

***Final Evaluation Report for PacifiCorp wattsmart Homes  
Program in Wyoming***

Final Evaluation Report, Program Years 2017-2018

---

Prepared for:  
***Rocky Mountain Power***

*February 4, 2020*

Prepared by:



ADM Associates, Inc.  
3239 Ramos Circle  
Sacramento, CA 95827  
916-363-8383

---

# Table of Contents

---

1	Executive Summary .....	1
2	Introduction and Purpose of Study .....	8
3	Impact Evaluation .....	13
4	Process Evaluation .....	43
5	Cost-Effectiveness .....	61
6	Conclusions and Recommendations .....	64
7	Appendices.....	66

# 1 Executive Summary

---

This report provides results of the ADM Associates, Inc. (ADM) impact and process evaluation of the PacifiCorp 2017-2018 wattsmart Homes Program in Wyoming. The wattsmart Homes Program in the state of Wyoming provides incentives for PacifiCorp (also referred to as Rocky Mountain Power in this report) residential customers who purchase various eligible products or services.

During the 2017 and 2018 program years, the wattsmart Homes Program claimed gross energy savings of 9,279,661 kWh. The wattsmart Homes Program provided incentives for the following measure categories:

- **Appliances:** clothes washers, freezers and refrigerators
- **Building Shell:** insulation and windows
- **Electronics:** advanced power strips (APS)
- **Energy Kits:** mailed energy kits containing combinations of LEDs, bathroom and kitchen faucet aerators, and showerheads
- **Heating, ventilation, and air conditioning (HVAC):** evaporative coolers, furnace fans, duct sealing and insulation, and heat pumps
- **Lighting:** LED bulbs and fixtures and CFL bulbs (2017 only)
- **Water Heating:** heat pump water heaters

For the impact evaluation, ADM determined the ex-post verified energy (kWh) savings that are achieved through Rocky Mountain Power's 2017-2018 wattsmart Homes Program in Wyoming. Rocky Mountain Power contracted with Navigant to assess program cost-effectiveness. The results of the cost-effectiveness assessment are also included in this report. For the process evaluation, ADM attempted to gain an in-depth understanding of program operations, challenges and evaluation needs through Rocky Mountain Power and implementation contractor key staff interviews, complemented with program documentation review and program participant surveys.

## 1.1 Evaluation Results

### 1.1.1 Impact Evaluation Results

Table 1-1 and Figure 1-1 present the impact evaluation results, including the claimed savings, evaluated gross savings, realization rates, evaluated net savings and net-to-gross (NTG) values for each measure category across both program years, 2017 and 2018. Table 1-2 and Table 1-3 present this information for each year 2017 and 2018 individually.

Table 1-1: Wyoming wattsmart Homes Program Claimed and Evaluated Savings by Measure Category, 2017-2018

Year	Measure Category	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	Net to Gross
2017-2018	Appliances	11,947	11,947	100%	9,564	80%
	Building Shell	157,649	157,649	100%	128,219	81%
	Electronics	579,312	579,312	100%	475,805	82%
	Energy Kits	1,923,468	1,545,762	80%	1,456,394	94%
	HVAC	356,161	356,161	100%	286,630	80%
	Lighting	6,236,772	4,332,865	69%	3,279,367	76%
	Water Heating	14,352	14,352	100%	11,476	80%
<b>2017-2018 TOTAL</b>		<b>9,279,661</b>	<b>6,998,048</b>	<b>75%</b>	<b>5,647,454</b>	<b>81%</b>

