Northwest Utility Rebate Program	84%
A Midwest Utility Rebate Program	98%

Barriers

Perceptions Regarding Energy Efficiency

During management staff and partner interviews, HES program staff felt a poor economy, coupled with a lack of general knowledge regarding energy efficiency in Pacific Power's California territory, presented participation barriers for the program. While implementer staff cited California's general sense of energy efficiency as better than in other territories, a lack of knowledge continued in the market.

Surveyed trade allies' opinions split regarding whether energy efficiency offered a useful tactic to promote their businesses; just over half of trade allies (55 percent) reported they used the availability of high-efficiency products to attract customers to their business.

Fifty-six percent of retailers who sold energy-efficient products beyond just lighting reported they believed customers were least aware of energy-efficient appliances, such as dishwashers, refrigerators, freezers, and washing machines. Two of these retailers suggested implementing increased advertising to promote these technologies, and another specifically said it might help to inform customers how much more energy old appliances used compared to energy-efficient ones.

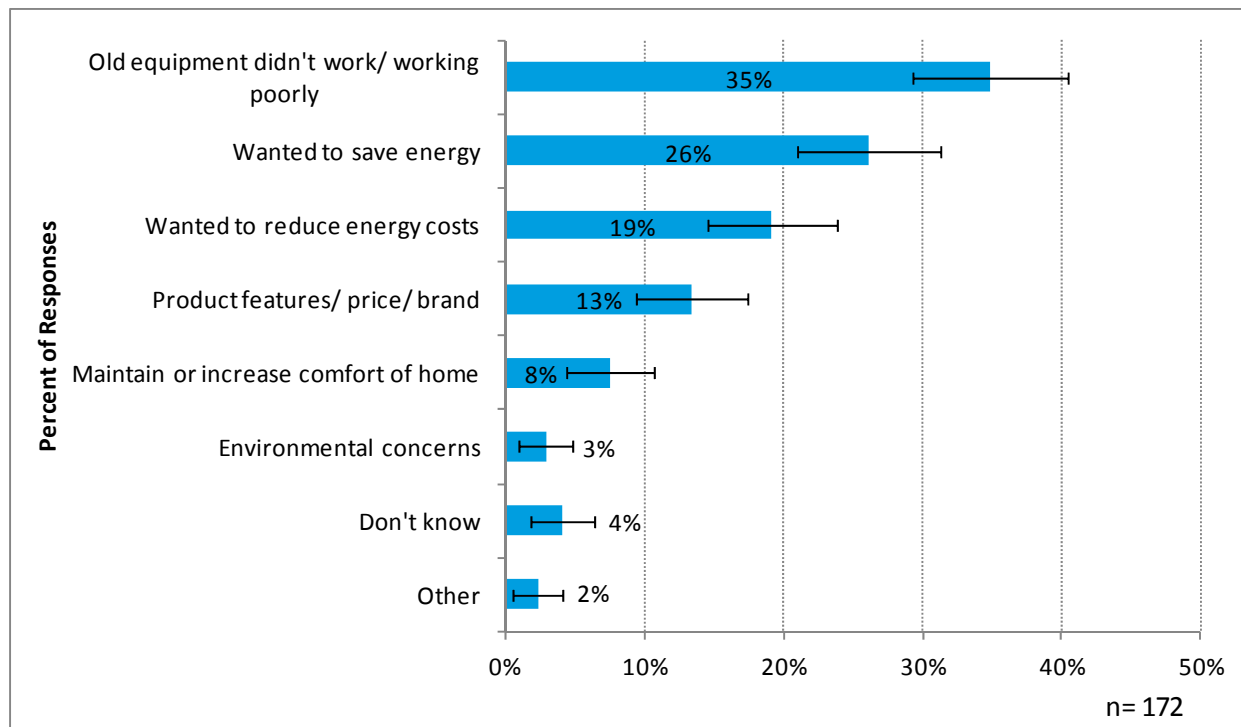
While 91 percent of trade allies believed customers understood the energy-related benefits of higher-efficiency products, and 73 percent noted energy savings tend to be selling points for high-efficiency products, 18 percent of retailers believed customers chose not to participate in the HES Program as they disliked energy-efficient products. Retailers specifically noted consumer aversion to CFLs, either due to negative perceptions of their lighting quality or concerns about mercury content.

Appliance and HVAC participants reported being motivated by other factors than energy efficiency. While 26 percent²⁸ of appliance and HVAC participants overall were motivated to purchase high-efficiency equipment to save energy, 35 percent²⁹ simply needed new equipment. Figure 14 illustrates the full distribution of customers' purchasing motivations.

²⁸ Multiple responses allowed.

²⁹ Multiple responses allowed.

Figure 14. Factors that Motivated Appliance and HVAC participants to Purchase a Qualifying Measure* (with 90% Confidence Intervals)



Pacific Power CA HES Participant Telephone Survey Question M4

* "Don't know" responses removed from this figure.

Economic Constraints

According to implementer staff, economic pressures across the country were reflected by customers prioritizing expenses. Over one-quarter (27 percent) of trade allies reported the main reason customers chose not to participate in the program was measures being too expensive. However, from the incentive perspective, only three trade allies indicated HES program incentives were set too low; with the majority (64 percent) reporting incentives set at appropriate levels.

Cadmus compared Pacific Power's 2010 HES incentive levels for a variety of measures to those of other utilities in California, including: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), Sacramento Municipal Utility District (SMUD), and the City of Burbank Water and Power. Our research revealed HES incentives were competitive. Except for refrigerators and dishwashers, which fell below the range offered by other utilities, Pacific Power's appliance rebates were comparable to other utilities studied. HVAC measure incentives, however, tended to represent the low side of the incentive spectrum, as shown in Table 66.

Table 66. Benchmarking of California Utility Incentive Levels

Incentive Levels					
Measure	Pacific Power 2010 HES Incentive Levels	Current PG&E	Current SCE	Current SMUD	Current Burbank Water and Power
Clothes Washer	Up to \$175	\$50-\$125	N/A	\$35 - \$125	\$75 - \$100
Dishwasher	\$20	\$30-\$50	N/A	\$30 - \$50	\$50 - \$75
Water Heater	\$40	\$30-\$50	\$30	N/A	N/A
Refrigerator	\$20	N/A	\$50	N/A	\$100 - \$150*
Room Air Conditioner	\$30	\$50	\$50	\$50	\$50 - \$75
Central Air Conditioner	\$50 - \$100	\$50	N/A	\$400 - \$1,100	\$80/ton - \$140/ton
Ceiling Fans	\$20	N/A	N/A	N/A	\$15 - \$25 each (limit 3)
Evaporative Cooler	\$50 - \$150	N/A	\$300	N/A	N/A
Refrigerator Recycling	\$35	\$35	\$50	\$35	N/A
Heat Pumps	\$350 - \$750	N/A	N/A	\$400 - \$500	N/A

*With proof of recycling of your replaced refrigerator

Sources: PGE: <http://www.pge.com/myhome/saveenergymoney/rebates/>

SCE: http://www.sce.com/residential/rebates-savings/home_upgrade_projects/homeowners/default.htm

SMUD: <https://www.smud.org/en/residential/save-energy/rebates-incentives-financing/>

Burbank: <http://www.burbankwaterandpower.com/download/HomeRewardsApplicationInteractive.pdf>

Almost half (45 percent)³⁰ of surveyed trade allies cited potential cost savings on energy bills as a major selling point for energy-efficient products, confirming the effect financial savings can have on consumers.

Communication

To ensure program success, the program implementer communicated with program staff and trade allies through channel teams. The retailer channel had close relationships with store staff at every location, where they focused on exciting store personnel about the program, and disseminating information to as many qualified retailers as possible. The retailer channel also offered field staff an opportunity to conduct on-the-ground outreach to store staff, to ensure they understood all program aspects.

The program implementer's contractor channel works similarly to the retailer channel. The team reached out to contractors, informing them of the program, and attempting to recruit new participants. Once contractors agreed to participate, the contractor channel team met with them in the field, training them on how to discuss the program with customers and promote program measures. Program staff at Pacific Power and the program implementer agreed the channel structure served as a very effective communication tool.

³⁰ Multiple responses allowed.

Summary and Recommendations

In 2010, Pacific Power implemented several changes to program operations, delivery structures, and marketing approaches, leading to significant improvements in participation and savings: specifically, a 30 percent increase in participation volume, and a 55 percent increase in reported savings results from 2009 to 2010.³¹ Conclusions and recommendations have been drawn from process evaluation interviews, surveys, and other analysis. While Cadmus' process evaluation found several aspects of HES Program operations and delivery have improved, the program may benefit from additional changes through providing additional value to customers, preparing for upcoming changes in the lighting market, and continuing to increase participation and savings results as the HES Program matures.

Some of the following conclusions include recommendations, while others indicate the current approach appears to be working well.

Program Design and Implementation

- ***The program implementer's management of retailer and contractor delivery channels provides the structure for communication and program success among program implementers and trade allies.*** The program implementer's revised delivery structure has reduced many initial HES Program's implementation barriers by streamlining program staff responsibilities, building relationships with retailers and contractors, and increasing the total number of trade allies promoting the program to end-use customers.
- ***The implementation of a flexible tariff approach proved to be a positive change for the California HES Program.*** Allowing for "floating specifications" in the tariff will ensure program requirements evolve in concert with ENERGY STAR specifications. The proactive approach will also alleviate administrative burdens of filing tariff changes.
- ***More California-based outreach staff in the field increased the frequency of one-on-one meetings with participating and potential trade allies.*** While this strategy proved helpful in terms of increasing retailer and contractor participation, especially in California's diverse market, other implementation barriers have yet to be addressed.

Lighting

- ***Very few lighting customers and retailers know of the upcoming EISA legislation.*** This most likely resulted from the Huffman Bill's mandated standards, which phase out incandescent bulbs in California a year before EISA.
- ***EISA legislation and ingrained customer preferences could have wide-ranging impacts on utility lighting programs.*** Lighting participant surveys indicated customers tend to purchase CFLs over other energy-efficient lighting options (despite survey findings indicating many customers have concerns about CFL quality and other issues). When presented with choices to purchase a more efficient incandescent bulb, CFL, LED, or halogen bulb, more than one-third of lighting customers chose CFLs. Given more than a decade's history of successful utility market transformation activities, customers' CFL

³¹ According to a comparison of Pacific Power's 2009 Annual Review of DSM Programs and 2010 Annual Review of Energy Efficiency Programs.

preference likely results from familiarity with CFLs as energy-efficient, inexpensive options. Additionally, as reported in the impact evaluation's WTP section, CFL demand relates inversely to price, indicating participants tend to purchase products at lower prices. This same theory likely applies to other lighting options.

Due to EISA's phase out of incandescent bulbs, however, the DSM market's lighting savings baseline will likely increase; resulting in attributing approximately 75 percent lower savings per CFL to utility lighting programs. Program stakeholders report Pacific Power's plans to offer a robust variety of EISA-compliant bulbs through its lighting portfolio. Given customers' preference for CFLs over other the market's energy-efficiency lighting options, Pacific Power may still face challenges in meeting its lighting savings targets, due to the adjusted baseline.

- **Recommendation:** Given changes in the evolving lighting industry, explore which higher-efficiency lighting options (e.g., LEDs) will provide the most savings per unit. Align marketing messages with the preferred lighting option, and heighten awareness using market transformation tactics.
- **Recommendation:** The evolving lighting market can act as a platform to clarify marketing messages about lighting options and bulbs best for each customer's intended use. Continue to create marketing collateral comparing various lighting options' prices with expected lifetime savings associated with those options to demonstrate higher efficiency options' long-term value. Potential long-term savings attributed to qualifying measures have provided the primary purchasing motivators for appliance and HVAC participants. These same marketing tactics should continue to be implemented in the lighting market, given the elimination of traditional, inexpensive options. Messaging should also highlight comparisons of lighting quality and other factors consumers emphasized in the satisfaction surveys.
- **Lighting customers do not know of proper CFL disposal methods.** The majority of surveyed CFL owners disposing of a CFL in the past 12 months threw the bulb in the trash.
 - **Recommendation:** Continue with plans to provide recycling centers at all participating retail locations; so customers can simply bring in spent bulbs when purchasing replacements. Recycling centers could convey a positive public image, enhancing Pacific Power's reputation in the community and adding public relations value to the program, particularly among interveners. Pacific Power should raise awareness of the recycling centers' availability through bill inserts, training for retail staff, and other outreach tactics.
- **The EISA standard will impact Rocky Mountain Power savings analysis of CFLs.**
 - **Recommendation:** Baseline wattage assumptions will need to be updated to account for the new EISA standards. The EISA standard established an equivalent baseline by rated lamp lumens. If the actual baseline wattage replaced is not known (i.e. no surveys were conducted), the recommended approach uses the

CFL rated lumens and equivalent lumens in EISA to determine baseline wattage. This approach can be used for program evaluations in 2012 and beyond.

- ***Rocky Mountain Power impact analysis of CFLs does not include a waste heat factor (WHF) in the planning estimates.***
 - ***Recommendation:*** The WHF is an adjustment representing the interactive effects of lighting measures on heating and cooling equipment operation. Cadmus did not apply the WHF adjustment to lighting savings estimates as Rocky Mountain Power did not include it in their initial planning estimates. However, Cadmus recommends using the approach outlined in Appendix L and including this adjustment for future planning estimates and evaluations.

Marketing and Participation Decisions

- ***Program staff report service territory-focused marketing messages benefit program participation.*** The program implementer believes the shift from “one-size-fits-all” marketing messages to those targeting particular states may contribute to increased multi-purchase HES participation.
- ***Trade allies (both retailers and contractors) provide a valuable channel for increasing program awareness.*** Maintaining trade ally satisfaction remains important to further motivating contractors to promote the program as a trusted partner.
 - ***Recommendation:*** As the lighting savings baseline changes, HES Program non-lighting savings may take on increased significance. Although the retailer and contractor market in California may be more difficult to penetrate than in other service territories, continue to recruit new trade allies to broaden program awareness throughout the service territory. HES Program has an effective trade ally; an increased trade ally network could lead to heightened incentive awareness, and increased program participation.
 - ***Recommendation:*** To ensure trade allies find participation easy and continue to promote the HES program, carry on with plans to include online application access for trade allies.
 - ***Recommendation:*** Continue with plans to provide trade ally-focused marketing collateral for download within program Web pages’ trade ally section. If necessary, these materials can be offered through a password-protected area, and personalization options can be offered for trade ally promotion.
- ***Customers do not connect upstream lighting products they purchase with Pacific Power’s HES Program incentives.*** Although most HES Program savings accrue through the lighting component, very few lighting customers know Pacific Power’s HES Program provides CFL discounts.
 - ***Recommendation:*** Ensure lighting retailers are trained to inform customers that Pacific Power discounts incentivized lighting products.

- ***Pacific Power has created compelling, broad-reaching marketing materials.*** Cadmus understands marketing represents a key lever for controlling program participation. The utility’s marketing materials, use of marketing channels, and online presence largely remain consistent with utility program best practices. The below recommendations offer additional marketing opportunities.
 - ***Recommendation:*** Continue to leverage meetings with contractors and promote increased participation as the primary method of engaging with program trade allies. Invitations to road shows and/or event sponsorships can also offer effective marketing opportunities, Events targeted to trade allies can be particularly effective.
 - ***Recommendation:*** Continue to leverage on- and offline social networks to capitalize on customer satisfaction. Enhance the HES Program’s social network distribution by providing online and in-person networking opportunities. These groups (such as stakeholder trade associations, community networks, Chambers of Commerce, LinkedIn groups, and e-mail networks) provide low-cost, high-volume information distribution vehicles. Continue to consider implementing innovative tactics, such as Living Social or Groupon coupon-focused lead generation vehicles.
 - ***Recommendation:*** Broaden promotion of the program’s URL. Only 5 percent of appliance and HVAC participants and no trade allies cited the Website as a referral source. Online marketing can be one of the most cost-effective tools to generate interest and leads in remote geographic areas. Pacific Power should emphasize its Website in marketing materials as a key tool for obtaining detailed program information. However, marketing channels should continue to focus on the approaches reported most effective with customers: bill inserts and in-store displays.
- **Website content does not reflect market segmentation described by program staff.** Program descriptions, currently identical, have not been tailored for each state.
 - ***Recommendation:*** Mirror segment-driven messages found within collateral and promotional events on the Website.
 - ***Recommendation:*** Use money-saving messages to motivate lower-income California residents.

Quality Assurance

- ***QC inspections prove costly in California due to the dispersed customer community and low overall participation volumes.*** While California’s HES participation volume does not merit budgeting for full-time, locally-based QC staff, travel between installation sites proves budget constricting for the program implementer required to conduct QC inspections within 45 days of a service measure installation.
 - ***Recommendation:*** Outsource the QC process to a locally-based QC firm. Subcontracting with a locally-based firm with viable outside work would decrease travel costs and eliminate concerns regarding a full-time staff member experiencing idle time between installation inspections.

Satisfaction and Perceived Barriers

- ***Program satisfaction generally runs high.*** In benchmarking program satisfaction against results from other states and other utilities' programs, Cadmus found customer satisfaction consistent with good performance. Pacific Power and its trusted program partners (including the program implementer and participating retailers and contractors) facilitate program clarity at the customer level, promotion of high-quality products, and short turnaround times for incentive checks.
- ***The need for new equipment most often motivates appliance and HVAC participants to purchase qualified measures.*** Many appliance and HVAC participants reported participating in the HES Program as their existing equipment ceased working or functioned poorly.
 - ***Recommendation:*** Continue to utilize marketing messages targeting the equipment replacement market. Trade allies should be trained to capture this market's interest by promoting the HES Program when contacted to install new equipment in emergency replacement situations.
- ***Economic constraints may serve as significant barriers to meeting savings and participation goals.*** In benchmarking program incentives against those offered by other utilities' programs throughout California, Cadmus found measure incentives comparable with other offerings; however, a limited income customer community, married with lower incentive offerings, may hinder program performance.
 - ***Recommendation:*** Continue to review measure incentive levels. Customers with less disposable income may need higher financial motivators to purchase qualifying measures. Based on Cadmus' benchmarking study, measures that could be considered for review include dishwashers, refrigerators, room air conditioners, central air conditioners, and evaporative coolers.

Cost-Effectiveness

In assessing cost-effectiveness, Cadmus analyzed program costs and benefits from five different perspectives, using Cadmus' DSM Portfolio Pro³² model (as used for recent evaluations of Pacific Power's residential portfolio). Benefit-to-cost ratios conducted for these tests were based on methods described in the California Standard Practice Manual for assessing DSM programs' cost-effectiveness. Tests utilized included the following:

- a. **PacifiCorp Total Resource Cost Test (PTRC):** This test examined program benefits and costs from Pacific Power's and participants' perspectives, combined. On the benefit side, it included avoided energy costs, capacity costs, and avoided line losses, plus a 10 percent adder to reflect non-quantified benefits. On the cost side, it included costs incurred by both the utility and participants.
- b. **Total Resource Cost Test (TRC):** This test examined program benefits and costs from Pacific Power's and participants' perspectives, combined. On the benefit side, it included avoided energy costs, capacity costs, and avoided line losses. On the cost side, it included costs incurred by both the utility and participants.
- c. **Utility Cost Test (UCT):** From Pacific Power's perspective, benefits included avoided energy, capacity costs, and avoided line losses. Costs included program administration, implementation, or incentive costs associated with program funding.
- d. **Ratepayer Impact (RIM):** From all ratepayers' (participants and nonparticipants) perspectives; this test included all Pacific Power program costs as well as lost revenues. Benefits included avoided energy costs, capacity costs, and avoided line losses.
- e. **Participant Cost Test (PCT):** From this perspective, program benefits included bill reductions and incentives received. Costs included a measure's incremental cost (compared to the baseline measures), plus installation costs incurred by the customer.

Table 67 summarizes the five tests' components.

Table 67. Benefits and Costs Included in Various Tests

Test	Benefits	Costs
PTRC	Present value of avoided energy and capacity costs,* with 10 percent adder for non-quantified benefits	Program administrative and marketing cost
TRC	Present value of avoided energy and capacity costs*	Program administrative and marketing cost
UCT	Present value of avoided energy and capacity costs*	Program administrative, marketing, and incentive cost
RIM	Present value of avoided energy and capacity costs*	Program administrative, marketing, and incentive cost + present value of lost revenues
PCT	Present value of bill savings and incentives received	Incremental measure cost and installation cost

*Present value of avoided energy and capacity costs includes avoided line losses occurring from reductions in customer electric use.

³² DSM Portfolio Pro has been independently reviewed by various utilities, their consultants, and a number of regulatory bodies, including the Iowa Utility Board, the Public Service Commission of New York, the Colorado Public Utilities Commission, and the Nevada Public Utilities Commission.

Table 68 provides selected cost analysis inputs, including: evaluated energy savings for each year, discount rate, line loss, and program costs. Pacific Power provided all values, except energy savings. The discount rate derived from Pacific Power’s 2008 Integrated Resource Plan. Pacific Power also provided values for line loss and program costs.

Table 68. Selected Cost Analysis Inputs*

Input Description	2009	2010	Total
Program Net Savings (kWh/year)	785,231	1,097,649	1,882,880
Discount Rate	7.40%	7.40%	7.40%
Line Loss	11.20%	9.10%	NA
Inflation Rate	1.90%	1.90%	1.90%
Total Program Costs	\$168,392	\$194,502	\$362,894
Program Management Costs	\$161,166	\$188,697	\$349,863
Utility Administrative Costs	\$7,226	\$5,805	\$13,031

*Savings reflect impacts at generation and have been increased for line losses.

Program benefits included energy savings and their associated avoided costs. The cost-effectiveness analysis used energy savings derived from this study’s evaluated kWh. Analysis used a weighted average measure life of 10.5 years, based on measure lifetimes, and weighted by savings and frequency of installations. All analyses used avoided costs associated with Pacific Power’s 2008 *IRP 35 Percent Load Factor Westside Residential Whole Home Decrement*.³³

Cadmus analyzed cost-effectiveness for two scenarios. The first assumed no freeridership and spillover (NTG equaling 100 percent). The second incorporated evaluated freeridership and spillover.

Table 69 presents program cost-effectiveness analysis results, with NTG equaling 100 percent for all program measures for the evaluation period (2009–2010), though not accounting for non-energy benefits (except those represented by the 10 percent conservation adder included in the PTRC). For this scenario, cost-effectiveness analysis results indicated the program was cost-effective from all perspectives, except the RIM (a 1.0 or greater benefit-cost ratio is considered cost-effective). Most programs do not pass the RIM test due to adverse impacts of lost revenue.

³³ IRP decrements are detailed in Appendix G of PacifiCorp’s 2008 Integrated Resource Plan, Vol. II Appendices: http://www.pacificorp.com/content/dam/pacificorp/doc/Environment/Environmental_Concerns/Integrated_Resource_Planning_6.pdf

Table 69. Program Cost-Effectiveness Summary for 2009–2010 (NTG = 100 percent)

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.040	\$894,839	\$2,133,848	\$1,239,009	2.38
Total Resource No Adder (TRC)	\$0.040	\$894,839	\$1,939,862	\$1,045,023	2.17
Utility (UCT)	\$0.024	\$523,586	\$1,939,862	\$1,416,275	3.70
Ratepayer Impact (RIM)	\$0.132	\$2,913,262	\$1,939,862	(\$973,401)	0.67
Participant (PCT)	\$0.025	\$545,346	\$2,563,770	\$2,018,424	4.70

Table 70 presents program cost-effectiveness analysis results, including evaluated NTG for all program measures for the evaluation period (2009–2010), though not accounting for non-energy benefits (except those represented by the 10 percent conservation adder included in the PTRC). For this scenario, cost-effectiveness analysis results indicated the program was cost-effective from all perspectives except the RIM (a 1.0 or greater benefit-cost ratio is considered cost-effective). Most programs do not pass the RIM test due to adverse impacts of lost revenue.

Table 70. Program Cost-Effectiveness Summary for 2009–2010 (Evaluated NTG)

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.053	\$723,801	\$1,328,713	\$604,912	1.84
Total Resource No Adder (TRC)	\$0.053	\$723,801	\$1,207,921	\$484,120	1.67
Utility (UCT)	\$0.038	\$523,586	\$1,207,921	\$684,335	2.31
Ratepayer Impact (RIM)	\$0.147	\$2,002,024	\$1,207,921	(\$794,102)	0.60
Participant (PCT)	\$0.025	\$545,346	\$2,563,770	\$2,018,424	4.70

Table 71 presents program cost-effectiveness analysis results, including evaluated NTG for all program measures for the 2009 evaluation period, though not accounting for non-energy benefits (except those represented by the 10 percent conservation adder included in the PTRC). For this scenario, cost-effectiveness analysis results indicated the program was cost-effective from all perspectives except the RIM (a 1.0 or greater benefit-cost ratio is considered cost-effective). Most programs do not pass the RIM test due to adverse impacts of lost revenue.

Table 71. Program Cost-Effectiveness Summary for 2009 (Evaluated NTG)

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.054	\$319,328	\$542,427	\$223,098	1.70
Total Resource No Adder (TRC)	\$0.054	\$319,328	\$493,115	\$173,787	1.54
Utility (UCT)	\$0.041	\$241,879	\$493,115	\$251,236	2.04
Ratepayer Impact (RIM)	\$0.147	\$867,473	\$493,115	(\$374,358)	0.57
Participant (PCT)	\$0.024	\$228,015	\$1,087,885	\$859,870	4.77

Table 72 presents program cost-effectiveness analysis results, including evaluated NTG for all program measures in the 2010 evaluation period, though not accounting for non-energy benefits (except those represented by the 10 percent conservation adder included in the PTRC). For this scenario, cost-effectiveness analysis results indicated the program was cost-effective from all perspectives except the RIM (a 1.0 or greater benefit-cost ratio is considered cost-effective). Most programs do not pass the RIM test due to adverse impacts of lost revenue.

Table 72. Program Cost-Effectiveness Summary for 2010 (Evaluated NTG)

Cost-Effectiveness Test	Levelized	Costs	Benefits	Net	Benefit / Cost Ratio
	\$ / kWh			Benefits	
Total Resource + Conservation Adder (PTRC)	\$0.052	\$434,404	\$844,472	\$410,068	1.94
Total Resource No Adder (TRC)	\$0.052	\$434,404	\$767,702	\$333,298	1.77
Utility (UCT)	\$0.036	\$302,554	\$767,702	\$465,148	2.54
Ratepayer Impact (RIM)	\$0.146	\$1,218,507	\$767,702	(\$450,805)	0.63
Participant (PCT)	\$0.025	\$340,814	\$1,585,100	\$1,244,286	4.65

Appendices

Appendix A: Survey and Data Collection Instruments

Appendix B: Precision Calculations

Appendix C: NTG Evaluation Methodology

Appendix D: Lighting NTG (Retailer Surveys)

Appendix E: Lighting NTG (Secondary Review)

Appendix F: Lighting NTG (WTP)

Appendix G: See Ya Later, Refrigerator Detailed Findings

Appendix H: SYLR Participant Demographics

Appendix I: Marketing Materials

Appendix J: Engineering Review and Whole House Modeling

Appendix K: Waste Heat Factor

Please find the appendices to this report attached as a separate file.

Appendix A. Survey Instruments and Data Collection Tools

Appendix A. Survey Instruments and Data Collection Tools	A1
1. Management Staff and Program Partner Interview Guide.....	A2
2. Participant Telephone Survey (Appliances and HVAC)	A6
3. Participant Retailer/Contractor Survey	A29
4. In-Territory Lighting Survey	A45
5. Participant Refrigerator Appliance Recycling Program Survey	A66
6. Nonparticipant Refrigerator Appliance Recycling Program Survey	A88

1. Management Staff and Program Partner Interview Guide

Program/Implementation Staff: _____ Survey Date: _____
Contact Name: _____ Interviewer Initials: _____
Contact Phone Number: _____ Contact Title: _____

[Make it clear to the interviewee, that this process evaluation interview covers the 2009 and 2010 program years, and to the extent possible, we would like to try to attach their responses (events, activities referenced, transitions, evolution) to the appropriate program year.]

General

1. What is your role in the program?
2. Who do you work closely with (on the program), both internally and at other agencies? In what capacity?
1. [DO NOT SKIP THIS QUESTION] What are your top three successes or most important achievements?
2. [DO NOT SKIP THIS QUESTION] What your three biggest challenges or concerns with the program? Do you have suggestions for addressing them?
3. Do you have suggestions for improving the program?

Program History and Design

1. How did the program concept come about?
- 2.
3. When was the program launched [in the relevant state]?
4. Were perceived barriers identified and used in the program design? If so, how does the design address barriers?
5. How has the program progressed over the last two years (2009, 2010)?
 - a. What barriers or challenges has the program faced? What was done to address them?
 - b. Are you happy with the program's performance with regards to:
 - i. Local delivery capacity in the states in which the program is offered
 - ii. Program delivery and implementation (internal and external)
 - iii. Tracking processes and reporting
 - iv. Awareness of the program and energy efficiency
 - v. Participation and savings

What program components are key to meeting program goals?

6. Were there been any design changes during the 2009 and/or 2010 program years? (e.g., targeted customers, measures promoted, delivery process, incentive levels) [try to attach dates [2009 or 2010 program year] to design changes and probe why they were made] Any planned? Why?
7. Do you have any design changes (including changes to the program’s marketing and educational components) planned in response to the EISA legislation?
8. What steps are you taking to minimize leakage of incentivized CFLs to customers outside of the PacifiCorp service territories?

Program Goals

1. What are the program’s process goals, if any? (e.g. participation of customers (including, customers in all regions of the service territory; single family and multifamily, etc.), of contractors market transformation, increase awareness, education of trade allies?)
2. Do you use metrics to track progress against process goals? If so, what are they?
3. Have there been any changes to goals in 2009/2010? Why?
4. Do you think the program has succeeded in addressing participation barriers (mentioned above)?
5. How do you think the program performed against its goals in 2009 and 2010?

Trade Allies and Partners

1. Who implements the program?
2. What are their responsibilities?
3. How do you communicate with them? How often? Have the communications been effective? Does their performance meet your expectations? How do you address issues that arise?
4. Who are the program’s trade allies? How are they targeted? Is there any formal relationship?
5. Who do you consider a “Partner”? What makes them a partner? How are they invited or chosen to be a partner?
6. Do you offer tangible benefits to trade allies and/or partners? What benefits do they get? What role do you expect them to play? What is level of interaction do you have with them (e.g., do you provide training)?

Coordination with JACO [CALIFORNIA ONLY]

1. How long has appliance recycling been offered through HES?
2. How do you coordinate with JACO? (E.g., are there regular meetings?)
3. Does JACO report any participation data to PECEI? If so, how often and in what format?
4. In 2009 - 2010, was appliance recycling promoted through partnerships with appliance retailers?
5. Were there cross-promotional activities, e.g., promoting appliance recycling to recipients of the refrigerator rebate?

Program Marketing

1. Who does the marketing? (Utility or external firm?)
2. Do you have a marketing plan? A schedule of activities? [get a copy if possible]
3. Is your advertising more focused on general efficiency program marketing or program specific marketing?
4. What marketing channels and approaches are used? (to consumers, to trade allies?)
5. Are social marketing tactics used (e.g. attendance at community events, twitter, Flickr, Facebook?) [probe] Do you feel these tactics have been effective?
6. What collateral is used? [get copies] (bring checklist table)
7. What role do trade allies play in marketing the program?
8. Are they incented to promote the program? How? Are these incentives effective?
9. How is marketing effectiveness measured?
10. What marketing methods and messages do you think have been most effective?
11. Are the customer incentive levels appropriately set?

Internal Program Management

1. How many staff run the program? What are their roles? How do you coordinate with other programs or other offices (e.g. marketing, call center, research staff, database management); Organization chart? Do you feel management and administration is effective overall? Budget adequate? Paperwork/admin right or overwhelming?
2. Overall internal program management working? Areas for improvement?

External Program Management

1. How is the third party administrator organized?
2. Are you happy with the third party administrator? Anything that needs to be improved? Good reporting? Useful? Timely?
3. What types of trade allies are most active? Are you satisfied?

Customer Response

1. Do you feel program is meeting the needs of your customers?
2. Is program participation meeting your expectations? Why?
3. How effective is the program at connecting with the “hard to reach” market? Are there any customer groups you feel may be overlooked?

5. Do you have any direct contact with customers?
6. How do you collect, document, track and respond to complaints? How is that process working?
7. What feedback have you received so far? From whom (e.g., directly from customers, from the implementation partner)?

Data Management

1. How does program data get entered? Is there a process to upload data to a central tracking system? What is the QAQC process for data entry and transfers? Who checks? How often? How are errors handled/corrected?
2. Is it easy to get data extracts and reports?
3. How do you use the database?

Final Thoughts

4. Are there any specific questions or issues would you like us to investigate during the evaluation or include in a customer or trade ally survey?
5. What do you anticipate for the future of the program? Expand, scale back (perhaps for specific measures) or stay about the same level?
6. What information can the evaluation deliver to inform the program's processes?

List of Requested Material

1. Reports, participant & measure tracking databases, budget tracking
2. Marketing plan, marketing collateral (e.g., brochures, Web text, etc.), research, materials, market metrics, social media metrics
3. Flow diagrams and org charts
4. Application forms
5. Survey instruments or results to date

2. Participant Telephone Survey (Appliances and HVAC)

[UTILITY]

Washington, and California:

Pacific Power

Utah, Wyoming, and Idaho:

Rocky Mountain Power

[MEASURE]

- A1. Clothes Washer
- A2. Refrigerator
- A3. Dishwasher
- A4. Window
- A5. Fixture
- A6. Heat Pump
- A7. Ceiling Fan
- A8. Electric Water Heater
- A9. Room AC
- A10. Attic Insulation
- A11. Wall Insulation
- A12. Floor Insulation

Introduction

[TO RESPONDENT] Hello, I'm [INSERT FIRST NAME] I am calling from [DISCOVERY RESEARCH] on behalf of [INSERT UTILITY]. We are exploring the impacts of energy efficiency programs offered in your area. I'm not selling anything; I just want to ask you some questions about your energy use and the impact of promotions that have been run by [INSERT UTILITY].

Responses to Customer Questions [IF NEEDED]

(Timing: This survey should take about 15 minutes of your time. Is this a good time for us to speak with you?)

(Who are you with: I'm with DISCOVERY RESEARCH, an independent research firm that has been hired by [INSERT UTILITY] to conduct this research. I am calling to learn about your experiences with the [INSERT MEASURE] that you received through [INSERT UTILITY]'s Home Energy Savings program.

(Sales concern: I am not selling anything; we would simply like to learn about your experience with the products you bought and received an incentive for through the program. Your responses will be kept confidential. If you would like to talk with someone from [INSERT UTILITY] about this study, feel free to call 1-800-942-0266, or visit their website: <http://www.homeenergysavings.net/>)

(Who is doing this study: [INSERT UTILITY], your electric utility, is conducting evaluations of several of its efficiency programs, including the Home Energy Savings program.)

(Why are you conducting this study: Studies like this help [INSERT UTILITY] better understand customers' needs and interests in energy programs and services.)

S1. Our records show that in [INSERT YEAR] your household received an incentive from [INSERT UTILITY] for installing energy efficient equipment. We're talking with customers about their experiences with the incentive program. Are you the best person to talk with about this?

1. Yes
2. No, not available [SCHEDULE CALLBACK]
3. No, no such person [THANK AND TERMINATE]
- 98. DON'T KNOW [TRY TO REACH RIGHT PERSON; OTHERWISE TERMINATE]
- 99. REFUSED [THANK AND TERMINATE]

S2. Were you the primary decision maker when deciding to purchase [INSERT MEASURE](S)?

1. Yes
2. No

S3. Have you ever been employed in the market research field?

1. Yes [THANK AND TERMINATE]
2. No [CONTINUE]
- 98. DON'T KNOW [THANK AND TERMINATE]
- 99. REFUSED [THANK AND TERMINATE]

S4. Have you, or anyone in your household, ever been employed by or affiliated with [INSERT UTILITY] or any of its affiliates?

1. Yes [THANK AND TERMINATE]
2. No [CONTINUE]
- 98. DON'T KNOW [THANK AND TERMINATE]
- 99. REFUSED [THANK AND TERMINATE]

Measure Verification

Now I have a few questions to verify my records are correct.

C1. [INSERT UTILITY] records show that you applied for an incentive for [INSERT QUANTITY] [IF MEASURE = WINDOWS OR INSULATION, SAY "square feet of" AFTER QUANTITY] [INSERT MEASURE](S). Is that correct? [DO NOT READ RESPONSES]

1. Yes
2. No, quantity is incorrect
3. No, measure is incorrect
4. No, both quantity and measure are incorrect

- 98. DON'T KNOW
- 99. REFUSED [TERMINATE]

C2. [ASK IF C1 = 2] How many [IF MEASURE = WINDOWS OR INSULATION SAY "square feet of"] [MEASURE] (S) did you apply for an incentive? [NUMERIC OPEN ENDED. DOCUMENT AND USE AS QUANTITY FOR REMAINDER OF SURVEY]

[IF NEEDED SAY: "We know you may have applied for other incentives, but for this survey, we'd like to focus on just this one type of equipment."]

