



# 2015–2016 Report: California Home Energy Savings Program Evaluation

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## Glossary of Terms

**ANCOVA**

Analysis of Covariance

**APS**

Advanced Power Strips

**CDD**

Cooling Degree Days

**CSA**

Conditional Savings Analysis

**CV**

Coefficient of Variation

**DEER**

The Database for Energy Efficient Resources is developed by the California Public Utilities Commission and contains information on selected energy-efficient technologies and measures offered through ratepayer-funded energy efficiency programs.

**DLC**

Design Lights Consortium

**Downstream**

Programs offering rebates on targeted products after purchase. When the buyer applies for the rebate, the program verifies that the intended use meets program requirements, sometimes even including verification that the buyer has a gas or electric account with a sponsoring utility.

**DSM**

Demand-Side Management

**DSMC**

Demand-Side Management Central

**eFAF**

Electric Forced Air Furnaces

**EISA**

Energy Independence and Security Act of 2007



### **Evaluated Savings**

Evaluated savings represent the total program savings, 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:

$$Evaluated\ Savings_i = Verified\ Installations_i * Unit\ Consumption_i$$

### **HDD**

Heating Degree Days

### **HES**

Home Energy Savings

### **HOU**

Hours of Use

### **In-Service Rate**

Also called the installation rate, the ISR is the proportion of incented measures actually installed. For lighting, the average measure life of a light bulb takes burn-outs into account. A light bulb that is installed but later removed as a result of a burn-out is counted as in-service.

### **KWYS**

Key What You See

### **MHDS**

Manufactured Homes Duct Sealing

### **Midstream**

Programs implemented as agreements between the program and a range of intermediaries, including distributors, retailers, and contractors. As noted, midstream intermediaries must apply a defined rebate amount to the measure’s retail price.

### **NEEA**

Northwest Energy Efficiency Alliance

### **NTG**

Net-to-Gross

### **PCT**

Participant Cost Test

### **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 that, with 90% confidence, the finding resulted from the intervention.

**Realization Rate**

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

**Regional Technical Forum**

The RTF is an advisory committee to the Northwest Power and Conservation Council, established in 1999 to develop standards to verify and evaluate energy efficiency savings.

**Reported Savings**

Savings that Pacific Power presented in its annual report for conservation acquisition.

**RIM**

Ratepayer Impact Measure

**RSAT**

Retail Sales Allocation Tool

**SEEM**

Simplified Energy Enthalpy Model

**SKU**

Stock Keeping Unit

**SPIF**

Sales Performance Incentive Funds

**TRC**

Total Resource Cost

**TRM**

Technical Reference Manual

**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 there is a 90% probability that the estimated coefficient is different from zero.

**Trade Ally**

Trade allies include retailers and contractors that supply and install discounted light bulbs and fixtures, appliances, HVAC, or insulation through the program.

**UCT**

Utility Cost Test

**UES**

Unit Energy Savings



**UMP**

Uniform Methods Project

**Upstream**

Programs implemented as agreements between the product manufacturer, distributors or retailers, and the program. The distributor or retailer must pass the entire product discount to buyers, resulting in target products offered at below-market prices.

## Executive Summary

Pacific Power first offered the Home Energy Savings (HES) Program in California in 2008. The program provides residential customers with incentives to facilitate their purchases of energy-efficient products and services through upstream (manufacturer), midstream (retailer), and downstream (customer) incentive mechanisms.

During the 2015 and 2016 program years, Pacific Power's HES program reported gross electricity savings of 4,680,306 kWh. The HES program contributed 40% of California's total **wattsmart** portfolio site energy savings in 2015 and 2016.<sup>1,2</sup>

The HES program provided incentives for the following measure categories during the 2015-2016 period, however not all measures were offered in both years:

- **Appliances:** efficient clothes washers and refrigerators
- **Building Shell:** attic and wall insulation
- **HVAC:** efficient heating and cooling equipment, including evaporative coolers, heat pumps, ductless heat pumps, room air conditioners, and duct leakage testing and sealing services
- **Water Heating:** high-efficiency electric and heat pump water heaters
- **Whole Home:** whole-home performance path efficiency improvements for new homes
- **Lighting:** CFL and LED bulbs and lighting fixtures
- **Electronics:** advanced power strips (APS)<sup>3</sup> (during 2015 only)
- **wattsmart Starter Kits:** low-cost (or, for some configurations, no-cost) mailed kits, containing various combinations and quantities of CFLs, LEDs, bathroom and kitchen faucet aerators, and high-efficiency showerheads

Pacific Power contracted with Cadmus to conduct impact and process evaluations of the California HES program for program years 2015 and 2016. The program was last evaluated for the 2009 - 2010 program years. For the impact evaluation, Cadmus assessed energy impacts and program cost-effectiveness. For

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<sup>1</sup> Residential portfolio and total portfolio savings (at the customer site) sourced from the 2015 and 2016 Pacific Power California annual reports.

<sup>2</sup> In 2015, Pacific Power reported the appliance recycling ("See ya later, refrigerator") program as part of the HES program in California. Cadmus did not evaluate this part of the HES program. Reported 2015 HES program savings in this report exclude appliance recycling and will thus not match Pacific Power's 2015 annual report. Pacific Power discontinued the appliance recycling program in 2016.

<sup>3</sup> Pacific Power offered APS incentives to customers through upstream, mail by request, direct install, and downstream channels.



the process evaluation, Cadmus assessed program delivery and efficacy, bottlenecks, barriers, best practices, and opportunities for improvements. This document presents the results of these evaluations.

## Key Findings

Cadmus' impact evaluation addressed 99% of the HES program savings by collecting primary data on the top savings measures, performing billing analyses for insulation and duct sealing measures, and completing engineering reviews for the remaining measures. For lighting and **wattsmart** starter kits, Cadmus conducted engineering reviews using commonly accepted engineering algorithms (with primary or secondary data inputs as noted in this report). For electronics, HVAC, and water heating measures, Cadmus reviewed the Database for Energy Efficient Resources (DEER) and since specific measure offerings or efficiencies were not available, Cadmus referred to the Regional Technical Forum's (RTF) library of measure workbooks.

## Key Impact Evaluation Findings

Key evaluation findings include the following (summarized in Table 1):

- **Appliances:** Overall, Cadmus assigned a 100% pass-through gross realization rate of reported savings for the appliance measure category. Due to the low savings contributed to the program, Cadmus did not perform a detailed engineering review of measures in this category. Appliance measures had a 66% savings-weighted net-to-gross (NTG) ratio.
- **Building Shell:** Overall, Cadmus estimated a 78% net realization rate for the building shell measure category,<sup>4</sup> which consisted of attic and wall insulation. Cadmus evaluated the insulation measures using a billing analysis that produced a net realization rate, and therefore did not apply a net adjustment to those measures, resulting in the 100% NTG ratio for the entire measure category.
- **Electronics:** The electronics category achieved a 100% realization rate. Cadmus agreed with the RTF assumptions used by the program to calculate APS reported savings. Electronics measures had an 85% NTG. This measure was only offered in 2015.
- **HVAC:** Overall, the HVAC measure category realized 78% of reported gross savings. Evaluated gross savings realization rates ranged from 52% (duct sealing in manufactured homes) to 143% (heat pump conversion). HVAC measures had an 83% savings-weighted NTG.
- **wattsmart Starter Kits:** Cadmus evaluated kit measures (e.g., lighting and water saving devices) separately, but, when combined at the kit level, these measures realized 109% of reported savings. Installation rates varied from 60% for kitchen faucet aerators to 90% for LEDs. Kits had a 91% savings-weighted NTG.
- **Lighting:** The HES lighting component realized 92% of reported savings and had a 57% weighted NTG, which was driven largely by relatively low price elasticities. Membership club stores

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<sup>4</sup> Billing analysis for insulation consisted of comparing a participant group to a nonparticipant group, which produced net realization rates.

typically account for a large share of sales in upstream lighting programs across the country and have greater-than-average price elasticities. There are no participating club store retailers in Pacific Power’s California service territory and therefore price elasticities were lower than typically observed.

- **Water Heating:** The water heating category achieved an 85% realization rate. Heat pump water heaters produced realization rates ranging from 81% to 119%, based on Cadmus’ detailed engineering reviews, which accounted for the size and location of installed water heaters. The study did not evaluate electric water heaters due to low participation rates. Water heating measures had a 79% savings-weighted NTG.
- **Whole Home:** The whole home component realized 100% of savings, with 10 claimed and verified participants in the new construction performance program. Cadmus reviewed and agreed with the program modeling and saving estimates, and applied a 100% NTG ratio to these measures.

**Table 1. 2015 and 2016 HES Program Savings<sup>1,2</sup>**

Measure Category	Reported Units <sup>3,4</sup>	Evaluated Units <sup>3,4</sup>	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Precision (at 90% Conf)	Evaluated Net Savings (kWh)	NTG
Appliances	72	72	9,591	9,591	100%	N/A	6,330	66%
Building Shell	74,259	74,259	72,805	56,654	78%	± 98.5%	56,654	100%
Electronics	1,177	1,177	35,310	35,310	100%	N/A	30,014	85%
HVAC	555	555	1,335,588	1,044,437	78%	± 5.1%	864,381	83%
Energy Kits	2,531	2,531	918,900	998,737	109%	± 8.7%	908,850	91%
Lighting	137,521	137,521	2,262,116	2,079,590	92%	± 5.4%	1,184,816	57%
Water Heating	18	18	24,063	20,462	85%	± 6.1%	16,104	79%
Whole Home	10	10	21,934	21,934	100%	N/A	21,934	100%
<b>Total</b>	<b>216,143</b>	<b>216,143</b>	<b>4,680,306</b>	<b>4,266,715</b>	<b>91%</b>	<b>± 3.9%</b>	<b>3,089,084</b>	<b>72%</b>

<sup>1</sup>Totals in tables may not add exactly due to rounding.

<sup>2</sup>Reported 2015 HES program savings exclude appliance recycling and as such the 2015-2016 total does not match Pacific Power’s annual report total.

<sup>3</sup>Cadmus counted each square foot of incented insulation or windows as one unit for the Building Shell category.

<sup>4</sup>Cadmus counted each home that participated in the whole home measure category as one unit.

Table 2 and Table 3 show impact evaluation findings by program year. Overall realization rates exhibited small changes associated with changes in participation and savings.



**Table 2. 2015 HES Program Savings<sup>1,2</sup>**

Measure Category	Reported Units <sup>3</sup>	Evaluated Units <sup>3</sup>	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Evaluated Net Savings (kWh)	NTG
Appliances	36	36	4,728	4,728	100%	3,120	66%
Building Shell	51,893	51,893	40,175	31,263	78%	31,263	100%
Home Electronics	1,177	1,177	35,310	35,310	100%	30,014	85%
HVAC	271	271	689,696	543,726	79%	448,510	82%
Energy Kits	1,844	1,844	675,669	733,644	109%	667,616	91%
Lighting	99,902	99,902	1,607,384	1,423,938	89%	836,309	59%
Water Heating	7	7	4,966	4,644	94%	3,608	78%
<b>Total<sup>4</sup></b>	<b>155,130</b>	<b>155,130</b>	<b>3,057,928</b>	<b>2,777,253</b>	<b>91%</b>	<b>2,020,440</b>	<b>73%</b>

<sup>1</sup>Totals in tables may not add exactly due to rounding.

<sup>2</sup>Reported 2015 HES program savings exclude appliance recycling and as such the total 2015 reported saving does not match Pacific Power's 2015 annual report.

<sup>3</sup>Cadmus counted each square foot of incented insulation or windows as one unit for the Building Shell category.

<sup>4</sup>Pacific Power did not offer whole home measure category in 2015.

**Table 3. 2016 HES Program Savings<sup>1</sup>**

Measure Category	Reported Units <sup>2,3</sup>	Evaluated Units <sup>2,3</sup>	Reported Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Gross Realization Rate	Evaluated Net Savings (kWh)	NTG
Appliances	36	36	4,863	4,863	100%	3,210	66%
Building Shell	22,366	22,366	32,630	25,392	78%	25,392	100%
HVAC	284	284	645,892	500,711	78%	415,871	83%
Energy Kits	687	687	243,231	265,092	109%	241,234	91%
Lighting	37,619	37,619	654,732	655,652	100%	348,507	53%
Water Heating	11	11	19,097	15,818	83%	12,496	79%
Whole Home	10	10	21,934	21,934	100%	21,934	100%
<b>Total<sup>4</sup></b>	<b>61,013</b>	<b>61,013</b>	<b>1,622,378</b>	<b>1,489,462</b>	<b>92%</b>	<b>1,068,644</b>	<b>72%</b>

<sup>1</sup>Totals in tables may not add exactly due to rounding.

<sup>2</sup>Cadmus counted each square foot of incented insulation or windows as one unit for the Building Shell category.

<sup>3</sup>Cadmus counted each home that participated in the whole home measure category as one unit.

<sup>4</sup> Pacific Power did not offer home electronics incentives in 2016.

## Key Process Evaluation Findings

Key process evaluation findings include the following:

- Retailers (23%) and word-of-mouth (21%) constituted the most commonly cited sources of program awareness for non-lighting participants, while the Pacific Power general population of customers most commonly reported learning about the **wattsmart** offerings through bill inserts (51%) and Pacific Power's website (9%). Manufactured homes participants (60%) and Starter Kits participants (46%) also reported learning about the program through bill inserts.
- Pacific Power customers largely remain unfamiliar with APS, with 79% not having heard of this technology. Of eight general population survey respondents purchasing APS, six reported being very satisfied with their purchases.
- General population survey respondents expressed satisfaction with LEDs and APS purchased. Energy and cost savings remained the most commonly cited reason motivation for purchasing LEDs, with cost cited most commonly for not purchasing LEDs. It appears, however, that customers' habits served as another common reason for not purchasing LEDs: they simply did not think about making such purchases.
- Most general population customers used a wood stove, electric baseboard heating system, or Monitor or Toyotomi direct-vent fuel oil heaters, with an average reported age of all heating systems reported as 14.71 years. Though most general population customers reported they did not use cooling, those using cooling reported employing central air conditioning and/or room air conditioners. All cooling systems reported an average age of 10.2 years.
- Non-lighting participants expressed overwhelming satisfaction levels (99%) with the program overall. In addition, non-lighting customers expressed high satisfaction levels with measures they installed and their contractors, and only somewhat less satisfaction with incentive amounts they received.
- Manufactured Home duct-sealing participants reported high satisfaction levels with the professionalism and attitude of contractors performing the measure, and with the application process.
- Manufacturers, distributors, and retailers expressed high satisfaction levels with the lighting program, suggesting only that Pacific Power increase in-store events to help customers better understand the difference between LEDs and other lighting, and to work to increase customers' awareness of the program.
- Manufacturers, distributors, and retailers anticipate rapid, frequent, technology driven changes to LED lighting over the next few years, along with widespread adoption of California lighting standards.

## Benchmarking

- For the upstream lighting program, Pacific Power exhibited a lower evaluated savings per unit value (for both CFLs and LEDs) than evaluated net savings reported by some utilities outside of the region. This partly results from the evaluators basing CFL wattage baseline, ISR, and HOU



parameters on a recent California 2015 impact evaluation<sup>5</sup> which reflects the market baseline. State legislation in California prohibited the sale of general service incandescent lamps in 2012 (one year earlier than the rest of the country), which has resulted in greater market penetration of LEDs independent from direct intervention by the regional utilities.

- Similar to other utilities, Pacific Power offers lighting measures through an upstream and/or midstream channel and many non-lighting measures through downstream channels (post-purchase rebates). Other utilities, however, increasingly use midstream channels (i.e., instant rebates available from contractors and retailers) as a strategy to encourage adoption of new technologies, such as heat pump water heaters.
- The most effective new construction programs offer greater incentives for homes built to operate at substantially higher efficiency levels than codes or ENERGY STAR minimum requirements. Although Pacific Power does not offer a standalone new construction program in California, it addresses the new construction market through its downstream incentives, including a whole-home, performance-based incentive.

### Cost-Effectiveness Results

As shown in Table 4, the HES program proved cost-effective across the 2015–2016 evaluation period from all test perspectives, except the Ratepayer Impact Measure (RIM) test. From the Total Resource Cost (TRC) perspective, the program achieved an average benefit-cost ratio of 2.0 for the two years examined.

**Table 4. 2015–2016 Evaluated Net HES Program Cost-Effectiveness Summary**

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost (TRC)	\$0.0945	\$2,312,062	\$4,626,180	\$2,314,118	2.00
Utility Cost Test (UCT)	\$0.0626	\$1,532,635	\$4,626,180	\$3,093,545	3.02
Ratepayer Impact Measure (RIM) Test	\$0.2154	\$5,271,107	\$4,626,180	(\$644,927)	0.88

The RIM test measures program impacts on customer rates. Most energy efficiency programs do not pass the RIM test because, although energy efficiency programs reduce energy delivery costs, they also reduce energy sales. Thus, the average rate per unit of energy may increase. A RIM benefit-cost ratio greater than 1.0 indicates that the program produces reduced rates and costs. Typically, this happens only for demand response programs or programs targeting the highest marginal cost hours (when marginal costs are greater than rates).

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<sup>5</sup> California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

## Summary and Recommendations

Drawing upon the impact and process evaluation interviews, surveys, and other analyses, Cadmus presents the following conclusions and recommendations:

- **wattsmart Kit Participant Phone Numbers:** As the *wattsmart* kit measure administrator did not collect kit participant phone numbers or e-mail addresses, Pacific Power filled in available data using its own customer database. While a small detail in operating the program efficiently, this created additional strain on evaluation efforts and on Pacific Power to update program administrator data with kit participant phone numbers.  
*Recommendation:* Require that the *wattsmart* kit program administrators collect kit participant phone numbers and e-mail addresses for kit program survey data collection activities.
- **Upstream Lighting Point-of-Sale Merchandizing Data:** Program tracking data did not include information about high-visibility product placements or merchandizing within retail locations. Though decreasing the price of efficient lighting products primarily drives sales, merchandizing also can generate substantial sales lift. Without these data, Cadmus cannot attribute merchandizing's effect on the program.  
*Recommendation:* Track dates and locations for the program's merchandizing and product placements. Providing model numbers, store locations, dates, and display types (e.g., end caps, pallet displays) allows more precise estimates of program-generated sales lift.
- **Customer Motivation:** Some customers continue to avoid LEDs as they believe the bulbs remain cost-prohibitive, or they generally do not think about their lighting purchases, selecting bulbs that are familiar, on sale, or conveniently located on the store shelf. Additionally, manufacturers, distributors, and retailers described the need for more customer education about LEDs, addressing their benefits over other bulb or fixture types, and instructing how to select and install the best LEDs for applications. As LEDs become more specialized and efficient, and as less efficient bulbs drop from the market, Pacific Power has an opportunity to increase customer acceptance of LEDs through more aggressive education.  
*Recommendation:* Expand marketing and outreach efforts, through bill inserts, websites, and media, focusing on benefits, cost savings, and appropriate applications for LEDs, and through driving customers to in-store events presented by Pacific Power. Partner with participating retailers to schedule regular in-store events that demonstrate LEDs' applications and proper installation, and, through such events, increase word-of-mouth marketing between neighbors, friends, and colleagues.



## Introduction

### *Program Description*

During the 2015 and 2016 program years, Pacific Power contracted with CLEAResult to administer the Home Energy Savings (HES) Program and to provide prescriptive incentives to residential customers who purchased qualifying high-efficiency appliances, HVAC, water heating, whole home, and building shell measures.<sup>6</sup> The HES program included an upstream lighting component, providing high-efficiency lighting options by offering incentives for eligible CFLs and LED lamps and for CFL or LED fixtures at the retail level. The program also continued to offer low- and no-cost **wattsmart** Starter Kits. In 2015, Pacific Power offered customers incentives to purchase and install advanced power strips (APS).

The HES program offered the following measures for part or all of the 2015–2016 evaluation period:

- Appliances:
  - Clothes washer
  - Refrigerator
- Building Shell:
  - Insulation (attic, wall)
- Home Electronics: APS (2015 only)
- HVAC:
  - Ductless heat pump
  - Evaporative cooler
  - Duct sealing manufactured home
  - Air source heat pump conversion
  - Air source heat pump upgrade
  - Room air conditioner
- Lighting:
  - CFLs
  - LEDs
  - Efficient light fixtures
- Water Heating:
  - Electric water heater (2015 only)
  - Heat pump water heater

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<sup>6</sup> CLEAResult's contract for HES administration expired at the end of 2015. PacifiCorp rebid the administration contract, and, in March 2016, issued a new three-year contract to CLEAResult.

- **wattsmart** Starter Kits (e.g., CFLs, LEDs, aerators, high-efficiency showerheads)<sup>7</sup>
- Whole Homes: whole-home performance improvement

## Program Participation

During the 2015–2016 HES program years, Pacific Power provided the following:

- Prescriptive incentives to more than 600 residential customers
- **wattsmart** Starter Kits to more than 2,500 residential customers
- Upstream discounts for more than 130,000 products<sup>8</sup>

Table 5 shows participation and savings by measure category and measure for this period.

**Table 5. HES Reported Quantity and Savings by Measure, 2015–2016**

Measure Category	Measure Name	Reported Quantity	Quantity Type	Reported kWh Savings
Appliances	Energy Efficient Clothes Washer	69	Units	9,240
	Energy Efficient Refrigerator	3	Units	351
Building Shell	Insulation-Attic	36,187	Square Feet	13,735
	Insulation-Attic - Multifamily Homes	28,060	Square Feet	19,923
	Insulation-Wall	10,012	Square Feet	39,147
Home Electronics	Advanced Power Strip	1,177	Units	35,310
HVAC	Duct Leakage Test - Manufactured Homes	23	Measures	0
	Duct Sealing - Manufactured Homes	192	Measures	307,257
	Duct Sealing w/Crossover - Manufactured Homes	30	Measures	53,436
	Ductless Heat Pump - New Home	1	Units	1,717
	Electric System to Heat Pump Conversion - Tier 1	12	Units	49,848
	Electric System to Heat Pump Conversion - Tier 2	6	Units	26,622
	Energy Efficient Room Air Conditioner	37	Units	2,126
	Evaporative Cooler - Tier 2	5	Units	1,215

<sup>7</sup> Starting on January 1, 2016, Pacific Power stopped offering CFL kits in California. Any CFL measures incented in 2016 were carryover from the prior year.

<sup>8</sup> Detailed counts of participants are provided in Table 8 under Sample Design and Data Collection Methods

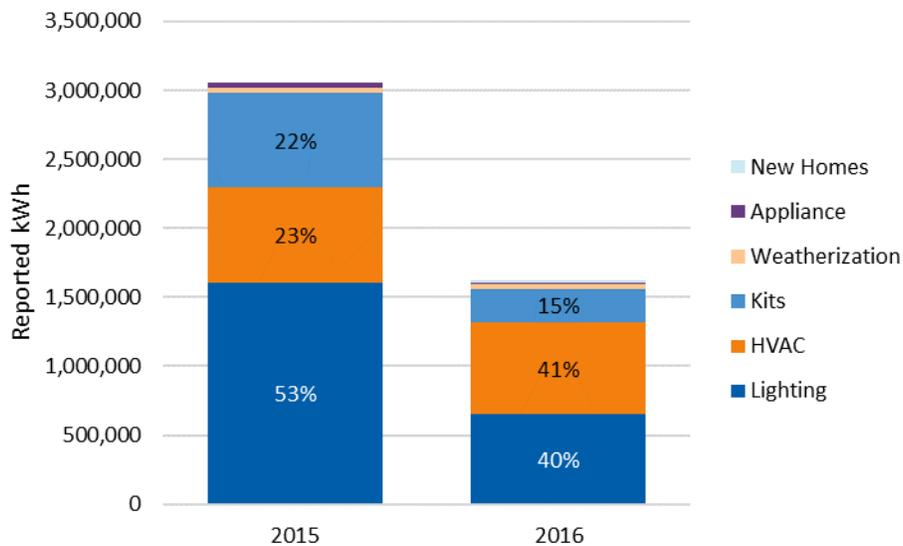


Measure Category	Measure Name	Reported Quantity	Quantity Type	Reported kWh Savings
	Heat Pump to Heat Pump Upgrade - Tier 1	14	Units	3,724
	Heat Pump to Heat Pump Upgrade - Tier 2	1	Units	368
	Heat Pump, Ductless - New Homes	7	Units	12,019
	Heat Pump, Multi-Head, Ductless	68	Units	320,756
	Heat Pump, Single-Head, Ductless	159	Units	556,500
Kits	Basic Kit	1,909	Kits	764,696
	Best Kit	268	Kits	118,386
	Better Kit	45	Kits	17,592
	CFL Kit	279	Kits	15,823
	LED Kit	30	Kits	2,404
Lighting	Light Bulbs - CFL	85,066	Bulbs	1,247,667
	Light Bulbs - LED	47,110	Bulbs	933,953
	Light Fixtures - CFL	125	Fixtures	1,883
	Light Fixtures - LED	5,220	Fixtures	78,613
Water Heating	Electric Water Heater	3	Units	468
	Heat Pump Water Heater	15	Units	23,595
Whole Home	Whole Home Performance Path - New Homes	10	Units	21,934
<b>Total</b>				<b>4,680,306</b>

Source: Pacific Power 2015 and 2016 annual reports and 2015–2016 kits, lighting, and non-lighting databases, provided by the program administrator.

Historically, the majority of HES program savings derived from lighting savings. In 2016, however, lighting savings exhibited significantly lower savings (almost 1,000,000 kWh) than in 2015, contributing only 40% of HES program savings. As shown in Figure 1, HVAC savings were nearly the same in 2015 as in 2016, but these became the largest single contributor to HES program savings in 2016 (at 41% of savings) due to reductions in kit and lighting savings from 2015 to 2016.

Figure 1. Reported Gross kWh Savings by Measure Category from 2015–2016<sup>1</sup>



<sup>1</sup>Percentages may not add to 100% due to rounding.

### ***Data Collection and Evaluation Activities***

For the impact evaluation, Cadmus assessed energy impacts and program cost-effectiveness. For the process evaluation, Cadmus assessed program design and process effectiveness, participant satisfaction, bottlenecks, barriers, marketing effectiveness, and opportunities for improvements. Cadmus also benchmarked select HES program aspects against other similar utility programs. Table 6 summarizes evaluation activities that supported the impact and process evaluations. Appendix A provides survey and data collection instruments used.



**Table 6. Summary of Evaluation Approach**

Activities	Impact		Process
	Gross Savings	Net Savings	
Program Staff and Program Administrator Interviews			X
Participant Rebate Surveys (Non-Lighting)	X	X	X
Participant Kit Surveys	X	X	X
Participant HVAC Manufactured Homes Duct Sealing Survey			X
General Population Surveys (Upstream Lighting/APS)	X	X <sup>1</sup>	X
Upstream Lighting Manufacturer/Distributor/Retailer Interviews			X
Building Shell and Duct Sealing Billing Analysis		X	
Engineering Reviews	X		
Demand Elasticity Modeling		X	
Logic Model Review			X
Benchmarking Review			X

<sup>1</sup>This activity provided an estimate of nonparticipant spillover savings applied to program savings.

### Sample Design and Data Collection Methods

For each measure category, Cadmus developed a representative sample of each surveyed population, designed to achieve  $\pm 10\%$  precision with 90% statistical confidence. Cadmus assumed a coefficient of variation (CV)<sup>9</sup> equal to 0.5 for computing initial sample sizes. For a small surveyed population, Cadmus applied a finite population adjustment factor, which effectively reduced the necessary sample size while maintaining the target precision of  $\pm 10\%$  with 90% statistical confidence.

Table 7 shows the final sample disposition for various data collection activities. For nearly all data collection (except administrator and management staff interviews), Cadmus drew samples using simple or stratified random sampling.<sup>10</sup>

<sup>9</sup> The CV equals the ratio of standard deviation (a measure of the dispersion of data points in a data series) to the series mean.

<sup>10</sup> Simple random samples were drawn from an entire population, whereas stratified random samples were drawn randomly from subpopulations (strata), and then weighted to extrapolate to the population.

**Table 7. Sample Disposition for Various HES Program Data Collection Activities in California**

Data Collection Activity	Population	Sampling Frame	Target Completes	Achieved Completes
Program Staff Interview	N/A	N/A	1	1
Program Administrator Interviews	N/A	N/A	1	1
Non-Lighting Participant Surveys <sup>1</sup>	367	356	240	119 <sup>2,3</sup>
Kit Participant Survey <sup>1</sup>	2,531	2,436	140	121 <sup>4</sup>
HVAC Manufactured Homes Duct Sealing Participant Survey <sup>5</sup>	222	214	15	15
General Population Surveys	33,513	31,046	250	250
Upstream/Midstream Lighting Retailer and Manufacturer Interviews	26	26	19	14

<sup>1</sup>Non-lighting and kit participant populations represent all unique participants by account number according to program tracking data from the administrator. Non-lighting participant population excludes Manufactured Home participants, which are listed separately in this table.

<sup>2</sup>Cadmus developed the number of targeted completes prior to receiving program participation data. Because of the small population of appliance, HVAC and building shell participants, Cadmus could not attain the target number of completed surveys. All efforts were made to attain the target without placing undue burden on customers; up to five attempts were made to reach each participant.

<sup>3</sup>Total includes five partially completed surveys that yielded sufficient information.

<sup>4</sup>Cadmus stratified the sample frame of kit participants into those that received kits containing CFLs and those that received kits containing LEDs. Cadmus conducted two rounds of kit participant surveys in 2015 and 2016. Because of the small population of LED kit participants in 2016, Cadmus could not attain the target number of completed surveys in that year. All efforts were made to attain the target without placing undue burden on customers; up to five attempts were made to reach each participant.

<sup>5</sup>The Manufactured Homes Duct Sealing (MHDS) participant number represents all unique MHDS participants by account number. Though the MHDS population is a subset of the Non-Lighting Participant Population, the sampling frames were separate, and duplicate account numbers from the Non-Lighting Participant sample frame were removed from the MHDS sample frame.

### ***Non-Lighting Participant Telephone Surveys***

Cadmus surveyed 119 non-lighting participants, gathering measure-level and measure-category level information on installations, freeridership, spillover, program awareness and satisfaction, and demographics. In developing the targets by measure category, Cadmus used the measure mix from the 2015–2016 non-lighting database and randomly selected participants and measures within each measure category for the survey.

Cadmus also surveyed 15 manufactured homes’ duct-sealing participants (a subset of the HVAC category participants) for the manufactured homes duct-sealing survey. This survey covered all topic areas addressed in the non-lighting participant survey, though particularly tailored towards gathering insights into the midstream measure delivery process.



Table 8 provides the population of non-lighting participants, targets, and the number of surveys achieved. Due to the small population of appliance participants, Cadmus could not attain the target number of completed surveys. All efforts were made to attain the target without placing undue burden on customers, with up to five attempts made to reach each participant.

**Table 8. Non-Lighting Participant Survey Sample**

Measure Category	Population	Sampling Frame	Targeted	Achieved
Appliances	75	67	80	26 <sup>2</sup>
HVAC	268	265	80	79 <sup>3</sup>
HVAC Manufactured Homes Duct Sealing	222	214	15	15
Building shell	31	31	80	14
<b>Total</b>	<b>596<sup>1</sup></b>	<b>577</b>	<b>255</b>	<b>134</b>

<sup>1</sup>The total population differs from the total population in Table 7 as some participant respondents participated in multiple measure categories.

<sup>2</sup>Total includes two partially completed surveys

<sup>3</sup>Total includes three partially completed surveys

### **Participant Kit Surveys**

In gathering measure-level information on installations, program awareness and satisfaction, and demographics, Cadmus surveyed 121 customers who received **wattsmart** Starter Kits in 2015–2016.

Cadmus targeted samples to achieve statistically significant results for kits containing CFLs and kits containing LEDs, and stratified the sample into two groups: participants who received LEDs; and participants who received CFLs (all kit types contained only one type of lighting). Cadmus then randomly selected survey participants. Table 9 lists the population of kit participants, targets, and numbers of surveys achieved.

**Table 9. Participant Kit Survey Targeted and Achieved**

Lighting Type	Population	Sampling Frame	Targeted	Achieved
CFL	2,233	2,146	70	70
LED	298	290	70	51 <sup>1</sup>
<b>Total</b>	<b>2,531</b>	<b>2,436</b>	<b>140</b>	<b>121</b>

<sup>1</sup>Due to the small population of LED kit participants in 2016, Cadmus could not attain the target number of completed surveys. All efforts were made to attain the target without placing undue burden on customers; up to five attempts were made to reach each participant.

### **General Population Surveys**

The 2015–2016 general population surveys collected information on HES program awareness, key data for lighting and APS' engineering reviews, and nonparticipant spillover from a random group of customers in California. Cadmus drew the general population survey sample from a random list of California residential customers (provided by Pacific Power) and achieved 250 completed responses.

## *Upstream Manufacturer/Distributor/Retailer Interviews*

Cadmus interviewed 14 manufacturers, distributors, and retailer program partners that provided LED bulbs and/or LED fixtures to customers in Pacific Power's service territory. The interviews collected information about the following:

- The state of the efficient products market
- The manufacturer/distributor/retailer's operations and satisfaction with their HES program experience
- The ways that the efficient products market and manufacturer/retailer operations would differ in the HES program's absence



## Impact Evaluation

This chapter provides HES program impact evaluation findings derived from Cadmus' data analysis, using the following methods:

- Participant and general population surveys
- Demand elasticity modeling
- Billing analysis
- Engineering reviews

This report presents two evaluated savings values: gross savings and net savings. Reported gross savings are electricity savings (kWh) that Pacific Power reported in the 2015 and 2016 Pacific Power Energy Efficiency and Peak Reduction Annual Reports (annual reports).<sup>11</sup> To determine evaluated gross savings, Cadmus applied Step 1 through Step 3; to determine evaluated net savings, Cadmus applied the fourth step:

- **Step 1** (verify participant database): this included reviewing the program tracking database to ensure participants and reported savings matched 2015 and 2016 annual reports.
- **Step 2** (adjust gross savings with the actual installation rate): using telephone surveys, Cadmus determined the number of program measures installed and those that remained installed.
- **Step 3** (estimate gross unit energy savings [UES]): this included reviews of measure saving assumptions, equations, and inputs (e.g., engineering reviews for lighting and appliances, billing analysis for insulation and duct sealing measures).
- **Step 4** (applying net adjustments): Cadmus calculated net saving adjustments using results from customer self-response and demand elasticity modeling. No net savings adjustments were applied to insulation and duct sealing measures as the billing analysis produced net savings through Step 3.

Table 10 lists the methodologies used for each evaluation savings step in the 2015–2016 HES program.

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<sup>11</sup> Pacific Power California Annual Review of Energy Efficiency Programs. Available online:

2015 report:

[http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2016/2015\\_CA\\_DSM\\_Annual\\_Report\\_FINAL.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2015_CA_DSM_Annual_Report_FINAL.pdf)

2016 report:

[http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2017/CA\\_2016\\_DSM\\_Annual\\_Report.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2017/CA_2016_DSM_Annual_Report.pdf)

**Table 10. 2015–2016 HES Impact Methodology by Measure**

Measure Category	Measure Name	Percentage of Savings	Step 1: Database Review	Step 2: Verification	Step 3: Unit Energy Savings	Step 4: Net Adjustments
Appliance	Energy Efficient Clothes Washer	0.2%	Non-Lighting Tracking Database Review	In-Service Rate: Non-Lighting Survey	Reported	Self-Response NTG
	Energy Efficient Refrigerator	Less than 0.1%				
Building Shell	Insulation-Attic	0.3%		Billing Analysis	Billing Analysis	No adjustment <sup>1</sup>
	Insulation-Attic—Multifamily Homes	0.4%				
	Insulation-Wall	0.8%				
Electronics	Advanced Power Strip	0.8%		In-Service Rate: General Population Survey	Engineering Review	NTG based on secondary sources
HVAC	Duct Leakage Test—Manufactured Homes	Less than 0.1%		Billing Analysis	Billing Analysis	No adjustment <sup>1</sup>
	Duct Sealing - Manufactured Homes	6.6%				No adjustment <sup>1</sup>
	Duct Sealing w/Crossover—Manufactured Homes	1.1%				No adjustment <sup>1</sup>
	Ductless Heat Pump - New Home	Less than 0.1%		In-Service Rate: Non-Lighting Participant Survey	Reported	Self-Response NTG
	Electric System to Heat Pump Conversion—Tier 1	1.1%	Engineering Review			
	Electric System to Heat Pump Conversion—Tier 2	0.6%	Reported		Self-Response NTG	
	Energy Efficient Room Air Conditioner	Less than 0.1%				
	Evaporative Cooler—Tier 2	Less than 0.1%				



Measure Category	Measure Name	Percentage of Savings	Step 1: Database Review	Step 2: Verification	Step 3: Unit Energy Savings	Step 4: Net Adjustments
	Heat Pump to Heat Pump Upgrade—Tier 1	0.1%				
	Heat Pump to Heat Pump Upgrade—Tier 2	Less than 0.1%				
	Heat Pump, Ductless—New Homes	0.3%				
	Heat Pump, Multi-Head, Ductless	6.9%			Engineering Review	
	Heat Pump, Single-Head, Ductless	11.9%				
Kits	Basic Kit	16.3%	Kit Tracking Database Review	In-Service Rate: Kit Participant Survey	Engineering Review	Self-Response NTG
	Best Kit	1.7%				
	Better Kit	1.2%				
	CFL Kit	0.3%				
	LED Kit	0.1%				
Lighting	Light Bulbs—CFL	26.7%	Lighting Tracking Database Review	In-Service Rate: General Population Survey	Engineering Review	Demand Elasticity Modeling
	Light Bulbs—LED	20.0%				
	Light Fixtures—CFL	Less than 0.1%				
	Light Fixtures—LED	1.7%				Current practice baseline used <sup>2</sup>
Water Heating	Electric Water Heater	Less than 0.1%	Non-Lighting Tracking Database Review	In-Service Rate: Non-Lighting Survey	Reported	Self-Response NTG
	Heat Pump Water Heater	0.5%			Engineering Review	Self-Response NTG
Whole Home	Whole Home Performance Path—New Homes	0.5%			Engineering Review	Not evaluated

<sup>1</sup>Net adjustments were not applied to insulation and duct sealing measures as the billing analysis conducted to generate savings produced a net result.

<sup>2</sup>Freeridership adjustments were not applied to measures as the engineering review used a current practice baseline to estimate savings, producing a net-of-freeridership result.

**Evaluated Gross Savings**

To calculate evaluated savings for HES program measures, Cadmus reviewed the tracking database, verified measures, and conducted either engineering reviews or billing analyses of measures that accounted for 99% of program savings. Table 11 presents the share of savings and the evaluated savings’ evaluation methods used for measures representing the applicable percentage during the 2015–2016 period.

**Table 11. Measure Selection for Step 3: Engineering and Billing Analysis**

Measure Category	Measure Group	Percentage of Reported kWh Savings	Step 3: Evaluation Method
Building Shell	Attic and Wall Insulation	2%	Billing Analysis
Electronics	Advanced Power Strip	1%	Engineering Review
HVAC	Manufactured Homes Duct Sealing	8%	Billing Analysis
	Ductless Heat Pump	19%	Engineering Review
	Heat Pump Conversion	2%	Engineering Review
Kits	<b>watt</b> smart Starter Kits	20%	Engineering Review
Lighting	Light Bulbs--CFL	27%	Engineering Review
	Light Bubs--LED	20%	Engineering Review
	Fixtures	2%	Engineering Review
Water Heating	Heat Pump Water Heater	Less than 1%	Engineering Review
Whole Home <sup>1</sup>	Whole Home	Less than 1%	Engineering Review
<b>Sum % of Reported Savings Evaluated</b>		<b>99%</b>	

<sup>1</sup>Cadmus agreed with the assumptions used to calculate deemed savings for the whole-home performance measures and applied a 100% realization rate to those measures.

Table 12 provides gross savings evaluation results for evaluated quantities, gross savings, and realization rates by measure types.

**Table 12. Reported and Evaluated Gross HES Program Savings for 2015–2016**

Measure Category	Measure Name	Quantity	Program Savings (kWh)		Realization Rate
			Reported	Evaluated <sup>3</sup>	
Appliance	Energy Efficient Clothes Washer	69	9,240	9,240	100%
	Energy Efficient Refrigerator	3	351	351	100%
Building Shell <sup>1</sup>	Insulation	74,259	72,805	56,654	78%
Electronics	Advanced Power Strip	1,177	35,310	35,310	100%
HVAC	Duct Leakage Test— Manufactured Homes	23	0	0	N/A
	Duct Sealing— Manufactured Homes	222	360,693	187,029	52%



Measure Category	Measure Name	Quantity	Program Savings (kWh)		Realization Rate
			Reported	Evaluated <sup>3</sup>	
	Ductless Heat Pump—New Home	1	1,717	1,717	100%
	Electric System to Heat Pump Conversion—Tier 1	12	49,848	71,206	143%
	Electric System to Heat Pump Conversion—Tier 2	6	26,622	35,651	134%
	Energy Efficient Room Air Conditioner	37	2,126	2,126	100%
	Evaporative Cooler—Tier 2	5	1,215	1,215	100%
	Heat Pump to Heat Pump Upgrade	15	4,092	4,092	100%
	Heat Pump, Ductless—New Homes	7	12,019	12,019	100%
	Heat Pump, Multi-Head, Ductless	68	320,756	221,159	69%
	Heat Pump, Single-Head, Ductless	159	556,500	508,223	91%
Kits	Basic Kit	1,909	764,696	835,950	109%
	Best Kit	176	78,036	83,946	108%
	Better Kit	137	57,941	62,886	109%
	CFL Kit	279	15,823	13,792	87%
	LED Kit	30	2,404	2,163	90%
Lighting	Light Bulbs—CFL	85,066	1,247,667	1,087,992	87%
	Light Bulbs—LED	47,110	933,953	862,085	92%
	Light Fixtures—CFL	125	1,883	2,196	117%
	Light Fixtures—LED	5,220	78,613	127,318	162%
Water Heating	Electric Water Heater	3	468	468	100%
	Heat Pump Water Heater	15	23,595	19,994	85%
Whole Home	Whole Home Performance Path—New Homes	10	21,934	21,934	100%
<b>Total<sup>2</sup></b>			<b>4,680,306</b>	<b>4,266,715</b>	<b>91%</b>

<sup>1</sup>Quantities for building shell measures are in square feet.

<sup>2</sup>Savings may not add exactly to the total due to rounding.

<sup>3</sup>The billing analysis produced net savings for insulation and duct sealing measures.

### Step 1: Tracking Database Reviews

The program administrator provided three tracking databases containing California data that covered all 2015 and 2016 participation for the three delivery methods: lighting, kits, and non-lighting rebates (e.g., HVAC, appliance, water heating, whole home, electronics, building shell).

Cadmus' review of tracking databases for 2015 and 2016 did not find discrepancies in total reported quantities or total savings compared to the 2015 and 2016 annual reports.

The **wattsmart** Starter Kit database provided account numbers, addresses, names, and types and quantities of kit types, but the program administrator did not track or provide phone numbers from 2015 to 2016 (which were necessary for conducting surveys). Pacific Power provided participant phone numbers by mapping participant account numbers to its customer database.

Cadmus also reviewed the program administrator's tracking database of 2015 and 2016 non-lighting measures, which collected measure-level information (e.g., efficiency standards, unit quantities, purchase dates, incentive amounts). Total quantities and savings matched the 2015 and 2016 annual reports.

The upstream lighting measures database contained information on bulbs and fixtures incented, in addition to retailers, electric savings, purchase dates, models, and stock keeping units [SKUs]<sup>12</sup>. During the 2015–2016 evaluation cycle, Cadmus conducted lighting demand elasticity modeling to estimate freeridership for lighting incentives. In conducting this analysis, Cadmus requested merchandising and product placement data from the program administrator and included these in the demand elasticity model. Ideally, the program administrator would track products featured on high-visibility, off-shelf displays within each store location (i.e., end caps or pallet displays) along with the time frame for each display. With these data, Cadmus could have estimated sales lift due to price effects as well as product merchandising conducted separately.

As the program administrator's merchandising and product placement data proved unavailable, Cadmus could only account for program price changes and not program merchandising. This could lead to bias in our freeridership estimates. Any merchandising coinciding with price changes and leading to increased sales, when unaccounted for in the demand elasticity model, could potentially lead to an upward bias in the price elasticity coefficients and lead to the model ultimately underestimating freeridership. Merchandising not coinciding with price changes, when unaccounted for in the model, would not be credited to the program, thus leading to the model overestimating freeridership.

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<sup>12</sup> SKU numbers represent unique make and model indicators for a specific retailer.



**Step 2: Verification**

To verify in-service rates (ISRs) (i.e., installation rates), Cadmus used the non-lighting participant survey for non-lighting measures, the participant kit survey for kit measures, and the general population survey for upstream LED bulbs and APS.

**Non-Lighting ISR**

For each measure category, Cadmus asked survey respondents a series of questions designed to determine if they installed products for which they received incentives. Table 13 shows ISRs for each measure. All survey respondents reported installing all measures listed in the survey, resulting in 100% ISRs for all non-lighting measures. Table 13 also shows the breadth and quantity of measures addressed by the survey.

**Table 13. ISR by Measure Category, 2015–2016**

Measure Category	Measure	2015 and 2016			
		Total Surveyed Measures	Installed Measures	Percentage Installed	Percentage Average Weighted Installation
Appliances	Energy Efficient Clothes Washer	25	25	100%	100%
Building Shell <sup>1</sup>	Attic Insulation	13,530	13,530	100%	100%
	Wall Insulation	3,020	3,020	100%	
Water Heating	Heat Pump Water Heater	4	4	100%	100%
HVAC	Ductless Heat Pump	66	66	100%	100%
	Evaporative Cooler—Tier 2	1	1	100%	
	Heat Pump	9	9	100%	

<sup>1</sup>Quantities for building shell measures are in square feet.

**wattsmart Starter Kit ISRs**

Cadmus calculated ISRs for each **watt**smart Starter Kit measure using data collected through a survey Cadmus conducted with 121 California kit recipients. The survey, administered six months to one year after kit delivery, verified the number of kit measures received and installed (at the time of the survey). If respondents reported that they did not have measures currently installed, the survey asked what happened to the uninstalled measures (e.g., stored, discarded) and why.

Table 14 shows measure-level ISR results along with total measures distributed and reportedly installed.

**Table 14. ISRs by Kit Measure, 2015-2016**

Measure	Total Surveyed Measures	Measures Reported Installed	ISR
Bathroom Aerator	155	95	61%
CFLs <sup>1</sup>	248	197	79%
Kitchen Aerator	93	56	60%
LEDs <sup>1</sup>	192	172	90%
Showerheads	172	109	63%

<sup>1</sup>Consistent with upstream CFL and LED ISR analysis, Cadmus considered bulbs removed after burning out as “installed” rather than “removed.”

Kit participant survey results indicated LEDs and CFLs achieved the highest reported ISRs (90% and 79%, respectively) at the time of the survey. Customers paid a nominal cost (\$4.99 each) for kits with LEDs, which could contribute to higher ISRs for LEDs than CFLs. Kitchen aerators achieved the lowest ISRs (60%).

Cadmus compared HES program kit ISRs with those from two other utilities’ residential energy efficiency kit programs. *Ameren IL 2013* used two channels – direct mail and school-based delivery – to distribute no-cost kits containing the energy-efficient measures described in Table 15. *Ameren MO 2014* distributed no-cost kits to customers who requested them after receiving targeted postcards from Ameren Missouri. The program offered low-cost kits that, for a \$4.95 copay, also included advanced power strips. The program also distributed kits to multifamily properties.

As shown in Table 15, other kit programs exhibited slightly lower ISRs than those from the HES program. *Ameren IL 2013* offered two to four CFLs of varying wattages; *Ameren MO 2014* offered as many as 12 CFLs, two showerheads, and three faucet aerators per kit, and not all kit combinations contained LEDs. These differences may have contributed to lower ISRs than those of the *wattsmart* Starter Kit.

**Table 15. Mailed-In Kit Program ISRs Comparison**

Measure	Ameren IL 2013 <sup>1</sup>	Ameren MO 2014 <sup>2</sup>	Washington HES 2015–2016	California HES 2015–2016
Faucet Aerators	49%	52%	62%–65%	60%–61%
Showerheads	41%	47%	60%	63%
CFLs	66%	75%	84%	79%
LEDs	N/A	92%	90%	90%

<sup>1</sup>Opinion Dynamics. *Impact and Process Evaluation of 2013 (PY6) Ameren Illinois Company Residential Energy Efficiency Kits Program*. 2015. Available online: [http://ilsagfiles.org/SAG\\_files/Evaluation\\_Documents/Ameren/AIU%20Evaluation%20Reports%20EPY6/AIC\\_PY6\\_EEKits\\_Report\\_FINAL\\_2015-07-20.pdf](http://ilsagfiles.org/SAG_files/Evaluation_Documents/Ameren/AIU%20Evaluation%20Reports%20EPY6/AIC_PY6_EEKits_Report_FINAL_2015-07-20.pdf)

<sup>2</sup>Cadmus and Nexant. *Efficient Products Impact and Process Evaluation: Program Year 2014*. 2015. Available online: <https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935933387>



### **CFL and LED Bulb ISRs**

Cadmus calculated first-year ISRs for 2015–2016 using data collected through the general population survey of 250 Pacific Power California customers. Each survey asked participants about the number of bulbs they purchased, installed, removed, and stored within the prior 12 months. If respondents reported removing bulbs, the survey asked why these removals took place. For customers stating that they removed bulbs due to burnout, Cadmus adjusted the ISRs based on assumptions that bulbs removed due to burn out would not have been removed had they remained functional. Additionally, the assumed effective useful life considered the burnout rate.

Surveys asked customers to consider bulbs purchased in the past 12 months rather than those purchased during the entire two-year evaluation period. This resulted from Cadmus’ concerns about a customer’s ability to recall purchases that occurred more than two years prior to the survey. The calculated ISRs did not account for installations occurring after the first year of purchase.

The following formula calculated lighting ISRs:

$$ISR = \frac{\text{Installed in first year} - (\text{Removed} - \text{Removed After Burning Out})}{\text{Purchased}}$$

To reflect the program’s move away from CFL incentives in California, the 2015–2016 survey did not include questions related to CFL purchases. Therefore, CFL first-year ISR values reported for the current evaluation derived from a recent 2015 California Public Utilities Commission (CPUC) Evaluation Report.<sup>13</sup>

### **CFL In-Service Rates**

As the general population survey did not include questions about CFL bulbs, Cadmus obtained CFL installation rates from a recent California 2015 impact evaluation.<sup>13</sup> This evaluation used a telephone survey of 317 participants who received CFL bulbs and could answer the pertinent questions. The surveys asked respondents about the quantity of CFL lamps they installed, the quantity remaining in storage, and how many will or will not be installed in the future. The results suggest that 95% of CFLs in PG&E, SCE, and SDG&E’s territory homes have been or will eventually be installed, but only 77% were currently installed. Therefore, Cadmus applied a 77% first-year ISR for CFL bulbs.

### **LED In-Service Rates**

Cadmus calculated LED first-year ISRs for 2015–2016 using data collected through the general population survey of 250 California Pacific Power customers. The survey asked participants about the number of LED bulbs they purchased, installed, removed, and stored within the previous 12 months. If respondents reported removing bulbs, the survey asked why removal took place and adjusted the ISR

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<sup>13</sup> California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

accordingly. The calculated ISR did not account for installations occurring after the first year of purchase.

Of 250 customers surveyed, 182 did not purchase LEDs and 12 could not confirm or estimate how many they had purchased; consequently, the analysis excluded these data. The analysis also removed an additional five responses for other reasons, including not knowing how many bulbs had been installed, removed, or stored, or reporting demonstrably inconsistent bulb quantities. Cadmus used data from the remaining 51 respondents to calculate the ISR. Table 16 provides ISR results for 2015–2016 LEDs.

**Table 16. 2015 and 2016 First-Year LED ISR<sup>1</sup>**

Bulb Status	Number of Bulbs Reported	ISR
<b>Purchased</b>	<b>630</b>	81.6%
Installed	516	
Stored	114	
Removed	23	
Removed After Burning Out	21	
<b>In-Service Bulbs (including burned out)</b>	<b>514</b>	

<sup>1</sup>n = 51 respondents

Table 17 compares LED ISR values to those calculated for LEDs in other jurisdictions (including the concurrent Pacific Power evaluation of the Washington HES program). Others have collected comparative LED ISR values from data collected through site visits and phone surveys. The comparison indicates that ISRs evaluated through site visits may be higher than those evaluated through self-report surveys. However, the first-year LED ISR in this evaluation (82%) is lower than the first-year LED ISR evaluated through self-report phone surveys published by the CPUC (90%).

**Table 17. Comparison of Evaluated First-Year LED ISR Estimates**

Source	Data Collection Method	Reported Year	ISR
Arkansas 2013 Evaluation Report	75 Residential Site Visits	2014	100%
CPUC (LED bulbs)	Self-reporting: 267 Phone Surveys	2017	90%
Midwest Utility 1	Self-Reporting: determined by interview during home inventory site visits	2016	99%
Midwest Utility 2	103 Residential Site Visits	2013	96%
Northeast Utility	70 Residential Site Visits	2015	96%
Southwest Utility	70 Residential Site Visits	2015	84%
Pacific Power Washington 2015–2016 HES Evaluation	Self-Reporting: 64 In-territory Phone Surveys	2017	78%
<b>Pacific Power California 2015–2016 HES Evaluation</b>	<b>Self-Reporting: 156 In-Territory Lighting Surveys</b>	<b>2016</b>	<b>82%</b>



### Step 3: Unit Energy Savings Reviews

Cadmus conducted either an engineering review or a billing analysis to estimate UES values for measures representing 99% of program-reported gross savings. These included the following program measures:

- APS
- CFL and LED bulbs
- Light fixtures
- **wattsmart** Starter Kits (including CFLs, LEDs, faucet aerators, and high-efficiency showerheads)
- Heat pump conversions
- Ductless heat pumps
- Heat pump water heaters
- New homes<sup>14</sup>

Cadmus evaluated the following measures using billing analysis:

- Attic and wall insulation
- Manufactured homes duct sealing

Cadmus applied 100% realization rates to measures not listed above (when combined, these contributed less than 1% of program savings). As shown in Table 18, UES realization rates for evaluated measures ranged between 52% for manufactured homes duct sealing and 161% for fixtures.

**Table 18. 2015–2016 Gross<sup>1</sup> Unit Energy Savings and Realization Rate Summary**

Measure Category	Measure	Average UES (kWh/Unit)		UES Realization Rate <sup>2</sup>	UES Method
		Reported	Evaluated		
HVAC	Duct Sealing—Manufactured Homes	1,600.3	829.8	52%	Billing Analysis
	Electric System to Heat Pump Conversion—Tier 1	4,154.0	5,933.8	143%	Engineering Review
	Electric System to Heat Pump Conversion—Tier 2	4,437.0	5,941.9	134%	Engineering Review
	Heat Pump, Multi-Head, Ductless	4,717.0	3,252.3	69%	Engineering Review
	Heat Pump, Single-Head, Ductless	3,500.0	3,196.4	91%	Engineering Review
	Heat Pump Water Heater	1,573	1,332.9	85%	Engineering Review
Kits	<b>wattsmart</b> Starter Kits	363.1	394.6	109%	Engineering Review
Lighting	CFL Lamps	14.7	12.8	87%	Engineering Review
	LED Lamps	19.8	18.3	92%	Engineering Review
	CFL Fixtures	15.1	17.6	117%	Engineering Review

<sup>14</sup> Agreeing with assumptions used to calculate deemed savings for whole-home performance measures, Cadmus applied a 100% realization rate to those measures.

Measure Category	Measure	Average UES (kWh/Unit)		UES	UES Method
		Reported	Evaluated	Realization Rate <sup>2</sup>	
	LED Fixtures	15.1	24.4	162%	Engineering Review
Building Shell	Insulation-Attic <sup>3</sup>	0.4	0.3	78%	Billing Analysis
	Insulation-Attic—Multifamily Homes <sup>3</sup>	0.7	0.6	78%	Billing Analysis
	Insulation-Wall <sup>3</sup>	3.9	3.0	78%	Billing Analysis
Whole Home	Whole Home	2,193.4	2,193.4	100%	Engineering Review

<sup>1</sup>Gross savings values or net values from billing analysis.

<sup>2</sup>The UES realization rate may not calculate exactly due to rounding the reported and evaluated UES values.

<sup>3</sup>Attic and wall insulation units are kWh/square foot.

The following sections describe the methodology and results of the measurement activities for each measure listed in Table 18.

### *CFL and LED Bulbs*

During the 2015–2016 program years, Pacific Power provided incentives for 85,066 CFLs and 47,110 LEDs through nine different retailers representing 13 stores. Table 19 shows quantities and savings for 13 different bulb types. Overall, upstream light bulbs represented 47% of total reported HES savings.

**Table 19. 2015–2016 Incented CFL and LEDs Bulbs by Type**

Lighting Type	Bulb Type	Reported Quantity (Bulbs)	Reported Quantity % (Bulbs)	Reported Savings (kWh)
CFL	A-Lamp	1,106	0.8%	11,230
	Spiral	69,895	52.9%	1,007,853
	Candelabra	139	0.1%	2,053
	Globe	235	0.2%	3,134
	Reflector	1,113	0.8%	25,246
	Daylight	12,562	9.5%	197,816
	Dimmable	4	Less than 0.1%	84
	Outdoor	12	Less than 0.1%	251
<b>CFL Total</b>		<b>85,066</b>	<b>64.4%</b>	<b>1,247,667</b>
LED	A-Lamp	35,568	26.9%	588,884
	Candelabra	2,337	1.8%	42,325
	Globe	888	0.7%	19,532
	Downlight	8,283	6.3%	282,079
	3-Way	34	0.0%	1,133
<b>LED Total</b>		<b>47,110</b>	<b>35.6%</b>	<b>933,953</b>
<b>Overall Total</b>		<b>132,176</b>	<b>100.0%</b>	<b>2,181,620</b>



For the 2015–2016 evaluation period, LEDs made up 36% of the upstream programs. This fraction increased from 2015 to 2016, as shown in Table 20. In 2016, CFL participation dropped precipitously while LED participation held relatively steady.