- 1. [RECORD]
- 98. DON'T KNOW
- 99. REFUSED

C3. [ASK IF C1 = 3 OR 4 OR 98] Please tell me for what type of equipment you applied for an incentive? [PROBE FOR MEASURE AND QUANTITY THEN SAY: "Thanks for your time, but unfortunately you do not qualify for this survey." THEN THANK AND TERMINATE]

- 1. [RECORD VERBATIM]
- 98. DON'T KNOW – THANK AND TERMINATE
- 99. REFUSED – THANK AND TERMINATE

C4. Did you have a chance to install [IF QUANTITY MEASURE = 1 SAY "the [INSERT MEASURE]", IF QUANTITY MEASURE > 1 SAY "any of the [INSERT QUANTITY] [INSERT MEASURE] (S)", IF MEASURE = WINDOWS OR INSULATION, SAY "all of the [QUANTITY] square feet of the windows"] at any point? [IF RESPONDENT SAYS THAT A CONTRACTOR OR SOMEONE ELSE INSTALLED IT, THEN CODE ANSWER AS "YES"] [DO NOT READ RESPONSES]

- 1. Yes
- 2. No
- 98. DON'T KNOW [SKIP TO E1]
- 99. REFUSED [SKIP TO E1]

C5. [ASK IF QUANTITY MEASURE > 1] How many [IF MEASURE = WINDOWS OR INSULATION, SAY "square feet"] are installed now?

- 1. [RECORD # 1-10,000]
- 2. None
- 98. DON'T KNOW
- 99. REFUSED

- C6. **[ASK IF C4 = 2, OR C5 = 2, OR C5 < QUANTITY MEASURE. IF QUANTITY MEASURE IS > 1 SAY: "Why haven't you had a chance to install all [QUANTITY] of the [MEASURE]", IF QUANTITY MEASURE=1 SAY: "Why haven't you had a chance to install the [MEASURE]?" [MULTIPLE RESPONSE UP TO 3; DO NOT READ]**
1. Failed or broken unit
 2. Removed because did not like it
 3. Have not had time to install it yet
 4. In-storage
 5. Back up equipment to install when other equipment fails
 6. Have not hired a contractor to install it yet
 7. Purchased more than was needed
 8. Other **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED

Program Awareness & Purchase Decisions

- M1. How did you first hear about **[INSERT UTILITY]**'s Home Energy Savings program? **[DO NOT PROMPT. RECORD ONLY THE FIRST WAY HEARD ABOUT THE PROGRAM]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Home Energy Savings website
5. Other website
6. Internet Advertising/Online Ad
7. Family/friends/word-of-mouth
8. Rocky Mountain Power/Pacific Power Representative
9. Radio
10. TV
11. Billboard/outdoor ad
12. Retailer/Store
13. Sporting event
14. Home Shows/Trade Shows (Home and Garden Shows)
15. Social Media
16. Other **[RECORD VERBATUM]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

- M2. **[IF M1 <> 4]** Have you been to the Home Energy Savings Website? **[DO NOT READ RESPONSES]**

1. Yes
2. No

M3. **[IF M2 = 1, OR M1 = 4]** Was the website... **[READ]**

1. Very helpful
2. Somewhat helpful
3. Somewhat unhelpful
4. Very unhelpful
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

M4. Please think back to the time when you were deciding to buy the energy saving **[MEASURE](s)**. What factors motivated you to purchase the **[MEASURE](s)**? **[DO NOT READ. INDICATE ALL THAT APPLY. ONCE THEY RESPONDENT HAS FINISHED, SAY: "Are there any other factors?"]**

1. Old equipment didn't work
2. Old equipment working poorly
3. The program incentive
4. The program technical assistance
5. Wanted to save energy
6. Wanted to reduce energy costs
7. Environmental concerns
8. Recommendation from other utility **[PROBE: "What utility?" RECORD]**
9. Recommendation of dealer/retailer **[PROBE: "From which store?" RECORD]**
10. Recommendation from friend, family member, or colleague
11. Recommendation from a contractor
12. Advertisement in newspaper **[PROBE: "For what program?" RECORD]**
13. Radio advertisement **[PROBE: "For what program?" RECORD]**
14. Health or medical reasons
15. Maintain or increase comfort of home
16. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

M5. **[IF TYPE OF INSULATION = ATTIC]** What type of insulation was in the attic before installation **[RECORD MULTIPLE RESPONSES]**?

1. Fiberglass batts
2. Blown in Fiberglass
3. Blown in Cellulose
4. Rockwool
5. Spray Foam
6. Foam boards
7. No insulation before **[SKIP TO I1]**
8. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

M6. **[IF TYPE OF INSULATION = ATTIC]** How thick (in inches) was the attic insulation before installation?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

Measure Usage

E1.A Do you have a clothes washer in your home?

1. Yes
2. No **[SKIP TO E9]**
- 98. DON'T KNOW **[SKIP TO E9]**
- 99. REFUSED **[SKIP TO E9]**

E1. B Approximately how many loads of clothes does your household wash in a typical week?

1. **[RECORD]**
2. Don't have a clothes washer/or uses a Laundromat **[SKIP TO E9]**
- 98. DON'T KNOW
- 99. REFUSED

E2. **[ASK IF MEASURE = CLOTHES WASHER AND C4 = 1]** How does the number of wash loads you do now compare to the number that you did with your old clothes washer? **[DO NOT READ RESPONSES]**

1. Same
2. Different
- 98. DON'T KNOW
- 99. REFUSED

E3. **[ASK IF E2 = 2]** Do you do more or fewer loads now than you did before? Could you estimate a percentage?

1. More loads now, Record percentage **[MUST BE GREATER THAN 100%, EG 125% FOR 25% MORE]**
2. Fewer loads now, Record percentage **[MUST BE LESS THAN 100%, EG 75% FOR 25% LESS THAN BEFORE]**
- 98. DON'T KNOW
- 99. REFUSED

E4. On what percentage of loads do you use a high spin cycle? **[READ CATEGORIES IF NEEDED]**

1. Never
2. LESS THAN 25%
3. 25-50%
4. 50-75%
5. 75-100%
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E5. **[ASK IF E4 = 1-5]** When you do not use the high spin cycle, what is your reason?

1. Noise/vibration
2. Impact on clothing
3. Other **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E6. **[ASK IF E4 = 1-5]** On what floor of the building is your washing machine located?

1. Basement
2. First floor
3. Second floor or higher
- 99. **[DO NOT READ]** REFUSED

E7. What percentage of your loads do you dry using a clothes dryer? **[READ CATEGORIES IF NEEDED]**

1. Never **[SKIP TO E9]**
2. LESS THAN 25%
3. 25-50%
4. 50-75%
5. 75-100%
- 98. DON'T KNOW **[SKIP TO E9]**
- 99. REFUSED **[SKIP TO E9]**

E8. When you dry your clothes do you... **[READ]**

1. Use a timer to determine drying times.
2. Use the dryer's moisture sensor to determine when the load is dry.
3. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E9. How many times a week do you use the dishwasher?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

MEASUREE10. [ASK IF MEASURE = WINDOWS AND C4 = 1] What type of windows did you have before the new windows were installed? **[IF MEASURE <> WINDOWS]** What type of windows do you have?

1. Single pane **[OLDER WINDOWS]**
2. Double Pane **[NEWER WINDOWS]**
3. Triple Pane **[RARE]**
- 98. DON'T KNOW
- 99. REFUSED

E11. [ASK IF MEASURE = WINDOWS AND C4= 1] What type of window frames (not window trim, which is almost always wood) did you have before the new windows were installed? **[IF MEASURE <> WINDOWS]** What type of window frames do you have?

1. Wood
2. Vinyl
3. Metal
- 98. DON'T KNOW
- 99. REFUSED

E12. How many showers per week are taken at your home?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E13. How many baths per week are taken at your home?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

[Ask E14-E16 if MEASURE = heat pump and C4= 1]

E14. What type of heating system did you have before the new heat pump was installed?

1. Furnace
2. Boiler
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Stove
6. Baseboard
7. No heating system before **[SKIP TO E16]**
8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E15. How many years old was the previous heating system?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E16. What type of fuel does the new heating system use... **[READ]**

1. Gas
2. Electric
3. Oil
4. Propane
5. Coal
6. Wood
7. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

[ASK E17-E19 IF MEASURE <> HEAT PUMP]

E17. What type of heating system do you have now... **[READ]**

1. Furnace
2. Boiler
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Stove
6. Baseboard
7. No heating system **[SKIP TO E20]**
8. OTHER **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E18. How many years old is the heating system?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E19. What type of fuel does the heating system use... **[READ]**

1. Gas
2. Electric
3. Oil
4. Propane
5. Coal
6. Wood
7. Other **[SPECIFY]**

- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

[Ask E20- E21 if MEASURE = heat pump and C4 = 1]

E20. What type of cooling system did you have before the new heat pump was installed? **[READ]**

- 1. Central Air Conditioner
- 2. Room Air Conditioner
- 3. Evaporative Cooler
- 4. Air Source Heat Pump
- 5. Ground Source Heat Pump
- 6. Whole house fan
- 7. No cooling system before **[SKIP TO E24]**
- 8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E21. How many years old was the previous cooling system?

- 1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

[ASK E22-E23 IF MEASURE <> HEAT PUMP]

E22. What type of cooling do you have now? A... **[READ]**

- 1. Central Air Conditioner
- 2. Room Air Conditioner
- 3. Evaporative Cooler
- 4. Air Source Heat Pump
- 5. Ground Source Heat Pump
- 6. Whole house fan
- 7. No cooling system **[SKIP TO E24]**
- 8. OTHER **[SPECIFY]**-98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E23. How many years old is your current cooling system?

- 1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E24. **[IF MEASURE = LIGHTING FIXTURES AND C4=1]** in which room(S) **[IS/ARE]** the lighting fixture(s) installed? **[MULTIPLE RESPONSES ALLOWED]**

1. Living/family room
2. Bedroom
3. Unoccupied bedroom
4. Bathroom
5. Kitchen
6. Garage
7. Office
8. Attic
9. Closet/storage
10. Hallway
11. Exterior
- 98. DON'T KNOW
- 99. REFUSED

Satisfaction

F1. Overall, how satisfied are you with your **[INSERT MEASURE](S)** Would you say you are...? **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

F2. **[ASK IF MEASURE= WINDOWS, HEAT PUMP, ELECTRIC WATER HEATER, OR INSULATION]** Did a contractor install the **[INSERT MEASURE](S)** for you?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

F3. **[ASK IF F2=1]** How satisfied were you with the contractor that installed the **[INSERT MEASURE](S)** for you? **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

- F4. **[IF F3 = 3 or 4]** Why were you not satisfied with the contractor that installed the **[INSERT MEASURE](S)** ?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- F5. How satisfied were you with the amount of the incentive you received for the **[INSERT MEASURE](S)**?
1. Very Satisfied
 2. Somewhat Satisfied
 3. Not Very Satisfied **[PROBE FOR REASON AND RECORD]**
 4. Not At All Satisfied **[PROBE FOR REASON AND RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- F6. After you submitted the incentive application for the **[INSERT MEASURE](S)**, how long did it take to receive the incentive check from **[INSERT UTILITY]**? Was it... **[READ CATEGORIES IF NEEDED, RECORD ONLY FIRST RESPONSE]**
1. Less than 4 weeks
 2. Between 4 and 6 weeks
 3. Between 7 and 8 weeks
 4. More than 8 weeks
 5. Have not received the incentive yet
 - 98. **[DO NOT READ]** DON'T KNOW SKIP TO F7
 - 99. **[DO NOT READ]** REFUSED SKIP TO F7
- F7. **[ASK IF F6<> 5]** Were you satisfied with how long it took to receive the incentive?
1. Yes
 2. No **[PROBE FOR REASON AND RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- F8. How satisfied were you with the application process?
1. Very Satisfied
 2. Somewhat Satisfied
 3. Not Very Satisfied **[PROBE FOR REASON AND RECORD]**
 4. Not At All Satisfied **[PROBE FOR REASON AND RECORD]**
- F8. Overall, how satisfied are you with the Home Energy Savings incentive program? **[READ CATEGORIES; RECORD ONLY FIRST RESPONSE]**
1. Very Satisfied **[PROBE FOR REASON AND RECORD]**
 2. Somewhat Satisfied **[PROBE FOR REASON AND RECORD]**
 3. Not Very Satisfied **[PROBE FOR REASON AND RECORD]**
 4. Not At All Satisfied **[PROBE FOR REASON AND RECORD]**

- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

F10. Did your participation in **[UTILITY]**'s HES Program cause your satisfaction with **[UTILITY]** to...

- 1. Increase
- 2. Stay the same
- 2. Decrease
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

Prior Equipment [FOR ALL BUT INSULATION]

G1. Was the purchase of your new **[INSERT MEASURE](S)** intended to replace an old **[INSERT INSERT MEASURE TYPE]**?

- 1. Yes
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

G2. **[ASK IF G1 = 1]** What did you do with the old **[INSERT MEASURE TYPE]** after you got your new **[INSERT MEASURE](S)**? **[READ CATEGORIES IF NEEDED]**

- 1. Sold or given away
- 2. Recycled
- 3. Installed in another location in the home
- 4. Still in home but permanently removed **[STORED IN GARAGE, ETC.]**
- 5. Thrown away
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

Impact of Other Programs

H1. Did you receive financial assistance, an incentive or a rebate from a source other than **[UTILITY]** for purchasing the **[INSERT MEASURE](S)**?

- 1. Yes
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

H2. [ASK IF H1= 1] Who did you receive it from? [INDICATE ALL THAT APPLY]

1. Dealer
2. Manufacturer
3. Local government
4. State tax credit
5. Federal tax credit
6. Other State rebate/assistance
7. Beartooth Electric Coop
8. Bighorn Rec
9. Bighorn County EC
10. Black Hills Power & Light
11. Bridger Valley EA 12. Carbon Power & Light
13. Cheyenne Light Fuel & Power
14. Fall River REC
15. Garland Light & Power
16. High Plains Power
17. High West Energy
18. Lower Valley Energy
19. Montana-Dakota Utilities
20. Niobrara Electric
21. Powder River Energy
22. Wheatland REA
23. Wyrulec Company
24. Yampa Valley Electric
25. Energy West
26. Frannie-Deaver
27. MGTC Inc.
28. Pinedale
29. Questar Gas Co.
30. Source Gas
31. Town of Walden
32. Wyoming Gas Co.
33. Other utility **[RECORD]**
34. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

H3. [ASK IF H1 = 1] About how much did you receive from [FOR EACH MENTIONED IN H2]?

1. **[RECORD. ROUND TO NEAREST WHOLE DOLLAR]**
2. I have not received anything back yet
- 98. DON'T KNOW
- 99. REFUSED

H4. **[ASK IF H1 = 1]** How influential would you say the **[FOR EACH MENTIONED IN H2]** incentive was in your decision to purchase the **[INSERT MEASURE](S)**? Was it... **[READ]**

1. Very influential
2. Somewhat influential
3. Moderately influential
4. Not at all influential
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

Freeridership

Now I'd like to talk with you a little more about the **[INSERT MEASURE](S)** you installed.

I1. When you first heard about the incentive from **[Utility]**, had you already been planning to purchase the **[Insert MEASURE](S)**?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

I2. Ok. Had you already purchased or installed the new **[INSERT MEASURE](S)** before you learned about the incentive from the Home Energy Savings Program?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF I1 AND I2 BOTH = 1 SKIP TO I12]

I3. **[ASK IF I2 = 2, -98, -99]** Would you have installed the same **[INSERT MEASURE](S)** without the incentive from the Home Energy Savings program?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF I3 = 1 THEN SKIP TO I5]

14. **[ASK IF I3 = 2, -98 OR -99]** Help me understand, would you have installed something without the Home Energy Savings program incentive? **[DO NOT READ RESPONSES]**
1. Yes, I would have installed something
 2. No, I would not have installed anything
- 98. DON'T KNOW
-99. REFUSED

[IF I4 = 2 SKIP TO I8. IF I4 = -98 OR -99 SKIP TO I12]

15. **[ASK IF I3 = 1 OR I4 = 1]** Let me make sure I understand. When you say you would have installed a **[MEASURE](S)**, would you have installed the same **[ONE(S)]** that **[WAS/WERE]** **[IF MEASURE = WINDOWS, HEAT PUMP OR INSULATION, SAY "just as energy efficient"; ALL OTHER SAY "ENERGY STAR qualified"]** ?
1. Yes
 2. No
- 98. DON'T KNOW
-99. REFUSED

16. **[ASK IF I3 = 1 OR I4 = 1 AND QTY MEASURE>1]** And would you have installed the same quantity of **[MEASURE](S)**?
1. Yes
 2. No
- 98. DON'T KNOW
-99. REFUSED

17. **[ASK IF I3 = 1 OR I4 = 1]** And would you have installed the **[INSERT MEASURE](S)...** **[READ]**
1. At the same time
 2. Within one years?
 3. In more than one year?
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** REFUSED

[Skip to I12]

18. **[ASK IF I3 =2 OR I4=2]** To confirm, when you say you would not have installed the same **[MEASURE](S)**, do you mean you would not have installed the **[INSERT MEASURE](S)** at all?
1. Yes
 2. No
- 98. DON'T KNOW
-99. REFUSED

[IF I8 = 1 SKIP TO I12]

I9. **[ASK IF I8 = 2, -98, -99]** Again, help me understand. Would you have installed the same type of **[INSERT MEASURE](S)** but **[IT/THEY]** would not have been as energy- efficient?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

I10. **[ASK IF I8= 2, -98, -99 AND QTY MEASURE>1]** Would it have been the same **[INSERT MEASURE](S)** but fewer of them?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

I11. **[ASK IF I8 = 2, -98, -99]** And, would you have installed the same **[INSERT MEASURE](S)**... **[READ]**

1. At the same time
2. Within one years?
3. In more than one year?
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

I12. In your own words, please tell me the influence the Home Energy Saving incentive had on your decision to purchase **[INSERT MEASURE](S)**?

_____ [Record Response]

Spillover

J1. Since participating in the program, have you added any other energy efficient equipment or services in your home that were not incentivized through the Home Energy Savings Program?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF J1 = 2, -98 OR -99 SKIP TO J5]

J2. Did you purchase any of the following items since the beginning of 2009, not including the **[MEASURE]** that we have been discussing today? **[LIST OF OTHER ELIGIBLE APPLIANCES AND MEASURES OTHER THAN THOSE LISTED IN PROGRAM RECORDS. PROMPT IF NEEDED]**

1. Clothes Washers
2. Refrigerators
3. Dishwashers
4. Windows
5. Fixtures
6. Heat Pumps
7. Ceiling Fans
8. Electric Water Heater
9. CFLs
10. Insulation
11. Other **[RECORD]**
12. None
- 98. DON'T KNOW
- 99. REFUSED

[IF J2 = 12, -98 OR -99 SKIP TO J6. REPEAT J3 THROUGH J5 FOR ALL RESPONSES TO J2]

J3. When did you purchase **[INSERT MEASURE TYPE]**?

1. 2009
2. 2010
3. 2011
- 98. DON'T KNOW
- 99. REFUSED

J4. Did you receive an incentive for **[INSERT MEASURE TYPE]**?

1. Yes **[PROBE AND RECORD]**
2. No
- 98. DON'T KNOW
- 99. REFUSED

J5. How influential would you say the Home Energy Savings program was in your decision to add energy efficient equipment or services to your home? Was it...

1. Highly Influential
2. Somewhat Influential
3. Not at all influential
- 98. DON'T KNOW
- 99. REFUSED

- J6. Have you participated in and received an incentive from any other **[UTILITY]** energy efficiency Program?
1. Yes **[PROBE AND RECORD]**
 2. No
 - 98. DON'T KNOW
 - 99. REFUSED
- J7. **[IF J6 = 1]** On a scale of 0 to 10, where 0 is not at all influential and 10 is very influential; how influential would you say the Home Energy Savings program was in your decision to participate in other **[INSERT UTILITY]** program[s]?
1. **[RECORD]**
 2. No
 - 98. DON'T KNOW
 - 99. REFUSED

Demographics

I have just a few more questions about your household. Again, all your answers will be strictly confidential.

- D1. Which of the following best describes your house? **[READ LIST]:**
1. Single-family home
 2. Townhouse or duplex
 3. Mobile home or trailer
 4. Apartment building with 4 or more units
 5. Other **[RECORD]**
 - 98. **[DO NOT READ]** DON'T KNOW
 - 99. **[DO NOT READ]** REFUSED
- D2. Do you rent or own your home?
1. Own
 2. Rent
 3. Other **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- D3. Including yourself and any children, how many people currently live in your home?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED

D8. About when was this building first built? **[READ LIST IF NEEDED]**

1. Before 1970's
2. 1970's
3. 1980's
4. 1990-94
5. 1995-99
6. 2000's
7. OTHER **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D15. How many floors are in your building?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D16. What type of foundation does your home have? **[READ LIST IF NEEDED]**

1. Full finished basement
2. Unfinished Basement
3. Crawlspace
4. Slab on Grade
5. OTHER **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D9. Approximately how many square feet is the home in which the **[MEASURE](S)** was installed? **[READ LIST IF NEEDED]**

1. Under 1,000 square feet
2. 1,000 – 1,500 square feet
3. 1,501 – 2,000 square feet
4. 2,001 – 2,500 square feet
5. Over 2,500 square feet
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D17. What type of thermostat do you use to adjust the temperature in your home?

1. A programmable thermostat, and you use the automatic settings
2. A programmable thermostat but you don't use the automatic settings
3. A non-programmable thermostat, and you have no controls *[NOTE: USUALLY IN A BUILDING WITH 3 OR 4 APARTMENTS].*
4. OTHER **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D18. What are the temperature settings in winter when you are heating your home and... **[READ QUESTION "What are the temperature setting..." FOR 1 AND 2, FOR 3 AND 4 ONLY REPEAT QUESTION IF NECESSARY]**

1. At home. **[RECORD]**
2. Asleep at night. **[RECORD]**
3. Out during the day. **[RECORD. NA IF SOMEONE ALWAYS HOME]**
4. Away on vacation. **[RECORD]**
- 98. **[DO NOT READ] DON'T KNOW**
- 99. **[DO NOT READ] REFUSED**

D19. What are the temperature settings in summer when you are cooling your home and... **[READ QUESTION "What are the temperature setting..." FOR 1 AND 2, FOR 3 AND 4 ONLY REPEAT QUESTION IF NECESSARY]**

1. At home. **[RECORD]**
2. Asleep at night. **[RECORD]**
3. Out during the day. **[RECORD. NA IF SOMEONE ALWAYS HOME]**
4. Away on vacation. **[RECORD]**
- 98. **[DO NOT READ] DON'T KNOW**
- 99. **[DO NOT READ] REFUSED**

D20. How many weeks out of the year do you go on vacation... **[READ]**

1. During the winter. **[RECORD]**
2. During the summer **[RECORD]**
- 98. **[DO NOT READ] DON'T KNOW**
- 99. **[DO NOT READ] REFUSED**

D21. **[ASK IF MEASURE = HEAT PUMP OR E20 ≠ 7, 98 OR 99]** How many weeks out of the year do use your **[IF MEASURE = HEAT PUMP SAY "heat pump" OTHERWISE INSERT ANSWER FROM E20]** to cool your home? (Please remember to not include those weeks in the summer when on vacation).

1. **[RECORD 1-100]**
- 98. **DON'T KNOW**
- 99. **REFUSED**

D13. **[SKIP IF MEASURE = ELECTRIC WATER HEATER]** What is the fuel used by your primary water heater?

1. Electric
2. Natural Gas
3. Fuel oil
4. Other **[RECORD]**
- 98. **DON'T KNOW**
- 99. **REFUSED**

D14. **[IF D13 = 1-4]** How old is the primary water heater? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD 1-100]**
- 98. DON'T KNOW
- 99. REFUSED

D4. Can you please tell me in what year you were born?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D5. In 2010, was your pre-tax household income above or below \$50,000?

1. Below \$50,000
2. Above \$50,000
3. Exactly \$50,000
- 98. DON'T KNOW
- 99. REFUSED

[IF D5 = -98 OR -99 SKIP TO L1]

D6. **[ASK IF D5=1]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. Under \$10,000
2. \$10,000 to under \$20,000
3. \$20,000 to under \$30,000
4. \$30,000 to under \$40,000
5. \$40,000 to under \$50,000
- 98. DON'T KNOW
- 99. REFUSED

D7. **[ASK IF D5=2]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. \$50,000 to under \$60,000
2. \$60,000 to under \$75,000
3. \$75,000 to under \$100,000
4. \$100,000 to under \$150,000
5. \$150,000 to under \$200,000
6. \$200,000 or more
- 98. DON'T KNOW
- 99. REFUSED

Conclusion

L1. Do you have any additional feedback or comments?

1. Yes **[RECORD VERBATUM]**
2. No
- 98. DON'T KNOW
- 99. REFUSED

L2. Sex **[DO NOT READ]**

1. Female
2. Male
- 98. DON'T KNOW

That concludes the survey. Thank you very much for your time and feedback.

3. Participant Retailer/Contractor Survey

Retailer Name: _____ Survey Date: _____
Contact Name: _____ Interviewer Initials: _____
Contact Phone Number: _____ Contact Title: _____
National ENERGY STAR Partner: Yes No

Retailer Segment

1. Department or discount department store (e.g., Dollar, Target, Wal-Mart, Costco)
2. Drug store (e.g., CVS, Walgreens)
3. Electronics (Radio Shack, Best Buy, Ultimate Electronics)
4. Furniture or home furnishing store (e.g., Bed Bath & Beyond, Ikea)
5. Grocery store (e.g., Jewel, Dominicks...)
6. Hardware store (e.g., Ace, True Value)
7. Home improvement store (e.g., Home Depot, Lowe's)
8. Lighting specialty store
9. Other **[RECORD]**

Introduction

[TO RESPONDENT] Hello, my name is **[INSERT FIRST NAME]** and I am calling from **[THE CADMUS GROUP]** on behalf of **[PACIFICORP/PACIFIC POWER/ROCKY MOUNTAIN POWER]**. May I please speak with **[INSERT CONTACT]**

[IF CONTACT IS AVAILABLE, CONTINUE; IF UNAVAILABLE TRY TO RESCHEDULE, IF CONTACT CONTINUES TO BE UNAVAILABLE SAY "I AM HOPING TO SPEAK WITH SOMEONE WHO IS FAMILIAR WITH PACIFIC POWER/ROCKY MOUNTAIN POWER'S HOME ENERGY SAVINGS PROGRAM. CAN YOU DIRECT ME TO SOMEONE ELSE WHO IS KNOWLEDGABLE ABOUT THESE ENERGY-EFFICIENT PRODUCTS? REINTRODUCE, THEN CONTINUE]

We are currently evaluating the Home Energy Savings Program and I have a few questions I'd like to ask you about your store and the products you carry. Your responses will remain confidential.

[UTILITY REGION]

Utah, Wyoming and Idaho = Rocky Mountain Power
Washington and California = Pacific Power

[RESPONSES TO RETAILER QUESTIONS – MAY BE USED IF NECESSARY]

(TIMING: This survey should take about 15 minutes of your time. Is this a good time for us to speak with you? **[IF NOT, SET UP CALL BACK APPOINTMENT])**

(WHO ARE YOU WITH: I'm with **[THE CADMUS GROUP]**, an independent research firm that has been hired by PacifiCorp/PP/RMP to evaluate the Home Energy Savings program.)

(SALES CONCERN: I am not selling anything; we would simply like to learn about your experience with the Home Energy Savings program. Your individual responses and your company-specific information will remain confidential. If you would like to talk with someone from **[PACIFIC POWER/ROCKY MOUNTAIN POWER]** about this study, feel free to call [see provided retailer contact list])

(WHY ARE YOU CONDUCTING THIS STUDY: Studies like this help **[PACIFIC POWER/ROCKY MOUNTAIN POWER]**. better understand customers' need and interest in energy programs and services. Sharing your opinions and experiences will help us as we consider modifications and improvements to the program going forward.)

B1. Do you have 15 minutes to talk?

1. Yes
2. No **[ARRANGE CALLBACK]**

B2. **[IF INITIAL CONTACT WAS NOT REACHED, ASK B2]** Are you familiar with the energy-efficient product lines you carry, and the products for which there are energy-efficient or ENERGY STAR models available?

1. Yes
2. No **[SAY: "Can you provide me with a contact name and phone number for a person at your store who might be more familiar with the energy-efficient products you carry?" [IF NO, THANK AND TERMINATE, IF YES - EITHER HANG UP AND RESTART, OR CONTINUE WITH SURVEY IF TRANSFERRED]**

B3. **[IF INITIAL CONTACT WAS REACHED, ASK B3]** Our records show that you are a contact for **[UTILITY]'s** Home Energy Savings Program and hence are familiar with the energy-efficient products that you carry. Is that correct?

1. Yes
2. No **[SAY: "Can you provide me with a contact name and phone number for a person at your store who might be more familiar with the energy-efficient products you carry?" [IF NO, THANK AND TERMINATE, IF YES - EITHER HANG UP AND RESTART, OR CONTINUE WITH SURVEY IF TRANSFERRED]**

B4. The questions I will be asking you focus on the calendar years 2009 and 2010. Were you employed at this store during those years?

1. Yes
2. No **[SAY: "Can you provide me with a contact name and phone number for a person at your store who was employed during that time and is familiar with the energy-efficient products that you carry?" [IF NO, THANK AND TERMINATE, IF YES - EITHER HANG UP AND RESTART, OR CONTINUE WITH SURVEY IF TRANSFERRED]**

1. [REINTRODUCE IF NECESSARY, OR ARRANGE CALLBACK]**Interaction with Program / Program staff**

C1. How did you initially find out about the HES program?

1. HES field staff called
2. HES field staff stopped by
3. Received a marketing package/materials
4. From another retailer
5. From the utility
6. At a presentation **[RECORD WHICH PRESENTATION]**
7. Manufacturer
8. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

C2. How helpful are the HES staff at addressing your needs? Would you say they are...**[READ LIST]**

1. Not at all helpful
2. Not very helpful
3. Somewhat helpful
4. Very helpful
5. I have never interacted with the HES staff
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

C3. What could they have done better?

1. **[RECORD]**
2. Nothing
- 98. DON'T KNOW
- 99. REFUSED

[IF C1 = 3 SKIP TO C5]

C4. Did you receive marketing materials from **[PACIFICORP/ROCKY MOUNTAIN POWER]** or Portland Energy Conservation, Inc. (PECI) staff?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF C4<>1 SKIP TO D1]

- C5. How would you describe the amount of marketing materials provided? Would you say there was...**[READ LIST]**
3. No information/materials provided
 4. Some information/materials provided, but not enough
 5. A good amount of information/materials
 6. Too much information/materials
 - 98. **[DO NOT READ]** DON'T KNOW
 - 99. **[DO NOT READ]** REFUSED
- C6. Was there any information lacking?
1. Yes **[RECORD]**
 2. No
 - 98. DON'T KNOW
 - 99. REFUSED
- C7. What type of marketing materials did you receive? **[DO NOT READ]**
1. FAQs
 2. Applications to hand out to customers
 3. Posters
 4. Product clings
 5. List of qualified products
 6. End caps
 7. Aisle violators
 8. Other **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- C8. What type of marketing materials did you find most useful? **[DO NOT READ]**
1. FAQs
 2. Applications to hand out to customers
 3. Posters
 4. Product clings
 5. List of qualified products
 6. Other **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- C9. Do you have any suggestions for changing the marketing materials?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED

CFL Pricing

Now I would like to ask you a few questions about the energy-efficient products that you sell. Please remember that questions that I will ask you focus on the years 2009 and 2010.

D1. Did you sell compact fluorescent lamps (or CFLs) during those years?

1. Yes
2. No **[SKIP TO E1]**
- 98. DON'T KNOW **[SKIP TO E1]**
- 99. REFUSED **[SKIP TO E1]**

D2. Which of the following types of light bulbs did your store stock in 2009 and 2010? **[READ LIST; MAY HAVE MULTIPLE RESPONSES]**

1. Standard ENERGY STAR compact fluorescent light bulbs, or CFLs, that are 42 watts or less. By “standard ENERGY STAR CFLS” I mean bulbs with the ENERGY STAR label that are not dimmable or reflectors, and have just one light level.
2. Specialty CFLs, such as dimmable, 3-way, spotlights, or reflector CFLS.
3. Both Standard and Specialty
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D3. Did you sell compact fluorescent lamps (or CFLs) that were discounted through the Home Energy Savings Program?

1. Yes
2. No **[SKIP TO E1]**
- 98. DON'T KNOW **[SKIP TO E1]**
- 99. REFUSED **[TO E1]**

D4. Did your participation in the program, or the materials you received from the program, affect the way you presented the price differences for high-efficiency products to your customer?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

D5. If the HES incentives were not available during 2009 and 2010, do you think your sales of standard ENERGY STAR CFL bulbs would have been about the same, lower, or higher? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

1. Same **[SKIP TO D11]**
2. Lower
3. Higher
- 98. DON'T KNOW **[SKIP TO D11]**
- 99. REFUSED **[SKIP TO D11]**

- D6. Why do you think sales of CFL bulbs would have been **[LOWER/HIGHER]** **[CHECK TO MAKE SURE THAT THE EXPLANATION MATCHES THE RESPONSE TO THE PREVIOUS SECTION]**?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- D7. **[ASK IF D5= 2 OR 3]**, By what percent would your sales of standard ENERGY STAR CFLs have been **[LOWER/HIGHER]** without the Home Energy Savings program? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**
1. Less than 10%
 2. 10%-19%
 3. 20%-29%
 4. 30%-39%
 5. 40-49%
 6. 50%-59%
 7. 60%-69%
 8. 70%-79%
 9. 80%-89%
 10. 90% or more
 - 98. DON'T KNOW
 - 99. REFUSED
- D8. Just to confirm, your sales of standard ENERGY STAR CFLs would have been **[INSERT % FROM D7]** **[LOWER/HIGHER]** in 2009 and 2010 if the **[PACIFIC POWER/ROCKY MOUNTAIN POWER]** program was not available?
1. Yes **[PROBE: WHY?]**
 2. No **[PROBE: WHY?]**
 - 98. DON'T KNOW
 - 99. REFUSED
- [IF D2 <> 2 SKIP TO D11]**
- D9. You said that during 2009 and 2010 your sales of standard CFLs without the Home Energy Savings Incentive program would have been **[LOWER, SAME, HIGHER]** as/than with the program. How about for specialty ENERGY STAR CFLs, such as dimmable, 3-way, or reflectors— would your sales of specialty ENERGY STAR CFLs have been about the same, lower, or higher without the **[PACIFIC POWER/ROCKY MOUNTAIN POWER]** incentives? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**
1. Same
 2. Lower
 3. Higher
 - 98. DON'T KNOW
 - 99. REFUSED

D10. **[ASK IF D9 = 2 OR 3]** By what percent would your sales of specialty ENERGY STAR CFLs have been **[LOWER/HIGHER]** without the program? **[IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

1. Less than 10%
2. 10%-19%
3. 20%-29%
4. 30%-39%
5. 40-49%
6. 50%-59%
7. 60%-69%
8. 70%-79%
9. 80%-89%
10. 90% or more
- 98. DON'T KNOW
- 99. REFUSED

D11. Can you estimate the percent of customers who were buying CFLs for their own homes, the percentage who were buying CFLs for their own businesses, and the percentage who were builders or contractors buying them for construction or retrofit projects?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF D11 <>1 SKIP TO D14]

D12. What's your percent estimate of this breakdown? **[IF NEEDED PROMPT: "Is it about 50% contractors, 50% homeowners, etc."]**

1. _____% of customers buying CFLs for their own homes
2. _____% of customers buying CFLs for their own businesses
3. _____% of customers buying CFLs for construction/retrofit projects
- 98. DON'T KNOW
- 99. REFUSED

[IF D12 = -98 OR -99 SKIP TO D14]

D13. What information is this based on? **[IF NEEDED, PROMPT: "Size of purchase, interaction with customers, etc."]**

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D14. Considering data you might have available or your personal knowledge, what would you estimate the total *sales* in dollars and in number of bulbs of all CFLs to be for your store over the course of a year? **[THIS INCLUDES PROGRAM BULBS AND NON-PROGRAM BULBS, STANDARD AND SPECIALTY BULBS][IF CAN'T ESTIMATE YEAR, ASK TO ESTIMATE MONTH; ALSO TRY TO GET ANSWER IN BOTH \$\$ AND UNITS]**

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D15. During 2009 & 2010, what percent of your total CFL sales would you estimate are CFLs purchased through the HES Lighting Program? Would it be...**[READ] [IMPORTANT QUESTION FOR NTG: PROBE IF DON'T KNOW]**

1. Less than 10%
2. 10%-19%
3. 20%-29%
4. 30%-39%
5. 40-49%
6. 50%-59%
7. 60%-69%
8. 70%-79%
9. 80%-89%
10. 90% or more
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D16. Are you familiar with the coming energy efficiency requirements for light bulbs from the Energy Independence and Security Act of 2007? It is commonly referred to as EISA.

1. Yes
2. No
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** Refused

[If D16=1 SKIP TO D18]

D17. EISA requires new efficiency requirements for common light bulbs. The new federal standards in EISA require the same amount of light output be produced with fewer watts. The standards outlined in EISA will be phased in over the next 3 years starting in 2012. Does this sound familiar?

1. Yes
2. No
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** Refused

[If D17<>1 SKIP TO D22]

- D18. Has your store changed stocking practices to prepare for EISA? If so, how?
1. Yes **[RECORD]**
 2. No
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** Refused
- D19. Does your store or company plan on making any other stocking changes in preparation for EISA?
1. Yes **[RECORD]**
 2. No
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** Refused
- D20. Does your store have any plans to help educate customers on EISA with marketing materials such as in-store displays?
1. Yes **[RECORD]**
 2. No
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** Refused
- D21. Have you received any feedback from your customers on EISA?
1. Yes **[RECORD]**
 2. No
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** Refused
- D22. **[IF D17<>1]** Since you're not familiar with EISA, would you like program staff to follow-up with you to provide you information on EISA?
1. Yes
 2. No
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** Refused

E. Program Promotion

The next few questions focus on how you market energy efficiency and the Home Energy Savings program.

E1. How do you typically inform your customers of the incentives available for qualifying energy-efficient products? **[DO NOT READ; RECORD MULTIPLE RESPONSES]**

1. Radio ads
2. TV ads
3. Print ads
4. Post posters on the retail floor
5. Product clings on qualifying appliances
6. Put out applications
7. I mention the program when I assist customers
8. I don't inform customers of the program
9. I only mention if they ask about energy efficient appliances
10. Don't need to inform, they already know about it
11. I rely on marketing by the program.
12. Other **[RECORD]**
13. Did not promote the Program **[PROBE: WHY NOT?]**
- 98. DON'T KNOW
- 99. REFUSED

E3. What types of marketing materials seem to be most effective?

1. Product clings
2. Posters
3. Flyer/handout
4. List of qualified products
5. Send them to the website
6. They prefer talking with salesperson
7. End-caps
8. Aisle violators
9. Bill inserts
10. In-store tabling
11. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E4. Do you use the availability of high-efficiency products to attract customers to your business?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

- E5. How often do you and your sales staff recommend the more energy-efficient options to customers? Would you say...**[READ LIST]**
1. Never
 2. Rarely
 3. Sometimes
 4. Often
 5. Always
 - 98. **[DO NOT READ]** DON'T KNOW
 - 99. **[DO NOT READ]** REFUSED
- E6. What tends to be the selling point for the higher efficiency products?
1. Cost saving on bill
 2. Energy savings
 3. Incentive Amount
 4. Environmental benefits
 5. Other **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- E7. Do you think your customers understand the energy-related benefits?
1. Yes
 2. No
 - 98. DON'T KNOW
 - 99. REFUSED
- E8. What types of programs or incentives do you think **[PACIFICORP/PACIFIC POWER/ROCKY MOUNTAIN POWER]** should offer to make energy-efficient products or equipment more attractive to your customers?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- E9. Of all the energy-efficient products you sell, which one or two do you believe customers are the least aware of?
1. **[RECORD]**
 - 98. DON'T KNOW
 - 99. REFUSED
- E9a. Do you have any suggestions for how **[INSERT UTILITY]** could help promote these technologies?

1. Yes [**RECORD**]
2. No
- 98. DON'T KNOW
- 99. REFUSED

E10. Of all the energy-efficient products you sell, which one or two do you believe customers are the most aware of or most likely to purchase without any additional advertising or promotions?

1. [**RECORD**]
- 98. DON'T KNOW
- 99. REFUSED

E11. Why do you think most customers choose not to participate in the program?

1. Measures too expensive
2. Incentive applications are too complex
3. Program is too much of a hassle
4. Customers are unaware of the benefits of energy efficiency
- 98. DON'T KNOW
- 99. REFUSED

E12. Do you think that the incentives are set at the right level?

1. Yes
2. No [**RECORD ANSWER**]
- 98. DON'T KNOW
- 99. REFUSED

Sales

Now I have a few questions about the products you sell.

F1. Which of these appliances or pieces of equipment does your store sell? **[READ LIST, RECORD MULTIPLE RESPONSES]**

1. Clothes Washers
2. Refrigerators
3. Dishwashers
4. Water heaters - electric, natural gas, heat pump water heaters
5. Lighting Fixtures
6. Ceiling Fans
7. Windows
8. Insulation
9. Central A/C Equipment
10. Evaporative Cooler
11. Room AC
- 98. **[DO NOT READ] DON'T KNOW**
- 99. **[DO NOT READ] REFUSED**

[REPEAT QUESTIONS F2-F3 FOR EACH MEASURE THAT THE RETAILER CARRIES]

F2. During 2009 and 2010, how many **[IF MEASURE=INSULATION, "square feet of"]** **[INSERT MEASURE]** would you estimate that your store sold?

1. **[RECORD]**
- 98. **DON'T KNOW [ATTEMPT TO GET A RANGE TO NEAREST 50 OR 100]**
- 99. **REFUSED [ATTEMPT TO GET A RANGE TO NEAREST 50 OR 100]**

F3. What percent of the **[MEASURE]** you sold during 2009 and 2010 were high-efficiency (ENERGY STAR®) rated or above?

1. **[RECORD %]**

	F1	F2	F3
	Carry Product? (Y/N)	QTY SOLD (#)	% Energy Star (%)
Clothes Washers			
Refrigerators			
Dishwashers			
Electric Water Heaters			
Lighting Fixtures			
Ceiling Fans			
Windows			
Central A/C			
Evaporative Cooler			
Room AC			

[END REPEATED SEQUENCE]

F4. How would you rate the typical customer when you tell them about the energy-saving potential of ENERGY STAR appliances? Would you say they are:

1. Not at all interested
 2. Not very interested
 3. Somewhat interested
 4. Very interested
- 98. DON'T KNOW
-99. REFUSED

F5. During 2009 and 2010, did the NUMBER of energy efficiency PRODUCTS you offer customers increased, decreased or stayed the same?

1. Increase
 2. Same
 3. Decrease
- 98. DON'T KNOW
-99. REFUSED

[IF F5 = 2 OR -98 OR -99 SKIP TO G1]

F6. What do you think are the main reasons for this change?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

Program Satisfaction

We're almost done. I just have a few quick questions about your overall satisfaction with the program.

G1. How easy was it for your store to participate in **[UTILITY]**'s Home Energy Saving Program? Would you say it was...

1. Very easy
2. Somewhat easy
3. Not very easy
4. Not at all easy
- 98. DON'T KNOW
- 99. REFUSED

G2. How satisfied are you with your overall program experience? Would you say you are...

1. Very satisfied
2. Somewhat satisfied
3. Not very satisfied
4. Not at all satisfied
- 98. DON'T KNOW
- 99. REFUSED

G3. Are there any changes you would recommend to improve the Home Energy Services Program?

1. Yes **[RECORD]**
2. No
- 98. DON'T KNOW
- 99. REFUSED

Conclusion

H1. What is the best way to contact your store about **[PACIFIC POWER/ROCKY MOUNTAIN POWER]** programs and services?

1. HES field staff call
2. HES field staff visit
3. Mail marketing package/materials
4. Through manufacturer field reps
5. Through corporate office
6. At a presentation/trade show **[RECORD]**
7. Email
8. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

H2. Those are all of the questions I have for you; but if I have a quick follow-up question at a later date would it be alright if I called back at that time?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H3. Do you have any final questions or comments for **[INSERT UTILITY]**?

1. Yes **[RECORD]**
2. No
- 98. DON'T KNOW
- 99. REFUSED

Thank you again for your time.

4. In-Territory Lighting Survey

[UTILITY]

Washington and California: Pacific Power

Utah, Wyoming, and Idaho: Rocky Mountain Power

Introduction

[TO RESPONDENT] Hello, I'm **[INSERT FIRST NAME]**, calling from Discovery Research, on behalf of **[INSERT UTILITY]**. Can I speak with **[INSERT NAME]**?

Hello, we are conducting a survey about household lighting and home energy use and would like to ask you some questions about your household's lighting and energy use. We would greatly appreciate your opinions.

[IF NOT AVAILABLE, ASK FOR AN ADULT IN THE HOUSEHOLD WHO IS RESPONSIBLE FOR PURCHASING THE LIGHT BULBS. IF NO ONE APPROPRIATE IS AVAILABLE, TRY TO RESCHEDULE AND THEN TERMINATE. IF TRANSFERRED TO ANOTHER PERSON, REPEAT INTRO AND THEN CONTINUE.]

Responses to Customer Questions [IF NEEDED]

(Timing: This survey should take about 15 minutes of your time. Is this a good time for us to speak with you?)

(Who are you with: I'm with DISCOVERY RESEARCH, an independent research firm that has been hired by **[INSERT UTILITY]** to conduct this research. I am calling to learn about your household lighting and home energy use)

(Sales concern: I am not selling anything; we would simply like to learn about your household lighting and home energy use. Your responses will be kept confidential. If you would like to talk with someone from **[INSERT UTILITY]** about this study, feel free to call 1-800-942-0266, or visit their website: <http://www.homeenergysavings.net/>)

(Who is doing this study: **[INSERT UTILITY]**, your electric utility, is conducting evaluations of several of its efficiency programs, including the Home Energy Savings program.)

(Why are you conducting this study: Studies like this help **[INSERT UTILITY]** better understand customers' need and interest in energy programs and services.)

S2. This call may be monitored for quality assurance. First, Are you the person who usually purchases light bulbs for your household?

1. Yes
2. No, but person who does can come to phone [**START OVER AT INTRO SCREEN WITH NEW RESPONDENT**]
3. No, and the person who does is not available [**SCHEDULE CALLBACK**]
- 98. DON'T KNOW [**THANK AND TERMINATE**]
- 99. REFUSED [**THANK AND TERMINATE**]

S3. Have you ever been employed in the market research field?

1. Yes [**THANK AND TERMINATE**]
2. No [**CONTINUE**]
- 98. DON'T KNOW [**THANK AND TERMINATE**]
- 99. REFUSED [**THANK AND TERMINATE**]

S4. Have you, or anyone in your household, ever been employed by or affiliated with [**INSERT UTILITY**] or any of its affiliates?

1. Yes [**THANK AND TERMINATE**]
2. No [**CONTINUE**]
- 98. DON'T KNOW [**THANK AND TERMINATE**]
- 99. REFUSED [**THANK AND TERMINATE**]

Familiarity with CFLs

First, I would like to ask you about your familiarity with different types of light bulbs.

C1. Before this call today, had you ever heard of compact fluorescent bulbs, or CFLs?

1. Yes **[SKIP TO C3]**
2. No

C2. Compact fluorescent light bulbs – also known as CFLs – usually do not look like traditional incandescent light bulbs. The most common type of compact fluorescent bulb is made with a glass tube bent into a spiral, resembling soft-serve ice cream, and it fits in a regular light bulb socket. Before today, were you familiar with CFLs?

1. Yes
2. No **[THANK AND TERMINATE]**

C3. How familiar are you with CFLs? Would you say that you are... **[READ]**

1. Very familiar
2. Somewhat familiar
3. Not too familiar, or
4. Not at all familiar
- 98. **[DO NOT READ] DON'T KNOW**
- 99. **[DO NOT READ] REFUSED**

CFL Purchases

Now I have some questions about your lighting purchases during the last two calendar years, 2009 and 2010.

E1. Did you purchase or receive any CFLs in 2009 or 2010?

1. Yes
2. No **[THANK AND TERMINATE]**
- 98. **DON'T KNOW [THANK AND TERMINATE]**
- 99. **REFUSED [THANK AND TERMINATE]**

E2. **[ASK IF E1= 1]** During 2009 and 2010, how many *CFLs* did you or your household purchase or acquire? Please try to estimate the total number of *individual CFL bulbs*, as opposed to packages. **[IF "DON'T KNOW," PROBE: "Is it less than or more than five bulbs?" WORK FROM THERE TO GET AN ESTIMATE]**

[NUMERIC OPEN END: RECORD NUMBER OF CFLS, NOT A RANGE.] [IF QUANTITY=0, THANK AND TERMINATE]

1. **[RECORD # OF CFLs]**
 - 98. DON'T KNOW **[PROBE FOR ESTIMATES; IF UNABLE TO GET AN ANSWER, THANK AND TERMINATE]**
 - 99. REFUSED **[THANK AND TERMINATE]**
- E3. Of these **[INSERT QUANTITY FROM E2]** CFLs that you acquired in 2009 and 2010, how many did you buy at a retail store as opposed to receiving them for free?
1. **[RECORD # OF CFLs]**
 2. **NONE**
 - 98. DON'T KNOW
 - 99. REFUSED
- E4. **[ASK IF E3=1]** How many, if any, of the **[INSERT QUANTITY FROM E3]** CFLs that you bought at a retail store were part of a **[INSERT UTILITY]** sponsored sale?
1. **[RECORD # OF CFLs]**
 2. **NONE**
 - 98. DON'T KNOW
 - 99. REFUSED
- E5. How many did you receive for free from an individual or organization?
1. **[RECORD # OF CFLs]**
 2. **NONE**
 - 98. DON'T KNOW
 - 99. REFUSED
- E6. **[ASK IF E3+ E5< QUANTITY FROM 0]** Thanks, that accounts for **[E3+E5]** of the total quantity that you bought during those two years. Can you tell me where you got the **[INSERT QUANTITY OF 0 MINUS (E3+E5)]** other bulbs from?
1. **[RECORD VERBATUM] OR ADJUST E3 AND E5 ACCORDINGLY**
 - 98. REFUSED
 - 99. DON'T KNOW
- E7. **[ASK IF E4.1 > 0]** Did the utility discount influence your decision to purchase CFLs over another type of bulb?
1. Yes
 2. No
 - 98. DON'T KNOW
 - 99. REFUSED

E8. What **[IF E7=01 IS ASKED SAY “other”]** factors influenced your decision to buy CFLs over other types of bulbs? **[DO NOT READ] [MULTIPLE RESPONSES ALLOWED]**

1. Energy savings
2. Cost savings on electricity bill
3. Price of bulb
4. Environmental concerns
5. Quality of light
6. Lifetime of bulb
7. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

E9. **[SKIP IF E3 = 2; i.e. “did not buy any bulbs, only received free bulbs”]** Where did you buy the majority of your CFL bulbs purchased in 2009-2010? **[MULTIPLE RESPONSES ALLOWED. DO NOT READ]**

1. Ace Hardware **[RECORD CITY AND STATE]**
2. Albertsons **[RECORD CITY AND STATE]**
3. Bed Bath and Beyond **[RECORD CITY AND STATE]**
4. Best Buy **[RECORD CITY AND STATE]**
5. CVS **[RECORD CITY AND STATE]**
6. Decker's Food Center **[RECORD CITY AND STATE]**
7. Discount Grocery **[RECORD CITY AND STATE]**
8. Do it Best Hardware **[RECORD CITY AND STATE]**
9. Dollar Tree **[RECORD CITY AND STATE]**
10. Family Dollar **[RECORD CITY AND STATE]**
11. Home Depot **[RECORD CITY AND STATE]**
12. Kennedy Hardware Inc. **[RECORD CITY AND STATE]**
13. Kmart **[RECORD CITY AND STATE]**
14. Lighting One **[RECORD CITY AND STATE]**
15. Loaf'N Jug **[RECORD CITY AND STATE]**
16. Lowe's **[RECORD CITY AND STATE]**
17. Office Depot **[RECORD CITY AND STATE]**
18. Red Eagle Food Store **[RECORD CITY AND STATE]**
19. Rite Aid **[RECORD CITY AND STATE]**
20. Ridley's Family Market **[RECORD CITY AND STATE]**
21. Safeway **[RECORD CITY AND STATE]**
22. Sam's Club **[RECORD CITY AND STATE]**
23. Staples **[RECORD CITY AND STATE]**
24. The Home Depot **[RECORD CITY AND STATE]**
25. True Value Hardware **[RECORD CITY AND STATE]**
26. Walgreens **[RECORD CITY AND STATE]**
27. Walmart **[RECORD CITY AND STATE]**
28. Whole Foods **[RECORD CITY AND STATE]**
29. Other **[RECORD VERBATIM] [RECORD CITY AND STATE]**

- 98. DON'T KNOW
- 99. REFUSED

Now I'd like to ask you a few questions about where the **[READ IN QUANTITY FROM [INSERT E2]** CFLs you acquired in 2009 and 2010 are now.

E10. How many are currently installed in your home?

- 1. **[RECORD # OF CFLs] [IF THIS QUANTITY = E2 QUANTITY, SKIP TO E14, IE "ALL BULBS ARE INSTALLED IN HOME"]**
- 2. **NONE**
- 98. DON'T KNOW
- 99. REFUSED

E11. How many are in storage for later use?

- 1. **[RECORD # OF CFLs]**
- 2. **NONE**
- 98. DON'T KNOW
- 99. REFUSED

E12. How many were discarded or given away?

- 1. **[RECORD # OF CFLs]**
- 2. **NONE**
- 98. DON'T KNOW
- 99. REFUSED

E13. **[ASK IF E10+ E11+E12<> QUANTITY FROM 0]** Thanks, that accounts for **[E10+ E11+E12]** of the total quantity that you bought during those two years. Can you tell me where the **[INSERT QUANTITY OF 0 MINUS (E8+ E9+ E10)]** other bulbs are now?

- 1. **[RECORD VERBATUM]**
- 98. REFUSED
- 99. DON'T KNOW

E14. **[Skip if E10 = 0]** Of the **[INSERT QUANTITY E10]** bulbs that are currently installed in your home that were purchased during 2009 and 2010, can you tell me how many CLFs are installed in each room in your house?

1. Bedroom **[RECORD]**
2. Bedroom (unoccupied) **[RECORD]**
3. Basement **[RECORD]**
4. Bathroom **[RECORD]**
5. Closet **[RECORD]**
6. Dining **[RECORD]**
7. Foyer **[RECORD]**
8. Garage **[RECORD]**
9. Hallway **[RECORD]**
10. Kitchen **[RECORD]**
11. Office/Den **[RECORD]**
12. Living Space **[RECORD]**
13. Storage **[RECORD]**
14. Outdoor **[RECORD]**
15. Utility **[RECORD]**
16. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

E15. **[ASK IF TOTAL BULBS IN E14 < QUANTITY FROM E10 (IF TOTAL NUMBER OF BULBS LISTED IN EACH ROOM DOES NOT MATCH THE NUMBER OF BULBS INSTALLED STATED IN E10)]** Thanks, that accounts for **[TOTAL BULBS IN E14]** of the total quantity that are currently installed in your home. Can you tell me where the **[QUANTITY OF E10 MINUS TOTAL BULBS IN E14]** other bulbs are installed?

1. **[RECORD VERBATUM]**
- 98. DON'T KNOW
- 99. REFUSED

Program Awareness

B4. **[UTILITY]** offers discounts on CFLs at participating retailers in your area through a program called Home Energy Savings. Before today, were you aware of this program?

1. Yes
2. No

[IF B4=1, OTHERWISE SKIP TO F1]

B1. How did you first hear about the **[INSERT UTILITY]**'s Home Energy Savings program? **[DO NOT READ LIST. RECORD FIRST RESPONSE. ONE ANSWER ONLY]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Home Energy Savings website
5. Other website
6. Internet Advertising/Online Ad
7. Family/friends/word-of-mouth
8. Rocky Mountain Power/Pacific Power Representative
9. Radio
10. TV
11. Billboard/outdoor ad
12. Retailer/Store
13. Sporting event
14. Home Shows/Trade Shows (Home and Garden Shows)
15. Social Media
16. Other **[RECORD VERBATUM]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

B2. **[ASK IF B1<>4]** Have you ever visited the Home Energy Savings website?

1. Yes
2. No

B3. **[ASK IF B2 = 1 OR B1=4]** Was the website... **[READ]**

1. Very helpful
2. Somewhat helpful
3. Somewhat unhelpful
4. Very unhelpful
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

B5. **[ASK IF B2=1 OR B1 = 4]** Have you ever viewed the list of participating retailers on **[INSERT UTILITY]**'s Home Energy Savings website?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

Willingness to Pay

I am going to ask you a few questions about prices of CFL bulbs. Thinking about the **[INSERT QUANTITY FROM E2]** CFLs that you purchased in 2009 and 2010 please tell me if you would have purchased more, less or the same amount of CFLs at each price. **[RANDOM ORDER OF QUESTIONS, EITHER ASCENDING OR DECENDING PRICES]**

F1. If the bulbs were \$18, would you have bought more, less or the same amount? **[PROBE IF DON'T KNOW]**

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

F2. **[IF F1 = 1 OR 2]** And how many CFLs would you have purchased if each bulb had cost \$18? **[PROBE IF DON'T KNOW]**

1. **[RECORD NUMBER]**
- 98. DON'T KNOW
- 99. REFUSED

F3. If the bulbs were \$12, would you have bought more or less than **[INSERT QUANTITY FROM E2]** CFLs? **[PROBE IF DON'T KNOW]**

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

F4. **[IF F3 = 1 OR 2]** And how many would you have purchased at \$12? **[PROBE IF DON'T KNOW]**

1. **[RECORD NUMBER]**
- 98. DON'T KNOW
- 99. REFUSED

Thanks. I just have two more prices that I would like to ask you about.

F5. If the bulbs were \$6, would you have bought more or less than **[INSERT QUANTITY FROM E2]** CFLs?
[PROBE IF DON'T KNOW]

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

F6. **[IF F5 = 1 OR 2]** And how many would you have purchased at \$6? **[PROBE IF DON'T KNOW]**

1. **[RECORD NUMBER]**
- 98. DON'T KNOW
- 99. REFUSED

F7. If the bulbs were \$0.50, would you have bought more or less than **[INSERT QUANTITY FROM E2]** CFLs? **[PROBE IF DON'T KNOW]**

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

F8. **[IF F7 = 1 OR 2]** And how many would you have purchased at \$0.50? **[PROBE IF DON'T KNOW]**

1. **[RECORD NUMBER]**
- 98. DON'T KNOW
- 99. REFUSED

CFL Satisfaction

[ASK CFL SATISFACTION SECTION ONLY IF E8 > 0 (CURRENTLY HAS CFLS INSTALLED)]

G1. Approximately how long ago did you FIRST use a compact fluorescent light bulb? **[RECORD EITHER MONTHS OR YEARS]**

1. Months **[RECORD]**
2. Years **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

G2. How satisfied are you with the compact fluorescent light bulb(s) currently in your home? Would you say you are... **[READ]**

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G3. **[IF G2= 3 OR 4]** And why do you say that?

1. **[RECORD VERBATUM]**
- 98. DON'T KNOW
- 99. REFUSED

Behavioral Changes

H1. Think about the last CFL that you installed in your home. What type of bulb was in the socket before you installed the CFL?

1. Incandescent (or "traditional" bulbs)
2. CFL
3. LED
4. Florescent
5. Halogen
6. Empty
7. Has never installed a CFL
- 98. DON'T KNOW
- 99. REFUSED

[IF H1 = 6, 7, 98 OR 99 SKIP TO J1]

H2. Was the bulb still working when you removed it?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H3. **[IF H2 = 1]** Was the bulb you removed... **[READ]**

1. Moved to a different socket
2. Stored for later use
3. Thrown away
4. Recycled
5. Other **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

H4. Since installing the CFL in that socket, has your use of that light... **[READ]**

1. Increased
2. Stayed the same
3. Decreased
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

H5. **[IF H4 = 1 OR 3]** After you replaced the bulb with a CFL did your use **[INCREASE/DECREASE]** by... **[READ]**

1. More than 1 hour a day, or
2. Less than or equal to 1 hour a day
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

H6. **[IF H4 = 1 OR 3]** Why did your use of the socket **[INCREASE/DECREASE]**?

1. **[RECORD VERBATUM]**
- 98. DON'T KNOW
- 99. REFUSED

EISA Awareness

J1. The Energy Independence and Security Act of 2007 sets new federal efficiency standards for lighting that will be phased in beginning in 2012. These standards will require that traditional incandescent light bulbs improve their efficiency by about 25% over current levels. Most traditional incandescent light bulbs will not meet the efficiency standard and will not be sold. Before this call today, had you ever heard of this new federal standard for lighting?

1. Yes
2. No

J2. Manufacturers are developing more efficient incandescent bulbs that will meet the new federal standards. Given the choice of purchasing a more efficient incandescent bulb or a CFL, LED or halogen bulb, which do you think you would purchase?

1. Incandescent bulb
2. CFL
3. LED
4. Halogen
5. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

CFL Disposal

K1. Have you had any CFLs burn out in the past 12 months?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

K2. Have you disposed of any CFLs in the past 12 months?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

K3. **[ASK IF K2=1]** How did you dispose of the CFL(s)? **[DO NOT READ. ALLOW MULTIPLE RESPONSE]**

1. Threw away in trash
2. Recycled / dropped off at hazardous waste center
3. Brought to a Home Depot or another retail store to recycle
4. Held onto/stored at home
5. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

K4. **[SKIP TO K6 IF B2 =2]** Have you visited the Home Energy Savings or **[UTILITY]**'s webpage on CFL disposal?

1. Yes
2. No

K5. **[IF K4 = 1]** How satisfied were you with the information provided on **[UTILITY]**'s CFL disposal webpage?

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

- K6. What concerns, if any, do you have with the disposal of CFLs? **[DO NOT READ. ALLOW MULTIPLE RESPONSES]**
1. None
 2. Mercury
 3. Requires special disposal/Must be recycled
 4. Fire hazard
 5. Other **[RECORD]**
- 98. DON'T KNOW
-99. REFUSED

[IF RESPONDENT ASKS: Why should I be concerned about the disposal of CFLs? ANSWER: CFLs contain a very small amount of mercury sealed within the glass tubing. The Environmental Protection Agency (EPA) recommends that consumers take advantage of available recycling options offered by manufacturers and retailers. Many stores that sell CFLs also recycle them. You can find a listing of participating retailers and CFL recycling locations on [UTILITY]'s Proper CFL Disposal webpage [IF UTILITY = ROCKY MOUNTAIN POWER] (<http://www.rockymountainpower.net/cfldisposal>); [if UTILITY = PACIFIC POWER] <http://www.pacificpower.net/cfldisposal>].]

LED Usage

Now I would like to ask you about your experience with LED bulbs.

- M1. LEDs or light emitting diodes are bulbs that are comprised of many smaller nodular shaped lights that are very bright. Common uses for LEDs include car brake lights and flashlights. We are interested in the LEDs that have been developed to replace traditional household lighting. How familiar are you with LEDs? Would you say that you are... **[READ]**
1. Very Familiar
 2. Somewhat familiar
 3. Not too familiar, or
 4. Not at all familiar
- 98. DON'T KNOW **[DO NOT READ]**
-99. REFUSED **[DO NOT READ]**
- M2. Did you or someone in your household purchase any LED bulbs for standard lighting sockets in 2009 and 2010 to be installed in your home?
1. Yes
 2. No
- 98. DON'T KNOW **[DO NOT READ]**
-99. REFUSED **[DO NOT READ]**

[IF M2 = 2, 98 OR 99 SKIP TO D1]

M3. How many did you purchase during 2009 and 2010?

1. **[RECORD NUMBER]**
- 98. DON'T KNOW
- 99. REFUSED

M4. Of the LED bulbs that are currently installed in your home can you tell me how many LEDs are installed in each room in your house?

1. Bedroom **[RECORD]**
2. Bedroom (unoccupied) **[RECORD]**
3. Basement **[RECORD]**
4. Bathroom **[RECORD]**
5. Closet **[RECORD]**
6. Dining **[RECORD]**
7. Foyer **[RECORD]**
8. Garage **[RECORD]**
9. Hallway **[RECORD]**
10. Kitchen **[RECORD]**
11. Office/Den **[RECORD]**
12. Living Space **[RECORD]**
13. Storage **[RECORD]**
14. Outdoor **[RECORD]**
15. Utility **[RECORD]**
16. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

M5. How satisfied are you with the LED bulbs currently in your home? Would you say you are... **[READ]**

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

M6. **[IF M5 = 3 OR 4]** And why do you say that?

1. **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

M7. The retail cost of a comparable LED bulb for use in a traditional light socket is approximately \$20 per bulb. If LEDs cost twice as much per bulb or \$40, do you think you would have purchased more, fewer or the same number of LEDs?

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

M8. **[IF M7 = 1 OR 2]** How many LEDs would you have purchased if each bulb had cost twice as much per bulb?

1. **[RECORD NUMBER]**
2. NONE
- 98. DON'T KNOW
- 99. REFUSED

M9. If LEDs cost half as much per bulb (or \$10), do you think you would have purchased more, fewer or the same number of LEDs?

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

M10. **[IF M9 = 1 OR 2]** How many would you have purchased if each bulb had cost half as much?

1. **[RECORD NUMBER]**
2. NONE
- 98. DON'T KNOW
- 99. REFUSED

M11. If LEDs cost one quarter as much per bulb (or \$5), do you think you would have purchased more, fewer or the same number of LEDs?

1. More
2. Fewer
3. Same number
- 98. DON'T KNOW
- 99. REFUSED

M12. **[IF M11 = 1 OR 2]** How many would you have purchased if each bulb had cost one quarter as much?

1. **[RECORD NUMBER]**
2. NONE
- 98. DON'T KNOW
- 99. REFUSED

Demographics

I have just a few more questions about your household. Again, all your answers will be strictly confidential.

D1. Which of the following best describes your house? **[READ LIST]:**

1. Single-family home
2. Townhouse or duplex
3. Mobile home or trailer
4. Apartment building with 4 or more units
5. Other **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D2. Do you rent or own your home?

1. Own
2. Rent
3. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D3. About when was this building first built? **[READ LIST IF NEEDED]**

1. Before 1970's
2. 1970's
3. 1980's
4. 1990-94
5. 1995-99
6. 2000's
7. OTHER **[RECORD]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D4. Approximately how many square feet is your home? **[READ LIST IF NEEDED]**

1. Under 1,000 square feet
2. 1,000 – 1,500 square feet
3. 1,501 – 2,000 square feet
4. 2,001 – 2,500 square feet
5. Over 2,500 square feet
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D5. What is the primary heating source for your home? **[READ LIST IF NEEDED]**

1. Forced air natural gas furnace
2. Forced air propane furnace
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Electric baseboard heat
6. Gas fired boiler/radiant heat
7. Oil fired boiler/radiant heat
8. Passive Solar
9. Pellet stove
10. Wood stove
11. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D6. **[IF D5 = 1-11]** How old is the primary heating system? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD 1-100]**
- 98. DON'T KNOW
- 99. REFUSED

D7. What type of air conditioning system, if any, do you use in your home? **[INDICATE ALL THAT APPLY]**

1. Central Air Conditioner
2. Room Air Conditioner
3. Evaporative Cooler
4. Air Source Heat Pump
5. Ground Source Heat Pump
6. Whole house fan
7. No cooling system before
8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D8. **[SKIP IF D7 = 7]** How many years old is your primary cooling system? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D9. What is the fuel used by your primary water heater?

1. Electric
2. Natural Gas
3. Fuel oil
4. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D10. How old is the primary water heater? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD 1-100]**
- 98. DON'T KNOW
- 99. REFUSED

D11. Including yourself and any children, how many people currently live in your home?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D12. **[IF D11 > 1]** Are any of the people living in your home dependent children under the age of 18?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

D13. Can you please tell me in what year you were born?

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D14. In 2010, was your pre-tax household income above or below \$50,000?

1. Below \$50,000
2. Above \$50,000
3. Exactly \$50,000
- 98. DON'T KNOW
- 99. REFUSED

[IF D14 = -98 OR -99 SKIP TO L1]

D15. **[ASK IF D14=1]** Which of the following categories best represents your household income in 2010? Please stop me when I read your category:

1. Under \$10,000
 2. \$10,000 to under \$20,000
 3. \$20,000 to under \$30,000
 4. \$30,000 to under \$40,000
 5. \$40,000 to under \$50,000
- 98. DON'T KNOW
-99. REFUSED

D16. **[ASK IF D14=2]** Which of the following categories best represents your household income in 2010? Please stop me when I read your category:

1. \$50,000 to under \$60,000
 2. \$60,000 to under \$75,000
 3. \$75,000 to under \$100,000
 4. \$100,000 to under \$150,000
 5. \$150,000 to under \$200,000
 6. \$200,000 or more
- 98. DON'T KNOW
-99. REFUSED

Conclusion

L1. How satisfied are you with the service that **[INSERT UTILITY]** provides overall? Would you say you are... **[READ]**

1. Very Satisfied
 2. Somewhat Satisfied
 3. Not Very Satisfied
 4. Not At All Satisfied
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** REFUSED

L2. **[ASK IF E4.1 > 0]** Did **[UTILITY]**'s discount program cause your satisfaction with **[UTILITY]** to...

1. Increase
 2. Stay the same
 2. Decrease
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** REFUSED

L3. Do you have any additional feedback or comments?

1. Yes **[RECORD VERBATUM]**
 2. No
- 98. DON'T KNOW
-99. REFUSED

L4. Sex **[INTERVIEWER: DO NOT READ]**

1. Female
2. Male
- 98. DON'T KNOW

That concludes the survey. Thank you very much for your time and feedback.

5. Participant Refrigerator Appliance Recycling Program Survey

Introduction

[TO RESPONDENT]: Hello, my name is **[INSERT FIRST NAME]** from Discovery Research Group. I'm calling on behalf of **[UTILITY]**. I am calling to ask you some survey questions about the See ya later, Refrigerator recycling program.

[IF RESPONDENT EXPRESSES RESERVATIONS AT THIS POINT, USE THE FOLLOWING SCRIPT TO PERSUADE. IF RESPONDENT DOES NOT EXPRESS RESERVATIONS SKIP TO S1]:

I'm not selling anything, we are interested in your opinions to help improve our programs, and understand how to assist customers in saving money on their utility bills. Your responses will remain confidential.

Screening Questions

S1. According to our records, someone in your household signed up to recycle an appliance through the **[UTILITY]** "See ya Later, Refrigerator" program. Are you that person?

1. Yes
2. No
- 98. DON'T KNOW **[TERMINATE]**
- 99. REFUSED **[TERMINATE]**

S2. **[ASK IF S1=2]** Is that person available to speak with?

1. Yes **[CONTINUE WITH NEW RESPONDENT]**
2. No **[TERMINATE, ARRANGE CALLBACK IF POSSIBLE]**

Measure Verification

A1. **[ASK IF QUANTITY_REF>0]** Program records indicate that you received an incentive for having **[INSERT QUANTITY_REF]** refrigerator(s) recycled by the program around **[INSERT DATE OF PICKUP]**. Is this correct?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED **[TERMINATE]**

A2. **[ASK IF A1=2 OR A1=98]** How many refrigerators did you recycle through the **[INSERT UTILITY]** program?

1. **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

[IF A2=0, RECODE QUANTITY_REF=0]

A3. **[ASK IF QUANTITY_FRZ>0]** Program records indicate that you received an incentive for having **[INSERT QUANTITY_FRZ]** freezer(s) recycled by the program around **[INSERT DATE OF PICKUP]**. Is this correct?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED **[TERMINATE]**

A4. **[ASK IF A3=2 OR A3=98]** How many freezers did you recycle through the **[INSERT UTILITY]** program?

1. **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

[IF A4=0, RECODE QUANTITY_FRZ=0]

Awareness

B1. How did you learn about the **[INSERT UTILITY]** appliance recycling program? **[DO NOT READ LIST. RECORD UP TO 3 RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Rocky Mountain Power/Pacific Power Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Retailer/Store
12. Sporting event

13. Home Shows/Trade Shows
14. Appliance Recycling Contractor
15. Other **[RECORD VERBATUM]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

B2. What are the best ways for **[INSERT UTILITY]** to inform you about energy-efficiency offerings like the appliance recycling program? **[DO NOT READ. PROMPT IF NECESSARY. RECORD UP TO THREE RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Rocky Mountain Power/Pacific Power Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Retailer/Store
12. Sporting event
13. Home Shows/Trade Shows
14. Appliance Recycling Contractor
15. E-mail from Rocky Mountain Power/Pacific Power
16. Other **[RECORD VERBATUM]**
- 98. DON'T KNOW
- 99. REFUSED

B3. How would you rate your current understanding of energy-efficiency? Would you say you... **[READ LIST. RECORD FIRST RESPONSE]**

1. Have no knowledge of energy-efficiency
2. Are somewhat knowledgeable about energy-efficiency
3. Are very knowledgeable about energy-efficiency
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

Appliance Description

[IF QUANTITY_REF=0, SKIP TO H4]

H1. [ASK IF QUANTITY_REF=1 AND QUANTITY_FRZ=0] When you decided to get rid of the refrigerator, were you using it as your main refrigerator, or had it been a secondary or spare?