**Table 20. CFL and LED Upstream Lighting Participation, 2015–2016**

Year	CFL Quantity	LED Quantity	Total	LED %
2015	75,464	22,305	97,769	23%
2016	9,602	24,805	34,407	72%

**Savings Calculation**

The following equation provided evaluated lighting savings:

$$\text{Evaluated Per Unit Savings (kWh per unit)} = \frac{\Delta\text{Watts} \cdot \text{ISR} \cdot \text{HOU} \cdot 365.25 \cdot \text{WHF}}{1,000}$$

Where:

- $\Delta\text{Watts}$  = Delta watts, the difference between the evaluated baseline bulb wattage ( $W_{\text{BASE}}$ ) and the evaluated efficient bulb wattage ( $W_{\text{EFF}}$ )
- ISR = In-service rate, the percentage of incented units installed within the first year
- HOU = Hours of use, the daily lighting operating hours
- WHF = Waste heat factor, accounting for interactive effects with a home’s heating and cooling systems

To calculate the various CFL and LED lighting component inputs, Cadmus conducted the primary and secondary data collection and analysis activities shown in Table 21.

Table 21. CFL and LED Bulb Evaluated Gross Savings Activities

Savings Variable	Lighting Type	Activity	Value
ΔWatts	CFL	Lumen Equivalency Method, via the Uniform Methods Project (UMP) <sup>2</sup>	32.0 <sup>1</sup>
	LED		36.2 <sup>1</sup>
ISR	CFL	2015 CPUC Evaluation Report (n = 317) <sup>3</sup>	77.0%
	LED	2015-2016 General Population Survey (n=51)	81.6%
HOU	CFL	2015 CPUC Evaluation Report (n = 1,200) <sup>3</sup>	1.6 <sup>1</sup>
	LED	Multistate HOU Regression Model, 2015-2016 General Population Survey (n=40)	1.9
WHF	CFL	RTF Residential Lighting Workbook v4.2	0.916
	LED		

<sup>1</sup>Weighted average value for all bulbs.

<sup>2</sup>National Renewable Energy Laboratory. *The Uniform Methods Project*. Chapter 21: Residential Lighting Evaluation Protocol. February 2015. Available online: <http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter21-residential-lighting-evaluation-protocol.pdf>

<sup>3</sup>California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

Cadmus derived the annual savings algorithm from industry standard engineering practices, consistent with the methodology that the UMP prescribed for calculating residential lighting energy use and savings. The following sections discuss each equation component (except for ISR, discussed above in the Step 2: Verification section).

**Delta Watts**

Delta watts represent the wattage difference between a baseline bulb and an equivalent CFL or LED bulb. Cadmus determined baseline wattages using the 2015–2016 upstream lighting tracking data, which included CFL and LED sales data by model numbers and bulb types for 132,176 bulbs sold through the program.

The lumen equivalency method produces delta watts for a given lamp by determining the lamp’s lumen output and type. Each lamp type corresponds with a set of lumen bins, and each bin corresponds to an assumed baseline wattage. Delta watts equals the difference between this baseline wattage and the bulb’s efficient wattage.

Whenever possible, Cadmus estimated each lamp’s lumen output and efficient wattage by mapping it to the ENERGY STAR database. When this was not possible, Cadmus interpolated lumen outputs from efficient wattage, based on a best-fit line derived from the ENERGY STAR database.

The UMP defines five lamp types:

- Standard



- Decorative
- Globe
- Energy Independence and Security Act of 2007 (EISA)-exempt (typically three-way and certain globe lamps)
- Reflector

Cadmus used the UMP’s latest methodology available to evaluate delta watts. Table 22 shows reported quantities for the five reported general lamp categories.

**Table 22. 2015 and 2016 CFL Database Quantities by Bulb Types**

Bulb Type	2015 Quantity	2015 Percentage	2016 Quantity	2016 Percentage	Overall Quantity	Overall Percentage
Standard	90,555	92.6%	28,605	83.1%	119,160	90.2%
Decorative	1,324	1.4%	1,139	3.3%	2,463	1.9%
Globe	670	0.7%	453	1.3%	1,123	0.8%
EISA-Exempt	24	0.0%	10	0.0%	34	0.0%
Reflector	5,196	5.3%	4,200	12.2%	9,396	7.1%
<b>Total</b>	<b>97,769</b>		<b>34,407</b>		<b>132,176</b>	

The majority of bulbs fell into the standard bulb category. Table 23 shows the lumen bins, UMP-specified baseline wattages, and 2015–2016 bulb quantities for standard lamps. Appendix B. Lighting Impacts provides lumen bins and quantities for the remaining bulb types, including a plot of baseline wattages compared to lumen outputs for various bulb types. Overall, for a given lumen output, standard lamps possessed a lower baseline wattage than reflector, globe, decorative, or EISA-exempt lamps. Notably, baselines for reflector lamps were set by a 2009 lamps ruling,<sup>15</sup> with reflector lamps divided into six separate categories, following the practice of the Mid-Atlantic Technical Reference Manual (TRM).<sup>16</sup>

<sup>15</sup> Energy Conservation Program: Energy Conservation Standards and Test Procedures for General Service Fluorescent Lamps and Incandescent Reflector Lamps. 74 FR 34080. <https://www.gpo.gov/fdsys/pkg/FR-2009-07-14/pdf/E9-15710.pdf>

<sup>16</sup> The Mid-Atlantic TRM presents an analysis examining requirements and defining lumen bins for six different reflector categories, depending on the reflector type and diameter. Northwest Energy Efficiency Partnerships. *Mid-Atlantic Technical Reference Manual V5*. June 2015. Available online: <http://www.neep.org/mid-atlantic-technical-reference-manual-v5>

**Table 23. Lumen Bins for Standard Lamps and Lamp Quantities**

Lumen Bin	Baseline Wattage	2015 Quantity	2016 Quantity	Total Quantity
0-309	25	0	0	0
310-449	25	91	74	165
450-799	29	4,359	2,234	6,593
800-1,099	43	72,301	23,564	95,865
1,100-1,599	53	4,765	774	5,539
1,600-1,999	72	9,039	1,959	10,998
2,000-2,600	72	0	0	0

**ENERGY STAR Qualified Product List Analysis**

While all program bulbs had to be ENERGY STAR certified, 3% of bulbs (representing 57 models) could not be matched to the compiled ENERGY STAR qualified product list that Cadmus used. This does not mean these models were not ENERGY STAR certified; rather, it means these 57 models (out of 433) did not automatically match to the ENERGY STAR database and consisted of too few to warrant manual look-ups. To estimate lumen outputs for these bulbs, Cadmus created linear fits of lumens to wattage, based on the ENERGY STAR’s qualified product list.

To determine a relationship between CFL and LED wattages and lumen outputs, Cadmus used the ENERGY STAR-qualified bulb product lists captured in October 2015 and October 2016.<sup>17</sup> The database consisted of approximately 8,300 CFL products and 36,900 LED products, along with their associated wattages and lumens. Lumen outputs for a given lamp wattage varied significantly. For example, 90 CFL products rated for 20 watts had lumen outputs ranging from 1,000 to 1,367.

Cadmus addressed these variations by using median lumens to create the relationship shown in Figure 2. The figure’s calculated trend line shows a strong linear relationship between CFL wattages and lumen outputs. Cadmus used this linear relationship to determine lumen outputs for CFL lamps with model numbers not matched in the ENERGY STAR-qualified lamp product list.

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<sup>17</sup> The ENERGY STAR-qualified bulb list can be downloaded from ENERGY STAR’s “Find and Compare Products” webpage: <http://www.energystar.gov/productfinder/product/certified-light-bulbs/results>.



**Figure 2. Median Lumens vs. CFL Wattage for ENERGY STAR-Qualified Standard CFLs**

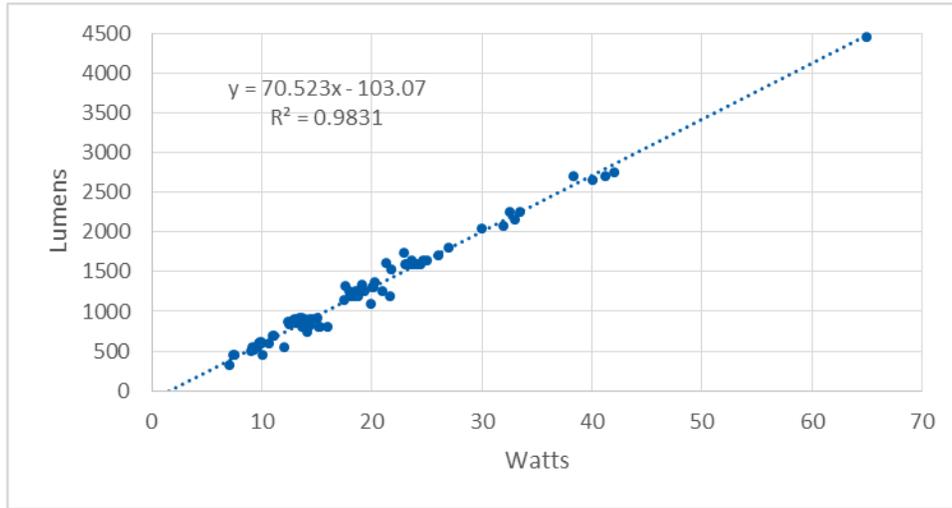
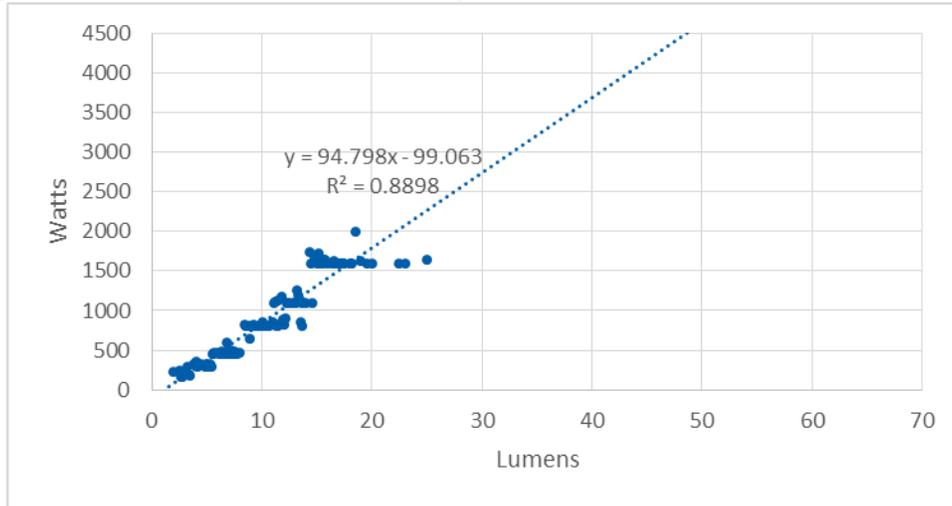


Figure 3 shows the same chart for LED standard lamps, indicating an even wider spread of efficacies, though the average efficacy was clearly higher than the average efficacy of CFLs (based on the slope of the linear fit).

**Figure 3. Median Lumens vs. LED Wattage for ENERGY STAR-Qualified Standard LEDs**



In total, the analysis employed six linear best-fit lines for LED and CFL standard, reflector, and specialty lamps. Cadmus also created two additional trend lines, drawn from ENERGY STAR' database for CFL and LED fixtures. Appendix B lists all trend lines employed.

**Hours of Use**

Because the 2015-2016 general population survey did not ask questions regarding CFLs, its data could not be used to derive HOU for CFL bulbs. Instead, Cadmus used data from the 2015 CPUC study.<sup>18</sup> This report derived HOU from an analysis of covariance (ANCOVA) model using data from a 2010 light metering study and from lamp installations from a 2012 residential lamp inventory study in California. As shown in Table 24, CFL HOU values split into three categories, based on lamp types and wattages. Generally, Cadmus used values for PG&E as this territory is geographically closest to Pacific Power’s territory in California.

**Table 24. HOU Values for CA CFL Lamps**

Lamp Type	HOU	Note
Standard ≤ 30 W	1.6	PG&E value, average of values for spiral and A-lamp
Reflector ≤ 30 W	1.7	Average of value for SCE and SDG&E (value for PG&E not provided)
> 30 W	1.9	PG&E value

For LED lighting products, Cadmus used the bulb installation location from the general population survey of Pacific Power customers in California, which focused exclusively on the LED technology. Cadmus calculated an average of 1.85 HOU using ANCOVA model coefficients, drawn from combined, multistate, multiyear data produced by two CFL HOU metering studies conducted by Cadmus in Maryland and Missouri in 2014. This model expressed average HOU as a function of room type. Cadmus did not use the LED HOU estimates from the 2015 CPUC evaluation, since it relied on an older metering study conducted in 2012, and Cadmus had Pacific Power in-territory LED bulb installation location data from the 2015-2016 general population survey.

HOU data used for the 2015–2016 evaluation drew upon two states (i.e., Maryland and Missouri). The studies employed a sampling strategy that prioritized rooms where efficient lighting would most likely be installed. Table 25 presents the evaluations’ HOU results in California.

**Table 25. LED HOU by Evaluation Period**

Evaluation Period	Evaluated HOU
2015–2016 LED bulbs	1.85 hours

Using response data from the general population surveys, Cadmus estimated the lighting distribution by room, as shown in Table 26.

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<sup>18</sup> California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)



**Table 26. 2015–2016 General Population Survey Reported LED Installation Locations**

Bulb Location	Percentage of Bulbs Installed in Location
Living Space	12%
Bedroom	26%
Kitchen	17%
Bathroom	11%
Outdoor	8%
Basement	4%
Other	22%
<b>Total<sup>1</sup></b>	<b>100%</b>

Current estimated HOU remains consistent and very similar to HOU calculated by the Regional Technical Forum (RTF). The RTF Residential Lighting Workbook v4.2, approved in January 2016 provided an average HOU of 2.0.<sup>19</sup>

**Waste Heat Factor**

A WHF adjustment made to energy savings accounted for lighting measures’ effects on the operation of heating and cooling equipment. As lower-wattage bulbs produce less waste heat, their use requires more heating and less cooling to maintain a room’s setpoint temperature.

The evaluation used Simplified Energy Enthalpy Model (SEEM) results from the RTF Residential Lighting Workbook v4.2 as a foundation for CFL and LED bulbs’ WHF analysis.<sup>20,21,22</sup>

Table 27 and Table 28 show the RTF’s SEEM results and evaluation weightings. Cadmus determined saturation weightings for heating and cooling systems, based on the 2015–2016 general population surveys of Pacific Power California’s residential customers, cooling zone weightings from Typical Meteorological Year 3 (TMY3) weather data, and census population data for California counties.

<sup>19</sup> RTF’s savings workbook for residential, screw-in, CFL and LED lamps: ResLighting\_Bulbs\_v4\_2.xlsm.

<sup>20</sup> SEEM is a building simulation model that the RTF calibrated for residential homes, thus providing the magnitude of interaction between lighting and HVAC systems. Additional background information for SEEM may be found at: Regional Technical Forum. “Simplified Energy Enthalpy Model (SEEM).” Accessed September 2017: <http://rtf.nwcouncil.org/measures/support/seem/>

<sup>21</sup> RTF’s savings workbook for residential, screw-in, CFL and LED lamps: ResLighting\_Bulbs\_v4\_2.xlsm.

<sup>22</sup> Cadmus reviewed the DEER 2014 updated values for interactive effects but used the RTF methodology to incorporate equipment saturation weightings determined based on the 2015-2016 general population survey of Pacific Power customers in California.

**Table 27. WHF Heating Inputs Summary**

WHF Component	Heating System Type	SEEM Results (kWh/kWh Saved)	Cadmus Saturation Weighting <sup>1</sup>
Heating Impact	Electric Zonal	-0.440	0.215
	Electric Forced Air	-0.479	0.030
	Heat Pump	-0.258	0.075
	Non-Electric	0.000	0.680

<sup>1</sup>Percentages may not add to 100% due to rounding.

**Table 28. WHF Cooling Inputs Summary**

WHF Component	System Type	SEEM Results (kWh/kWh Saved)	Cadmus Zone Weighting <sup>1</sup>	Cadmus Saturation Weighting
Cooling Impact	Cooling Zone 1	0.033	0.295	0.039
	Cooling Zone 2	0.053	0.705	
	Cooling Zone 3	0.074	0	

<sup>1</sup>Percentages may not add to 100% due to rounding.

Calculating the weighted averages of values in Table 27 and Table 28 provided the impacts from heating and cooling of a bulb installed in a conditioned space, shown in Table 29. Summing heating and cooling impacts produced an estimated combined impact of -0.12 kWh per kWh of lighting savings.

**Table 29. WHF Weighted Average Impact, Conditioned Space**

Component	kWh/kWh Savings <sup>1</sup>
Heating	-0.128
Cooling	0.008
<b>Combined</b>	<b>-0.120</b>

<sup>1</sup>Table may not sum to total due to rounding.

Cadmus also considered bulb locations in determining the appropriate WHF and accounting for bulbs not installed in conditioned spaces. As shown in Table 30, Cadmus applied bulb allocations by space types from the 2015–2016 general population survey data to thermal coupling factors from the RTF.

**Table 30. Thermal Coupling by Space Type**

Space Type	RTF Thermal Coupling Correction Factor	Bulb Allocation <sup>1</sup>
Basement	50%	0.2%
Main House	75%	93.1%
Outdoor	0%	6.7%
<b>Weighted Average</b>		<b>69.9%</b>

<sup>1</sup>Percentages may not add to 100% due to rounding.

Multiplying the combined impacts from Table 29 with the weighted thermal coupling in Table 30 and adding 1 provided the final WHF, shown in Table 31.



**Table 31. California CFL Bulb WHF, Average Installation Location**

Fuel	Value	Units
Electric	0.916	kWh/kWh Saved

<sup>1</sup>Final WHF value does not compute exactly from reported variables due to rounding.

### CFL and LED Bulbs Total Savings

Table 32 shows reported and evaluated savings inputs and input sources for CFL lamps, in addition to reported and evaluated energy savings per unit (UES). Cadmus determined evaluated savings and inputs using assumptions provided by Pacific Power and using information drawn from the tracking database. Reported and evaluated delta watts input varied widely across and within bulb categories.

As such, many values in Table 32 represent weighted averages. The far-right column shows the fraction produced by dividing evaluated savings or inputs by the reported savings or inputs. Its UES value equals the CFL bulb realization rate. It also serves as an approximate “partial realization rate” for each of the other inputs—delta watts, WHF, HOU, and ISR.

**Table 32. 2015–2016 Reported and Evaluated CFL Bulb Savings and Inputs**

Input <sup>1</sup>	Reported		Evaluated		Evaluated/ Reported
	Value	Source	Value	Source	
UES (kWh/bulb)	14.67 <sup>1</sup>	Tracking database	12.79 <sup>1</sup>	Calculated from factors below	87%
W <sub>EFF</sub>	14.7 <sup>1</sup>	Tracking database, UES values split and set by integer wattages	14.8 <sup>1</sup>	Tracking database, with some verification. Values used were binned for each model.	100%
W <sub>BASE</sub>	46.9 <sup>1</sup>	Lumen equivalence via EISA bins and baselines, special reflector bins	46.8 <sup>1</sup>	Lumen equivalence via UMP, Mid-Atlantic TRM	100%
ΔWatts (W)	32.2 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	32.0 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	99%
WHF	0.878	Cadmus 2009 – 2010 evaluation <sup>2</sup>	0.916	2015-2016 general population survey	104%
HOU (hr/day)	2.00		1.55 <sup>1</sup>	2015 CPUC evaluation <sup>3</sup>	78%
ISR	71.0%		77.0%		108%

<sup>1</sup>Weighted average values.

<sup>2</sup>Cadmus. *Pacific Power 2009 – 2010 California Residential Home Energy Savings Evaluation*. February 29, 2012. Available online:

[http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/CA\\_Home\\_Energy\\_Savings\\_Program\\_Evaluation\\_2009-2010.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf)

<sup>3</sup>California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online:

[http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

These weighted average input values could be used to discern general drivers of differences between CFL evaluated and reported savings. As seen in the Evaluated/Reported column for UES, CFL bulbs had an 87% overall realization rate. This realization rate is a result of several factors. From the 2015 CPUC evaluation, the average evaluated HOU value was only 78% of the reported HOU value, which derived from an older evaluation. This was somewhat offset, however, by the evaluated WHF and ISR of 104% and 108%, respectively, of reported values. Although reported delta watts values derived from a different set of lumen bins from the evaluated ones, the differences were very slight.

Table 33 shows reported and evaluated savings inputs and input sources for LED bulbs, with many values representing weighted averages. Several factors contributed to the overall 92% LED bulb UES realization rate. In comparing average reported inputs to average evaluated inputs,  $\Delta$ Watts was 17% higher and WHF was 4% higher, but HOU was 7% lower and the ISR was 18% lower.

The large difference in  $\Delta$ Watts largely arises from a difference in  $W_{BASE}$ , most of which came from one bulb subcategory: the 9-watt LED A-lamp reported bulb category made up 34% of program LED bulbs and had a reported 29-watt baseline. However, applying the lumen bins and baselines of the UMP assigned a 43-watt baseline for these bulbs, resulting in an evaluated delta watts value 70% higher than reported delta watts value for this bulb category. For the other 38 reported bulb categories, the  $W_{BASE}$  differences varied, though reported values generally were less than evaluated values.

While average evaluated  $\Delta$ Watts were higher than average reported values, the evaluated installation rate was much lower. Cadmus' 2009–2010 evaluation assumed a 100% ISR for LEDs, but the 2015–2016 general population survey revealed a much lower value, at 82%.



**Table 33. 2015–2016 Reported and Evaluated LED Bulb Savings and Inputs**

Input <sup>1</sup>	Reported		Evaluated		Evaluated/ Reported
	Value	Source	Value	Source	
UES (kWh/bulb)	19.82 <sup>1</sup>	Tracking database	18.29 <sup>1</sup>	Calculated from factors below	92%
W <sub>EFF</sub>	9.3 <sup>1</sup>	Tracking database, UES values split and set by integer wattages	9.3 <sup>1</sup>	Tracking database, with some verification. Values used were binned for each model.	99%
W <sub>BASE</sub>	40.3 <sup>1</sup>	Lumen equivalence via EISA bins and baselines, special reflector bins	45.5 <sup>1</sup>	Lumen equivalence via UMP, Mid-Atlantic TRM	113%
ΔWatts (W)	31.0 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	36.2 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	117%
WHF	0.878	Cadmus 2009 – 2010 evaluation <sup>2</sup>	0.916	2015-2016 general population survey	104%
HOU (hr/day)	2.00		1.85 <sup>1</sup>		93%
ISR	100.0%		81.6%		82%

<sup>1</sup>Weighted average values.

<sup>2</sup>Cadmus. *Pacific Power 2009 – 2010 California Residential Home Energy Savings Evaluation*. February 29, 2012. Available online:

[http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/CA\\_Home\\_Energy\\_Savings\\_Program\\_Evaluation\\_2009-2010.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf)

Table 34 provides evaluated CFL and LED quantities, evaluated savings, and realization rates by bulb types.

**Table 34. 2015–2016 Evaluated and Reported HES Program CFL and LED Savings (kWh)**

Bulb Type	Reported		Evaluated		Realization Rate		
	CFL	LED	CFL	LED	CFL	LED	Overall
Standard	1,217,287	589,005	1,065,205	585,858	88%	99%	91%
Decorative	2,000	42,204	1,755	37,428	88%	89%	89%
Globe	3,134	19,532	4,418	13,528	141%	69%	79%
EISA-Exempt	0	1,133	0	1,383	n/a	122%	122%
Reflector	25,246	282,079	16,614	223,888	66%	79%	78%
<b>Overall</b>	<b>1,247,667</b>	<b>933,953</b>	<b>1,087,992</b>	<b>862,085</b>	<b>87%</b>	<b>92%</b>	<b>89%</b>

### Light Fixtures

During the 2015–2016 program period, Pacific Power provided incentives for 5,345 ENERGY STAR light fixtures, representing 1.7% of reported program savings. Cadmus grouped and analyzed savings for fixtures within two categories:

- Downlight fixtures
- Miscellaneous fixtures

Respectively, these categories contributed 70.4% and 28.3% of program fixtures by quantity, with 1.3% of fixtures of unidentifiable types. Generally, fixture savings calculations used the same methodology as

that employed for light bulbs, though the two fixture types required slight variations in their energy savings calculations. Again, the lighting saving evaluation used the following general equation:

$$\text{Evaluated Per Unit Savings (kWh per unit)} = \frac{\Delta\text{Watts} \cdot \text{ISR} \cdot \text{HOU} \cdot 365.25 \cdot \text{WHF}}{1,000}$$

To calculate various light fixture component inputs, Cadmus conducted the primary and secondary data collection activities shown in Table 35.

**Table 35. Light Fixture Evaluated Savings Activities and Results**

Savings Variables	Lighting Technology	Activity	Value
ΔWatts	CFL	Market baseline, via 2015 CPUC evaluation <sup>2</sup>	39.3 <sup>1</sup>
	LED		
ISR	CFL	Previous 2013–2014 HES evaluations <sup>3</sup>	100.0%
	LED		
HOU	CFL	2015 CPUC Evaluation Report	1.550 <sup>1</sup>
	LED	Multistate HOU Regression Model, 2015-2016 General Population Survey (n=40)	1.851
WHF	CFL	RTF Residential Lighting Workbook v4.2	0.916
	LED		

<sup>1</sup>Weighted average for all fixtures.

<sup>2</sup>California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

<sup>3</sup>Cadmus. *Rocky Mountain Power 2013-2014 Utah Home Energy Savings Program Evaluation*. April 25, 2016. Available online: [www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2016/2013-2014\\_Utah\\_HES\\_Evaluation.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2013-2014_Utah_HES_Evaluation.pdf)

Cadmus applied the same HOU and WHF used in the CFL and LED bulb analyses, and a 100% ISR, based on previous HES program evaluation work in Utah.<sup>23</sup> Lighting fixture incentives were primarily

<sup>23</sup> Pacific Power administered the light fixture incentives upstream and the light fixture ISR could not be verified in the 2015-2016 general population survey due to the relatively limited quantity of fixtures incented. Cadmus referred to a previous evaluation of this program in UT, where fixture incentives were administered downstream. UT is the largest territory of Pacific Power’s sister brand (Rocky Mountain Power) and the referenced evaluation included the largest number of lighting fixture incentive survey responses (32) among 2013-2014 Pacific Power and Rocky Mountain Power HES program evaluations:

Cadmus. *Rocky Mountain Power 2013-2014 Utah Home Energy Savings Program Evaluation*. April 25, 2016. Available online: [www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2016/2013-2014\\_Utah\\_HES\\_Evaluation.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2013-2014_Utah_HES_Evaluation.pdf)



administered upstream, so Cadmus could not verify fixture ISRs through participant surveys and the quantity of fixtures incented limited the opportunity to verify an ISR through the general population survey. For delta watts, Cadmus used the market baseline presented in the 2015 CPUC evaluation report. A detailed discussion of the delta watts calculation follows for each fixture category.

**Downlight Fixtures**

By quantity, downlight fixtures (as shown in Figure 4) made up 70% of 2015–2016 lighting fixtures, designed for installation into recessed ceiling or “can” light receptacles (intended to accept reflector lamps). This fixture type differs from other fixtures in that each purchase replaces a particular lamp, meriting application of a lamp baseline to calculate delta watts. The 2015 CPUC evaluation used a 53.5 watt market baseline for reflector lamps, and Cadmus applied this baseline wattage to all downlight fixtures.

**Figure 4. Example of a Downlight Fixture**



**Miscellaneous Fixtures**

Of fixtures sold, 28% could not be classified as downlights. LED ceiling lamps with known efficient wattages made up most of these. The 2015 CPUC report presented an average baseline, across three IOUs, of 46.7 watts for standard bulbs ≤ 30 watts and 53.5 watts for bulbs > 30 watts. Cadmus used these values for miscellaneous fixtures’ baselines.

**Unknown Fixtures**

The database included 1.3% of fixtures falling outside of known categories. As these fixtures could not be matched to the ENERGY STAR database, Cadmus applied the weighted average UES for the downlight and miscellaneous fixture categories.

**Lighting Fixture Findings**

Table 36 shows reported and evaluated savings inputs and input sources for downlight fixtures, all of which were LED fixtures. All downlight and miscellaneous fixtures had a reported 15.08 kWh UES value, driven by the same HOU, ISR, and WHF assumptions as CFL bulbs and by similar wattage assumptions. After calculating reported savings values for several assumed bulb wattages, a single, weighted, average savings value was calculated for an assumed wattage population spread. This value was then

multiplied by a factor of 1.06, presumably to convert from bulb savings to fixture savings, although the source and reasoning for this factor remain unknown.

Downlight fixtures achieved a 175% overall realization rate, driven largely by differences in wattage values and in ISRs. Generally, fixture models exhibited actual efficient wattages less than reported values; further, the CPUC evaluation assumed a reflector baseline higher than reported baselines. The reported ISR value matched that used for CFL bulbs. Based on previous HES evaluation work, Cadmus used a 100% ISR value for fixtures.<sup>24</sup> Smaller differences between reported and evaluated WHF and HOU values largely cancelled out one another.

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<sup>24</sup> Ibid.



**Table 36. 2015–2016 Reported and Evaluated Downlight Fixture Savings and Inputs**

Input <sup>1</sup>	Reported		Evaluated		Evaluated/ Reported
	Value	Source	Value	Source	
UES (kWh/bulb)	15.08	Program tracking database	26.41 <sup>1</sup>	Calculated using the variable values below.	175%
W <sub>EFF</sub>	14.8 <sup>1</sup>	Lumen equivalence for standard bulbs via EISA bins and baselines, with a discrete set of wattages and assumed lumens for each wattage. Weighted average across an assumed population of bulbs.	10.9 <sup>1</sup>	Program tracking database, with occasional corrections to bulb types or wattages. Values used were binned for each model.	73%
W <sub>BASE</sub>	46.0 <sup>1</sup>		53.5 <sup>1</sup>	2015 CPUC evaluation <sup>2</sup>	116%
ΔWatts (W)	31.2 <sup>1</sup>		42.6 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	137%
WHF	0.878	Cadmus 2009–2010 evaluation <sup>3</sup>	0.916	2015-2016 general population survey (LED)	104%
HOU (hr/day)	2.00		1.85	2015 CPUC evaluation <sup>2</sup> (CFL)	93%
ISR	71.0%		100%	Previous 2013–2014 HES evaluation <sup>4</sup>	141%
Fixture Factor	1.06	Unknown	n/a	n/a	106%

<sup>1</sup>Weighted average values.

<sup>2</sup>California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online: [http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

<sup>3</sup>Cadmus. *Pacific Power 2009 – 2010 California Residential Home Energy Savings Evaluation*. February 29, 2012. Available online: [http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/CA\\_Home\\_Energy\\_Savings\\_Program\\_Evaluation\\_2009-2010.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf)

<sup>4</sup>Cadmus. *Rocky Mountain Power 2013-2014 Utah Home Energy Savings Program Evaluation*. April 25, 2016. Available online: [www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2016/2013-2014\\_Utah\\_HES\\_Evaluation.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2013-2014_Utah_HES_Evaluation.pdf)

Table 37 shows reported and evaluated savings inputs and input sources for miscellaneous fixtures, with the difference between reported and evaluated ISRs serving as the driving factor. Most values aligned closely, resulting in a 126% overall realization rate for these fixtures.

Table 38 provides lamp quantities, savings, and realization rates by fixture and technology types (CFL or LED) for 2015–2016. Fixtures achieved a 161% overall realization rate, driven largely by high realization rates for downlight fixtures.

**Table 37. 2015–2016 Reported and Evaluated Miscellaneous Fixture Savings and Inputs**

Input <sup>1</sup>	Reported		Evaluated		Evaluated/ Reported
	Value	Source	Value	Source	
UES (kWh/bulb)	15.08	Tracking database.	18.80 <sup>1</sup>	Calculated from factors below.	125%
W <sub>EFF</sub>	14.8 <sup>1</sup>	Lumen equivalence for standard bulbs via EISA bins and baselines, with a discrete set of wattages and assumed lumens for each wattage. Weighted average across an assumed population of bulbs.	15.9 <sup>1</sup>	Tracking database, with occasional corrections to bulb types or wattages. Values used were binned for each model.	107%
W <sub>BASE</sub>	46.0 <sup>1</sup>		46.7 <sup>1</sup>	Lumen equivalence via UMP, Mid-Atlantic TRM	101%
ΔWatts (W)	31.2 <sup>1</sup>		30.8 <sup>1</sup>	W <sub>BASE</sub> - W <sub>EFF</sub>	99%
WHF	0.878		0.916 <sup>1</sup>	2015-2016 general population survey (LED), 2015 CPUC evaluation (CFL) <sup>4</sup>	104%
HOU (hr/day)	2.00		1.83 <sup>1</sup>		91%
ISR	71.0%		100% <sup>3</sup>		141%
Fixture Factor	1.06		Unknown	n/a	n/a

<sup>1</sup>Weighted average values.

<sup>2</sup>Cadmus. *Pacific Power 2009 – 2010 California Residential Home Energy Savings Evaluation*. February 29, 2012. Available online:

[http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/CA\\_Home\\_Energy\\_Savings\\_Program\\_Evaluation\\_2009-2010.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/CA_Home_Energy_Savings_Program_Evaluation_2009-2010.pdf)

<sup>3</sup>Cadmus. *Rocky Mountain Power 2013-2014 Utah Home Energy Savings Program Evaluation*. April 25, 2016. Available online:

[www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/2016/2013-2014\\_Utah\\_HES\\_Evaluation.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2016/2013-2014_Utah_HES_Evaluation.pdf)

<sup>4</sup>California Public Utilities Commission. *Impact Evaluation of 2015 Upstream and Residential Downstream Lighting Programs*. April 1, 2017. Available online:

[http://www.calmac.org/publications/2015\\_LTG4\\_Impact\\_Evaluation\\_Report-FINALES.pdf](http://www.calmac.org/publications/2015_LTG4_Impact_Evaluation_Report-FINALES.pdf)

**Table 38. 2015–2016 Light Fixture Quantity and Gross Savings**

Fixture Category	CFL/LED	Quantity	Reported Savings (kWh)	Evaluated Savings (kWh)	Reported UES (kWh/unit)	Evaluated UES (kWh/unit)	Realization Rate
Downlight	CFL	0	0	0	N/A	N/A	N/A
	LED	3,763	56,671	99,362	15.1	26.4	175%
Miscellaneous	CFL	123	1,852	2,148	15.1	17.5	116%
	LED	1,391	20,948	26,321	15.1	18.9	126%
Unknown	N/A	68	1,024	1,683	15.1	24.8	165%
<b>Total</b>		<b>5,345</b>	<b>80,496</b>	<b>129,514</b>	<b>15.1</b>	<b>24.2</b>	<b>161%</b>

<sup>1</sup>Savings may not sum exactly to totals due to rounding.



### wattsmart Starter Kits

Pacific Power’s HES program includes eight varieties of **wattsmart** Starter Kits, containing unique combinations of 13-watt CFLs, 10-watt LEDs, kitchen aerators, bathroom aerators, and showerheads. Table 39 shows components for each of the eight kits available in 2015 and 2016.

**Table 39. Components in Each wattsmart Starter Kit**

Kit Name	Quantity per Kit				
	CFL	LED	Kitchen Aerator	Bathroom Aerator	Showerhead
Basic 1	4	0	1	1	1
Basic 2	4	0	1	2	2
Better 1 <sup>1</sup>	4	0	1	1	1
Better 2 <sup>1</sup>	4	0	1	2	2
Best 1	0	4	1	1	1
Best 2	0	4	1	2	2
CFL Only	4	0	0	0	0
LED Only	0	4	0	0	0

<sup>1</sup>Better kits provided a handheld showerhead with the same flow rate as the fixed showerhead provided in the Basic kits.

### Kit CFLs and LEDs

Cadmus estimated energy savings for CFLs and LEDs distributed through the **wattsmart** Starter Kit, using the following equation, as outlined in the UMP’s Residential Lighting Evaluation Protocol:<sup>25</sup>

$$\Delta kWh = \left( \frac{W_{Base} - W_{EE}}{1,000} \right) * ISR * HOU * WHF$$

Table 40 defines key variables from the above equation, provides values used in analysis, and lists sources for these values.

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<sup>25</sup> National Renewable Energy Laboratory. *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures*, Chapter 21: Residential Lighting Evaluation Protocol. December 2014. Available online: <http://www.nrel.gov/extranet/ump/pdfs/ump-res-lighting-clean.pdf>

**Table 40. wattsmart Starter Kit CFL and LED Key Variables and Assumptions**

Parameter	Definition	CFL	LED	Unit	Source(s)
$W_{Base}$	Baseline wattage	43	43	$W$	Lumens equivalence method
$W_{EE}$	Measure wattage	13.0	10.5	$W$	Program materials
$ISR$	In-service rate	79.4	89.6	%	2015–2016 kit participant surveys (n=62 - CFL, 48 - LED)
$HOU$	Hours of use	566	675	$\frac{hours}{year}$	2015–2016 HES light bulb room and HOU analysis (See Table 32 and Table 33)
$WHF$	Waste heat factor	0.916	0.916		2015–2016 HES light bulb WHF analysis (See Table 32 and Table 33)
$\Delta kWh$	<b>Energy Savings</b>	<b>12.4</b>	<b>18.0</b>	$\frac{kWh}{year}$	<b>Calculated</b>

In 2015–2016 kit participant survey, Cadmus asked respondents ISR-related questions, specifically relating to bulbs they received (to prevent, for example, asking a participant who received LEDs about CFLs). Cadmus calculated evaluated HOU and WHF assumptions from its 2015–2016 general population surveys.

Table 41 shows reported and gross evaluated savings for each bulb type, along with realization rates.

**Table 41. Kit CFL and LED per Unit Reported and Evaluated Gross Savings**

Kit Measure	Reported Savings Per Unit (kWh)	Evaluated Savings Per Unit (kWh)	Realization Rate
CFL	14.2	12.4	87%
LED	20.0	18.0	90%

CFLs and LEDs achieved 87% and 90% realization rates respectively due to varying HOU and ISR assumptions. Table 42 shows the comparison between reported and evaluated parameters used to calculate kit CFL and LED bulb savings.

**Table 42. Reported and Evaluated Parameters Used to Calculate Kit LED and CFL Bulb Savings**

Variable	CFL		LED		Units
	Reported	Evaluated	Reported	Evaluated	
$W_{base}$	43	43	Unknown	43	$W$
$W_{eff}$	13	13	Unknown	10.5	$W$
HOU	730	566	Unknown	675	Hours
ISR	74.0%	79.4%	Unknown	89.6%	%
$WHF_e$	-0.122	-0.084	Unknown	-0.084	-
Savings	14.23	12.4	20.0	18.0	kWh



**Kit Aerators**

Cadmus evaluated faucet aerator electric savings using the following equation:<sup>26</sup>

$$\Delta kWh = ISR * (GPM_{Base} - GPM_{EE}) * MPD * 365.25 * \frac{PH}{FH} * (T_{Mix} - T_{In}) * \frac{8.345}{RE * 3,412.14} * \%DHW$$

Table 43 defines the equation’s key variables, provides values used in the analysis, and lists sources for these values.

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<sup>26</sup> Average DEER aerator saving values for residential bathroom and kitchen aerators are 30 and 125.5 kwh per year, respectively, for California climate zones 1 and 16. Cadmus evaluated the kit product savings using the commonly accepted engineering equation provided with inputs from the 2015-2016 kit participant surveys in the Pacific Power territory.

**Table 43. wattsmart Starter Kit Aerator Key Variables and Assumptions**

Parameter	Definition	Kitchen Aerator	Bathroom Aerator	Unit	Source(s) <sup>1</sup>
<i>ISR</i>	In-service rate	60.2	61.3	%	2015–2016 kit participant surveys (n=93 - kitchen, 92 - bathroom)
<i>GPM<sub>Base</sub></i>	Baseline flow rate	2.2	2.2	$\frac{gal}{min}$	Federal rated maximum flow rate (10CFR430.32) (DOE 1998)
<i>GPM<sub>EE</sub></i>	Measure flow rate	1.5	0.5	$\frac{gal}{min}$	Program materials
<i>MPD</i>	Minutes of use per person per day	4.5	1.6		2013 Cadmus Study <sup>2</sup>
<i>PH</i>	People per household	2.40	2.40		2015–2016 kit participant survey (n=114)
<i>FH</i>	Faucets per household	1	2.11		Bathroom: 2015–2016 kit participant survey (n=115). Kitchen: One per household.
<i>T<sub>Mix</sub></i>	Usage water temperature	93	86	°F	2013 Cadmus Study <sup>2</sup>
<i>T<sub>In</sub></i>	Inlet water temperature	64.77	64.77	°F	DOE Hot Water Scheduler, 2016 U.S. Census Bureau
<i>RE</i>	Recovery efficiency of electric water heater	98	98	%	NREL, “Building America Research Benchmark Definition” <sup>3</sup>
<i>%DHW</i>	Households with electric hot water	95.1	95.1	%	2015–2016 kit participant survey (n=103)
<b><i>ΔkWh</i></b>	<b>Energy Savings</b>	<b>111.6</b>	<b>34.9</b>	$\frac{kWh}{year}$	<b>Calculated</b>

<sup>1</sup>Survey results reflect averages only for those receiving water-saving measures.

<sup>2</sup>Cadmus and Opinion Dynamics. *Showerhead and Faucet Aerator Meter Study*. Prepared for Michigan Evaluation Working Group. 2013.

<sup>3</sup>National Renewable Energy Laboratory. *Building America Research Benchmark Definition*. December 2009. pg. 12. Available online: <http://www.nrel.gov/docs/fy10osti/47246.pdf>

Cadmus used its participant survey to estimate the number of people per household and bathroom faucets per household, and the percentage for households with electrically heated water. A 2013 study informed Cadmus’ assumptions regarding usage duration and water temperature at TOU; this included assuming each home had one kitchen and, thus, one kitchen faucet.<sup>27</sup>

Table 44 shows reported and evaluated gross savings for each aerator type, along with realization rates.

<sup>27</sup> Cadmus and Opinion Dynamics. *Showerhead and Faucet Aerator Meter Study*. Prepared for Michigan Evaluation Working Group. 2013.



**Table 44. Kit Kitchen and Bathroom Aerator per Unit Reported and Evaluated Gross Savings**

Kit Measure	Reported Savings Per Unit (kWh)	Evaluated Savings Per Unit (kWh)	Realization Rate
Kitchen Aerator	21.7	111.6	515%
Bathroom Aerator	52.6	34.9	66%

Kitchen aerators achieved a 515% realization rate and bathroom aerators achieved a 66% realization rate due to varying assumptions related to water temperatures, usage, and residents and faucets per household. The Pacific Power reported kitchen aerator savings were developed using a different methodology than the one used in this evaluation. The reported savings are based on whole house savings estimates from a 2013 Cadmus potential study,<sup>28</sup> where all faucets (bathrooms and kitchen) are replaced with 1.5 GPM aerators (the deemed savings workbook divides the whole house savings by the average number of faucets per home, and applies a realization rate). Averaging savings between kitchen and bathroom aerators underestimates kitchen aerator savings, since kitchen faucets have higher daily use and average outlet water temperature. Additionally, neither the evaluated nor the reported kitchen aerator savings account for a drain factor, the percentage of kitchen faucet flow that fills a fixed volume like the sink, a pot, or a glass. If water is collected in a sink, a faucet aerator will not result in water or electrical energy savings. Available estimates of 25-50% drain factor are based on professional judgement and thus not included in the evaluation analysis. The evaluated kitchen aerator savings are overestimating the savings due to not accounting for a drain factor.

**Kit Showerheads**

Cadmus evaluated showerhead electric savings using the following equation:

$$\Delta kWh = (GPM_{Base} - GPM_{EE}) * MPS * EV * \frac{PH}{SH} * (T_{Mix} - T_{In}) * \frac{8.345}{RE * 3,412.14} * ISR * \%DWH$$

Table 45 defines the equation’s key variables, provides values used in the analysis, and lists sources for these values.<sup>29</sup>

**Table 45. wattsmart Starter Kit Showerhead Key Variables and Assumptions**

Parameter	Definition	Value	Unit	Source(s) <sup>1</sup>
<i>MPS</i>	Shower duration	7.8	$\frac{min}{shower}$	2013 Cadmus Study <sup>2</sup>
<i>GPM<sub>Base</sub></i>	Baseline flow rate	2.5	$\frac{gal}{min}$	Federal-rated maximum flow rate for showerheads (10CFR430.32 (p) (DOE 1998)
<i>GPM<sub>EE</sub></i>	Efficient flow rate	1.5	$\frac{gal}{min}$	Program materials

<sup>28</sup> Cadmus. Assessment of Long-Term, System-Wide Potential for Demand-Side and Other Supplemental Resources, 2013-2032. Prepared for: PacifiCorp. March 2013.

<sup>29</sup> Average DEER saving value for residential showerhead is 206 kwh per year for California climate zones 1 and 16. Cadmus evaluated the kit product savings using the commonly accepted engineering equation provided with inputs from the 2015-2016 kit participant surveys in the Pacific Power territory.

Parameter	Definition	Value	Unit	Source(s) <sup>1</sup>
<i>EV</i>	Showers per person per year	219		2013 Cadmus Study <sup>2</sup>
<i>PH</i>	People per household	2.40		2015–2016 kit participant survey (n=114)
<i>SH</i>	Showerheads per household	1.71		2015–2016 kit participant survey (n=115)
<i>T<sub>Mix</sub></i>	Usage water temperature	101	°F	2013 Cadmus Study <sup>2</sup>
<i>T<sub>In</sub></i>	Inlet water temperature	64.77	°F	Weather data
<i>RE</i>	Recovery efficiency	98	%	Constant
<i>ISR</i>	In-service rate	63.4	%	2015–2016 kit participant survey (n=104)
<i>%DHW</i>	Households with electric hot water	95.1	%	2015–2016 kit participant survey (n=103)
<b><i>ΔkWh</i></b>	<b>Energy Savings</b>	<b>130.4</b>	<b><i>kWh</i> <i>year</i></b>	<b>Calculated</b>

<sup>1</sup>Survey results reflect averages only for those receiving water-saving measures.

<sup>2</sup>Cadmus and Opinion Dynamics. *Showerhead and Faucet Aerator Meter Study*. Prepared for Michigan Evaluation Working Group. 2013.

Using the 2015–2016 kit participant survey, Cadmus calculated the evaluated ISR, the percentage of households with electrically-heated water, and the number of people and showers per household. The 2013 study informed assumptions regarding shower events per person, per year, the shower duration, and the water temperature at the TOU.

Table 46 shows reported and evaluated gross savings for kit showerheads, along with realization rates.

**Table 46. Kit Showerhead per Unit Reported and Evaluated Gross Savings**

Kit Measure	Reported Savings Per Unit (kWh)	Evaluated Savings Per Unit (kWh)	Realization Rate
Showerhead	140.0	130.5	93%

### **wattsmart Starter Kit Summary**

Using the above evaluated savings for CFLs, LEDs, aerators, and showerheads, Cadmus calculated savings for each kit type. Table 47 shows the percentage of evaluated savings attributable to each kit component.



**Table 47. Percent of Evaluated Savings Attributable to Each Kit Component**

Kit Name	Percent of Evaluated Savings				
	CFL Bulbs	LED Bulbs	Kitchen Aerators	Bathroom Aerators	Showerheads
Basic 1	15%	0%	34%	11%	40%
Basic 2	10%	0%	23%	14%	53%
Better 1	15%	0%	34%	11%	40%
Better 2	10%	0%	23%	14%	53%
Best 1	0%	21%	32%	10%	37%
Best 2	0%	14%	22%	14%	51%
CFL Only	100%	0%	0%	0%	0%
LED Only	0%	100%	0%	0%	0%

For all kits that included water-saving measures in addition to lighting, showerheads accounted for the greatest share of evaluated savings, followed by kitchen aerators.

For each of the eight **wattsmart** Starter Kit configurations, Table 48 shows quantities of each component included in the kit, the quantities of kits installed in 2015-2016, the reported and evaluated savings per kit, and the realization rates.

**Table 48. Components in and Savings by Each *wattsmart* Starter Kit**

Kit Name	Quantity per Kit					Kits Distributed	kWh Savings per Kit		Realization Rate
	CFL	LED	Kitchen Aerator	Bathroom Aerator	Showerhead		Reported	Evaluated	
Basic 1	4	0	1	1	1	624	271	327	120%
Basic 2	4	0	1	2	2	1,285	464	492	106%
Better 1	4	0	1	1	1	17	272	327	120%
Better 2	4	0	1	2	2	28	463	492	106%
Best 1	0	4	1	1	1	63	294	349	119%
Best 2	0	4	1	2	2	205	487	515	106%
CFL Only	4	0	0	0	0	279	57	49	87%
LED Only	0	4	0	0	0	30	80	72	90%
<b>Total<sup>1</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>2,531</b>	<b>918,900</b>	<b>998,737</b>	<b>109%</b>

<sup>1</sup>Total kits distributed and savings achieved.

Overall, **wattsmart** Starter Kits realized 109% of their reported overall savings, with kits including one of each water-saving measure performing best (i.e., 120% for Basic Kit 1, 120% for Better Kit 1, and 119% for Best Kit 1).

### *Advanced Power Strips*

In 2015, the HES program provided incentives for 1,117 APS. Cadmus evaluated APS savings using version 2.4 of the RTF workbook for APS.<sup>30</sup> The program incented master/periphery APS, which cut power to peripheral devices while master devices remained inactive.<sup>31</sup>

The RTF estimated annual savings of 20 kWh for units with a desktop as the master device (Home Office), and 40 kWh for units with a television as the master device (Home Entertainment Center). This resulted in 30 kWh in average savings per unit, assuming 39% of APS units used a desktop computer as the master device and assuming 61% of units used a television as the master device.

To better estimate master devices used by program participants, Cadmus included questions about APS use in its 2015-2016 general population survey of Pacific Power customers, but only eight survey respondents reported purchased an APS and none of those surveyed reported having purchased them as part of a utility sponsored sale. Cadmus also surveyed the general population on how they would use an APS if they were to buy one. Of those who responded 63% said they would use the device for their home entertainment center, 28% said they would use it for their home office, and 8% said they would use it somewhere other than a home entertainment center or home office. These findings closely match the RTF placement assumptions.

Due to the lack of participant survey responses Cadmus used the RTF assumed savings for APS units resulting in annual savings of 30 kWh resulting in a realization rate of 100%.

### *Heat Pumps*

Cadmus evaluated savings for four heat pump measures—including electric system to heat pump conversions and ductless heat pumps—for which Pacific Power offered incentives. Table 49 shows measures incented by Pacific Power and the RTF workbooks used in the evaluation.<sup>32</sup>

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<sup>30</sup> RTF. "Residential: Advanced Power Strips." ResAdvancedPowerStrips\_v2.4.xlsm. Available online: <https://rtf.nwcouncil.org/measure/advanced-power-strips>

<sup>31</sup> The APS deemed savings value of 213 kWh per year in DEER pertains to Tier 2 APS and thus not applicable to this evaluation.

<sup>32</sup> The DEER database does not include the ductless heat pump measure. For heat pump conversion, the savings were last updated in 2014, and are missing the combination of efficiencies in Pacific Power's program tracking database, reflecting the improvements in efficiency since 2014.



**Table 49. Heat Pump Measure List and Evaluation Sources**

Measure	Source
Electric System to Heat Pump Conversion—Tier 1	[1]
Electric System to Heat Pump Conversion—Tier 2	[1]
Heat Pump, Multi-Head, Ductless	[2],[3]
Heat Pump, Single-Head Ductless	[2]

[1]RTF. “Air Source Heat Pump Conversions SF.” ResSFExistingHVAC\_v4\_1.xlsm. July 18, 2016. Available online: <https://rtf.nwccouncil.org/measure/air-source-heat-pump-conversions-sf>

[2]RTF. “Ductless Heat Pumps for Zonal Heat SF.” ResSFExistingHVAC\_V4\_1.xlsm. July 18, 2016, Available online: <https://rtf.nwccouncil.org/measure/ductless-heat-pumps-zonal-heat-sf>

[3]Cadmus. *Ductless Mini-Split Heat Pump Impact Evaluation*. Prepared for: Electric and Gas Program Administrators of Massachusetts and Rhode Island. December 30, 2016. Available online: <http://ma-eeac.org/wordpress/wp-content/uploads/Ductless-Mini-Split-Heat-Pump-Impact-Evaluation.pdf>

Whenever possible, Cadmus refined the RTF model by incorporating program- or California-specific data. Cadmus used the 2015-2016 non-lighting rebate participant surveys to define baseline conditions. An estimated 48% of participants had central air conditioning prior to installing a heat pump. Prior to converting to heat pumps, Cadmus assumed all participants used an electric forced air furnace. The survey also indicated that 72% of participants used zonal heating systems, and 28% used electric forced air furnaces prior to installing ductless heat pumps. Therefore, for ductless heat pumps, Cadmus used this breakdown as a baseline, proportionally applying RTF-modeled savings for the baseline.

The RTF provided unique savings values for distinct heating and cooling zones, defined by the average annual heating degree days (HDDs) and cooling degree days (CDDs). Table 50 shows the distribution of units across the RTF-defined climate zones.<sup>33</sup>

**Table 50. Distribution of Units Across Climate Zones**

Heating Zone	# of Units	Percentage	Cooling Zone	# of Units	Percentage
1	242	98%	1	119	48%
2	4	2%	2	127	52%
3	0	0%	3	0	0%
<b>Sum</b>	<b>246</b>	<b>100%</b>		<b>246</b>	<b>100%</b>

Table 51 shows the quantity of each heat pump measure incentivized in 2015 and 2016, the reported and evaluated savings, and the realization rates.

<sup>33</sup> Cadmus classified the California participant zip codes into RTF-defined heating and cooling zones based on the following definitions: Cooling Zone (CZ) 1 < 300 Cooling Degree Days (CDD), 300 CDD < CZ2 < 600 CDD; Heating Zone (HZ) 1 < 6,000 Heating Degree Days (HDDs), 6,001 HDD < HZ2 < 7,499 HDD, HZ3 > 7,500 HDD.

Table 51. 2015–2016 Reported and Evaluated Heat Pump Savings

Measure	Quantity 2015	Reported Per-Unit Savings 2015	Evaluated Per-Unit Savings 2015	Realization Rate 2015	Quantity 2016	Reported Per-Unit Savings 2016	Evaluated Per-Unit Savings 2016	Realization Rate 2016
Electric System to Heat Pump Conversion—Tier 1	5	4,154	5,910	142%	7	4,154	5,951	143%
Electric System to Heat Pump Conversion—Tier 2	3	4,437	5,942	134%	3	4,437	5,942	134%
Heat Pump, Multi-Head, Ductless	34	4,717	4,185	89%	35	4,717	4,186	89%
Heat Pump, Single-Head, Ductless	92	3,500	3,206	92%	67	3,500	3,183	91%
<b>Weighted Average*</b>	<b>134</b>			<b>94%</b>	<b>112</b>			<b>95%</b>

\*Quantity values are summations, not average values.

The RTF provides saving values for single-head heat pumps but does not provide guidance on multi-head heat pumps. In 2016, Cadmus completed a metering study of 152 ductless heat pumps, including 45 multi-head units. Cadmus found the average rated heating capacity at 17 °F for multi-head units is 13,682 Btu/h and for single-head units is 10,632 Btu/h. To calculate the evaluated multi-head ductless heat pump savings, Cadmus increased the savings in proportion to the increased heating capacity at 17 °F.



### Heat Pump Water Heaters

Pacific Power offered incentives for several heat pump-related measures, and Cadmus evaluated these measures' savings using the relevant RTF workbooks. Table 52 shows measures incented by Pacific Power and RTF workbooks used in the evaluation.<sup>34</sup>

**Table 52. Heat Pump Water Heater Measure List and Evaluation Sources**

Measure	Source
Heat Pump Water Heater	[1]
Heat Pump Water Heater—New Homes	[1]

[1]RTF. "Heat Pump Water Heaters." ResHPWH\_v3\_4.xlsx. April 5, 2017. Available online: <https://rtf.nwcouncil.org/measure/hpwh>

Whenever possible, Cadmus refined the RTF model by incorporating program- or California-specific data. The RTF provided unique savings values for distinct heating and cooling zones, defined by average annual HDDs and CDDs. Cadmus used zip codes of California participants to map to specific RTF heating and cooling zones based on the HDDs and CDDs of the specific zip code. In addition, Cadmus used the Pacific Power tracking database efficiency tiers to match to the most-updated, corresponding RTF savings values. Beyond the measure-specific heating and cooling zone and efficiency tier, Cadmus used average savings from any size and any location.

Table 53 shows the quantity of each heat pump water heater measure incented in 2015 and 2016, along with reported and evaluated savings, and realization rates. The difference between the evaluated 2015 and 2016 savings is that all 2015 heat pump water heaters were Tier 1 and all 2016 units were Tier 2.