[IF RESPONDENT IS UNSURE: “A main refrigerator is typically in the kitchen, and a spare refrigerator is usually in the garage or basement and might not be in use all the time.”]

1. Main
2. Secondary or Spare
- 98. DON'T KNOW
- 99. REFUSED

[ASK IF QUANTITY_REF>1, OR IF QUANTITY_REF>=1 AND QUANTITY_FRZ>0] The next few questions focus on just one appliance. Since you recycled more than one refrigerator through the program, please answer these questions about the first refrigerator you recycled.

H2a. Can you please tell me if this first appliance was a refrigerator or a freezer?

1. Refrigerator
2. Freezer
- 98. DON'T KNOW
- 99. REFUSED

H2. During the time just before you decided to get rid of this refrigerator, was it being used as your main refrigerator, or had it been a secondary or spare?

[IF RESPONDENT IS UNSURE: “A main refrigerator is typically in the kitchen, and a spare refrigerator is usually in the garage or basement and might not be in use all the time.”]

1. Main
2. Secondary or Spare
- 98. DON'T KNOW
- 99. REFUSED

H3. [ASK IF H1=2 OR H2=2] How long were you using it as a spare before you recycled it through the program?

1. [RECORD VALUE IN MONTHS. IF RESPONDENT ANSWERS IN YEARS, MULTIPLY BY 12 AND RECORD VALUE IN MONTHS]
- 98. DON'T KNOW
- 99. REFUSED

[IF QUANTITY_REF=0, AND QUANTITY_FRZ>1, SAY: “The next few questions focus on just one appliance. Since you recycled more than one freezer through the program, please answer these questions about the first freezer you recycled.”]

H4. During the year before you recycled it, was the appliance plugged in and running... **[READ LIST]**

1. All the time
2. For special occasions only
3. During certain months of the year only
4. Never plugged in or running
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

H5. **[ASK IF H4=2 OR H4=3]** If you were to add up the total time it was running as a spare in the last year before you recycled it, how many months would that be? **[IF RESPONDENT IS UNSURE: “Your best estimate is okay.”]**

1. **[RECORD MONTHS 1-12]**
- 98. DON'T KNOW
- 99. REFUSED

H6. Where was the **[INSERT APPLIANCE TYPE]** located during most of the year before you recycled it?

1. Kitchen
2. Garage
3. Porch/Patio
4. Basement
5. Yard/Outside
6. Other **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

H7. Was the location heated?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H8. Was the location air-conditioned?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H9. Would you say the **[INSERT APPLIANCE TYPE]** you recycled... **[READ LIST. RECORD FIRST RESPONSE]**

1. Worked and was in good physical condition
2. Worked but needed minor repairs
3. Worked but had some major problems
4. Didn't work
- 98. **[DO NOT READ]**DON'T KNOW
- 99. **[DO NOT READ]**REFUSED

H10. Did you get a new **[INSERT APPLIANCE TYPE]** to replace the one you recycled?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H11. **[ASK IF H10=2]** Do you plan to get a replacement appliance in the near future?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H12. **[ASK IF H10=1]** Would you have purchased the new **[INSERT APPLIANCE TYPE]** without the \$30 incentive you received for recycling the old one?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H13. **[IF H10=1 AND H12=2]** Just to confirm: you would *not* have replaced your old **[INSERT APPLIANCE TYPE]** without the **[INSERT UTILITY]** incentive for recycling, is that correct?

1. Correct
2. Incorrect
- 98. DON'T KNOW
- 99. REFUSED

H14. Is the **[INSERT APPLIANCE TYPE]** you replaced it with an ENERGY STAR or high efficiency model?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H15. Had you already considered getting rid of this **[INSERT APPLIANCE TYPE]** before hearing about **[INSERT UTILITY]**'s appliance recycling program?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

H16. Without the **[INSERT UTILITY]** refrigerator recycling program, what would you most likely have done with your old **[INSERT APPLIANCE TYPE]**? Would you have... **[READ LIST]**

1. Gotten rid of it
2. Kept it
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

H17. **[ASK H16=1]** Would you have gotten rid of it within a year of when the program took it, or more than a year later?

1. Within a year of when the program took it
2. More than a year later
- 98. DON'T KNOW
- 99. REFUSED

H18. **[ASK H16=2]** If you had kept it, would you have used it full time, stored it unplugged, or used it occasionally?

1. Used full time
2. Stored it unplugged
3. Used it occasionally
- 98. DON'T KNOW
- 99. REFUSED

Consideration of Alternatives & Freeridership

Now I have a few questions about the different options you might have considered before recycling your appliance. For each statement please tell me whether you gave serious consideration to this action:

F1. selling it to someone through an ad or to someone you know?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F2. Did selling it to a used appliance dealer?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F3. giving it away to someone for free?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F4. giving it away to a charity organization, such as Goodwill, **[IF STATE = UT, ID, SAY “Deseret Industries”]** or a church?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F5. having it removed by the dealer you got your new or replacement appliance from?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F6. hauling it to the dump yourself?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F7. hauling it to a recycling center yourself and paying the disposal fee?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F8. hiring someone else to haul it away for junking or dumping?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F9. keeping it?

1. Yes – considered
2. No – did not consider or did not know about
- 98. DON'T KNOW
- 99. REFUSED

F10. Did you consider any other ways of getting rid of your **[INSERT APPLIANCE TYPE]** that I haven't mentioned?

1. Yes **[RECORD VERBATIM]**
2. No
- 98. DON'T KNOW
- 99. REFUSED

F11. **[ASK IF F1=1 OR F2=1]** Why did you not follow through with your consideration to sell the **[INSERT APPLIANCE TYPE]**?

1. Couldn't find an interested buyer
2. Decided recycling unit was more important than selling it
3. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

F12. **[ASK IF F5=1]** If an appliance dealer were to take it away, how much, if anything, do you think you would have to pay for this service?

1. Nothing/Free Service
2. **[RECORD AMOUNT]**
- 98. DON'T KNOW
- 99. REFUSED

F13. **[ASK IF F8=1]** If you were to hire someone else to haul it away for junking or dumping, how much, if anything, do you think you would have to pay for this service?

1. Nothing/Free Service
2. **[RECORD AMOUNT]**
- 98. DON'T KNOW
- 99. REFUSED

F14. **[ASK IF F6=1 or F7=1]** You mentioned earlier that you considered hauling the **[INSERT APPLIANCE TYPE]** to the dump or recycling center yourself. Do you have the ability to do this or would you have needed assistance such as renting or borrowing a truck?

1. Yes, could do it myself
2. Would need assistance
- 98. DON'T KNOW
- 99. REFUSED

F15. **[ASK IF F6=1 or F7=1]** Most dumps and recycling centers charge a fee of at least \$25 to dispose of a refrigerator or freezer. Were you aware that you would have to pay a fee??

1. Yes, I would have paid the fee
2. No, I wouldn't pay
- 98. DON'T KNOW
- 99. REFUSED

F16. **[ASK F3=1 or F4=1]** You mentioned that you considered giving the **[INSERT APPLIANCE TYPE]** away. Did you identify and contact a specific person or charity to give the **[INSERT APPLIANCE TYPE]** to?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

F17. Now that we have talked about various ways you could have gotten rid of your **[INSERT APPLIANCE TYPE]**, what do you really think you would have most likely done with it without the **[INSERT UTILITY]** program? **[READ LIST ONLY IF NEEDED]**

1. Sold it to a private party, either by running an ad or to someone you know
2. Sold it to an used appliance dealer
3. Given it away to a private party, such as a friend or neighbor
4. Given it away to a charity organization, such as Goodwill Industries or a church
5. Had it removed by the dealer you got your new or replacement appliance from
6. Hauled it to the dump yourself and pay the disposal fee
7. Hauled to a recycling center yourself and pay the disposal fee
8. Had someone else pick it up for junking or dumping
9. Kept it
10. Some other way **[RECORD VERBATIM]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

F18. What is the main reason you chose the **[INSERT UTILITY]** program over other methods of disposing of your appliance? **[DO NOT READ. RECORD ONLY ONE RESPONSE]**

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

F19. Would you have participated in the program without the incentive check?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

CFL INSTALLATION

E1. Was a free kit containing two CFL light bulbs and energy information given to you at the time of pickup?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF E1<>1 SKIP TO SP1]

E2. How would you rate the information found in this kit? Would you say it was... **[READ LIST]**

1. Very helpful
2. Somewhat helpful
3. Not very helpful
4. Not at all helpful
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

E3. **[ASK IF E2<>98 Or E2<>99]** Why did you assign this rating? **[DO NOT READ LIST. RECORD MULTIPLE]**

1. Information too general
2. Already aware of information
3. Information did not apply
4. Used the suggestions provided in information
5. Written well
6. Passed information along to others
7. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

E4. How many of the CFLs that came in the kit did you install?

1. None
2. One
3. Two
- 98. DON'T KNOW
- 99. REFUSED

E5a. **[ASK IF E4=2 OR E4=3]** What type of bulbs were in the socket before you installed the CFLs? **[READ LIST IF NECESSARY]**

1. Incandescent (or “traditional” bulbs)
2. CFL
3. LED
4. Florescent
5. Halogen
6. Empty
- 98. DON'T KNOW
- 99. REFUSED

E5b. **[ASK IF E4=1 OR E4=2]** Why didn't you install **[IF E4=1, “them?” IF E4=2, “the other CFL?”** **[DO NOT READ LIST. RECORD MULTIPLE]**

1. Did not fit fixtures
2. Intend to install later
3. Do not like style
4. Do not like quality
5. Defective product
6. Other [RECORD VERBATIM]
- 98. DON'T KNOW
- 99. REFUSED

E6. **[ASK IF E4=2 OR E4=3]** Where did you install the CFL(s)? **[DO NOT READ. RECORD UP TO TWO]**

1. Bedroom
2. Bedroom (unoccupied)
3. Basement
4. Bathroom
5. Closet
6. Dining
7. Foyer
8. Garage
9. Hallway
10. Kitchen
11. Office/Den
12. Living Space

- 13. Storage
- 14. Outdoor
- 15. Utility
- 16. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

E7. Did you install the refrigerator thermometer included in your energy-saving kit?

- 1. Yes
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF E7=1, ASK E8. ELSE, SKIP TO E10]

E8. After installing the thermometer, did you change the temperature setting on your refrigerator?

- 1. Yes
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF E8=1, ASK E9. ELSE, SKIP TO E10]

E9. Did you increase or decrease the temperature setting in your refrigerator?

- 1. Increase
- 2. Decrease
- 98. DON'T KNOW
- 99. REFUSED

E10. Do you remember receiving a booklet with information about how to save energy?

- 1. Yes
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF E10=1, ASK E11, ELSE SKIP TO SP1]

E11. Have you followed any of the advice mentioned in the booklet? If so, which ones?

- 1. Yes, **[RECORD VERBATIM]**
- 2. No
- 98. DON'T KNOW
- 99. REFUSED

Spillover and Market Impact

SP1. Since participating in the appliance recycling program, have you participated in any other incentive programs offered by **[INSERT UTILITY]**?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

SP2. **[ASK SP1=1]** Which programs did you participate in?

1. **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

SP3. **[ASK SP1=1]** How influential was the recycling program in your decision to participate in other **[INSERT UTILITY]** energy efficiency programs? Would you say it was... **[READ LIST]**

1. Very influential
2. Somewhat influential
3. Not very influential
4. Not at all influential
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

SP4. **[ASK IF SP1=2]** Based on your experience in recycling your appliance, how likely are you to participate in another utility energy efficiency program? Would you say you are... **[READ LIST]**

1. Much more likely
2. Somewhat more likely
3. No more or less likely
4. Less likely to participate in another program
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

SP5. Besides recycling your old **[APPLIANCE TYPE]**, have you made other energy efficiency improvements or purchases on your own?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

SP6. **[ASK IF SP5=1]** What did you install? **[DO NOT READ. RECORD MULTIPLE]**

1. High efficiency dishwasher
2. High efficiency washer
4. High efficiency refrigerator
5. High efficiency water heater
6. CFLs (Compact Fluorescent Light bulbs or curly bulbs)
7. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

SP6a. **[ASK IF SP5=1]** Did you receive an incentive for any of those items?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

SP7. **[ASK IF SP5=1]** How much did your experience with the See ya later, refrigerator program influence your decision to install other high efficiency equipment on your own? Would you say it was... **[READ LIST]**

1. Very influential
2. Somewhat influential
3. Not very influential
4. Not at all influential
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

Program Satisfaction

G1. How satisfied are you with the **[INSERT UTILITY]** Appliance Recycling Program overall? Would you say you are... **[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G2. **[ASK IF G1= 2, 3, or 4]** Why do you give it that rating? **[DO NOT READ. RECORD MULTIPLE]**

1. Incentive was too small.
 2. Contractor never called me back.
 3. Contractor never showed up/showed up late.
 4. Contractor was unreliable/unprofessional.
 5. Difficult to get an appointment time that was convenient for me.
 6. Wanted to use a different [non-program] contractor.
 7. Other **[RECORD VERBATIM]**
- 98. DON'T KNOW
-99. REFUSED

G3. How satisfied are you with the sign-up process for the program? Would you say you are... **[READ LIST]**

1. Very satisfied
 2. Somewhat satisfied
 3. Somewhat dissatisfied
 4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** REFUSED

G4. How easy was it to schedule a convenient pickup time? Would you say it was... **[READ LIST]**

1. Very easy
 2. Somewhat easy
 3. Somewhat difficult
 4. Very difficult
- 98. **[DO NOT READ]** DON'T KNOW
-99. **[DO NOT READ]** REFUSED

G5. How satisfied are you with the appliance pick-up portion of the program? Would you say you are... **[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G6. Did the crew that picked up your appliance check to see if it was working before they took it away?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

G7. How satisfied are you with how quickly you received your incentive? Would you say you are...

[READ LIST]

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G8. How satisfied are you with the amount of the incentive? Would you say you are... **[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G9. Would you have participated in the program if the amount of the incentive had been less?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

G10. How likely are you to recommend the **[INSERT UTILITY]** Appliance Recycling Program to friends and family members? Would you say you are... **[READ LIST]**

1. Very likely
2. Somewhat likely
3. Not very likely
4. Not at all likely
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

G11. Is there anything you would suggest to improve the **[INSERT UTILITY]** Appliance Recycling Program?

1. **[RECORD VERBATIM]**
- 98. DON'T KNOW
- 99. REFUSED

Demographics

I have just a few more questions about your household. Again, all your answers will be strictly confidential.

D1. Which of the following best describes your house? **[READ LIST]:**

1. Single-family home
2. Townhouse or duplex
3. Mobile home or trailer
4. Apartment building with 4 or more units
5. Other **[RECORD]**
- 98. **[DO NOT READ]** REFUSED
- 99. **[DO NOT READ]** DON'T KNOW

D1a. Do you know about how old your home is? **[RECORD # YEARS OLD – IF ACTUAL YEAR IS PROVIDED, TRANSLATE TO YEARS RELATIVE TO 2011]**

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

D2. Do you rent or own your home?

1. Own
2. Rent
3. Other **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

D3. How long have you lived at that location?

1. Less than one year
 2. 2-5 years
 3. More than 5 years
- 98. REFUSED
-99. DON'T KNOW

D4. Including yourself and any children, how many people currently live in your home?

1. **[RECORD]**
- 98. REFUSED
-99. DON'T KNOW

D4a. **[ASK IF D4>1]** Are any of the people living in your home under the age of 18?

1. Yes
 2. No
- 98. DON'T KNOW
-99. REFUSED

D5. Can you please tell me in what year you were born?

1. **[RECORD]**
- 98. REFUSED
-99. DON'T KNOW

D6. In 2010, was your pre-tax household income above or below \$50,000?

1. Below \$50,000
 2. Above \$50,000
 3. Exactly \$50,000
- 98. DON'T KNOW **[SKIP TO C1]**
-99. REFUSED **[SKIP TO C1]**

D7. **[ASK IF D6=1]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. Under \$10,000
 2. \$10,000 to under \$20,000
 3. \$20,000 to under \$30,000
 4. \$30,000 to under \$40,000
 5. \$40,000 to under \$50,000
- 98. REFUSED
-99. DON'T KNOW

D8. **[ASK IF D6=2]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. \$50,000 to under \$60,000
2. \$60,000 to under \$75,000
3. \$75,000 to under \$100,000
4. \$100,000 to under \$150,000
5. \$150,000 to under \$200,000
6. \$200,000 or more
- 98. REFUSED
- 99. DON'T KNOW

D9. What is the primary heating source for your home? **[READ LIST IF NEEDED]**

1. Forced air natural gas furnace
2. Forced air propane furnace
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Electric baseboard heat
6. Gas fired boiler/radiant heat
7. Oil fired boiler/radiant heat
8. Passive Solar
9. Pellet stove
10. Wood stove
11. Other [record]
- 98. DON'T KNOW
- 99. REFUSED

D10. **[IF D9 = 1-11]** How old is the primary heating system? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD 1-100]**
- 98. Don't Know
- 99. Refused

D11. What type of air conditioning system, if any, do you use in your home? **[READ LIST IF NECESSARY, INDICATE ALL THAT APPLY]**

1. Central Air Conditioner
2. Room Air Conditioner
3. Evaporative Cooler
4. Air Source Heat Pump
5. Ground Source Heat Pump
6. Whole house fan
7. No cooling system before
8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

D8. How old is your primary cooling system? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD]**
- 98. DON'T KNOW
- 99. REFUSED

Conclusion

C1. How satisfied are you with the service that **[INSERT UTILITY]** provides overall? Would you say you are... **[READ LIST]**

1. Very satisfied
2. Somewhat satisfied
3. Somewhat dissatisfied
4. Very dissatisfied
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

C2. Do you have any additional feedback or comments?

1. Yes **[RECORD VERBATUM]**
2. No
- 98. REFUSED
- 99. DON'T KNOW

That concludes the survey. Thank you very much for your time and feedback.

6. Nonparticipant Refrigerator Appliance Recycling Program Survey

Introduction

[TO RESPONDENT]: Hello, my name is **[INSERT FIRST NAME]** from Discovery Research Group. I'm calling on behalf of **[UTILITY]**. I am calling to ask you some survey questions that will help **[UTILITY]** improve their energy-efficiency programs.

[IF RESPONDENT EXPRESSES RESERVATIONS AT THIS POINT, USE THE FOLLOWING SCRIPT TO PERSUADE. IF RESPONDENT DOES NOT EXPRESS RESERVATIONS SKIP TO S1]:

I'm not selling anything, we are interested in your opinions to help improve our programs, and understand how to assist customers in saving money on their utility bills. Your responses will remain confidential.

S. Screening Questions

S1. Did you discard a refrigerator or freezer in 2009 or 2010? By discard, we mean getting rid of it either by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center.

1. Yes, refrigerator(s)
 2. Yes, freezer(s)
 3. Yes, both appliances
 4. No **[TERMINATE]**
- 98. Don't know **[TERMINATE]**
-99. Refused **[TERMINATE]**

S2. Did the appliance(s) work? **[IF RESPONDENT IS UNSURE, SAY: "Even if it didn't get cold, did the appliance turn on when it was plugged in?"]**

1. Yes
 2. No **[TERMINATE]**
- 98. Don't know **[TERMINATE]**
-99. Refused **[TERMINATE]**

S3. Did you have the appliance(s) picked up through **[INSERT UTILITY]'s** See Ya Later, Refrigerator program?

1. Yes **[TERMINATE]**
 2. No
- 98. Don't know **[TERMINATE]**
-99. Refused **[TERMINATE]**

S4. **[INSERT UTILITY]** offers an incentive to pick up and recycle old working refrigerators and freezers. A contractor would have picked the appliance up at your home and you would have been paid \$30 later in the mail. Are you sure your appliance wasn't picked up by the utility program?

1. Yes, I'm sure it wasn't picked up by the program or I received no incentive
2. No, I did get the incentive check **[TERMINATE]**
- 98. I still don't know for sure **[TERMINATE]**
- 99. Refused **[TERMINATE]**

[TERMINATION SCRIPT: "Those are all the questions we have for you. Thank you very much for your time."]

N. Nonparticipant Awareness

N1. Were you aware of the **[INSERT UTILITY]** appliance recycling program prior to getting rid of your appliance?

1. Yes
2. No
- 98. DON'T KNOW
- 99. REFUSED

[IF N1=1, ASK N2, ELSE SKIP TO N4]

N2. How did you learn about the **[INSERT UTILITY]** appliance recycling program? **[DO NOT READ LIST. RECORD UP TO 3 RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Rocky Mountain Power/Pacific Power Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Retailer/Store
12. Sporting event
13. Home Shows/Trade Shows
14. Appliance Recycling Contractor
15. Other **[RECORD VERBATIM]**
16. Postcard
17. Direct mail

-98. **[DO NOT READ]** DON'T KNOW

-99. **[DO NOT READ]** REFUSED

N3. What made you decide not to have your appliance picked up through the **[INSERT UTILITY]** appliance recycling program? **[DO NOT READ. RECORD UP TO THREE RESPONSES.]**

1. Unit didn't qualify
2. Did not know how to sign up
3. Was not able to schedule convenient pickup time
4. Too much hassle
5. Other **[RECORD VERBATUM]**

-98. DON'T KNOW

-99. REFUSED

N4. What are the best ways for **[INSERT UTILITY]** to inform you about energy-efficiency offerings like the appliance recycling program? **[DO NOT READ. PROMPT IF NECESSARY. RECORD UP TO THREE RESPONSES]**

1. Newspaper/Magazine/Print Media
2. Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. Other website
5. Internet Advertising/Online Ad
6. Family/friends/word-of-mouth
7. Rocky Mountain Power/Pacific Power Representative
8. Radio
9. TV
10. Billboard/outdoor ad
11. Retailer/Store
12. Sporting event
13. Home Shows/Trade Shows
14. Appliance Recycling Contractor
15. E-mail from Rocky Mountain Power/Pacific Power
16. Other **[RECORD VERBATUM]**
17. Postcard
18. Direct mail

-98. DON'T KNOW

-99. REFUSED

N5. How would you rate your current understanding of energy-efficiency? Would you say you... **[READ LIST. RECORD FIRST RESPONSE]**

1. Have no knowledge of energy-efficiency
 2. Are somewhat knowledgeable about energy-efficiency
 3. Are very knowledgeable about energy-efficiency
- 98. **[DO NOT READ]** DON'T KNOW
- 99. **[DO NOT READ]** REFUSED

A. Appliance Characteristics

[IF MORE THAN ONE APPLIANCE DISCARDED, SAY:] For the rest of the survey, I'd like you to focus on only one of the appliances you got rid of. Please answer these questions about the appliance you discarded most recently. How would you like to have this programmed? What should we use to determine if we should pull the script in? I was thinking on S1 we can have the interviewers record the number of appliances discarded... Or we can change the script above to something along the lines of

For the rest of the survey we would like to ask you about the appliance you discarded. If you discarded multiple appliances please answer the following questions about the appliance you got rid of MOST recently.

A1. At the time you discarded it, approximately how old was the appliance?

[RECORD AGE IN YEARS]

- 98. Don't know
- 99. Refused

A2. Before you made the decision to get rid of the appliance, in what room was the appliance used/located?

1. Kitchen
 2. Garage
 3. Porch/patio
 4. Basement
 5. Other **[SPECIFY]**
- 98. Don't know
- 99. Refused

A3. Would you say the appliance ...? **[READ LIST, RECORD ONLY ONE RESPONSE]**

1. Worked and was in good physical condition
2. Worked but needed minor repairs

3. Worked but had some major problems

-98. **[DO NOT READ]** Don't know

-99. **[DO NOT READ]** Refused

A4. Did you get a new appliance to replace the one you got rid of?

1. Yes

2. No

-98. Don't know

-99. Refused

[IF A4=1, ASK A5. ELSE SKIP TO A6]

A5. Is the appliance you replaced it with an ENERGY STAR or high efficiency model?

1. Yes

2. No

-98. Don't know

-99. Refused

A6. How did you get rid of your old appliance? **[IF NEEDED, PROMPT: "For example, did you sell it or give it away?"]**

1. Sold it to a private party, either by running an ad or to someone you know

2. Sold it to a used appliance dealer

3. Gave it away to a private party, such as a friend or neighbor

4. Gave it away to a charity organization, such as Goodwill Industries or a church

5. Had it removed by the dealer you got your new or replacement appliance from

6. Hauled it to the dump yourself

7. Hauled to a recycling center yourself

8. Had someone else pick it up for junking or dumping

9. Kept it

10. Some other way **[RECORD VERBATIM]**

-98. Don't know

-99. Refused

Demographics

D1. Which of the following best describes your house? **[READ LIST]:**

1. Single-family home
2. Townhouse or duplex
3. Mobile home or trailer
4. Apartment building with 4 or more units
5. Other **[RECORD]**
- 98. **[DO NOT READ]** REFUSED
- 99. **[DO NOT READ]** DON'T KNOW

D2. Do you rent or own your home?

1. Own
2. Rent
3. Other **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

D3. How long have you lived at that location?

1. Less than one year
2. 2-5 years
3. More than 5 years
- 98. REFUSED
- 99. DON'T KNOW

D4. Including yourself and any children, how many people currently live in your home?

1. **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

D5. Can you please tell me in what year you were born?

1. **[RECORD]**
- 98. REFUSED
- 99. DON'T KNOW

D6. In 2010, was your pre-tax household income above or below \$50,000?

1. Below \$50,000
2. Above \$50,000
3. Exactly \$50,000
- 98. DON'T KNOW **[SKIP TO C1]**
- 99. REFUSED **[SKIP TO C1]**

D7. **[ASK IF D6=1]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. Under \$10,000
2. \$10,000 to under \$20,000
3. \$20,000 to under \$30,000
4. \$30,000 to under \$40,000
5. \$40,000 to under \$50,000
- 98. REFUSED
- 99. DON'T KNOW

D8. **[ASK IF D6=2]** Which of the following categories best represents your household income in 2010?

Please stop me when I read your category:

1. \$50,000 to under \$60,000
2. \$60,000 to under \$75,000
3. \$75,000 to under \$100,000
4. \$100,000 to under \$150,000
5. \$150,000 to under \$200,000
6. \$200,000 or more
- 98. REFUSED
- 99. DON'T KNOW

CLOSING SCRIPT: Those are all the questions we have. **[INSERT UTILITY]** appreciates your input. Thank you for your time.

Appendix B. Precision Calculations

To determine the level of uncertainty for results, Cadmus considered the effect of sampling error on all estimates presented in the report. Sampling error refers to the uncertainty introduced by the use of sampled data to infer characteristics of the overall population. These data include survey results, meter data, and those from secondary sources. Cadmus used sampled data to estimate parameters for per-unit savings calculations (such as installation rates) or in consumption of specific equipment types (such as in billing analysis).

Confidence intervals about the estimates reflect sampling error. Unless otherwise noted, Cadmus estimated intervals at 90 percent confidence, meaning that one can be 90 percent confident the true population value lies within the given interval. Cadmus calculated confidence intervals for means, proportion, regression estimates, and any calculated values using sample estimates as an input. Cadmus calculated all confidence intervals using standard formulae to estimate uncertainty for proportions and means. The following formula provided mean values:

$$\text{Confidence Interval}_{\text{mean}} = \text{mean} \pm 1.645 * \sqrt{\frac{s^2}{n}}$$

Where s^2 equals to the sample variance and 1.645 equals the z-score for a 90 percent confidence interval.

In some cases, uncertainty of estimates derived from several sources. For example, in summed estimates, such as those for total program savings, the root of the sum of the squared standard errors was calculated to estimate the confidence interval:¹

$$\text{Confidence Interval}_{\bar{X}+\bar{Y}} = (\bar{X} + \bar{Y}) \pm 1.645 * \sqrt{\left(\frac{s^2_{\bar{X}}}{n_{\bar{X}}}\right) + \left(\frac{s^2_{\bar{Y}}}{n_{\bar{Y}}}\right)}$$

In some cases, Cadmus multiplied estimates. For instance, net savings calculations involve combining gross estimates with an in-service rate and/or NTG ratio estimated from participant surveys. For these results, Cadmus calculated combined standard errors for the final estimates. In cases where the relationship was multiplicative, Cadmus used the following formula:²

$$\text{Confidence Interval}_{\bar{X}*\bar{Y}} = \bar{X} * \bar{Y} \pm 1.645 * \sqrt{\bar{Y}^2 \left(\frac{s^2_{\bar{X}}}{n_{\bar{X}}}\right) + \bar{X}^2 \left(\frac{s^2_{\bar{Y}}}{n_{\bar{Y}}}\right) + \left(\frac{s^2_{\bar{X}}}{n_{\bar{X}}}\right) \left(\frac{s^2_{\bar{Y}}}{n_{\bar{Y}}}\right)}$$

¹ This approach to aggregation errors follows the methods outlined in Appendix D, from: Schiller, Steven et. al. "National Action Plan for Energy Efficiency." Model Energy Efficiency Program Impact Evaluation Guide. 2007. www.epa.gov/eeactionplan.

² Derived from: Goodman, Leo. "The Variance of the Product of K Random Variables." Journal of the American Statistical Association. 1962.

In some cases, a ratio of two estimates was needed. An example of this would be estimating the spillover ratio, expressed as the ratio of spillover savings to program savings. For this calculation, Cadmus used the following formula:³

$$\text{Confidence Interval}_{\bar{X}/\bar{Y}} = \frac{\bar{X}}{\bar{Y}} \pm 1.645 * \frac{\bar{X}}{\bar{Y}} \sqrt{\frac{\left(\frac{S^2_{\bar{X}}}{n_{\bar{X}}}\right)}{\bar{X}^2} + \frac{\left(\frac{S^2_{\bar{Y}}}{n_{\bar{Y}}}\right)}{\bar{Y}^2}}$$

To ensure transparency of the error aggregation process, Cadmus reported precision for both individual and combined estimates, where relevant.

³ Stuart, A. and Ord, J. *Kendall's Advanced Theory of Statistics (6th Edition)*. Edward Arnold. 1998.

Appendix C. NTG Evaluation Methodology

Net-to-gross (NTG) estimates serve as a critical part of demand-side management (DSM) program impact evaluations, allowing utilities to determine portions of gross energy savings influenced by and attributable to their DSM programs, free from other influences. Freeridership and spillover comprise NTG's two components. Freeriders are customers who would have purchased the measure without any program's influence. Spillover is the amount of additional savings obtained by customers investing in additional energy-efficient measures or activities due to their program participation. Various methods can be used to estimate program freeridership and spillover. This evaluation's baseline approach used self-reports through participant surveys.

Program Categorization

Prior to designing the NTG surveys, Cadmus worked with Pacific Power to conduct a thorough review of its DSM programs, determining the following:

- **Each program's unique characteristics.** As each DSM program and measure operates differently, a clear understanding of them had to be determined. This helped inform the survey design and question wording, assuring acknowledgement and accounting for nuances.
- **The appropriate interviewee.** This step proved critical as survey questions had to reach the right decision makers. For example, a review of an ENERGY STAR Homes program may indicate the home builder as the decision maker, not the customer purchasing the home. Thus, survey questions would be worded to apply to home builders, not homeowners.

Following the program review, Cadmus aggregated the HES Program measures into two distinct categories:

- Appliances (clothes washers, dishwashers, fixtures, heat pump best practices, heat pump system conversions, heat pump tune-ups, heat pump upgrades, and refrigerators); and
- CFLs.

In creating the program categories, a balance was struck between each measure's unique characteristics (requiring the NTG influences to be measured differently), and retaining a sufficiently large participant population to obtain a statistically significant and reliable sample.

The methodology described in this appendix was not used to evaluate NTG for CFLs. As the HES program incents CFLs at the retailer level, participants often do not know they have participated in a program or have purchased an incented CFL. Therefore, calculating freeridership and spillover by surveying participants of upstream measures did not offer a viable option.

Survey Design

Direct questions (such as: "Would you have installed measure X without the program incentive?") tend to result in exaggerated "yes" responses. Participants surveyed tend to provide answers they believe surveyors seek; so a question becomes the equivalent of asking: "Would

you have done the right thing on your own?” An effective solution for avoiding such bias involves asking a question in several different ways, then checking for consistent responses.

Cadmus designed survey questions to determine why customers installed a given measure, and the program’s influence over their decisions. The survey sought to establish what the decision maker might have done in the program’s absence, with five core freeridership questions addressing that answer:

- Would participants have installed measures without the program?
- Had participants ordered or installed the measures before learning about the program?
- Would participants have installed the measures at the same efficiency levels without the program incentive?
- Would participants have installed the same quantity of measures without the program?
- In the program’s absence, when would respondents have installed the measures?

The spillover survey sought to answer three primary questions:

- Since participating in the evaluated program, did participants install additional energy-efficient equipment or services incented through a utility program?
- How influential was the evaluated program on the participants’ decisions to install additional energy-efficient equipment in their homes?
- Did customers receive incentives for additional measures installed?

Freeridership Survey Questions

The residential survey’s freeridership portion included 11 questions, addressing the five core freeridership questions above. The survey’s design included several skip patterns, allowing interviewers to confirm answers previously provided by respondents by asking the same question in a different format. Freeridership questions (as asked in the survey format) included:

1. When you first heard about the incentive from Pacific Power, had you already been planning to purchase the measure?
2. Ok. Had you already purchased or installed the new measure before you learned about the incentive from the Home Energy Savings program?
3. [*Ask if question 2 is No or Don’t Know*] Would you have installed the same measure without the incentive from the Home Energy Savings program?
4. [*Ask if question 3 is No or Don’t Know*] Help me understand, would you have installed something without the Home Energy Savings program incentive?
5. [*Ask if question 3 or question 4 is Yes*] Let me make sure I understand. When you say you would have installed the measure, would you have installed the same one that was just as energy efficient?
6. [*Ask if question 3 or question 4 is Yes AND measure quantity > 1*] And would you have installed the same quantity?

7. *[Ask if question 3 or question 4 is Yes]* And would you have installed the measure at the same time?
8. *[Ask if question 3 or question 4 is No]* To confirm, when you say you would not have installed the same measure, do you mean you would not have installed the measure at all?
9. *[Ask if question 8 is No or Don't Know]* Again, help me understand. Would you have installed the same type of measure but it would not have been as energy-efficient?
10. *[Ask if question 8 is No or Don't Know AND measure quantity > 1]* Would it have been the same measures but fewer of them?
11. *[Ask if question 8 is No or Don't Know]* And, would you have installed the same measure at the same time?

Spillover Survey Questions

As noted, spillover questions sought to determine whether program participants installed other energy-saving measures since participating in the program. Savings participants received from additional measures would be considered spillover savings if the program significantly influenced their decisions to purchase additional measures, and if they did not receive additional incentives for those measures.

Surveys specifically asked residential participants whether they installed the following measures:

1. Clothes Washers
2. Refrigerators
3. Dishwashers
4. Windows
5. Fixtures
6. Heat Pumps
7. Ceiling Fans
8. Electric Water Heater
9. CFLs
10. Insulation

If the participant installed one or more of these measures, additional questions asked what year they purchased the measure, if they received an incentive for the measure, and how influential (highly influential, somewhat influential, or not at all influential) the HES program was on their purchasing decisions.

Cadmus combined the freeridership and spillover questions in the same survey, simultaneously asking them through telephone interviews of randomly selected program participants. Prior to beginning the live participant phone calls, Cadmus worked with the survey company to pretest the survey, ensuring all appropriate prompts and skip patterns would be followed. Cadmus also monitored initial phone calls to verify:

- The survey respondents understood the questions; and
- Adjustments were not required.

Freeridership Methodology

Cadmus developed a transparent, straightforward matrix for assigning scores to participants, based on their objective responses to targeted survey questions. Question response patterns received freeridership scores, with confidence and precision estimates calculated on the distribution of these scores (a specific approach cited in the NAPEE Handbook on DSM Evaluation, 2007 edition, page 5-1).

Response patterns and scoring weights remained explicit; they could be discussed and changed, with results shown in real time. The approach provided other important features, including:

- Derivation of a partial freeridership score, based on the likelihood of a respondent taking similar actions in the incentive's absence.
- Use of a rules-based approach for consistency among multiple respondents.
- Use of open-ended questions to ensure quantitative scores matched respondents' more detailed explanations regarding program attribution.
- The ability to change weightings in a "what if" exercise, testing the response set's stability.