<sup>34</sup> Pacific Power's deemed savings for this measure follow the RTF and are based on Northwest Energy Efficiency Alliance's advanced heat pump water heater specification tiers (refer to: <http://neea.org/docs/default-source/advanced-water-heater-specification/advanced-water-heater-specification.pdf?sfvrsn=22>). The tiers are based on northern climate uniform energy factors (UEF). By contrast, the DEER workbooks are organized by energy factor (EF) and one third of the units incented have an EF in the program tracking database (EF=2.7) that is not addressed in the DEER database. Cadmus used the RTF workbooks to evaluate savings for all incented heat pump water heater units.

Table 53. 2015-2016 Reported and Evaluated Heat Pump Water Heater Savings

Measure	Quantity 2015	Reported Per-Unit Savings 2015	Evaluated Per-Unit Savings 2015	Realization Rate 2015	Quantity 2016	Reported Per-Unit Savings 2016	Evaluated Per-Unit Savings 2016	Realization Rate 2016
Heat Pump Water Heater	1	881	1,044	119%	2	1,786	1,438	81%
Heat Pump Water Heater, Self-installed	3	1,206	1,044	87%	9	1,725	1,438	83%
<b>Weighted Average*</b>	<b>4</b>			<b>93%</b>	<b>11</b>			<b>83%</b>

\*Quantity values are summations, not average values.

### Attic and Wall Insulation

Cadmus conducted a billing analysis to assess actual net energy savings associated with insulation measure installations.<sup>35</sup> Billing analysis is the accepted and widely used evaluation methodology for weatherization measures. The analysis determined the savings estimate using a pooled, conditional savings analysis (CSA) regression model to determine the savings estimate. The analysis involved the following groups:

- 2015–2016 insulation participants (combined attic and wall insulation)
- Nonparticipant homes, serving as the comparison group

Cadmus used program participants, a control group, billing consumption, and California weather data (specific to participant zip codes) to create a final database for conducting the billing analysis. This required matching participant program data with billing data and, using zip codes, mapping daily HDDs and CDDs to respective monthly read-date periods. The process defined the billing analysis pre-period as 2014 (before measure installations occurred) and the post-period as June 2016 through May 2017.<sup>36</sup>

To ensure the final model used complete pre- and post-participation and nonparticipant billing data, Cadmus applied several screening mechanisms (Appendix C provides further details).

### Insulation Results

Cadmus estimated average insulation savings of 767 kWh per participant, translating to a 78% net realization rate for insulation measures. This analysis resulted in net (rather than gross) savings as it

<sup>35</sup> Billing analysis was performed for customers only installing attic and wall insulation.

<sup>36</sup> Cadmus removed participants installing measures in late 2016 as they had less than 10 months of post-installation period data. Similarly, it removed customers participating in 2015 with measure installation dates before November 2014 as this produced less than 10 months of pre-period data.



compared participant use trends to a nonparticipant group, thereby accounting for market conditions outside of the program.

With an average participant pre-use of 12,437 kWh, savings represented a 6% reduction in total energy use from the insulation measures installed. Table 54 presents the overall net savings estimate for wall and attic insulation.

**Table 54. Insulation Net Realization Rates**

Model	Billing Analysis Participants (n)	Reported kWh Savings per Premise	Evaluated Net kWh Savings per Premise	Net Realization Rate	Relative Precision at 90% Confidence	90% Confidence Bounds
Overall	9	986	767	78%	±99%	1%–154%

Low insulation program participation rates resulted in the small sample sizes. Though leading to poor precision for savings, those savings nevertheless remained significant. The state-specific realization rate point estimate provided the best estimate for the program performance. In this case, using another state’s realization rate would not have been a better alternative as 12,437 kWh of pre-period usage was considerably lower than that of other states.

**Manufactured Homes Duct Sealing**

Cadmus conducted a billing analysis to assess evaluated energy savings associated with manufactured home duct-sealing measure installations,<sup>37</sup> determining the savings estimate from a pooled, CSA regression model that included the following groups:

- 2015–2016 duct-sealing participants
- Nonparticipant homes, serving as the comparison group

Cadmus used program participants, a control group, billing consumption, and California weather data to create a final database for conducting the billing analysis. This required matching participant program data with billing data, and, using zip codes, mapping daily HDDs and CDDs to respective monthly read-date periods. The process defined the billing analysis pre-period as 2014 (before measure installations occurred) and the post-period as June 2016 through May 2017.<sup>38</sup>

To ensure the final model used complete pre- and post-participation and nonparticipant billing data, Cadmus applied several screening mechanisms (with details provided in Appendix C).

<sup>37</sup> Billing analysis was performed for customers only installing duct sealing and/or duct insulation measures.

<sup>38</sup> As participants installing measures in late 2016 had less than 10 months of post-period data, Cadmus removed them from the analysis. Similarly, Cadmus removed customers participating in 2015 with measure installation dates before November 2014 as this produced less than 10 months of pre-period data.

## Manufactured Homes Duct Sealing Results

Cadmus estimated manufactured home average duct sealing savings of 875 kWh per home, translating to a 52% net realization rate for these measures. As with the insulation results, this produced net (rather than gross) savings as it compared participant usage trends to a nonparticipant group, thereby accounting for market conditions outside of the program.

With average participant pre-installation usage of 12,166 kWh, the savings represented a 7% reduction in total energy use from duct-sealing measures installed. Table 55 presents the overall savings estimate for duct sealing.

**Table 55. Manufactured Homes Duct Sealing Net Realization Rates**

Model	Billing Analysis Participant (n)	Reported kWh Savings per Premise	Evaluated Net kWh Savings per Premise	Net Realization Rate	Relative Precision at 90% Confidence	90% Confidence Bounds
Overall	144	1,688	875	52%	±26%	38%–65%

## Evaluated Net Savings

Cadmus tailored the net savings adjustment analysis to each measure and measure category, and developed net-to-gross (NTG) analysis methods prioritized by the highest saving measures. For upstream incentives offered for light bulbs, Cadmus conducted demand elasticity modeling, which estimated freeridership by modeling the elasticity of demand with respect to changes in a bulb’s price. For non-lighting measure categories, Cadmus conducted freeridership and participant spillover analysis using responses from the non-lighting rebated and kits participant surveys.

Further, Cadmus included a spillover battery in the 2015-2016 general population survey of Pacific Power customers in California to estimate nonparticipant spillover, consisting of savings generated by customers motivated by the program’s reputation and marketing to conduct energy efficiency installations without receiving an incentive. Cadmus estimated nonparticipant spillover as 2% of total Pacific Power residential **wattsmart** program evaluated savings. Cadmus applied the 2% NPSO equally across Pacific Power’s residential **wattsmart** program measures.

Table 56 provides the net savings evaluation results for evaluated gross savings, evaluated net savings, and NTG by measure type as well as the NTG methodology used.



**Table 56. HES Program NTG Methods and Results for 2015–2016**

Measure Category	Measure Name	Program Savings (kWh)		NTG	NTG Methodology
		Evaluated Gross	Evaluated Net		
Appliance	Clothes Washer	9,240	6,098	66%	Self-Response NTG
	Refrigerator	351	232		
Home Electronics	Advanced Power Strip	35,310	30,014	85%	Deemed <sup>3</sup>
HVAC	Single Head Ductless Heat Pump	508,223	401,496	79%	Self-Response NTG
	Ductless Heat Pump - New Home	13,736	10,851	79%	Self-Response NTG
	Duct Sealing	187,029	187,029	100%	No Adjustments <sup>2</sup>
	Evaporative Cooler	1,215	960	79%	Self-Response NTG
	Heat Pump Upgrade	4,092	3,233	79%	Self-Response NTG
	Heat Pump System Conversion	106,857	84,417	79%	Self-Response NTG
	Multi Head Ductless Heat Pump	221,159	174,716	79%	Self-Response NTG
	Room Air Conditioner	2,126	1,679	79%	Self-Response NTG
Kits	<b>watt</b> smart Starter Kit	998,737	908,850	91%	Self-Response NTG
Lighting	CFL Bulb	1,087,992	667,651	61%	Demand Elasticity Modeling
	LED Bulb	862,085	385,101	45%	
	CFL Fixture	2,196	2,240	102%	Current practice baseline used <sup>1</sup>
	LED Fixture	127,318	129,864	102%	Current practice baseline used <sup>1</sup>
Whole Home	All Measures	21,934	21,934	100%	Not evaluated
Water Heating	Heat Pump Water Heater	19,994	15,795	79%	Self-Response NTG
	Water Heater	468	309	66%	Self-Response NTG
Building shell	Attic Insulation	26,192	26,192	100%	No Adjustments <sup>2</sup>
	Wall Insulation	30,463	30,463		
<b>Total</b>		<b>4,266,715</b>	<b>3,089,084</b>	<b>72%</b>	

<sup>1</sup>Freeridership adjustments were not applied to measures as the engineering review used a current practice baseline to estimate savings, producing a net-of-freeridership result.

<sup>2</sup>Net adjustments were not applied to insulation and duct-sealing measures as the billing analysis conducted to generate savings produced a net result.

<sup>3</sup>Deemed NTG from California work paper: San Diego Gas & Electric. *Tier 2 Audio Visual (AV) Advanced Power Strip*. Work Paper WPSDGEREHE0004 Revision 0.3. August 25, 2015. Available at: <http://www.embertec.com/assets/pdf/CPUC%20Approval.pdf>

The following sections describe the NTG methodology used and provide detailed results for lighting and non-lighting.

## Lighting Evaluated Net Savings

To estimate HES program freeridership for CFL and LED bulbs, Cadmus performed demand elasticity modeling—a method for estimating net lighting savings based on actual observed sales. Cadmus used information from the program tracking database (provided by the program administrator) to predict bulb sales. The analysis expressed sales as a function of price (including incentives), seasonality, retail channel, and bulb characteristics. Appendix B provides further details about the elasticity model’s equation and diagnostics.

To complete the analysis, Cadmus used model coefficients to predict sales with program incentives in place (as observed in the tracking data) and for prices remaining at their original levels, in effect predicting sales absent program intervention. Cadmus then multiplied predicted sales—at the incented program price and at the price absent program incentives—by evaluated gross kWh savings per bulb.<sup>39</sup> The difference in savings between the hypothetical original price scenario and what actually occurred produced the CFL bulb savings attributable to the program.

The Pacific Power program, however, exhibited insufficient price variation for an evaluation specific to its California territory, and Cadmus combined California sales with Pacific Power’s Wyoming, Washington, and Idaho sales data to produce the elasticity estimates. While differences may occur in consumer behaviors between the three regions, combined Pacific Power sales provided the primary Pacific Power data covering the evaluation period and served as the most representative data available for estimating price elasticities (Appendix B provides detailed elasticity estimates).

Cadmus then applied these elasticity estimates to California sales data to reflect the observed markdown levels (i.e., the incentive price compared to the price without the incentive), the product mix (i.e., elasticities varied between standard, reflector, and specialty bulbs), and the retailer mix specific to Pacific Power California. Table 57 shows the net savings results.

**Table 57. Lighting Freeridership and Net of Freeridership**

Bulb Type	Freeridership	Net of Freeridership	NPSO	NTG*
CFLs	40%	60%	2%	61%
LED	57%	43%	2%	45%

\*May not sum due to rounding.

Overall, freerider savings were estimated at 40% for CFLs and 57% for LEDs. CFLs were discounted more in 2015 with a 64% markdown, decreasing to 59% in 2016. LEDs exhibited a 43% average markdown in

<sup>39</sup> Though statistical models over- or under-predict to some degree, predicted program sales should be close to actual sales using a representative model. Further, using predicted program sales rather than actual sales mitigated bias by comparing predicted program sales to predicted non-program sales.



2015, with higher discounts in 2016 of 56%. Table 58 shows average per-bulb prices and markdowns by year and bulb technology.

**Table 58. Per-Bulb Price and Freeridership by Technology**

Year	Technology	Final Price per Bulb	Original Price per Bulb	Markdown %	FR
2015	CFL	\$0.71	\$1.96	64%	38%
	LED	\$5.66	\$9.98	43%	61%
2016	CFL	\$0.98	\$2.41	59%	61%
	LED	\$2.91	\$6.64	56%	54%

Appendix B provides a detailed report on the demand elasticity modeling methodology and results.

**Freeridership Comparisons**

Table 59 compares LED freeridership estimates from several recent evaluations using the elasticity model approach. The table also shows the average markdown (if available), which serves as a significant driver of freeridership estimates.

**Table 59. Comparisons of LED Freeridership and Incentive Levels**

Evaluation	Freeridership	Markdown
<b>Pacific Power California (2015–2016)</b>	<b>57%</b>	<b>44%</b>
Focus on Energy Wisconsin (2016)	38%	57%
Focus on Energy Wisconsin (2015)	29%	NA
Midwest Utility 1 (2016)	40%	42%
Ameren Missouri (2015)	35%	NA
Northeast Utility (2016)	39%	47%
Mid-Atlantic (2015–2016)	39%	48%

Pacific Power California’s freeridership estimates were slightly higher than those observed in other Pacific Power/Rocky Mountain Power HES programs across the 2015 and 2016 evaluation periods. The California program notably differed from the other states in California’s lack of membership club store retailers. Club stores typically experience greater price elasticities than DIY and Mass Market retailers. Additionally, club stores typically account for a significant portion of program sales, therefore contributing to lower freeridership estimates.

Overall, CFL sales for 2016 were considerably lower than in 2015, and two of the three peak program sales months for 2015 coincided with months when lighting sales typically peak, regardless of program activity. The third peak and largest peak, occurred in June 2015, when prices did not significantly change and therefore did not appear to correlate with program activity.

LED sales appeared to correlate more closely with price changes, particularly in 2015, as considerably lower sales occurred through most of 2016, even as prices fell below those in 2015.

### Non-Lighting Evaluated Net Savings

Cadmus relied on the non-lighting participant survey to determine non-lighting NTG for appliances and home electronics, HVAC, and building shell measure categories for 2013 and 2014 participants. Freeridership and participant spillover constituted the NTG.

Cadmus used the following formula to determine the final NTG ratio for each non-lighting program measure:

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

### Methodology

Cadmus determined freeridership based on an approach previously developed for Pacific Power's 2009–2010 program evaluation<sup>40</sup> and most recently used for the other Pacific Power state's 2013–2014 HES program evaluations.<sup>41</sup> The approach determined freeridership using response patterns to a series of survey questions. Answered as “yes,” “no,” or “don't know,” these questions asked participants whether they would have installed the same equipment in the program's absence, and at the same time, amount, and efficiency. Question response patterns received freerider scores, and score distributions allowed Cadmus to calculate confidence and precision estimates.<sup>42</sup>

Cadmus determined participant spillover by estimating the savings amount derived from additional measures installed and whether respondents credited Pacific Power with influencing their decisions to install additional measures. Cadmus included measures eligible for program incentives, provided the respondent did not request or receive the incentive. Cadmus then used freeridership and spillover results to calculate the program NTG ratio. (Appendix D provides a detailed explanation of Cadmus' self-reported NTG methodology.)

### Freeridership

After conducting non-lighting participant surveys for appliances and home electronics, HVAC, and building shell participants, Cadmus converted responses to six freeridership questions into a score for each participant, using the Excel-based matrix approach described in Appendix D. Cadmus then derived each participant's freerider score by translating responses into matrix values and applying a rules-based calculation.

Figure 5 shows freeridership score distributions for surveyed non-lighting participants.

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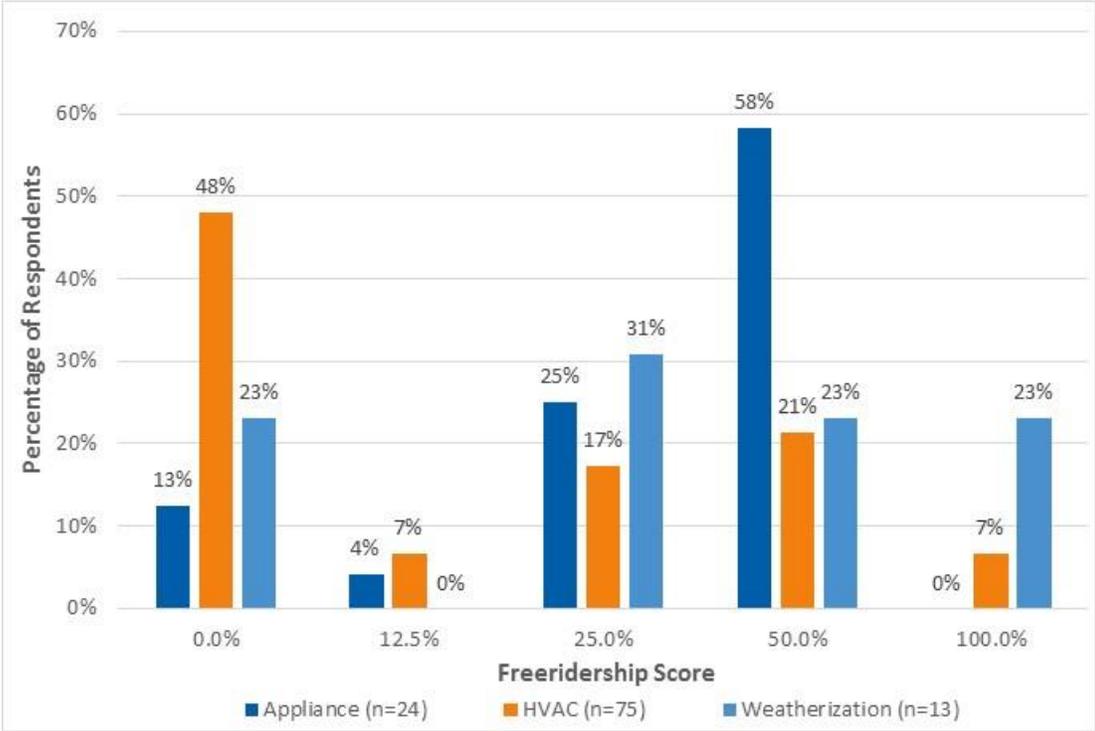
<sup>40</sup> Rocky Mountain Power. *Wyoming Evaluation 2009-2010 Report: Appendix I. NTG Evaluation Methodology*. [http://www.pacificorp.com/content/dam/pacificorp/doc/Energy\\_Sources/Demand\\_Side\\_Management/DSM\\_WY\\_HES\\_Report\\_2011.pdf](http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_WY_HES_Report_2011.pdf).

<sup>41</sup> The 2009–2010 California evaluation report did not include methodology details, while other Pacific Power states included the methodology. Cadmus did not evaluate the 2013–2014 HES program in California.

<sup>42</sup> This approach was outlined in Schiller, Steven, et al. “National Action Plan for Energy Efficiency.” *Model Energy Efficiency Program Impact Evaluation Guide*. 2007. Available online: [www.epa.gov/eeactionplan](http://www.epa.gov/eeactionplan).



Figure 5. Distribution of Freeridership Scores by Measure Category<sup>1, 2</sup>



<sup>1</sup>Total may not sum to 100% due to rounding.

<sup>2</sup>As the figure is not weighted by measure savings, it does not reflect the final freeridership rates.

Though approximately 13% of appliance measure category respondents and 48% of HVAC measure category respondents did not indicate freeridership, almost 23% of building shell measure category respondents were estimated as non-freeriders. This means they would not have purchased the efficient measure in the absence of Pacific Power’s program. More appliance respondents indicated high freeridership levels (scores of 50%–100%) than did the other measure categories.

**Kit Freeridership**

By measure, Table 60 summarizes freeridership findings for the kit measure category. Measure-level freeridership estimates were weighted by evaluated gross program population kWh savings to arrive at a 14% freeridership estimate for kit measures.

Table 60. HES Kit Measure Category Freeridership by Measure

Measure	Responses (n)	Freeridership Ratio	Evaluated Program Population kWh Savings
CFL	65	31%	110,311
LED	49	15%	21,474
Kitchen Faucet Aerator	62	6%	247,879
Bathroom Faucet Aerator	70	11%	130,516
Showerhead	77	15%	487,872
<b>Overall</b>		<b>14%<sup>1</sup></b>	<b>998,053</b>

<sup>1</sup>Weighted by evaluated program population kWh savings.

### Spillover

This section presents the results produced by additional, energy-efficient measures that customers installed after participating in the HES program. Although many participants installed such measures after receiving Pacific Power incentives, Cadmus attributed program spillover only to additional purchases significantly influenced by HES program participation and not claimed through the program. No respondents fell into this category, producing a 0% spillover estimate.

### Non-Lighting NTG Findings

Cadmus conducted surveys with participants in each measure category (e.g., appliance/home electronics, HVAC, building shell) to generate NTG ratios ranging from 66% for appliance/home electronics measures to 79% for HVAC.

Table 61 lists these findings. The NTG column indicates the percentage of gross savings attributable to the program. For example, participants purchasing an appliance measure received a 66% NTG, indicating that 66% of gross savings for appliance measures could be attributed to the HES program.

Table 61. Non-Lighting NTG Ratio by Measure Category

Program Category	Responses (n)	Freeridership Ratio	Participant Spillover Ratio	NPSO Ratio	NTG	Absolute Precision at 90% Confidence
Appliance	24	36%	0%	2%	66%	±6%
HVAC	75	23%	0%	2%	79%	±6%
Building Shell	13	34%	0%	2%	68%	±10%
Kit	118	14%	3%	2%	91%	±13%

<sup>1</sup>Weighted by evaluated program savings.

Table 62 shows freeridership, spillover, and NTG estimates for appliance and home electronic, HVAC, and building shell rebate programs, as reported for prior Pacific Power program years as well as for other utilities with similar programs and measure offerings.



Table 62. Non-Lighting NTG Comparisons<sup>1</sup>

Utility/Region	Reported Year	Responses (n)	Percentage FR <sup>2</sup>	Participant Spillover	NPSO	NTG
<b>Appliances</b>						
<b>Pacific Power California 2015–2016 HES Evaluation: Appliance/Home Electronics</b>	2016	24	36%	0%	2%	66%
Northeast Utility—Appliance	2015	65	65%	NA	3%	38%
Northwest Utility—Appliance	2014	73	79%	NA	2%	23%
<b>HVAC</b>						
<b>Pacific Power California 2015–2016 HES Evaluation: HVAC</b>	2016	75	23%	0%	2%	79%
Midwest Utility—HVAC	2015	73	51%	NA	1%	50%
Northwest Utility—HVAC	2014	48	72%	NA	1%	29%
<b>Building Shell</b>						
<b>Pacific Power California 2015–2016 HES Evaluation: Building shell</b>	2016	13	34%	0%	2%	68%
Midwest Utility—Weatherization	2015	208	30%	NA	2%	72%
Midwest Utility—Weatherization	2015	79	36%	NA	2%	66%
<b>Kits</b>						
<b>Pacific Power California 2015–2016 HES Evaluation: Kits</b>	2016	13	14%	3%	2%	91%
Midwest Utility—Kit	2015	150	8%	1%	NA	93%

<sup>1</sup>NTG values derived from self-response surveys, though differences in analysis and scoring methodologies may vary across evaluations.

<sup>2</sup>FR = Freeridership

<sup>3</sup>NPSO = Nonparticipant spillover

## Process Evaluation

This section describes the detailed findings arising from Cadmus’ process evaluation of the HES program. Cadmus based these findings on analysis of data collected through program staff interviews, lighting manufacturer/retailer interviews, the general population survey, three participant surveys, and secondary research. In conducting the evaluation, Cadmus focused on assessing the following:

- Effectiveness of the program design, marketing, and process
- Customer satisfaction and participation barriers
- HES upstream/midstream/downstream delivery channels vs. those used by other similar utility programs

Cadmus focused the research activities on key topics identified during the evaluation kick-off and on topics of interest identified by program stakeholders. Table 63 lists primary research questions used.

Table 63. Research Areas

Research Areas	Researchable Questions and Topics
<b>Program Implementation and Delivery</b>	
Program status	How did the program perform in 2015–2016, and what opportunities and challenges do program staff foresee for future program years?
Awareness	Are customers aware of the Pacific Power programs? If so, how did they learn about the programs?
Satisfaction	How satisfied are customers with their LEDs, APS, <b>wattsmart</b> Starter Kits, incented non-lighting measures, or contractors? Why?
Motivations	What actions have customers taken to save energy, and what motivated them to purchase a rebated LED, APS, <b>wattsmart</b> Starter Kit, or non-lighting measure?
Demographics	How do awareness/activities/behaviors vary by demographic characteristics?

## Methodology

Cadmus conducted the following process evaluation research:

- Program and marketing materials review
- Utility and administrator staff interviews
- General population survey
- Non-lighting participant survey
- **wattsmart** Starter Kit participant surveys
- Manufactured homes participant survey
- Upstream lighting retailer and manufacturer interviews
- Benchmarking of selected program components



### Program Materials Review

The program materials review concentrated on critical program documents and the program logic model:<sup>43</sup>

- Cadmus reviewed the HES program logic model and determined it reflected, with minor changes, the 2015–2016 program processes (see Appendix G)
- Cadmus reviewed Pacific Power’s marketing plans, online materials, and website, and compared the conveyed messages to challenges and motivations described by customers

### Utility and Administrator Staff Interviews

Cadmus developed stakeholder interview guides, collecting information about key topics from program management staff. The evaluation involved four interviews—one with program staff at Pacific Power, and three with program staff at CLEAResult (the program administrator, which oversaw the HES program in five PacifiCorp service territory states). These interviews covered the following topics:

- Program status and delivery processes
- Program design and implementation changes
- Marketing and outreach tactics
- Customer and trade ally experiences
- Barriers and areas for improvement
- Data tracking

Cadmus conducted the interviews by telephone, contacting interviewees via e-mail with follow-up questions or clarification requests, as needed.

### Participant Survey

Cadmus conducted telephone surveys with non-lighting participants, manufactured homes participants, and **wattsmart** Starter Kit participating customers, designing the survey instruments to collect data about the following process topics:

- **Program process.** Details to inform the following performance indicators:
  - Effectiveness of program processes
  - Program awareness
  - Participation motivations and barriers
  - Behavior changes (manufactured homes participants)

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<sup>43</sup> CLEAResult. **wattsmart Homes—Program Manual**. Pacific Power. Updated June 2016. CLEAResult. *Home Energy Savings—Implementation Manual*. Pacific Power. Updated August 2015. **wattsmart Homes 2015–2016 Marketing Activities** Excel file provided by CLEAResult. Updated March 9, 2017. Pacific Power. *2015 California Annual Review of Energy Efficiency Programs*. Issued March 15, 2016.

- Customer satisfaction
- Program strengths and/or areas for improvement
- **Customer information.** Demographic information and household statistics

### General Population Survey

Cadmus conducted a telephone survey with customers regarding LED lighting and APS purchases, designing the survey instrument to collect data regarding the following process topics:

- **Survey topics.** Details to inform the following performance indicators:
  - Upstream lighting and APS rebate awareness
  - Lighting purchase decisions and barriers to purchasing energy-efficient lighting
  - APS purchase decisions and barriers to purchasing APS
  - General population satisfaction with products purchased
- **Customer information.** Demographic information and household statistics

### Upstream Manufacturer/Distributor/Retailer Interviews

Cadmus conducted telephone interviews with five manufacturers, five distributors, and four retailers that provided LED bulbs and/or LED fixtures through the HES program, designing the interview to collect information about the following topics:

- State of the efficient products market
- Manufacturer/distributor/retailer's operations and stocking practices
- Experience with the HES program
- How the efficient products market and manufacturer/distributor/retailer operations would differ in the HES program's absence

### Benchmarking

In conversations with Pacific Power, Cadmus selected to benchmark the HES upstream/midstream/downstream delivery channels and measures offered through each channel against other similar utility programs across the country. Cadmus conducted this benchmarking, utilizing its ESource data resource as well as a library of Cadmus' current and past utility program evaluations.<sup>44</sup>

### Program Implementation and Delivery

Drawing on stakeholder interviews and participant survey data, this section discusses HES program implementation and delivery.

### Program Overview

During the evaluation period, Pacific Power offered energy efficiency measures in three primary categories (e.g., lighting/product, non-lighting, and **wattsmart** Starter Kits). The lighting component

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<sup>44</sup> Data from DSM Insights, used with permission from E Source.



used an upstream or midstream incentive mechanism with a discount applied at the point of sale, whereas the non-lighting component paid incentives post-purchase using mail-in or online incentive applications. All non-lighting component incentives were prescriptive.

In 2015, Pacific Power added APS to the program, initially offering it to customers through the upstream channel. In November 2016, Pacific Power expanded the delivery channels for APS to include mail by request, direct install, and downstream, but no units were incented in 2016.

Participants could order **wattsmart** Starter Kits through Pacific Power’s website, with delivery by mail. Alternatively, the program offered kits as direct-install measures to manufactured home duct-sealing participants. Pacific Power offered eight kit types, containing a mix of measures that depended on the participant’s lighting preferences (i.e., CFLs or LEDs) and on whether the participant used an electric water heater. Pacific Power delivered the basic kit package—including four CFLs—at no cost to customers. If customers reported using an electric water heater, they qualified for water-savings measures (e.g., bath and kitchen faucet aerators, a high-efficiency showerhead). The 2015 program offered a kit upgrade option from CFLs to LEDs for \$4.99. On January 1, 2016, Pacific Power stopped offering general purpose CFLs.

**Tariff Changes**

Pacific Power files program modifications (i.e., tariff changes) with the California Public Service Commission if making changes to the program or program measures. During the evaluation period, Pacific Power did not file tariff changes for California that affected the HES program.

**Delivery Structure and Processes**

In 2015, following a successful direct-install duct sealing pilot in 2014, CLEAResult partnered with a third-party trade ally to market direct-install duct sealing to owners of manufactured homes. Customers responded strongly, requiring CLEAResult to consider meeting the demand by extending the marketing opportunity to local trade allies in 2017. The Trade Ally section, below, discusses this in greater detail.

Additionally, CLEAResult increased retailer support to expand product LED selection in response to market shifts from CFL to LED technologies.

Pacific Power offered its midstream and upstream lighting incentives through retailers, identifying retailers using the Retail Sales Allocation Tool (RSAT), developed in partnership with the Bonneville Power Administration. RSAT helped Pacific Power reduce sales of incentivized measures to people residing outside of the company’s territory. The program administrator reported that RSAT’s approach helped the program reach customers in outlying areas, while enabling the program to stop incentivizing measures as its funds became exhausted for the year.

### *Data Tracking*

#### **Program Data**

CLEAResult reported that it enters downstream rebate application data into the program's Key What You See (KWYS) system, a Microsoft Access-based tool that performs an auto check to ensure an applicant's eligibility and all required information have been provided on the application. From KWYS, the information transmitted to Sprocket, a Salesforce database. Weekly, the program administrator pulled data from Sprocket into a DSM Central (DSMC) spreadsheet for invoicing. DSMC serves as Pacific Power's project management and reporting database.

Monthly, the program administrator provides Pacific Power with a snapshot of the program's actual performance compared to forecasts (a technique that Pacific Power reported as easy to use). In late 2016, the administrator began specifically addressing the program's quarterly progress toward goals, seeking to identify areas at risk for underdelivery or overdelivery, and to initiate more frequent program delivery strategy conversations to address these risks.

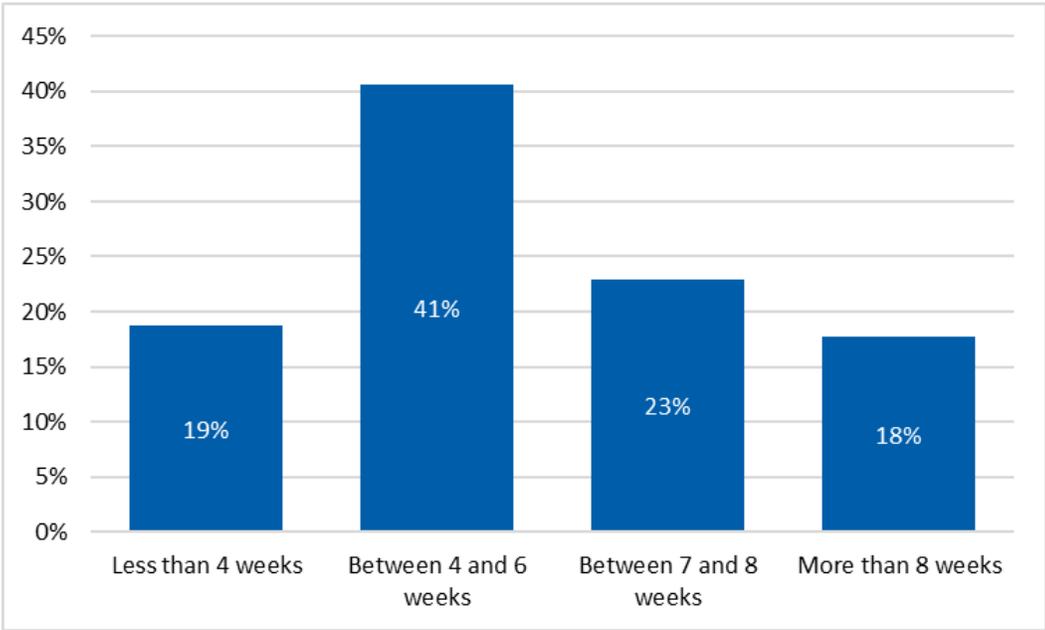
#### ***Application Processing***

In 2016, CLEAResult added mobile phone applications for contractors, and expanded online applications to include evaporative coolers, heat pumps, heat pump water heaters, and windows. These actions sought to streamline the submittal process and reduce missing information required to process the applications. Program staff, however, said customers still struggled to provide clear, legible images of their invoices. In 2016, CLEAResult also launched an online portal that allowed customers to enter their account numbers and track the status of their applications and incentives.

As shown in Figure 6, 41% of non-lighting customers reported receiving their incentive in four to six weeks after they submitted their applications.



Figure 6. Time Between Non-Lighting Application Submission and Incentive Receipt



Source: Pacific Power California HES Residential Non-Lighting Survey (Appendix A) (QE7). Don't know, refused, and have not received the incentive yet, responses removed. (n=96)

Regarding the time required to receive the incentive, 81% of non-lighting customers expressed satisfaction. Overall, 72% of non-lighting customers expressed high satisfaction rates (i.e., very satisfied) with the application process, and 23% said they were somewhat satisfied. The 4% reporting they were not very satisfied offered the following reasons:

- Having to resubmit the application multiple times
- An overly complicated and confusing process that took a great deal of time

**Trade Allies**

The program administrator continued use of a tiered system for trade allies, reflecting savings delivered to the HES Program by a trade ally and the attention level provided by the administrator. At a minimum, Tier 1 trade allies—those delivering 80% of program savings—would receive monthly calls from the administrator. The administrator provided a dedicated trade ally account manager to recruit and support trade allies in California, providing one-on-one coaching and sales tips, and answering questions. The administrator noted that, as the HES program moved more rebate applications online, trade allies reacted positively.

In 2015, Pacific Power successfully transitioned the manufactured homes duct-sealing initiative from a pilot to a program, delivered by a trade ally from Utah that generated interest and reached the initiative's goals. Initially, the administrator marketed the program with materials that directed customers to the trade allies. The administrator, however, reported that trade allies quickly became

overwhelmed with customers expressing interest. This led to the administrator stepping in to provide additional support and training for the trade allies, preparing them to manage the customer response.

## *Marketing*

### *Approach*

In 2016, Pacific Power emphasized **wattsmart** Starter Kits marketing to increase activity and capture additional savings. HES continued utilizing a variety of channels to communicate with customers, retailers, and trade allies. The administrator marketed the HES program using articles in the Voices bimonthly newsletter, direct mailers, bill inserts, social media, targeted letters to customers, a trade ally newsletter, and website features that employed tailored messages.

The program followed several key marketing strategies, including the following:

- Focusing on priority measures during key seasonal selling windows (e.g., heating season, cooling season, lighting season)
- Promoting **wattsmart** Starter Kits throughout the year, using targeted customer communication, multiple communication channels, and bill inserts in Spanish and English

The administrator also provided trade allies with some marketing collateral, such as general program fact sheets. In March, this help included providing funding to a trade ally that planned to run a newspaper advertisement for heat pumps; this allowed them to enlarge the ad and focus it on program-eligible ductless heat pumps.

In 2015, the program also targeted the manufactured homes market through a free duct testing and sealing offer. In 2016, the program introduced the online Home Energy Advisor tool, a survey allowing customers to visit the program website, quickly compare their home's energy usage to similar homes in their area, and receive savings estimates, along with recommendations of incentivized measures to help them save energy.

### *Effectiveness*

In California in 2015-2016, the administrator marketed the HES program using a combination of tactics, including bill inserts and content in Pacific Power customer newsletters and social media channels, to drive customers the HES website, where customer visits could be tied back to specific marketing activities.

Monthly, the administrator measured web traffic to HES landing pages and compared it to the prior and subsequent months to determine its effectiveness in increasing traffic to the site.

Table 64 illustrates two direct-to-customer bill inserts deployed in 2015-2016 and the subsequent lift in visits to the website.



**Table 64. Examples of Direct-to-Customer Bill Inserts 2015-2016**

Tactic	Measure(s)	Date	Increase in Website Visits
<b>2015</b>			
Bill Insert	Ductless Heat Pumps, Insulation	June, 2015	21%
<b>2016</b>			
Bill Insert	Cooling/Ductless Heat Pump	June, 2016	20%

Source: CLEAResult provided the data included in this table in response to follow-up questions submitted by Cadmus.

The administrator pointed out that bill inserts featuring specific equipment measures—such as those shown Table 64 above—continue to be effective vehicles to increase customer awareness about program incentives and measure benefits. However, the administrator noted, due to the number of regulatory inserts Pacific Power must send out each month in California, obtaining space for marketing can be very difficult.

The administrator added that while articles in Pacific Power newsletters and social media do not notably increase website traffic; they are used to maintain baseline awareness of the energy efficiency offerings from Pacific Power, at very low cost to the program.

Also, because the customer purchases qualified products offline, the program administrator is unable to tie marketing to actual purchases and installations.

One of the primary objectives of the HES website noted by the administrator, is to drive customers toward applying online for incentives. The administrator reported an increase in the number of year over year visits to the application landing page from 401 in 2015, to 748 in 2016.

***Program Challenges and Successes***

The administrator noted challenges in recruiting enough California trade allies due to the program’s small size and the market’s rural nature in Northern California. Throughout 2016, HES continued to utilize a trade ally located in Utah, to deliver duct testing and sealing to customers living in manufactured homes in California.

At Pacific Power’s request, the program administrator reached out to new homes energy raters to increase program engagement within the new homes market. The administrator set up a formal process for builders to apply for new homes measures and engaged one rater in California who provided one new homes project in 2015 (ductless heat pump), and 17 new homes projects in 2016 (7 ductless heat pumps and 10 whole homes)

In 2015–2016, the program distributed more than 2,500 kits, charging \$4.99 for kits containing LEDs. Customer participation declined from prior years, when the program provided kits containing CFLs at

no cost to customers. The administrator worked with the kit vendor to lower this price; currently (2017), Pacific Power offers LED kits at no charge.

### Customer Response

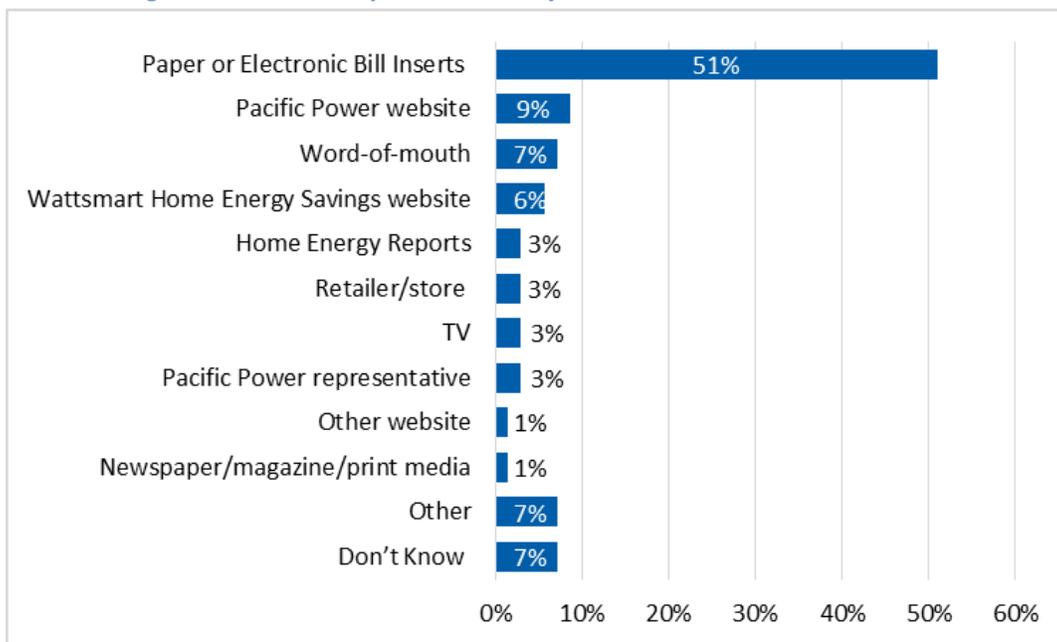
#### Awareness

Of the 250 general population customers surveyed, 69 knew of the **wattsmart** HES program, learning of the program from a variety of sources. Of those, 51% (n=69) reported bill inserts. Customers’ next most frequently cited the Pacific Power website (9%), and 7% could not recall where they learned of the program. “Other” responses included mail or emails received from Pacific Power or prior participation in a Pacific Power program.

The general population reported infrequently visiting the **wattsmart** website. Those visiting the site found it very helpful (9 of 16) or somewhat helpful (6 of 16), and said they looked for incentives, ways to save energy, or just were curious to see site materials.

Figure 7 presents general population awareness sources.

Figure 7. General Population Survey Source of **wattsmart** Awareness



Source: Pacific Power California HES Residential General Population Survey (Appendix A) (QE3). Refused responses removed. (n=69).

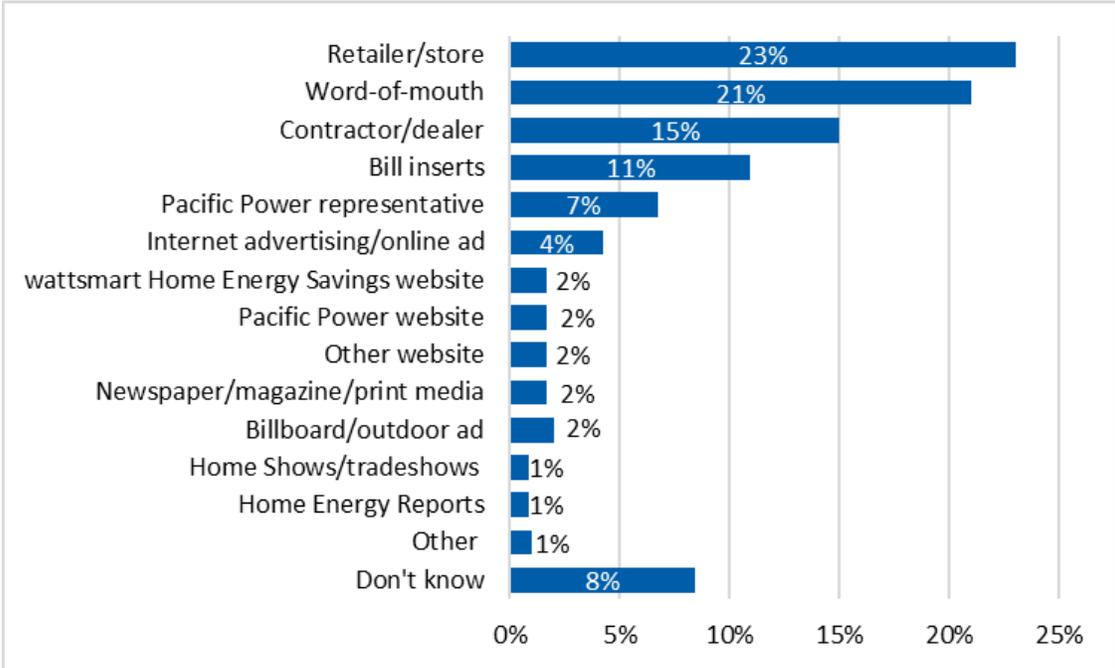
As shown in Figure 8, non-lighting participants more commonly reported learning of the program through a person or bill insert than through online or media. Participants most often cited the following sources:

- Retailers (23%)



- Word-of-mouth (21%)
- Installing contractors (15%)
- Bill inserts (11%, n=119)

Figure 8. Non-Lighting Participant Source of Awareness



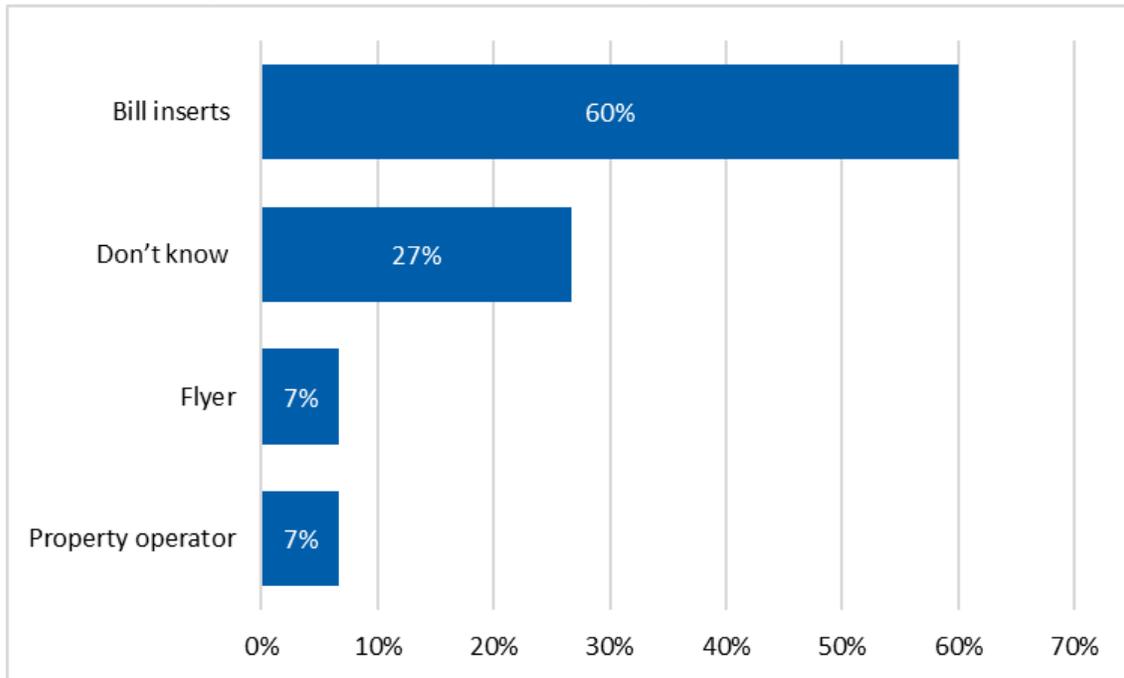
Source: Pacific Power California HES Residential Non-lighting Survey (Appendix A) (QC1). Refused responses removed. (n=119)

Of non-lighting participants visiting the **watt**smart website, 31% (n=115) found it very or somewhat helpful; and, of those visiting the website, 23% (n=13) said it needed nothing more to make it more helpful. The remaining participants made the following suggestions:

- Make the website easier to navigate
- Make program information more clear and concise
- Incorporate more visual information (e.g., charts, graphs, images) and less text
- Provide easier access to customer service or FAQs
- Provide links to other incentives

As shown in Figure 9, manufactured home participants most frequently reported learning about the program through bill inserts (60%). Only one of the 15 participants reported visiting the program website prior to participating in the program.

Figure 9. Manufactured Homes Participant Source of Awareness

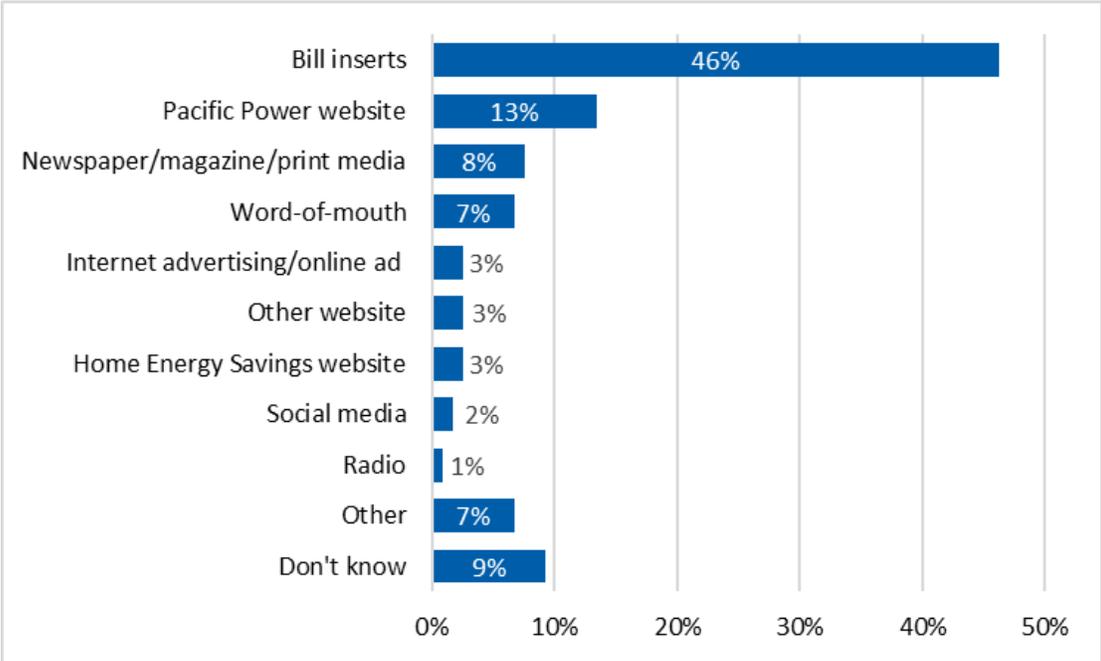


Source: Pacific Power California HES Residential Manufactured Homes Participant Survey (Appendix A) (QB1) (n=15).

Of kit customers, 46% reported learning about the program through bill inserts, 13% cited the Pacific Power website, 8% cited newspaper/magazines or print media, and 7% cited word-of-mouth. “Other” responses included phone, e-mail, and previous experience with other programs. Six kit customers (n=47) participated in the Home Energy Reports’ web portal. Figure 10 shows how all participants learned about the **wattsmart** Starter Kits.



Figure 10. Sources of Awareness (wattsmart Starter Kits)



Source: Pacific Power California HES Kit Survey (Appendix A) (QE5). Refused responses removed. (n=121)

**Lighting and APS Purchasing Decisions**

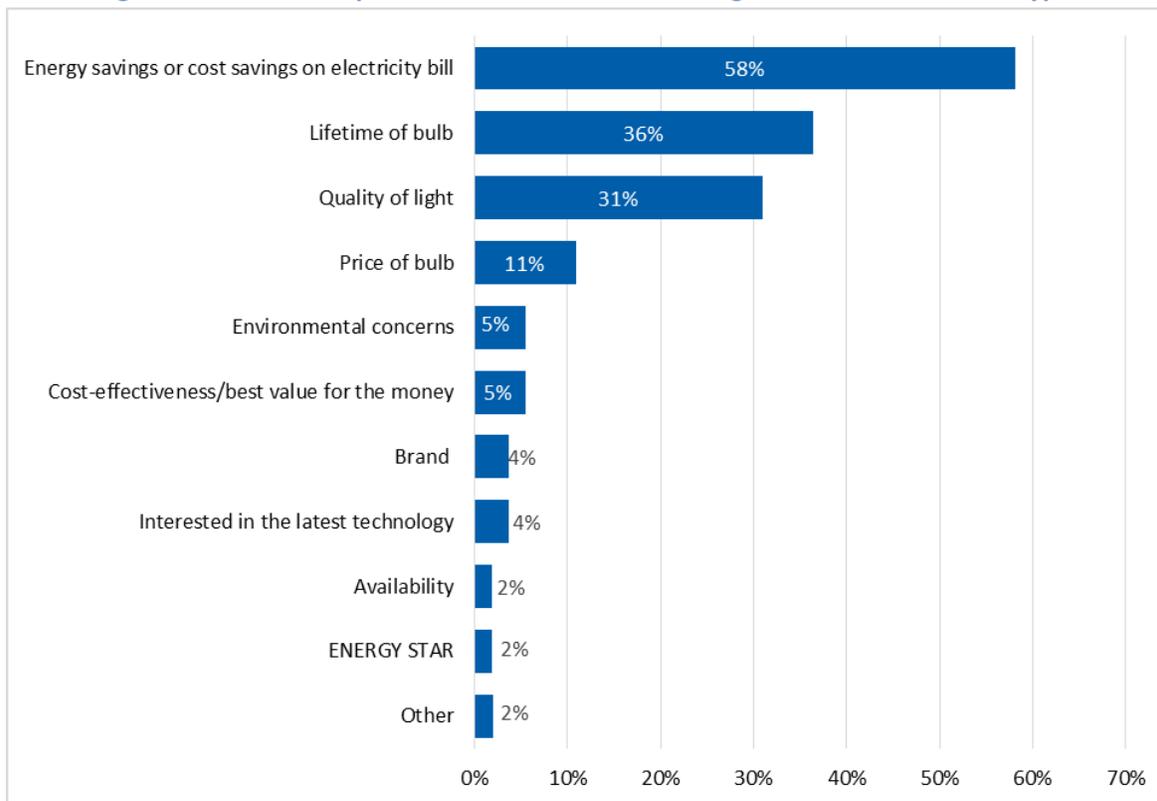
Through the general population survey, Pacific Power’s California customers expressed a variety of reasons for purchasing LEDs. As shown in Figure 11, participants most commonly cited energy or cost savings (58%) and bulb lifetimes (36%). “Other” reasons included familiarity with existing bulb types. Among customers purchasing LEDs in the past 12 months, 87% (n=53) intended to purchase LEDs over other bulb types.

Of 28 participants choosing not to buy LEDs, most commonly cited the bulbs’ cost as a reason to decline participation, with 36% considering the LEDs expensive (10 of 28). Respondents cited the following reasons:

- They did not think about the purchase and just chose what was readily available (5 of 28)
- LEDs were not available (4 of 28)
- Dissatisfaction with LED light quality (3 of 28)

The remaining respondents cited a familiarity with CFLs or other reasons that did not lead to a dominant theme.

Figure 11. General Population Reasons for Purchasing LEDs over Other Bulb Types



Source: Pacific Power California HES Residential General Population Survey (Appendix A) (QC7). Don't know responses removed. (n=55). Multiple responses allowed.

When asked, 79% of general population customers had not heard of APS (n=230); eight customers purchased and installed APS in the last 12 months, with most (five of eight) motivated to save energy.

### Non-Lighting Participation Decisions

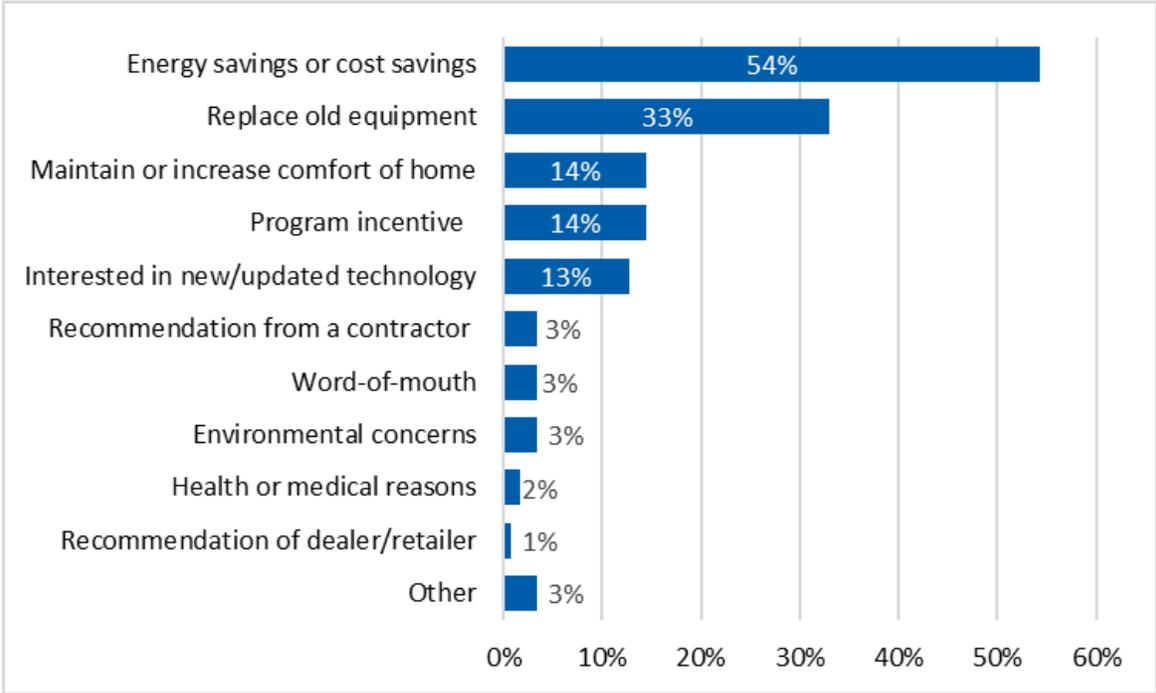
Pacific Power non-lighting participants reported different factors influenced their decisions to participate in the program. Most commonly, participants cited a desire to reduce energy use or costs (54%). They also cited the following reasons for participating in the HES program:

- Replacing old equipment that did not work or worked poorly (33%)
- Maintaining or increasing their home's comfort (14%)

"Other" responses included the equipment was on sale or provided in a "bundled" equipment purchase, or the new equipment simply was easier to operate than the equipment replaced.



Figure 12. Reasons for Participation (Non-Lighting)



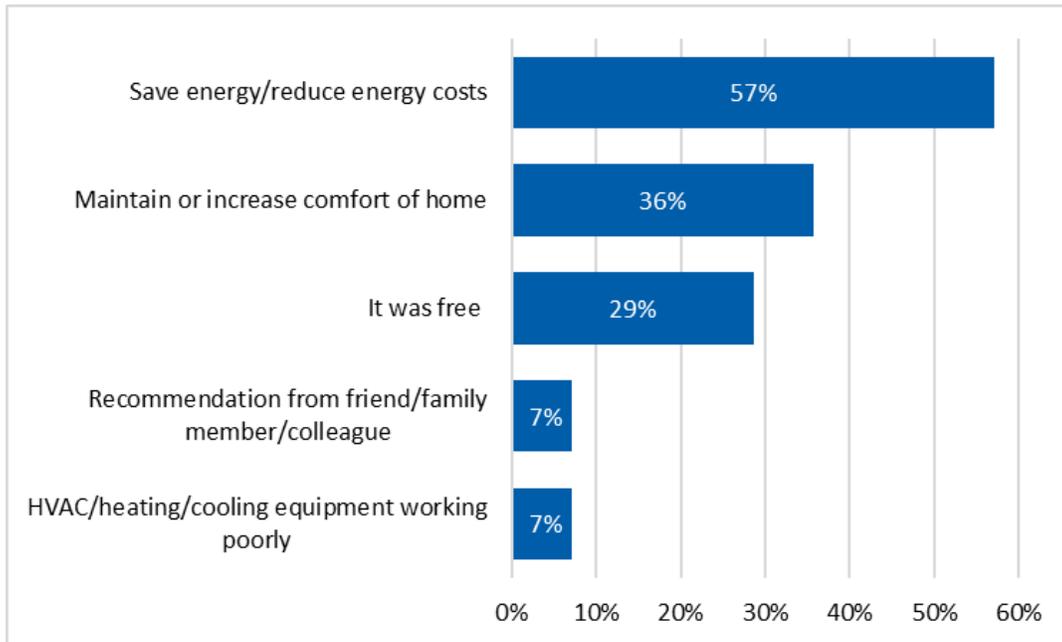
Source: Pacific Power California HES Residential Non-lighting Survey (Appendix A) (QC5) (n=118). Don't know and refused responses removed. Multiple responses allowed.

A majority of manufactured homes participants acted for the following reasons:

- Save energy and reduce energy costs (57%), 36% chose to Maintain or increase their home's comfort (36%)
- The service was offered at no cost (29%) (n=14)

Figure 13 shows all respondents' reasons.

Figure 13. Participation Reasons (Manufactured Homes)



Source: Pacific Power California HES Residential Manufactured Homes Participant Survey (Appendix A) (QB5). Multiple responses allowed (n=14).

### Kit Purchasing Decisions

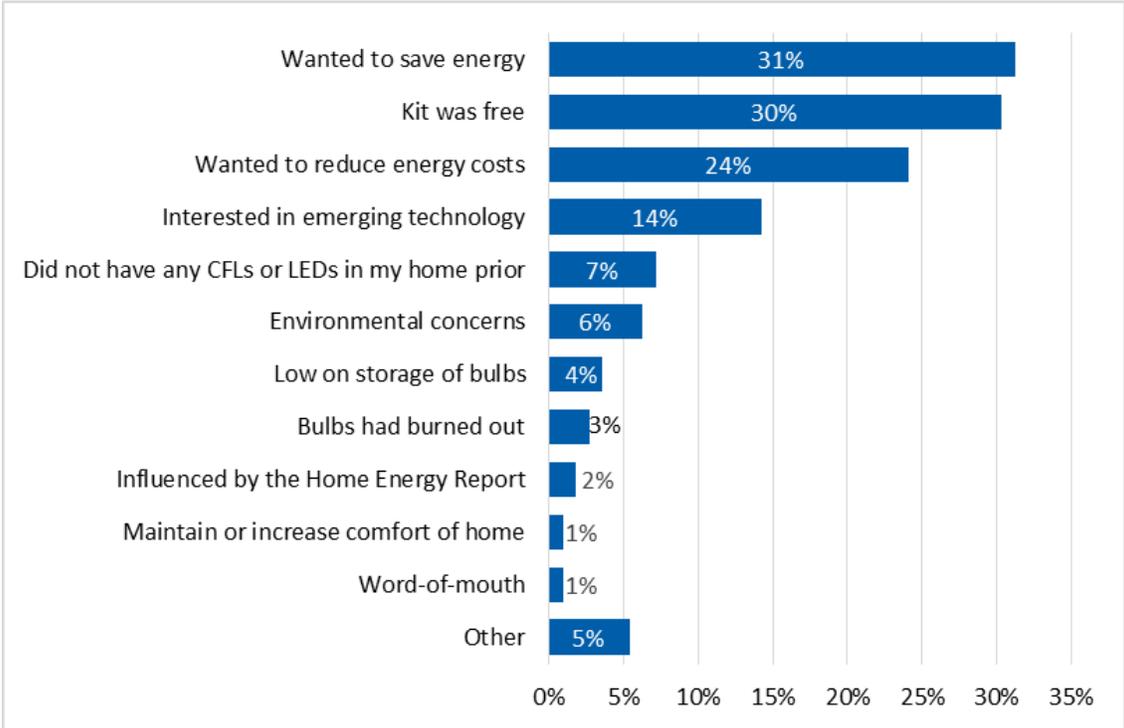
Pacific Power customers expressed a variety of reasons for applying for the **wattsmart** Starter Kit:

- Energy efficiency (31%)
- Free kits (30%)
- Reducing energy costs (24%)
- Emerging technology (14%)

Figure 14 illustrates customers’ motivations for requesting kits.



Figure 14. Reasons for Requesting a wattsmart Starter Kit



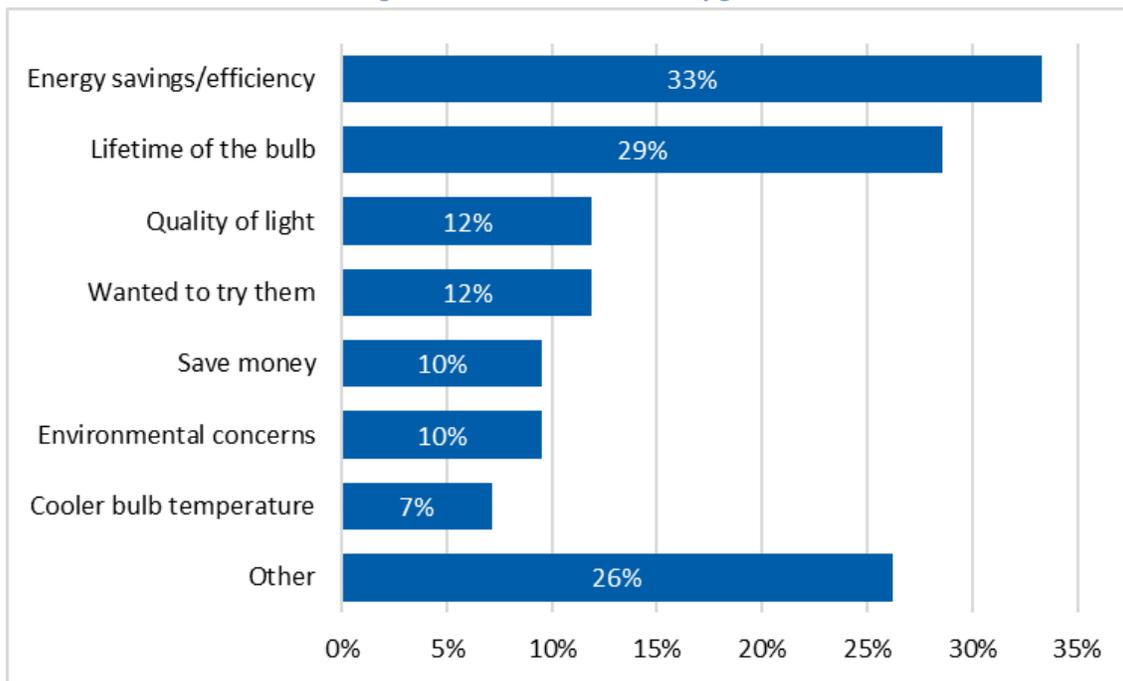
Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QE10). Don't know and refused responses removed. Multiple responses allowed. (n=112)

During the application process, customers could upgrade their kits from CFLs to LEDs for \$4.99 (down from \$19.99 in 2013–2014). Of 42 customers paying to upgrade their kits, top motivating factors included the following:

- Energy efficiency (33%)
- Bulb lifetimes (29%)
- Quality of light (12%)
- Interest in trying LEDs (12%)

“Other” responses included the bulb’s aesthetic (i.e., “They just look better”), the speed at which they come on, and wider availability in stores. Thirty-six percent (n=45) of respondents already planned to purchase the same type of LEDs that they received in the kits, and 13 customers already averaged 3.8 LEDs in their homes. Figure 15 shows all reasons customer cited for upgrading their kits to include LEDs.

Figure 15. Reasons for LED Upgrade



Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QB20). This was asked as an open-ended question, multiple response allowed. (n=42)

Cadmus asked customers why, when selecting CFL kits, they chose not to upgrade their kits to include LEDs. Of seven customers responding to this question, three chose not to do so due to cost, a lack of familiarity with LEDs, or a preference for CFLs. Of the remaining four customers, two said they would have upgraded had they known of the option.

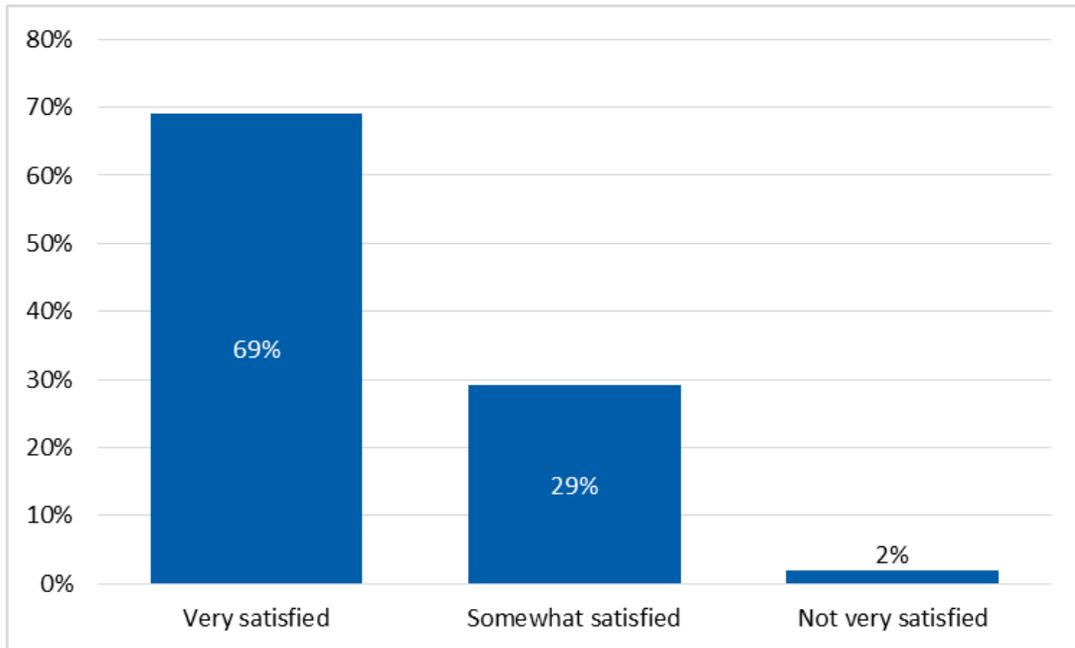
### Satisfaction

#### Lighting and APS

General population customers expressed satisfaction in purchasing LEDs, with 69% very satisfied, 29% somewhat satisfied, and 2% not very satisfied, as shown in Figure 16. Participants reported they were not very satisfied said the bulbs burned out quickly or it did not work with dimmers or three-way switches. Of general population customers purchasing APS in the last 12 months, only one was not satisfied, citing no reduction in energy use.



**Figure 16. General Population LED Satisfaction**



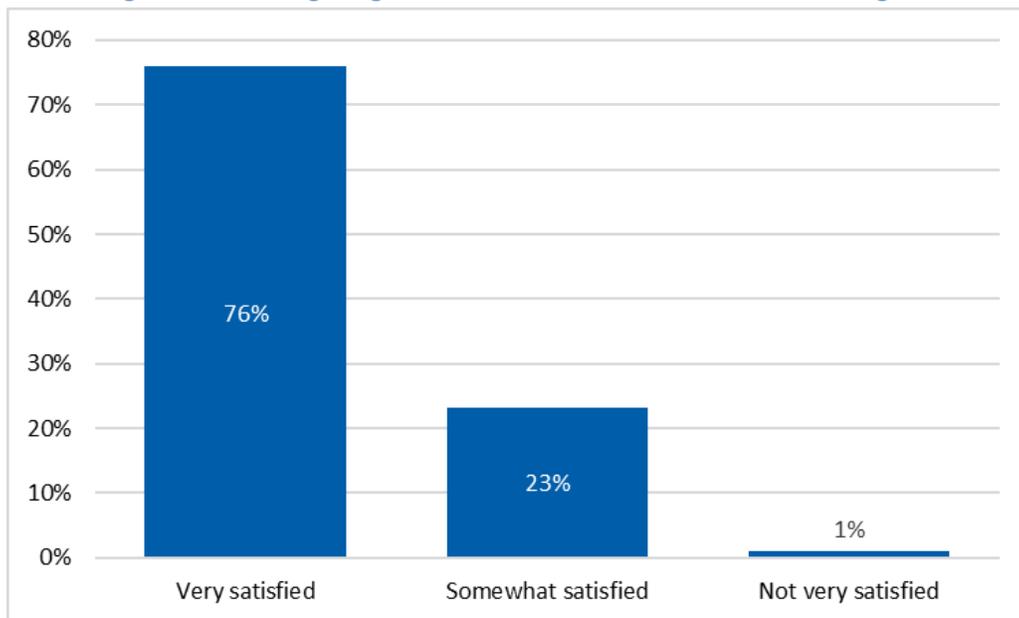
Source: Pacific Power California HES Residential General Population Survey (Appendix A) (QC16). Don't know and refused responses removed. (n=55).

### ***Non-lighting***

As shown in Figure 17, non-lighting customers expressed satisfaction with the HES program, with 99% of participants reporting their satisfaction. Participants reported many reasons for their responses, with representative comments including the following:

- “The incentives give information to make changes to our home.”
- “It’s easy and simple.”
- “Well our bills are stable. Our house is comfortable all day long.”
- “Because it is just what I need to push me over to be able to be energy-efficient.”

Figure 17. Non-Lighting Satisfaction with the wattsmart HES Program



Source: Pacific Power California HES Residential Non-lighting Survey (Appendix A) (QE10). Don't know and refused responses removed. (n=108)

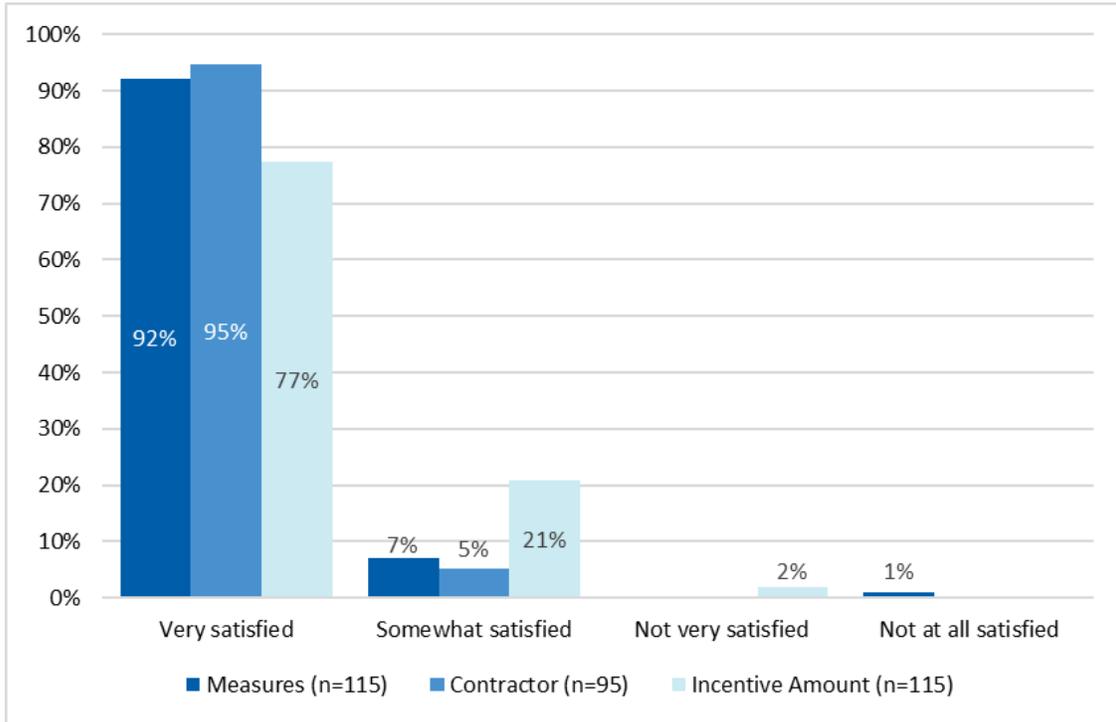
Program participation appeared to positively or neutrally affect most customers' perceptions of Pacific Power. When asked whether their participation in the HES program caused their satisfaction with Pacific Power to change, 43% of non-lighting customers said it increased their satisfaction, 53% said it stayed the same, and 4% said it decreased. In addition to overall HES program satisfaction levels, non-lighting customers expressed high satisfaction levels with measures they installed, their contractors, and incentive amounts they received.

As shown in Figure 18, 92% of non-lighting customers reported they were very satisfied with measures installed; 7% were somewhat satisfied.

More than three-quarters (82%, n=116) of non-lighting participants hired contractors to install measures for which they received program incentives. As Figure 18 also shows, 95% of participants reported being very satisfied with their contractors; 5% were somewhat satisfied.



Figure 18. Non-Lighting Satisfaction with Measures, Contractors, Incentive Amounts



Source: Pacific Power California HES Residential Non-lighting Survey (Appendix A) (QE1, QE3, QE6). Don't know and refused responses removed.

A slightly smaller share of participants expressed satisfaction with the incentive amounts they received, with 77% reporting they were very satisfied and 21% said they were somewhat satisfied.

Non-lighting customers found the HES program incentive application easy to fill out, with 73% of respondents reporting it very easy, 21% reporting it somewhat easy, 4% reporting it not very easy, and 2% reporting it not at all easy. Participants reporting trouble with filling out the application noted the application's complexity and filing the paperwork multiple times for reasons such as a missing signature.

Participants in manufactured homes duct sealing reported high satisfaction levels with the professionalism and attitude of contractors performing the measure, with 87% very satisfied, 7% somewhat satisfied, and 7% not very satisfied (n=15). A large majority of participants reported satisfaction with the application process (93%, n=15). On average, 15.4 days passed between arranging the appointment and the contractor's first visit to the home (including two participants who reported the process took 30 days), and the work took 8.4 days to complete (n=5). Most participants (n=10) reported not knowing the number of days between arranging the appointment and the contractor's visit or the time required to complete the job.

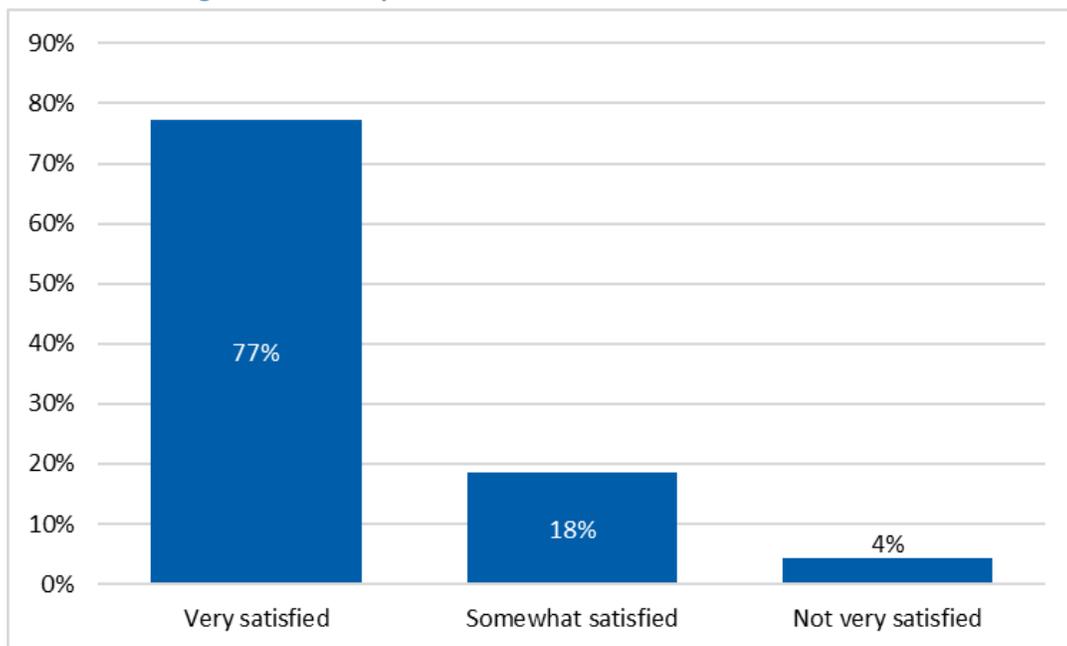
Though 33% found their homes more comfortable after duct sealing, 67% noticed no change (n=15). Forty percent of manufactured homes participants said participation in duct testing and sealing

increased their satisfaction with Pacific Power, 47% said their satisfaction levels stayed the same, and 13% said their satisfaction levels decreased. Nothing in the collected data indicated why these two participants were less satisfied.

**wattsmart Starter Kits Program Satisfaction**

As shown in Figure 19, nearly all kit recipients expressed satisfaction with the **wattsmart** Starter Kit overall, with 95% of participants reporting they were very or somewhat satisfied with the kit they received.

**Figure 19. Participant Satisfaction with *wattsmart* Starter Kit**



Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QE4). Don't know responses were removed. (n=119)

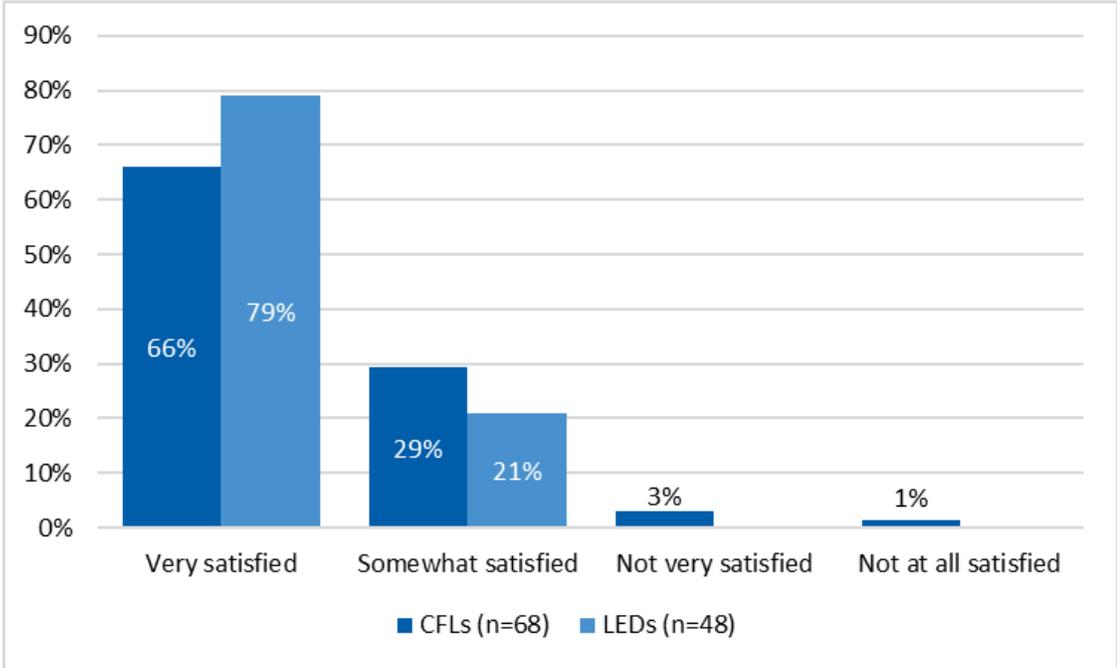
**Satisfaction with Kit Measures**

Kit recipients reported high satisfaction levels with kit components. As Pacific Power offered eight kit variations, with either CFLs or LEDs and water measures (depending on whether the customer had electric water heating), survey respondents answered questions pertaining only to their specific kit's contents.

As shown in Figure 20, 66% of CFL kit respondents were very satisfied with CFLs they received, 29% were somewhat satisfied, and 3% were not very satisfied; 1% reported being not at all satisfied. Dissatisfied customers reported CFLs did not produce bright enough light and made a "buzzing" noise. One-hundred percent of LED respondents were very satisfied or somewhat satisfied with the bulbs.



Figure 20. Satisfaction with CFLs and LEDs in wattsmart Starter Kit

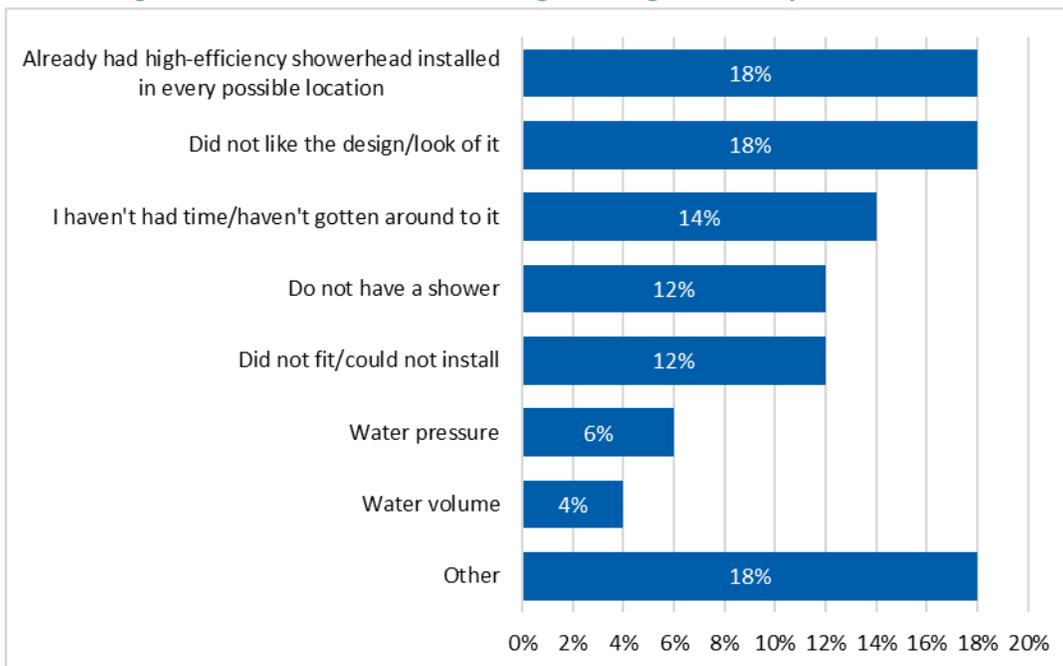


Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QB6, QB21). Don't know and refused responses removed

Kit participants expressed satisfaction with the number of CFL and LED bulbs provided: 67% of customers receiving a CFL kit reported being very satisfied, and 30% reported being somewhat satisfied. Sixty-eight percent of customers receiving an LED kit reported being very satisfied and 30% reported being somewhat satisfied with the number of LEDs in the kit. Both CFL and LED participants expressed dissatisfaction with receiving too few bulbs. Overall, customers reported 79% (n=248) of the CFLs received and 90% (n=192) of the LEDs received remained currently installed in their homes. A small number of bulbs originally received had been removed upon burning out. Customers stored the remaining uninstalled bulbs.

Customers reported somewhat lower installation rates for kit water measures than for CFLs or LEDs, as shown in Figure 21, with customers installing 63% (n=172) of showerheads received. Of customers not installing all units provided, 18% already had a high-efficiency showerhead, 18% did not like the design, 14% had yet to install units, and 12% said they did not have a shower. Of "other" responses, 18% (9 of 50) preferred the showerhead they had. The majority (74%) of these customers put unused showerheads in storage.

Figure 21. Reasons for Not Installing Both High-Efficiency Showerheads



Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QC2). Don't know removed. Multiple responses allowed. (n=50)

Customers expressed satisfaction with showerheads received: 65% of respondents said they were very satisfied; 24% said they were somewhat satisfied; and 71% found the showerheads very easy to install.

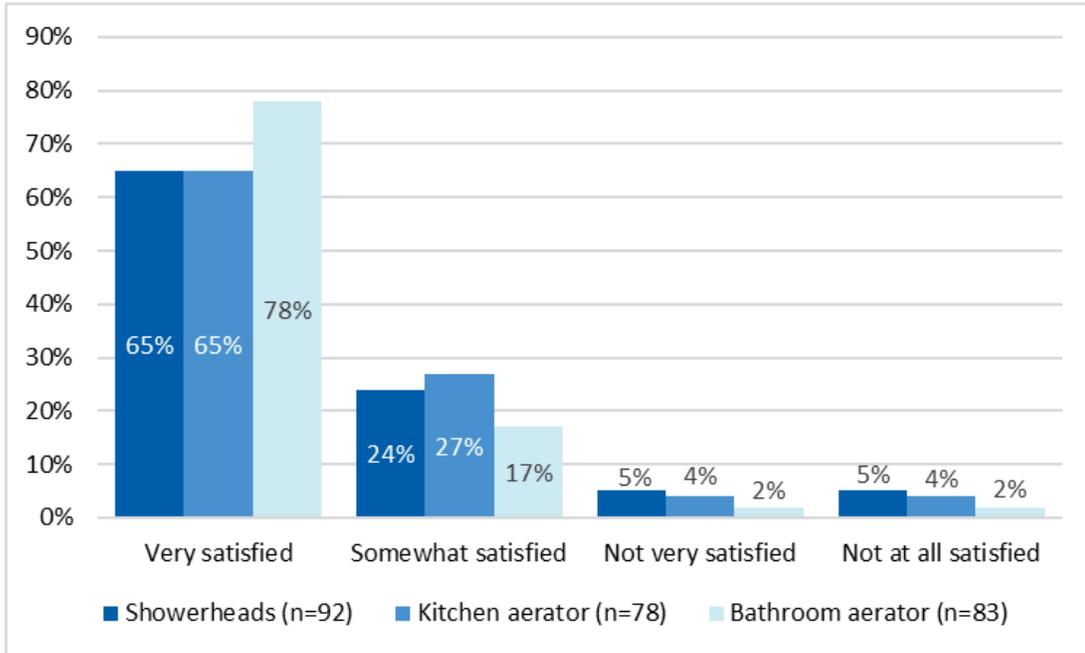
Respondents installed 60% (n=93) of kitchen faucet aerators. Over one-third (32%, n=37) of respondents not installing the kitchen faucet aerators said they did not fit, and 22% said they already had kitchen faucet aerators installed in every possible location. Respondents also installed 61% (n=155) of bath aerators. Twenty-eight percent (n=43) of respondents not installing the aerator said they did not have sufficient time or had not "gotten around to it yet"; 21% said they already had bathroom faucet aerators installed in every possible location, and 14% said they did not fit. Seventy percent of respondents that did not install the kitchen aerator, and 85% of those not installing the bathroom aerators put the units in storage.

Kit recipients expressed similar satisfaction levels with all water measures with two exceptions: very satisfied customers reported higher satisfaction levels with bathroom aerators than with kitchen aerators or showerheads.<sup>45</sup> Figure 22 shows satisfaction levels for each water measure.

<sup>45</sup> Statistically significant change (p-value <0.10).



Figure 22. Water Measure Satisfaction



Source: Pacific Power California HES Residential Kit Survey (Appendix A) (QC4, QD4, QD12). Percentages may not total 100% exactly, due to rounding.

Customers found the application easy to fill out, with 84% of respondents reporting it very easy, 13% reporting it somewhat easy, and 1% reporting it somewhat difficult due to trouble with getting the application to advance to the next screen (n=109).

### Customer Demographics

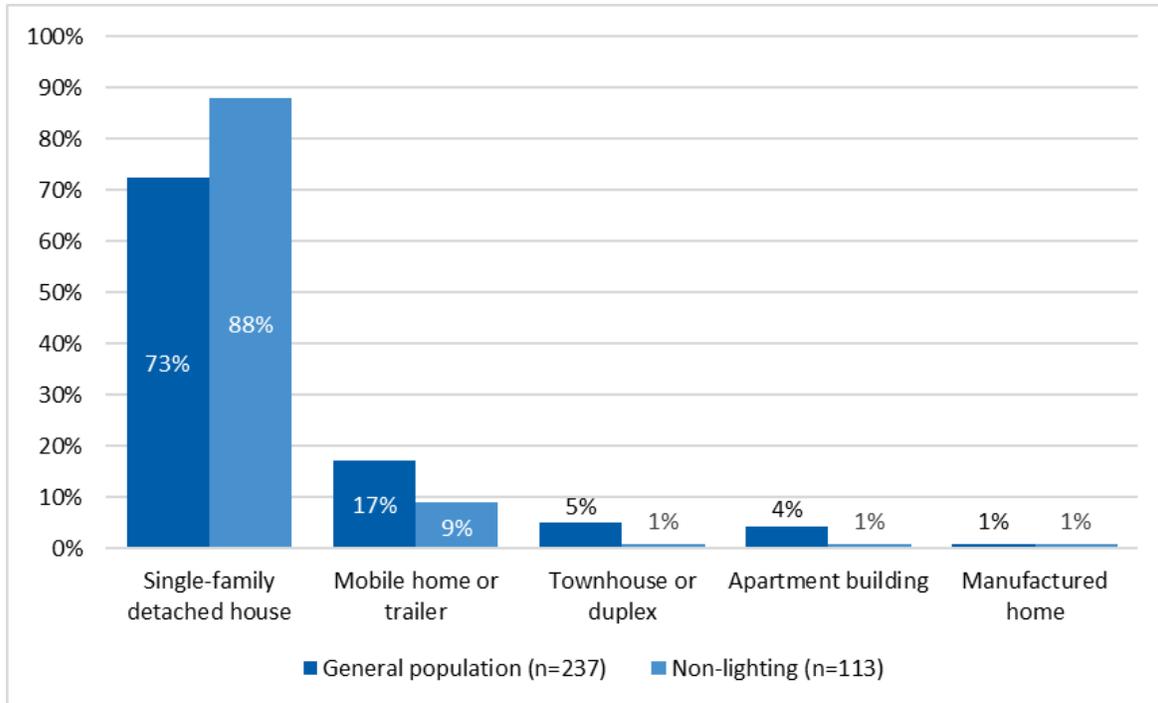
As shown in Figure 23, most of the general population surveyed and non-lighting participants lived in single-family homes, with a small percentage of customers residing in mobile homes, townhomes, apartments, or manufactured homes.

Sixty-four percent of the general population surveyed (n=235), 96% of non-lighting participants surveyed (n=112), and 100% of manufactured homes participants (n=14) reported owning their homes, with an average of fewer than three people residing in non-lighting participants' homes, and fewer than two people residing in manufactured homes. Eighty-five percent of non-lighting participants (n=105), 81% of general population customers (n=228), and 93% of manufactured home participants (n=14) used electricity to heat water. Additionally, 80% of non-lighting participants reported living in a home of 2,000 square feet or less (n=103), and 75% of manufactured homes participants reported living in a home of 1,500 square feet or less (n=12).

Most general population customers used a wood stove (34%) or electric baseboard heating systems (16%, n=213); 16 customers (8%) reported using Monitor or Toyotomi direct-vent fuel oil heaters. Respondents reported the average age of all heating systems as 14.71 years, and most general population customers reported not using cooling (45%). Those using cooling reported central air

conditioning (14%) and/or room air conditioners (13%, n=223, multiple responses allowed). All cooling systems had a reported average age of 10.2 years.

Figure 23. General Population and Non-Lighting Residence Types



Source: Pacific Power California HES Residential General Population and Non-lighting Surveys (Appendix A). (QG1 General Population, QH1 Non-lighting). Don't know and refused responses removed. General population apartment buildings break down as follows: 1% at four units or less, and 3% at five or more units. All non-lighting apartment buildings had four or more units.

Manufactured home participants heated with an electric furnace (75%), ground or air source heat pump (16%), or a kerosene Monitor heater (8%, n=12), with that average age of all heating systems reported as 16.3 years. Most manufactured home customers also used a heat pump (30%), whole-house fan (23%), central air conditioning, or window unit (15% and 8%, respectively); 31% reported not using cooling (n=13, multiple responses allowed). Cooling systems reported an average age of 14.12 years.

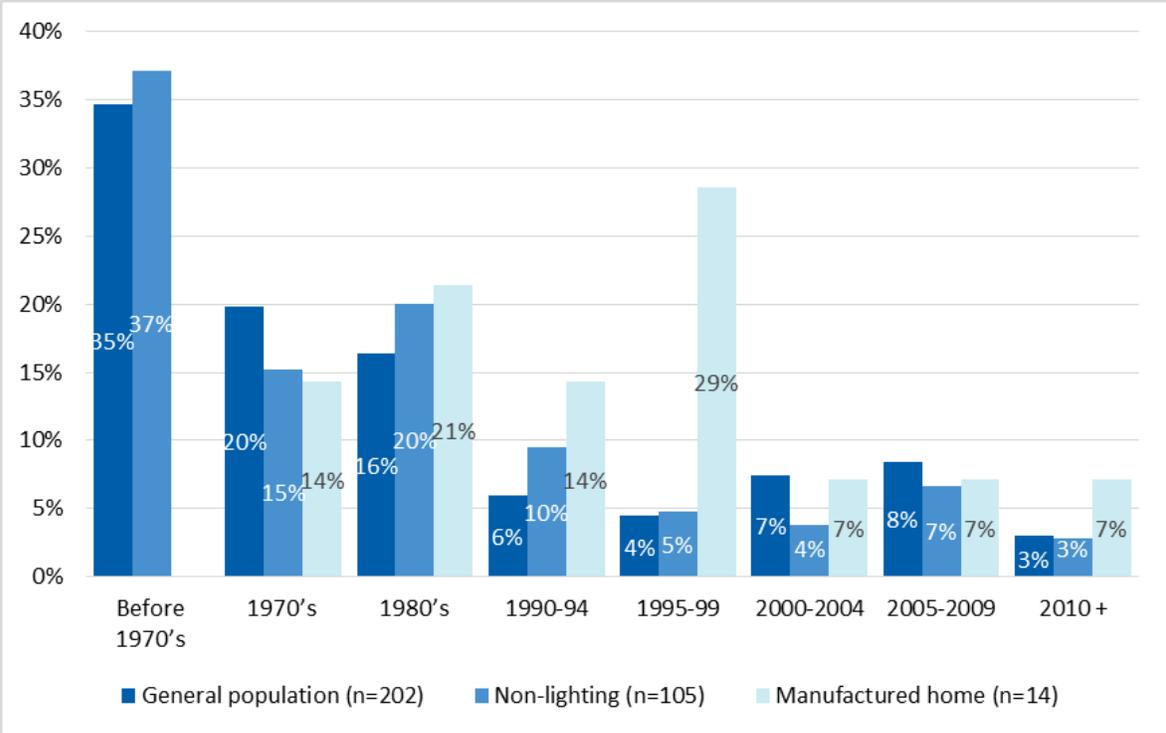
During summer, manufactured home participants set their thermostats at an average of 73.66 degrees before duct sealing (n=9) and an average of 74.5 degrees after duct sealing (n=4). During winter, participants set their thermostats at an average of 69.6 degrees before duct sealing (n=15) and an average of 68.57 degrees after duct sealing (n=7).

Figure 24 shows survey respondents in the general population and non-lighting groups reported similar results for all home vintage categories. Cadmus did not find statistically significant differences between these two groups. Manufactured home participants did not report pre-1970 vintage homes, with



significantly more homes built between 1995 and 1999 than the homes of general population or non-lighting participants.<sup>46</sup>

**Figure 24. General Population and Non-Lighting, and Manufactured Home Age**



Source: Pacific Power California HES Residential General Population, Non-lighting, and Manufactured Home Surveys (Appendix A). (QG3 General Population, QH4 Non-lighting, QG6 Manufactured Home). Don't know and refused responses removed.

**Upstream Lighting Manufacturer, Distributor, and Retailer Response**

Cadmus interviewed five manufacturers, five distributors, and four retailers.<sup>47</sup> Program partners' time with the program varied from 1.5 years to more than 10 years, averaging 4.5 years (n=13).

**Retailer Product Sourcing and Stocking Practices**

Three interviewed retailers sourced LED lighting products directly from the manufacturer; one sourced through a buying group.

When deciding which program-eligible products and the quantities of those products to stock, retailers reported different considerations. One—an independent retailer— cited the product's price as well as

<sup>46</sup> Statistically significant change (p-value <0.10).

<sup>47</sup> Three distributors were represented by the same third-party company that provided mark-down rebate services. The third-party respondent provided responses unique for each of the three companies represented.

customer requests. A second independent retailer ordered and stocked all program eligible products, basing the quantity stocked on the volume of sales for each product. A third independent retailer only stocked a small quantity of “basics,” while the fourth respondent, a big box chain, remained unsure, saying the corporate level—not store levels—decided selections and quantities ordered.

Retailers reported changing their stocking practices during the last year in response to a market slowdown and the products provided to them. Changes included stocking larger packs of bulbs, conducting buybacks as LEDs improved, and a retailer moving product from an endcap (reserved for high-volume new products) to a wall, and placing a large banner on the wall that said "Presented by Pacific Power."

When asked, hypothetically, what stocking changes respondents would make if Pacific Power ended the HES program tomorrow, three said they would discontinue or reduce the product, and one said they would immediately look for another supplier to maintain volumes on their shelves as their customers asked for these products. Retailers also said the phase-out of discounts on screw-based CFLs had little to no effect on their stocking practices, and one reported that LED sales quickly filled the initial vacuum.

### Manufacturing and Distribution Practices

All but one manufacturer reported constantly changing products to keep up with breakthroughs in higher-efficiency bulbs, to meet ENERGY STAR guideline for bulbs or Design Lights Consortium (DLC)<sup>48</sup> certification for fixtures, or to comply with California lighting standards. Manufacturers also reported modifying products to compete in the market for higher-efficiency, lower-cost fixtures—particularly to compete with products from China. Distributors said they regularly changed their product to meet ENERGY STAR guidelines.

When asked the same hypothetical question (i.e., what changes they would make if Pacific Power ended the HES program tomorrow), all 10 retailers said they would change little or not at all for the following reasons: the California program represented a small portion of their sales; changes to manufacturing required multi-state scales; and because Pacific Power already required that program-eligible bulbs and fixtures met ENERGY STAR standards.

Respondents also said discounts phase-outs on screw-based CFLs had little to no effect on their manufacturing or distribution practices, with only one reporting they stopped manufacturing CFLs due to strict specifications which, in their opinion, “killed the CFL market.” Another manufacturer commented that consumers never really embraced CFLs.

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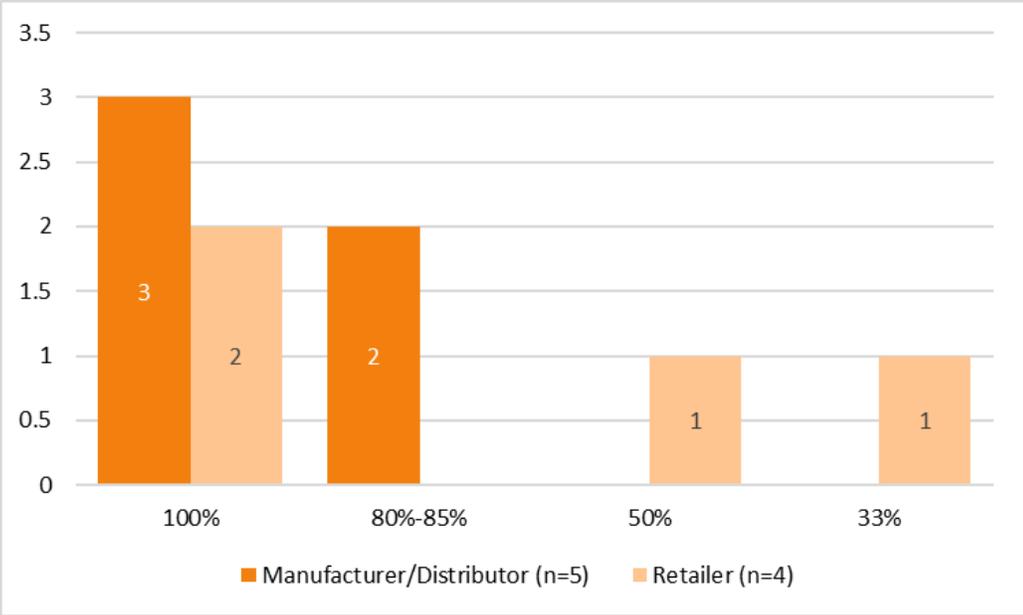
<sup>48</sup> DLC’s website: “The Design Lights Consortium is a non-profit organization whose mission is to drive efficient lighting by defining quality, facilitating thought leadership, and delivering tools and resources to the lighting market through open dialogue and collaboration.” Available online: <https://www.designlights.org/>



### Sales Practices

Of all bulbs respondents sold in Pacific Power territory, three manufacturers/distributors and two retailers sold only ENERGY STAR-certified LED bulbs. As shown in Figure 25, two additional manufacturers and distributors, and two retailers sold 33% to 85% of bulbs. Similarly, eight manufacturers and distributors said 100% or “almost all” LED fixtures they sold in Pacific Power’s territory were ENERGY STAR certified.

**Figure 25. ENERGY STAR Certified LED Bulbs as Percentage of all Bulbs Sold in Pacific Power Territory**



Source: Pacific Power California HES Manufacturer and Retailer Interview (Appendix A). (QD1) Don’t know responses removed.

One manufacturer and two retailers offered discounts in Pacific Power territory for non-HES lighting products (n=10). These included quarterly promotions and case or individual product discounts.

Three of the four retailers said they assisted customers in selecting products, explaining wattage equivalencies between LEDs, CFLs, or incandescents, and providing in-store product demonstrations. The one retailer that did not assist customers identified themselves as a grocery/convenience store.

### **Marketing, Outreach, and Training**

One-half of the manufacturers, distributors, and retailers reported marketing HES program-eligible products. For manufacturers (three of five), this included working with retailers on merchandising techniques as well as with endcaps, signage and beam labels, events, brochures, and weekly ads/flyers. For distributors (two of five), marketing included off-shelf displays, signage, and quarterly end-caps. Two distributors said their marketing efforts were dictated by Pacific Power. Retailers (two of four) used newspaper ads, an in-store monthly newsletter, end-caps, and in-store lighting installation demonstrations.

None of the partners said they provided in-store materials beyond the information include in the displays or on the products. One manufacturer noted: “In a utility program, nothing beyond this works.” When asked if they tracked marketing effectiveness, one manufacturer indicated their marketing department looked at effectiveness, but this respondent did not provide first-hand knowledge about the results; one manufacturer had not seen sales increases from point-of sale displays, though saying these effectively raised customers’ awareness of the program or provided program attribution to the utility.

When manufacturers, distributors, and retailers were asked what, if anything, could the Pacific Power HES program representative do to help them promote program-eligible products, respondents (7 of 13) said more in-store events and giveaways, demonstrating differences between LEDs and other lighting, and raising customer awareness of Pacific Power’s program involvement with these products.

### *Partner Satisfaction*

The manufacturers, distributors, and retailers were very satisfied or somewhat satisfied with the products incentivized, the process of signing the Memorandum of Understanding, and the HES program overall.

Additionally, Cadmus asked these partners about their satisfaction in communicating with the program administrator. Four manufacturers, one distributor, and three retailers said they were very satisfied. One distributor reported they were somewhat satisfied, and one manufacturer was not at all satisfied. This manufacturer was terminated from the program, and stated they were disappointed and surprised by the termination, and thought their agenda differed from the program administrator’s.

Respondents offered only two suggestions for program improvements: offer higher incentives and increase program awareness. One respondent noted: “[It’s a] tough market to promote because of location—the fact that they [Pacific Power] are even doing it is great.”

### *Market Perspective*

Finally, Cadmus asked respondents to provide their perspectives on the efficient products market and the HES program’s influence. Respondents anticipated the lighting market would change in the next few years, driven by rapid technology changes and customer demand for units with better quality, light color, and ease of use. Anticipated changes included the following:

- Lower-priced, higher-quality bulbs
- Slowdown in sales due to longer bulb life
- California lighting standards becoming the norm across the country
- LEDs’ market share would continue growing while CFLs and halogens disappear
- Retraining sales staff to market LEDs differently, taking earlier advantage of trends
- ENERGY STAR becoming the LED baseline in 2020
- Larger roles for smart technology and LEDs



- Incentive dollars shifting away from bulbs to integrated fixtures (i.e., “bulb prices have bottomed out”)
- More innovative products and specialty bulbs

Respondents said Pacific Power and utilities in general should continue to focus incentives on more efficient products, driving market transformation locally, and noting that as prices come down, incentives can follow, moving to lower levels. One manufacturer said, “All utility programs have done what they needed to do to get the market transformed, and by 2020 they won’t need to do anything else.”<sup>49</sup>

### **Benchmarking**

This section describes findings from Cadmus’ benchmarking review of comparable utility programs within the United States.

In conducting the benchmarking process, Cadmus sought to achieve the following objectives:

- Establish consistent definitions of upstream, midstream, and downstream; so programs could be characterized consistently in these terms.
- Collect information on specific residential programs of interest to Pacific Power. Specifically, the research focused on the following program and measure categories: lighting, non-lighting, and new construction.

In addition to high-level findings presented in the main report, Appendix H. Benchmarking provides details on programs, channels, and measures.

### **Definitions**

As Pacific Power specifically expressed interest in delivery channels used to implement residential programs, Cadmus developed definitions of descriptive terms consistently used in this report to characterize program delivery.

Cadmus found a primary distinction arose between upstream, midstream, and downstream programs depending on whether a payment, made at some point in the supply chain, had to be passed through to the end customer. In practice, this meant midstream and upstream program participants only had to pay the measure price after applying discounts. In contrast, participants in downstream programs had to pay the full price of a measure, at which point they could apply for a rebate. If the program determined that they qualified, the rebate could be paid.

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<sup>49</sup> The second tier of EISA 2007 (EISA Tier 2) regulation goes into effect beginning January 2020.

Cadmus summarizes these definitions as follows:

- **Upstream Programs:** Implemented as agreements between the product manufacturer, distributors, or retailers and the program. Through these agreements, specific products—lighting, in all instances Cadmus identified—were offered at reduced prices to distributors and retailers. The distributor or retailer had to pass the entire product discount to buyers, resulting in target products offered at below-market prices. Cadmus notes that upstream programs typically do not enforce buyer requirements (e.g., use in a residence, use within the service territory). Consequently, products used outside the service territory (i.e., leakage) and cross-sector sales (into nonresidential applications) raised concerns for upstream lighting programs, though such programs may offer compensation to distributors or retailers through Sales Performance Incentive Funds (SPIF) or bonuses.
- **Midstream Programs:** Implemented as agreements between the program and a range of market intermediaries, including distributors, retailers, and contractors. As noted, midstream intermediaries had to apply a defined rebate amount to the measure's retail price. Again, intermediaries might receive a separate SPIF or bonus for their role in the program. Unlike upstream programs, however, midstream programs sometimes enforced program requirements (e.g., use of the measure in a residence or use of the measure in the service territory), reducing the potential for leakage or cross-sector participation. Midstream programs included those allowing retailers to offer instant rebates on home appliances or those allowing HVAC installers to offer discounted prices that target high-efficiency equipment.
- **Downstream Programs:** Offering rebates on targeted products after purchase. When buyers applied for the rebate, the program verified that the intended use met program requirements, sometimes even including verification that the buyer had a gas or electric account with a sponsoring utility.

Cadmus notes that midstream programs offered an advantage in enabling program administrators to wield greater influence on products stocked by distributors, retailers, and contractors than downstream programs. This factor often proved important as programs worked to support adoption of new technologies (e.g., heat pump clothes dryers in markets where products would otherwise not be available or recommended by installers).

Cadmus also notes that, for new home programs, the homebuilder served as the primary participant. As the builder retained the incentive payment (i.e., no adjustment to home price is required), these met Cadmus' definitions for downstream programs.

### Upstream: Lighting

As shown in Table 65, Cadmus reviewed residential lighting programs offered by four other utilities, comparing these to Pacific Power's program.



**Table 65. Summary of Upstream Lighting Programs**

Utility/PA, State	Administrator	Measures	Program Year	Participation Units	Net MWh <sup>1</sup>	kWh/ Unit
Pacific Power, CA	CLEAResult	CFLs, LEDs, Fixtures	2015–2016	137,521	1,261 <sup>2</sup>	9 <sup>2</sup>
Ameren, MO	ICF	LEDs	2016	917,013	24,418	27
EmPOWER, MD	ICF, Honeywell	CFLs, LEDs, Fixtures	1/1/2016–5/31/2016	2,442,683	47,519	20
SRP, AZ	SRP	CFLs	6/1/2016–5/31/2017	693,595	30,488	44
PPL, PA	Ecova	LEDs	6/1/2015–5/31/2016	1,419,223	42,219	30

<sup>1</sup>Net MWh—values determined by evaluators—were taken from final evaluation reports.

<sup>2</sup>Cadmus determined the Pacific Power savings value using the 2015 CPUC Report and other sources, as noted in Table 21. Other utility evaluations often calculate gross values based on EISA requirements and net values adjusted for freeridership.

Program administrators expected savings may be substantially impacted when EISA’s second lighting-standard tiers become effective.

### **Midstream and Downstream: Non-Lighting**

Cadmus reviewed residential programs focused on measures other than lighting, as offered by four other utilities and the Energy Trust of Oregon. Table 66 summarizes these programs’ key aspects.

**Table 66. Summary of Midstream and Downstream Non-Lighting Programs**

Utility/PA, State	Year	Measures	Delivery Notes
Ameren, MO	2016	HPWHs, Room ACs, Room Air Purifiers, Pool Pumps, Smart T-stats	<b>Downstream:</b> Participants receive rebates by mail after approval of their applications.
EmPOWER, MD	1/1/16–5/31/16	Clothes W+D, Pool Pump, Refrigerators, HPWHs	<b>Downstream/Midstream Mix:</b> Retail locations are primary channel HPWHs and pool pumps available from trade allies (instant rebates to customers).
		AS/GS Heat pumps, Central ACs, Furnaces	
PPL, PA	PY7	Refrigerators, HPWHs, Efficient WHs	<b>Downstream:</b> Participants receive rebates by mail after approval of their applications.
PSE, WA	2013-2015	APS, Refrigerators, Clothes W+D, Smart T-stats, Energy Reports, Insulation, Air/Duct Sealing, Heat System	<b>Downstream/Midstream Mix</b> (single-family, multifamily up to four units): Low-income weatherization; direct-install downstream rebates; midstream rebates through retailers and contractors
Energy Trust, OR	2015	Smart T-stats, Energy Reports, Kits, Heat Pumps, Pool Pumps, HPWHs Insulation, Air/Duct Sealing	<b>Downstream/Midstream Mix:</b> Recent efforts to increase midstream engagement (distributor SPIFs and information sessions); instant incentives through trade allies; specialized offers for moderate-income rental properties.

### New Construction Programs

Cadmus reviewed residential new construction programs offered by three other utilities and a similar program offered by the Energy Trust of Oregon, with key program aspects summarized in Table 67.

Note: Due to relatively small new construction volumes in California, Pacific Power did not operate a dedicated new construction program in this service territory. Rather, the HES program offered a whole-home performance measure.



**Table 67. Summary of New Construction Programs**

Utility/PA, State	Admin.	Measure(s)	Program Year	Homes	Gross MWh <sup>1</sup>	kWh/Home <sup>1</sup>	Notes
SRP, AZ	SRP	ES V3	FY17	6,613	32,079	4,851	ENERGY STAR Homes have over 70% market share in Phoenix area.
EmPOWER, MD	ICF	ES V3.1 guidelines; at least 90% of lamps use CFLs, LEDs	1/1/2016-5/31/2016	1,987	4,061	2,044	New single-family homes account for most program savings (53% of the total), followed by new townhomes, accounting for 30% of the total.
Focus On Energy, WI <sup>2</sup>	WECC	Level 1 15% above code Level 2 25% Level 3 35% Level 4 45%	2016	2,400	4,735	1,973	Distribution of homes completed in 2016: Level 1: 18% Level 2: 62% Level 3: 15%
Energy Trust, OR	CLEAResult	Energy Trust developed the performance-based EPS track in 2008, in response to a more stringent state building code.	2015	4,192	3,420	816	The program continues to perform well, with the market share of program homes in Oregon increasing from 21% in 2013 to 36% in 2015; the program attained its electric and gas savings goals in 2014 and 2015.

<sup>1</sup>Gross MWh—values determined by evaluators—were taken from final evaluation reports, and were used to calculate kWh/home.

<sup>2</sup>Measures shown for Focus On Energy’s program reflect a 5% increase in efficiency for all tiers (implemented in 2016). The program is currently being redesigned, with updates to be introduced in October 2017.

ENERGY STAR certification alone does not ensure savings. A recent evaluation of the ENERGY STAR homes program offered by Wisconsin’s Focus on Energy did not find electric savings; rather, it found only small gas savings. Consequently, the Wisconsin program is being redesigned to incent beyond-code construction. This approach is expected to deliver greater future savings.