The Cadmus method offered a key advantage by introducing the concept of partial freeridership. Experience has shown program participants do not fall neatly into freerider and not-freerider categories. For example, partial freeridership scores were assigned to participants with plans to install the measure; though, the program exerted some influence over their decisions, other market characteristics outside the program proved influential. Further, with partial freeridership, "don't know" and "refused" responses could be used to assign partial credit, rather than removing respondents entirely from the analysis.

The study assessed freeridership at three levels. First, it converted each participant survey response into freeridership matrix terminology. Each participant's combination of responses then received a score from the matrix. Finally, all participants were aggregated into an average freeridership score for the entire program category.

Convert Responses to Matrix Terminology

The study independently evaluated each survey question's response, assessing participants' freeridership levels for each question, with each survey response option converted into values of:

- "Yes" (100 percent freerider);
- "No" (0 percent freerider); or
- "Partial" (50 percent freerider).

Table C1 lists 11 survey questions, their corresponding response options, and values which they converted to (in parentheses). "Don't know" and "refused" responses were converted to "partial" for all but the first three questions. For those questions, if a participant was unsure whether they had already purchased or were planning to purchase the measure before learning about the incentive, they were considered an unlikely freerider.

Table C1. Assignments of HES Survey Response Options into Matrix Terminology

Already planning to purchase?	Already purchased or installed?	Installed same measure without incentive?	Installed something without incentive?	Installed same efficiency?	Installed same quantity?	Installed at the same time?	Would not have installed measure?	Installed lower efficiency?	Installed lower quantity?	Installed at the same time?
Yes (Yes)	Yes (Yes)	Yes (Yes)	Yes, I would have installed something. (Yes)	Yes (Yes)	Yes (Yes)	At the same time (Yes)	Yes (Yes)	Yes (Yes)	Yes (Yes)	At the same time (Yes)
No (No)	No (No)	No (No)	No, I would not have installed anything. (No)	No (No)	No (No)	Within one year (Partial)	No (No)	No (No)	No (No)	Within one year (Partial)
Don't Know (No)	Don't Know (No)	Don't Know (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (Partial)	In more than one year (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (Partial)	In more than one year (No)
Refused (No)	Refused (No)	Refused (No)	Refused (Partial)	Refused (Partial)	Refused (Partial)	Don't Know (Partial)	Refused (Partial)	Refused (Partial)	Refused (Partial)	Don't Know (Partial)
						Refused (Partial)				Refused (Partial)

Participant Freeridership Scoring

After converting survey responses into matrix terminology, a freeridership matrix was created, allowing the combination of each participant's question responses to be assigned a freeridership score. In creating the matrix, every combination of possible survey question responses were considered, and then each combination received a freeridership score of 0 to 100 percent. Using this matrix, every participant combination of responses was assigned a score of 0 to 100 percent.

Program Category Freeridership Scoring

After assigning a freeridership score to every survey respondent, Cadmus calculated a savings-weighted average freerider score for the program category. Respondent freerider scores were individually weighted by estimated savings of equipment installed.

$$\text{Savings Weighted Freeridership} = \frac{\sum[\text{Respondent Score}] \times [\text{Rebated Measure kWh Savings}]}{\sum[\text{Rebated Measure kWh Savings} - \text{All Respondents}]}$$

The Cadmus Freeridership Scoring Model

Cadmus developed an Excel-based model to assist with freeridership calculation and to improve consistency and quality of results. The model translated raw survey responses into matrix terminology, and then assigned each participant's response pattern a score from the matrix.

Program participants in the sample could be then aggregated by program category to calculate the average freerider score.

The model incorporated the following inputs, described in this methodology:

- Raw survey responses for each participant, along with the program category for their incented measures, and energy savings from those measures, if applicable;
- Figures converting raw survey responses into matrix terminologies for each program category; and
- Custom freeridership scoring matrices for each unique survey type.

The model used a simple interface, allowing users to quickly reproduce a scoring analysis for any program category. It displayed each participant's combination of responses and corresponding freeridership score, and then produced a summary table, providing the average score and precision estimates for the program category. The model used the sample size and a two-tailed test target at the 90 percent confidence interval to determine the average score's precision.

Table C2 shows a summary table example for the HES appliances program category, with the final freeridership score in the lower right corner. The example program category averaged freeridership at 43 percent, meaning 43 percent of energy savings, derived from freeriders, should be removed from gross program savings. Based on a 172 response sample size, the program had an absolute precision of 3.9 percentage points.

Table C2. Freerider Scoring Model Output

Population (P)	1,436	Finite Population Correction	1
Responses (n)	172	Adjusted Standard Error	0.024
Variance Of Mean	0.097	Adjusted Relative Precision	9.06%
Standard Deviation	0.312	Coefficient of Variation	0.723
Standard Error of Mean	0.024	Upper Bound Score	0.47
Relative Precision	9.06%	Weighted Mean Score	0.43
Absolute Precision	0.039	Lower Bound Score	0.39

Spillover Methodology

Spillover refers to additional savings generated by program participants through their program participation, but not captured by program records. Spillover occurs when participants choose to purchase energy-efficient measures or adopt energy-efficient practices because of a program, but do not participate (or are otherwise unable to participate) in the program. As these customers are not participants, they do not typically appear in program records of savings generated by spillover impacts.

Spillover examples include:

- Program participants adopting additional measures without an incentive.
- Consumers acting on the programs' influence resulting from changes in available energy-using equipment in the marketplace.
- Changes brought about by more efficient practices employed by architects and engineers, ultimately forcing consumer behavior into desired patterns.
- Changes in nonparticipants behaviors resulting from direct marketing or changes in stocking practices.

The energy-efficiency programs' spillover effect serves as an additional impact, which can be added to the program's direct results.

For the HES Program, Cadmus measured spillover by asking a sample of participants purchasing and receiving an incentive for a particular measure if, due to the program, they installed another efficient measure or undertook other energy-efficiency activity. Respondents were asked to rate the HES Program's (and incentive's) relative influence (either highly, somewhat, or not at all influential) on their decisions to pursue additional savings.

Participant Spillover Analysis

Calculating spillover savings used a top-down approach. The analysis started with a subset containing only survey respondents indicating they installed additional energy-savings measures after participating in the HES program. From this subset, participants were removed if they indicated the program had little influence on their decisions to purchase additional measures, thus only retaining participants rating the incentive as highly influential. Participants were also removed if they applied for HES incentives covering additional measures they installed.

For remaining participants with spillover savings, energy savings were estimated for additional measures installed. Savings values Cadmus engineers calculated were matched to additional measures installed by survey participants.

The spillover percentage per program category was calculated by dividing the sum of additional spillover savings, reported by respondents for a given program category, by total incentivized gross savings achieved by all respondents in the program category:

$$\text{Spillover \%} = \frac{\sum \text{Spillover Measure kWh Savings for All Survey Respondents}}{\sum \text{Program Measure kWh Savings for All Survey Respondents}}$$

Appendix D. Lighting Net Savings Approach (Retailer Surveys)

Cadmus estimated NTG for HES program lamps using responses from in-depth participating retailer interviews. Cadmus interviewed 11 retailers across various distribution channels, and obtained responses about HES Program lighting components from six of these retailers. Table D1 presents all participating retailers and numbers of program lamps each sold in California.

Table D1. Retailers in Sample and Program Lamp Sales

Retailer Name	Number of Stores in Sample	Program Lamps Sold	Percent of Program Lamps
Retailer 1	4	9,657	16.28%
Retailer 2	9	2,535	4.27%
Retailer 3	1	77	0.13%
Retailer 4	1	28,088	47.36%
Retailer 5	1	49	0.08%
Retailer 6	2	14,078	23.74%
Retailer 7	2	4,824	8.13%
Total	20	59,308	100%

As shown in Table D2, the six lighting retailers participating in the interviews accounted for approximately 75 percent of total program lamps sold through the HES program.

Table D2. Interviewed Retailers and Program Lamp Sales

Retailer Name	Stores Interviewed	Program Lamps Sold	Percent of Total Program Lamps (59,308)
Retailer 1	1	7,199	12.14%
Retailer 2	1	28,088	47.36%
Retailer 3	1	6,558	11.06%
Retailer 4	1	1,410	2.38%
Retailer 5	1	1,326	2.24%
Retailer 6	1	49	0.08%
Totals	6	44,630	75.25%

During these interviews, Cadmus asked store representatives a standard battery of questions to inform NTG estimation of HES program lamps. Specifically, Cadmus asked a series of questions designed to estimate the percentage of all CFLs retailers would have sold in the program's absence as well as the percentage of CFL sales they sold through the HES lighting program during 2009 and 2010. These surveys also accounted for freeridership and spillover, using questions about lift in total CFL sales due to the program (e.g., CFL sales attributable to the program, including non-program CFLs). Appendix A includes the retailer interview guide.

The battery of questions for program NTG included:

1. “If the HES incentives were not available during 2009 and 2010, do you think your sales of standard ENERGY STAR CFL bulbs would have been about the same, lower, or higher?”
2. “By what percent would your [store’s] sales of standard ENERGY STAR CFLs have been [lower/higher] without the Home Energy Savings program?”
3. “During 2009 & 2010, what percent of your [store’s] total CFL sales would you estimate are CFLs purchased through the HES Lighting Program?”

By assessing retailers’ responses to the above questions, Cadmus estimated NTG as follows:

1. As responses to questions 2 and 3 fell in ranges, Cadmus used the midpoint of each range for the following calculations.
2. Cadmus obtained program lamp sales data by store from the program tracking database. This provided an estimate of the number of program CFLs sold by each retailer.
3. Cadmus estimated total CFL sales by retailer using the following equation:

$$\text{Total CFL Sales} = \frac{\text{Number of CFLs Sold Through the Program}}{\% \text{ Program CFLs sold over past two years (Q \#3)}}$$

4. Cadmus estimated sales in program’s absence by retailer using the following equation:

$$\begin{aligned} \text{Sales without Program} \\ = \text{Total CFL Sales} \times (1 - \% \text{ Lower Sales w/out program (Q \#2)}) \end{aligned}$$

5. Next, Cadmus estimated lift, or CFL sales attributable to the program by each retailer, using the following equation:

$$\text{Lift} = \text{Total CFL Sales} - \text{Sales w/out Program}$$

6. Finally, Cadmus estimated NTG by retailer using the following equation:

$$\text{NTG} = \frac{\text{Lift in CFL Sales for Each Retailer}}{\text{CFLs Sold Through the Program (Tracking Database)}}$$

To ensure the accuracy and reliability of retailer responses to questions 1 and 2, survey administrators repeated responses to these questions back to each retailer in the following manner:

“Just to confirm, your sales of standard ENERGY STAR CFLs would have been [insert % from D7] [lower/higher] in 2009 and 2010 if the [Pacific Power/Rocky Mountain Power] program was not available?”

Of six retailers that reported participating in the HES Program’s lighting component, all provided useable responses to the NTG questions. Cadmus also weighted individual NTG ratios by the distribution of program lamps sold by each retailer providing useable responses to the NTG

survey questions. For example, Cadmus weighted the results from Retailer 1 by the percentage of HES program lamps they sold. This weighting approach ensured the final NTG estimation reflected the distribution of program CFLs, given Cadmus weighted high-volume retailers more heavily in the final NTG calculation.

To calculate the weight for each store, Cadmus first calculated the percentage of each stores' program lamp sales, out of 59,308 program lamps sold by all participating California retailers, then divided the quotient by the sum percent of all six stores' lamp sales. As shown in Table D3, these six retailers accounted for 75 percent of all HES program lamp sales among California retailers.

Table D3. Interviewed Retailer Program Lamp Sales and Weights

Retailer NTG Contributing	[A] Total Program Lamp Sales	[B] % of Total Program Lamps [A/59,308]	Weight Calculation [B/0.4399]	[C] Weight
Retailer 1	7,199	12.14%	0.1214/0.7525	0.161
Retailer 2	28,088	47.36%	0.4736/0.7525	0.629
Retailer 3	6,558	11.06%	0.1106/0.7525	0.147
Retailer 4	1,410	2.38%	0.0238/0.7525	0.032
Retailer 5	1,326	2.24%	0.0224/0.7525	0.030
Retailer 6	49	0.08%	0.0008/0.7525	0.001
Totals	44,630	75.25%		1.00

As shown in Table D4, the calculations resulted in a 0.33 store-weighted NTG.

Table D4. Responses to NTG Questions and Weighted NTG Estimate

Retailer	If CFL Sales Would be Lower, Higher, or the Same w/o the HES Program	Estimated Program Lamps Sales as % of Total Lamp Sales	Total Program Lamp Sales	Total CFL Sales	Lift	NTG
Retailer 1	Lower	65%	7,199	11,075	4,984	69.2%
Retailer 2	Same	25%	28,088	112,352	0	0.0%
Retailer 3	Lower	85%	6,558	7,715	4,243	64.7%
Retailer 4	Higher	5%	1,410	28,200	4,230	300.0%
Retailer 5	Lower	65%	1,326	2,040	1,326	100.0%
Retailer 6	Lower	25%	49	196	29	60.0%
Weighted NTG			44,630	161,579		0.33

Potential bias sources contributed to uncertainty around the 0.33 store-weighted NTG estimate. Generally, Cadmus interviewed a small sample of market actors, with responses resulting in a wide range of NTG estimates. Additionally, responses from this small sample size may not have sufficiently represented all retail stores with the same name, or all stores within each retail distribution channel. Other potential bias sources creating uncertainty around the store-weighted NTG estimate included:

- Program lamp sales for the six retailers contributing to NTG represented three-fourths (75 percent) of total lamps sold through the HES program (59,308).
- Nonresponse bias: some retailers could not provide estimates of program lamp sales or estimate how sales would be impacted without the HES incentives.

At the 90 percent confidence level, Cadmus estimated uncertainty around the 0.33 NTG estimate at approximately ± 0.70 , representing a relative precision of ± 210 percent (see Table D5 for these statistics).

Table D5. Confidence Interval Estimation and Summary Statistics

NTG Estimate	Store-weighted NTG	Standard Deviation	Standard Error	Coefficient of Variation	Relative Precision \pm	90% Confidence Interval
Initial	0.33	1.04	0.42	3.12	210%%	-0.36 – 1.03

Appendix E. Lighting NTG Secondary Data Review

California

The 2006–2008 Upstream Lighting Program (implemented by PG&E, SCE, and SDG&E) provided manufacturer and distributor buy-downs or retailer instant discounts for eligible lighting products, which were sold through participating retailers. Kema and Cadmus evaluated the program in 2010.

Cadmus derived the final recommended NTG ratio estimates from supplier interviews and revealed-preference intercept surveys. Cadmus based the supply-side, self-reported NTG method on information collected during in-depth interviews and surveys with manufacturers, retail buyers, and retail store managers. Cadmus analyzed the results to determine the NTG ratio by channel for basic CFLs, specialty CFLs, and energy-efficient fixtures. Final NTG recommendations were: 0.49 for PG&E; 0.64 for SCE; and 0.48 for SDG&E.

Colorado

The Colorado Home Lighting Program, first implemented in 2006, sought to provide energy savings for Xcel Energy's DSM residential program portfolio. The program's NTG ratios derived from four different data collection sources:

1. Self-report, end-use customer telephone surveys;
2. Supply-side interviews;
3. A multistate regression model using on-site audit results; and
4. Benchmarking of other utilities around the country.

Cadmus incorporated questions in an end-use customer telephone survey to determine freeridership and spillover levels. Cadmus also established NTG calculations for the retail channel, based on retail store manager interviews. Cadmus based the third method of calculating the NTG ratio—the multistate regression model—on data from 16 different geographic regions in the U.S., and incorporated data from telephone surveys of over 9,300 households and on-site saturation surveys from approximately 1,400 households. Finally, Cadmus gathered NTG values from secondary data on other lighting programs across the country. Cadmus and Nexus recommended an overall NTG ratio of 1.0, based on the range of values Cadmus established through the four calculation methods.

Illinois

Through the Lighting and Appliance Program, launched in August 2008, Ameren Illinois encourages its customers to purchase high-efficiency lighting products (such as CFLs) and ENERGY STAR-rated dehumidifiers, ceiling fans, and room air conditioners. For the program's lighting portion, Ameren provides upstream buy-downs to CFL manufacturers, and markets the program through participating retail stores and an online store selling discounted CFLs. The program discounts several types of lights, with an average incentive of \$1.04 for each standard CFL and \$1.86 for each specialty bulb. In 2011, Cadmus evaluated Program Year 2 (2009–2010) operations.

Maine

Implemented from 2003 to 2006, the Efficiency Maine Residential Lighting Program sought to transform the lighting market towards energy efficiency, rather than to achieve specific levels of energy savings or sales volumes. Nexus evaluated the program in 2007.

Nexus determined spillover and freeridership using results from three different telephone surveys conducted with Maine residents, including:

1. Surveys with participants purchasing a lighting product through the coupon program after November 2005;
2. Surveys with participants purchasing a bulb through the coupon program prior to November 2005; and
3. Surveys with the general customer population.

The study determined freeridership using:

- Respondents' awareness of efficient lighting products prior to their purchases through the program;
- Their intent to purchase the product (either at the same time or within three months of the program purchase); and
- Their willingness to pay the average retail price for products they purchased.

In a final analysis, Nexus recommended a 0.94 NTG ratio.

Massachusetts

The Massachusetts ENERGY STAR Lighting Program incented its residential customers to use ENERGY STAR-qualified lighting. Nexus evaluated the 2010 and early 2011 program in its 2010 Annual Report.

A panel of experts determined the most accurate NTG ratios Nexus developed for the program. Methodologies Nexus used to calculate the NTG ratios the panel assessed included:

1. Willingness-to-pay assessments;
2. Supplier self-reports;
3. Active purchaser revealed preferences;
4. A multistate regression model; and
5. A conjoint/pricing elasticity analysis (for specialty bulbs only).

In the final analysis, Nexus recommended a 0.47 NTG value.

Missouri

A market transformation program, launched in 2009, the Ameren Missouri Lighting and Appliance Program seeks to deliver energy savings through higher sales of residential, energy-efficient ENERGY STAR products, including CFLs. The program discounts ENERGY STAR

CFLs and ENERGY STAR lighting fixtures, with an average incentive of \$1.09 per bulb and \$15 per fixture. In 2011, Cadmus evaluated the Program Year 2 (2009–2010) operations.

Cadmus determined the NTG ratio for this program using a multistate fitted model to predict per-household CFL purchases with the program. For the model, Cadmus used actual bulb purchases per household the program supported during January through June 2010. To predict purchases made through the program, Cadmus included assumptions in the model that the program had not supported any bulbs during the first six months of 2010 (the without-program scenario). The analysis used a recommended 0.96 NTG value.

New Mexico

The Southwestern Public Service (SPS) Company Home Lighting and Recycling Program provides two ways for customers to purchase energy-saving CFLs through:

1. Mail order, and
2. Instant rebates at retail stores.

SPS worked with retailers and manufacturers to buy-down bulb prices to roughly \$1.00 each. Implemented in 2009, Xcel Energy evaluated the program the same year.

Xcel Energy used information they collected through surveys of program participants to develop freeridership estimates. Those surveys questioned customers about: their knowledge of energy efficiency, their reasons for participating, and measure implementation decisions they would have made in the program's absence. Xcel Energy's analysis recommended a 0.81 final NTG value.

Pennsylvania

The PPL Electric Compact Fluorescent Lighting Campaign provides incentives to CFL manufacturers, reducing retail prices of ENERGY STAR CFL bulbs. Cadmus' NTG analysis addressed December 1, 2010, through February 28, 2011.

Cadmus based the NTG analysis on findings drawn from participant and nonparticipant telephone surveys. Analysis incorporated all respondents purchasing one or more CFLs in the three months prior to the survey, regardless of whether or not they knew of the CFL Campaign. The freeridership estimates calculated from the customer surveys indicated NTG ratios from 0.72 to 0.93. Cadmus chose a 0.85 value, estimated from the higher end of the range. Cadmus based this estimation on assuming it unlikely all recent CFL purchasers, unaware of the CFL campaign before participating in the customer survey, would have purchased the same quantity of CFLs without the program incentive.

Utah and Washington

Rocky Mountain Power's residential lighting programs, within the 2006–2008 Utah Home Energy Savings Program and the 2006–2008 Washington Home Energy Savings Program, offer upstream incentives for manufacturers to reduce retail prices on CFL bulbs. Both programs were implemented from 2006 to 2008, and were evaluated by Cadmus in 2010.

Cadmus determined freeridership and spillover results through participant and nonparticipant phone surveys. Additionally, Cadmus used CFL retailer interviews to calculate CFL leakage, and conducted a secondary data analysis to determine per-unit savings, based on deemed reported savings, DEER, and RTF. Finally, Cadmus prepared a third data analysis to compare NTG values across programs. Final NTG values recommended for the Utah Home Energy Savings Program included: 0.84 for PY2006; 0.822 for PY2007; and 0.868 for PY2008.

Final NTG values recommended for the Washington Home Energy Savings Program included: 0.919 for PY2006; 0.894 for PY2007; and 0.807 for PY2008.

Wisconsin

The Wisconsin Focus on Energy ENERGY STAR Lighting Program is a statewide program, launched in 2001. The program provides:

- \$2 instant and mail-in rebates for purchases of CFLs;
- \$15 instant and mail-in rebates for purchases of fixtures; and
- \$20 instant rebates for purchases of torchieres.

In 2010, PA Consulting Group and NMR Group, Inc., established the program's most recent NTG ratio.

NTG analysis included three steps:

1. Analysis of retailer-provided 2008 CFL sales data, and a review of secondary research sales data and NTG values;
2. Analysis of the 2008 CFL reward database, and
3. Calculation of NTG estimates.

In 2010, PA Consulting/NMR Group used a multistate modeling effort to establish a 0.62 program NTG value. In a 2010 memo, these evaluators stated the multistate modeling method preferable, with advantages including:

- The ability to isolate program effects on CFL use and purchases;
- Use of a large sample size of households and a diversity of states; and
- Inclusion of nonprogram factors influencing CFL use.

Final NTG values used in analysis included: 0.75 for PY2007; 0.67 for PY2008; and 0.62 for PY2010.

Appendix F. Lighting NTG—Customer Willingness to Pay

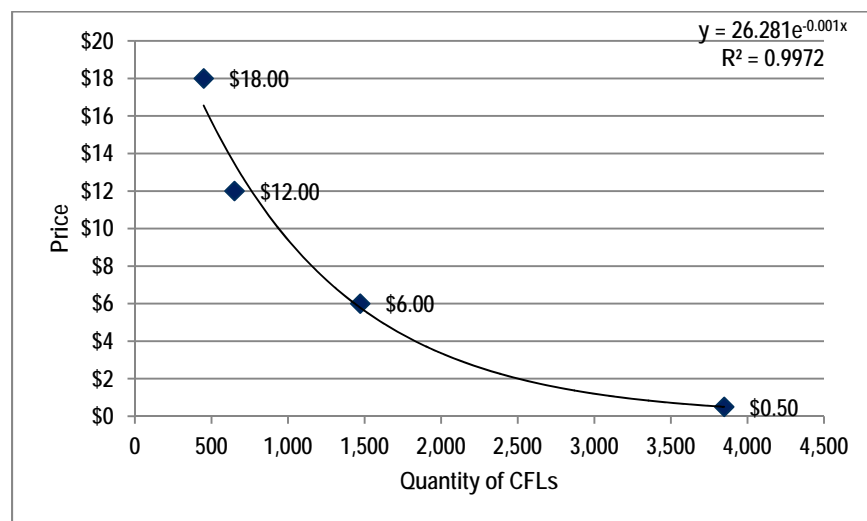
Cadmus conducted 251 in-territory lighting phone surveys in August 2011 through a random digit dial (RDD) process. This survey asked respondents a battery of questions to determine their willingness to pay for CFLs in absence of HES program mark-downs as well as a battery of freeridership and spillover questions. After determining how many CFLs participants purchased in 2009 and 2010, participants were asked to indicate whether they would:

1. Generally purchase more CFLs, fewer CFLs, or the same number of CFLs at various unincentivized hypothetical price levels; and
2. The quantity of CFLs they would hypothetically purchase at various unincented prices.

Specifically, Cadmus determined the average price of an unincented standard twister CFL at \$2.72,¹ and then asked participants how many lamps they would purchase at the following hypothetical prices: \$18.00 per CFL, \$12.00 per CFL, \$6.00 per CFL, and \$0.50 per CFL.

Cadmus assumed demand for CFLs related inversely to price, which holds true for most normal economic goods, and, therefore, participants would purchase more CFLs at lower prices. To estimate participants' willingness to pay for unincentivized lamps, Cadmus constructed a standard Marshallian demand schedule² (representing a mini-market for CFLs), relating hypothetical prices with quantities. Figure F1 illustrates the program lamp demand function, based on responses from the in-territory lighting telephone survey. The Y-axis shows prices, and the X-axis shows the quantity of lamps that would be purchased at each price.

Figure F1. Demand Schedule for Hypothetical Lamps



¹ To estimate the average price for an unincentivized CFL, Cadmus reviewed CFL pricing data by participating retailers, as provided by Pacific Power; determined each store's average unincented per-lamp price for non-specialty twister-style CFLs; and calculated a weighted average of store prices and each stores' distribution of program lamps. This was repeated for incented non-specialty twister-style CFLs.

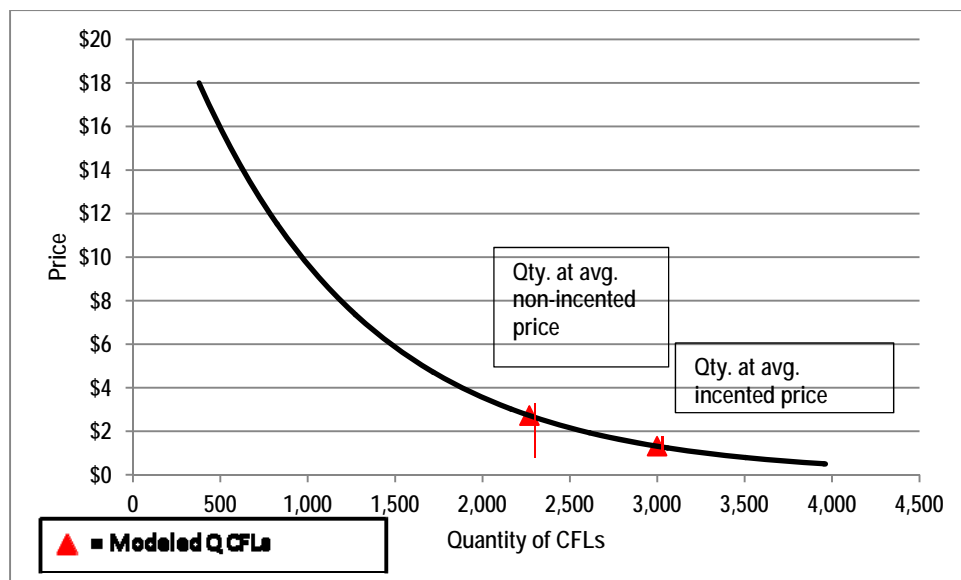
² Demand schedules are traditionally presented with price on the Y-axis and quantity on the X-axis.

After plotting the data points shown in Figure F1, Cadmus specified an exponential function to relate these quantities with hypothetical prices, represented by the following equation:

Equation F1:

To estimate the number of lamps that would be purchased at the average program price per lamp (net lamps), and the number of lamps that would be purchased without the program incentive (freeridership), Cadmus solved Equation F1 for x ; the quantity of lamps, determining 2,999 CFLs would be purchased at the average incented price of \$1.31, and 2,268 lamps would be purchased at the average unincented price of \$2.72. Figure F2 shows these modeled quantities.

Figure F2. Modeled CFL Quantities for NTG Estimation



The following equation estimated NTG of HES program lamps:

Where:

$Q_{cfl_{avg_incented}}$ = 2,999; the quantity of CFLs that would be purchased at the average price of incented lamps (\$1.31).

$Q_{cfl_{avg_unincented}}$ = 2,268; the quantity of CFLs that would be purchased at the average price of unincented lamps (\$2.72).

Responses to the in-territory lighting survey produced a 76 percent FR estimate, and, therefore, a 24 percent NTG estimate.

This approach produced the overall program effect minus freeridership, but the approach does not account for potential program spillover; which upstream lighting programs could produce.

Upstream programs primarily produce spillover by reducing prices of lamps sold without incentives. CFL incentives' wide availability has reduced the price of un-incented and incented lamps. Thus, the observed un-incented CFL price of \$2.72 runs substantially below recent prices in other markets. For instance, recent research in Maryland indicates an un-incented CFL price of \$4.53. Other research indicates un-incented prices between \$3.37 and \$3.50.

A recent lighting shelf survey of lighting retailers in Maryland indicates un-incented prices as high as \$6.10 per lamp. These higher prices better reflect CFL costs in the absence of program incentives. As the un-incented price estimate rises, the FR rate declines, as fewer lamps would have been purchased in the program's absence. An un-incented lamp at \$3.37 would have an FR rate of 68 percent. A \$4.53 price produces an FR rate of 59 percent. A \$6.10 price per lamp produces an FR rate of 49 percent. Program impacts of un-incented lamps cannot be quantified with the data available, though \$4.00 represents a reasonable value. This cost results in an FR estimated rate from WTP data of 63 percent, for a 0.37 NTG value.

Statistical Significance and Uncertainty

An RDD phone survey is designed to avoid bias through the randomness of the selection process. Some bias may enter the estimate as certain people may be more likely to be home or agree to participate in the survey. Such bias can be addressed through post-weighting responses to more closely reflect known demographic characteristics of the population.

Every sample, however, is subject to a type of random error that reflects the particular group of people participating in the study. This is the error due to sampling, for which we can estimate a margin of error within a given degree of confidence. For instance, members of this sample reported they would purchase a combined total of 1,471 CFLs at a price of \$6.00 per CFL. Had a different group of people been sampled, one would expect, by random circumstance of those in the sample, that the total could be somewhat larger or smaller. Using classical sampling theory allowed estimation of likely boundaries within which that error falls. The study constructed a 90 percent confidence interval for this random error around the sum of CFLs and LEDs that reportedly would be purchased at each hypothetical price level.

Table F3 presents sampling error for the sum of purchased bulbs at each price for CFLs.

Table F3. 90% Confidence Interval and Summary Statistics—CFLs (n= 191 respondents)

Price	Sum of CFLs purchased	Standard Deviation	Standard Error	Relative Precision +/-	90% Confidence Interval
\$18.00 per CFL	449	8.36	115.47	42.3%	259–639
\$12.00 per CFL	650	5.99	82.76	20.9%	514–786
\$6.00 per CFL	1,471	10.83	149.72	16.7%	1,225–1,717
\$0.50 per CFL	3,848	18.90	261.26	11.2%	3,418–4,278

Appendix G. See ya later, refrigerator[®] Detailed Impact and Process Findings

This appendix provides detailed impact and process findings for the See ya later, refrigerator[®] (SYLR) Program, HES Program's appliance recycling component. Findings resulted from the extensive data collection activities detailed below, including participant surveys, program staff and market actor interviews, participant surveys, and secondary research.

Based on these evaluation findings, Cadmus offers the following recommendations for the California SYLR program:

- Pacific Power should continue implementing the SYLR program to achieve cost-effective electric savings.
- Pacific Power should adjust its expected per-unit savings to reflect estimates calculated in this evaluation.
- Per-unit savings can be greatly affected by changes in appliance characteristics, such as configuration, age, and size. The program administrator tracks these characteristics, and Pacific Power should closely monitor changes in participating units' characteristics. This could be achieved by summarizing participation data on an annual basis, and noting changes in average participant unit characteristics.
- The program administrator and Pacific Power should continue with plans to improve reporting processes to eliminate reporting discrepancies, and increase accuracy of reported results.

Program Description

The California SYLR residential refrigerator and freezer recycling program serves as part of Pacific Power's ongoing demand-side management (DSM) resource acquisition strategy.¹ The program's overarching objective is to decrease electricity usage (kWh) through removal and recycling of inefficient secondary refrigerators and freezers, and older primary refrigerators. This prevents older units from remaining in service at a participant's premise or elsewhere within Pacific Power's California service territory. The program encourages those shopping for replacement units to consider ENERGY STAR[®]-labeled models, and refers them to the rebate portion of the program, where they may be eligible for incentives for other energy-efficiency measures and services. In addition to reducing energy consumption at the household and utility levels, the program recycles participating appliances in an environmentally sound manner.²

In operation since August 2008, the program provides residential customers with a \$35 incentive for each recycled appliance. Participants receive an incentive for up to two refrigerators or freezers. Renters owning their appliances may participate, and apartment complex owners or

¹ See ya later, refrigerator[®] has been registered to PacifiCorp through the U.S. Patent and Trademark Office since April 6, 2010, under registration number 3770705.

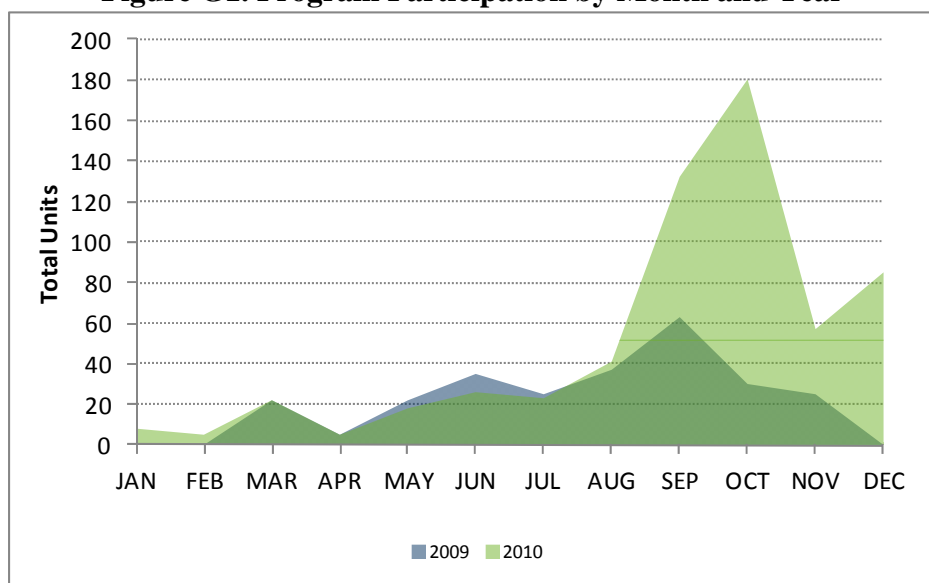
² Environmentally-sound disposal of this equipment includes: proper disposal of oils, PCBs, mercury, and CFC-11 foam; and recycling of CFC-12, HFC-134a, plastic, glass, steel, and aluminum.

managers are eligible if they provide tenants with appliances. Participants also receive a free energy-saving kit, which includes: two 13-watt compact fluorescent lamps (CFLs), a refrigerator/freezer thermometer card, energy savings educational materials, and information on other company efficiency programs relevant to residential customers. Qualifying refrigerators and freezers must be in working condition when picked up, and at least 10 cubic feet or more in size. Pacific Power contracted with JACO Environmental, Inc. (the program administrator), to deliver the program in California. The program administrator disables and removes the appliances, and recycles at least 95 percent of the materials, including refrigerant capture.

Program Participation

Program participation in appliance recycling programs typically follows a seasonal pattern, with the highest participation during the late summer, and declining into winter. As shown in Figure G1, the SYLR program saw a steady increase from spring through summer. Participation declined in the winter months, following the typical appliance recycling program seasonal pattern. During the program's second year, participation increased more dramatically in the late summer and early fall.

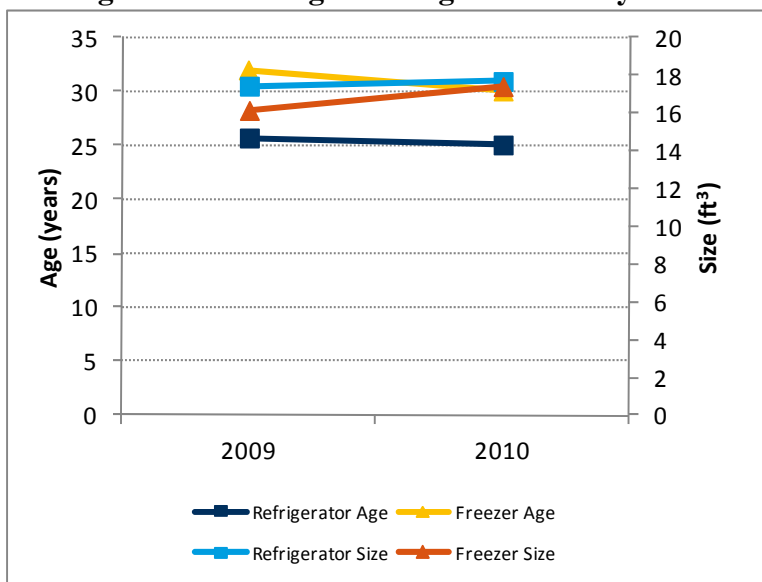
Figure G1. Program Participation by Month and Year



As programs mature, the composition of recycled appliances tends to change. In their infancy, programs recycle more secondary appliances (particularly those in use for only a portion of the year) in customer populations. Such units tend to be older, smaller, and located in unconditioned spaces, such as garages or basements, and to be less efficient. Such refrigerators also are much more likely to be single-door units.