Generally, program participation depends on factors more likely to be present in urban areas. Such factors include the presence of high-volume “production” builders, access to a pool of efficiency raters, available inventory of efficient equipment, and subcontractors skilled in efficient home construction (e.g., HVAC technicians, insulation specialists, electricians, plumbers).

The process evaluation<sup>50</sup> for Energy Trust of Oregon 2014–2015 specifically discussed challenges faced by program participation in rural eastern Oregon. Cadmus notes that similar challenges constrain

<sup>50</sup> Evergreen Economics. *2014–2015 New Homes Program Process Evaluation*. March 17, 2016.

participation in new home programs within Pacific Power’s California territory. As discussed, Pacific Power offers new construction measures through the HES program within this service territory.



## Cost-Effectiveness

In assessing HES program cost-effectiveness, Cadmus analyzed program benefits and costs from five different perspectives, using the California E3 Calculator. The California Standard Practice Manual for assessing demand-side management (DSM) program cost-effectiveness describes the benefit-cost ratios Cadmus used for the following three tests:

- **Total Resource Cost (TRC) Test:** This test also examined program benefits and costs from Pacific Power’s and Pacific Power customers’ perspectives (combined). On the benefit side, it included avoided energy costs, capacity costs, and line losses. On the cost side, it included costs incurred by both the utility and participants.
- **Utility Cost Test (UCT):** This test examined program benefits and costs solely from Pacific Power’s perspective. The benefits included avoided energy, capacity costs, and line losses. Costs included program administration, implementation, and incentive costs associated with program funding.
- **Ratepayer Impact Measure (RIM) Test:** All ratepayers (participants and nonparticipants) may experience rate increases designed to recover lost revenues. The benefits included avoided energy costs, capacity costs, and line losses. Costs included all Pacific Power program costs and lost revenues.

Table 68 list the components of the three tests.

**Table 68. Benefits and Costs Included in Various Cost-Effectiveness Tests**

Test	Benefits	Costs
TRC	Present value of avoided energy and capacity costs <sup>1</sup>	Program administrative and marketing costs, and costs incurred by participants
UCT	Present value of avoided energy and capacity costs <sup>1</sup>	Program administrative, marketing, and incentive costs
RIM	Present value of avoided energy and capacity costs <sup>1</sup>	Program administrative, marketing, and incentive costs, plus the present value of lost revenues

<sup>1</sup>Includes avoided line losses.

Table 69 provides selected cost analysis inputs for each year, including evaluated energy savings, discount rated, line loss, inflation rated, and total program costs. Pacific Power provided all of these values.

**Table 69. Selected Cost Analysis Inputs**

Input Description	2015	2016	Total
Evaluated Gross Energy Savings (kWh/year) <sup>1</sup>	2,777,253	1,489,462	4,266,715
Discount Rate	6.66%	6.66%	N/A
Inflation Rate <sup>2</sup>	1.9%	1.9%	N/A
Total Program Costs	\$826,697	\$767,701	\$1,594,398

<sup>1</sup>Savings are realized at the meter, while benefits account for line loss.

<sup>2</sup>Future retail rates determined using a 1.9% annual escalator.

HES program benefits included energy savings and their associated avoided costs. For the cost-effectiveness analysis, Cadmus used this study’s evaluated energy savings.

Cadmus analyzed HES program cost-effectiveness for net savings with evaluated freeridership and spillover incorporated.

Table 70 presents the 2015–2016 program cost-effectiveness analysis results. For both 2015 and 2016, Cadmus found that the HES program was cost-effective from all perspectives except the RIM test.

The primary criterion for assessing cost-effectiveness in California is the TRC, which achieved a 2.00 benefit-cost ratio for the combined years’ net savings. These results include the evaluated NTG.

The RIM test measures program impacts on customer rates. Many programs do not pass the RIM test because, although energy efficiency programs reduce costs, they also reduce energy sales. As a result, the average rate per unit of energy may increase. A passing RIM test indicates that rates as well as costs will decrease due to the program. Typically, this only happens for demand response programs or programs targeting the highest marginal cost hours (when marginal costs are greater than rates).

**Table 70. HES Program Cost-Effectiveness Summary for 2015–2016 (Evaluated Net)**

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost (TRC)	\$0.0945	\$2,312,062	\$4,626,180	\$2,314,118	2.00
Utility Cost Test (UCT)	\$0.0626	\$1,532,635	\$4,626,180	\$3,093,545	3.02
Ratepayer Impact Measure (RIM) Test	\$0.2154	\$5,271,107	\$4,626,180	(\$644,927)	0.88

Table 71 and Table 72 show cost effectiveness results for 2015 and 2016 separately. Both years passed from the TRC and UCT test perspectives and failed from the RIM test perspective.



**Table 71. HES Program Cost-Effectiveness Summary for 2015 (Evaluated Net)**

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost (TRC)	\$0.08	\$1,254,372	\$2,750,233	\$1,495,861	2.19
Utility Cost Test (UCT)	\$0.05	\$818,201	\$2,750,233	\$1,932,032	3.36
Ratepayer Impact Measure (RIM) Test	\$0.20	\$3,129,078	\$2,750,233	(\$378,845)	0.88

**Table 72. HES Program Cost-Effectiveness Summary for 2016 (Evaluated Net)**

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost (TRC)	\$0.12	\$1,129,280	\$2,004,040	\$874,760	1.77
Utility Cost Test (UCT)	\$0.08	\$762,586	\$2,004,040	\$1,241,454	2.63
Ratepayer Impact Measure (RIM) Test	\$0.23	\$2,190,181	\$2,004,040	(\$186,141)	0.92

## Conclusions and Recommendations

Based on this evaluation's findings, this section provides Cadmus' conclusions and recommendations.

- **wattsmart Kit Participant Phone Numbers:** As the *wattsmart* Starter Kit measure administrator did not collect kit participants' phone numbers, Pacific Power filled in data where available using its own customer database. While a small detail in operating the program efficiently, this strained the evaluation efforts and Pacific Power to update program administrator data with kit participant phone numbers.

**Recommendation:** Have the *wattsmart* kit program administrator collect kit participant phone numbers to support kit program survey data collection activities.

- **Upstream Lighting Point-of-Sale Merchandizing Data:** Program tracking data did not include information about high-visibility product placements or merchandising within retail locations. Decreasing the price of efficient lighting products primarily drives sales, but merchandising also can generate substantial sales lift. Without these data, Cadmus cannot attribute merchandizing's effect on the program.

**Recommendation:** Track dates and locations for all of the program's merchandising and product placement. Providing model numbers, store locations, dates, and display types (e.g., end caps, pallet displays) allows more precise estimates of program-generated sales lift.

- **Customer Motivation:** Customers not choosing LEDs still consider them cost-prohibitive or generally do not think about their lighting purchases, selecting bulbs that are familiar, on sale, or conveniently located on store shelves. Additionally, manufacturers, distributors, and retailers described the need to educate customers further about LEDs, explaining their benefits over other bulb or fixture types, and instructing customers how to select and install the best LEDs for their applications. As LEDs become more specialized and efficient, and as less-efficient bulbs drop from the market, Pacific Power has an opportunity to increase customer acceptance of LEDs through more aggressive education.

**Recommendation:** Expand marketing and outreach efforts through bill inserts, websites, and media, focusing on benefits, cost savings, and appropriate applications for LEDs.

**Recommendation:** Drive customers to in-store events provided by Pacific Power. Partner with participating retailers to schedule regular in-store events to demonstrate LED applications and proper installations, thus increasing the word-of-mouth marketing between neighbors, friends, and colleagues that can result from such events.



## Appendices

A separate volume contains the following appendices:

***Appendix A. Survey and Data Collection Forms***

***Appendix B. Lighting Impacts***

***Appendix C. Billing Analysis***

***Appendix D. Self-Report NTG Methodology***

***Appendix E. Nonparticipant Spillover***

***Appendix F. Measure Category Cost-Effectiveness***

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## PacifiCorp HES Program Management Interview Guide PY 2015-2016

Name:

Title:

Interviewer:

Date of Interview:

### Introduction

The purpose of the interview is to collect background and insight on the design and implementation of the HES program, from your perspective. We will use input from a variety of staff involved with the program to describe how the program worked during 2015 and 2016, what made it successful, and where there may be opportunities for improvement. Please feel free to let me know if there are questions that may not apply to your role so that we can focus on the areas with which you have worked most closely.

### Program Overview, Management Roles and Responsibilities:

1. To start, please tell me about your role and associated responsibilities with the HES Program. How long have you been involved?
2. Who are the other key PacifiCorp staff involved in the 2015 and 2016 program period and what are their roles?

### Program Goal and Objectives:

3. How would you describe the main objective of the 2015 and 2016 HES Program?
4. In general, how did the program perform in 2015 and 2016, relative to what you expected? Did any measure not meet, or exceed, participation targets? If appropriate, please review state by state.
5. Did the program have any informal or internal goals/Key Performance Indicators for this year, such as level of trade ally engagement, participant satisfaction, participation in certain regions, etc.?
  - a. How or why were these goals developed?
  - b. How did the program perform in terms of reaching the internal goals (for each state)?

### Program Design:

Thank you. Now I'd like to ask you about the program design.

6. Were there any major changes in program design in 2015 and 2016 relative to 2013 and 2014? For example, with regard to eligible measures, eligible customers, delivery channel, or other aspects of program design? [For each change: what led to the change? Was the objective of the change realized, in your opinion? Verify the following are discussed:
  - a. Upstream
    - i. Adding LEDs/reducing CFLs
    - ii. Adding APS
  - b. Rebates
    - i. Eliminating lighting fixtures
    - ii. Changes to clothes washers, other appliances]
7. How did the program differ among the five states in 2015 - 2016?
8. According to staff interviews in 2014, the HES program is designed to deliver prescriptive efficiency measures across residential market segments, which might include low- and standard income, rural and urban, etc. How did the program target different segments within the residential market in 2015 - 2016?
  - a. How has the program's approach to serving multifamily customers changed over the past two years, if at all?
  - b. How has the program's approach to serving the new single family homes market changed over the past two years, if at all?
9. [If not answered above] In 2013-2014, the program introduced kits and Simple Steps retailer participation for lighting. How did these initiatives perform in 2015-2016?
10. What do you think are the program's most notable successes in the 2015-2016 period?
11. Conversely, what aspects of the program do you think did not work as well as anticipated?
12. What barriers or challenges did the program face in 2015-2016? What was done/what is planned to address them?
13. Could you describe [PacifiCorp's/CLEARResult's] QA/QC processes in 2015-2016? [Probe: what are PC/CLEARResults methods for validating Trade Ally workmanship, verifying rebate application information, review of program data tracking, or other QC?]

14. Now I would like to know about any changes you anticipate for the 2017-18 cycle. Let's start with eligible measures. What measures do you think you might add to the program, or expand to new states? What measures might be eliminated, or pulled out of certain states? Are there any measures that you are planning to research for possible inclusion in the future?
15. Are there any other changes you anticipate for 2017-18? These might include changes to rules for participating retailers or trade allies, changes to application forms or processing, or new marketing approaches.

## Program Marketing

These next questions will go into more detail on particular aspects of program implementation, starting with marketing.

16. Do you have a marketing plan from 2015-2016 you could share with me? What were the primary marketing activities during that time period?
  - a. Did all five states use the same marketing plan and tactics?
  - b. How did the messaging differ in the five states?
  - c. How much of the marketing is **wattsmart** vs program specific (HES)?
  - d. Is marketing targeted to specific segments of the population? If so, how is it tailored to different groups?
17. Did any of the marketing in 2015-2016 represent a change from previous years? Which strategies were new, and why did you adopt those new strategies?
18. Did you track marketing effectiveness? What did you track?
  - a. What was the most effective marketing channel? (Why do you say this?)
  - b. What do you think is the most important messaging, by retail channel?

## Customer Experience

Thank you. Next I'd like to learn more about the customer's experience, and how you monitor that.

19. Do you have a process by which you receive customer feedback about the program? (Probe: What is that process and how frequently does it happen, what happens to the information, if a response is required who does that? Feedback may come through exit surveys, call center reports, or other channels. )

20. What feedback did you receive from customers about the program? (Probe: incentive levels, timing for project approvals, incentive payments, satisfaction with studies, trade allies, etc.)
21. What are the most common questions you get from customers about the program?
22. What do you think participants are most pleased with, in terms of their experience with the program?
23. What do you think they are least pleased with? Why do you say that?
24. Do you monitor customer satisfaction ratings by contractor?
25. Please describe the process to complete, submit, correct and approve a rebate application. (Probe: responsible party, method of submittal, check recipient.)
26. Were any changes made to the rebate application forms in 2015 or 2016? (Note: recommendations from last evaluation included reviewing applications for duct sealing and insulation applications for opportunities to streamline, and offering additional training for contractors to mitigate data entry error issues (UT 2013-14 Report))
27. Does CLEAResult have a target application processing time? What is the average time to process an application?
28. Are you aware of any common application errors, or parts of the application that customers have difficulty completing?
29. Do you track the rate of application errors? Have you noticed any change in the number of customer or contractor errors on rebate applications since 2014?

## Trade Ally Experience

Now I'd like to discuss Trade Allies.

30. Please tell me about how the program works with trade allies. What are trade ally roles and responsibilities with regard to the program?
31. How many trade allies participated in the program, by state? (I can follow up later for the exact figures.) Was this more or fewer than the 2013-14 cycle?
32. How did the program recruit trade allies (contractors and retailers)? [Probe: program staff have indicated that it has been difficult to recruit trade allies this year.]
33. Do you feel you had sufficient trade allies to support the program? Why or why not?

34. What barriers have the trade allies said they encounter with the program, if any?
  - a. How has the program addressed these barriers?
35. What kind of training was required and/or offered for trade allies? How frequently and on what topics? How was training distributed across states?
36. What marketing resources or sales training did the program provide to trade allies?
- 37.

## Data Tracking and Savings

These last questions ask about data tracking activities.

38. Please tell us about program data tracking for each channel: upstream, rebates, and kits.
39. Did the data tracking systems in place meet your needs? Why or why not?
40. How do PacifiCorp program staff receive tracking data during the year? Does CLEAResult send reports, or do they have access to real-time data, such as through an online portal?
41. How do PacifiCorp and CLEAResult Program staff monitor progress against savings goals? (Probe: how often is progress reviewed? Is it reviewed at the measure level, or channel level? Is it reviewed in the same manner for all states?)
42. How were savings deemed for each program measure? How often were the unit energy savings values updated in the tracking data?]

## Closing

43. Cadmus has budgeted for benchmarking research for the 2015-2016 process evaluation. We would like to know what aspects of program design or performance you would be interested in comparing to other programs around the country. Typically, this might include participation level, incentive levels, comparison of eligible measures, or other aspects of program design or performance.
44. Are there other topics you are interested in learning more about from our evaluation this year?

Thank you very much for your time today!

## PacifiCorp Home Energy Savings *wattsmart* Starter Kit Survey (2016 Participants)

*Audience: This survey is designed for PacifiCorp residential customers in Idaho, Utah, California, Wyoming and Washington who received energy efficiency kits through HES in 2016. The primary purpose of this survey is to collect information on receipt of the kit, installation and satisfaction of kit items, **wattsmart**/Homes Energy Savings Program awareness and satisfaction. This survey will be administered through telephone calls.*

*Quota: 35 completed surveys for CFLs and 35 for LEDs for each state (ID, UT, CA, WY and WA) (350 total)*

Topics	Researchable Questions	Survey Questions
Receipt of kit	Did the customer receive (or recall receiving) the <b>wattsmart</b> Home Energy Savings starter kit?	A3-A6
Installation of kit measures	How many of each kit item did the customer install? How many items were removed? How many items remain in storage?	B1, B2, B5, B15, B16, B19, C1, C3, C5, D1, D3, D9D11
Reasons for removal or non-installation	Why were items removed? Why were items never installed? Where are the items now?	B3-B5, B17-B19, C2-C3, D2, D3
Satisfaction with kit items	How satisfied are customers with the kit items and overall kit? How easy was it to install the water items? How easy was it to fill out online request form? Why did the customer request the kit?	B6, B7, B20-B22, C4-C5, D4-D5, E1-E4, E10
Program awareness	How did the customer hear about the <b>wattsmart</b> Home Energy Savings Starter Kit? Are kit recipients familiar with Home Energy Savings program (Home Energy Savings)? Have they received other incentives from <b>wattsmart</b> ?	E5, E6, E7
NTG	What is the freeridership and spillover associated with this program.	B8-B14, B23-B26, C6-C8, D6-D8, D14-D16, Section F
Household Characteristics	What are some general household characteristics (used to inform engineering review)?	Section G

- Interviewer instructions are in green.
- CATI programming instructions are in red.

**[UTILITY]**

Washington, California: Pacific Power

Idaho, Utah, Wyoming: Rocky Mountain Power

**[KIT TYPE]**

Kit Name	Kit Type	Quantity CFLs	Quantity LEDs	Quantity Kitchen Aerators	Quantity Bath Aerators	Quantity Showerheads	Cost of Kit
Basic 1	1	4	0	1	1	1	\$0
Basic 2	2	4	0	1	2	2	\$0
Better 1	3	4	0	1	1	1	\$4.99
Better 2	4	4	0	1	2	2	\$4.99
Best 1	5	0	4	1	1	1	\$4.99
Best 2	6	0	4	1	2	2	\$4.99
CFL Only	7	4	0	0	0	0	\$0
LED Only	8	0	4	0	0	0	\$4.99

## A. Introduction

- A1. **[TO RESPONDENT]** Hello, I'm **[INSERT FIRST NAME]**, calling from **[INSERT SURVEY FIRM]**, on behalf of **[INSERT UTILITY]**. May I please speak with **[INSERT NAME]**?
1. Yes
  2. No, the person is not available **[SCHEDULE CALLBACK]**
  98. Don't Know **[THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**
- A2. **[INSERT UTILITY]** is sponsoring additional research about their energy efficiency programs. Our records indicate that you requested a **wattsmart** Home Energy Savings starter kit online. Would you be willing to participate in a very quick 5 to 10 minute survey to talk about the kit?
1. Yes
  2. No **[THANK AND TERMINATE]**
  98. Don't know **["IS THERE SOMEONE ELSE THAT WOULD BE ABLE TO ANSWER?" IF YES, START AGAIN, IF NO, THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**

### **RESPONSES TO CUSTOMER QUESTIONS [IF NEEDED]**

(Timing: This survey should take about 5-10 minutes of your time. Is this a good time for us to speak with you?)

**(WHO ARE YOU WITH: I'M WITH [INSERT SURVEY FIRM], AN INDEPENDENT RESEARCH FIRM THAT HAS BEEN HIRED BY [INSERT UTILITY] TO CONDUCT THIS RESEARCH. I AM CALLING TO LEARN ABOUT THE wattsmart Home Energy Savings STARTER KIT THAT YOU RECEIVED FROM [INSERT UTILITY])**

(Sales concern: I am not selling anything; we would simply like to learn about the **wattsmart** Home Energy Savings **STARTER** kit you received and hear your feedback on the items included. Your responses

will be kept confidential. If you would like to talk with someone from the Home Energy Savings Program about this study, feel free to call 1-800-942-0266, or visit their website:

[http://www.homeenergysavings.net/.](http://www.homeenergysavings.net/))

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

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

- A1. 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]**
- A2. Thank you. To confirm, did you receive a kit containing energy-saving items from **[INSERT UTILITY]** by mail?
1. Yes **[SKIP TO A5]**
  2. No **[CONTINUE TO A3]**
  98. Don't know **["THE WATTSMART HOME ENERGY SAVINGS STARTER KIT WAS A BOX THAT CONTAINED ENERGY EFFICIENT HOUSEHOLD ITEMS THAT WAS MAILED TO YOU BY [INSERT UTILITY]. IT CONTAINED FOUR CFLS OR LED LIGHT BULBS AND ALSO MAY HAVE CONTAINED FAUCET AERATORS AND HIGH-EFFICIENT SHOWERHEADS. DO YOU RECALL WHETHER YOUR HOUSEHOLD RECEIVED ONE OR MORE OF THESE KITS?" IF YES, ADJUST RESPONSE AND SKIP TO A5, IF NO, SKIP TO A4]**
- A3. Did you or a member of your household request a **wattsmart** Home Energy Savings Starter Kit?
1. Yes **["WE APPOLOGIZE THAT YOU DID NOT RECEIVE YOUR REQUESTED KIT. WOULD YOU LIKE US TO NOTIFY [INSERT UTILITY] ON YOUR BEHALF?" IF YES, ASK FOR NAME AND PHONE NUMBER, THANK AND TERMINATE]**
  2. No **[THANK AND TERMINATE]**
  98. Don't know **[THANK AND TERMINATE]**
- A4. Is there anyone else in your household who would recall if you received a **wattsmart** Home Energy Savings starter kit from **[INSERT UTILITY]**?
1. Yes **[ASK TO SPEAK WITH SOMEONE WHO KNOWS AND BEGIN AGAIN, IF UNAVAILABLE, UPDATE SAMPLE LIST WITH NEW CONTACT AND CALL BACK ANOTHER TIME]**
  2. No **[THANK AND TERMINATE]**
  98. Don't know **[THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**

- A5. **[ASK ONLY IF KIT TYPE = 7 OR 8, OTHERWISE SKIP TO A6]** My records show that you received a **wattsmart** Home Energy Savings Starter Kit that contained **[IF KIT TYPE = 7, “FOUR CFL LIGHT BULBS”, IF KIT TYPE = 8, “FOUR LED LIGHT BULBS”]**, is that correct?
1. Yes
  2. No **[ASK: WHAT DID YOU RECEIVE IN YOUR KIT?]**
    - A5a. (Specify \_\_\_\_\_) **[ADJUST QUANTITY OF MEASURES AND KIT TYPE AS APPROPRIATE]**
  98. Don't know **[THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**
- A6. **[ASK ONLY IF KIT TYPE = 1-6]** My records show that you received a **wattsmart** Home Energy Savings Starter Kit that contained several items such as energy efficient light bulbs, faucet aerators and showerheads. I'd like to confirm the number of each item that you received in your kit. I will read the quantity of each item, please confirm if they are correct. My records show that you received **[READ A-D AND USE RESPONSE OPTIONS BELOW FOR EACH]:**
- A6a. **[IF KIT TYPE = 1-4, “FOUR CFL LIGHT BULBS”, IF KIT TYPE = 5 OR 6, “FOUR LED LIGHT BULBS”]**
2. Yes
  3. No **[ASK: WHAT DID YOU RECEIVE IN YOUR KIT?]**
  98. Don't Know
  99. Refused
- A6b. One kitchen faucet aerator
4. Yes
  5. No **[ASK: WHAT DID YOU RECEIVE IN YOUR KIT?]**
  98. Don't Know
  99. Refused
- A6c. **[BATHROOM FAUCET AERATOR QUANTITY]** bathroom faucet aerator(s)
6. Yes
  7. No **[ASK: WHAT DID YOU RECEIVE IN YOUR KIT?]**
  98. Don't Know
  99. Refused
- A6d. **[SHOWERHEAD QUANTITY]** showerhead (s)
8. Yes
  9. No **[ASK: WHAT DID YOU RECEIVE IN YOUR KIT?]**
    - A6b. (Specify \_\_\_\_\_) **[ADJUST QUANTITY OF MEASURES AS APPROPRIATE]**
  98. Don't know
  99. Refused **[THANK AND TERMINATE]**
- A7. **[THANK AND TERMINATE IF PARTICIPANT ANSWERS “DON'T KNOW” OR “REFUSED” TO ALL QUESTIONS A6. A-D]**

## B. Light Bulbs

**[ASK B1 TO B14 IF [KIT TYPE= 7 AND A5=1] OR [KIT TYPE=8 AND A5=2 AND CORRECTED BULB TYPE IS CFL] OR [KIT TYPE = 1-4 AND A6A=1] OR [KIT TYPE= 5-6 AND A6A=2 AND CORRECTED BULB TYPE IS CFL] OTHERWISE SKIP TO B15]**

**[IF [A5 = 98 OR 99] OR [A6.A6A = 98 OR 99] OR [IF A6.A6A = 2 AND THE CORRECTED QUANTITY IS ZERO] OR [A5=2 AND THE CORRECTED QUANTITY IS 0] THEN SKIP TO SECTION C]**

- B1. Of the **[CORRECTED CFL QUANTITY]** CFL bulbs you received in the kit, how many are currently installed in your home?
1. \_\_\_\_\_ **[RECORD # OF BULBS FROM 0-4 RANGE] [IF=4 SKIP TO B6]**
  98. (Don't know) **[SKIP TO B6]**
- B2. Of the **[[CORRECTED CFL QUANTITY]-B1.1]** CFL bulb(s) that is/are not currently installed, "was this"/"were any of these" bulb(s) ever installed in your home and then removed?
1. Yes \_\_\_\_\_ **["HOW MANY WERE REMOVED?" RECORD # OF BULBS]**
  2. No **[SKIP TO B4]**
  98. (Don't know) **[SKIP TO B5]**
- B3. And why were the **[INSERT B2.1 QUANTITY]** CFL bulb(s) removed? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
1. Burned out
  2. Quality of light
  3. Mercury content
  4. Requires special disposal/must be recycled
  5. Fire hazard
  6. Replaced with new technology (LEDs)
  7. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. (Don't know)

**[SKIP TO B5, UNLESS [CORRECTED CFL QUANTITY] -B1.1- B2.1>0 (CONTINUE)]**

- B4. Why wasn't/weren't the **[QUANTITY NEVER INSTALLED: [CORRECTED CFL QUANTITY]-B1.1- B2.1]** CFL bulb(s) ever installed? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
1. Quality of light
  2. Mercury content
  3. Requires special disposal/must be recycled
  4. Fire hazard
  5. Already had CFL bulbs (or LEDs) installed in every possible location
  6. Waiting for a bulb to burn out
  7. I haven't had time/ haven't gotten around to it
  8. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know

- B5. What did you do with the bulbs that are not currently installed in your home? **[DO NOT READ, MULTIPLE RESPONSES ALLOWED]**
1. Put into storage
  2. Gave Away
  3. Sold it
  4. Threw it away in trash
  5. Recycled it
  6. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- B6. Overall, how satisfied are you with the CFLs you received in the kit? Please choose from one of these options: **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**
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]**
  5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- B7. And how satisfied were you with the number of CFLs you received in the **wattsmart** Home Energy Savings Starter Kit? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)]**
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]**
  5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
  98. Don't Know
  99. Refused
- B8. Before you signed up for the kit, did you already have CFLs installed in your home?
1. (Yes)
  2. (No)
  98. (DON'T KNOW)
  99. (REFUSED)
- B9. **[ASK IF B8 = 1]** How many CFLs were you using in your home at the time you signed up for the kit?
1. (# of Bulbs): \_\_\_\_\_
  98. (DON'T KNOW)
  99. (REFUSED)

B10. At the time you signed up for the kit, were you already planning to purchase CFLs?

1. (Yes)
2. (No)
3. (No, I already had them installed in all available sockets)
98. (DON'T KNOW)
99. (REFUSED)

B11. **[ASK IF B10 = 1]** In terms of timing, when would you have purchased the CFLs?

1. (Around the same time I received the kit)
2. (Later but within the same year)
3. (In one year or more)
98. (Don't know)
99. (REFUSED)

B12. **[ASK IF KIT TYPE = 7]** Were you aware of the option to upgrade your kit from CFLs to LED bulbs for \$4.99?

1. (Yes) **[CONTINUE TO B13]**
2. (No) **[SKIP TO B14]**
98. Don't Know **[SKIP TO B14]**
99. Refused **[SKIP TO B14]**

B13. **[ASK IF B12 = 1]** Why did you decide not to upgrade to LEDs? **[DO NOT READ, MULTIPLE RESPONSES ALLOWED]**

1. The cost/too expensive **[SKIP TO C1]**
2. Not familiar with LEDs **[SKIP TO C1]**
3. Prefer CFLs **[SKIP TO C1]**
4. Other **[RECORD] [SKIP TO C1]**
98. Don't Know **[SKIP TO C1]**
99. Refused **[SKIP TO C1]**

B14. **[ASK IF B12 = 2, 98, OR 99]** If you knew about the option to upgrade from CFLs to LEDs at a cost of \$4.99, would you have upgraded to the LED kit?

1. (Yes) **[SKIP TO C1]**
2. (No) **[SKIP TO C1]**
98. Don't Know **[SKIP TO C1]**
99. Refused **[SKIP TO C1]**

**[ASK B15 THROUGH B26 IF [KIT TYPE =8 AND A5=1] OR [KIT TYPE=7 AND A5=2 AND CORRECTED BULB TYPE IS LED] OR [KIT TYPE = 1-4 AND A6A=2 AND CORRECTED BULB TYPE IS LED] OR [KIT TYPE = 5-6 AND A6A=1] OTHERWISE SKIP TO SECTION C]**

- B15. Of the **[CORRECTED LED QUANTITY]** LED bulbs you received in the kit, how many are currently installed in your home?
1. \_\_\_\_\_ **[RECORD # OF BULBS FROM 0-4 RANGE] [IF=4 SKIP TO B20]**
  98. Don't know **[SKIP TO B20]**
- B16. Of the **[[CORRECTED LED QUANTITY]-B15.1]** LED bulb(s) that is/are not currently installed, "was this"/"were any of these" bulb(s) ever installed in your home and then removed?
1. Yes \_\_\_\_\_ **["HOW MANY WERE REMOVED?" RECORD # OF BULBS]**
  2. No **[SKIP TO B18]**
  98. (Don't know) **[SKIP TO B19]**
- B17. And why was/were the **[INSERT B16.1 QUANTITY]** LED bulb(s) removed? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
1. Burned out
  2. Quality of light
  3. Requires special disposal/must be recycled
  4. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- [SKIP TO B19 UNLESS [corrected led quantity] - B15.1- B16 >0 (CONTINUE)]*
- B18. Why wasn't/weren't the **[QUANTITY NEVER INSTALLED: [CORRECTED LED QUANTITY] - B15.1-B16.1]** LED bulb(s) ever installed? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
1. Quality of light
  2. Requires special disposal/must be recycled
  3. Fire hazard
  4. Already had LEDs bulbs (or CFLs) installed in every possible location
  5. Waiting for a bulb to burn out
  6. I haven't had time/ haven't gotten around to it
  7. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- B19. What did you do with the bulbs that are not currently installed in your home? **[DO NOT READ, MULTIPLE RESPONSES ALLOWED]**
1. Put into storage
  2. Gave Away
  3. Sold it
  4. Threw it away in trash
  5. Recycled it
  6. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- B20. Why did you choose to have LEDs included in your kit instead of CFLs?
1. \_\_\_\_\_ **[OPEN RESPONSE, RECORD VERBATIM]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused

B21. Overall, how satisfied are you with your LEDs? Please choose from one of these options: **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

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]**
5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

B22. How satisfied were you with the number of LEDs you received in the kit? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)]**

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]**
5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
98. Don't Know
99. Refused

B23. Before you signed up for the kit, did you already have LEDs installed in your home?

1. (Yes)
2. (No)
3. (DK/NS)

B24. **[ASK IF B23 = 1]** How many LEDs were you using in your home at the time you signed up for the kit?

1. (# of Bulbs): \_\_\_\_\_
2. (DK/NS)

B25. At the time you signed up for the kit, were you already planning on buying the same kind of LEDs you received in the kit? **[IF NEEDED: WERE YOU PLANNING ON BUYING THE SAME WATTAGE OF LED BULB?]**

1. (Yes)
2. (No)
3. (No, already had them installed in all available sockets)
4. (DK/NS)

B26. **[ASK IF B25 = 1]** In terms of timing, when would you have purchased the LEDs on your own if they were not offered through the kit?

1. (Around the same time I received the kit)
2. (Later but within the same year)
3. (In one year or more)

- 98. (Don't know)
- 99. (Refused)

**[ASK SECTION CAND D IF KIT TYPE = 1-6, OTHERWISE SKIP TO SECTION E]**

## C. High-Efficiency Showerheads

**[IF A6D= 98 OR 99, OR IF A6D = 2 AND THE CORRECTED QUANTITY IS ZERO THEN SKIP TO SECTION D]**

- C1. How many of the **[CORRECTED SHOWERHEAD QUANTITY]** high-efficiency showerhead(s) you received are currently installed in your home?
- 1. Record \_\_\_\_\_ **[IF RESPONSE = CORRECTED SHOWERHEAD QUANTITY, SKIP TO C4]**
  - 98. Don't know **[SKIP TO C5]**
- C2. Why is/are the **[CORRECTED SHOWERHEAD QUANTITY - INSERT C1.1 QUANTITY]** high-efficiency showerhead(s) not currently installed?? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
- 1. Water volume
  - 2. Water temperature
  - 3. Water pressure
  - 4. Did not like the design/look of it
  - 5. Did not fit/could not install
  - 6. Already had high-efficiency showerhead installed in every possible location
  - 7. Do not have a shower
  - 8. I haven't had time/ haven't gotten around to it
  - 9. Other **[OPEN ENDED, WRITE RESPONSE]**
  - 98. Don't know
- C3. What did you do with the high-efficiency showerhead(s) that is/are not installed? **[DO NOT READ, SINGLE RESPONSE]**
- 1. Put into storage
  - 2. Gave Away
  - 3. Sold it
  - 4. Threw it away in trash
  - 5. Recycled it
  - 6. Other **[OPEN ENDED, WRITE RESPONSE]**
  - 98. Don't know

C4. Overall, how satisfied are you with the high-efficiency showerhead(s) you received in the kit?  
Please choose from one of these options: **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

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]**
5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

C5. **[IF C1.1 = 0 OR C1 = 98 SAY "IF YOU ATTEMPTED TO INSTALL IT,"]**How easy was it to install your high-efficiency showerhead(s)? Please choose from one of these options: **[READ]**

1. Very Easy
2. Somewhat Easy
3. Somewhat Difficult **[PROBE FOR REASON AND RECORD]**
4. Very Difficult **[PROBE FOR REASON AND RECORD]**
5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
6. **[DO NOT READ]** Did not attempt to install it
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

C6. Did you have any **other** high-efficiency showerheads installed in your home at the time you signed up the kit?

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

C7. At the time you signed up for the kit, were you already planning on buying a high-efficiency showerhead for your home?

1. (Yes)
2. (No)
3. (No, I already have them installed in all showers)
4. (Maybe)
98. (Don't know)
99. (Refused)

C8. **[ASK IF C7=1]** In terms of timing, when would you have purchased the showerhead?

1. (Around the same time I received the kit)
2. (Later but within the same year)
3. (In one year or more)
98. (Don't know)
99. (Refused)

## D. Faucet Aerators

[IF A6B = 98 OR 99, OR IF A6B = 2 AND THE CORRECTED QUANTITY IS ZERO THEN SKIP TO D9]

- D1. Is the kitchen faucet aerator you received in the kit currently installed in your home?
1. Yes **[SKIP TO D4]**
  2. No **[CONTINUE]**
  98. Don't know **[SKIP TO D5]**
- D2. Why is the kitchen faucet aerator not currently in use? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]**
1. Water volume
  2. Water temperature
  3. Water pressure
  4. Did not like the design/look of it
  5. Did not fit/could not install
  6. Already had faucet aerators installed in every possible location
  7. I haven't had time/ haven't gotten around to it
  8. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- D3. What did you do with the kitchen faucet aerator that is not installed? **[DO NOT READ, SINGLE RESPONSE]**
1. Put into storage
  2. Gave Away
  3. Sold it
  4. Threw it away in trash
  5. Recycled it
  6. Other **[OPEN ENDED, WRITE RESPONSE]**
  98. Don't know
- D4. Overall, how satisfied are you with the kitchen faucet aerator you received in the kit? Please choose from one of these options: **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**
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]**
  5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- D5. **[IF D1= 2 OR 98 SAY "IF YOU ATTEMPTED TO INSTALL IT,"]**How easy was it to install the kitchen faucet aerator? please choose from one of these options: **[READ]**
1. Very Easy
  2. Somewhat Easy
  3. Somewhat Difficult **[PROBE FOR REASON AND RECORD]**
  4. Very Difficult **[PROBE FOR REASON AND RECORD]**

- 5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
- 6. **[DO NOT READ]** Did not attempt to install it
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

D6. Did you have any **other** high-efficiency kitchen faucet aerators installed in your home before you signed up for the kit?

- 3. (Yes)
- 4. (No)
- 98. (Don't know)
- 99. (Refused)

D7. At the time you signed up for the kit, were you already planning on buying a high-efficiency kitchen faucet aerator for your home?

- 1. (Yes)
- 2. (No)
- 3. (No, I already have them installed on all faucets)
- 4. (Maybe)
- 98. (Don't know)
- 99. (Refused)

D8. **[ASK IF D7 = 1 OR 4]** In terms of timing, when would you have purchased the kitchen faucet aerators?

- 1. (Around the same time I received the kit)
- 2. (Later but within the same year)
- 3. (In one year or more)
- 98. (Don't know)
- 99. (Refused)

**[IF A6C = 98 OR 99, OR IF A6C = 2 AND THE CORRECTED QUANTITY IS ZERO THEN SKIP TO SECTION E]**

D9. How many of the **[CORRECTED BATHROOM FAUCET AERATOR QUANTITY]** bathroom faucet aerator(s) you received are currently installed in your home?

- 1. Record \_\_\_\_\_ **[IF RESPONSE = CORRECTED BATHROOM FAUCET AERATOR QUANTITY, SKIP TO D12]**
- 98. Don't know **[SKIP TO D13]**

D10. Why is/are the **[CORRECTED BATHROOM FAUCET AERATOR QUANTITY]** bathroom faucet aerator(s) not currently installed? **[DO NOT READ, MULTIPLE RESPONSE ALLOWED]?**

- 1. Water volume
- 2. Water temperature
- 3. Water pressure
- 4. Did not like the design/look of it
- 5. Did not fit/could not install
- 6. Already had faucet aerators installed in every possible location

- 7. I haven't had time/ haven't gotten around to it
- 8. Other **[OPEN ENDED, WRITE RESPONSE]**
- 98. Don't know

D11. What did you do with the bathroom faucet aerator(s) not installed? **[DO NOT READ, SINGLE RESPONSE]**

- 1. Put into storage
- 2. Gave Away
- 3. Sold it
- 4. Threw it away in trash
- 5. Recycled it
- 6. Other **[OPEN ENDED, WRITE RESPONSE]**
- 98. Don't know

D12. Overall, how satisfied are you with the bathroom faucet aerator(s) you received in the kit? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)] [RECORD FIRST RESPONSE ONLY]**

- 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]**
- 5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

D13. **[IF D9.1 = 0 OR D9= 98 SAY "IF YOU ATTEMPTED TO INSTALL IT,"]**How easy was it to install the faucet aerator? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)]**

- 1. Very Easy
- 2. Somewhat Easy
- 3. Somewhat Difficult **[PROBE FOR REASON AND RECORD]**
- 4. Very Difficult **[PROBE FOR REASON AND RECORD]**
- 5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
- 6. **[DO NOT READ]** Did not attempt to install it
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

D14. Did you have any **other** high-efficiency bathroom faucet aerators installed in your home before you signed up for the kit?

- 5. (Yes)
- 6. (No)
- 98. (Don't know)
- 99. (Refused)

- D15. At the time you signed up for the kit, were you already planning on buying a high-efficiency bathroom faucet aerator for your home?
1. (Yes)
  2. (No)
  3. (No, I already have them installed on all faucets)
  4. (Maybe)
  98. (Don't know)
  99. (Refused)
- D16. **[ASK IF D15 = 1 OR 4]** In terms of timing, when would you have purchased the bathroom faucet aerators?
1. (Around the same time I received the kit)
  2. (Later but within the same year)
  3. (In one year or more)
  98. (Don't know)
  99. (Refused)

## **E. Satisfaction and Program Awareness**

- E1. How easy was it to fill out the online request for the **wattsmart** Home Energy Savings Starter Kit? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)] [RECORD FIRST RESPONSE ONLY]**
1. Very Easy
  2. Somewhat Easy
  3. Not Very Easy **[PROBE FOR REASON AND RECORD]**
  4. Not At All Easy **[PROBE FOR REASON AND RECORD]**
  5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- E2. **AFTER YOU SUBMITTED THE REQUEST FOR THE wattsmart Home Energy Savings Starter Kit HOW LONG DID IT TAKE TO RECEIVE THE KIT FROM [INSERT UTILITY]? PLEASE CHOOSE FROM ONE OF THESE OPTIONS: [READ CATEGORIES IF NEEDED, RECORD ONLY FIRST RESPONSE]**
1. Less than 4 weeks
  2. Between 4 and 8 weeks
  3. More than 8 weeks
  98. **[DO NOT READ]** Don't Know **[SKIP TO E4]**
  99. **[DO NOT READ]** Refused **[SKIP TO E4]**

E3. Were you satisfied with how long it took to receive the **wattsmart** Home Energy Savings Starter Kit?

1. Yes
2. No **[PROBE FOR REASON AND RECORD]**
98. Don't Know
99. Refused

E4. Overall, how satisfied are you with your **wattsmart** Home Energy Savings Starter Kit? **[IF NEEDED: PLEASE CHOOSE FROM ONE OF THESE OPTIONS (READ RESPONSES)] [READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

1. Very Satisfied
2. Somewhat Satisfied
3. Not Very Satisfied
4. Not At All Satisfied
5. **[OPEN RESPONSE IF PARTICIPANT DOES NOT PROVIDE DIRECT ANSWER]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

E5. How did you first hear about **[INSERT UTILITY]'s wattsmart** Home Energy Savings Starter Kits? **[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. Northwest Energy Efficiency Alliance (NEEA)
17. Other **[RECORD VERBATIM]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

- E6. **[INSERT UTILITY]** also provides incentives for high-efficiency home equipment and upgrades such as appliances and insulation through the **wattsmart** Home Energy Savings program. Before today, were you aware of these offerings?
1. Yes
  2. No **[SKIP TO E8]**
  98. Don't Know **[SKIP TO E8]**
  99. Refused **[SKIP TO E8]**
- E7. Have you ever received an incentive from **[INSERT UTILITY]**'s **wattsmart** Home Energy Savings program?
1. Yes **[“WHAT DID YOU RECEIVE AN INCENTIVE FOR?” RECORD]**
  2. No
  98. Don't Know
  99. Refused
- E8. **[INSERT UTILITY]** also provides a Home Energy Reports Web portal to provide you with detailed information about your home's energy use and help you discover ways to save money. Before today, were you aware of this offering?
1. Yes
  2. No **[SKIP TO E10]**
  98. Don't Know **[SKIP TO E10]**
  99. Refused **[SKIP TO E10]**
- E9. Have you ever participated in the Home Energy Reports web portal?
1. Yes
  2. No
  98. Don't Know
  99. Refused
- E10. Please think back to the time when you were deciding to apply for the **wattsmart** Home Energy Savings Starter Kit. What were the reasons why you decided to request the kit? **[DO NOT READ. INDICATE ALL THAT APPLY. ONCE THEY RESPONDENT HAS FINISHED, SAY: “ARE THERE ANY OTHER FACTORS?”]**
1. Household bulbs had burned out
  2. Low on storage of household bulbs
  3. Did not have any CFLs or LEDs in my home prior
  4. Was interested in emerging technology
  5. The kit was free
  6. Wanted to save energy
  7. Wanted to reduce energy costs

8. Environmental concerns
9. Recommendation from friend, family member, or colleague
10. Advertisement in newspaper [PROBE: "FOR WHAT PROGRAM?" RECORD]
11. Radio advertisement [PROBE: "FOR WHAT PROGRAM?" RECORD]
12. Health or medical reasons
13. Maintain or increase comfort of home
14. Influenced by the Home Energy Reports the customer receives
15. Influenced by the **watt**smart Home Energy Savings Program
16. Other [RECORD]
98. Don't Know
99. Refused

**F. Spillover**

F1. Since receiving the **watt**smart Home Energy Savings Starter Kit have you added any other energy efficient equipment or services in your home that were not incentivized through the **watt**smart Home Energy Savings Program?

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

[IF F1 = 2, -98 OR -99 SKIP TO G1]

F2. What high-efficiency energy-saving equipment or services have you purchased since receiving the Kit? **[IF NEEDED: WE ARE INTERESTED IN KNOWING ABOUT ANY EQUIPMENT OR SERVICES YOU ADDED TO YOUR HOME, BESIDES THOSE INCLUDED IN THE KIT, FOR WHICH YOU DID NOT RECEIVE AN INCENTIVE THROUGH THE WATTSMAST HOME ENERGY SAVINGS PROGRAM. PROMPT IF NEEDED] MULTIPLE RESPONSE**

1. Clothes Washer **[RECORD QUANTITY]**
2. Refrigerator **[RECORD QUANTITY]**
3. Dishwasher **[RECORD QUANTITY]**
4. Windows **[RECORD QUANTITY IN SQ FT]**
5. Light Fixtures **[RECORD QUANTITY]**
6. Heat Pump **[RECORD QUANTITY]**
7. Central Air Conditioner **[RECORD QUANTITY]**
8. Room Air Conditioner **[RECORD QUANTITY]**
9. Ceiling Fans **[RECORD QUANTITY]**
10. Electric Storage Water Heater **[RECORD QUANTITY]**
11. Electric Heat Pump Water Heater **[RECORD QUANTITY]**
12. CFLs **[RECORD QUANTITY]**
13. LED bulbs **[RECORD QUANTITY]**
14. Insulation **[RECORD QUANTITY IN SQ FT]**
15. Air Sealing **[RECORD QUANTITY IN CFM REDUCTION]**
16. Duct Sealing **[RECORD QUANTITY IN CFM REDUCTION]**
17. Programmable thermostat **[RECORD QUANTITY]**
18. Other **[RECORD] [RECORD QUANTITY]**
19. None
98. Don't Know
99. Refused

**[IF F2 = 19 (ONLY), -98 OR -99 SKIP TO G1. REPEAT F3 THROUGH F5 FOR ALL RESPONSES TO F2]**

F3. In what year did you purchase **[INSERT MEASURE TYPE FROM F2]**?

1. 2015
2. 2016
4. 2017
3. Other **[RECORD YEAR]**
98. Don't Know
99. Refused

F4. Did you receive an incentive for **[INSERT MEASURE TYPE FROM F2]**?

1. Yes **[PROBE AND RECORD]**
2. No
98. Don't Know
99. Refused

- F5. How influential would you say the **wattsmart** Home Energy Savings program was in your decision to add the **[INSERT MEASURE FROM F2]** to your home? Please choose from one of these options:  
**[REPEAT FOR EACH MEASURE LISTED IN F2]**

1. Highly 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

## G. Household Characteristics

Before we conclude the survey, I have a few more questions regarding some information about your household. Please be advised that responses to these questions will be kept strictly confidential and you may opt to refuse to answer any proceeding question.

- G1. What is the fuel used by your primary water heater?
1. Electric
  2. Natural Gas **[IF KIT TYPE = 1-6, ASK "ARE YOU AWARE THAT YOU HAVE TO HAVE AN ELECTRIC WATER TO RECEIVE ANY FAUCET AERATORS OR SHOWERHEADS?" (RESPONSE OPEN END)]**
  3. Fuel oil **[IF KIT TYPE = 1-6, ASK "ARE YOU AWARE THAT YOU HAVE TO HAVE AN ELECTRIC WATER TO RECEIVE ANY FAUCET AERATORS OR SHOWERHEADS?" (RESPONSES OPEN END)]**
  4. Other **[OPEN ENDED, WRITE RESPONSE] [IF KIT TYPE = 1-6, ASK "ARE YOU AWARE THAT YOU HAVE TO HAVE AN ELECTRIC WATER TO RECEIVE ANY FAUCET AERATORS OR SHOWERHEADS?" (RESPONSE OPEN END)]**
  98. Don't know
  99. Refused
- G2. 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
- G3. How many showers are in your home?
1. \_\_\_\_\_ **[RECORD]**
  98. (Don't know)
  99. (Refused)

G4. How many bathroom sinks are in your home?

- 1. \_\_\_\_\_ [RECORD]
- 98. (Don't know)
- 99. (Refused)

G5. Including yourself and any children, how many people currently live in your home?

- 1. \_\_\_\_\_ [RECORD]
- 98. Don't Know
- 99. Refused

G6. **[ASK ONLY IF G5.1 > 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

## H. Conclusion

H1. That concludes the survey. Do you have any additional feedback or comments?

- 1. Yes [RECORD VERBATIM]
- 2. No
- 98. Don't know
- 99. refused

Thank you very much for your time and feedback. Have a great day.

## PacifiCorp Manufactured Homes Duct Sealing 15-16 Participant Survey

*Audience: This survey is designed for PacifiCorp residential customers in California, Idaho, and Washington that participated in the manufactured homes duct sealing offer in 2016.*

*Purpose: this survey will collect information on HES program awareness, motivations to participate, satisfaction, freeridership and spillover effects. This survey will be administered through telephone calls.*

*Quota: Aim for the following number of completed surveys for each state (CA, ID, and WA)*

	Sample (survey quota)
CA	15
ID	59
WA	15

Topics	Researchable Questions	Survey Questions
Program Awareness and Participation Decisions	How did the customer learn about the duct sealing retrofit measure? What role did the website play in informing the customer? Why did the customer choose to participate?	Section B
Behavioral Changes	Has customer heating or cooling behavior changed since the duct sealing? Has the customer noticed a difference in home comfort?	Section C
Satisfaction	With the contractor? With the process to sign up and time it took to complete the work? With the offer overall?	Section D
Net-to-Gross	Self-reported freeridership and spillover	Section E and Section F
Demographics	Customer household information for statistical purposes	Section G

- Interviewer instructions are in green.
- CATI programming instructions are in red.

**[UTILITY]**

Washington and California: Pacific Power

Idaho: Rocky Mountain Power

**[YEAR OF PARTICIPATION]**

**[SITE ADDRESS]**

## A. Introduction

- A1. **[TO RESPONDENT]** Hello, I'm **[INSERT FIRST NAME]** and I am calling from **[INSERT SURVEY FIRM]** on behalf of **[INSERT UTILITY]**. We are exploring the impacts of **[INSERT UTILITY]'S** energy efficiency improvement offerings in your area. I would like to ask you some questions about your recent participation in the duct sealing offer from **[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 [INSERT SURVEY FIRM], 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 DUCT SEALING OFFER THAT YOU RECEIVED THROUGH [INSERT UTILITY]'S WATTSMART HOME ENERGY SAVINGS PROGRAM. [IF NEEDED] YOU MAY HAVE RECEIVED OTHER EQUIPMENT OR BENEFITS THROUGH [INSERT UTILITY]'S WATTSMART HOME ENERGY SAVINGS PROGRAM, HOWEVER, WE ARE INTERESTED IN THE FREE DUCT SEALING THAT YOU RECEIVED.**

**(SALES CONCERN: I AM NOT SELLING ANYTHING; WE WOULD SIMPLY LIKE TO LEARN ABOUT YOUR EXPERIENCE WITH THE PROGRAM. YOUR RESPONSES WILL BE KEPT CONFIDENTIAL. IF YOU WOULD LIKE TO TALK WITH SOMEONE FROM THE WATTSMART HOME ENERGY SAVINGS PROGRAM TO VERIFY THE LEGITIMACY OF THIS STUDY, PLEASE CALL NIKKI KARPAVICH AT 801-220-4439.)**

**(WHO IS DOING THIS STUDY: [INSERT UTILITY], YOUR ELECTRIC UTILITY, IS CONDUCTING EVALUATIONS OF SEVERAL OF ITS EFFICIENCY PROGRAMS, INCLUDING THE WATTSMART HOME ENERGY SAVINGS PROGRAM.)**

**(WHY YOU ARE CONDUCTING THIS STUDY: STUDIES LIKE THIS HELP [INSERT UTILITY] BETTER UNDERSTAND CUSTOMERS' NEEDS AND INTEREST IN ENERGY PROGRAMS AND SERVICES.)**

- A2. Our records show that in **[INSERT YEAR]**, **[INSERT UTILITY]** provided you with a free inspection and sealing of your HVAC ducts. We're talking with customers about their experiences with this offer. 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]**

- A3. Were you the primary decision-maker when deciding to participate?
1. Yes
  2. No **[REQUEST TO SPEAK TO THE PRIMARY DECISION MAKER, IF AVAILABLE START OVER, IF NOT, SCHEDULE TIME TO CALL BACK]**
  98. Don't Know **[THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**
- A4. Have you, or anyone in your household, ever been employed by **[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]**

## ***B. Program Awareness & Participation Decisions***

- B1. How did you first hear about **[INSERT UTILITY]'s wattsmart** Home Energy Savings program? **[IF NEEDED: "THIS IS THE NAME OF THE PROGRAM YOU PARTICIPATED IN TO TEST AND SEAL YOUR HVAC DUCTS."]** **[DO NOT PROMPT. RECORD ONLY THE FIRST WAY HEARD ABOUT THE PROGRAM.]**
1. Property Operator
  2. A program affiliated contractor
  3. Bill Inserts
  4. Neighbor/family/friends/word-of-mouth
  5. Rocky Mountain Power/Pacific Power Representative
  6. Rocky Mountain Power/Pacific Power website
  7. **wattsmart** Home Energy Savings website
  8. Home Energy Reports
  9. Home and Garden Shows
  10. Social Media/Internet Advertising/Online Ad
  11. Newspaper/Magazine/Print Media
  12. Other website
  13. Radio
  14. Retailer/Store
  15. Social Media
  16. Sporting event
  17. TV
  18. Other **[RECORD VERBATIM]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused

- B2. **[ASK IF E5 <= 6 OR 7, OTHERWISE SKIP TO B3]** Prior to participating in the duct sealing offer, did you visit the **[INSERT UTILITY]** **wattsmart** Home Energy Savings program website to learn about the details of the offer? **[DO NOT READ RESPONSES]**
1. Yes
  2. No
- B3. **[ASK IF E5 = 6 OR 7, OR IF B2 = 1, OTHERWISE SKIP TO E10]** How helpful did you find the website—would you say it was ... **[READ]**
1. Very helpful **[SKIP TO E10]**
  2. Somewhat helpful
  3. Not very helpful
  4. Not at all helpful
  98. **[DO NOT READ]** Don't Know[SKIP TO B5]
  99. **[DO NOT READ]** Refused[SKIP TO B5]
- B4. **[ASK IF B3= 2, 3, OR 4. OTHERWISE SKIP TO E10]** What would make the website more helpful for you? **[DO NOT READ RESPONSES, MARK ALL THAT APPLY]**
1. Nothing, it is already very helpful for me.
  2. Make the website easier to navigate or more user-friendly
  3. Make program information more clear and concise
  4. Incorporate more visual information and less text
  5. Provide easier access to customer service or FAQs
  6. Other **[RECORD]**
- B5. Please think back to the time when you were deciding to participate in the duct sealing offer. What factors motivated you to have your ducts tested and sealed through the **wattsmart** Home Energy Savings Program? **[DO NOT READ. INDICATE ALL THAT APPLY. ONCE THEY RESPONDENT HAS FINISHED, SAY: "ARE THERE ANY OTHER FACTORS?"]**
1. HVAC/heating/cooling equipment working poorly
  2. Health or medical reasons
  3. Maintain or increase comfort of home
  4. The fact that it was offered for free
  5. Wanted to save energy and reduce energy costs
  6. Environmental concerns
  7. Recommendation from friend, family member, or colleague
  8. Recommendation from a contractor
  9. Other **[RECORD]**

- 98. Don't Know
- 99. Refused

B6. What type of heating system do you primarily use? Do you use... **[READ]**

- 1. Electric Furnace
- 2. Gas Furnace
- 3. Boiler
- 4. Air Source Heat Pump
- 5. Ground Source Heat Pump
- 6. Wood or Pellet Stove
- 7. Baseboard electric heaters
- 8. Portable electric heaters
- 9. Other **[SPECIFY]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

B7. How many years old is the heating system?

- 1. **[RECORD]**
- 98. Don't Know
- 99. Refused

B8. What type of central cooling system do you primarily use? Do you use a... **[READ, MULTIPLE CHOICES ALLOWED]**

- 1. Evaporative Cooler
- 2. Air Source Heat Pump
- 3. Ground Source Heat Pump
- 4. Whole house fan
- 5. Central Air Conditioner (other than those listed above)
- 6. Window Air Conditioner
- 7. No central cooling system **[SKIP TO C3]**
- 8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

B9. How many years old is your current cooling system?

- 1. **[RECORD]**
- 98. Don't Know
- 99. Refused

### C. Behavioral Changes

C1. Prior to having your ducts inspected and sealed, at what temperature did you typically set your thermostat for cooling in the summer? If you change the setting regularly, please estimate the average setting.

1. [RECORD RESPONSE]
2. Don't use thermostat in the summer/don't have central cooling [SKIP TO C3]
98. Don't Know [SKIP TO C3]
99. Refused [SKIP TO C3]

C2. And since having your ducts inspected and sealed, at what temperature do you typically set your thermostat for cooling in the summer?

1. [RECORD RESPONSE]
2. Same/no change
98. Don't Know
99. Refused

C3. Prior to having your ducts inspected and sealed, at what temperature did you typically set your thermostat for heating in the winter? If you change the setting regularly, please estimate the average setting.

1. [RECORD RESPONSE]
2. Don't use thermostat in the winter/don't have central heating [SKIP TO C5]
98. Don't Know [SKIP TO C5]
99. Refused [SKIP TO C5]

C4. And since having your ducts sealed, at what temperature do you typically set your thermostat for heating in the winter?

1. [RECORD RESPONSE]
2. Same/no change
98. Don't Know
99. Refused

C5. In general, have you noticed any difference in your home thermal comfort since having your ducts sealed? Do you feel... [READ]

1. More comfortable
2. Less comfortable
3. No change

- 98. [DO NOT READ] Don't Know
- 99. [DO NOT READ] Refused

## D. Satisfaction

- D1. Thank you. Now I would like to ask a few questions about your satisfaction with the duct sealing retrofit in your home. **HOW SATISFIED WERE YOU WITH THE PROFESSIONALISM AND ATTITUDE OF THE CONTRACTOR THAT PERFORMED THE DUCT TESTING AND SEALING?** [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
- D2. [IF D1 = 3 OR 4] Why were you not satisfied with the contractor that performed the duct testing and sealing?
- 1. [RECORD]
  - 98. Don't know
  - 99. Refused
- D3. How easy or difficult did you find the process to sign up for the initial duct testing appointment? [READ CATEGORIES; RECORD FIRST RESPONSE ONLY]
- 1. Very Easy
  - 2. Somewhat Easy
  - 3. Somewhat difficult [PROBE: WHY DO YOU SAY THAT? RECORD]
  - 4. Very difficult [PROBE: WHY DO YOU SAY THAT? RECORD]
  - 98. [DO NOT READ] Don't Know
  - 99. [DO NOT READ] Refused
- D4. About how many days passed from when you first set up an appointment to have your ducts tested and sealed, and when a contractor first visited your house?
- 1. [RECORD]
  - 98. Don't know
  - 99. Refused

- D5. About how many days passed from when the contractor first visited your house and when they completed the work?
1. [RECORD]
  2. None, the work was completed in the same day
  98. Don't know
  99. Refused
- D6. All in all, how many visits did the contractor (or contractors) make to your house to complete the work?
1. [RECORD] visits
  98. Don't know
  99. Refused
- D7. Did your participation in [INSERT UTILITY]'s duct sealing offer cause your satisfaction with [INSERT UTILITY] to...
1. Increase
  2. Stay the same
  3. Decrease
  98. [DO NOT READ] Don't Know
  99. [DO NOT READ] Refused

## E. Freeridership

Now I'd like to talk with you a little more about the duct sealing project.

- E1. When you first heard about the duct sealing offer from [INSERT UTILITY] THROUGH THEIR **watt**smart Home Energy Savings program, had you already been planning to have your ducts sealed?
1. Yes
  2. No [SKIP TO E7]
  98. Don't Know [SKIP TO E7]
  99. Refused [SKIP TO E7]
- E2. Would you have had your ducts tested and sealed without the **watt**smart Home Energy Savings program?
1. Yes
  2. No [SKIP TO E5]
  98. Don't Know
  99. Refused

- E3. Let me make sure I understand: without the program would you have had your ducts both tested and sealed?
1. Yes, I would have had the ducts both tested and sealed
  2. I would have had the ducts sealed, without the testing
  3. I would have had the ducts tested, but not necessarily sealed
  4. No, I would not have had any work done on my ducts at all **[SKIP TO E5]**
  98. Don't Know
  99. Refused
- E4. Without the program incentive would you have had this work on your ducts done... **[READ]**
1. At the same time?
  2. Within one year?
  3. In more than one year?
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- E5. **[ASK IF E2=2 OR E3=4]** To confirm, when you say you would not have had your ducts tested and sealed without the program, do you mean you would not have had any work done to your duct system at all?
1. Yes
  2. No
  98. Don't Know
  99. Refused
- E6. **[ASK IF E5= 2, 98 OR 99]** Can you clarify what work you might have done to your duct system without the program?
1. **[RECORD RESPONSE]**
- E7. In your own words, please tell me the influence the **watt**smart Home Energy Savings program incentive had on your decision to test and seal your ducts?
1. **[RECORD RESPONSE]**

## F. Spillover

F1. Since participating in the duct sealing offer, have you added any other energy efficient equipment or services in your home that were not incentivized through the **wattsmart** Home Energy Savings Program? **[IF NEEDED: IN OTHER WORDS, HAVE YOU PURCHASED ANY HIGH-EFFICIENCY EQUIPMENT OR APPLIANCES, OR MADE ANY EFFICIENCY UPGRADES, THAT YOU PAID FOR YOURSELF AND FOR WHICH YOU DID NOT RECEIVE A REBATE FROM THE UTILITY.]**

1. Yes
2. No **[SKIP TO G1]**
98. Don't Know **[SKIP TO G1]**
99. Refused **[SKIP TO G1]**

**[IF F1 = 2, 98 OR 99 SKIP TO G1]**

F2. What high-efficiency energy-saving equipment or services have you purchased since participating in the duct sealing offer? **[LIST OF OTHER ELIGIBLE APPLIANCES AND MEASURES OFFERED IN THE PROGRAM OTHER THAN DUCT TESTING AND SEALING. PROMPT IF NEEDED]**

1. Clothes Washer **[RECORD QUANTITY]**
2. Refrigerator **[RECORD QUANTITY]**
3. [Dishwasher](#) **[RECORD QUANTITY]**
4. Windows **[RECORD QUANTITY IN SQ FT]**
5. Fixtures **[RECORD QUANTITY]**
6. Heat Pump **[RECORD QUANTITY]**
7. Central Air Conditioner **[RECORD QUANTITY]**
8. Room Air Conditioner **[RECORD QUANTITY]**
9. Ceiling Fans **[RECORD QUANTITY]**
10. Electric Tankless Water Heater **[RECORD QUANTITY]**
11. Electric Heat Pump Water Heater **[RECORD QUANTITY]**
12. CFLs **[RECORD QUANTITY]**
13. LEDs **[RECORD QUANTITY]**
14. Insulation **[RECORD QUANTITY IN SQ FT]**
15. Air Sealing **[RECORD QUANTITY IN CFM REDUCTION]**
16. Duct sealing **[RECORD QUANTITY IN CFM REDUCTION]**
17. Programmable thermostat **[RECORD QUANTITY]**
18. Other **[RECORD] [RECORD QUANTITY]**
19. None
98. Don't Know
99. Refused

**[IF F2 = 19, 98 OR 99 SKIP TO G1. REPEAT F3 THROUGH F5 FOR ALL RESPONSES TO F2]**

F3. In what year did you purchase the **INSERT MEASURE TYPE FROM F2**?

1. 2015
2. 2016
3. 2017
4. Other **[RECORD YEAR]**
98. Don't Know
99. Refused

F4. Did you receive an incentive for the **INSERT MEASURE TYPE FROM F2**?

1. Yes **[PROBE : Who paid you the incentive for the [MEASURE]? ]**
2. No
98. Don't Know
99. Refused

F5. How influential would you say the **wattsmart** Home Energy Savings program was in your decision to add the **INSERT MEASURE FROM F2** to your home? Was it... **[REPEAT FOR EACH MEASURE LISTED IN F2]**

1. Highly Influential
2. Somewhat Influential
3. Not very influential
4. Not at all influential
98. Don't Know
99. Refused

## G. Demographics

I have just a few more questions about the house at **[SITE ADDRESS]**. Again, all your answers will be strictly confidential.

G1. Do you own this home, or are you the renter?

1. Own
2. Rent
3. Other **[RECORD]**
98. Don't Know
99. Refused

G2. Is this your primary residence?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

G3. **[IF G2=2]** Is the home occupied year-round?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

G4. **[IF G3=2]** How many months of the year is the home occupied, on average?

- 1. **[RECORD # MONTHS]**
- 98. Don't Know
- 99. Refused

G5. How many people currently live in your home?

- 1. **[RECORD]**
- 98. Don't Know
- 99. Refused

G6. About when was this home built? **[READ LIST IF NEEDED]**

- 1. Before 1970's
- 2. 1970's
- 3. 1980's
- 4. 1990-94
- 5. 1995-99
- 6. 2000-2004
- 7. 2005-2009
- 8. 2010 +
- 9. OTHER **[RECORD]**
- 98. **[DO NOT READ]** don't know
- 99. **[DO NOT READ]** refused

G7. Approximately how many square feet is the home in which the **DUCT SEALING WAS PERFORMED?**  
**[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

G8. What is the fuel used by your primary water heater?

1. Electricity
2. Natural gas
3. Fuel oil
4. Other **[RECORD]**
98. Don't know
99. Refused

G9. Can you tell me which of the following categories applies to your total household income for the year 2016? Please stop me when I get to the right one.

1. Under \$20,000
2. \$20,000 to under \$30,000
3. \$30,000 to under \$40,000
4. \$40,000 to under \$50,000
5. \$50,000 to under \$60,000
6. \$60,000 to under \$80,000
7. \$80,000 to under \$100,000
8. \$100,000 to under \$120,000
9. \$120,000 or more
98. Don't Know
99. Refused

## ***H. Conclusion***

H1. That concludes the survey. Do you have any additional feedback or comments?

1. Yes **[RECORD VERBATIM]**
2. No
98. Don't know
99. refused

Thank you very much for your time and feedback. Have a great day.

## PacifiCorp HES General Population Survey

*Audience: This survey is designed for PacifiCorp residential customers in Utah, Idaho, Washington, Wyoming and California. The primary purpose of this survey is to collect information on awareness, satisfaction, installation of energy efficient lighting and energy efficient equipment purchases and motivations. This survey will be administered through telephone calls.*

*Quota: 250 completed surveys for each state (UT, ID, WA, WY and CA)*

Topics	Researchable Questions	Survey Questions
Awareness	Are respondents aware of LED lighting products? Are respondents aware of advanced power strip products?	B1, D1
Installation	What percent of LEDs purchased in the past 12 months were installed in the home? Where were the purchased LEDs installed (room)? What percent of purchased advanced power strips in the past 12 months were installed in the home? Where are the purchased advanced power strips installed (entertainment center or home office)?	C1, C9, C14 D6, D10, D14
Removal and Storage	What percent of LEDs purchased in the past 12 months were removed and why? What percent of LEDs purchased in the past 12 months are in storage for future use? What percent of advanced power strips in the past 12 months were removed and why? What percent of advanced power strips purchased in the past 12 months are in storage for future use?	C10-C13 D11-D13
Satisfaction with LEDs and advanced power strips	How satisfied are respondents with their LEDs? What do they like or dislike about them? How satisfied are respondents with their advanced power strips? What do they like or dislike about them?	C4-C7, C11, C16, C17 D12, D15, D16
Program Awareness	Are respondents aware of the PacifiCorp programs? How did they hear about them? Have respondents visited the Home Energy Savings Website?	Section E
Nonparticipant Spillover	What actions are respondents taking to save energy? Did they receive a rebate from PacifiCorp during the 2015-2016 program period for other equipment purchased? How influential were the PacifiCorp programs in their decision to install the equipment?	Section F
Demographics	How do awareness /activities/behaviors vary by demographic characteristics?	Section G

- Interviewer instructions are in green.
- CATI programming instructions are in red.

**[UTILITY]**

Washington and California: Pacific Power

Utah, Wyoming, and Idaho: Rocky Mountain Power

**A. Introduction**

A1. **[TO RESPONDENT]** Hello, I'm **[INSERT FIRST NAME]**, calling from **[INSERT SURVEY FIRM]**, on behalf of **[UTILITY]**. May I please speak with **[INSERT NAME]**?

Hello, we are conducting a survey about household energy use and would like to ask you some questions about your household's lighting and appliances. 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 to 20 minutes of your time. Is this a good time for us to speak with you?)

**(WHO ARE YOU WITH: I'M WITH [INSERT SURVEY FIRM], AN INDEPENDENT RESEARCH FIRM THAT HAS BEEN HIRED BY [UTILITY] TO CONDUCT THIS RESEARCH. I AM CALLING TO LEARN ABOUT YOUR HOUSEHOLD LIGHTING AND APPLIANCE ENERGY USE)**

**(Sales concern:** I am not selling anything; we would simply like to learn about your household lighting and appliance energy use. Your responses will be kept confidential. If you would like to talk with someone from the Home Energy Savings Program 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.)

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

A2. This call may be monitored for quality assurance. First, are you the person who usually purchases light bulbs and household equipment and appliances 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]**

A3. 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 **[CONTINUE]**
99. Refused **[THANK AND TERMINATE]**

## **B. Awareness and Purchase of LEDs**

B1. Before this call today, had you heard of light emitting diode light bulbs or L-E-D **[SAY THE LETTERS L-E-D]** for short? **[IF NEEDED: THESE BULBS HAVE REGULAR SCREW BASES THAT FIT INTO MOST HOUSEHOLD SOCKETS.]**

1. Yes
2. No

B2. Have you purchased any regular screw base light bulbs in the last twelve months? **[IF NEEDED, REGULAR SCREW BASE LIGHT BULBS ARE THOSE THAT FIT INTO MOST HOUSEHOLD SOCKETS. PLEASE DON'T INCLUDE BULBS YOU MAY HAVE RECEIVED FOR FREE AS PART OF A KIT.]**

1. Yes
2. No **[SKIP TO SECTION D]**
98. Don't Know **[SKIP TO SECTION D]**
99. Refused **[SKIP TO SECTION D]**

B3. What kind of regular screw base light bulbs did you purchase in the last twelve months? **[READ RESPONSE OPTIONS AND SELECT ALL THE APPLY]**

1. CFLs **[IF NEEDED: THESE ARE SPIRAL SHAPED INSIDE AND FIT INTO MOST HOUSEHOLD SOCKETS]**
2. **LED LIGHT BULBS** **[IF NEEDED: THESE ARE THE NEWEST TECHNOLOGY BULBS THAT FIT INTO MOST HOUSEHOLD SOCKETS]**
3. **INCANDESCENT LIGHT BULBS** **[IF NEEDED: THESE ARE THE OLDEST TECHNOLOGY BULBS WITH THE ELEMENT INSIDE]**

- 4. **HALOGEN LIGHT BULBS** [IF NEEDED: THESE ARE GAS-FILLED INCANDESCENT BULBS THAT FIT INTO MOST HOUSEHOLD SOCKETS]
- 5. Other: **[RECORD VERBATIM]**
- 98. **[DON'T READ]** Don't Know **[SKIP TO SECTION D]**
- 99. **[DON'T READ]** Refused **[SKIP TO SECTION D]**

B4. **[ASK IF B3<>2]** Why did you not choose to purchase LEDs to meet your lighting needs?

- 1. **[RECORD VERBATIM]**
- 98. Don't Know
- 99. Refused

**[IF B3<>2 SKIP TO SECTION D]**

## C. LED Installation and Satisfaction

C1. In the last 12 months, how many regular screw base LEDs did you or your household purchase? Please try to estimate the total number of *individual LED bulbs you purchased*, as opposed to packages. Don't include LEDs you may have received for free as part of a kit. **[IF "DON'T KNOW," PROBE: "IS IT LESS THAN OR MORE THAN FIVE BULBS?" WORK FROM THERE TO GET AN ESTIMATE.]**

- 1. **[RECORD # OF LEDS: NUMERIC OPEN END] [IF C1.1= 0 SKIP TO SECTION D]**
- 98. Don't Know **[PROBE: "IS IT LESS THAN OR MORE THAN FIVE BULBS?" WORK FROM THERE TO GET AN ESTIMATE] [IF UNABLE TO GET AN ANSWER, SKIP TO SECTION D]**
- 99. Refused **[SKIP TO SECTION D]**

C2. As far as you know, were any of the **[C1.1]** LEDs you purchased part of a **[INSERT UTILITY]** sponsored discount?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

C3. **[ASK IF C2= 1, OTHERWISE SKIP TO C4]** Did the **[INSERT UTILITY]** discount influence your decision to purchase LEDs over another type of bulb?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

- C4. When you purchased those LED bulbs, did you intend to definitely purchase LEDs, or did you consider any other bulb types?
1. I wanted LEDs **[SKIP TO C7]**
  2. Considered other bulb types
  98. Don't Know **[SKIP TO C7]**
  99. Refused **[SKIP TO C7]**
- C5. **[ASK IF C4=2]** What other types of bulb did you consider? **[IF NEEDED: OTHER COMMON TYPES OF REGULAR SCREW BASE BULBS INCLUDE INCANDESCENT, HALOGEN, AND CFLS] [SELECT ALL THAT APPLY]**
1. Incandescent bulbs
  2. Halogen bulbs
  3. CFL bulbs
  4. Other **[RECORD]**
  5. Any type/was not concerned with bulb type **[SKIP TO C7]**
  98. Don't know
  99. Refused
- C6. What types of regular screw base bulb, if any, would you be unwilling to purchase? **[IF NEEDED: OTHER COMMON TYPES OF REGULAR SCREW BASE BULBS INCLUDE INCANDESCENT, HALOGEN, AND CFL BULBS] [SELECT ALL THAT APPLY]**
1. There were no types I would NOT have purchased
  2. Would not have purchased incandescent bulbs
  3. Would not have purchased halogen bulbs
  4. Would not have purchased CFLs
  5. Other **[RECORD]**
  98. Don't know
  99. Refused
- C7. What **[IF C3=1 SAY "OTHER"]** factors were most important to you when you made the decision to purchase the LED bulbs? **[DO NOT READ. MULTIPLE RESPONSES ALLOWED]**
1. Energy savings or cost savings on electricity bill
  2. Price of bulb
  3. Cost-effectiveness/best value for the money
  4. Environmental concerns
  5. CFL disposal concerns
  6. Quality (brightness, color) of light
  7. Lifetime of bulb
  8. Interested in the latest technology
  9. Brand (i.e., Philips, Sylvania, etc.)

- 10. ENERGY STAR
- 11. There were no other choices
- 12. Other **[RECORD]**
- 98. Don't Know
- 99. Refused

C8. Do you know how many, if any, of the LEDs you purchased are ENERGY STAR certified? **[IF NEEDED: ENERGY STAR CERTIFIED BULBS HAVE THE ENERGY STAR LABEL ON THE PACKAGE. SOME, BUT NOT ALL, LEDS ARE ENERGY STAR CERTIFIED.]**

- 1. **[RECORD #]**
- 98. Don't know
- 99. Refused

C9. Now I'd like to ask you a few questions about the **[C1.1]** LED(s) you acquired in the last twelve months. How many did you install in your home since you purchased them?

- 1. **[RECORD # OF LEDS]**
- 2. None **[SKIP TO C13]**
- 98. Don't Know **[SKIP TO C16]**
- 99. Refused **[SKIP TO C16]**

C10. Have you since removed any of those LED bulbs from the sockets?

- 1. Yes **[ASK "HOW MANY DID YOU REMOVE?" RECORD # OF LEDS]**
- 2. No **[SET C10.1=0 AND SKIP TO C13]**
- 98. Don't Know **[SKIP TO C16]**
- 99. Refused **[SKIP TO C16]**

C11. **[ASK IF C10= 1, OTHERWISE SKIP TO C13]** What were the reasons you removed the **[C10.1]** purchased LEDs from the sockets? **[QUANTITIES SHOULD ADD TO C10.1, IF NOT, ASK "WHAT ABOUT THE REMAINING BULBS YOU REMOVED?"] [DO NOT READ, MULTIPLE RESPONSES ALLOWED]**

- 1. Bulb burned out **[ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]**
- 2. Bulbs were too bright **[ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]**
- 3. Bulbs were not bright enough **[ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]**
- 4. Delay in light coming on **[ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]**
- 5. Did not work with dimmer/3-way switch **[ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]**

6. Didn't fit properly [ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]
7. Stuck out of fixture [ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]
8. Light color [ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]
9. Light is too pointed/narrow [RECORD VERBATIM] [ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]
10. Other [RECORD VERBATIM] [ASK: "HOW MANY DID YOU REMOVE BECAUSE OF THIS?" RECORD # OF LEDS]
98. Don't Know
99. Refused

C12. [ASK IF C10= 1, OTHERWISE SKIP TO C13] What type of light bulb did you replace the removed LEDs with? [MULTIPLE RESPONSES ACCEPTED]

1. Incandescent bulb
2. Halogen bulb
3. CFL
4. Other: [RECORD VERBATIM]
98. Don't know
99. Refused

C13. [ASK IF C1.1-C9.1>0] Are any of the [C1.1] LEDs you purchased in the last twelve months currently in storage for later use? (these are bulbs that you never installed)

1. Yes [ASK: "HOW MANY ARE NOW IN STORAGE?" RECORD # OF LEDS] [IF C13.1=C1.1, SKIP TO C16]
2. No
98. Don't Know
99. Refused

C14. [ASK IF (C9.1-C10.1)>0 OTHERWISE SKIP TO C16] Of the [C9.1-C10.1] LED bulbs that are currently installed in your home that were purchased during the last twelve months, can you tell me how many are installed in each room in your house? Please try to count only the LED bulbs that were purchased in the last 12 months.

1. All occupied bedrooms [RECORD]
2. All unoccupied bedrooms [RECORD]
3. Basement [RECORD]
4. All bathrooms [RECORD]
5. All closets [RECORD]
6. Dining [RECORD]
7. Foyer [RECORD]

8. Garage [RECORD]
9. Hallway [RECORD]
10. Kitchen [RECORD]
11. Office/Den [RECORD]
12. Living space including family rooms, living rooms, rec rooms and similar areas [RECORD]
13. Storage areas other than closets [RECORD]
14. Outside [RECORD]
15. Utility room [RECORD]
16. Other [RECORD VERBATIM]
98. Don't Know
99. Refused

C15. **[ASK ONLY IF TOTAL BULBS IN C14 PLUS C10.1 < C9.1 (IF TOTAL NUMBER OF BULBS LISTED IN EACH ROOM, PLUS THOSE REMOVED DOES NOT MATCH THE NUMBER OF BULBS INSTALLED STATED IN C9.1) OTHERWISE SKIP TO C16]** Thanks, that accounts for [TOTAL BULBS IN C14] of the total quantity that were installed in your home. Can you tell me where the [C9.1 MINUS TOTAL BULBS IN C14 MINUS C10.1] other bulbs are installed?

1. [RECORD VERBATIM]
98. Don't Know
99. Refused

C16. How satisfied are you with the LEDs that you purchased during the last twelve months? 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

C17. **[ASK ONLY IF C16= 3 OR 4]** Why would you say you are [INSERT ANSWER FROM C16] with LEDs? [DO NOT READ LIST AND RECORD ALL THAT APPLY]

1. Light is too pointed/narrow
2. Too expensive
3. Bulbs are too bright
4. Bulbs are not bright enough
5. Delay in light coming on
6. Did not work with dimmer/3-way switch
7. Didn't fit properly
8. Stuck out of fixture
9. Light color

- 10. Bulb started flickering
- 11. Bulb did not last/burnt out
- 12. Other **[RECORD VERBATIM]**
- 98. Don't Know
- 99. Refused

## D. *Advanced Power Strips*

D1. Now I would like to ask you a few questions about the use of advanced power strips in your house. Before this call today, had you ever heard of a specific type of power strips called *advanced* power strips? **[EMPHASIS ON "ADVANCED" TO CLARIFY THAT THE QUESTION IS NOT ABOUT REGULAR POWER STRIPS]**

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused **[SKIP TO SECTION E]**

D2. **[ASK IF D1=1 OTHERWISE SKIP TO D3]** Can you tell me what you know about advanced power strips?

- 1. **[RECORD VERBATIM THEN SKIP TO D4]**
- 98. Don't Know
- 99. Refused **[SKIP TO D4]**

D3. **[ASK IF D1=2, 98 OR D2= 98]** Let me clarify what I am referring to: Many plugged in electronics continue to use electricity when they are turned off. An *advanced* power strip helps reduce this wasted electricity by utilizing a main outlet and a number of controlled outlets. The power strip senses when the TV or computer plugged into the main outlet is turned off, and automatically eliminates power to the controlled outlets, where any peripheral devices may be plugged in.

Given this clarification, had you heard of advanced power strips before today?

- 1. Yes
- 2. No **[SKIP TO D5]**

D4. Have you purchased any advanced power strips in the last twelve months?

- 1. Yes **[SKIP TO D6]**
- 2. No
- 98. Don't Know
- 99. Refused

- D5. If you obtain an advanced power strip in the future where would you install it? **[READ RESPONSE OPTIONS AND SELECT ALL THAT APPLY]**
1. Home entertainment center (This is where your main TV is installed, and is typically in the family room or TV room)
  2. Home office (This is where your home computer and any peripheral devices are installed)
  3. Other **[RECORD VERBATIM]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- D6. **[ASK IF D4=1 OTHERWISE SKIP TO SECTION E]** In the last 12 months, how many advanced power strips did you or your household purchase?
1. **[RECORD # OF ADVANCED POWER STRIPS] [IF D6.1=0 SKIP TO SECTION E]**
  98. Don't Know **[PROBE FOR ESTIMATES; IF UNABLE TO GET AN ANSWER, SKIP TO SECTION E]**
  99. Refused **[SKIP TO SECTION E]**
- D7. Were any of the **[D6.1]** advanced power strips you purchased part of a **[INSERT UTILITY]** sponsored sale?
1. Yes
  2. No
  98. Don't Know
  99. Refused
- D8. **[ASK IF D7= 1, OTHERWISE SKIP TO D9]** Did the **[INSERT UTILITY]** discount influence your decision to purchase an advanced power strip as opposed to a regular power strip?
1. Yes
  2. No
  98. Don't Know
  99. Refused

- D9. What **[IF D8=1 SAY "OTHER"]** factors were important in your decision to buy an advanced power strip as opposed to a regular one? **[DO NOT READ. MULTIPLE RESPONSES ALLOWED]**
1. Energy savings or cost savings on electricity bill
  2. Good price of the advanced power strip compared to regular power strips
  3. Ability to control multiple sockets
  4. Environmental concerns
  5. Interested in the latest technology
  6. Other **[RECORD]**
  98. Don't Know
  99. Refused
- D10. Thinking of the advanced power strip (s) you acquired in the last twelve months, how many did you install in your home since you purchased them?
1. **[RECORD # INSTALLED]**
  2. None **[SKIP TO D13]**
  98. Don't Know **[SKIP TO D13]**
  99. Refused **[SKIP TO D13]**
- D11. Have you since removed any of the advanced power strips installed?
1. Yes **[ASK "HOW MANY DID YOU REMOVE?" RECORD #]**
  2. No **[SET D11.1=0 AND SKIP TO D13]**
  98. Don't Know **[SKIP TO D13]**
  99. Refused **[SKIP TO D13]**

- D12. What were the reasons you removed the **[D11.1]** purchased advanced power strip(s) from the sockets? **[QUANTITIES SHOULD ADD TO D11.1, IF NOT, ASK “WHAT ABOUT THE REMAINING ADVANCED POWER STRIPS YOU REMOVED?”] [DO NOT READ, MULTIPLE RESPONSES ALLOWED]**
1. Not working correctly **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  2. Turns appliances/electronics off too early or during use **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  3. Not compatible with my appliances/electronics **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  4. **INCONVENIENT/ANNOYING/CONFUSING/FRUSTRATING** **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  5. **FLASHING LIGHT IS ANNOYING OR TOO BRIGHT** **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  6. **CAUSED DAMAGE TO MY APPLIANCES/ELECTRONICS** **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  7. **NO NEED FOR IT ANY MORE** **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  8. **DID NOT LOOK GOOD** **[ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  9. Other **[RECORD VERBATIM] [ASK: “HOW MANY DID YOU REMOVE BECAUSE OF THIS?” RECORD # OF ADVANCED POWER STRIPS]**
  98. Don't Know
  99. Refused
- D13. **[ASK IF D6.1-D10.1>0, OR IF D10=2, 98, OR 99]** Are any of the **[D6.1]** ADVANCED POWER STRIPS you purchased in the last twelve months currently in storage for later use?
1. Yes **[ASK: “HOW MANY ARE NOW IN STORAGE?” RECORD #]**
  2. No
  98. Don't Know
  99. Refused

D14. **[ASK IF D10.1 MINUS D11.1>0]** Of the **[D10.1 MINUS D11.1]** advanced power strip (s) that remain installed in your home, can you tell me where each one is installed? **[READ RESPONSE OPTIONS AND SELECT ALL THAT APPLY]**

1. Home entertainment center (This is where your main TV is installed, and is typically in the family room or TV room) **[RECORD # INSTALLED IN HOME ENTERTAINMENT CENTER]**
2. Home office (This is where your home computer and any peripheral devices are installed) **[RECORD # INSTALLED IN HOME OFFICE]**
3. Other **[RECORD # AND LOCATION VERBATIM]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

D15. How satisfied are you with the advanced power strips that you purchased during the last twelve months? 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

D16. **[ASK ONLY IF D15= 3 OR 4]** Why would you say you are **[INSERT ANSWER FROM D15]** with the advanced power strips? **[DO NOT READ LIST AND RECORD ALL THAT APPLY]**

1. Not working properly
2. Turns appliances/electronics off too early (during use)
3. Not compatible with my appliances/electronics
4. **NOT USER-FRIENDLY**
5. **INCONVENIENT TO USE**
6. **FLASHING LIGHT ANNOYING OR TOO BRIGHT**
7. **CAUSED DAMAGE TO MY APPLIANCES/ELECTRONICS**
8. **NO CHANGE IN ELECTRICITY CONSUMPTION/BILL**
9. **DID NOT LOOK GOOD**
10. Other **[RECORD VERBATIM]**
98. Don't Know
99. Refused

## **E. Program Awareness**

E1. Before this call, were you aware that **[INSERT UTILITY]** offers energy-efficiency programs that provide monetary incentives to customers for installing equipment that will reduce their utility bills?

1. Yes
2. No **[SKIP TO SECTION F]**
98. Don't Know
99. Refused **[SKIP TO SECTION F]**

E2. One of these **[INSERT UTILITY]** programs is the “**wattsmart** Home Energy Savings Program” and it provides discounts on CFLs, LEDs, advanced power strips and room air conditioners at participating retailers in your area as well as incentives for high-efficiency home equipment and upgrades such as appliances and insulation. Before today, were you aware of this program?

1. Yes
2. No **[SKIP TO SECTION F]**
98. Don't Know **[SKIP TO SECTION F]**
99. Refused **[SKIP TO SECTION F]**

E3. Where did you most recently hear about **[INSERT UTILITY]'s wattsmart** Home Energy Savings program? **[DO NOT READ LIST. RECORD FIRST RESPONSE. ONE ANSWER ONLY]**

1. Newspaper/Magazine/Print Media
2. Paper or Electronic Bill Inserts
3. Rocky Mountain Power/Pacific Power website
4. **wattsmart** Home Energy Savings website
5. Other website
6. Social media/internet Advertising/online ad
7. Family/friends/neighbor/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. Home Energy Reports
17. Other **[RECORD VERBATIM]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

- E4. **[ASK ONLY IF E3<=3 AND E3<=4]** Have you ever visited the **wattsmart** Home Energy Savings Website?
1. Yes
  2. No
- E5. **[ASK ONLY IF E4=1]** How often do you visit the **wattsmart** Home Energy Savings Website? Would you say you visit the website: **[READ RESPONSE OPTIONS]**
1. More frequently than once a month
  2. About once a month
  3. About once every six months
  4. About once every year
  5. Less frequently than once every year
- E6. **[ASK ONLY IF E4=1]** When you visit the **wattsmart** Home Energy Savings Website, what is typically the purpose of your visit?
1. **[RECORD VERBATIM]**
  98. Don't Know
  99. Refused
- E7. **[ASK ONLY IF E4 = 1 OR E3=3 OR 4, OTHERWISE SKIP TO SECTION F]** 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
- E8. What would make the website more helpful for you? **[DO NOT READ RESPONSES. MARK ALL THAT APPLY]**
1. Nothing, it is already very helpful for me.
  2. Make the website easier to navigate or more user-friendly (clear hierarchy)
  3. Make program information more clear and concise
  4. Incorporate more visual information (charts, graphs, images) and less text
  5. Provide easier access to customer service or FAQs
  6. Other **[RECORD]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused

## F. Nonparticipant Spillover

F1. **[INSERT UTILITY]**'s Home Energy Reports portal provides you with detailed information about your home's energy use and helps you discover ways to save money and make your home more energy efficient. Did you use the Home Energy Reports portal in 2015 or 2016?

1. Yes **[SKIP TO SECTION G]**
2. No
98. Don't Know
99. Refused

F2. Now, I will read a list of household equipment and upgrades. Please say yes, if you have installed the equipment or upgrade mentioned in 2015 or 2016 and no, if you haven't. **[READ MEASURES AT STEADY PACE IF NO RESPONSE THEN PROBE: IS THAT YES OR NO?]**

Measure Name	1=Yes	2=No	98=Don't know	99= Refused
a) High-efficiency heat pump water heater				
b) High-efficiency Furnace with electronically commutated motor or ECM				
c) High-efficiency Air Source Heat Pump				
d) High-efficiency Ground Source Heat Pump				
e) High-efficiency Ductless Heat Pump				
f) High-efficiency Central Air Conditioner				
g) High-efficiency Evaporative Cooler				

Measure Name	1=Yes	2=No	98=Don't know	99= Refused
h) ENERGY STAR Room Air Conditioner				
i) ENERGY STAR Clothes Washer				
j) ENERGY STAR Dishwasher				
k) ENERGY STAR Freezer				
l) ENERGY STAR Refrigerator				
m) Attic insulation				
n) Wall insulation				
o) Floor insulation				
p) Air sealing <b>[IF NEEDED: THIS IS CAULKING OR SEALING GAPS TO MAKE THE HOME AIRTIGHT]</b>				
q) Duct insulation				
r) Duct sealing <b>[IF NEEDED: THIS IS SEALING ANY GAPS IN DUCT CONNECTIONS]</b>				
s) Windows				
t) Low flow showerhead				
u) Low flow faucet aerator				
v) Smart Thermostat				
w) Ceiling fan				
x) Any other energy-				

Measure Name	1=Yes	2=No	98=Don't know	99= Refused
efficient products? [SPECIFY]				

**[IF F2.\*=1 THEN RANDOMLY SELECT ONE MEASURE FROM F2.\* = 1 AND CODE AS SELECTEDMEASURE1]**

**[IF F2.\* = 1 AND MEASURE NAME <> SELECTEDMEASURE1 RANDOMLY SELECT ONE MEASURE FROM F2.\* = 1 AND CODE AS SELECTEDMEASURE2]**

**[IF ALL F2.\* = 2 THEN AUTO PUNCH F2 = 97 DID NOT INSTALL ANYTHING AND SKIP TO SECTION G]**

**[IF ALL F2.\* = 98 OR 99 SKIP TO SECTION G]**

F3. Did you receive a rebate or discount from **[INSERT UTILITY]** for the purchase of **[SELECTEDMEASURE1]**?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

F4. **[IF SELECTEDMEASURE1=ATTIC INSULATION, OR WALL INSULATION, OR FLOOR INSULATION, OR AIR SEALING, OR DUCT INSULATION, OR DUCT SEALING, SAY "HOW MUCH" OTHERWISE SAY "HOW MANY"]** **[SELECTEDMEASURE1]** did you install?

- 1. **[RECORD QUANTITY OR AMOUNT WITH UNIT OF MEASUREMENT]**
- 98. Don't Know
- 99. Refused

F5. On a 1 to 4 scale, with 1 meaning "not at all influential," to 4, meaning the item was "highly influential," how influential was **[INSERT STATEMENT FROM TABLE BELOW]** on your decision to purchase the **[SELECTEDMEASURE1]** ?

Statement	Not at all influential	Not very influential	Somewhat influential	Highly influential	Don't know	Not applicable
	1	2	3	4	98	96
a. General information about energy efficiency provided by <b>[INSERT UTILITY]</b> .						

b. Information from friends or family members who installed energy efficient equipment and received a rebate from <b>[INSERT UTILITY]</b> .						
c. Your experience with a past <b>[INSERT UTILITY]</b> energy efficiency program.						

**[SKIP F6 THROUGH F8 IF SELECTEDMEASURE2="NULL"]**

F6. Did you receive a rebate or discount from **[INSERT UTILITY]** for the purchase of **[SELECTEDMEASURE2]**?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

F7. **[IF SELECTEDMEASURE2=ATTIC INSULATION, OR WALL INSULATION, OR FLOOR INSULATION, OR AIR SEALING, OR DUCT INSULATION, OR DUCT SEALING, SAY "HOW MUCH" OTHERWISE SAY "HOW MANY"]** **[SELECTEDMEASURE2]** did you install?

- 1. **[RECORD QUANTITY OR AMOUNT WITH UNIT OF MEASUREMENT]**
- 98. Don't Know
- 99. Refused

F8. On a 1 to 4 scale, with 1 meaning "not at all influential," to 4, meaning the item was "highly influential," how influential was **[INSERT STATEMENT FROM TABLE BELOW]** on your decision to purchase the **[SELECTEDMEASURE2]** ?

Statement	Not at all influential	Not very influential	Somewhat influential	Highly influential	Don't know	Not applicable
	1	2	3	4	98	96
a. General information about energy efficiency provided by <b>[INSERT UTILITY]</b> .						
b. Information from friends or family members who installed energy efficient equipment and received a rebate from <b>[INSERT UTILITY]</b> .						

c. Your experience with a past <b>[INSERT UTILITY]</b> energy efficiency program.						
---	--	--	--	--	--	--

F9. **[ASK IF F3= 2 OR F6 =2 OTHERWISE SKIP TO SECTION G]** What are the reasons you did not apply for a rebate from **[INSERT UTILITY]** for these energy efficiency improvements? **[DO NOT READ LIST; RECORD ALL THAT APPLY]**

1. Didn't know/wasn't aware
2. Was going to apply but forgot
3. Not interested
4. Too busy/didn't have time
5. Dollar rebate for rebate was not high enough
6. Application too difficult to fill out
7. Did apply but never received rebate
8. Other **[SPECIFY]**
9. Don't Know
10. Refused

## G. Demographics

G1. Next are a few questions for statistical purposes only. Which of the following best describes your home? **[READ LIST]**

1. Single-family detached house
2. Townhouse or duplex
3. Mobile home or trailer
4. Apartment building with 4 or less units
5. Apartment building with 5 or more units
6. Other **[RECORD]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

G2. Do you or members of your household own this home or do you rent?

1. Own
2. Rent
3. Other **[RECORD]**
98. Don't Know
99. Refused

G3. 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. 2000-2004
7. 2005-2009
8. 2010 +
9. OTHER **[RECORD]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

G4. What is the primary heating system for your home? **[READ LIST IF NEEDED]**

1. Forced air natural gas furnace
2. Forced air propane furnace
3. Air Source Heat Pump **[FUEL SOURCE]**
4. Ground Source Heat Pump **[FUEL SOURCE]**
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

G5. How old is the primary heating system? **[RECORD RESPONSE IN YEARS]**

1. **[RECORD 0-97]**
98. Don't Know
99. Refused

- G6. What is the primary cooling system for 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
  8. Other **[SPECIFY]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- G7. **[SKIP IF G6= 7,98 OR 99]** How many years old is your primary cooling system? **[RECORD RESPONSE IN YEARS]**
1. **[RECORD 0-97]**
  98. Don't Know
  99. Refused
- G8. What type of fuel is the primary source for your water heating? **[INDICATE ALL THAT APPLY]**
1. Electricity
  2. Natural Gas
  3. Propane
  4. Other **[RECORD]**
  98. **[DO NOT READ]** Don't Know
  99. **[DO NOT READ]** Refused
- G9. Including yourself and any children, how many people currently live in your home?
1. **[RECORD]**
  98. Don't Know
  99. Refused
- G10. **[ASK ONLY IF G9 > 1 AND <98,99]** 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

**H. Conclusion**

H1. Do you have any additional feedback or comments regarding your household lighting or energy usage?

1. Yes [RECORD VERBATIM]
2. No
98. Don't Know
99. Refused

**14. [SEX; DO NOT READ]**

3. Female
4. Male
98. Don't Know

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

## PacifiCorp Home Energy Savings Participant Survey

*Audience: This survey is designed for PacifiCorp residential customers in California, Utah, Idaho, Washington, and Wyoming that applied for an incentive through the incentive application process in the first half of 2016. The primary purpose of this survey is to collect information on measure installation, program awareness, motivations to participate, satisfaction, freeridership and spillover effects. This survey will be administered through telephone calls.*

*Quota: Aim for 60 completed surveys for each state (CA, UT, ID, WA, and WY)*

	APPLIANCE	HVAC	Weatherization
	Sample (survey quota)	Sample (survey quota)	Sample (survey quota)
CA	20 (as many as possible)	86 (20)	3 (as many as possible)
ID	43 (20)	26 (as many as possible)	15 (as many as possible)
UT	400 (20)	400 (20)	400 (20)
WA	129 (20)	210 (20)	48 (20)
WY	58 (as many as possible)	56 (20)	9 (as many as possible)

Topics	Researchable Questions	Survey Questions
Measure Verification	Did program measure(s) get installed in the household?	Section B
Program Awareness and Purchase Decisions	How did the customer learn about the program? Has the customer been to the <b>wattsmart</b> website (feedback)? Why did the customer purchase the program measure?	Section B
Measure Usage	How is the customer using certain common household appliances and equipment? What was replaced when the new measure was installed?	Section D
Satisfaction	How satisfied is the customer with the measure? With the contractor? With the incentive amount and time it took to receive it? With the overall application process? With the program overall?	Section C
Net-to-Gross	Self-reported freeridership and spillover batteries	Section E and F
Demographics	Customer household information for statistical purposes	Section G

- Interviewer instructions are in green.
- CATI programming instructions are in red.

### [UTILITY]

Washington and California: Pacific Power

Utah, Wyoming, and Idaho: Rocky Mountain Power

**[MEASURE]**

**[YEAR OF PARTICIPATION]**

**[MEASURE QUANTITY]**

**["MEASURE TYPES" TO BE USED IN THE INTERVIEWER INSTRUCTIONS/SKIP PATTERN ARE INCLUDED IN GREEN FONT IN THE TABLE OF MEASURES]**

Measure Name	Measure Type for Interviewer Instructions/ Skip Pattern
Air sealing	SEALING
Duct Sealing	SEALING
Duct Sealing and Insulation	SEALING
Ceiling Fan	OTHER
Central Air Conditioner	COOLING
Central Air Conditioner Best Practice Installation	SERVICE
Central Air Conditioner Proper Sizing	SERVICE
Heat Pump Best Practice Installation	SERVICE
Heat Pump Proper Sizing	SERVICE
Clothes Washer	CLOTHES WASHER
Computer Monitor	OTHER
Desktop Computer	OTHER
Dishwasher	OTHER
Ductless Heat Pump	HEATING/COOLING
Evaporative Cooler	COOLING
Portable Evaporative Cooler	COOLING
Flat Panel TV	OTHER
Freezer	OTHER
Furnace	HEATING
Ground Source Heat Pump	HEATING/COOLING
Heat Pump	HEATING/COOLING
Heat Pump Service	SERVICE
Heat Pump Water Heater	OTHER
Light Fixture	LIGHTING
Refrigerator	REFRIGERATOR
Room Air Conditioner	ROOM AC
Electric Water Heater	OTHER
Attic Insulation	INSULATION
Wall Insulation	INSULATION
Floor Insulation	INSULATION
Windows	WINDOWS
Smart Thermostat	OTHER

## A. Introduction

- A1. **[TO RESPONDENT]** Hello, I'm **[INSERT FIRST NAME]** I am calling from **[INSERT SURVEY FIRM]** 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 [INSERT SURVEY FIRM], 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 WATTSMAST HOME ENERGY SAVINGS PROGRAM. [IF NEEDED] YOU MAY HAVE RECEIVED OTHER EQUIPMENT OR BENEFITS THROUGH [INSERT UTILITY]'S WATTSMAST HOME ENERGY SAVINGS PROGRAM, HOWEVER, WE ARE INTERESTED IN FOCUSING ON THE [INSERT MEASURE] THAT YOU RECEIVED.**

**(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 THE WATTSMAST HOME ENERGY SAVINGS PROGRAM 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 YOU ARE CONDUCTING THIS STUDY: STUDIES LIKE THIS HELP [INSERT UTILITY] BETTER UNDERSTAND CUSTOMERS' NEEDS AND INTERESTS IN ENERGY PROGRAMS AND SERVICES.)**

- A2. Our records show that in **[INSERT YEAR]** your household received an incentive from **[INSERT UTILITY]** for purchasing **[IF QUANTITY =1; "A OR AN"] [INSERT MEASURE NAME]** through the **watt**smart Home Energy Savings program. 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]

A3. Were you the primary decision-maker when deciding to purchase the **[INSERT MEASURE](S)**?

- 1. Yes
- 2. No [REQUEST TO SPEAK TO THE PRIMARY DECISION MAKER, IF AVAILABLE START OVER, IF NOT, SCHEDULE TIME TO CALL BACK]
- 98. Don't Know [THANK AND TERMINATE]
- 99. Refused [THANK AND TERMINATE]

A4. Have you, or anyone in your household, ever been employed by 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]

## B. Measure Verification

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

[FOR SECTION B "MEASURE VERIFICATION", FOLLOW THE RULES BELOW TO DETERMINE WHICH QUESTIONS TO ASK BEFORE CONTINUING TO SECTION C:

IF MEASURE TYPE = SEALING OR SERVICE SKIP TO B7 AND ASK QUESTIONS B7 TO B8;

IF MEASURE TYPE = INSULATION OR WINDOWS SKIP TO B9 AND ASK QUESTIONS B9 TO B14;

ALL REMAINING MEASURE TYPES, CONTINUE TO B1 AND ASK QUESTIONS B1 TO B6]

B1. **[INSERT UTILITY]** records show that you applied for an incentive for [IF MEASURE QUANTITY = 1 SAY "A"] [IF MEASURE QUANTITY >1 INSERT MEASURE QUANTITY] **[INSERT MEASURE](S)** in **[YEAR OF PARTICIPATION]**. Is that correct? [DO NOT READ RESPONSES]

[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. Yes [SKIP TO B4]
- 2. No, quantity is incorrect [CONTINUE TO B2]
- 3. No, measure is incorrect [SKIP TO B3]
- 4. No, both quantity and measure are incorrect [SKIP TO B3]
- 98. Don't Know [SKIP TO B3]
- 99. Refused [TERMINATE]

B2. **[ASK IF B1 = 2]** For how many **[INSERT MEASURE](S)** did you apply for an incentive? **[NUMERIC OPEN ENDED. DOCUMENT AND USE AS QUANTITY FOR REMAINDER OF SURVEY]**

1. **[RECORD] [SKIP TO B4]**
98. Don't Know **[SKIP TO B4]**
99. Refused **[SKIP TO B4]**

B3. **[ASK IF B1 = 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] [IF RESPONSE = SAME MEASURE, GO BACK TO B1]**
98. Don't Know **[THANK AND TERMINATE]**
99. Refused **[THANK AND TERMINATE]**

B4. **DID [IF MEASURE QUANTITY >1 SAY "ALL OF"]** the **[INSERT MEASURE](S)** get installed in your home? **[DO NOT READ RESPONSES]**

1. Yes **[SKIP TO E5]**
2. No **[CONTINUE TO B5]**
98. Don't know **[SKIP TO E5]**
99. Refused **[SKIP TO E5]**

**[ASK B5 IF B4 = 2 AND MEASURE QUANTITY > 1 OTHERWISE SKIP TO B6]**

B5. **HOW MANY [INSERT MEASURE](S)** were installed?

1. **[RECORD # 1-100] [CONTINUE TO B6]**
98. Don't Know **[CONTINUE TO B6]**
99. Refused **[CONTINUE TO B6]**

B6. **[ASK IF B4 = 2]** Why haven't you installed the **[INSERT MEASURE](S)** **[MULTIPLE RESPONSE UP TO 3; DO NOT READ, THEN SKIP TO E5]**

1. Failed or broken unit **[SKIP TO E5]**
2. Removed because did not like it **[SKIP TO E5]**
3. Have not had time to install it yet **[SKIP TO E5]**
4. In-storage **[SKIP TO E5]**
5. Back up equipment to install when other equipment fails **[SKIP TO E5]**
6. Have not hired a contractor to install it yet **[SKIP TO E5]**
7. Purchased more than was needed **[SKIP TO E5]**
8. Other **[RECORD] [SKIP TO E5]**
98. Don't Know **[SKIP TO E5]**
99. Refused **[SKIP TO E5]**

B7. **[INSERT UTILITY]** records show that you applied for an incentive for **[INSERT MEASURE]** in **[YEAR OF PARTICIPATION]**. Is that correct? **[DO NOT READ RESPONSES]**

**[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. Yes **[SKIP TO E5]**
- 2. No, measure is incorrect **[SKIP TO B8]**
- 98. Don’t Know **[SKIP TO B8]**
- 99. Refused **[TERMINATE]**

B8. **[ASK IF B7 = 2 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] [IF RESPONSE =SAME MEASURE, GO BACK TO B7]**
- 98. Don’t Know **[THANK AND TERMINATE]**
- 99. Refused **[THANK AND TERMINATE]**

B9. **[INSERT UTILITY]** records show that you applied for an incentive for **[INSERT MEASURE QUANTITY]** square feet of **[INSERT MEASURE](S)** in **[YEAR OF PARTICIPATION]**. Is that correct? **[DO NOT READ RESPONSES; IF CORRECTED YEAR IS NOT 2015, THANK AND TERMINATE,]**

**[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. Yes **[SKIP TO B12]**
- 2. No, quantity is incorrect **[CONTINUE TO B10]**
- 3. No, measure is incorrect **[SKIP TO B11]**
- 4. No, both quantity and measure are incorrect **[SKIP TO B11]**
- 98. Don’t Know **[SKIP TO B11]**
- 99. Refused **[TERMINATE]**

B10. **[ASK IF B9 = 2]** How many square feet of **[INSERT MEASURE](S)** did you apply for an incentive? **[NUMERIC OPEN ENDED. DOCUMENT AND USE AS QUANTITY FOR REMAINDER OF SURVEY]**

- 1. **[RECORD] [SKIP TO B12]**
- 98. Don’t Know **[SKIP TO B12]**
- 99. Refused **[SKIP TO B12]**

- B11. **[ASK IF B9 = 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] [IF RESPONSE = SAME MEASURE, GO BACK TO B9]**
  98. Don't Know **[THANK AND TERMINATE]**
  99. Refused **[THANK AND TERMINATE]**
- B12. **DID ALL OF THE [INSERT MEASURE QUANTITY]** square feet of **[INSERT MEASURE](S)** get installed in your home? **[DO NOT READ RESPONSES]**
1. Yes **[SKIP TO E5]**
  2. No **[CONTINUE TO B13]**
  98. Don't know **[SKIP TO E5]**
  99. Refused **[SKIP TO E5]**
- B13. **WHAT PERCENTAGE OF THE [INSERT MEASURE](S)** was installed?
1. **[RECORD 0-100%] [CONTINUE TO B14]**
  98. Don't Know **[CONTINUE TO B14]**
  99. Refused **[CONTINUE TO B14]**
- B14. Why haven't you had a chance to install all **[INSERT MEASURE QUANTITY]** square feet of **[INSERT MEASURE] (S)**? **[MULTIPLE RESPONSE UP TO 3; DO NOT READ, THEN SKIP TO E5]**
1. Failed or broken unit **[SKIP TO E5]**
  2. Removed because did not like it **[SKIP TO E5]**
  3. Have not had time to install it yet **[SKIP TO E5]**
  4. In-storage **[SKIP TO E5]**
  5. Back up equipment to install when other equipment fails **[SKIP TO E5]**
  6. Have not hired a contractor to install it yet **[SKIP TO E5]**
  7. Purchased more than was needed **[SKIP TO E5]**
  8. Other **[RECORD] [SKIP TO E5]**
  98. Don't Know **[SKIP TO E5]**
  99. Refused **[SKIP TO E5]**

**C. Program Awareness & Purchase Decisions**

C1. How did you first hear about **[INSERT UTILITY]**'s **wattsmart** Home Energy Savings program? **[DO NOT PROMPT. RECORD ONLY THE FIRST WAY HEARD ABOUT THE PROGRAM.]**

1. Bill Inserts
2. Billboard/outdoor ad
3. Family/friends/word-of-mouth
4. Home Energy Reports
5. Home Shows/Trade Shows (Home and Garden Shows)
6. Internet Advertising/Online Ad
7. Newspaper/Magazine/Print Media
8. Northwest Energy Efficiency Alliance (NEEA)
9. Other website
10. Radio
11. Retailer/Store
12. Rocky Mountain Power/Pacific Power Representative
13. Rocky Mountain Power/Pacific Power website
14. Social Media
15. Sporting event
16. TV
17. **wattsmart** Home Energy Savings website
18. Other **[RECORD VERBATIM]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

C2. **[ASK IF E5 <= 13 OR 17, OTHERWISE SKIP TO B3]** Have you been to the **[INSERT UTILITY]** **wattsmart** Home Energy Savings program website? **[DO NOT READ RESPONSES]**

1. Yes
2. No

C3. **[ASK IF E5 = 13 OR 17, OR IF B2 = 1, OTHERWISE SKIP TO E10]** Was the website... **[READ]**

1. Very helpful **[SKIP TO E10]**
2. Somewhat helpful
3. Somewhat unhelpful
4. Very unhelpful
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

C4. **[ASK IF B3= 2, 3, OR 4. OTHERWISE SKIP TO E10]** What would make the website more helpful for you? **[DO NOT READ RESPONSES, MARK ALL THAT APPLY]**

1. Nothing, it is already very helpful for me.
2. Make the website easier to navigate or more user-friendly (clear hierarchy)
3. Make program information more clear and concise
4. Incorporate more visual information (charts, graphs, images) and less text
5. Provide easier access to customer service or FAQs
6. Other **[RECORD]**

C5. Please think back to the time when you were deciding to buy the energy saving **[INSERT MEASURE](S)**. What factors motivated you to purchase the **[INSERT 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. A program affiliated contractor
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. Interested in new/updated technology
17. Other **[RECORD]**
98. Don't Know
99. Refused

## D. Measure Usage

[SAY "I HAVE SOME QUESTIONS ABOUT YOUR GENERAL HOUSEHOLD ENERGY USE AND COMMON HOUSEHOLD APPLIANCES"]

D1. [IF MEASURE TYPE = CLOTHES WASHER, SKIP TO D2] Do you have a clothes washer installed in your home?

1. Yes
2. No [SKIP TO D10]
98. Don't Know [SKIP TO D10]
99. Refused [SKIP TO D10]

D2. Approximately how many loads of clothes does your household wash in a typical week [IF MEASURE TYPE = CLOTHES WASHER, SAY "WITH THE NEW CLOTHES WASHER"]?

1. [RECORD]
98. Don't Know
99. Refused

D3. [ASK IF MEASURE TYPE = CLOTHES WASHER, OTHERWISE SKIP TO D7] How does the number of wash loads you do now compare to the number that you did with your old clothes washer? Is it the same or different? [DO NOT READ RESPONSES]

1. Same [SKIP TO D7]
2. Different [CONTINUE TO D4]
98. Don't Know [SKIP TO D7]
99. Refused [SKIP TO D7]

D4. [ASK IF D3 = 2] How many loads per week did your household do on average week before you installed the new clothes washer?

1. [RECORD]
98. Don't Know
99. Refused

D5. Is your new washer smaller, bigger, or the same size as your older one?

1. Smaller
2. Bigger
3. Same Size
98. Don't Know
99. Refused

D6. Is your new washing machine top loading or front loading?

1. Top-Loading
2. Front-Loading
98. Don't Know
99. Refused

D7. What percentage of your loads do you dry using a clothes dryer? **[READ CATEGORIES IF NEEDED]**

1. Never **[SKIP TO B6]**
2. LESS THAN 25%
3. 25-50%
4. 50-75%
5. 75- 99%
6. Always or 100%
98. Don't know **[SKIP TO B6]**
99. Refused **[SKIP TO B6]**

D8. 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

D9. Is your dryer powered by electricity or natural gas?

1. Electricity
2. Natural Gas
3. Other **[SPECIFY]**
98. **[DO NOT READ]** Don't know
99. **[DO NOT READ]** Refused

**[if MEASURE type= heating skip to B8 or heating/cooling skip toD20]**

D10. What type of heating system do you primarily use... **[READ]**

1. Furnace
2. Boiler
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Ductless Heat Pump
6. Stove
7. Baseboard
8. No heating system **[SKIP TO B8]**
9. Other **[SPECIFY]**
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

D11. How many years old is the heating system?

1. **[RECORD]**
98. Don't Know
99. Refused

D12. 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

D13. **[IF MEASURE TYPE= COOLING SKIP TOD24]** What type of cooling system do you primarily use **[IF MEASURE TYPE = ROOM AC THEN SAY "BESIDES THE ROOM AIR CONDITIONER"]**? A... **[READ, MULTIPLE CHOICES ALLOWED]**

1. Central Air Conditioner
2. Evaporative Cooler
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Ductless heat pump
6. Whole house fan

- 7. No central cooling system **[SKIP TO D15]**
- 8. Other **[SPECIFY]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

D14. How many years old is your current cooling system?

- 1. **[RECORD]**
- 98. Don't Know
- 99. Refused

**IF MEASURE TYPE WINDOWS SKIP TO E1**

D15. **[ASK IF MEASURE TYPE = LIGHTING] [UTILITY]** provides incentives for several different kinds of light fixtures. Were any of the light fixtures that you received an incentive for recessed ceiling or can light fixtures?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

D16. **[ASK IF MEASURE TYPE = LIGHTING AND D15 =1]** What kind of lightbulb(s) did your recessed ceiling or can fixture(s) replace? Were they....**[READ LIST]**

- 1. Standard shaped bulbs **[IF NEEDED: THIS IS A TYPICAL HOUSEHOLD INCANDESCENT, CFL OR LED BULB, SOMETIMES REFERRED TO AS A-SHAPED AND SPREADS LIGHT IN ALL DIRECTION]**
- 2. Reflector or flood lightbulbs **[IF NEEDED: THIS IS A BULB THAT POINTS LIGHT IN ONE DIRECTION]**
- 3. No lightbulbs replaced
- 4. **[DO NOT READ]** Other **[SPECIFY]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

**[FOR QUESTIONS D17 - D25 USE THE FOLLOWING SKIP PATTERN FOR MEASURE TYPES OTHER, CLOTHES WASHER, ROOM AC, AND LIGHTING: READ QUESTIONS D17 – D19 THEN SKIP TO E1;**

**FOR MEASURE TYPE REFRIGERATOR ASK D17 TO ERROR! REFERENCE SOURCE NOT FOUND. THEN SKIP TO E1**

**FOR MEASURE TYPE HEATING: READ QUESTIONS D20 TO D23 THEN SKIP TO E1**

**FOR MEASURE TYPE COOLING: READ QUESTIONS D24 TO D25 THEN SKIP TO E1;**

**FOR MEASURE TYPE HEATING/COOLING: READ QUESTIONS D20 TO D22 AND D24 TO D25 THEN SKIP**

**TO E1;**

**FOR MEASURE TYPES WINDOWS, SEALING, INSULATION AND SERVICE: SKIP TO E1]**

D17. Was the purchase of your new **[INSERT MEASURE](S)** intended to replace **[AN]** old **[INSERT MEASURE TYPE]**?