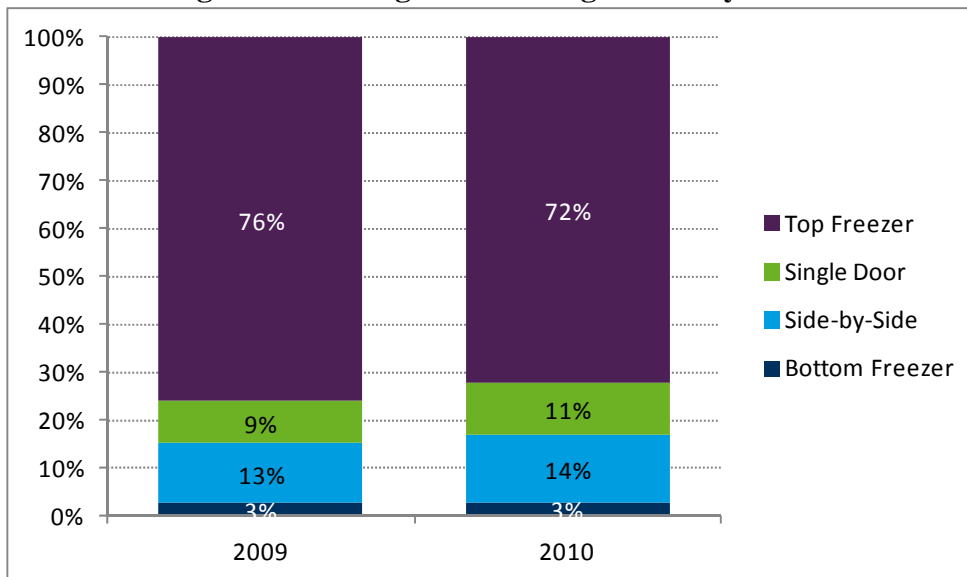
Figure G2 shows two-year trends in unit age and size. Freezers' and refrigerators' average unit ages showed a slightly declining trend, while average size showed an increasing trend (newer units tend to be larger). These trends, while only based on two years of data, follow patterns Cadmus has observed in similar programs elsewhere. For the SYLR program in California, these patterns may or may not be confirmed using additional data from future program years.

Figure G2. Average Unit Age and Size by Year



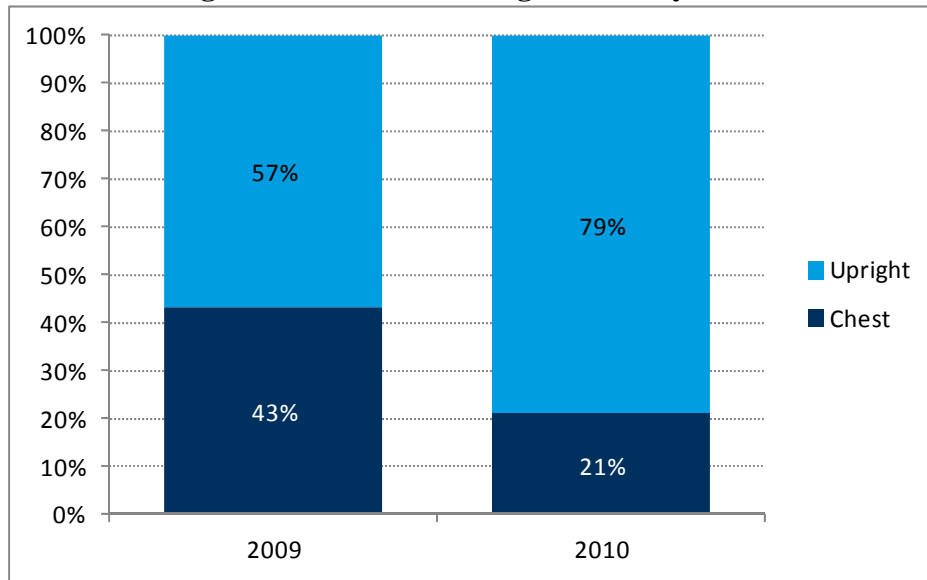
The program’s refrigerator configurations also matched the expected trends. For example, side-by-side units (a more modern, albeit less efficient, configuration) increased.

Figure G3. Refrigerator Configuration by Year



As shown in Figure G4, 2010 saw a decreased proportion of chest-style freezers, compared to 2009.

Figure G4. Freezer Configurations by Year



Impact Evaluation

Methodology

This report presents two values for evaluated savings: evaluated gross savings, and evaluated net savings. The evaluation defined reported gross savings as electricity savings (kWh) Pacific Power reported to Cadmus and contained in its 2009 and 2010 annual program reports. To determine evaluated net savings, Cadmus applied four steps to reported gross program savings, as shown in Table G1.

Table G1. Impact Steps

Saving Estimate	Step	Action
Evaluated Gross Savings	1	Verify accuracy of data in participant database
	2	Perform statistical/engineering review to evaluate saving calculations
	3	Adjust evaluated gross savings with actual installation rate/part-use factor
Evaluated Net Savings	4	Apply net-to-gross adjustments

Step one (verifying accuracy of data in the participant database) included reviewing the program tracking database to ensure participants and reported savings matched the 2009 and 2010 annual reports.

Step two (performing a statistical/engineering analysis to evaluate per-unit savings) involved estimating refrigerator and freezer savings as well as CFL savings assumptions, such as delta watts and hours-of-use.

Step three (adjusting evaluated gross savings with the actual installation rate/part-use factor) determined the mean proportion of the year in which recycled appliances were used as well as the number of CFLs program participants installed (and remained installed). Using a telephone survey, information was collected to estimate an installation and persistence rate (referred to as the In-Service Rate or ISR), which was then used in calculating evaluated gross savings.

The first three steps resulted in evaluated gross savings. The fourth step (applying net-to-gross [NTG] adjustments) determined the net savings. Through participant and nonparticipant telephone surveys, Cadmus estimated effects for freeridership and spillover.³

Sampling Approach

Cadmus developed survey samples of randomly selected program participants and nonparticipants, seeking precision of ± 10 percent at the 90 percent confidence level for individual estimates at the measure level. The evaluation determined sample sizes assuming a 0.5 coefficient of variation. For small population sizes, Cadmus applied a finite population adjustment to achieve precision estimates. Table G2 shows planned and achieved sample sizes by target group.

³ This appendix's *Net-to-Gross* section provides a detailed description of the estimation of these parameters.

Table G2. Sample Sizes by Target Group

Data Collection Activity	Population	Sample Goal	Achieved Surveys
Participant Telephone Survey	866	120	114
Nonparticipant Telephone Survey	N/A	70	56

Table G3 details the screening process for eligible participants. The 114 participants were randomly selected from 761 unique participants with California mailing addresses, valid phone numbers, and valid Pacific Power customer account numbers. Fifty-six nonparticipants were selected through screening questions from a random sample of Pacific Power customers residing in California.

Table G3. Participant Survey Sample

	Participants	Nonparticipants
Total Records	866	2,000
No Customer Number	0	0
Duplicate records (by customer number and phone number)	105	0
Eligible participants in call list	761	2,000
Completed Surveys	114	56
Response Rate*	15%	3%
Cooperation Rate**	31%	3%

* The response rate is defined as the number of customers completing a survey, divided by the number of eligible participants in the call list.

** The cooperation rate is defined as the number of customers completing a survey, divided by the number of customers reached by phone.

Regression Analysis

Cadmus developed a multivariate regression model to estimate gross unit energy consumption (UEC) for retired refrigerators and freezers. Cadmus estimated model coefficients using an aggregated *in situ* metering⁴ dataset, composed of over 400 appliances, metered as part of four California and Michigan evaluations conducted between May 2009 and April 2011.⁵ Collectively, these evaluations offered a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions. The dataset's diverse nature provided an effective secondary data source for estimating energy savings when California-specific metering could not be conducted.

Cadmus prefers using in-home metering data for estimating energy consumption, as opposed to Department of Energy's (DOE's) testing protocols, for two reasons.

⁴ *In situ* metering involves metering units in the environment in which they are typically used. This contrasts with lab testing, where units are metered under controlled conditions.

⁵ Southern California Edison, Pacific Gas & Electric, San Diego Gas & Electric, DTE Energy, and Consumers Energy.

First, metering the appliance in its original location captures impacts of critical external factors on appliance energy use (such as door openings, unit locations, and weather); these factors cannot be accounted for when relying on DOE databases, which contain data on units metered under controlled conditions.

Second, most existing DOE databases estimate energy consumption at the time of appliance manufacture, not of unit retirement.⁶ Consequently, evaluations require devising and applying additional assumptions in appliance degradation. In-home metering data reflect observed usage of appliances actually participating in appliance recycling programs at the time of retirement and as used in the homes from which they were removed.

Each observation in the aggregated dataset represents an appliance metered for a minimum of 10 days in a manner consistent with its preprogram use (i.e., in the same location, cooling food, and used by the home's occupants). Cadmus mapped weather data to participating homes' ZIP code-specific National Oceanic and Atmospheric Administration weather stations, and collected additional on-site data on relevant appliance characteristics to ensure data consistency with administrator tracking databases.

Cadmus' approach to model specification weighed the impacts of including alternative independent variables, using a variety of criteria. The model specification process sought to include variables adequately reflecting program design, while maintaining model simplicity. For each set of estimated parameters, the analysis assessed variance inflation factors (VIFs), adjusted R²s, and measures of statistical significance.⁷

Cadmus used the following modeling considerations in the specification process:

- **Using an ordinary least squares method to estimate model parameters.** Data were approximately normally distributed, an important condition for the analysis. An examination of the final model's residual plot supported this hypothesis of normality.
- **Considering all relevant appliance characteristics for inclusion in the model.** These included: configuration, defrost type, age, size, and (in the case of refrigerators) primary or secondary designations. Age was considered as a continuous variable (capturing degradation), as dummy variables for decades of manufacture (to approximate vintages), and as a dummy variable for units manufactured before enactment of 1990s' National Appliance Energy Conservation Act (NAECA), which required new refrigerators and freezers to be more energy efficient.
- **Considering two environmental factors in the *in situ* model.** In addition to terms pertaining to appliance characteristics, the analysis considered two environmental factors in the *in situ* model: cooling degree-days (CDD) and primary or secondary appliances. Appliances in warmer climate zones were assumed to consume greater energy—as were primary appliances—due to more frequent door openings.

⁶ The California Energy Commission maintains one such database, which can be accessed online at http://www.energy.ca.gov/appliances/database/historical_excel_files/Refrigeration/

⁷ VIFs, R²s, and statistical significance are tests of the validity of a regression model. In this case VIFs under 5 were deemed sufficient.

- **Including interaction terms only for theoretical importance to the model.** The model only included one interaction term, between units located in garages and CDDs, to account for additional impacts of warmer temperatures on refrigerators in unconditioned spaces.
- **Considering transformations of explanatory variables.** These included logged and squared values, based on theoretical and empirical grounds.

Kit Savings Algorithm and Assumptions

With each pickup ordered, participants received an energy-saving kit, which contained:

- Two 13-watt CFLs;
- One refrigerator thermometer; and
- Energy-savings educational materials and other program references.

The following algorithm estimated CFL savings:

$$\text{Evaluated Per Unit Savings (kWh per unit)} = \frac{\Delta \text{Watts} * \text{ISR} * \text{HOU} * 365}{1,000}$$

Where:

- Δ Watts = Wattage of baseline bulb - Wattage of ENERGY STAR CFL
- ISR = In-service rate or the percentage of units installed
- HOU = Hours of use; per day
- 365 = Constant; days per year
- 1,000 = Constant; conversion of watts to kilowatts

The ISR captured CFLs installed, removed, and replaced by other energy-efficient light bulbs. Specifically:

$$\text{CFL In - Service Rate (ISR \%)} = \frac{\text{Installed} - \text{Removed}}{\text{Sent}}$$

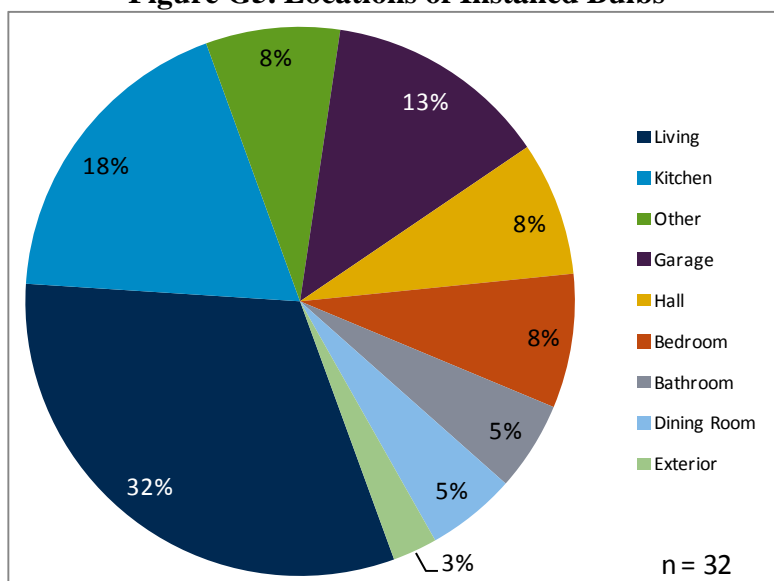
Cadmus estimated wattage changes by comparing lumen outputs of kit CFLs to their incandescent equivalents. The 13-watt kit CFLs output 900 lumens, equivalent to a 60-watt incandescent bulb. Cadmus chose to use 60 watts as the baseline because it is the incandescent bulb of equivalent lighting output (measured in lumens). Cadmus found this represented the most reasonable, cost-effective assumption for calculating CFL savings, and provided a consistent approach across the other Cadmus California evaluations.

Cadmus calculated average hours of use (HOU) using ANCOVA⁸ model coefficients, estimated from a combined multistate, multiyear database of light logger data, compiled by recent Cadmus CFL HOU studies. This model expressed average HOU as a function of room type, existing CFL saturations, and the presence of children in a home. The report provides a more detailed exploration of the impact methodology used to estimate CFL HOU.

Figure G5 shows distributions of bulbs by room types.⁹ The values for all explanatory variables, save existing CFL saturations, were based on response data from the participant survey. For CFL saturations, Cadmus used data from the PacifiCorp Energy Decisions Survey.

⁸ ANCOVA, or analysis of covariance, refers to a type of statistical modeling.

⁹ Cadmus conducted 114 participant surveys, but only 32 respondents recalled the location of CFLs they installed.

Figure G5. Locations of Installed Bulbs

Pacific Power CA SYLR Participant Survey: Question E6.

Estimating Average Gross Unit Consumption

Cadmus used regression models to estimate consumption for refrigerators (Table G4) and freezers (Table G5). Each independent variable's coefficient indicated the influence of that variable on daily consumption, holding all other variables constant. A positive coefficient indicated an upward influence on consumption; a negative coefficient indicated a downward effect.

The value of the coefficient indicates the marginal impact on the unit energy consumption (UEC) of a one-point increase in the independent variable. For instance, a 1 cubic foot increase in refrigerator size results in a 0.081 kWh increase in daily consumption. In the case of dummy variables, the value of the coefficient represents the difference in consumption if the given condition is true. For example, in the refrigerator model, the coefficient for the variable that indicates a refrigerator was a primary unit is 0.633, indicating, all else being equal, a primary refrigerator consumes 0.633 kWh per day more than a secondary unit.

In the refrigerator model, there is no dummy variable for units manufactured after the 1990s. These units are considered the baseline, and, therefore, all other dummy coefficient values are relative to this baseline. For example, the coefficient for the variable that indicates a unit was manufactured before 1980 is 1.372. This coefficient implies that units manufactured in the 1970s consume 1.372 kWh per day more than units manufactured in the 2000s.

Refrigerator Regression Model

Table G4 shows the model used to estimate refrigerators' annual energy consumption and its estimated parameters.

**Table G4. Refrigerator UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, $R^2 = 0.26$)**

Independent Variables	Coefficient	p-Value	VIF
Intercept	0.662	0.001	0.0
Age (years)	0.005	0.169	2.1
Dummy: Manufactured Pre-1980	1.372	<.0001	2.8
Dummy: Manufactured in 1980s	0.960	<.0001	4.7
Dummy: Manufactured in 1990s	0.199	0.042	4.8
Size (ft. ³)	0.081	<.0001	1.9
Dummy: Single Door	-1.172	<.0001	1.3
Dummy: Side-by-Side	0.823	<.0001	1.6
Dummy: Primary	0.633	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.031	<.0001	1.2

The results indicated:

1. Older refrigerators use more electricity, due to degradation and changes in efficiency over time. The impact of vintage on daily consumption, represented by the decade-of-manufacture coefficients, drops from 0.960 in the 1980s to 0.199 in the 1990s. This shows the effect of the 1990 enactment of the NAECA standard, which required new refrigerators to be more energy efficient.
2. Larger refrigerators consume more energy.
3. Single-door units consume less energy, as these units typically do not have full freezers.
4. Side-by-side refrigerators experience higher consumption due to greater exposure to outside air when opened and due to through-door features common in these units.
5. Primary appliances experience higher consumption due to increased usage.
6. At higher temperatures, refrigerators in unconditioned spaces consume more energy.¹⁰

Freezer Regression Model

Table G5 details final model specifications used to estimate energy consumption of participating freezers and its results.

**Table G5. Freezer UEC Regression Model Estimates
(Dependent Variable = Average Daily kWh, $R^2 = 0.36$)**

Independent Variables	Coefficient	p-Value	VIF
Intercept	-0.590	0.003	0.0
Age (years)	0.040	<.0001	1.9
Dummy: Unit Manufactured Pre-1990	0.566	<.0001	2.1
Size (ft. ³)	0.109	<.0001	1.2

¹⁰ It is also likely units in unconditioned spaces, such as garages, consume less energy at extremely cold temperatures. Comprehensive in-home metering of refrigerators and freezers in winter months has not been extensive.

Dummy: Chest Freezer	-0.265	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.059	<.0001	1.1

The results show:

1. Older freezers experienced higher consumption due to year-on-year degradation.
2. Freezers manufactured before the 1990 NAECA standard consumed more energy.
3. Larger freezers consumed more energy.
4. Chest freezers consumed less energy than upright units, due to reduced heat infiltration from door openings in these units.
5. At higher temperatures, freezers in unconditioned spaces consumed more energy.

Extrapolation

After estimating the final regression models, Cadmus analyzed the corresponding characteristics (the independent variables) for participating appliances (as captured in the program administrator program database). Table G6 summarizes program averages or proportions for each independent variable.

Table G6. 2009–2010 Participant Mean Explanatory Variables*

Appliance	Independent Variables	Participant Population Mean Value
Refrigerator	Age (years)	25.29
	Dummy: Manufactured Pre-1980	0.29
	Dummy: Manufactured in 1980s	0.37
	Dummy: Manufactured in 1990s	0.29
	Size (ft.3)	17.62
	Dummy: Single Door	0.10
	Dummy: Side-by-Side	0.13
	Dummy: Primary	0.53
	Interaction: Unconditioned Space x CDDs	0.28
Freezer	Age (years)	30.54
	Dummy: Unit Manufactured Pre-1990	0.85
	Size (ft.3)	17.11
	Dummy: Chest Freezer	0.21
	Interaction: Unconditioned Space x CDDs	0.59

*CDDs are the weighted average CDDs from TMY3 data for weather stations mapped to participating appliance zip codes. TMY3 is a typical meteorological year, using median daily values for a variety of weather data collected from 1991–2005.

For example, using values from Table G5 and Table G6, the estimated annual UEC for freezers was calculated as:¹¹

¹¹ This equation illustrates the inputs, but Cadmus' analysis took a slightly different approach to calculating average UECs. The analysis used the regression coefficients to predict an average daily UEC for each unit in the program administrator tracking database. The annualized average of these predictions represented the average

Freezer UEC = 365 days

** $(-0.590 + 0.040 * [30.54 \text{ years old}]) + 0.566$*

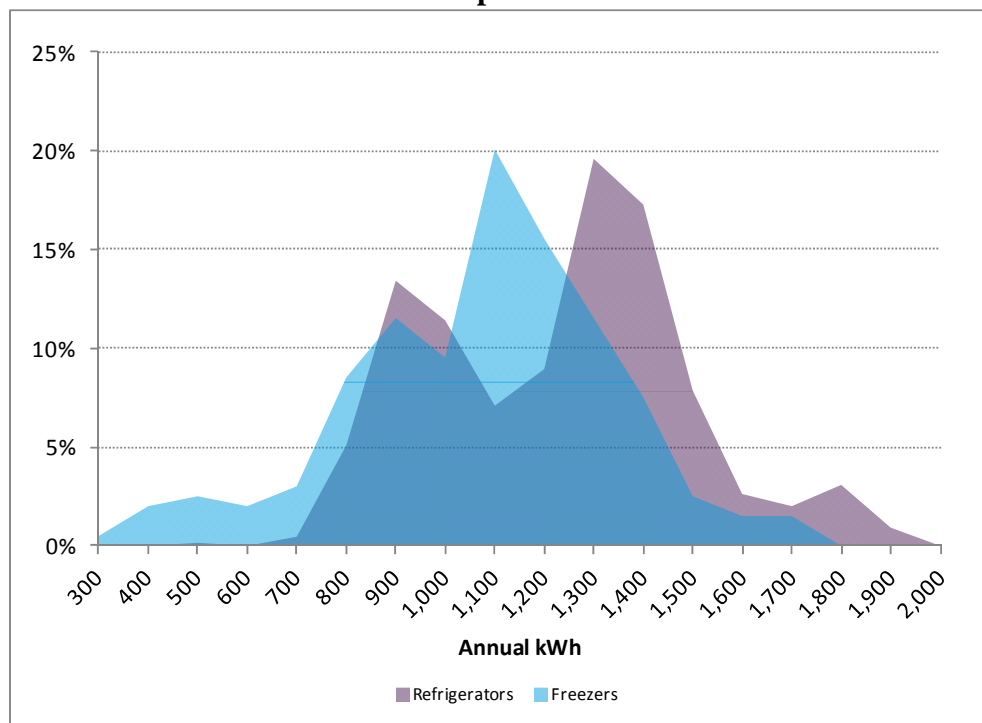
** $[85\% \text{ units manufactured pre-1990}] + 0.109 * [17.11 \text{ ft.}^3] - 0.265$*

** $[21\% \text{ units that are chest freezers}] + 0.059$*

** $[0.59 \text{ unconditioned CDDs}] \approx 1,056 \text{ kWh}$*

Figure G6 compares distributions of estimated UEC values for refrigerators and freezers.

Figure G6. 2009–2010 Distribution of Estimated Annual UECs by Appliance Type for Participant Units



Kit Savings

Table G7 shows final inputs and gross savings estimated for CFLs distributed in the energy-savings kits.

UEC for the participant population during the program period. This approach ensured the resulting UEC would be based on specific units recycled through Pacific Power's program. The two approaches would be mathematically identical if the tracking database were 100 percent complete. Due to rare instances of missing data, results from the two approaches differ slightly.

Table G7. Unadjusted CFL Savings (Not Including Adjustment for In-Service Rate)

Incandescent Watts	CFL Watts	HOU	Installation Rate	Annual Unadjusted Gross Savings(kWh per bulb)	Annual Unadjusted Gross Savings (kWh per kit)
60	13	1.96	0.87	33.6	67.3

Cadmus did not calculate savings from the refrigerator/freezer thermometer or from educational materials provided in the kits, as these savings were likely small and quite difficult to quantify accurately. However, participant survey results indicated 98 percent of participants found information provided in the kit at least somewhat helpful, and approximately 38 percent of participants reported using the refrigerator thermometer. Of those installing thermometers, however, 17 percent reported decreasing their refrigerator temperatures.

UEC Summary

Table G8 reports evaluated per-unit average annual energy consumption for refrigerators and freezers recycled by the SYLR during the 2009–2010 program period. The following section describes adjustments to these estimates used to determine gross per-unit saving estimates for participant refrigerators and freezers. The results indicated an evaluated freezer value 534 kWh lower than the reported value, with refrigerators values 80 kWh higher.

The evaluation shows Pacific Power used a slightly low reported value for refrigerators (though only marginally different from the regression analysis' average annual UEC).

Table G8. Estimates of Per-Unit Annual Energy Consumption

Appliance	Reported Annual UEC (kWh/year)	Evaluated Annual UEC (kWh/year)	Relative Precision (90% Confidence)
Refrigerators	1,149	1,229	±3.3%
Freezers	1,590	1,056	±4.1%
Energy Savings Kits	81	67	±11.1%

In-Service Rates

Appliance Part-Use Factor

Participants used some refrigerators and freezers recycled through the program for part of the year. Cadmus calculated a weighted average part-use factor, representing the three participant usage categories, as defined by the appliance's operational status during the year before it was recycled. For example, participants not using their appliance at all received a part-use factor of zero as no immediate savings were generated by their appliance's retirement. Table G9 shows part-use factors for the three usage categories.

Table G9. Part-Use Factors by Operational Status Description

Operational Status Description	Part-Use Factor
Not running for at least one full year	0
Running part time during the year*	0 to 1
Running throughout the year	1

*Participants using their appliances part of the year received a part-use factor derived from the proportion of total months they used the appliance.

Table G10 shows participants using their appliances for only part of the year had average part-use factors of 0.40 for refrigerators and 0.34 for freezers. Thus, the average freezer recycler, using a freezer for part of the year, used it for approximately 4.1 months.

Using participant survey data, Cadmus assessed the percentage of participants in each of the three usage categories (no usage, full-year usage, and partial usage). These percentages informed weighted average usage for each appliance type: the part-use factor. Refrigerators and freezers had part-use factors of 0.85 and 0.82, respectively, indicating that, prior to recycling, the average unit was in use a high percentage of the time.

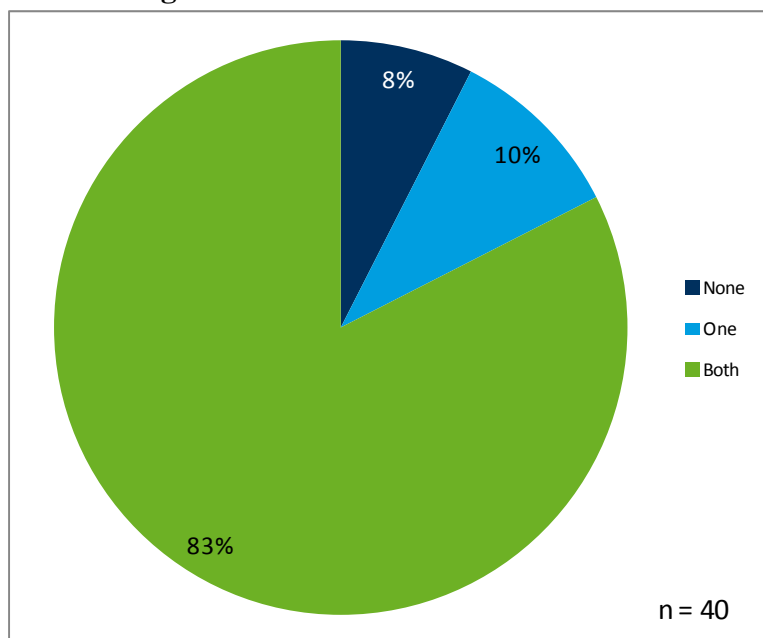
Table G10. Part-Use Factors and Evaluated Energy Savings by Appliance Type

Operational Status	Refrigerators			Freezers		
	Percent of Total Recycled Refrigerator	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)	Percent of Total Recycled Freezers	Average Part-Use Factor	Part-Use Adjusted Energy Savings (kWh/Year)
Not Running	7%	0	0	11%	0	0
Running Part Time	13%	0.40	495	11%	0.34	361
Running All Time	79%	1.00	1,229	79%	1.00	1,056
Total	100%	0.85	1,039	100%	0.82	869

*"Not Running" refers to units that were simply not plugged in, as inoperable units were excluded from the program.

CFL Installation Rate

On average, participants initially installed, 1.75 of the two bulbs received, resulting in an 87.5 percent installation rate. Figure G7 shows the proportion of participants installing zero, one, or two bulbs.

Figure G7. Number of Bulbs Installed

Pacific Power CA SYLR Participant Survey: Question E4.

Evaluated Gross Savings

Table G11 provides estimates of per-unit evaluated gross energy savings. Cadmus determined estimated energy consumption of units through the *in situ* metering study, adjusting it by part-use factors determined from the participant survey.

Table G11. Part-Use Adjusted Per-Unit Evaluated Gross Energy Savings by Measure

Appliance	Gross Energy Savings (kWh/Year)	Relative Precision(90% Confidence)
Refrigerators	1,039	±8.5%
Freezers	869	±9.7%
Energy Savings Kits	59	±11.1%

Tracking Database Review

The program administrator manager reported three types of program data tracked:

- Data on recycled appliances (stored in a “Units” database);
- Information about pickups (stored in an “Orders” database); and
- Data about customers (stored in a “Customers” database).

These integrated databases allowed the program administrator to record information collected via the call center or Website, along with on-site data collected during pickups, and post-pickup data recorded during recycling. The program administrator’s client Web portal provided the Pacific Power program manager with real-time access to collection data and other program results.

Every month, the program administrator completed a monthly report using a template provided by Pacific Power, documenting the number of units recycled that month and the number of kits distributed. Pacific Power received the monthly report on the 25th of every month, and used monthly reports to compile its annual DSM reports.

During the evaluation, Cadmus learned the monthly reports documented a slightly different number of recycled units than the complete Units database, provided by the program administrator for evaluation purposes. Upon further examination of the data, the program administrator could not identify the source of this discrepancy, but confirmed the discrepancy did not affect invoicing, as invoicing occurred separately from monthly reporting. The program administrator and Pacific Power have planned changes to the reporting processes to prevent such discrepancies from occurring in the future. For the impact evaluation activities, Cadmus assumed the program administrator's Units database provided the most reliable source of the total number of units recycled. Table G12 details reporting discrepancies.

Table G12. Reporting Discrepancies

Appliance	2009		2010		Total		Difference in Totals	
	Annual Report	JACO Database	Annual Report	JACO Database	Annual Report	JACO Database	Nominal	Proportion
Refrigerator	211	213	431	448	642	661	19	3%
Freezer	49	51	146	154	195	205	10	5%
Total	260	264	577	602	837	866	29	3%

Table G13 compares total reported and evaluated gross savings by measure.

Table G13. Reported vs. Evaluated Savings by Measure

Measure	Participation (units)		Per Unit Savings (kWh/unit)		Gross Savings (kWh)		Precision at 90% Confidence
	Reported	Evaluated	Reported	Evaluated	Reported	Evaluated	
Refrigerator Recycling	642	661	1,149	1,039	737,658	686,552	±8.5%
Freezer Recycling	195	205	1,590	869	310,050	178,234	±9.7%
Energy Savings Kit	756	756	81	59	61,236	44,496	±11.1%
Totals	N/A	N/A	N/A	N/A	1,108,944	909,282	±6.7%

Net-to-Gross

Cadmus' analysis estimated net savings for recycled refrigerators using the following formula:

$$\text{Net savings} = \text{Gross Savings} * (1 - \text{Freeridership Ratio} + \text{Spillover Ratio})$$

Where:

$$\text{Gross Savings} = \text{Evaluated } \textit{in situ} \text{ UEC for the recycled unit, adjusted for part-use;}$$

Freeridership Ratio = The proportion of program savings that would have occurred in the program's absence;

Spillover = Non-programmatic savings induced by the program, expressed as a proportion of gross savings;

Freeridership

Assessing freeridership for appliance recycling programs can be challenging, as the programs not only seek to remove inefficient appliances from the customers' homes, but seek to remove them from the utility grid. Thus, freeridership must be estimated based on participants' reports of what would have happened to the appliance in the program's absence. This invites the risk of biased responses from participants, as participants must assess what they would have done hypothetically. Such assessments very often suffer from social desirability bias, which results from the respondents' tendency to answer questions in a manner that will be viewed favorably by others. To counteract this potential bias, Cadmus collected additional data from nonparticipants¹² about how they actually disposed of their appliances.

Table G14 presents four possible scenarios, assuming participating refrigerators or freezers had not been recycled through the program. As Scenarios 1 and 3 indicate freeridership, the report addresses those scenarios in further detail.

Table G14. Potential Freeridership Scenarios

Scenarios Independent of Program	Scenario	Indicative of Freeridership	Percent of Refrigerator Participants (n=51)	Percent of Freezer Participants (n=39)
Unit Kept But Not Used	1	Yes	2%	0%
Unit Kept And Used	2	No	24%	26%
Unit Discarded and Destroyed	3	Yes	35%	38%
Unit Discarded, Transferred, Used	4	No	39%	36%

Scenarios 1 and 2

For participants reporting they would have kept units had they not participated in the program, the survey asked whether they would have used the unit or would have stored it unplugged. These responses provided the proportion of units that would have been kept and not used at this time (therefore, not drawing electricity from the grid—an indication of freeridership). To maintain conservative estimates, energy savings associated with these units were subtracted from the program's evaluated gross savings.

¹² Nonparticipants were defined as Pacific Power customers disposing of a working refrigerator or freezer outside of the HES program during 2009 or 2010.

Scenarios 3 and 4

Calculating freeridership associated with Scenarios 3 and 4 (units discarded and destroyed in the program's absence, and units transferred to another owner in the program's absence) proved slightly more complex, as they included a number of different hypothetical actions.

Table G15 presents participants' Scenario 3 and 4 responses, indicating actions participants claimed they would have taken had the program not been available.

Table G15. Freeridership Scenarios 3 and 4 (Participant Responses)

Hypothetical Method of Disposal In Absence of Program	Indicative of Freeridership	Percent of Refrigerator Participants (n=38)	Percent of Freezer Participants (n=29)
Sell it to a private party, either by running an ad or to someone you know	No	5%	7%
Sell it to a used appliance dealer	Varies by appliance age*	0%	3%
Give it away to a private party, such as a friend or neighbor	No	21%	24%
Give it away to a charity organization, such as Goodwill Industries or a church	No	5%	6%
Have it removed by the dealer you got your new or replacement appliance from	Yes**	5%	0%
Haul it to the dump or recycling center yourself	Yes	53%	59%
Hire someone else to haul it away for junking or dumping	Yes	11%	3%

Pacific Power CA SYLR Participant Survey: Question F17.

*Cadmus' prior market research has indicated that used appliance dealers do not resell units over 15 years old. Thus the analysis assumed units over 15 years of age would not have remained on the grid.¹³

**Although it is possible that some dealers resell used units that are picked up, Cadmus' prior market research has shown that a majority of dealers do not resell these units. Cadmus's assumption that none of these appliances were resold is conservative, but since it affects only a small portion of participants, it has a minimal effect on overall NTG.

Table G16, below, provides comparable responses for nonparticipants.

Table G16. Freeridership Scenario 3 and 4 (Nonparticipant Responses)*

Hypothetical Method of Disposal In Absence of Program	Indicative of Freeridership	Percent of Nonparticipants (n=53)
Sell it to a private party, either by running an ad or to someone you know	No	4%
Sell it to a used appliance dealer	Varies by appliance age	2%
Give it away to a private party, such as a friend or neighbor	No	30%
Give it away to a charity organization, such as Goodwill Industries or a church	No	6%
Have it removed by the dealer you got your new or replacement appliance from	Yes	25%
Haul it to the dump or recycling center yourself	Yes	23%
Hire someone else to haul it away for junking or dumping	Yes	11%

¹³ An example of the market research that informed these assumptions can be found in the Ameren Illinois PY2 Appliance Recycling Evaluation Report, available online at http://ilsag.org/evaluation_documents.

*Refrigerators and freezers pooled due to smaller sample size.
Pacific Power CA SYLR Nonparticipant Survey: Question A6.

The freeridership calculations outlined above yield the appliance-specific freeridership ratios presented in Table G17.

Table G17. Participant and Nonparticipant Freeridership Responses

Respondent Group	Measure Stratum	Respondents Factored into Freerider Score*	Identified # of Freeriders	Freerider Ratio	Absolute Precision at 90% Confidence**
Participant	Refrigerator	52	20	38%	±10.2%
Participant	Freezer	40	16	40%	±10.1%
Nonparticipant	Refrigerator	43	16	37%	±12.4%
Nonparticipant	Freezer	10	2	20%	±23.2%

* The number of respondents factored into the freerider score differs from total number of participants and nonparticipants surveyed, because some respondents gave a response of “Don’t know” to one or more essential questions.