1. Yes **[CONTINUE TO D18]**
2. No **[SKIP TO E1]**
98. Don't Know **[SKIP TO E1]**
99. Refused **[SKIP TO E1]**

D18. **[ASK IF MEASURE TYPE = REFRIGERATOR AND IF D17 = 1]** Is your refrigerator bigger, smaller, or the same size as the one it may have replaced?

1. Smaller
2. Bigger
3. Same Size
4. Did not replace an existing unit
98. Don't Know
99. Refused

D19. **[ASK IF D17 = 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 **[SKIP TO E1]**
2. Recycled **[SKIP TO E1]**
3. Installed in another location in the home **[SKIP TO E1]**
4. Still in home but permanently removed [stored in garage, etc.] **[SKIP TO E1]**
5. Thrown away **[SKIP TO E1]**
98. **[DO NOT READ]** Don't Know **[SKIP TO E1]**
99. **[DO NOT READ]** Refused **[SKIP TO E1]**

**[Ask D20 to D23 if MEASURE type = heating or heating/cooling. otherwise skip to E1]**

D20. What type of heating system did you have before the new **[INSERT MEASURE]** was installed?

1. Furnace
2. Boiler
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Ductless Heat Pump
6. Stove
7. Baseboard

- 8. No heating system before **[SKIP TO E1]**
- 9. Other **[SPECIFY]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

D21. How many years old was the previous heating system?

- 1. **[RECORD]**
- 98. Don't Know
- 99. Refused

D22. 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

D23. **[ASK IF MEASURE TYPE = HEATING OTHERWISE SKIP TO D24]** Did you also replace an air conditioner when you installed the new furnace?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

**[Ask D24 to D25 if MEASURE type = cooling or heating/cooling]**

D24. What type of cooling system did you have before the new **[INSERT MEASURE]** 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. Ductless Heat Pump
- 7. Whole house fan
- 8. No cooling system before **[SKIP TO E1]**

- 9. Other [SPECIFY]
- 98. [DO NOT READ] Don't Know
- 99. [DO NOT READ] Refused

D25. How many years old was the previous cooling system?

- 1. [RECORD]
- 98. Don't Know
- 99. Refused

## **E. Satisfaction**

E1. 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

E2. **DID A CONTRACTOR INSTALL THE [INSERT MEASURE](S) FOR YOU?**

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

E3. **[ASK IF E2=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

E4. **[IF D1 = 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

E5. How easy did you find filling out the **wattsmart** Home Energy Savings Program incentive application? **[READ CATEGORIES; RECORD FIRST RESPONSE ONLY]**

- 1. Very Easy
- 2. Somewhat Easy
- 3. Not Very Easy **[PROBE FOR REASON AND RECORD]**
- 4. Not At All Easy **[PROBE FOR REASON AND RECORD]**
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

E6. 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

E7. **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 E9]**
- 99. **[DO NOT READ]** Refused **[SKIP TO E9]**

E8. **[ASK IF E7<> 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

E9. How satisfied were you with the entire 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]**

E10. Overall, how satisfied are you with the **wattsmart** Home Energy Savings 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

E11. Did your participation in **[INSERT UTILITY]'s wattsmart** Home Energy Savings Program cause your satisfaction with **[INSERT UTILITY]** to...

1. Increase
2. Stay the same
3. Decrease
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

## **F. Freeridership**

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

F1. When you first heard about the incentive from **[INSERT UTILITY]**, had you already been planning to purchase the **[INSERT MEASURE](S)**?

1. Yes
2. No **[SKIP TO E2]**

- 98. Don't Know **[SKIP TO E2]**
- 99. Refused **[SKIP TO E2]**

F2. Ok. Had you already purchased or installed the new **[INSERT MEASURE](S)** before you learned about the incentive from the **wattsmart** Program?

- 1. Yes
- 2. No **[SKIP TO E2]**
- 98. Don't Know **[SKIP TO E2]**
- 99. Refused **[SKIP TO E2]**

F3. Just to confirm, you learned about the **[INSERT UTILITY]** rebate program after you had already purchased or installed the **[INSERT MEASURE](S)** ?

- 1. Yes **[SKIP TO E6]**
- 2. No
- 98. Don't Know
- 99. Refused

**[IF F3= 1 SKIP TO E6]**

F4. Would you have purchased the same **[INSERT MEASURE](S)** without the incentive from the **wattsmart** Home Energy Savings program?

- 1. Yes **[SKIP TO F6]**
- 2. No
- 98. Don't Know
- 99. Refused

**[IF E2 = 1 THEN SKIP TO F6]**

F5. **[ASK IF E2 = 2, -98 OR -99]** Help me understand, would you have purchased something without the **wattsmart** Home Energy Savings program incentive? **[DO NOT READ RESPONSES]**

- 1. Yes, I would have purchased something
- 2. No, I would not have purchased anything **[SKIP TO E5]**
- 98. Don't Know **[SKIP TO E6]**
- 99. Refused **[SKIP TO E6]**

**[IF F5 = 2 SKIP TO E5. IF F5 = -98 OR -99 SKIP TO E6]**

F6. **[ASK IF E2= 1 OR F5 = 1]** Let me make sure I understand. When you say you would have purchased **[A] [MEASURE](S)** without the program incentive, would you have purchased **[A] [INSERT MEASURE](S) THAT [WAS/WERE] JUST AS ENERGY EFFICIENT”?**

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

F7. **[ASK IF E2= 1 OR F5 = 1 AND MEASURE QUANTITY >1]** Without the program incentive would you have purchased the same amount of **[INSERT MEASURE](S)?**

1. Yes, I would have purchased the same amount
2. No, I would have purchased less
98. Don't Know
99. Refused

F8. **[ASK IF E2= 1 OR F5 = 1]** Without the program incentive would you have purchased the **[INSERT MEASURE](S)...** **[READ]**

1. At the same time
2. Within one year?
3. In more than one year?
98. **[DO NOT READ]** Don't Know
99. **[DO NOT READ]** Refused

**[SKIP TO E6]**

F9. **[ASK IF F5=2]** To confirm, when you say you would not have purchased the same **[INSERT MEASURE](S)** without the program incentive, do you mean you would not have purchased the **[INSERT MEASURE](S) at all?**

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

**[IF E5 = 1 SKIP TO E6]**

F10. **[ASK IF E5 = 2, -98, -99]** Again, help me understand. Without the program incentive, would you have purchased the same type of **[INSERT MEASURE](S)** but **[A] **[[INSERT MEASURE](S)] THAT [WAS/WERE] NOT AS ENERGY EFFICIENT?****

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

F11. **[ASK IF E5= 2, -98, -99 AND QTY MEASURE>1]** Without the program incentive would you have purchased the same amount of **[INSERT MEASURE](S)**?

1. Yes, I would purchase the same amount
2. No, I would have purchased less
98. Don't Know
99. Refused

F12. **[ASK IF E5 = 2, -98, -99]** And, would you have purchased 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

F13. In your own words, please tell me the influence the Home Energy Saving incentive had on your decision to purchase **[INSERT MEASURE](S)**?

1. \_\_\_\_\_ **[RECORD RESPONSE]**

## G. Spillover

G1. Since participating in the program, have you added any other energy efficient equipment or services in your home that were not incentivized through the **wattsmart** Home Energy Savings Program?

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

**[IF F1 = 2, -98 OR -99 SKIP TO H1]**

G2. What high-efficiency energy-saving equipment or services have you purchased since applying for the incentive, not including the **[INSERT 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 Washer **[RECORD QUANTITY]**
2. Refrigerator **[RECORD QUANTITY]**
3. [Dishwasher](#) **[RECORD QUANTITY]**
4. Windows **[RECORD QUANTITY IN SQ FT]**
5. Fixtures **[RECORD QUANTITY]**
6. Heat Pump **[RECORD QUANTITY]**
7. Central Air Conditioner **[RECORD QUANTITY]**
8. Room Air Conditioner **[RECORD QUANTITY]**
9. Ceiling Fans **[RECORD QUANTITY]**
10. Electric Storage Water Heater **[RECORD QUANTITY]**
11. Electric Heat Pump Water Heater **[RECORD QUANTITY]**
12. CFLs **[RECORD QUANTITY]**
13. LEDs **[RECORD QUANTITY]**
14. Insulation **[RECORD QUANTITY IN SQ FT]**
15. Air Sealing **[RECORD QUANTITY IN CFM REDUCTION]**
16. Duct Sealing **[RECORD QUANTITY IN CFM REDUCTION]**
17. Programmable thermostat **[RECORD QUANTITY]**
18. Other **[RECORD] [RECORD QUANTITY]**
19. None
98. Don't Know
99. Refused

**[IF F2 = 12 (ONLY), -98 OR -99 SKIP TO H1. REPEAT F3 THROUGH F5 FOR ALL RESPONSES TO F2]**

G3. In what year did you purchase **[INSERT MEASURE TYPE FROM F2]**?

1. 2015
2. 2016
3. Other **[RECORD YEAR]**
98. Don't Know
99. Refused

G4. Did you receive an incentive for **[INSERT MEASURE TYPE FROM F2]**?

1. Yes **[PROBE AND RECORD]**
2. No
98. Don't Know
99. Refused

G5. How influential would you say the **watt**smart Home Energy Savings program was in your decision to add the **[INSERT MEASURE FROM F2]** to your home? Was it... **[REPEAT FOR EACH MEASURE LISTED IN F2]**

1. Highly Influential
2. Somewhat Influential
3. Not very influential
4. Not at all influential
98. Don't Know
99. Refused

### H. Demographics

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

H1. 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

H2. Do you rent or own your home?

1. Own
2. Rent
3. Other **[RECORD]**
98. Don't Know
99. Refused

H3. Including yourself and any children, how many people currently live in your home?

1. **[RECORD]**
98. Don't Know
99. Refused

H4. 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. 2000-2004
7. 2005-2009
8. 2010 +
9. OTHER **[RECORD]**
98. **[DO NOT READ]** don't know
99. **[DO NOT READ]** refused

H5. 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

H6. Approximately how many square feet is the home in which the **[INSERT MEASURE](S)** was installed or purchased for? **[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

H7. **[SKIP IF MEASURE = ELECTRIC WATER HEATER OR HEAT PUMP WATER HEATER]** What is the fuel used by your primary water heater?

1. Electricity
2. Natural gas
3. Fuel oil
4. Other **[RECORD]**
98. Don't know
99. refused

### ***I. Conclusion***

I1. That concludes the survey. Do you have any additional feedback or comments?

1. Yes **[RECORD VERBATIM]**
2. No
98. Don't know
99. refused

Thank you very much for your time and feedback. Have a great day.

## Pacific Power Home Energy Savings Program Manufacturer and Retailer Interview Guide—California

### Objectives

- Understand the state of the program-eligible efficient products market and the manufacturer/retailer’s operations.
- Identify how the program-eligible efficient products market and manufacturer/retailer operations would differ in the absence of the Home Energy Savings (HES) program.
- Evaluate manufacturer/retailer experience in the HES program.

**Table 1. Researchable Questions Mapping**

Objective	Researchable Questions	Question
<i>Understand the state of the efficient products market and the manufacturer/retailer’s operations.</i>	<i>Understand retailer stocking patterns for efficient products.</i>	B1-B5
	<i>Understand manufacturer production patterns for efficient products.</i>	C1- C2
	<i>Identify current sales and marketing practices in the efficient products market in California.</i>	D1-Error! Reference source not found., Error! Reference source not found., E1-E3
	<i>Gather insights into efficient product market changes, both program-influenced and natural.</i>	G1- G3
<i>Identify how the efficient products market and manufacturer/retailer operations would differ in the absence of the program.</i>	<i>Identify influence of the HES program on retailer stocking and sales of efficient products.</i>	B6, B7, Error! Reference source not found.-D4,
	<i>Identify influence of the HES program on manufacturer production and sales of efficient products.</i>	C3-C3, Error! Reference source not found.-D4,
<i>Evaluate manufacturer/retailer experience in the HES program.</i>	<i>Discover reasons for participation in the HES program</i>	A6
	<i>Evaluate satisfaction with program aspects.</i>	F1-F4
	<i>Understand day-to-day implementation of the program, including staff training.</i>	E4

## Interview Guide

Name:

Title:

Interviewer:

Date of Interview:

### A. Introduction

Hello **[NAME]**. This is Mark Janett from Cadmus. Thank you for making the time to speak with me about Pacific Power's Home Energy Savings program. The purpose of this interview is to learn about your experience in the program, and learn about things that work well or any areas where you have experienced challenges. I will also ask about your **[STOCKING/DISTRIBUTION/PRODUCTION]**, sales, and marketing practices, and how this may have been different in the absence of the program. When I refer to the program, I am referring to Pacific Power's Home Energy Savings program only and not any other rebate or incentive programs in which you may participate.

I expect this interview to take approximately 15 minutes. Your responses will be kept anonymous and will be aggregated with other responses. Before we begin, do you have any questions?

A1. Our information shows that you participated in the Home Energy Savings program as a **[RETAILER/DISTRIBUTOR/MANUFACTURER]** in 2015 and 2016. Is this correct?

1. Yes
2. No
3. Other **[SPECIFY]**

A2. How long has your **[STORE/COMPANY]** been involved with the program?

A3. Do you **[SELL/DISTRIBUTE/MANUFACTURE]** both LED bulbs and LED fixtures?

1. Yes, both
2. LED bulbs but not LED fixtures
3. LED Fixtures but not LED bulbs
4. (Other)

A4. Are you involved with the process to sign the Memorandum of Understanding with Pacific Power each year? **(IF NEEDED READ: The Memorandum of Understanding is the agreement between CLEAResult and your company that describes your mutually agreed to actions for implementing the incentive program.)**

1. Yes
2. No

A5. Who do you interact with when participating in the program? Do you interact with...

1. Both CLEAResult (the program implementer) and Pacific Power
2. CLEAResult (the program implementer)
3. Pacific Power
4. Other **[SPECIFY]**

A6. In general, what benefits, if any, did you see from participating in the program?

1. Drives more customers to the store
2. Encourages customers to purchase additional products
3. Raises consumer awareness of energy efficient products
4. Raises employee awareness of energy efficient products
5. We stock more energy efficient products
6. Increases sales
7. (Other) **[SPECIFY]**
8. I don't see any benefit to participation

## B. Product Sourcing and Stocking Practices **[RETAILERS ONLY]**

I'd first like to ask you how you source and stock your lighting products, particularly LED bulbs and fixtures. As I ask you these questions, if your process is different for ENERGY STAR qualified LEDs vs non-ENERGY STAR LEDs, please let me know how the process differs.

B1. How do you source the LED lighting products that you sell? Do you... **[READ LIST]**

1. Buy directly from a manufacturer or manufacturer's representative
2. Order from a buying group or another supplier
3. Use a combination of manufacturer and buying group sourcing
4. Or do you source the **[INSERT ANSWER FROM A3, (LED bulbs and/or LED fixtures)]** in some other way? What is that? **[SPECIFY]**

B2. What factors do you consider when deciding which program-eligible **[INSERT ANSWER FROM A3, (LED bulbs and/or LED fixtures)]** to stock?

B3. What factors do you consider when deciding how many program-eligible **[INSERT ANSWER FROM A3, (LED bulbs and/or LED fixtures)]** to stock?

B4. In the past year, have you changed the way you stock lighting products? For example, have you changed the types and quantities? **[SPECIFY]**

- a. Have you changed anything else about your stocking practices for **[INSERT ANSWER FROM A3, (LED bulbs and/or LED fixtures)]**?

- B5. For what reasons, did you change the **[INSERT FIRST ANSWER FROM B4]**? **[REPEAT FOR EACH ANSWER]**
- B6. Hypothetically, if Pacific Power were to end its Home Energy Savings program tomorrow, what stocking changes, if any, do you think would be made at this store? **[IF SELLING BOTH LED BULBS AND FIXTURES, ASK ABOUT EACH SEPARATELY]**
- Would you make changes to number of program eligible products you stock? **[PROBE: WHAT CHANGES, WHICH PRODUCTS? WHAT PERCENTAGE CHANGE?]**
  - Would you discontinue selling specific products and increase something else?
- B7. In 2016, instant discounts were discontinued for regular screw-based CFL bulbs. Please tell me more about the effect this phase-out had on stocking practices at the store.

### C. Distribution/Production Practices **[DISTRIBUTORS/MANUFACTURERS ONLY]**

I'd first like to ask you about your **[DISTRIBUTOR "distribution" OR MANUFACTURERS "production"]** of lighting products, particularly LED bulbs and fixtures. As I ask you these questions, please let me know if the answers are different for ENERGY STAR qualified vs. non-ENERGY STAR qualified lighting products.

- C1. In the past two years, have you changed the way you **[DISTRIBUTE/MANUFACTURE]** lighting products? For example, have you changed the types/quantities/ efficiency levels? **[SPECIFY]**
- Have you changed anything else about your **[DISTRIBUTOR "distribution" OR MANUFACTURERS "production"]** practices for lighting products?
- C2. For what reasons, did you change the **[INSERT FIRST ANSWER FROM C1]**? **[REPEAT FOR EACH ANSWER]**
- C3. Hypothetically, if Pacific Power were to end its Home Energy Savings program tomorrow, what **[DISTRIBUTION/PRODUCTION]** changes, if any, would you make? **[IF PRODUCING BOTH LED BULBS AND FIXTURES, ASK ABOUT EACH SEPARATELY]**
- Would you make changes to number of efficient products you **[DISTRIBUTOR "distribute" OR MANUFACTURERS "produce"]**? **[PROBE: WHAT CHANGES, WHICH PRODUCTS? WHAT PERCENTAGE CHANGE?]**
  - Would you discontinue **[DISTRIBUTOR "distributing" OR MANUFACTURERS "producing"]** specific products?
- C4. In 2016, instant discounts were discontinued for regular screw-based CFL bulbs. Please tell me more about the effect this phase-out had on your **[DISTRIBUTOR "distribution" OR MANUFACTURERS "production"]** practices.

**D. Sales Practices [ASK EVERYONE]**

Thank you. Next, I'd like to ask you about sales of lighting products.

- D1. Thinking about your sales of all bulbs in **[RETAILERS: "this store"; DISTRIBUTORS/MANUFACTURERS: "Pacific Power's territory" IF INTERVIEWEE CANNOT SEPARATE OUT PACIFIC POWER TERRITORY, ASK ABOUT THE CA TERRITORY THEY REPRESENT]** approximately what proportion are:
- a. ENERGY STAR-certified LEDs
  - b. Non-ENERGY STAR-certified LEDs
  - c. Bulbs other than LEDs
- D2. **[IF A3=1 OR 3, THEY SELL LED FIXTURES]** Thinking about your sales of LED lighting fixtures in **[RETAILERS: "this store"; DISTRIBUTORS/MANUFACTURERS: "Pacific Power's territory" IF INTERVIEWEE CANNOT SEPARATE OUT PACIFIC POWER TERRITORY, ASK ABOUT THE CA TERRITORY THEY REPRESENT]** approximately what proportion are:
- a. ENERGY STAR fixtures
  - b. Non-ENERGY STAR-certified fixtures
- D3. Do you offer discounts for lighting products that are not part of the Home Energy Savings program?
- a. Yes
    - i. How do you decide which products to offer discounts on?
    - ii. How do you decide the amount of the discount? **[PROBE FOR SPECIFICS WHAT THE PRICING GOAL IS, (FOR EXAMPLE ARE THEY PRICING PRODUCTS TO BE LESS EXPENSIVE THAN THEIR COMPETITION OR PERHAPS TO BE PRICE COMPETITIVE WITH THE PROGRAM PRODUCTS?)]**
  - b. No
- D4. How would your company's pricing of program-eligible products be different if you did not receive incentives from Pacific Power? Would the price...?
1. Increase
  2. Decrease
  3. Remain the same
  4. Other **[SPECIFY]**
- D5. **[RETAILER]** Do you typically assist your customers in choosing the right products for their needs? If so, what assistance do they require? **[PROBE FOR SPECIFICS]**

Thank you, that's all the sales questions. Next, I'd like to ask you about your marketing of the lighting program.

#### E. Marketing, Outreach, and Training

- E1. First, please tell me how you market the program-eligible products. For example,
- What type of marketing tactics do you use? **[PROBE FOR: IN-STORE, ONLINE, WORD OF MOUTH, EMAIL, ETC.]**
  - Do you do any marketing outside of what the program provides?
  - [DISTRIBUTORS/MANUFACTURERS ONLY]** Do you provide any marketing materials for distribution to end-use customers, with the lighting products that you sell? **[SPECIFY WHAT IS PROVIDED]**

E2. Do you track how effective your marketing efforts are?

- Yes
  - How/what metrics?
  - Which tactics are most effective at increasing sales?
  - Which tactics are most effective at educating customers?
- No
- Don't know

E3. What, if anything, could the Pacific Power Home Energy Savings program representative do to help you promote program-eligible products?

E4. Does the program provide any training for your employees?

- Yes
  - Can you describe this training? **[PROBE FOR: TRAINING FORMAT, CONTENT, AND FREQUENCY]**
  - How effective do you think it is?
    - What would make it more effective?
- No

#### F. Program Satisfaction

Thank you. Now I'd like to ask you about your satisfaction with different program aspects. I will read each aspect separately and ask you to answer on a scale which I will read to you. Once you are familiar with the scale, I won't repeat it each time unless you need me to.

- F1. How satisfied are you with the Home Energy Savings program overall? Would you say you are...?
- Very satisfied
  - Somewhat satisfied
  - Not too satisfied

- 4. Not satisfied at all
- 98. (Don't Know)
- 99. (Refused)

F2. Please rate your satisfaction with the following:

a. **[IF A4=1 YES]** The process to sign the Memorandum of Understanding each year?

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied
  - a. Why do you say you are not too satisfied?
- 4. Not satisfied at all
  - a. Why do you say you are not satisfied at all?
- 98. (Don't Know)
- 99. (Refused)

b. Program incentive levels?

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied
  - a. What incentive level do you think is appropriate? Why?
- 4. Not satisfied at all
  - a. What incentive level do you think is appropriate? Why?
- 98. (Don't Know)
- 99. (Refused)

c. The products incentivized?

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied
  - a. What products do you think should be added or removed from the program?  
**[SPECIFY]**
- 4. Not satisfied at all
  - a. What products do you think should be added or removed from the program?  
**[SPECIFY]**
- 98. (Don't Know)
- 99. (Refused)

- d. **[RETAILER]** The in-store marketing support provided by CLEAResult, the program implementer?
1. Very satisfied
  2. Somewhat satisfied
  3. Not too satisfied
    - a. Why do you say you are not too satisfied?
  4. Not satisfied at all
    - a. Why do you say you are not satisfied at all?
  98. (Don't Know)
  99. (Refused)
- e. **[RETAILER ONLY]** Stocking support provided by the manufacturer?
1. Very satisfied
  2. Somewhat satisfied
  3. Not too satisfied
    - a. Why do you say you are not too satisfied?
  4. Not satisfied at all
    - a. Why do you say you are not satisfied at all?
  98. (Don't Know)
  99. (Refused)
- f. **[RETAILER ONLY]** The incentive invoicing process?
1. Very satisfied
  2. Somewhat satisfied
  3. Not too satisfied
    - a. How could the invoicing process be improved?
  4. Not satisfied at all
    - a. How could the invoicing process be improved?
  98. (Don't Know)
  99. (Refused)
- g. **[RETAILER ONLY]** The rebate processing time?
1. Very satisfied
  2. Somewhat satisfied
  3. Not too satisfied
    - a. What amount of time do you think is appropriate?
  4. Not satisfied at all

- a. What amount of time do you think is appropriate?
- 98. (Don't Know)
- 99. (Refused)
  
- h. General program communication with CLEAResult staff?
  - 1. Very satisfied
  - 2. Somewhat satisfied
  - 3. Not too satisfied
    - a. Why do you say you are not too satisfied?
  - 4. Not satisfied at all
    - a. Why do you say you are not satisfied at all?
- 98. (Don't Know)
- 99. (Refused)
  
- i. General program communication with Pacific Power staff?
  - 1. Very satisfied
  - 2. Somewhat satisfied
  - 3. Not too satisfied
    - a. Why do you say you are not too satisfied?
  - 4. Not satisfied at all
    - a. Why do you say you are not satisfied at all?
  - 5. NA
- 98. (Don't Know)
- 99. (Refused)

F3. Other than what we've just discussed, do you have any other recommendations to improve the program? **[SPECIFY]**

F4. **[LED FIXTURE RETAILERS ONLY]** Have you seen a difference in sales since the LED lighting fixtures rebate moved from downstream to upstream? **[IF NECESSARY, EXPLAIN THE TERMS "DOWNSTREAM" AND "UPSTREAM"]** If so, what was the difference?

### G. Perspectives on the Efficient Products Market and Influence of Program

Thank you. My final questions are about how the market has changed in recent years and what your thoughts are on where the market is headed.

- G1. What are the primary changes or developments you expect to see in the lighting market over the next couple of years?
- G2. What are the primary drivers behind these changes?
- G3. What role, if any, do you think the Home Energy Savings program will play in these changes?
  - a. If so, to what degree/how?

Thank you for your input. We appreciate your time. Have a nice day.

## Appendix B. Lighting Impacts

This appendix contains further details on the following lighting topics, as introduced in the report’s main body:

1. Delta Watts
2. Demand Elasticity Modeling

Where applicable, Cadmus followed the Uniform Methods Protocol for lighting impact evaluations.<sup>1</sup>

### Delta Watts Lumen Bins

Table B1 through Table B7 provide lumen bins by lamp types applied in the gross evaluated lighting evaluation (e.g., CFLs, LEDs, light fixtures). The tables include evaluated baseline wattages by year and total lamp quantities sold in 2013–2014.

**Table B1. Lumen Bins and Quantities for Standard Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
0–309	25	0
310–449	25	165
450–799	29	6,593
800–1,099	43	95,865
1,100–1,599	53	5,539
1,600–1,999	72	10,998
2,000–2,600	72	0

**Table B2. Lumen Bins and Quantities for Globe Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
250–349	25	253
350–499	29	633
500–574	43	92
575–649	53	21
650–1,099	72	124
1,100–1,300	72	0

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<sup>1</sup> Available online at: <http://www1.eere.energy.gov/wip/pdfs/53827-6.pdf>



**Table B3. Lumen Bins and Quantities for Decorative Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
70–89	10	6
90–149	15	0
150–299	25	779
300–499	29	1,493
500–699	43	185

**Table B4. Lumen Bins and Quantities for EISA-Exempt Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
310–449	25	0
450–799	40	0
800–1,099	60	0
1,100–1,599	75	2
1,600–1,999	100	32
2,000–2,600	150	0

**Table B5. Lumen Bins and Quantities for D > 20 Reflector Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
300–639	30	366
640–739	40	112
740–849	45	1
850–1,179	50	12
1,180–1,419	65	109
1,420–1,789	75	0
1,790–2,049	90	0
2,050–2,579	100	0
2,580–3,429	120	0

**Table B6. Lumen Bins and Quantities for BR30, BR40, ER40 Reflector Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
300–399	30	69
400–449	40	0
450–499	45	101
500–649	50	741
650–1,179	65	7,653
1,180–1,419	65	97
1,420–1,789	75	68
1,790–2,049	90	0
2,050–2,579	100	0
2,580–3,429	120	0

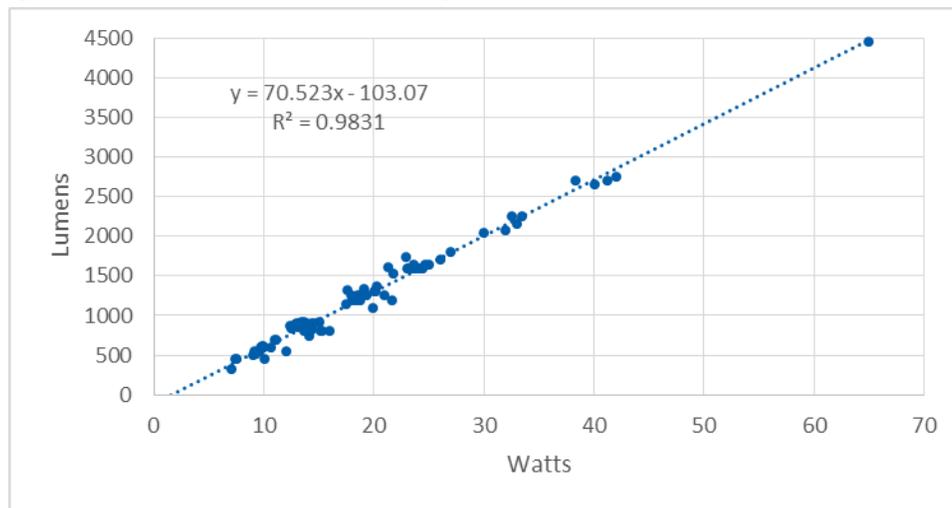
**Table B7. Lumen Bins and Quantities for R20 Reflector Lamps**

Lumen Bin	Baseline Wattage	Lamp Quantity
300–399	30	0
400–449	40	9
450–719	45	58
720–999	50	0
1,000–1,199	65	0
1,200–1,519	75	0
1,520–1,729	90	0
1,730–2,189	100	0
2,190–2,899	120	0

### Watts vs. Lumen ENERGY STAR Linear Fits

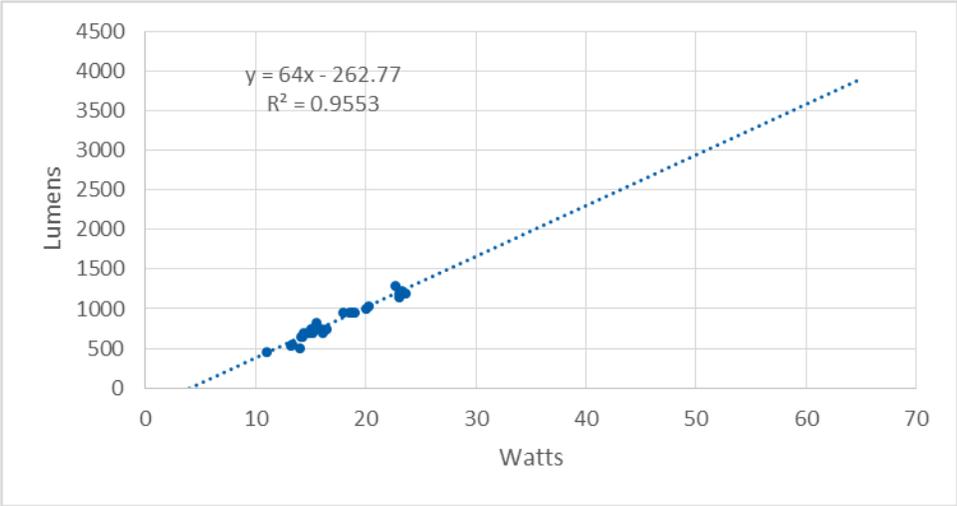
Figure B1 through Figure B8 show watts versus lumens from the ENERGY STAR database for eight different lamp categories, representing standard, reflector, and specialty LED and CFL lamps. When lumens could not be determined for a particular bulb model, Cadmus used these linear fits to obtain that bulb’s lumen output.

**Figure B1. Median Lumens vs. Wattage for ENERGY STAR-Qualified Standard CFLs**





**Figure B2. Median Lumens vs. Wattage for ENERGY STAR-Qualified Reflector CFLs**



**Figure B3. Median Lumens vs. Wattage for ENERGY STAR-Qualified Specialty CFLs**

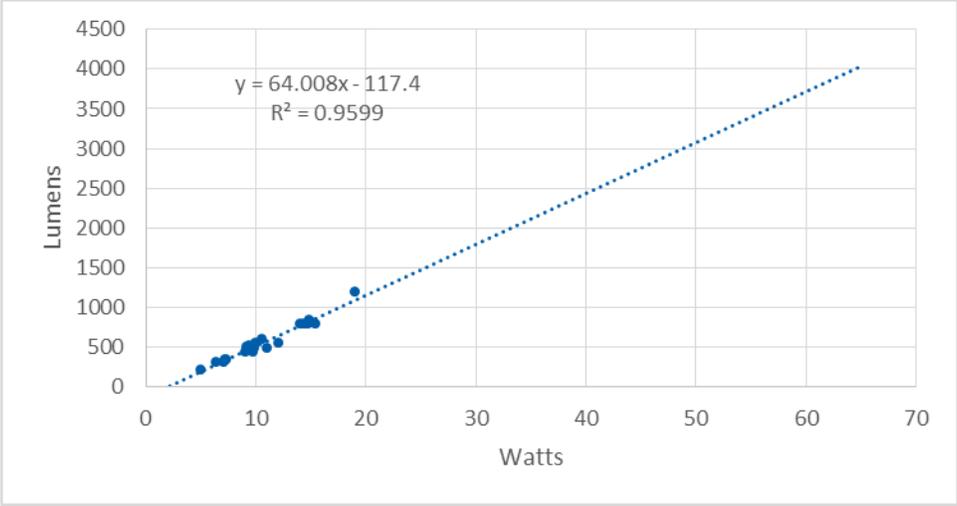


Figure B4. Median Lumens vs. Wattage for ENERGY STAR-Qualified CFL Fixtures

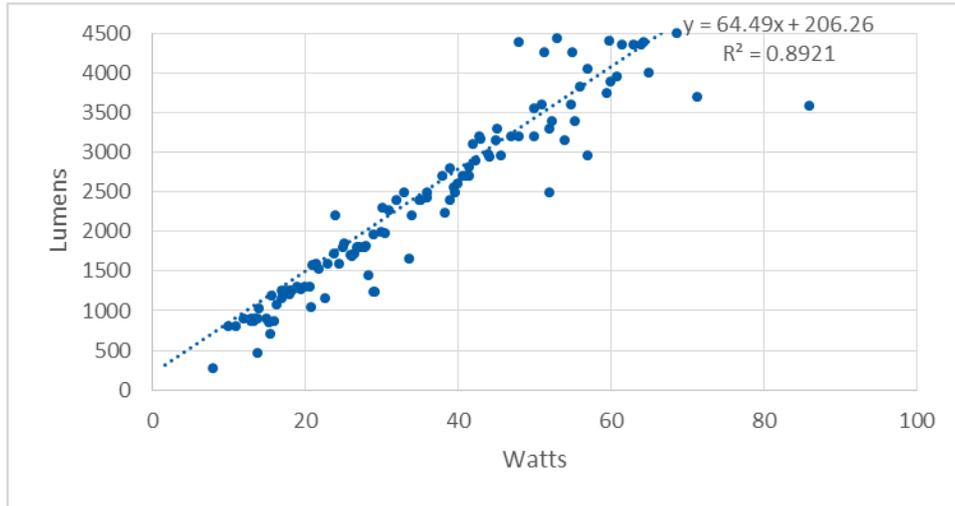


Figure B5. Median Lumens vs. Wattage for ENERGY STAR-Qualified Standard LEDs

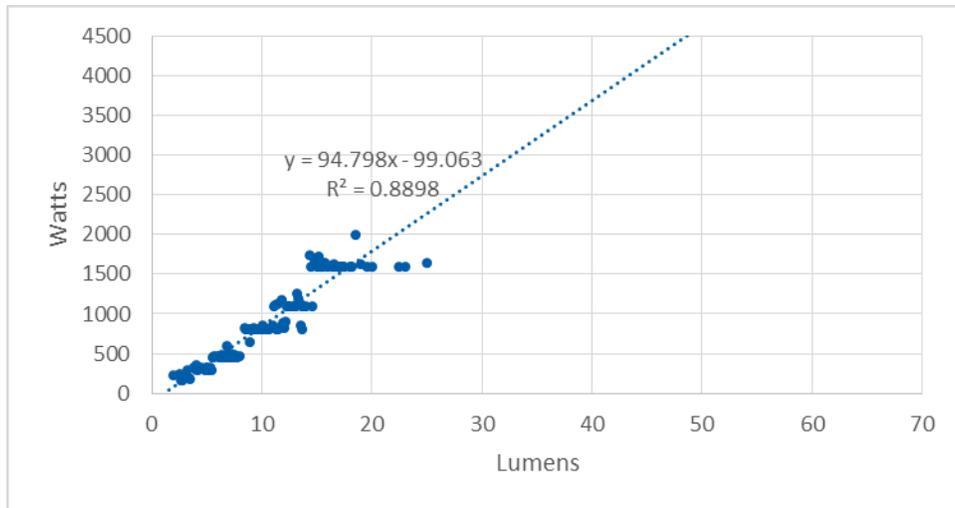




Figure B6. Median Lumens vs. Wattage for ENERGY STAR-Qualified Reflector LEDs

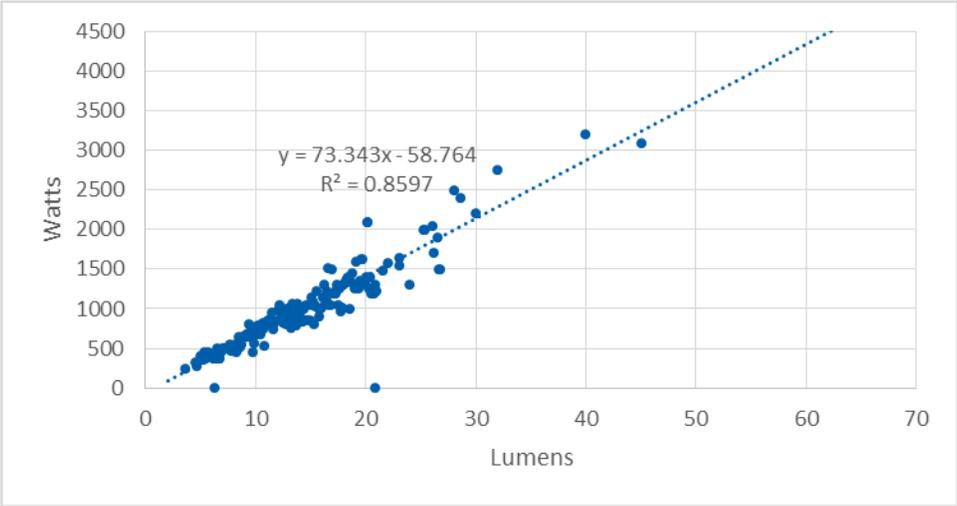


Figure B7. Median Lumens vs. Wattage for ENERGY STAR-Qualified Specialty LEDs

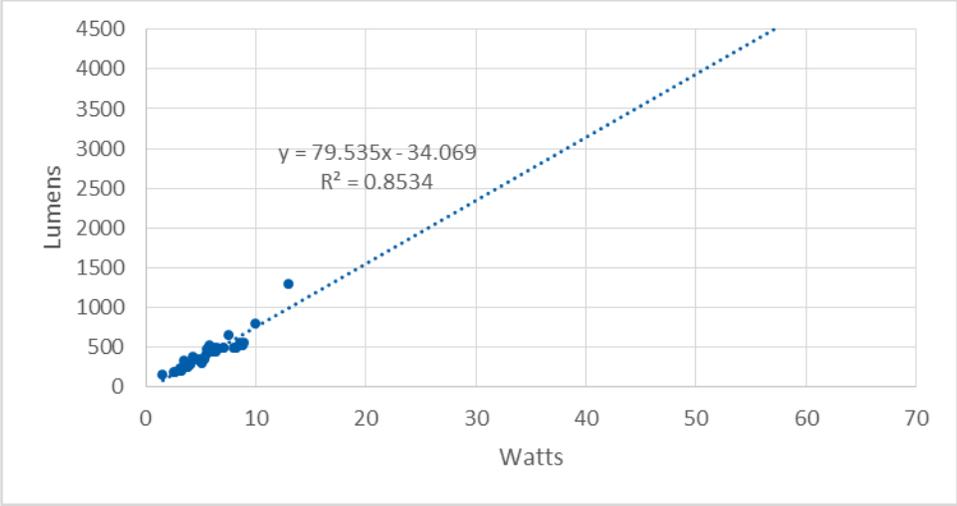
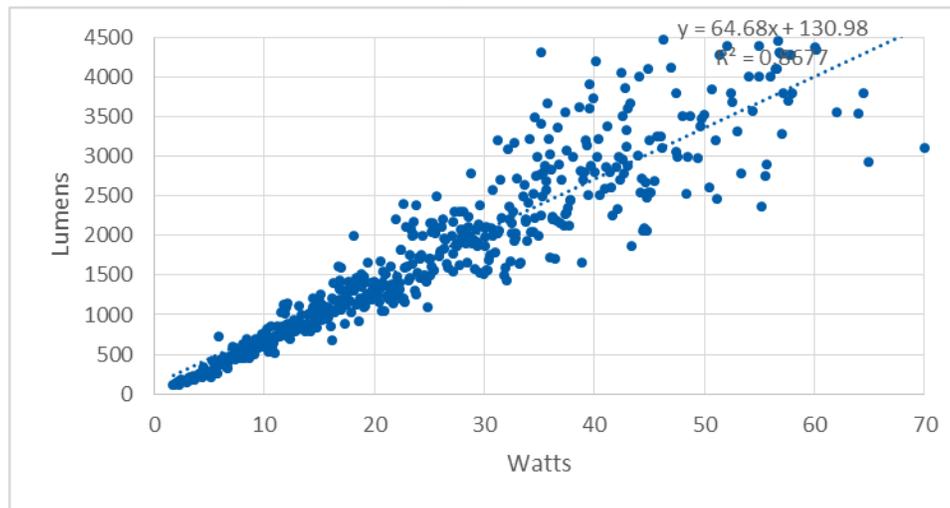


Figure B8. Median Lumens vs. Wattage for ENERGY STAR-Qualified LED Fixtures



### Demand Elasticity Modeling

As lighting products incur price changes and promotion over the program period, they provide valuable information regarding the correlation between sales and prices. Cadmus developed a demand elasticity model to estimate freeridership for the upstream markdown channel in 2015 and 2016. The following description details the methodology and analysis results.

#### Demand Elasticity Methodology

Demand elasticity modeling draws upon the same economic principle that drives program design: changes in price and promotion generate changes in quantities sold (i.e., the upstream buydown approach). Demand elasticity modeling uses sales and promotion information to achieve the following:

- Quantify the relationship of price and promotion to sales
- Determine likely sales levels without the program's intervention (baseline sales)
- Estimate freeridership by comparing modeled baseline sales with predicted program sales

After estimating variable coefficients, Cadmus used the resulting model to predict the following:

- Sales that would occur *without* the program's price impact
- Sales that would occur *with* the program (and should be close to actual sales with a representative model)

Once the model predicted sales that would occur with and without the program, Cadmus multiplied predicted bulb sales by evaluated savings values, calculated through this evaluation to estimate program savings and savings without the program's price impact.



### Input Data

As the demand elasticity approach relies exclusively on program data, a model’s robustness depends on data quality. The sales and pricing data provided for the 2015 and 2016 program years were sufficient and improved from previous program years.

### Price Variation

Price and sales variations were measured across all bulbs within a given retail location and bulb type category by taking the sales-weighted average price per bulb for all products within the retail location and the bulb category and the sum of bulb sales with the retailer/bulb category designations. For example, all 60 watt incandescent-equivalent general purpose LEDs within a specific Wal-Mart storefront location were combined into one category, regardless of manufacturer or pack size. Each monthly observation in the data reflected the average price per-bulb and the total bulb sales within that specific location.

Defining cross-sections for the model this way increased the observed variation levels in price and sales by not only capturing changes in a product’s own price (for a given bulb model number) but also changes in the bulb’s average price due to changes in pack size (e.g., a three-pack is introduced and displaces single pack bulb sales, thus lowering the average price per-bulb) or the introduction of new, comparable products to the program.

Table B8 shows the representativeness of data included in the model for each year as well as data combined for the evaluation cycle.

**Table B8. Share of Sales Represented in Model**

State	Year	Bulb Type	Total Sales	Share Represented by Year	Share Represented Combined
CA	2015	CFL	69,093	94%	93%
CA	2016	CFL	5,656	87%	
CA	2015	LED	22,828	62%	78%
CA	2016	LED	22,790	95%	

In both years and across both technologies, sales included in the model used to estimate elasticities represented a majority of sales. Representativeness was greater for CFLs in 2015 (when CFLs accounted for a larger share of sales) than 2016. Conversely, LED representation was greater in 2016.

### Promotional Displays

The program administrator did not provide detailed data on product merchandising (e.g., clip strips, end caps, pallet displays). Therefore, the model may not have captured all program impacts.<sup>2</sup>

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<sup>2</sup> To the degree that product merchandising and prices co-vary, elasticity estimates may capture some sales lift generated by merchandising. As data, however, were not available for incorporation into the model, separate impacts could not be estimated.

Evaluations in other jurisdictions have found that product merchandising can generate sales lift between 60% and 120%. Capturing and providing this detail level ensures that the program receives credit for all activities. Cadmus recommends collecting and providing these data for future evaluations.

### **Seasonality Adjustment**

In economic analysis, it proves critical to separate data variations resulting from seasonality from those resulting from relevant external factors. For example, suppose prices had been reduced on umbrellas at the beginning of the rainy season. Any estimate of this price shift's impact would be skewed if the analysis did not account for the natural seasonality of umbrella sales.

To adjust for seasonal variations in sales, Cadmus used time fixed-effects in the model. These fixed effects were unique to each retail channel and represented differences from average monthly sales within each retail channel.

Historically, Cadmus has used a seasonal trend derived from national sales from a major lighting products manufacturer for comparing program sales with the expected share of annual sales to occur within each month. However, as shown in Figure 9 and Figure 10, neither LED nor CFL sales followed the expected seasonal pattern, with a small peak in March and a larger peak in October and November.

Both technologies exhibited the highest sales in June 2015, with sales tapering off and achieving much smaller peaks in fall 2015. CFL sales dropped sharply in 2016, and price changes did not correspond with sales changes through 2016.

LED sales also dropped at the end of 2015 and through most of 2016, even when prices fell below levels realized during peak sales in 2015.

Ultimately, including the seasonal sales trend from the national retailer produced positive elasticities for CFLs, leading to extreme negative net-to-gross estimates. Given this result and the atypical monthly pattern of sales observed, the seasonal trend provided by the national retailer did not serve as an appropriate control in the model, and Cadmus opted for the time fixed-effects.

In addition to the fixed-effects, Cadmus added dummy variables for specific months, retailer, and bulb types where anomalous changes in sales were observed. These changes were unrelated to any program activity Cadmus observed in the data. Therefore, these dummy variables absorbed impacts from these events, as to not bias the price elasticities.



Figure 9. CFL Sales and Prices by Month

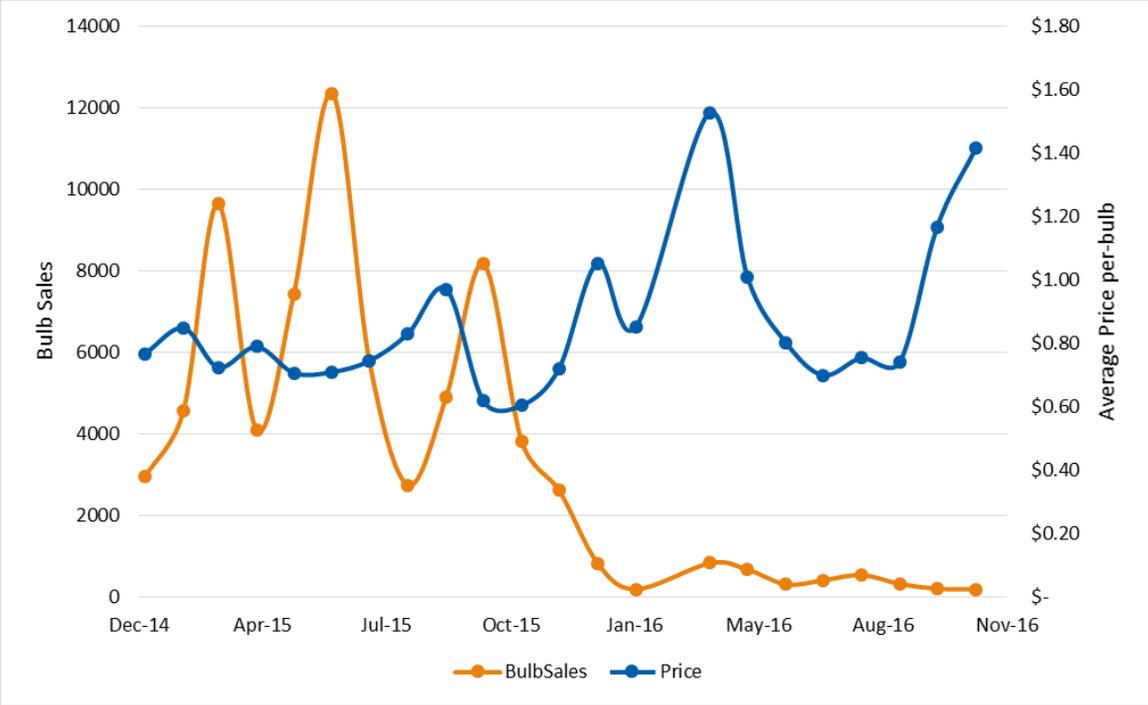
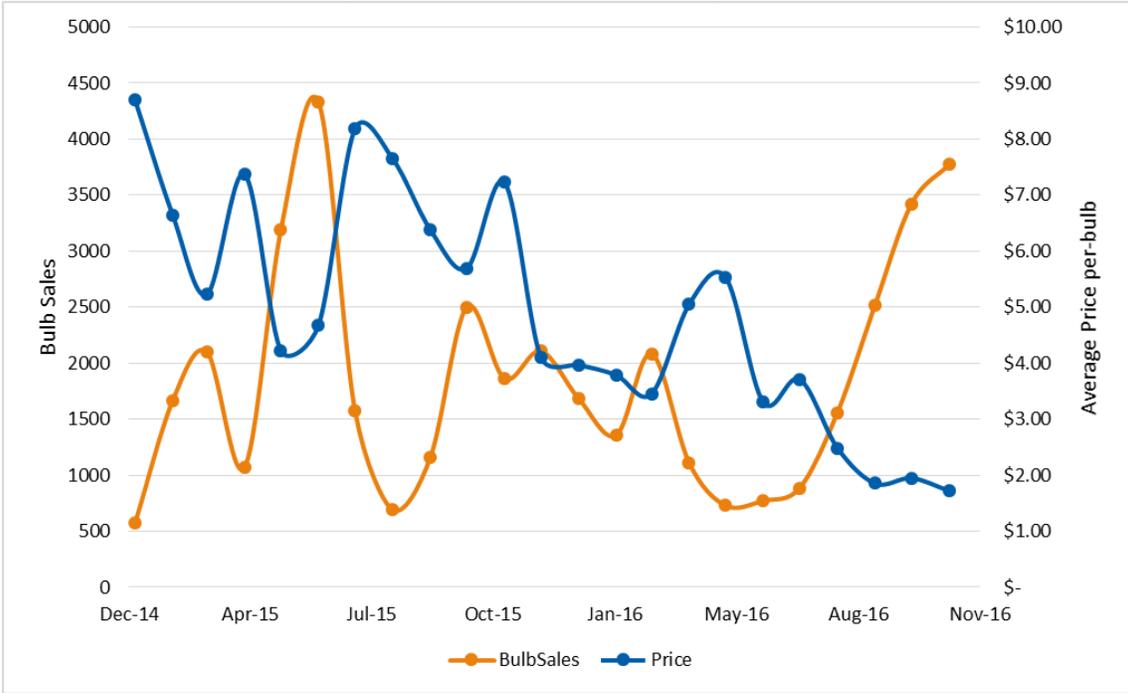


Figure 10. LED Sales and Prices by Month



## Model Specification

Cadmus modeled bulb, pricing, and promotional data using an econometric model that addressed these data as a panel, with a cross-section of program package quantities modeled over time as a function of prices, promotional events, and retail channels. Cadmus, however, analyzed the 2015 and 2016 data separately, producing two similar—though distinct—models. This involved testing a variety of specifications to ascertain price impacts (i.e., the main instrument affected by the program) on bulb demand.

Cadmus estimated the following equation for the 2015 model (for bulb model  $i$ , in month  $t$ ):

$$\begin{aligned} \ln(Q_{it}) = & \sum_{\pi} (\beta_{\pi} ID_{\pi,i}) \\ & + \sum_{\theta} (\beta_{\theta,i,j} [\ln(P_{it}) * (Retail\ Channel_{\theta,i}) * (Bulb\ Category_{\theta,j})]) \\ & + \sum_{\theta} (\beta_{ti} [Sales\ Month_t * (Retail\ Channel_{\theta,i})]) + \beta_3 * LED \\ & * Retailer_i Month_t + \varepsilon_i + \gamma_t \end{aligned}$$

Where:

ln	= Natural log
Q	= Quantity of bulbs sold during month $t$
P	= Sales-weighted retail price per-bulb (after markdown) in month $t$
Retail Channel	= Retail category (Club, DIY, Mass Market)
Retailer $_i$ Month $_t$	= Dummy variable indicating an anomalous sales event for retailer $i$ in month $t$ ; 0 otherwise
LED	= Dummy variable equaling 1 if a product is an LED bulb; 0 otherwise
ID	= Dummy variable equaling 1 for each unique retail channel, bulb technology, and bulb category; 0 otherwise
$\varepsilon_i$	= Cross-sectional random-error term
$\gamma_t$	= Time series random-error term

Due to slight differences in the 2016 model, Cadmus estimated elasticities within each retail channel separately (rather than estimating price elasticities within each retail channel, technology, and bulb type combination separately). The evaluation added a partial slope term for LED bulbs and standard, general-service bulbs. Partial slope terms measure the average incremental change in slope across all bulbs and *across* retail channels rather than *within* them.



Cadmus estimated the following equation for the 2016 model (for bulb model  $i$ , in month  $t$ ):

$$\begin{aligned} \ln(Q_{it}) = & \sum_{\pi} (\beta_{\pi} ID_{\pi,i}) \\ & + \sum_{\theta} (\beta_{\theta,i,j} [\ln(P_{it}) * (Retail Channel_{\theta,i})]) \\ & + \sum_{\theta} (\beta_{ti} [Sales Month_t * (Retail Channel_{\theta,i})]) + \beta_{i,t} * Retailer_i Month_t \\ & + \beta_3 \ln(P_{it}) * LED + \varepsilon_i + \gamma_t \end{aligned}$$

Where:

- ln = Natural log
- Q = Quantity of bulb packs sold during the month
- P = Sales-weighted retail price per-bulb (after markdown) in month t
- Retail Channel = Retail category (Club or non-Club store)
- LED = Dummy variable equaling 1 if a product is an LED bulb; 0 otherwise
- Retailer $_i$ Month $_t$  = Dummy variable indicating an anomalous sales event for retailer  $i$  in month  $t$ ; 0 otherwise<sup>3</sup>
- ID = Dummy variable equaling 1 for each unique retail channel, bulb technology, and bulb category; 0 otherwise
- $\varepsilon_i$  = Cross-sectional random-error term
- $\gamma_t$  = Time series random-error term

The model specification assumed a negative binomial distribution, which provided accurate predictions for a small number of high-volume sale bulbs.

Using the following criteria, Cadmus ran numerous model scenarios to identify the best parsimony and explanatory power:

- Model coefficient p-values (keeping values less than <0.1)<sup>4</sup>
- Explanatory variable cross-correlation (minimizing where possible)

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<sup>3</sup> In 2016, four anomalous sales events produced sales much greater or fewer than expected; these did not correspond with typical seasonality or program activity. Therefore, dummy variables absorbed these effects rather than attributing them to the program.

<sup>4</sup> Where a qualitative variable had many states (such as bulb types), Cadmus did not omit variables if one state's proved insignificant; rather, the analysis considered the joint significance of all states.

- Model Akaike’s Information Criteria (AIC) (minimizing between models)<sup>5</sup>
- Minimizing multicollinearity
- Optimizing model fit

Overall, the model predicted sales within 1.6% of actual bulb sales over the evaluation period.

## Findings

Cadmus estimated a combined CFL and LED freeridership of 48%. Table B9 shows the estimated freeridership ratio by bulb type. LEDs had slightly lower freeridership than CFLs.

**Table B9. Modeling Results by Bulb Type**

Bulb Type	Freeridership
CFLs	40%
LEDs	57%
<b>All Bulbs</b>	<b>48%</b>

Table B10 shows the incentive as a share of the original retail price and the estimated freeridership ratio, by bulb type. Typically, the proportional price reduction and the net of freeridership trend correlate: the higher the incentive, the lower the freeridership. This becomes particularly apparent in this case. The average markdown for LED bulbs was only 43%, resulting in an estimated 38% freeridership ratio. Due to the lower markdown for LEDs, the program generated a net sales lift of 62% for LEDs, compared to 77% for CFLs, which were marked down 63% of the original price.

**Table B10. Modeling Results by Bulb Type**

Year	Technology	Final Price per Bulb	Original Price per Bulb	Markdown %	Freeridership
2015	CFL	\$0.71	\$1.96	64%	38%
	LED	\$5.66	\$9.98	43%	61%
2016	CFL	\$0.98	\$2.11	54%	61%
	LED	\$2.91	\$5.66	48%	54%

## Elasticities

Freeridership ratios are derived from an estimate of price elasticities of demand. The price elasticity of demand measures the percentage change in the quantity demanded, given a percentage change in price. Due to the model’s logarithmic functional form, the elasticities were simply the estimated coefficients for each price variable. In previous, similar analyses, elasticities typically ranged from -1

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<sup>5</sup> Cadmus used AIC to assess model fit, as nonlinear models did not define the R-square statistic. AIC also offered a desirable property, given it penalized overly complex models (similarly to the adjusted R-square).



to -3 for both CFLs and LEDs, meaning a 10% drop in price led to a 10% to 30% increase in the quantity sold.

As shown in Table B11, elasticity estimates for both 2015 and 2016 fell a bit below the expected ranges, with most estimates less than one.

**Table B11. Elasticity Estimates by Retail Channel and Bulb Type**

Year	Channel	Technology	Average Elasticity
2015	DIY	CFL	-0.75
		LED	-0.75
	Mass Market	CFL	-1.04
		LED	-0.99
2016	DIY	CFL	-0.58
		LED	-0.87
	Mass Market	CFL	-0.67
		LED	-0.96

## Appendix C. HES Billing Analysis

Cadmus conducted two billing analyses to estimate evaluated savings for the following measures:

- Insulation (attic and wall)
- Duct sealing

The following sections outline the methodology and results for each effort.

### *Insulation Billing Analysis*

Cadmus conducted billing analysis to assess evaluated energy savings associated with insulation measure installations.<sup>1</sup> Cadmus determined the savings estimate using a pooled, conditional savings analysis (CSA) regression model, which included the following groups:

- 2015–2016 insulation participants (combined attic and wall insulation)
- Nonparticipant homes, serving as the comparison group

The billing analysis resulted in a 78% evaluated realization rate for insulation measures.

### **Insulation Program Data and Billing Analysis Methodology**

Cadmus used the following sources to create the final database for conducting the billing analysis:

- **Participant program data**, collected and provided by the program administrator (including account numbers, measure types, installation dates, square footage of insulation installed, heat sources, and expected savings for the entire participant population).
- **Control group data**, which Cadmus collected from a census of approximately 53,000 nonparticipating customers in California. Cadmus matched energy use for the control group to quartiles of the participants' pre-participation energy use to ensure comparability of the two groups. To ensure adequate coverage of the nonparticipating population, Cadmus included four times the number of nonparticipants as participants.
- **Billing data**, provided by Pacific Power, included all California residential accounts. Cadmus matched the 2015–2016 participant program data to the census of California's billing data for participants installing only insulation measures (i.e., did not install other measures through HES). Billing data included meter-read dates and kWh consumption from January 2014 through May 2017. The final sample used in the billing analysis consisted of nine participants and 36 control customers.
- **California weather data**, including daily average temperatures from January 2014 to May 2017 for three weather stations, corresponding with HES participant locations.

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<sup>1</sup> Billing analysis performed for customers installing only attic or wall insulation measures.



Cadmus matched participant program data with billing data, mapping daily heating degree days (HDDs) and cooling degree days (CDDs) to respective monthly read date periods using zip codes. Cadmus defined the billing analysis pre-period as 2014, before measure installations occurred. This meant defining the post-period as June 2016 through May 2017.<sup>2</sup>

### **Data Screening**

To ensure the final model used complete pre- and post-participation and nonparticipant billing data, Cadmus selected accounts with the following:

1. Participant addresses matching to the billing data provided.
2. A minimum of 300 days in each of the pre- and post-periods (i.e., before the earliest installation, and after the latest reported installation).
3. More than 5,213 kWh per year or less than 18,594 kWh per year (the lowest and highest participant usage to remove very low- or high-usage nonparticipants).
4. Accounts showing a consumption change of less than 50% of pre-program usage, ensuring a better match between participants and the control group.
5. Expected savings under 70% of household consumption (i.e., accounts with a mismatch between participant database and billing data or with pre-period vacancies).
6. Participants installing other measures through the HES program.

Cadmus also examined individual monthly billing data to check for vacancies, outliers, and seasonal usage changes. If usage patterns remained inconsistent between pre- and post-periods, the analysis dropped accounts.

Table C1 shows participant and nonparticipant screening criteria used for the insulation billing analysis.

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<sup>2</sup> As participants installing measures in late 2016 had less than 10 months of post-period data, the analysis excluded them. Similarly, the analysis excluded customers participating in 2015 with measure installation dates before November 2014 (i.e., had less than 10 months of pre-period data).

**Table C1. Screen for Inclusion in Billing Analysis**

Screen	Attrition		Remaining	
	Nonparticipant	Participant	Nonparticipant	Participant
Original measures database (insulation installations only) and nonparticipant population			53,434	31
Matched billing data sample (reduced to nonparticipant, single-family residential accounts in participant zip codes; participant accounts that could be matched to the billing data addresses).	34,342	4	19,092	27
Rejected accounts with less than 300 days in pre- or post-period	8,283	14	10,809	13
Rejected accounts with less than 5,213 kWh or more than 18,594 kWh in pre- or post-period	3,382	-	7,427	13
Rejected accounts with consumption changing by more than 50%	760	-	6,667	13
Rejected accounts with expected savings over 70% of pre-period consumption	-	-	6,667	13
Rejected participant accounts that also received other measures through the HES program	-	2	6,667	11
Rejected accounts with billing data outliers, vacancies, and seasonal usage	747	2	5,920	9
Nonparticipant sample selection (random sample of nonparticipants to match participant pre-period usage by quartile; four times more than participants)	5,884	-	36	9
<b>Final Sample</b>			<b>36</b>	<b>9</b>

### Regression Model

After screening and matching accounts, the final analysis group consisted of nine participants and 36 nonparticipants.

Of the final sample, 100% of participant homes installed attic insulation and 11% installed wall insulation. As determining separate wall or attic insulation savings proved impossible, Cadmus estimated a combined realization rate for all insulation measures.

Cadmus used the following CSA regression specification to estimate HES Program insulation savings:

$$ADC_{it} = \alpha_i + \beta_1 HDD_{it} + \beta_2 CDD_{it} + \beta_3 PARTHDD_{it} + \beta_4 PARTCDD_{it} + \beta_5 POST_t + \beta_6 POSTHDD_{it} + \beta_7 POSTCDD_{it} + \beta_8 PARTPOST_{it} + \beta_9 PARTPOSTHDD_{it} + \beta_{10} PARTPOSTCDD_{it} + \varepsilon_{it}$$



Where for customer (i) and month (t):

- $ADC_{it}$  = Average daily kWh consumption
- $HDD_{it}$  = Average daily HDDs (base 65)
- $CDD_{it}$  = Average daily CDDs (base 65)
- $PARTHDD_{it}$  = Interaction of the participant indicator and Average daily HDDs (base 65)
- $PARTCDD_{it}$  = Interaction of the participant indicator and Average daily CDDs (base 65)
- $POST_t$  = Indicator variable of 1 in the post-period for participants and nonparticipants, 0 otherwise
- $POSTHDD_{it}$  = Indicator variable of 1 in the post-period for participants and nonparticipants interacted with Average daily HDDs (base 65), 0 otherwise
- $POSTCDD_{it}$  = Indicator variable of 1 in the post-period for participants and nonparticipants interacted with Average daily CDDs (base 65), 0 otherwise
- $PARTPOST_{it}$  = Indicator variable of 1 in the post-period for participants, 0 otherwise
- $PARTPOSTHDD_{it}$  = Indicator variable of 1 in the post-period for participants interacted with Average daily HDDs (base 65), 0 otherwise
- $PARTPOSTCDD_{it}$  = Indicator variable of 1 in the post-period for participants interacted with Average daily CDDs (base 65), 0 otherwise

The key coefficients  $\beta_8, \beta_9, \beta_{10}$  determined average insulation savings. The coefficients obtained insulation savings per program participant, normalizing the heating and cooling savings to TMY3 normal weather after accounting for nonparticipant trends. The final insulation savings estimate thus was  $\beta_8 * 365 + \beta_9 * 5135 + \beta_{10} * 515$ . Cadmus included individual customer intercepts ( $\alpha_i$ ) as part of a fixed-effects model specification to ensure no participants or nonparticipants exerted an undue influence over the final savings estimate; this resulted in a more robust model.<sup>3</sup>

### Insulation Results

Cadmus estimated overall insulation savings of 767 kWh per participant. Average insulation achieved expected savings of 986 kWh, translating to a 78% evaluated realization rate for insulation measures. With average participant pre-usage of 12,437 kWh, savings represented a 6% reduction in total energy usage from insulation measures installed. Table C2 presents the overall evaluated savings estimate for wall and attic insulation.

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<sup>3</sup> Due to the complexity of estimating the model with separate intercepts, Cadmus estimated a difference model, subtracting out the customer-specific averages for the dependent and independent variables. This method produced results identical to the fixed effects models with separate intercepts; however, using a difference model proved simpler in estimating savings and presenting final model outputs.

**Table C2. Insulation Evaluated Realization Rates**

Model	Billing Analysis Participants (n)	Reported kWh Savings per Premise	Evaluated kWh Savings per Premise	Realization Rate	Relative Precision at 90% Confidence	90% Confidence Bounds
Overall	9	986	767	78%	±99%	1%–154%

The small sample sizes resulted due to low insulation program participation. Though this led to poor precision on the savings, savings were significant. The state-specific point estimate of the realization rate offered the best estimate for the program performance. In this case, using another state’s realization rate would not provide a better alternative as pre-period usage was considerably lower than in other states at 12,437 kWh.

Table C3 summarizes model outputs for the regression model that Cadmus used to determine the insulation realization rate.

**Table C3. Insulation Regression Model for California (Overall Model)**

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	38,250	3,825	60.95	<.0001
Error	1,055	66,209	62.757		
Corrected Total	1,065	104,459			
Root MSE		7.9219	R-Square		0.3662
Dependent Mean		0.0000	Adj. R-Square		0.3662
Coefficient of Variation		7.92E+18			
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AvgHDD	1	0.9997	0.0668	14.96	<.0001
AvgCDD	1	1.4065	0.1814	7.75	<.0001
PartHDD	1	-0.2780	0.1298	-2.14	0.0324
PartCDD	1	0.1962	0.3636	0.54	0.5896
Post	1	-4.1814	1.3720	-3.05	0.0024
PostHDD	1	0.0941	0.0868	1.08	0.2782
PostCDD	1	0.6744	0.2633	2.56	0.0106
<b>PartPost</b>	<b>1</b>	<b>1.9841</b>	<b>3.0984</b>	<b>0.64</b>	<b>0.5221</b>
<b>PartPostHDD</b>	<b>1</b>	<b>-0.2613</b>	<b>0.1732</b>	<b>-1.51</b>	<b>0.1318</b>
<b>PartPostCDD</b>	<b>1</b>	<b>-0.2902</b>	<b>0.5274</b>	<b>-0.55</b>	<b>0.5823</b>
<b>Annual Normalized Savings</b>	<b>1</b>	<b>767.08</b>	<b>458.71</b>	<b>-1.67</b>	<b>0.0948</b>



## Ductwork Billing Analysis

Cadmus conducted a billing analysis to assess evaluated energy savings associated with duct-sealing measure installations,<sup>4</sup> determining the savings estimate from a pooled, CSA regression model, which included the following groups:

- 2015–2016 duct-sealing participants
- Nonparticipant homes, serving as the comparison group

The billing analysis resulted in a 52% evaluated realization rate for duct-sealing measures. This produced an evaluated result, as it compared participant usage trends to a nonparticipant group, accounting for market conditions outside of the program.

### Ductwork Program Data and Billing Analysis Methodology

Cadmus used the following sources to create the final database for conducting the billing analysis:

- **Participant program data**, collected and provided by the program administrator (including account numbers, measure types, installation dates, square footage of insulation installed, heat source, and expected savings for the entire participant population).
- **Control group data**, which Cadmus collected from a census of approximately 53,000 nonparticipating customers in California. This included matching energy use for the control group to quartiles of the participants' pre-participation energy use to ensure comparability of the two groups. To ensure adequate coverage of the nonparticipating population, Cadmus included four times the number of nonparticipants than participants.
- **Billing data**, provided by Pacific Power, included all California residential accounts. Cadmus matched the 2015–2016 participant program data to the census of billing data for the state (only for participants installing duct-sealing measures). The data included meter-read dates and kWh consumption from January 2014 through May 2017. The final sample used in the billing analysis consisted of 144 participants and 576 control customers.
- **California weather data**, including daily average temperatures from January 2014 to May 2017 for three weather stations, corresponding with HES participants' locations.

Cadmus matched participant program data with billing data and mapped daily heating and CDDs to respective monthly read-date periods using zip codes. Cadmus defined the billing analysis' pre-period as

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<sup>4</sup> Billing analysis performed for customers installing only duct-sealing measures.

2014, before measure installations occurred, and defined the post-period as June 2016 through May 2017.<sup>5</sup>

### Data Screening

To ensure the final model used complete pre- and post-participation and nonparticipation billing data, Cadmus selected accounts with the following:

1. Participant addresses matching to the billing data provided.
2. A minimum of 300 days in each of the pre- and post-periods (i.e., before the earliest installation and after the latest reported installation).
3. More than 4,853 kWh per year or less than 31,586 kWh per year (the lowest and highest participant usages to remove very low- or high-usage nonparticipants).
4. Accounts showing a consumption change of less than 50% of pre-program usage, ensuring a better match between participants and the control group.
5. Expected savings under 70% of household consumption (accounting for either a mismatch between participant database and billing data or pre-period vacancies).
6. Participants installing other measures through the HES program.

Further, Cadmus examined individual monthly billing data to check for vacancies, outliers, and seasonal usage changes. If usage patterns proved inconsistent between the pre- and post-periods, the analysis dropped the accounts. Table C4 shows participant and nonparticipant screening criteria used in the billing analysis.

**Table C4. Screen for Inclusion in Billing Analysis**

Screen	Attrition		Remaining	
	Nonparticipant	Participant	Nonparticipant	Participant
Original measures database (duct-work installations only) and nonparticipant population			53,243	222
Matched billing data sample (reduced to nonparticipant, manufactured home residential accounts in participant zip codes; participant accounts that could be matched to the billing data addresses)	42,207	5	11,036	217
Rejected accounts with less than 300 days in pre- or post-period	8,473	39	2,563	178

<sup>5</sup> As participants installing measures in late 2016 had less than 10 months of post-period data, Cadmus removed them from the analysis. Similarly, customers who participated in 2015 and with measure installation dates before November 2014 had less than 10 months of pre-period data and were removed from the analysis.



Screen	Attrition		Remaining	
	Nonparticipant	Participant	Nonparticipant	Participant
Rejected accounts with less than 4,853 kWh or more than 31,586 kWh in pre- or post-period	391	-	2,172	178
Rejected accounts with consumption changing by more than 50%	139	-	2,033	178
Rejected accounts with expected savings over 70% of pre-period consumption	-	-	2,033	178
Rejected participant accounts also receiving other measures through HES program	-	2	2,033	176
Rejected accounts with billing data outliers, vacancies, and seasonal usage	128	32	1,905	144
Nonparticipant sample selection (random sample of nonparticipants to match participant pre-period usage by quartile: four times more than participants)	1,329	-	576	144
<b>Final Sample</b>			<b>576</b>	<b>144</b>

### Regression Model

After screening and matching accounts, the final analysis group consisted of 144 participants and 576 nonparticipants. Cadmus used the following CSA regression specification to estimate duct-sealing savings from the HES Program:

$$ADC_{it} = \alpha_i + \beta_1 HDD_{it} + \beta_2 CDD_{it} + \beta_3 PARTHDD_{it} + \beta_4 PARTCDD_{it} + \beta_5 POST_t + \beta_6 POSTHDD_{it} + \beta_7 POSTCDD_{it} + \beta_8 PARTPOST_t + \beta_9 PARTPOSTHDD_{it} + \beta_{10} PARTPOSTCDD_{it} + \varepsilon_{it}$$

Where for customer (i) and month (t):

- $ADC_{it}$  = Average daily kWh consumption
- $HDD_{it}$  = Average daily HDDs (base 65)
- $CDD_{it}$  = Average daily CDDs (base 65)
- $PARTHDD_{it}$  = Interaction of the participant indicator and Average daily HDDs (base 65)
- $PARTCDD_{it}$  = Interaction of the participant indicator and Average daily CDDs (base 65)
- $POST_t$  = Indicator variable of 1 in the post-period for participants and nonparticipants, 0 otherwise
- $POSTHDD_{it}$  = Indicator variable of 1 in the post-period for participants and nonparticipants interacted with Average daily HDDs (base 65), 0 otherwise
- $POSTCDD_{it}$  = Indicator variable of 1 in the post-period for participants and nonparticipants interacted with Average daily CDDs (base 65), 0 otherwise

$PARTPOST_{it}$  = Indicator variable of 1 in the post-period for participants, 0 otherwise

$PARTPOSTHDD_{it}$ = Indicator variable of 1 in the post-period for participants interacted with Average daily HDDs (base 65), 0 otherwise

$PARTPOSTCDD_{it}$ = Indicator variable of 1 in the post-period for participants interacted with Average daily CDDs (base 65), 0 otherwise

$\beta_8, \beta_9, \beta_{10}$  served as the key coefficients determining average duct-sealing savings. The coefficients obtained duct-sealing savings per program participant, normalizing the heating and cooling savings to TMY3 normal weather, after accounting for nonparticipant trends. The final duct-sealing savings estimate thus was  $\beta_8 * 365 + \beta_9 * 5068 + \beta_{10} * 358$ . Cadmus included individual customer intercepts ( $\alpha_i$ ) as part of a fixed-effects model specification to ensure no participants or nonparticipants exerted an undue influence over the final savings estimate; this resulted in a more robust model.<sup>6</sup>

## Ductwork Results

Cadmus estimated manufactured home duct-sealing savings of 875 kWh per home. Expected average duct-sealing savings were 1,688 kWh, translating to a 52% evaluated realization rate for duct-sealing measures. With average participant pre-usage of 12,166 kWh, savings represented a 7% reduction in total energy usage from manufactured home duct-sealing measures installed. Table C5 presents the overall savings estimate for manufactured home duct sealing.

**Table C5. Manufactured Home Ductwork Evaluated Realization Rates**

Model	Billing Analysis Participant (n)	Reported kWh Savings per Premise	Evaluated kWh Savings per Premise	Realization Rate	Relative Precision at 90% Confidence	90% Confidence Bounds
<b>Overall</b>	<b>144</b>	<b>1,688</b>	<b>875</b>	<b>52%</b>	<b>±26%</b>	<b>38%–65%</b>
Electric Heat	144	1,688	875	52%	±26%	38%–65%
Electric Heat (HP)	79	1,887	1,055	56%	±28%	40%–71%
Electric Heat (Non-HP)	65	1,445	724	50%	±44%	28%–72%

Cadmus used the overall California model results above, but provided results for electric heat, heat pump, and non-heat pump participants.

Overall, electrically heated homes achieved duct-sealing savings of 875 kWh per home. Expected average electrically heated duct-sealing savings were 1,688 kWh, translating to a 52% evaluated

<sup>6</sup> Due to the complexity of estimating the model with separate intercepts, Cadmus estimated a difference model, subtracting out customer-specific averages for the dependent and independent variables. This method produced results identical to the fixed effects models with separate intercepts; however, using a difference model proved simpler in estimating savings and presenting final model outputs.



realization rate. With average electrically heated participant pre-usage of 12,166 kWh, savings represented a 7% reduction in energy usage from manufactured home duct-sealing measures. Electrically heated participants' home with heat-pumps achieved savings of 1,055 kWh (8%); those without heat pumps achieved 724 kWh (6%).

Table C6, Table C7, and Table C8 summarize model outputs for the regression models Cadmus used to determine the California manufactured home duct sealing realization rates.

**Table C6. Manufactured Home Ductwork Regression Model for California (Overall + Electric Heat)**

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	739,042	73,904	790.35	<.0001
Error	17,496	1,636,023	93.508		
Corrected Total	17,506	2,375,065			
Root MSE		9.6700	R-Square		0.3112
Dependent Mean		0.0000	Adj. R-Square		0.3112
Coefficient of Variation		3.48E+18			
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AvgHDD	1	0.9940	0.0222	44.73	<.0001
AvgCDD	1	1.4709	0.0600	24.52	<.0001
PartHDD	1	0.4455	0.0459	9.70	<.0001
PartCDD	1	0.5859	0.1199	4.89	<.0001
Post	1	-3.2154	0.4291	-7.49	<.0001
PostHDD	1	0.2475	0.0285	8.67	<.0001
PostCDD	1	0.5943	0.0800	7.43	<.0001
<b>PartPost</b>	<b>1</b>	<b>1.9781</b>	<b>0.9460</b>	<b>2.09</b>	<b>0.0366</b>
<b>PartPostHDD</b>	<b>1</b>	<b>-0.2819</b>	<b>0.0591</b>	<b>-4.77</b>	<b>&lt;.0001</b>
<b>PartPostCDD</b>	<b>1</b>	<b>-0.4700</b>	<b>0.1631</b>	<b>-2.88</b>	<b>0.004</b>
<b>Annual Normalized Savings</b>	<b>1</b>	<b>875.08</b>	<b>137.83</b>	<b>-6.35</b>	<b>&lt;.0001</b>

**Table C7. Manufactured Home Ductwork Regression Model for California (Heat Pumps)**

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	655,708	65,571	690.9	<.0001
Error	15,944	1,513,188	94.906		
Corrected Total	15,954	2,168,896			
Root MSE		9.7420	R-Square		0.3023
Dependent Mean		0.0000	Adj. R-Square		0.3023
Coefficient of Variation		3.20E+18			
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AvgHDD	1	0.9940	0.0224	44.40	<.0001
AvgCDD	1	1.4709	0.0604	24.34	<.0001
PartHDD	1	0.3933	0.0556	7.08	<.0001
PartCDD	1	0.4824	0.1413	3.41	0.0006
Post	1	-3.2154	0.4323	-7.44	<.0001
PostHDD	1	0.2475	0.0287	8.61	<.0001
PostCDD	1	0.5943	0.0806	7.37	<.0001
<b>PartPost</b>	<b>1</b>	<b>-0.1651</b>	<b>1.2661</b>	<b>-0.13</b>	<b>0.8962</b>
<b>PartPostHDD</b>	<b>1</b>	<b>-0.1692</b>	<b>0.0730</b>	<b>-2.32</b>	<b>0.0204</b>
<b>PartPostCDD</b>	<b>1</b>	<b>-0.2754</b>	<b>0.1971</b>	<b>-1.40</b>	<b>0.1623</b>
<b>Annual Normalized Savings</b>	<b>1</b>	<b>1054.96</b>	<b>178.94</b>	<b>-5.90</b>	<b>&lt;.0001</b>



**Table C8. Manufactured Home Ductwork Regression Model for California (Non-Heat Pumps)**

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	572,752	57,275	627.82	<.0001
Error	15,604	1,423,542	91.229		
Corrected Total	15,614	1,996,294			
Root MSE		9.5514	R-Square		0.2869
Dependent Mean		0.0000	Adj. R-Square		0.2869
Coefficient of Variation		5.63E+18			
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AvgHDD	1	0.9940	0.0220	45.28	<.0001
AvgCDD	1	1.4709	0.0592	24.83	<.0001
PartHDD	1	0.5178	0.0714	7.25	<.0001
PartCDD	1	0.6889	0.2048	3.36	0.0008
Post	1	-3.2154	0.4238	-7.59	<.0001
PostHDD	1	0.2475	0.0282	8.78	<.0001
PostCDD	1	0.5943	0.0790	7.52	<.0001
<b>PartPost</b>	<b>1</b>	<b>4.4315</b>	<b>1.3222</b>	<b>3.35</b>	<b>0.0008</b>
<b>PartPostHDD</b>	<b>1</b>	<b>-0.4404</b>	<b>0.0903</b>	<b>-4.88</b>	<b>&lt;.0001</b>
<b>PartPostCDD</b>	<b>1</b>	<b>-0.6019</b>	<b>0.2758</b>	<b>-2.18</b>	<b>0.0291</b>
<b>Annual Normalized Savings</b>	<b>1</b>	<b>723.66</b>	<b>193.69</b>	<b>-3.74</b>	<b>0.0002</b>

## Appendix D. Self-Reported Net-to-Gross Methodology

Net-to-gross (NTG) estimates provide a critical part of demand-side management (DSM) program impact evaluations as they allow utilities to determine portions of gross energy savings influenced by and attributable to their DSM programs. This evaluation calculated two NTG components: freeridership and participant spillover.

True freeriders are customers who would have purchased an incented appliance or equipment without any support from the program (e.g., taking the incentive). Participant spillover is the amount of 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. For this evaluation, Cadmus used self-reports from survey participants to estimate NTG for appliances, HVAC, weatherization, and kit measure categories; this method could gauge net effects for many measures at once, enabling Cadmus to monitor freeridership and spillover over several evaluation efforts.

### Survey Design

Direct questions (such as: “Would you have installed measure X without the program incentive?”) tend to result in exaggerated “yes” responses. Participants tend to provide answers that 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—and an industry standard—for avoiding such bias involves asking a question in several different ways, then checking for consistent responses.

Cadmus used industry-tested survey questions to determine why customers installed a given measure and what influence the program had on their decisions. For rebate measure participants, Cadmus used the survey to establish what decision makers might have done in the program’s absence, via five core freeridership questions:

1. Would participants have installed measures without the program?
2. Had participants ordered or installed the measures before learning about the program?
3. Would participants have installed the measures at the same efficiency levels without the program incentive?
4. Would participants have installed the same quantity of measures without the program?
5. In the program’s absence, when would respondents have installed the measures?

Cadmus used a separate set of questions and scoring approach when estimating the freeridership for the kit measure category. After conducting participant surveys with energy-efficient kit recipients, Cadmus utilized responses from three questions to estimate a freeridership score for each participant. Freeridership questions focused on whether the participant already used the measure in their home and if they planned to purchase the measure before signing up to receive the kit.



For participants receiving energy efficiency kits, Cadmus used the kit survey to establish what decision makers might have done in the program’s absence, via the core questions below:

1. Before the participant signed up for the kit, did they already have the measure installed in their home?
2. Was the participant already planning to purchase the measure at the time they signed up for the kit?
3. If the participant was planning to purchase the measure before signing up for the kit, in terms of timing, when would they have purchased the CFLs? (ex. at the same time, later but within the same year, in one year or more)

Cadmus sought to answer three primary questions using a participant spillover survey design:

1. Since participating in the program evaluated, did participants install additional energy-efficient equipment or services incented through a utility program?
2. How influential was the evaluated program on participants’ decisions to install additional energy-efficient equipment in their homes?
3. Did customers receive incentives for additional measures installed?

### Freeridership Survey Questions

The residential rebate survey’s freeridership portion included 12 questions, addressing the five core freeridership questions. 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. The rebate freeridership questions (as asked in the survey format) included the following:

1. When you first heard about the incentive from Pacific Power, had you already been planning to purchase the measure?
2. 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 Yes]* Just to confirm, you learned about the Pacific Power rebate program after you had already purchased or installed the new measure?
4. *[Ask if question 2 or 3 is No or Don’t Know]* Would you have installed the same measure without the incentive from the Home Energy Savings Program?
5. *[Ask if question 4 is No or Don’t Know]* Help me understand, would you have installed something without the Home Energy Savings Program incentive?
6. *[Ask if question 4 or 5 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?
7. *[Ask if question 4 or question 5 is Yes AND measure quantity > 1]* Would you have installed the same quantity?
8. *[Ask if question 4 or question 5 is Yes]* Would you have installed the measure at the same time?

9. *[Ask if question 5 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?
10. *[Ask if question 9 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?
11. *[Ask if question 9 is No or Don't Know AND measure quantity > 1]* Would you have installed the same measures, but fewer of them?
12. *[Ask if question 9 is No or Don't Know]* Would you have installed the same measure at the same time?

The kit freeridership questions asked of each measure (per the survey format) included:

1. Did you have any other high-efficiency [MEASURE] installed in your home at the time you signed up for the kit?
2. At the time you signed up for the kit, were you already planning on buying high-efficiency [MEASURE] for your home?
3. *[Ask if question 2 is Yes]* In terms of timing, when would you have purchased the high-efficiency [MEASURE]?

### Participant Spillover Survey Questions

As noted, Cadmus used the spillover question results to determine whether program participants installed additional energy-saving measures since participating in the program. Savings that participants received from additional measures were considered spillover if the program significantly influenced their decisions to purchase additional measures, and if they did not receive additional incentives for those measures.

Using the surveys, Cadmus specifically asked residential participants whether they installed the following measures:

- Clothes washers
- Refrigerators
- Dishwashers
- Windows
- Fixtures
- Heat pumps
- Ceiling fans
- Electric water heaters
- CFLs
- Insulation



If the participant installed one or more of these measures, Cadmus asked additional questions about what year they purchased the measure, if they received an incentive for the measure, and how influential (e.g., highly influential, somewhat influential, not at all influential) the HES Program was on their purchasing decisions.

Cadmus combined the freeridership and spillover questions in the same survey, asked over the telephone with randomly selected program participants. Prior to beginning the survey effort, Cadmus pre-tested the survey to ensure all appropriate prompts and skip patterns were correct. Cadmus also monitored the survey company's initial phone calls to verify the following:

- Survey respondents understood the questions
- Adjustments were not required

### ***Freeridership Methodology***

Cadmus developed a transparent, straightforward matrix for assigning freeridership scores to participants, based on their responses to targeted survey questions. This included assigning a freeridership score to each question response pattern, and calculating confidence and precision estimates based on the distribution of these scores (a specific approach cited in the National Action Plan for Energy Efficiency's *Handbook on DSM Evaluation*, 2007 edition, page 5-1).

Cadmus left the response patterns and scoring weights explicit so they could be discussed and changed. This involved using a rules-based approach to assign scoring weights to each response from each freeridership question. This allowed sensitivity analysis to be performed instantaneously, and tested the stability of the response patterns and scoring weights. Scoring weights could be changed for a given response option to a given question. This also provided the following important features:

- Derivation of a partial freeridership score, based on the likelihood of a respondent taking similar actions in the absence of the incentive
- 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 stability of the response patterns and scoring weights

This method offered a key advantage by including partial freeridership. Cadmus' experience has shown that program participants do not fall neatly into freerider and non-freerider categories. The study assigned partial freeridership scores to participants with plans to install the measure before hearing about the program, but for whom the program exerted some influence over their decisions. Further, by including partial freeridership, Cadmus could use "don't know" and "refused" responses rather than removing those respondents entirely from the analysis.

Cadmus assessed rebated measure freeridership at three levels:

1. Converting each participant's survey response into freeridership matrix terminology.
2. Assigning each participant's response combination a score from the matrix.
3. Aggregating all participants into an average freeridership score for the entire program category.

Cadmus assessed freeridership for each kit measure by estimating up to two separate freeridership scores:

1. Estimating a *future intent* freeridership score from questions focused on a participant's *future intent* to buy the kit measure within one year at the time of signing up to receive the kit.
2. In some instances, estimating a *prior use* freeridership score from a question focused on *prior use* of the kit measure in question in the respondent's home.

### Convert Rebated Measure Responses to Matrix Terminology

Cadmus evaluated and converted each survey question's response into one of the following values, based on assessing rebate measure participants' freeridership levels for each question:

- Yes (Indicative of freeridership)
- No (Not indicative of freeridership)
- Partial (Partially indicative of freeridership)

Table D1 lists the 12 rebate measure freeridership survey questions, their corresponding response options, and the values they converted to (in parentheses). "Don't know" and "refused" responses 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, Cadmus considered them as an unlikely freerider.



**Table D1. Assignments of HES Rebate Measure Survey Response Options into Matrix Terminology\***

Already planning to purchase?	Already purchased or installed?	Confirmatory: Already purchased 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 (Yes)	Yes (Yes)	Yes (Yes)	Yes (Yes)	Same time (Yes)	Yes (Yes)	Yes (Yes)	Yes (Yes)	Same time (Yes)
No (No)	No (No)	No (No)	No (No)	No (No)	No (No)	No (No)	Within one year (P)	No (No)	No (No)	No (No)	Within one year (P)
DK (No)	DK (No)	DK (No)	DK (No)	DK (P)	DK (P)	DK (P)	Over one year (No)	DK (P)	DK (P)	DK (P)	Over one year (No)
RF (No)	RF (No)	RF (No)	RF (No)	RF (P)	RF (P)	RF (P)	DK (P)	RF (P)	RF (P)	RF (P)	DK (P)
							RF (P)				RF (P)

\* In this table, (P) = partial, RF = refused, and DK = don't know.

## Participant Freeridership Scoring

### Non-lighting Rebate Measure

After converting survey responses into matrix terminology, Cadmus created a freeridership matrix, assigning a freeridership score to each participant's combined responses. This process considered all combinations of survey question responses when creating the matrix, and assigned each combination a freeridership score of 0% to 100%. Using this matrix, Cadmus then scored every participants' combination of responses.

### Kit Measure

If a respondent did not plan to purchase a kit measure within one year at the time they signed up to receive the kit, they were automatically estimated at 0% freeridership for that measure. If a respondent planned to purchase the measure at the time of signing up for the kit, their *future intent* freeridership score derived from the prescribed values in Table D2.

**Table D2. Kit Measure *Future Intent* Question Freeridership Scoring**

Response	<i>Future Intent</i> FR Score
Around the same time I received the kit	100%
Later but within the same year	50%
In one year or more	0%
[DON'T READ] Don't Know	25%

If a respondent did not already have any of the measures installed in their home at the time they signed up for the kit, they received a *prior-use* freeridership score of 0%, and this *prior-use* freeridership estimate was averaged with their *future intent* freeridership score only if they would have purchased the measure within one year of when they initially signing up for the kit.

For example, if a respondent said they would have purchased the measure at the same time they received the kit, but they also said they were not using any of the measures in their home at the time they signed up for the kit, their *future intent* freeridership score of 100% was averaged with their *prior use* freeridership of 0%, using the arithmetic mean to arrive at a participant’s final freeridership score of 50% for the measure. If the respondent said they would have purchased the measure at the same time they received the kit and also used the measure in their home at the time they signed up for the kit, their final freeridership score was 100%, coming from their *future intent* freeridership score.

### Measure Category Freeridership Scoring

#### *Non-lighting Rebate Measures*

After assigning a freeridership score to every survey respondent, Cadmus calculated a savings-weighted average freerider score for the program category. This individually weighted each respondent’s freerider scores by the estimated savings from the equipment they installed, using the following calculation:

$$\begin{aligned}
 & \text{Savings Weighted Freeridership} \\
 &= \frac{\sum(\text{Respondent FR Score}) * (\text{Rebated Measure kWh Savings})}{\sum(\text{Rebated Measure kWh Savings of All Respondents})}
 \end{aligned}$$

#### *Kit Measures*

After assigning freeridership scores to every survey respondent’s kit measures, Cadmus calculated a savings-weighted average freerider score for each kit measure. This individually weighted each respondent’s final measure level freeridership scores by estimated savings from the equipment they installed, using the following calculation:

$$\begin{aligned}
 & \text{Measure Level Savings Weighted Freeridership} \\
 &= \frac{\sum(\text{Kit Measure Respondent FR Score}) * (\text{Kit Measure kWh Savings})}{\sum(\text{Kit Measure kWh Savings of All Respondents})}
 \end{aligned}$$



Cadmus then weighted the kit measure-level freeridership estimates by the evaluated gross program population kWh savings to arrive at the overall kit measure category freeridership estimate, using the following equation:

$$\text{Kit Measure Category Weighted Freeridership} = \frac{\sum(\text{Measure Level FR Score}) * (\text{Measure Level kWh Population Savings})}{\sum(\text{All Kit Measures Population kWh Savings})}$$

### Cadmus’ Rebate Measure Freeridership Scoring Model

Cadmus developed an Excel-based model for calculating freeridership and to improve the consistency and quality of the evaluation’s results. The model translated raw survey responses into matrix terminology, and then assigned a matrix score to each participant’s response pattern. Cadmus aggregated the program participants into program categories to calculate average freeridership scores.

The model incorporated the following inputs:

- Raw survey responses from each participant, along with program categories for their incented measures, and their energy savings from those measures, if applicable
- Values converting raw survey responses into matrix terminologies for each program category
- Custom freeridership scoring matrices for each unique survey type

The model displayed each participant’s combination of responses and corresponding freeridership score, then produced a summary table with the average score and precision estimates for the program category. The model then used the sample size and a two-tailed test target at the 90% confidence interval to determine the average score’s precision.

### Cadmus’ Kit Measure Freeridership Scoring Model

Cadmus developed a freeridership score for each survey respondent using a rules-based assignment of responses to survey items. This estimated up to two freeridership scores for CFLs, LEDs, faucet and bathroom aerators, and showerheads, using two sets of questions and, in certain instances, taking the arithmetic mean of the two estimates for each participant’s measure to calculate final freeridership scores.

The first set of questions and freeridership scores focused on the participant’s *future intent* to buy the kit measure within one year at the time they signed up to receive the kit. In some instances, a second freeridership score was estimated from a question focused on *prior use* of the program measure in question. Where the respondent had *future intent* to buy the kit measure within one year, and they reported not having *prior use* of the measure in their home at the time of signing up for the kit, the arithmetic mean of the *future intent* and *prior use* freeridership scores was used as the participant’s final freeridership score for that measure.

By averaging individual measure-level participant freeridership scores, weighted by participant’s evaluated savings, Cadmus calculated measure-level freerider scores, and then averaged these scores to

calculate a kit measure category-level freeridership score, weighted by each measure's gross evaluated population energy savings.

### ***Participant Spillover Methodology***

For the HES Program, Cadmus measured participant spillover by asking a sample of participants about their purchases and whether they received an incentive for a particular measure (if they installed another efficient measure or undertook another energy efficiency activity because of their program participation). Cadmus also asked these respondents to rate the HES Program's (and incentive's) relative influence (e.g., highly, somewhat, not at all) on their decisions to pursue additional energy-efficient activities.

### **Participant Spillover Analysis**

Cadmus used a top-down approach to calculate spillover savings. The analysis began with a subset of data containing only survey respondents, who indicated they installed additional energy-savings measures after participating in the HES Program. From this subset, Cadmus removed participants who said the program had little influence on their decisions to purchase additional measures, thus solely retaining participants who rated the program as highly influential. Cadmus also removed participants who applied for an HES incentive for the additional measures they installed.

For the remaining participants with spillover savings, Cadmus estimated the energy savings from additional measures installed, calculating savings values, which were matched to additional measures installed by survey participants.

Cadmus calculated the spillover percentage by dividing the sum of additional spillover savings by the total incentivized gross savings achieved by all respondents in the program category:

$$Spillover \% = \frac{\sum Spillover Measure kWh Savings for All Survey Respondents}{\sum Program Measure kWh Savings for All Survey Respondents}$$

## Appendix E. Nonparticipant Spillover Analysis

Effective program marketing and outreach generates program participation and increases general energy efficiency awareness among customers. The cumulative effect of sustained utility program marketing can affect customers' perceptions of their energy usage and, in some cases, motivate customers to take efficiency actions outside of the utility's program. This is generally called nonparticipant spillover (NPSO), resulting in energy savings caused by—but not rebated through—utilities' demand-side management activities.

To understand whether Pacific Power's general and program marketing efforts generated energy efficiency improvements outside of the company's incentive programs, Cadmus collected spillover data through the general population survey, conducted with randomly selected residential customers.

### *Methodology*

Cadmus randomly selected and surveyed 250 customers from a sample of 10,000 randomly generated residential accounts provided by Pacific Power. From the 250 customers surveyed, Cadmus screened out 23 customers who self-reported that they participated in a Pacific Power residential program during 2015 or 2016. When estimating NPSO, Cadmus excluded these customers from analysis, focusing on identified nonparticipants; thus, the analysis avoided potential double-counting program savings and/or program-specific spillover.

Cadmus limited the NPSO analysis to the same efficiency measures rebated through Pacific Power programs (known as "like" spillover). Examples included installing a high-efficiency clothes washer and installing high-efficiency insulation that participants (for whatever reason) did not apply for and did not receive an incentive. Cadmus excluded one notable category of "like" measures: lighting products. This precluded potentially double-counting NPSO lighting savings already captured through the upstream lighting incentives.

Using a 1 to 4 scale, with 1 meaning "not at all important" and 4 meaning "very important," the survey asked customers to rate the importance of several factors on their decisions to install energy-efficient equipment without receiving an incentive from Pacific Power. This question determined whether Pacific Power's energy efficiency initiatives motivated energy-efficient purchases. The surveys asked respondents to address the following factors:

- Information about energy efficiency provided by Pacific Power
- Information from friends or family who installed energy-efficient equipment and received an incentive from Pacific Power
- Their experiences with past Pacific Power incentive programs

Cadmus estimated NPSO savings from respondents who rated any of the above factors as "very important" for any reported energy-efficient actions or installations.



Cadmus leveraged measure-level estimated gross savings from the 2015–2016 residential **wattsmart** evaluation activities for the reported NPSO measures. Using the variables shown in Table F1, Cadmus determine total NPSO generated by Pacific Power’s marketing efforts during the 2015–2016 evaluation year.

**Table F1. NPSO Analysis Method**

Variable	Metric	Source
A	Number of “like spillover” nonparticipant measures	Survey data
B	Total Nonparticipant Customers Surveyed	Survey disposition
C	Weighted Average of Per Unit Measures Savings in kWh	Variable C from Table F2
D	Total Residential Customer Nonparticipant Population	Based on 2016 Residential Customer Accounts provided and 2015-2016 Program Tracking Data
E	NPSO kWh Savings Applied to Population	$[(A \div B) \times C] \times D$
F	Total Gross Evaluated Savings	2015-2016 Evaluation
G	NPSO as a Percentage of Total residential Portfolio Evaluated Savings	$E \div F$

### Results

Of 250 Pacific Power California customers surveyed, six nonparticipant respondents reported installing four different measure types attributed to Pacific Power’s influence. Table F2 presents measures and gross evaluated kWh savings that Cadmus attributed to Pacific Power California, generating average savings per NPSO measure of 107 kWh.

**Table F2. NPSO Response Summary**

Reported Spillover Measures	Quantity	Unit Energy Savings (kWh)*	Total Savings (kWh)	Average Savings Per Spillover Measure (kWh)
ENERGY STAR Clothes Washer	1	133.9 per unit	134	
ENERGY STAR Refrigerator	2	117.0 per unit	234	
Low Flow Showerhead	3	130.4 per unit	391	
Windows	16 square feet	0.7 per unit	11	
<b>Total</b>	<b>8**</b>		<b>770</b>	<b>96 (Variable C)</b>

\*Unit energy savings (kWh) estimated for each measure were generated from average 2015–2016 HES evaluated gross savings by measure.

\*\*Two respondents installed a total of 16 square feet of windows, and each respondent accounted for two of the eight total like spillover measures.

Table F3 presents variables used to estimate overall NPSO for the HES Program, a figure Cadmus estimated as 2% of total Pacific Power residential **wattsmart** program evaluated savings. Cadmus applied the 2% NPSO equally across the Pacific Power residential **wattsmart** program measures.

**Table F3. NPSO Analysis Results**

Variable	Metric	Value	Source
A	Number of Like Spillover Nonparticipant Measures	8	Survey data
B	Total Nonparticipant Customers Surveyed	227	Survey disposition
C	Weighted Average of Per Unit Measures Savings in kWh	96	Calculated in Table F2
D	Total Residential Customer Population	29,472	Based on 2016 Residential Customer Accounts provided by Pacific Power and 2015-2016 Program Tracking Data
E	NPSO kWh Savings Applied to Population	99,981	$((A \div B) \times C) \times D$
F	Total Gross Reported Savings	4,266,715	2015-2016 Residential <b>wattsmart</b> Evaluated Savings
G	NPSO as a Percentage of Total Residential Portfolio Reported Savings	2%	$E \div F$

## Appendix F. Measure Category Cost-Effectiveness

Cadmus reported cost-effectiveness for evaluated savings and net savings at the measure category level. The net results applied the evaluated NTG to evaluated gross savings. Table F1 shows cost-effectiveness inputs for the evaluated results, and Table F2 shows cost effectiveness results by measure category for the TRC and UCT test perspectives.

**Table F1. California Measure Category Cost-Effectiveness Inputs**

Input Description	2015	2016	Total
<b>Average Measure Life*</b>			
Appliances	14.0	14.0	14.0
Building Shell	20.0	20.0	20.0
Home Electronics	5.0	N/A	5.0
HVAC	19.4	19.1	19.3
Lighting	10.0	11.9	10.6
Kits	9.3	9.2	9.3
Water Heating	15.0	15.0	15.0
Whole Home	N/A	27.0	27.0
<b>Evaluated Energy Savings (kWh/year)**</b>			
Appliances	4,728	4,863	9,591
Building Shell	31,263	25,392	56,654
Home Electronics	35,310	N/A	35,310
HVAC	543,726	500,711	1,044,437
Lighting	1,423,938	655,652	2,079,590
Kits	733,644	265,092	998,737
Water Heating	4,644	15,818	20,462
Whole Home	N/A	21,934	21,934
<b>Incentives</b>			
Appliances	\$872	\$1,800	\$2,672
Building Shell	\$5,763	\$8,156	\$13,919
Home Electronics	\$6,509	N/A	\$6,509
HVAC	\$87,105	\$216,800	\$303,905
Lighting	\$282,503	\$101,325	\$383,827
Kits	\$135,153	\$11,432	\$146,585
Water Heating	\$856	\$7,000	\$7,856
Whole Home	N/A	\$21,934	\$21,934
<b>Retail Rate</b>	<b>\$0.09</b>	<b>\$0.09</b>	<b>N/A</b>

\*Weighted average measure category lives are based on individual measure lifetimes and weighted by savings and the frequency of installations.

\*\*Evaluated savings reflect impacts at the customer meter.

\*\*\*Pacific Power provided program incentives in annual report data.



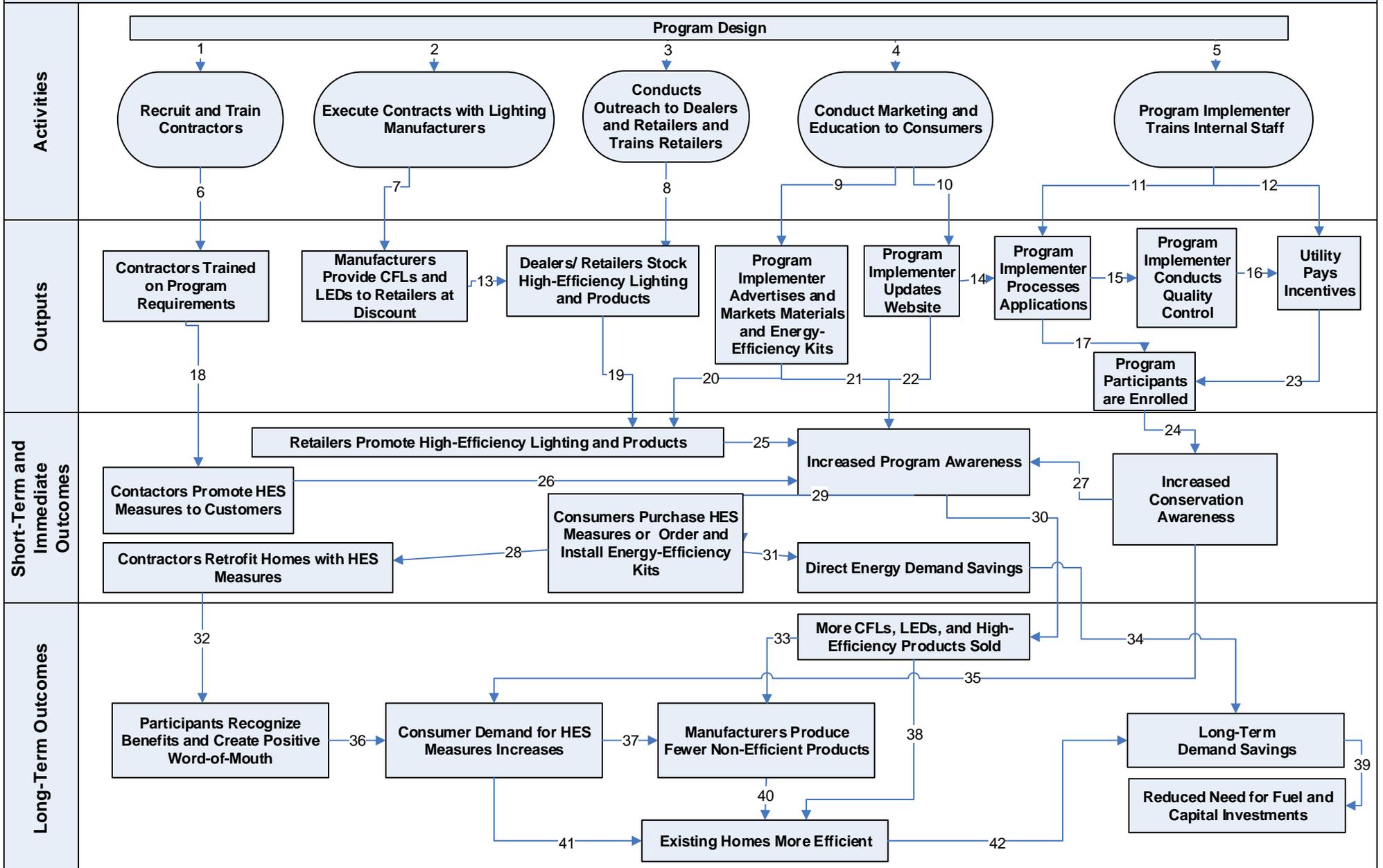
**Table F2. California Measure Category Cost-Effectiveness Results**

Measure Category	Year	Benefits*	TRC Costs*	TRC Net Benefits*	TRC Ratio	UCT Ratio
Appliances	2015	5,370	6,083	(713)	0.88	3.48
Building Shell	2015	33,344	17,520	15,824	1.66	3.84
Home Electronics	2015	1,130,996	1,150,523	(19,527)	0.43	1.80
HVAC	2015	227,289	(483,291)	710,580	2.44	5.30
Kits	2015	340,545	(151,678)	492,223	5.38	2.96
Lighting	2015	16,941	(150,559)	167,500	1.29	2.05
Water Heating	2015	74,050	72,908	1,141	1.30	3.47
Appliances	2016	5,370	6,449	(1,079)	0.83	1.89
Building Shell	2016	33,344	19,177	14,167	1.74	2.27
HVAC	2016	1,312,817	623,673	689,144	2.10	2.76
Kits	2016	227,444	58,502	168,943	3.89	4.01
Lighting	2016	333,566	370,027	(36,460)	0.90	2.01
Water Heating	2016	17,448	16,993	455	1.03	1.68
Whole Home	2016	74,050	34,459	39,591	2.15	2.04

\*Costs and Benefits are provided in program year dollars.

# Pacific Power Home Energy Savings (HES) Program Logic Model

Inputs: Funds, Experienced Staff, Allies, Market Knowledge, Synergistic Program Management



## Appendix H. Benchmark Detail

The tables in this appendix provide additional detail on programs included in Cadmus benchmark review of residential lighting and non-lighting.

**Table H1. Residential Upstream Lighting Programs**

Utility/PA, State	Program Name	Administrator	Measure Detail	Program Year	Unit Volume	Net MWh*	kWh/Unit*	NTG	Notes
Pacific Power, CA	HES	CLEAResult	CFLs (Gen Purpose) CFLs (Specialty) LEDs (Gen Purpose) LEDs (Specialty) CFL, LED Fixtures	2015-2016	137,521	1,184**	9**	57%	
Ameren, MO	Residential Lighting	ICF	10W General Purpose 15W General Purpose 20W General Purpose 4W Candelabra 8W Globe 12W Dimmable 10.5W Downlight 15W Flood (PAR 30) 18W Flood (PAR 38)	2016	917,013	24,418	27	59%	<ul style="list-style-type: none"> <li>• ICF negotiated memorandums of understanding with 13 retail chains and franchise retailers in Ameren Missouri’s territory, covering 177 storefront locations. Retailers fell into roughly four categories: Large Hardware, Large Mass-Merchandise, Specialty Electronics, and Discount Stores. Largest volume categories were 10W General Purpose (59% of total) and 15W Flood (23% of total) lamps.</li> <li>• The Lighting program operated through a point-of-sale markdown system at major chain retailers and through an online website.</li> <li>• Based on intercept surveys: sales-weighted average program leakage was 1.65% in PY16. Sales-weighted residential installation was 99.15%</li> </ul>
EmPOWER, MD	Residential Lighting	ICF, Honeywell	CFL Lamps, LED Lamps and Efficient Fixtures standard/specialty CFLs, standard/specialty LEDs, and	1/1/2016-5/31/2016	2,442,683	47,519	20	60%	Utilities should continue to incent energy-efficient residential lighting for the near future. The transition to an all-LED program has increased per-unit savings generated by the program, and net savings remain robust



Utility/PA, State	Program Name	Administrator	Measure Detail	Program Year	Unit Volume	Net MWh*	kWh/Unit*	NTG	Notes
			ENERGY STAR fixtures						
SRP, AZ	Retail Lighting	SRP	N/A	FY17	693,595	30,488	44	100%	SRP values based on NTG = 1.0
PPL, PA	Residential Retail	Ecova	N/A	6/1/2015-5/31/2016	1,211,953	42,219	30	69%	The upstream lighting component offered incentives to manufacturers to discount the price of energy-efficient, screw-in LEDs sold in retail stores. The program also distributed information about energy-efficient lighting in brochures, online, and at participating retailers. The ICSP worked directly with manufacturers and retail store channels to coordinate and track the sale of discounted bulbs. An additional quantity of bulbs was provided: Low-Income – Upstream Lighting 48,000 1,467 MWh savings.

\* Net MWh—values determined by evaluators—derived from the final evaluation reports.

\*\* Cadmus determined the Pacific Power savings value using primary data collection for LED lamps and relying on the in-service rates and hours-of-use evaluated in the 2015 CPUC Report for CFLs, as noted in the main report. Pacific Power exhibited lower per-unit lighting savings than other utility evaluations listed in this table, due to lower evaluated NTG, hours of use, and in-service rates.

Table H2. Residential Non-Lighting Programs Measure and Participation Detail

Utility/PA, State	Program Name	Implementer	Measure Detail	Program Year	Participation	Gross MWh*	NTG
Ameren, MO	Efficient Products Program	ICF International	ES room ACs ES HP water heaters ES room air purifiers ES pool pumps multi-speed ES pool pumps var speed Smart thermostats	2016	HPWHs 322 RACs 324 Room air purifiers 1,300 Multi speed pool pumps 147 Var speed pool pumps 550 Smart thermostats 8,200	6,671	HPWHs 84.8% RACs 59.8% Room air purifiers 50.2% Pool pumps 67.8%
EmPOWER, MD	Appliance Rebate Program	ICF Int'l for BGE, Pepco, Delmarva Power, and SMECO. Honeywell for PE	ES Cl Washer Tier 2 \$75 ES Cl Washer Tier 3 \$100 ES Refrig Tier 2 \$100 ES Refrig Tier 3 \$150 ES Room AC Tier 2 \$30 ES Elec Cl Dryer \$50 HP Water Heater \$500 Pool Pump Multi-speed \$150 Pool Pump Var-speed \$400	1/1/2016-5/31/2016	CL Dryer 1,730 CL Washer Tier 2 1,789 CL Washer Tier 3 120 Pool Pump 344 Refrig Tier 2 215 Refrig Tier 3 1 HP Water Heater 424	1,548	68%
EmPOWER, MD	Residential HVAC Program	ICF Int'l for BGE, Pepco, Delmarva Power, and SMECO. Honeywell for PE	ASHP SEER 16-18 ASHP SEER 18+ CAC SEER 16-18 CAC SEER 18 Furnace GSHP Mini Split HP	1/1/2016-5/31/2016	ASHP SEER 16-18 1,631 ASHP SEER 18+ 1,029 CAC SEER 16-18 2,094 CAC SEER 18+ 540 Furnace 848 GSHP 336 Mini Split HP 374	5,380	60%
PPL, PA	Residential Retail	Ecova	Energy-efficient refrigerators and heat pump water heaters. Also includes efficient fossil-fuel water heaters eligible for rebates under the fuel-switching pilot	PY7	Refrigerators HPWHs Efficient fossil-fuel WHs 4417	3,053	64%



Utility/PA, State	Program Name	Implementer	Measure Detail	Program Year	Participation	Gross MWh*	NTG
PSE, WA	Residential Single-Family Existing Dealer Channel & Low Income Weatherization Programs	N/A	Shell improvements/ wzn (insulation, air sealing, windows) HVAC (furnace, boiler, HPs), Water heat (equip. repl, SHs) Lighting (CFLs, LEDs), appliances (refrig.) Other direct install (power strips)	2013-2015	Ceiling Insulation 1,502 Floor Insulation 1,615 Wall Insulation 483 Air Sealing 190 Windows 3,078 Duct Sealing, Insulation 1,922 Heat System Repl 7,404 Fireplace 1,163 Integ Space Water Heat 95 Showerheads 188	N/A	N/A
Energy Trust, OR	Exiting Homes	CLEARresult	1) Incentives for OR homes that install energy-efficient electric or gas measures 2) Incentives for NW Natural customers in SW WA who install gas measures 3) Energy Saver Kits: LED lightbulbs, showerheads, and faucet aerators	2013-2015	Downstream/Midstream mix Recent effort to increase midstream engagement (Distrib. SPIFs, info sessions) Instant incentives through trade allies Specialized offers for Moderate income, rental properties	11,440	N/A
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Utility/PA, State	Program Name	Implementer	Measure Detail	Program Year	Participation	Gross MWh*	NTG
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