**For ease of interpretation, this report uses absolute precision for proportion estimates.

Cadmus averaged the freeridership ratio estimates for participating and nonparticipating appliances to arrive at final, measure-level freeridership ratios. Calculating the average using inverse variance weights ensured placing greater weight on values with a higher degree of certainty.

Table G18. Freeridership Ratios

Participants/Nonparticipants Combined	FR Ratio Weighted Average	Absolute Precision at 90% Confidence
Refrigerator	38%	±8.2%
Freezer	35%	±11.0%
Combined	37%	±7.1%

Spillover

Spillover refers to additional savings generated by program participants due to their program participation, but not captured by program records. Spillover occurs when participants purchase energy-efficient measures or adopt energy-efficient practices due to a program, but they choose not to participate (or are otherwise unable to participate) in the program. As these customers are not participants, they do not appear in program records of savings generated by spillover impacts.

Spillover examples include:

- Program participants adopting additional measures without an incentive.
- Consumers acting on the programs’ influence, resulting from changes in available energy-using equipment in the marketplace.
- Changes brought about by more efficient practices employed by architects and engineers, ultimately forcing consumer behaviors into desired patterns.

- Changes in nonparticipants' behaviors resulting from direct marketing or changes in stocking practices.

The energy-efficiency program's spillover effect serves as an additional impact, which can be added to the program's results, in contrast with freerider impacts (which reduce net savings attributable to the program).

Methodology

For the SYLR program, Cadmus measured spillover by asking a sample of participants purchasing and receiving an incentive for a particular measure if, due to the program, they installed another efficient measure or undertook other energy-efficiency activities. Respondents were asked to rate the relative influence of the SYLR program and incentive on their decisions to pursue additional savings.

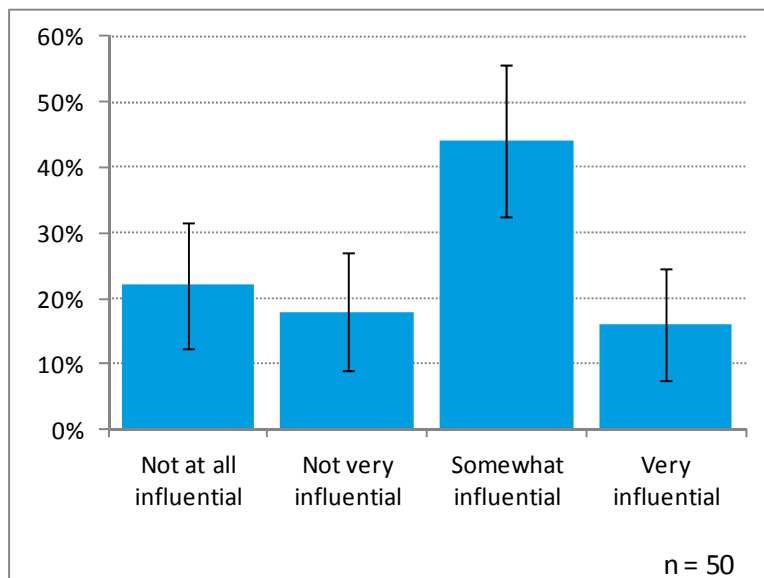
Spillover questions sought to determine whether program participants installed any other energy-saving measures since participating in the program. Savings participants received from additional measures would be considered spillover savings if the program significantly influenced their decisions to purchase additional measures, and if they did not receive additional incentives for those measures.

SYLR program participants were specifically asked whether they installed the following measures, which were associated with quantifiable spillover:

1. High-efficiency dishwashers
2. High-efficiency washers
3. High-efficiency refrigerators
4. High-efficiency water heaters
5. CFLs

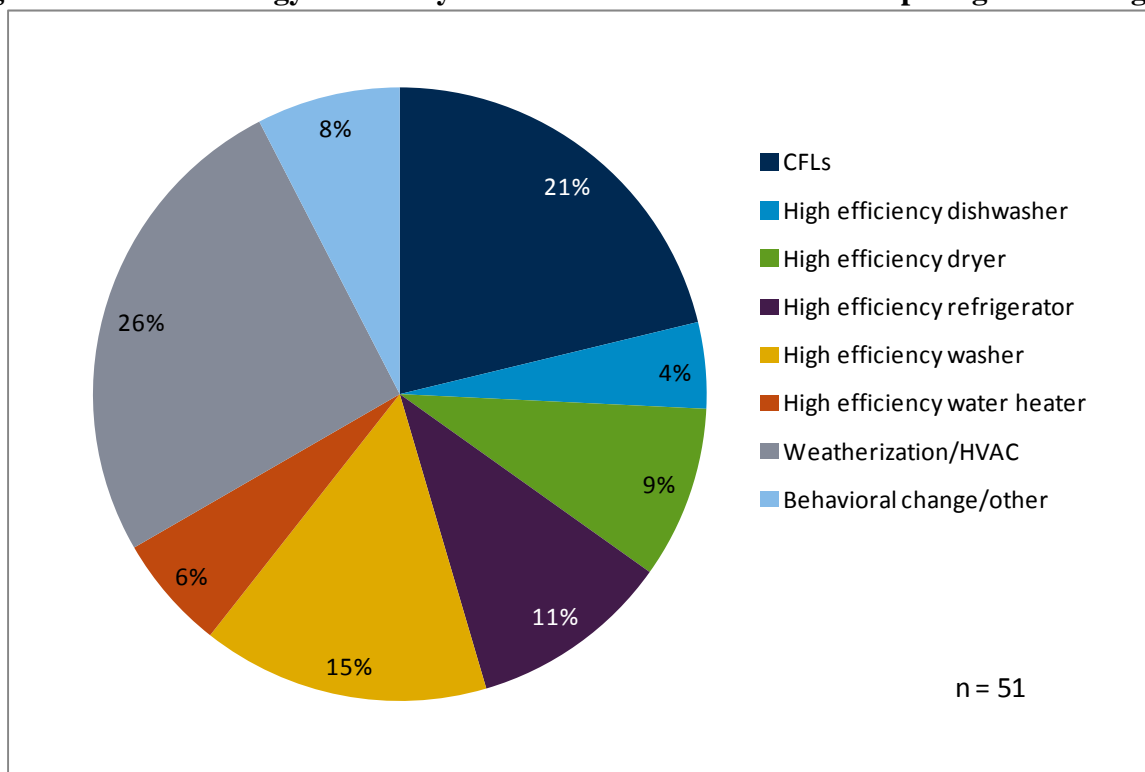
If the participant installed one or more of these measures, they were asked additional questions about which year they purchased the measure, and whether they received an incentive for the measure. If applicable, participants were asked how influential the SYLR program was on their purchasing decisions (participants could answer not at all, not very, somewhat, or very influential). Participants expressed mixed responses regarding the program's influence on these actions, with data indicating 60 percent found the program "somewhat" or "very" influential.

**Figure G8. Program Influence on Installing Additional Measures
(with 90% Confidence Intervals)**



Pacific Power CA SYLR Participant Survey: Question SP7.

Fifty-five percent of participants claimed to have installed energy-efficient measures or changed their behaviors after participating in the SYLR program. However, only five such purchases represent quantifiable savings: energy-efficient refrigerators, clothes washers, dishwashers, water heaters, and CFLs. Other measures, such as weatherization and HVAC, are difficult to quantify accurately based on survey data, and thus were not included in the spillover analysis. Figure G9 shows distributions of reported actions taken, including those not associated with spillover savings

Figure G9. Other Energy-Efficiency Measures Installed Since Participating in the Program

Pacific Power CA SYLR Participant Survey: Question SP6.

Cadmus calculated participant spillover by estimating savings attributable to additional measures installed, and whether respondents credited Pacific Power with influencing their decisions. Measures were counted if they were eligible for program incentives, but incentives were not requested. NTG ratios then were calculated, accounting for estimated freeridership and spillover effects.

Spillover Savings Analysis

For calculating spillover savings, Cadmus used a top-down approach. The analysis began using a subset containing only survey respondents who indicated they installed additional energy-savings measures after participating in the SYLR program, but without receiving any incentives. From this subset, Cadmus removed participants who indicated the program had little influence on their decisions to purchase additional measures.

For the remaining participants with legitimate spillover savings, Cadmus estimated energy savings from additional measures installed. Savings values, calculated by Cadmus, were matched to additional measures installed by survey participants.

Table G19 summarizes participant survey spillover responses. Appliance per-unit savings were derived from Cadmus' evaluation of 2009 and 2010 HES gross saving values. Cadmus assumed CFL savings equaled those calculated for energy-saving kits. Total spillover savings represented 1.51 percent of total refrigerator and freezer savings.

Table G19. Spillover Results

Sample Spillover kWh	Sample Program kWh	Spillover Ratio	Absolute Precision (90% Confidence)
1,668	110,453	1.51%	±0.96%

Final Net-to-Gross (NTG)

As summarized in Table G20, the evaluation determined final net savings (and, subsequently, the NTG ratio) as gross savings, adjusted for freeridership and spillover.

Table G20. Final NTG Ratios

Participants/Nonparticipants Combined	FR Ratio	Spillover Ratio	NTG Ratio	Absolute Precision (90% Confidence)
Refrigerator	37.9%	1.51%	63.6%	±8.3%
Freezer	34.5%		67.0%	±11.1%

Table G21 compares NTG ratios for similar appliance recycling programs evaluated over the last decade. As shown, NTG ratios for the California 2009 and 2010 SYLR program fell at the high end of the range of these values.

Table G21. Comparable Appliance Recycling Programs' NTG Ratios

Study	Study Year	Refrigerator NTG Ratio	Freezer NTG Ratio
Appliance Recycling Program Evaluation – PY 2, Ameren Illinois, The Cadmus Group	2010	0.79	0.82
Results for Pacific Gas & Electric, from Residential Retrofit High Impact Measure Evaluation Report, California Public Utility Commission, The Cadmus Group	2010	0.51	N/A
PowerWise Appliance Recycling Program, Salt River Project, FY 2009 Evaluation, The Cadmus Group	2009	0.67	0.68
EM&V Study of 2004–2005 Statewide Residential Appliance Recycling Program, ADM Associates, Inc.	2008	0.61	0.71
Residential Appliance Turn-In Program in Wisconsin, PA Consulting Group,	2008	0.57	N/A
Evaluation of the Washington Refrigerator and Freezer Recycling Program, PacifiCorp, PY 2005–2006, KEMA*	2007	0.31	0.56
Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program, Final Report, KEMA-Xenergy*	2004	0.35	0.54
Measurement and Verification Report for NCPA SB5X Refrigerator Recycling, Final Report, Robert Morris & Associates	2003	0.64	0.64
Measurement and Verification of SB5X Energy Efficiency Programs for the Sacramento Municipal Utility District, Final Report, Heschong Mahone Group	2003	0.55	0.68

*The methodology that KEMA applied in the 2002 California study and the 2005-2006 Washington study included part-use as one component of the NTG adjustment, resulting in lower than average NTG ratios.

Summary of Impact Findings

Table G22 and Table G23 summarize impact evaluation findings.

Table G22. 2009–2010 Per-Unit Savings by Measure

Measure	Reported Gross Savings (kWh)	Evaluated Annual UEC/Unadjusted Gross Savings (kWh)	Evaluated Adjusted Gross Savings (kWh)	Evaluated Net Savings (kWh)
Refrigerator Recycling	1,149	1,229	1,039	604
Freezer Recycling	1,590	1,056	869	518
Energy Savings Kit	81	67	59	59

Table G23. 2009–2010 Program Savings by Measure

Measure	Evaluated Participation	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	Precision at 90% Confidence
Refrigerator Recycling	661	737,658	686,552	436,432	±14.5%
Freezer Recycling	205	310,050	178,234	119,264	±16.1%
Energy Savings Kit	756	61,236	44,496	44,496	±11.1%
Totals	N/A	1,108,944	909,282	600,630	±11.1%

Process Evaluation

This section presents detailed staff interview findings as well as participant and nonparticipant survey results. Focus areas include:

- Delivery structure and effectiveness of the implementation strategy;
- Marketing approach and relative success;
- Customer satisfaction; and
- Internal and external communications.

Methodology

The research conducted to support the process evaluation followed three major steps:

1. Document review.
2. Utility staff and program administrator interviews.
3. Participant and nonparticipant surveys.

Cadmus reviewed program materials, including:

- Past evaluations;
- Marketing and communication materials designed to promote participation and educate target audiences on the program;
- Logic models; and
- The program's Website.

This review sought to assess:

- The general look and feel of marketing materials;
- Brand and message consistency, program accessibility; and
- Stakeholder forms and information.

Review results helped inform the design of stakeholder interview guides and customer surveys, and development of specific recommendations regarding program marketing.

Next, Cadmus developed stakeholder interview guides to collect information about key topics from program management staff. JACO Environmental implements the SYLR program (as they do in other Pacific Power service territories operating appliance recycling programs). Cadmus interviewed two main program staff: program managers at Pacific Power and at JACO, both of whom oversee the programs in all five states offering appliance recycling programs (Washington, California, Idaho, Utah, and Wyoming). Issues discussed included:

- Program history;
- Process flow;
- Program design versus program implementation;
- Changes in implementation and program marketing; and
- Strengths and areas for improvement.

Cadmus staff conducted stakeholder interviews by phone, and, for follow-up questions and clarifications, contacted stakeholders via e-mail.

Finally, Cadmus conducted telephone surveys with participant and nonparticipant customers. Cadmus designed survey instruments to collect data about the following topics:

- **Customer information.** Data characterizing participants and allowing extrapolation of results to the entire program population.
- **Program process.** Survey questions collecting information to inform the following performance indicators:
 - Is the program’s design appropriate to meet its goals?
 - Is program marketing effective?
 - What are participation motivations and barriers?
 - Are program incentives set correctly?
 - Is the program process effective?
 - Are customer satisfaction goals being met?
 - What are the program’s strengths or areas for improvements?

Program Implementation and Delivery

Drawing on stakeholder interviews and participant and nonparticipant survey response data, this section discusses implementation and delivery of the SYLR program.

Program Status

The SYLR program launched in California in May 2008, with 2009 its first full year of implementation. According to the program administrator, Pacific Power and the program administrator established program goals for the 2009–2010 period based on prior program performance and harvest rates in comparable programs elsewhere.¹⁴ Projected participation levels were included in the contract between Pacific Power and the program administrator, although no financial penalty was associated with lower-than-expected participation. The 2009 program did not reach the projected participation level, but the 2010 program experienced increased participation and achieved the projected participation level of 600 units for that year. Despite this improved level of participation in 2010, participation for the two year period was lower than originally expected: the preliminary target for the 2009–2010 period was 3,000 units, and the program recycled only 866 units in total, representing less than 30 percent of the original expectation.

Program staff noted several possible reasons for these participation trends:

- The program was still very new in the California territory, and awareness may have been low in 2009. Increased participation in 2010 indicated that awareness may have increased over time.

¹⁴ Harvest rate is defined as the number of units recycled through the program in a given year divided by the total number of residential customer accounts in the service territory.

- The economic downturn beginning shortly before the evaluation period may have caused diminished demand for program services. During difficult economic times, customers prove less likely to move to new homes or remodel, and thus less likely to dispose of appliances.
- Increased participation in 2010 is largely attributable to a change in the marketing approach to better engage the California market (described below).
- Increased participation in 2010 may also have been influenced by the availability of rebates for new refrigerators funded by the American Recovery and Reinvestment Act (ARRA).

Delivery Structure and Processes

Pacific Power and program administrator staff reported the program had been designed similarly to appliance recycling programs already operating in other states. The California program leveraged existing infrastructure by operating through the same call center used to implement the program in other states, furnishing the California program with experienced customer service representatives.

During 2009 and 2010, two main subcontractors contributed to program implementation:

- Runyon, Saltzman & Einhorn served as the marketing subcontractor, supporting the program administrator's program marketing, advertising, and public relations activities.
- Appliance Distribution served as the appliance pickup subcontractor, with multiple crews responsible for picking up and transporting appliances to the recycling facility.

The program delivery process followed four main steps:

1. Marketing.
2. Sign-up/scheduling.
3. Appliance pick-up.
4. Incentive payment.

Marketing (described in greater detail below) targeted owners of older and secondary refrigerators, although participating appliances had no minimum age requirements.

Pacific Power's California customers, interested in disposing of an eligible appliance, could obtain information or sign up to participate through Pacific Power's Website, or by calling the program administrator toll-free. When participants signed up, the program administrator collected data on how customers learned of the program, verified eligibility, and scheduled pick-up times. The customer received a window of time for appliance pickup on a specific day, and was required to have the appliance plugged in and running upon pickup.¹⁵ Times between scheduling and pickup averaged 17 days. The program administrator noted pickup wait times tended to be shortest in urban areas, while customers in outlying areas experienced longer waits.

¹⁵ The program administrator estimated that typically 2-3 percent of pickups are ineligible for participation because the appliance is found not to be working. Similarly, the program administrator reported that roughly 1-2 percent of units scheduled to be picked up are ineligible for participation due to their size.

This wait time was somewhat longer than that of other programs, however, longer waits are expected for a mostly-rural service territory such as Pacific Power’s in California. Furthermore, the high customer satisfaction found in the participant survey indicates that longer wait times did not have an appreciable negative effect on the participant experience.

At the scheduled time, the contractor picking up the appliance verified the unit was in working condition, and collected data about the appliance’s age, size, configuration, and features. During appliance pickup, participants received an energy-saving kit containing: two 13-watt CFLs, a refrigerator thermometer, energy-savings educational materials, and information about Pacific Power’s other energy-efficiency program offerings. Both program managers described these kits as effective program components.

During the 2009–2010 program period, Appliance Distribution’s facility received picked-up appliances for decommissioning and recycling. The program administrator then assumed responsibility for mailing incentive checks to participants.

Forms and Incentives

Unlike many incentive programs, the SYLR program requires minimal paperwork for participating customers. The signup process can be completed by phone or online, and neither process requires the customer to fill out lengthy forms. Customers signing up by phone are asked for information, including their address and the location of the unit as well as a few screening questions. Customers signing up online respond to these questions through a brief, one-page online form. Customers appreciated the simplicity of the sign-up process: 98 percent of surveyed customers reported being very or somewhat satisfied with the program sign-up process.

Participating customers reported high satisfaction levels with the incentive amount. Seventy-one percent of surveyed participants said they were very satisfied with the incentive amount, with an additional 27 percent reporting they were somewhat satisfied. Furthermore, 86 percent of participants claimed they would have participated in the program had the incentive amount been lower, and 81 percent said they would have participated even if no incentive had been offered. These results, however, may reflect social desirability bias.¹⁶

Marketing

Approach

The program administrator markets the SYLR program through an array of channels, which include:

- Direct mail;
- Newspaper advertisements;
- Radio and television advertisements;
- Online advertising;
- A program Website;
- Customer information sheets;

¹⁶ Social desirability bias is the tendency for respondents to exaggerate their inclination to “do the right thing.”

- Bill inserts;
- Retailer referrals;
- Point-of-purchase advertising; and
- Social media outreach through Pacific Power.

The program administrator oversees Runyon, Saltzman & Einhorn, the marketing subcontractor, which develops marketing materials and works with the program administrator to develop an overall strategy and approach. The program administrator manager described the process as collaborative, emphasizing that, as part of this process, Pacific Power must approve every piece of marketing collateral. The Pacific Power program manager confirmed this.

In addition to overseeing the collaborative process of creating and disseminating marketing material, the program administrator analyzes participation data to inform marketing strategy decisions. For example, the program administrator reported that bill inserts typically provoked spikes in program activity; so the timing of bill inserts has been coordinated to periods requiring increased volume.

The program administrator reported that in California, a direct mail postcard containing a refrigerator magnet was found to be particularly effective in increasing sign-ups. This direct mail campaign was first implemented in October 2009, and due to its success, it was repeated in August 2010. The program administrator noted that this method seemed particularly effective for customers living in rural areas, who are typically very difficult to reach.

Materials Review

Cadmus' review of SYLR program promotional materials evaluated the messaging content, look and feel, and user accessibility of collateral materials, online promotional elements, and other user forms and educational materials. Cadmus then incorporated insights gained through interviews with Pacific Power and program administrator staff to apply context and develop conclusions. The high-level findings, presented below, indicate Pacific Power's ongoing marketing efforts have been effective, and new retail partnerships have helped drive participation.

Cadmus' findings include the following:

- ***The SYLR marketing plan has been well constructed:*** Pacific Power's 2010 marketing plan includes best practice tactics, and provides an appropriate range of media channels to drive participation.
- ***SYLR program marketing collateral presents a consistent look and feel:*** Program Web pages, bill inserts, and other collateral include consistently uncluttered and clear designs, bold colors, and large typefaces.
- ***SYLR program marketing collateral provides consistent messaging:*** Marketing content includes basic calls-to-action and motivating messages. This helps reinforce word-of-mouth recommendations and awareness.
- ***Advertising frequency may affect program awareness.*** Program staff indicated infrequent advertising exposure may negatively impact program awareness, noting more frequent direct mail advertising or bill inserts could increase exposure.

- ***Direct mail advertising proved effective in reaching California customers.*** Program staff noted that a direct mail piece containing a refrigerator magnet drove an increase in participation in 2009 and again in 2010.

Table G24 and Table G25 compare SYLR program marketing approach elements to best practice elements in energy-efficiency program marketing. Pacific Power currently appears to utilize several best practice marketing channels, but additional, remaining opportunities could increase participation.

Table G24. SYLR Program Use of Best Practice Marketing Channels in 2009–2010

Best Practice Marketing Channels	SYLR Program
Direct Mail	Yes
Newspaper Ads /articles	Yes
Radio/TV Ads	Yes
Online Advertising	Yes
Website	Yes
Customer Information Sheets	Yes
Retailer Information Sheets	Yes
Telemarketing	No
Bill Inserts	Yes
Brochures	Yes
Newsletters	Yes
Presentations/Meetings	No
Events	Yes
Referrals/Retail Partnerships	No
Point of Purchase	No
Tests/Demonstrations	No
Social Media Outreach*	Pacific Power

*Social media (e.g. Twitter, Flickr, YouTube, Facebook) offer channels for utilities to connect with customers. Many utilities' communications efforts leverage one or more social media platform(s).

Table G25 summarizes: use of online best practices in the SYLR program's Website; and rationale, and additional information regarding particular online findings. Generally, the program administrator's experience with other utilities and regions has provided practical expertise in developing effective marketing tools.

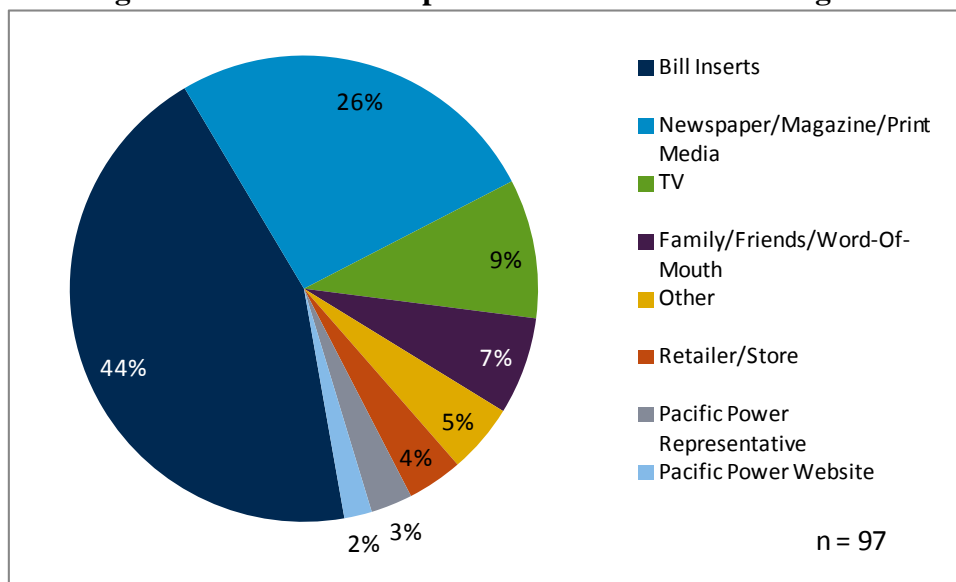
Table G25. SYLR Program use of Website Best Practices

Category	Website Best Practice Element	SYLR Program	Rationale/More Information
Navigation	Program highlighted on home page	No	Users often enter utility sites through the home page. Easy "one-click" access to a program makes participation easier, and provides greater program exposure. Other utilities have found a recycling registration button on the home page effective.
Navigation	Number of clicks from home page	Three	
Content	Description leads with benefits (i.e., What's in it for the participant?)	Home Page: WattSmart Programs and Incentives OR Save Energy (non-specific) SYLR Program Page: "Get Paid to Recycle Your Old Refrigerator or Freezer."	The SYLR program has a compelling, clear benefit statement.
Content	Clear call to action	Yes	The program's "why" has been clearly presented. We recommend including the call to action—"schedule your free pick up"—at the top and bottom of the page. Further, more consistent branding between the recycling page and the JACO ZIP code page would provide a more integrated user experience.
Marketing	Contact capture	Yes	
Content	Description of each individual program offered	Yes	
User Experience	Participant eligibility requirements	Yes	User experience refers to the online process and interactivity from the user's perspective. Easy downloads and online forms increase the likelihood that targets will participate and move forward with program activity. SYLR provides such documents online.
User Experience	Downloadable application forms	n/a	
User Experience	Online registration process	Yes	
Marketing	Downloadable program information in print format	No	Easy and simple to share marketing materials increases "word of mouth" activity, in-person or online. As most SYLR participants surveyed expressed satisfaction and would recommend the program, this element presents a particularly important opportunity.
Marketing	Social media "share" elements included (e.g. Facebook, Twitter, etc.)	No	

Effectiveness

According to program managers and per the marketing materials review, the SYLR program's overall marketing approach has been effective and responsive to changes in participation and market conditions. The program administrator reported tracking increased program activity in response to particular marketing pieces to evaluate the effectiveness of different marketing activities. Cadmus gathered further information about marketing effectiveness through the participant surveys. As shown in Figure G10, most participants learned of the program through two mechanisms: bill inserts and print advertising. These marketing methods accounted for 70 percent of all participants.

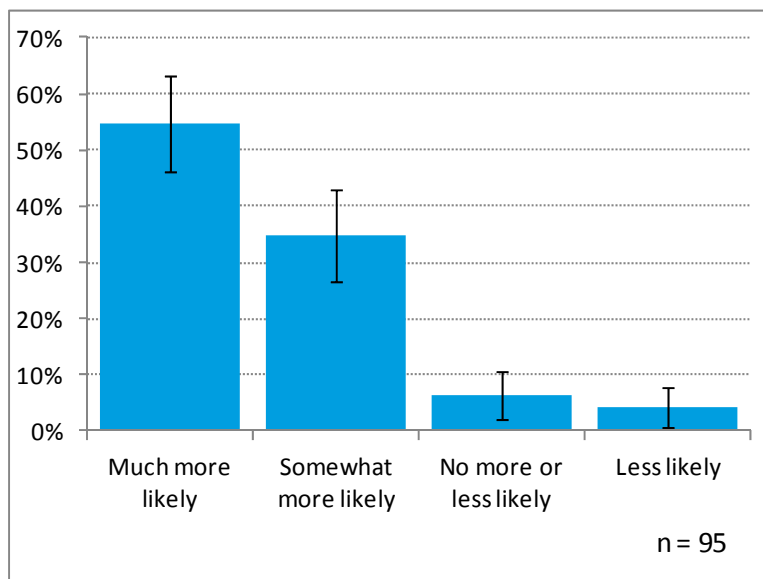
Figure G10. How Participants Learned about the Program



Pacific Power CA SYLR Participant Survey: Question B1.

The survey also asked whether SYLR program participants later participated in other Pacific Power energy-efficiency programs. Eleven percent of participants took part in other programs after participating in the SYLR program, and, as shown in Figure G11, the vast majority of respondents stated they were more likely to participate in future Pacific Power programs.

Figure G11. Likelihood of Participating in Another Pacific Power Program (with 90% Confidence Intervals)*



Pacific Power CA SYLR Participant Survey: Question SP4.
 *Confidence intervals indicated by black bars in figure.

Targeting

Compared to customers in the general population, appliance recycling program participants tended to be homeowners in single-family residences, averaged roughly 62 years of age, and had children. Table G26 shows average demographics for participants surveyed.

Table G26. Participant Demographics

Characteristic	Participants
Average Head of Household Age	61.6
Homeownership	92%
Average Household Size	2.3
Proportion Earning Less than \$50k	56%

The vast majority of participants (85 percent) lived in single-family residences, with 15 percent living in multifamily or manufactured homes. Respondents' ages reflected more than three quarters of participant respondents over age 50. As contact information derived from self-reported information (i.e., landlines or cell phones), the survey experienced no bias for respondents with landlines.

Comparison with Nonparticipants

A nonparticipant population differing demographically from the participant population may indicate misplaced or incomplete targeting of marketing efforts. Cadmus tested for similarities between nonparticipant and participant populations to rule out marketing not reaching some eligible demographic groups. For example, if a large portion of nonparticipants lived in mobile homes (and few participants lived in mobile homes), the mobile home market may have been overlooked.

Cadmus found few statistically significant differences between participants and nonparticipants. Table G27 shows t-test results for differences between the two groups¹⁷ for a series of relevant characteristics. For all p-values exceeding 0.10, these demographics cannot be said to differ with 90 percent confidence. Therefore, the only significant difference found was with respect to age, where participants were found to be older. Home types were not found to be significantly different. Cadmus conducted a chi-square test for independence between the two groups, and found they could not be said to differ with 90 percent confidence (p-value = 0.99).¹⁸

Table G27. T-Tests for Demographic Differences between Participants and Nonparticipants

Characteristic	Participants	Nonparticipants	Difference	p-value
Average Head of Household Age	61.6	56.1	5.5	0.03
Homeownership	92%	84%	8%	0.16
Average Household Size	2.3	2.7	-0.4	0.13
Proportion Earning Less than \$50k	56%	52%	4%	0.64

¹⁷ All t-tests conducted assumed unequal sample sizes and variances.

¹⁸ A chi-square test is a statistical test used in this case to determine whether the distribution of home types for participants differed statistically from the distribution of home types for nonparticipants.

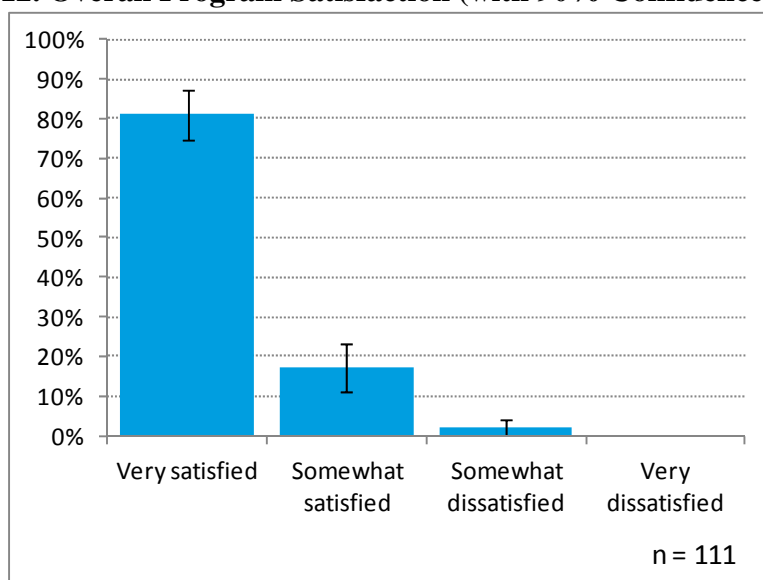
Participants' and nonparticipants' similar demographics indicate marketing has been targeted appropriately, though the younger average age of nonparticipants indicates that additional marketing targeted to younger customers may be appropriate.

Customer Response

Satisfaction

The program experienced high overall satisfaction rates. Approximately 81 percent of participants reported being very satisfied with the program, with less than 2 percent reporting dissatisfaction. When asked about program specifics, such as scheduling and incentive amounts, participants expressed similar satisfaction levels (see Figure G12).

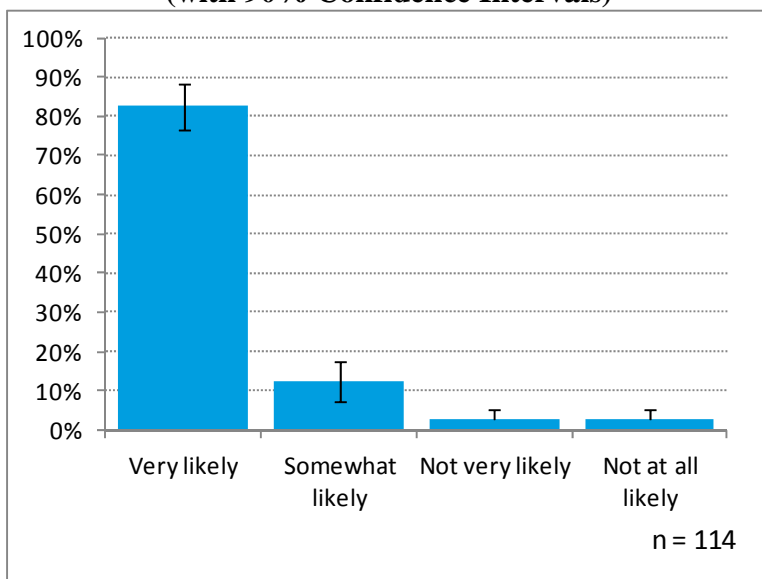
Figure G12. Overall Program Satisfaction (with 90% Confidence Intervals)



Pacific Power CA SYLR Participant Survey: Question G1.

Participants' willingness to recommend the program to others reflected their positive perceptions of the program. Figure G13 shows participants' self-reported likelihood of recommending the program ran quite high, with 95 percent saying they were somewhat or very likely to recommend the program.

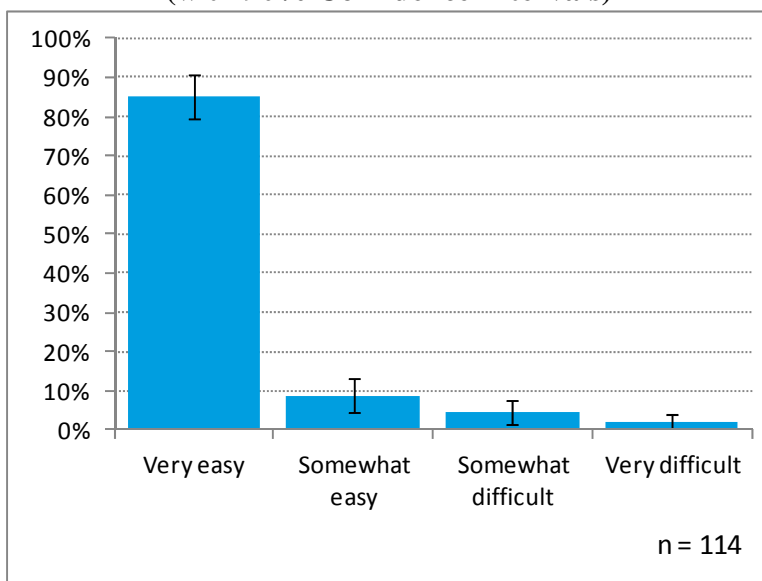
Figure G13. Likelihood of Recommending Program to Others (with 90% Confidence Intervals)



Pacific Power CS SYLR Participant Survey: Question G10.

Ninety-four percent of customers reported having positive experiences with the program’s scheduling process, with 85 percent expressing scheduling a convenient pickup time was very easy.

Figure G14. Level of Difficulty with Scheduling: Participant Survey Results (with 90% Confidence Intervals)



Pacific Power CA SYLR Participant Survey: Question G4.

Barriers

Overall, participant surveys did not reveal significant complaints or issues, and through the SYLR process evaluation, Cadmus noted no significant barriers. The program functions smoothly, likely due to its longevity in the California market and the program administrator's experience.

Communications

Both the program administrator and Pacific Power reported satisfaction with their relationships, noting they have collaborated on appliance recycling programs in California and other states for eight years.

Pacific Power noted the program administrator's response times (for example, on information requests or follow-ups regarding various customer situations) have occasionally been longer than desired. For example, Pacific Power cited a situation in which a customer became frustrated with a delayed pickup. In this case, the program administrator received a request for follow-up from Pacific Power, but did not respond until after the customer had been contacted and the issue had been resolved, leaving Pacific Power out of the loop regarding the status of the customer's complaint. This appears, however, to have been an isolated incident, and does not represent a widespread issue.

As noted in Tracking and Reporting, Cadmus identified a minor discrepancy between participation numbers Pacific Power reported in its annual reports and participation data provided by the program administrator.

Quality Assurance

Though the program administrator manager reported data collection at numerous points throughout the participation process, Cadmus identified data entry and pickups as two areas with established quality assurance procedures for the program:

- When data, collected in the field by appliance pickup contractors, are translated into the database, opportunities arise to identify and correct errors.
- The program administrator manager reported an independent quality assurance contractor, hired by Pacific Power, follows pickup crews for a sample of pickups to observe pickup procedures and customer service. The quality assurance contractor also interviews participating customers to assess their satisfaction with the service.

Appendix H. SYLR Participant Demographics

Over 80 percent of SYLR program participants lived in single-family homes or mobile homes. Roughly 92 percent of participants owned their residences. Table H1 summarizes participant home types and home ownership.

Table H1. Home Type Characteristics

Home Characteristics	Percent of Respondents	Precision at 90% Confidence
Home Type (n = 110)	-	-
Single-family home	80.9%	6.2%
Townhouse or duplex	2.1%	2.3%
Mobile home or trailer	14.9%	5.6%
Apartment building with 4 or more units	2.1%	2.3%
Own/Rent (n = 109)	-	-
Own	91.7%	4.3%
Rent	8.3%	4.3%

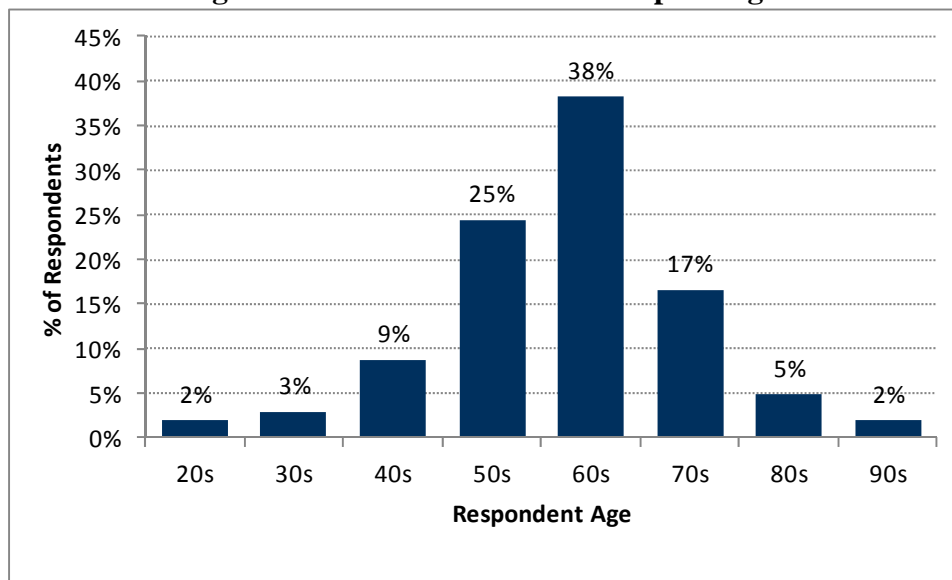
Table H2 shows average house ages, participant ages, and household sizes.

Table H2. Household Characteristics

Household Characteristics	Mean	Standard Deviation	Precision at 90% Confidence
Participant Age (n = 216)	61.6	12.5	3.3%
Number of Residents (n = 227)	2.3	0.94	4.7%

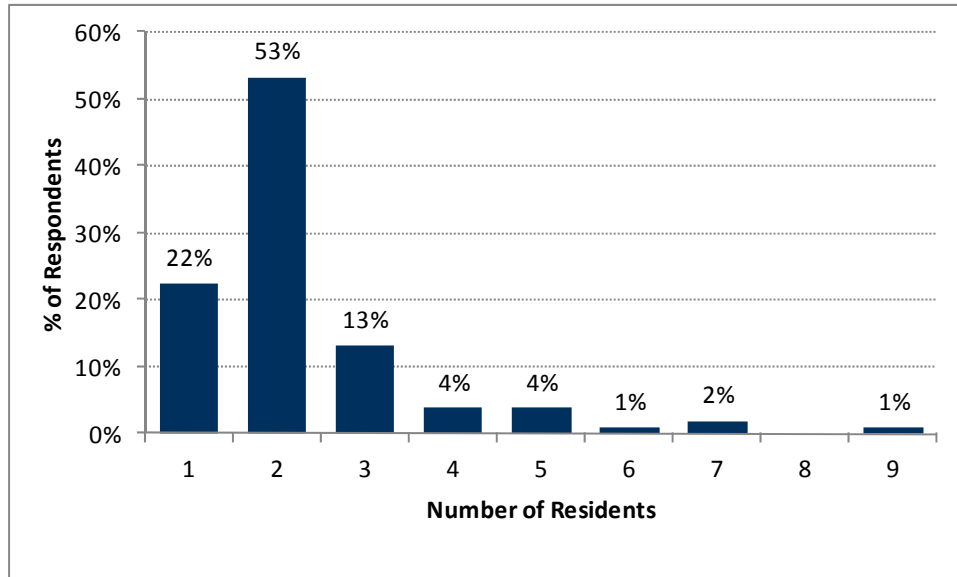
Figure H1 shows distributions of participants' ages.

Figure H1. Distributions of Participant Ages



Program participants averaged 61.6 years old, with 62 percent of participants over 60 years old. Only 5 percent of participants were in their 20s or 30s. Figure H2 shows distributions of household sizes.

Figure H2. Distributions of Household Sizes



On average, two to three people lived in households participating in the program. One- or two-person households accounted for 76 percent of program participants.

Appendix I. Marketing Materials Review

Interactive Best Practices

Leverage First Impressions

- Include a simple, attention-grabbing, and relevant offer.
- Keep offer highlights above the fold.
- Offer clear calls to actions.

Communicate Value

- Always ask “what’s in it for my reader?”
- Make offer attractive and easy to access.
- Target to site visitor as much as possible.

Keep It Simple

- Design clear and intuitive navigation.
- Don’t make your visitor hunt for the program/offer.
- Offer simple forms.
- Request the minimum contact information for lead capture.

Focus on “Conversion” to Maximize Results

- Make the “submit” or conversion button prominent.
- Offer more information and assistance in exchange for contact information.
- Become customer-centric; offer not only information, but also support.

Build Trust

- Communicate your privacy policy clearly.
- Make sure visitors know where any contact information will (and won’t) be used.
- Offer educational value; residents and businesses appreciate more information multiple energy efficiency programs.

Test, Measure, Fine Tune, Repeat

Website designers serious about leveraging their online presence constantly test multiple landing page variables in image, copy, look and feel, offer, and lead marketing.

Appendix J. Engineering Review and Whole-House Modeling

Engineering Review: Appliances

The engineering review used data from the participant phone surveys and secondary data to evaluate gross savings for clothes washers, refrigerators, dishwashers, ceiling fans and light fixtures. As shown in Table J1, realization rates ranged between 29 percent and 377 percent.

Table J1. Engineering Review Summary Table

Year	Measure	Standard	Gross Reported Savings (kWh/unit)	Gross Evaluated Savings (kWh/unit)	Realization Rate
2009-April 11, 2010	Clothes Washers	Clothes Washer-Tier One (1.72 - 1.99 MEF)	276	225	82%
	Clothes Washers	Clothes Washer-Tier Two (2.0 + MEF)	293	393	134%
April 12- December 31, 2010	Clothes Washers	Clothes Washer-Tier One (2.0-2.19 MEF)	115	434	377%
	Clothes Washers	Clothes Washer-Tier Two (2.2-2.45 MEF)	160	376	235%
	Clothes Washers	Clothes Washer-Tier Three (2.46 + MEF)	184	304	165%
2009-April 11, 2010	Refrigerator	ENERGY STAR Refrigerator	58	65.5	113%
April 12- December 31, 2010	Refrigerator	ENERGY STAR Refrigerator	141	65.5	46%
2009-10	Dishwasher	ENERGY STAR Dishwasher (weighted average)	74	37	50%
2009-10	Ceiling Fans	Ceiling Fans	105	30.6	29%
2009-10	Fixtures	Fixtures	92	49.9	54%

Clothes Washers

The clothes washer deemed savings values for 2009 and 2010 were based on the Planning, Tracking and Reporting System (PTR)¹ of the Bonneville Power Administration (BPA). On April 12, 2010, a tariff change occurred in California, establishing new rebate tiers, with an increased minimum efficiency level for rebate eligibility. Deemed savings for the new California tiers were based on the Northwest Power and Conservation Council's Sixth Power Plan (6PP). Depending on clothes washer purchase dates, a PTR value was applied to each clothes washer measure, based on the configuration of modified energy factor (MEF) level, water heater fuel and dryer fuel.

¹ <http://www.ptr.nwccouncil.org>

Cadmus calculated savings based on a metering study in 2009,² which metered more than 100 clothes washers in California homes for three weeks. This study was the largest *in situ* metering study on residential clothes washers and dryers conducted in the last decade, and indicated higher consumption and savings values than those often estimated. The majority of energy consumption and savings resulted from dryers, as high-efficiency washing machines removed more moisture from clothes, resulting in shorter drying times.

As a phone survey of clothes washer program participants revealed approximately 77 percent of washer loads were dried in dryers, Cadmus reduced average dryer savings per washer cycle by 23 percent.

Cadmus determined annual electricity savings by multiplying the metering study's adjusted kWh/cycle values by 319 cycles/year, which, based on the phone survey, was determined to be the average number of yearly clothes washer cycles.

The 2006 PacifiCorp Energy Decisions Survey indicated 83 percent of California residential customers used electric heaters for domestic hot water (DHW), and 95 percent used electric dryers. Cadmus developed savings values for each tier by using both weighted averages (based on these parameters) and measure data for distribution of sales, based on MEF.

Cadmus used the following equation to determine adjusted unit savings:

$$\text{adjusted kWh savings/cycle} \times \text{cycles/year} = \text{annual kWh savings}$$

Cadmus measured lower energy savings for machines with MEF ratings of at least 2.2 than for machines with ratings between 2.0 and 2.19. Factors contributing to this difference included machine sizes and user settings. If a high spin setting was not used in a high-efficiency washer, the full benefit of the high-efficiency equipment might not have been realized. While the high spin might not be available on all eligible machines, the survey indicated only 40 percent of California clothes washer rebate recipients reported using the high spin cycle at least 75 percent of the time. Reasons reported for not using the high spin included: impacts on clothing, noise or vibration, habit, and lack of awareness of a high spin cycle or its benefit.

Table J2 compares assumptions used for the reported and the evaluated savings values. As shown, electricity savings were negative for some configurations with gas dryers as clothes washers with a high-efficiency rating may use more energy in the spin cycle to remove more moisture from clothes. Removing more moisture in the washer can reduce total energy used for laundry, but electricity savings may not be realized for non-electric dryers.

² "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems", The Cadmus Group, Inc, 2010. http://www.cadmusgroup.com/pdfs/Do_the_Savings_Come_Out_in_the_Wash.pdf

Table J2. Clothes Washer Calculations, 2009–2010

Input		Reported Value	Evaluated Value		
Cycles per year		Unknown	319		
Percentage of Washer Loads Dried in a Dryer		Unknown	77%		
Water Heater Fuel	Electric	N/A	83%		
	Gas	N/A	17%		
Dryer Fuel	Electric	N/A	95%		
	Gas	N/A	5%		
Gross Unit Savings (kWh/year)	2009 – April 11, 2010	Electric DHW & Electric Dryer	MEF 1.72–1.99	295	226
			MEF 2.0+	320	424
		Gas DHW & Electric Dryer	MEF 1.72–1.99	188	245
			MEF 2.0+	211	338
		Electric DHW & Gas Dryer	MEF 1.72–1.99	128	-26
			MEF 2.0+	170	90
	Gas DHW & Gas Dryer	MEF 1.72–1.99	37	-6.4	
		MEF 2.0+	44	3.7	
	April 11 – December 31, 2010	Electric DHW & Electric Dryer	MEF 2.0–2.19	130	464
			MEF 2.2–2.45	173	405
			MEF 2.46 +	195	322
		Gas DHW & Electric Dryer	MEF 2.0–2.19	88	380
			MEF 2.2–2.45	120	318
			MEF 2.46 +	139	272
		Electric DHW & Gas Dryer	MEF 2.0–2.19	72	99
			MEF 2.2–2.45	93	89
			MEF 2.46 +	103	22
		Gas DHW & Gas Dryer	MEF 2.0–2.19	30	16
			MEF 2.2–2.45	40	3.2
			MEF 2.46 +	47	-27

As shown in Table J3, the weighted average evaluated savings values were higher than reported savings for all tiers.

Table J3. Clothes Washer Savings, 2009–2010

Modified Energy Factor	Configuration	Gross Unit Savings (kWh/year)		
		Reported	Evaluated	Difference
1.72-1.99	Electric DHW & Electric Dryer	295	-	-
	Electric DHW & Gas Dryer	128		
	Gas DHW & Electric Dryer	188		
	Gas DHW & Gas Dryer	37		
	Weighted average	276	225	-51
2.0+	Electric DHW & Electric Dryer	320	-	-
	Electric DHW & Gas Dryer	170		
	Gas DHW & Electric Dryer	211		
	Gas DHW & Gas Dryer	44		
	Weighted average	293	393	101

Table J4. Clothes Washer Savings, April 12—December 31, 2010

Modified Energy Factor	Configuration	Gross Unit Savings (kWh/year)		
		Reported	Evaluated	Difference
2.0-2.19	Electric DHW & Electric Dryer	130	-	-
	Electric DHW & Gas Dryer	72		
	Gas DHW & Electric Dryer	88		
	Gas DHW & Gas Dryer	30		
	Weighted average	115	434	319
2.2-2.45	Electric DHW & Electric Dryer	173	-	-
	Electric DHW & Gas Dryer	93		
	Gas DHW & Electric Dryer	120		
	Gas DHW & Gas Dryer	40		
	Weighted average	160	376	216
2.46+	Electric DHW & Electric Dryer	195	-	-
	Electric DHW & Gas Dryer	103		
	Gas DHW & Electric Dryer	139		
	Gas DHW & Gas Dryer	47		
	Weighted average	184	304	120

Refrigerators

Deemed savings values for refrigerators were based on the Database for Energy Efficient Resources (DEER). On April 12, 2010, at the time of the tariff change, savings values were updated from DEER 2004 data to DEER 2008, but the efficiency requirement for eligible models did not change.

For 2009 and 2010, Cadmus used the methodology shown in the Regional Technical Forum’s July 2011 analysis³ to estimate gross per-unit energy savings, as shown in Table J5. The July 2011 analysis included the assumption that 32 percent of the baseline units were ENERGY STAR[®]-qualified. This assumption embedded net-to-gross in the savings calculated. Cadmus modified the analysis to assume 0 percent of the baseline units were ENERGY STAR-qualified.

Table J5. Refrigerator Savings, 2009–2010

	Gross Unit Savings (kWh/year)		
	Reported	Evaluated	Difference
2009 – April 11, 2010	58	65.5	7.5
April 11 – December 31, 2010	141	65.5	-75.5

Dishwashers

Deemed savings values for dishwashers were based on data from the Northwest Power and Conservation Council’s Regional Technical Forum (RTF) FY07 analysis. Cadmus based its values on the more recent FY09 version of that analysis, included in the 6PP.

Cadmus used the 6PP values for electricity consumption per cycle of eight configurations of the energy factor (EF) and the water heater fuel. The 6PP used an EF of 65 for the baseline—the efficiency level required for a dishwasher to be eligible for a rebate in California from 2009–2010.

Based on research of available models, Cadmus used a baseline of 65 EF to calculate savings per cycle, and then multiplied savings per cycle for each configuration by 211 cycles/year (the average reported by customers in the survey). The following equation determined adjusted unit savings:

$$\text{adjusted kWh savings/cycle} \times \text{cycles/year} = \text{annual kWh savings}$$

Table J6 compares assumptions used for the deemed and adjusted savings values.

Table J6. Dishwasher Calculations, 2009–2010

Input		Reported Value		Evaluated Value	
Cycles per year		215		211	
Gross Unit Savings (kWh/cycle)	Machine	EF 0.68-0.75	6	EF 0.68-0.71	18
		EF 0.76-0.84	94	EF 0.72-0.82	30
		EF 0.85+	46	EF 0.83+	80
	Hot Water	EF 0.68-0.75	93	EF 0.68-0.71	12
		EF 0.76-0.84	39	EF 0.72-0.82	17
		EF 0.85+	116	EF 0.83+	27

The adjusted values for each of the six configurations of the EF level and for the water heater fuel were then applied to each dishwasher measure. EF level groups used in the deemed savings and the updated values did not match exactly.

³ <http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=122>

Table J7. Dishwasher Savings, 2009–2010

Water Heater Fuel	Energy Factor	Gross Unit Savings (kWh/year)	Energy Factor	Gross Unit Savings (kWh/year)	
		Reported		Evaluated	Difference
Electric	0.68-0.75	99	0.68-0.71	30	-
Electric	0.76-0.84	133	0.72-0.82	47	
Electric	0.85+	163	0.83+	107	
Electric	Weighted average	87	Weighted average	38	-49
Gas	0.68-0.75	6	0.68-0.71	18	-
Gas	0.76-0.84	94	0.72-0.82	30	
Gas	0.85+	46	0.83+	80	
Gas	Weighted average	22	Weighted average	32	10
Any	Weighted average	74	Weighted average	37	-37

Ceiling Fans

For both 2009 and 2010 program years, the HES Program offered ENERGY STAR ceiling fans. Reported ceiling fan saving values were derived from the sum of motor savings (from the ENERGY STAR savings calculator) and lighting savings (from the PTR). The PTR-based CFL savings for the average room type were multiplied by three to calculate the assumed number of bulbs per ceiling fan.

Cadmus used the same motor savings value as the ENERGY STAR calculator, calculating lighting savings via a methodology similar to that used for CFL lamps. The following equation reflects the ceiling fan savings methodology, and Table J8 lists input assumptions:

$$\Delta kWh = (MotorkWh) + (((\Delta Watts) / 1000) * ISR * (HOU * 365) * WHF * Number\ of\ Bulbs)$$

$$\Delta Watts = W_{base} - W_{eff}$$

Where:

$MotorkWh$ = Motor savings per ceiling fixture (kWh)

W_{eff} = Wattage of efficient ENERGY STAR CFL

W_{base} = Wattage of baseline fixture

HOU = Hours of use per day

ISR = In Service Rate or percentage of incented units installed

WHF = Waste Heat Factor for energy to account for HVAC interaction affects (heating and cooling)

365 = Constant (days per year)

1000 = Constant (conversion watts to kilowatts)

$Number\ of\ Bulbs$ = Number of bulbs per fixture

Table J8. Ceiling Fan Input Assumptions

Ceiling Fan Input Variable	Input	Source
MotorKWh	6	ENERGY STAR Calculator*
W_{eff}	20.28	Median ceiling fan lamp wattage based on ENERGY STAR Qualified Product List**
W_{base}	75	Comparable incandescent wattage, based on Cadmus' CFL lamp analysis
HOU	2.47	Cadmus' hours-of-use model and PacifiCorp's HES Residential Survey
ISR	1	Assume all fixtures were installed
WHF	1.00	Based on Cadmus' CFL lamp analysis (assume all fans are indoor)
Number of Bulbs	0.50	Model data; average number of bulbs based on 2009–2010 participant product data

* ENERGY STAR Ceiling Fan Calculator:

http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CF

** ENERGY STAR Qualified Product List (ENERGY STAR Ceiling Fans with Light Kits Product List, August 15, 2011).

The ceiling fan hours-of-use (HOU) were derived from room location assumptions, and the common room was identified as the typical location of ceiling fans. This differed from the CFL HOU analysis, which included all room locations in the calculation of overall daily HOU. Ceiling fan rooms consisted of main living spaces, kitchens, and bedrooms.

PacifiCorp's savings analysis documentation assumed all ceiling fans included a three-bulb lighting fixture; however, the company's 2009–2010 participant data specified only models and brands, and not the number of bulbs. During the two program years, the program only had four participants, and the program paid only four ceiling fan incentives.

Using reported model numbers, Cadmus verified the number of bulbs per fixture by conducting Web searches and referring to ENERGY STAR product lists. As shown in Table J9, of the four ceiling fans sold, one had lighting fixtures attached. Research determined fixtures averaged 0.5 bulbs.

Table J9. Ceiling Fan Lighting Kits

Ceiling Fan	Number of Unique Products	Total Number of Products Sold	Total Number of Lamps
No Light Kit	3	4	0
Light Kit	1	1	2
Model Not Found	0	0	0
Total	4	4	2

Table J10 shows reported and evaluated ceiling fan per-unit savings.

Table J10. Ceiling Fan Per-Unit Savings

Ceiling Fan Measure Unit	Reported	Evaluated
Motor per Unit Savings (kWh)	6	6.0
CFL per Bulb Savings (kWh)	33	49.3
CFL per Fan Savings (kWh)	99	24.6
Total Ceiling Fan Savings (kWh)	105	30.6

The largest per-unit savings variance resulted from the assumed number of bulbs per fixture. PacifiCorp's HES Program allowed ENERGY STAR ceiling fans with and without light fixtures; however, the savings analysis assumed installation of ceiling fans with light fixtures exclusively.

Table J11 shows evaluated savings of 123 kWh for the four ENERGY STAR ceiling fans receiving incentives.

Table J11. Evaluated and Reported Ceiling Fan Savings for 2009–2010

Measure Unit	HES Program Year	Participants	Number of Units	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)
Ceiling Fan	HES 2009–2010	4	4	420	123

ENERGY STAR Fixtures

In both 2009 and 2010 program years, HES offered ENERGY STAR fixtures. For these fixtures, the 2009–2010 reported saving values were based on the PTR. Using the PTR, RTF, and 6PP assumptions, Cadmus calculated total fixture savings, based on the assumption of two bulbs per fixture.

Cadmus' calculation of lighting savings was based on a methodology similar to that used for CFL lamp analysis. Using the ENERGY STAR fixtures calculation and input assumptions, shown in Table J12, the following equation provided savings:

$$\Delta kWh = (\Delta Watts) / 1000 * ISR * (HOU * 365) * WHF * Number\ of\ Bulbs$$

$$\Delta Watts = W_{base} - W_{eff}$$

Where:

W_{eff} = Wattage of efficient ENERGY STAR CFL

W_{base} = Wattage of baseline fixture

HOU = Hours of use per day

ISR = In Service Rate or percentage of incented units installed

WHF = Waste Heat Factor for energy to account for HVAC interaction affects (heating and cooling)

365 = Constant (days per year)

1000 = Constant (conversion watts to kilowatts)

$Number\ of\ Bulbs$ = Number of bulbs per fixture

Table J12. ENERGY STAR Fixture Input Assumptions

Ceiling Fan Input Variable	Input	Source
W_{eff}	18	Median fixture lamp wattage based on ENERGY STAR Qualified Product List*
W_{base}	75	Comparable incandescent wattage based on Cadmus' CFL lamp analysis
HOU	2.02	Cadmus' hours of use model and PacifiCorp's HES Residential Survey
ISR	1	Assume all fixtures were installed
WHF	1.00	Based on Cadmus' CFL lamp analysis
Number of Bulbs	1.19	Model data; average number of bulbs based on 2009–2010 participant product data

*ENERGY STAR Qualified Product List (ENERGY STAR Residential Light Fixtures Product List; August 15, 2011).

Cadmus based its ENERGY STAR fixture HOU on CFL HOU analysis, with all room locations included in determining overall daily HOU. As described in the CFL analysis, Cadmus used an HOU model and data collected from the HES residential survey, which detailed lighting information by room type.

Over two years, the HES Program had 17 participants, and incented 36 ENERGY STAR fixtures. PacifiCorp's 2009–2010 participant data specified the model and brand, but not the number of bulbs per fixture. As HES participant data did not include wattages, the efficient CFL wattage (W_{eff}) was based on the ENERGY STAR fixture product list, with a medium wattage of 18 watts per lamp for each fixture.

To verify the number of bulbs per fixture, Cadmus relied on reported model numbers, and used using Web searches and ENERGY STAR product lists. This resulted in an average 1.19 number of bulbs per fixture.

Table J13 shows reported and evaluated ENERGY STAR fixture per unit savings

Table J13. ENERGY STAR Fixture Per Unit Savings

ENERGY STAR Fixture Measure Unit	Reported	Evaluated
Number of Bulbs per Fixture	2	1.19
Per Bulb Savings (kWh)	46.0	42.1
Total Fixture Savings (kWh)	92.0	49.9

The large variance in numbers of bulbs per fixture directly impacted total fixture savings. As shown in Table J14, the HES Program reported evaluated savings for ENERGY STAR fixtures of 1,765 kWh for 36 products incented.

Table J14. Evaluated and Reported ENERGY STAR Fixture Savings for 2009–2010

Measure Unit	HES Program Year	Participants	Number of Units	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)
ENERGY STAR Fixtures	HES 2009–2010	17	36	3,312	1,795

Engineering Review: Systems

The engineering review used data from the participant phone surveys and secondary data to evaluate gross savings for water heaters, heat pumps, central air conditioners, room air conditioners, evaporative coolers, duct insulation, and HVAC commissioning.

For these measures, the methodology and savings utilized by the RTF were used to determine savings achieved by the program participants. As shown in Table J15, the realization rates ranged from 19 percent to 2,710 percent.

Table J15. Engineering Review Summary Table

Year	Measure	Baseline	Gross Reported Savings (kWh/unit)	Gross Evaluated Savings (kWh/unit)	Realization Rate
2009-10	Water Heaters	Federal Standard	125 - 179	149	
	Heat Pump Water Heaters	Federal Standard	125	903	722%
2009-10	Heat Pump System Conversion	Electric Furnace	4,249	3,840	90%
2009-10	Heat Pump Upgrade	HSPF 7.7	2,179	422	19%
2009-10	Heat Pump Tune-Up	Operating Heat Pump System	266	266	100%
2009-10	CAC Tune-Up	Operating CAC System	27	27	100%
2009-10	Room AC New Purchase	Standard Efficiency Room AC	83	83	100%
2009-10	Duct Sealing	Leaky Ducts, per RTF definition	51	1,382	2,710%

Water Heaters

Water heater deemed savings values for 2009 were based on the DEER Measure IDs D03-939 (Climate Zone 1) and D03-939 (Climate Zone 16). Water heater deemed savings values for 2010 were based on the BPA's PTR.⁴ The actual gross savings estimate used derived from a weighted average of various scenarios analyzed in the PTR. The PTR and the RTF used the WHAM⁵ method for calculating savings at different tank sizes.

Cadmus utilized the same WHAM methodology for determining annual electricity savings. Annual savings were calculated by tank size using the federal standard⁶ for the base-case energy factors. Average savings for water heaters rebated were the gross evaluated per-unit water heater savings.

For the seven heat pump water heaters installed through this program, reported savings were 125 kWh/year. Cadmus calculated savings for these units using the provisional savings developed for the RTF.⁷ Evaluated savings varied for each unit, based on the heating system and

⁴ <http://www.ptr.nwcouncil.org>

⁵ http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/d-2.pdf

⁶ http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/water_heater_fr.pdf

⁷ <http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=176>

fuel reported for the home. The reported gross evaluated per unit heat pump water heater savings was the average of savings for the seven rebated units.

Heat Pumps—System Conversion

Heat system conversion deemed savings were based on simulations performed using Architectural Energy Corporation's Rem-Rate V12.91. The actual reported deemed per unit savings was a weighted average of a simulated results for Arcata, CA, and Mount Shasta, CA, for a forced air furnace with 13 SEER air conditioner to a 8.5 HSPF and 15 SEER air source heat pump.

To determine deemed savings, Cadmus utilized the most recent RTF information available for these measures. RTF savings are now calculated using SEEM modeling⁸ of single-family homes, and the final savings represent weighted averages of multiple models using weights representing the region. Matching the methodology used in the RTF, evaluated gross savings were calculated by weighting the SEEM outputs to produce savings matching the average participant home and climate for this measure.

Heat Pumps—Upgrade

The heat pump upgrade deemed savings were stated to be sourced: "RTF, EStarHPandACUpgradeSFPTCSCrawIFY08v1_2.xls" To determine deemed savings, Cadmus utilized the most recent RTF information available for these measures. RTF savings are now calculated using SEEM modeling⁹ of single-family homes, and final savings represent weighted averages of multiple models using weights representing the region. Matching the methodology used in the RTF, evaluated gross savings were calculated by weighting SEEM outputs to produce savings matching the average participant home and climate for this measure. Application materials for this measure did not state a requirement that the installation include the use of the Performance-Tested Comfort System (PTCS) duct specification as was assumed in the per unit reported savings estimate. Evaluated savings therefore assume that the PTCS was not used and savings only occur due to the increase in equipment efficiency.

Heat Pumps and Central Air Conditioners—Tune-Up

The heat pump and central air conditioner tune-up deemed savings are stated to be sourced: "RTF, PTCSFY07v1_5.xls" Cadmus reviewed the RTF methodology and determined it reasonable for calculation of savings for this measure, and therefore utilized the same deemed savings value for evaluated gross savings.

Room Air Conditioners: New

The 2010 deemed savings for new room air conditioners were determined using the room air conditioner ENERGY STAR calculator.¹⁰ The reported savings were 83 kWh for all rebated units. This savings value was based on the purchase of a unit in Sacramento, CA, with a cooling capacity of 10,000 Btu/h, and an energy-efficiency ratio (EER) of 10.8, instead of a unit with an EER of 9.8.

⁸ <http://www.nwcouncil.org/energy/rtf/meetings/2011/05/SEEM.zip>

⁹ <http://www.nwcouncil.org/energy/rtf/meetings/2011/05/SEEM.zip>

¹⁰ http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls

Cadmus confirmed that Sacramento, CA, was the most reasonable weather file to use for this program. Based on Cadmus' previous experience with the ENERGY STAR calculator, it was determined deemed savings were reasonable for this measure. Therefore, the evaluated gross per unit savings for this measure equaled the deemed gross per unit savings.

Duct Sealing

Duct Sealing deemed savings values for 2009 were based on weighted averages of measures in the DEER.¹¹ The supported file stated savings were calculated based on a 50 percent reduction in losses from 24 percent of air flow to 12 percent of air flow.

Cadmus determined the evaluated deemed savings using the most recent RTF values, based on SEEM modeling runs. The evaluated gross energy savings were a weighted average of RTF provided savings based on HVAC system type and participant location.

Whole-House Energy Modeling

To independently confirm energy savings resulting from ductless split heat pump measures, Cadmus developed two building simulations.

Reported Gross Savings

Two incentives levels applied to ductless heat pumps, covering two different installations scenarios. In the first, single-head ductless heat pumps consist of one outdoor unit and one indoor unit that can heat and cool a single room or zone. In the second, multi-head ductless heat pumps consist of one outdoor unit and more than one indoor unit. These systems heat or cool more than one zone.

The program required ductless heat pump replace an existing electric heating system, and have an efficiency rating of at least 16 SEER and 9 HSPF. Table J16 shows gross deemed savings per measure.

Table J16. Ductless Heat Pump Reported Deemed Savings

Measure	Reported Savings (kWh/year)
Single-head ductless heat pump	4,348
Multi-head ductless heat pump	6,000

Deemed savings shown have been based on simulations performed using Architectural Energy Corporation's Rem-Rate V12.91. For the single-head ductless heat pump measure, a moderately well-insulated, 1,000 square foot home was modeled. For multi-head heat pump modeling, a well-insulated, 2,000 square foot home was modeled. Final savings results were weighted by location 69 percent to Arcata, CA and 31 percent to Mt Shasta, CA, to determine deemed savings for each measure. Arcata, CA, is in California climate zone 1; Mt. Shasta is in climate zone 16.

¹¹ <http://www.ptr.nwcouncil.org>

Gross Savings Realized

To evaluate both measures, Cadmus used the most recent version of the same residential energy simulation models—Architectural Energy Corporation’s Rem-Rate V12.96—to estimate realized savings. (RESNET[®] accredits Rem-Rate for modeling residential homes.)

The implementer provided exact models used for the original estimate, and Cadmus updated the models based on participation data provided by the implementer for the two measures. Home size, building vintage and the locations of the participant homes were the key inputs updated.

The average participating home in the single-head heat pump measure was 1,770 square feet and built in 1973. Every participating home was located in climate zone 1. The building envelope or building insulation levels used in the original model were determined to be representative for a 1970s vintage home, and were therefore unchanged.

With an average home this large, it would be incorrect to assume a single-head ductless heat pump could sufficiently condition the entire home, as assumed in the original 1,000 square foot model. More likely, the single-head heat pump would be installed in a large central room of the home, such as the living room or open floor plan kitchen. The heat pump would therefore only heat this room, plus some surrounding space, depending home geometry and heating set points. The modeling therefore assumed 30 percent of a 1,770 square foot home, or 531 square feet, would be conditioned by the single-head ductless heat pump. The rest of the home was modeled as conditioned by the original electric resistance heat. Finally, as all participating homes resided in climate zone 1, no weighting was applied to account for climate location. Results of these updates reduced confirmed unit savings to 923 kWh per year.

For multi-head heat pumps, the average participating home was 1,950 square feet and built in 1969. All but one of the participating homes resided in climate zone 1.

For this measure, the same insulation and construction characteristics were used as with single-head ductless heat pump model. Savings were first estimated assuming the new system conditioned all 1,950 square feet as multiple heads would be installed throughout the house. Resulting savings were compared to evaluated savings for a standard air source heat pump conversion, also conditioning the entire home.

Due to duct losses in the conversion measure, and, if all else remaining equal, a multi-head ductless heat pump should have lower savings than a traditional heat pump conversion. Based on this comparison and Cadmus’ confidence in the evaluated savings for a conversion measure, a multi head ductless heat pump was assumed to not condition the entire home, but 70 percent of it (equal to 1,365 square feet in this model). This was determined a reasonable assumption, as participating homes already had existing heating systems, which, realistically, would still be used for heating areas not serviced by the multi-head ductless system. This resulted in confirmed savings of 3,935kWh per year.

Table J17. Evaluated Gross Savings, Ductless Split Heat Pumps

Measure	Reported Savings (kWh/year)	Evaluated Gross Savings (kWh/year)	Realization Rate
Single-head ductless heat pump	4,348	923	21%
Multi-head ductless heat pump	6,000	3,935	66%

Appendix K. Waste Heat Factor

The waste heat factor (WHF) is an adjustment representing the interactive effects of lighting measures on heating and cooling equipment operation. Cadmus did not apply the WHF adjustment to lighting savings estimates, as Pacific Power did not include it in its initial planning estimates. However, Cadmus recommends using the following approach for future planning estimates and evaluations.

Cadmus calculated HES's WHF using ASHRAE data on heating and cooling degree days (HDD and CDD, respectively) in Pacific Power's service territory. In addition, Cadmus used 2006 Energy Decisions Survey data¹ to determine the saturation of heating and cooling equipment types in California.

To determine the portion of the year heating or cooling equipment operates, and, therefore, when lighting would affect heating or cooling energy, Cadmus used the Northwest Power and Conservation Council's workbook to estimate interactions for ENERGY STAR lighting savings in the 6th Regional Power Plan.² This calculator estimates heating and cooling interaction, based on building simulation models, for a variety of HVAC equipment and cities around the region. Cadmus estimated savings for Medford, Oregon, as representative for the California territory, by using a weighted average of HDD and CDD from cities across the region to most closely match Medford. This calculator determined heating and cooling interactions for zonal heating and heat pumps. To estimate interaction for electric forced air furnaces, a heating system efficiency of 75 percent (to account for duct losses) was included. The cooling interaction from heat pumps was used for all electric cooling systems. The table below provides these interactions:

Table K1. Interactions

HVAC System	% Space Heat Interaction	% Space Cool Interaction
Zonal	52%	NA
Electric Furnace	39%	NA
Heat Pump	33%	7.5%

The heating interaction was calculated as follows:

$$\text{Heating Interaction} = - \sum (\%SpHtInteraction * Market Share)_i = -16\%$$

Where the summation is over the three electric heating types. In addition,

$$\text{Cooling Interaction} = \%SpCoolInteraction * Electric Cooling MarketShare = 2.8\%$$

$$\begin{aligned} \text{Total electric WHF} &= 1 + \text{Heating Interaction} + \text{Cooling Interaction} \\ &= 1 - 16\% + 2.8\% = 87.1\% \end{aligned}$$

¹http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_VolumeI_2011_Study.pdf

² http://www.nwcouncil.org/energy/powerplan/6/supplycurves/res/EStarLighting_NewFY09v1_0.xls

The combined -12.9 percent adjustment was applied to electricity savings for all interior lighting measures to account for a net increase in electric heating and cooling load due to more efficient lighting. Weighting for the interior/exterior distribution found in participant surveys, Cadmus found the final WHF to be 83.19 percent (as shown below).

Interior Total Electric WHF

$$\begin{aligned} &= 1 + (\text{Heating Interaction} + \text{Cooling Interaction}) * \% \text{ Interior Lighting} \\ &= 1 + (-16\% + 2.8\%) * 94.7\% = 87.8\% \end{aligned}$$