Figure 1-1: Wyoming wattsmart Homes Program Energy Savings, 2017-2018

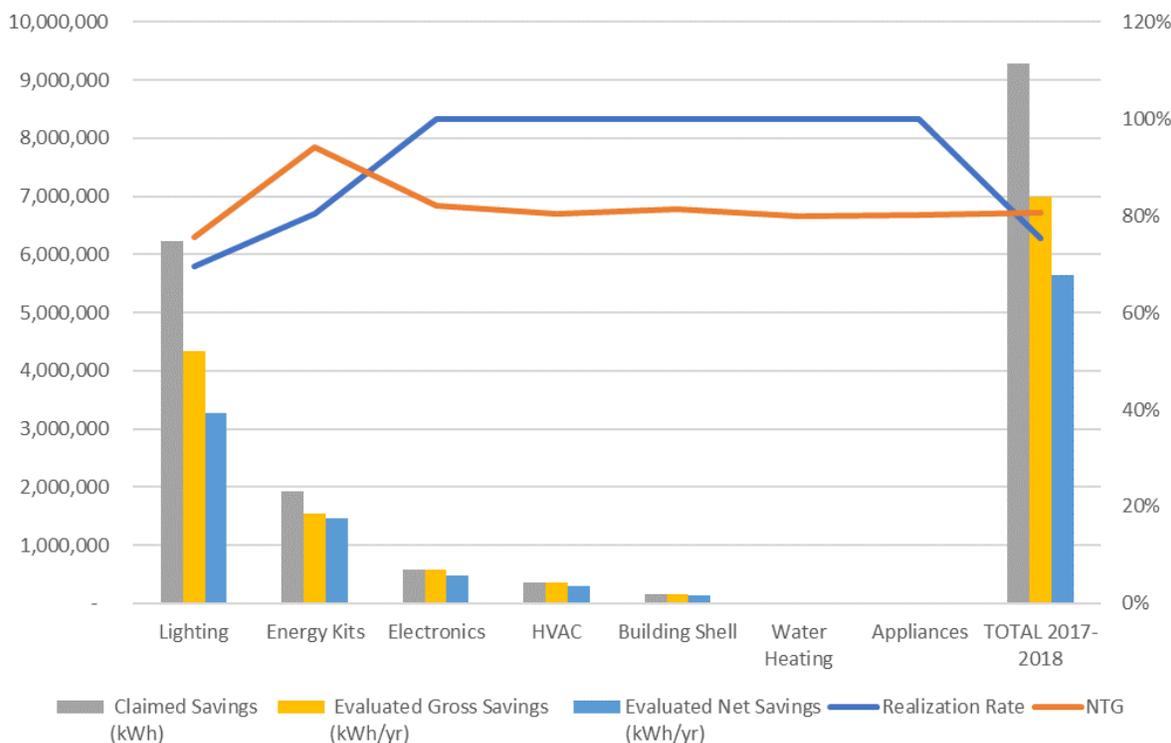


Table 1-2: Wyoming wattsmart Homes Program Claimed and Evaluated Savings by Measure Category, 2017

Year	Measure Category	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	Net to Gross
2017	Appliances	7,150	7,150	100%	5,624	79%
	Building Shell	36,293	36,293	100%	28,546	79%
	Electronics	-	-	0%	-	0%
	Energy Kits	524,133	420,140	80%	395,850	94%
	HVAC	169,493	169,493	100%	133,314	79%
	Lighting	3,262,779	2,239,998	69%	1,696,478	76%
	Water Heating	8,970	8,970	100%	7,055	79%
<b>2017 TOTAL</b>		<b>4,008,818</b>	<b>2,882,044</b>	<b>72%</b>	<b>2,266,868</b>	<b>79%</b>

Table 1-3: Wyoming wattsmart Homes Program Claimed and Evaluated Savings by Measure Category, 2018

Year	Measure Category	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	Net to Gross
2018	Appliances	4,797	4,797	100%	3,940	82%
	Building Shell	121,356	121,356	100%	99,673	82%
	Electronics	579,312	579,312	100%	475,805	82%
	Energy Kits	1,399,335	1,125,622	80%	1,060,544	94%
	HVAC	186,668	186,668	100%	153,316	82%
	Lighting	2,973,993	2,092,866	70%	1,582,888	76%
	Water Heating	5,382	5,382	100%	4,420	82%
<b>2018 TOTAL</b>		<b>5,270,843</b>	<b>4,116,003</b>	<b>78%</b>	<b>3,380,586</b>	<b>82%</b>

### 1.1.2 Process Evaluation Results

Key process evaluation results include the following:

- **Survey respondents are satisfied with Rocky Mountain Power as their electricity provider.** The large majority of survey respondents reported being either very satisfied or satisfied with Rocky Mountain Power (RMP) as their electricity service provider, with approximately 81% of General Population Survey respondents, 88% of Energy Kits Survey respondents and 91% of HVAC Survey respondents reporting that they were either very satisfied or satisfied.
- **Program participants are satisfied with Rocky Mountain Power’s wattsmart Homes Program.** Approximately 78% of Energy Kit Survey respondents and 91% of HVAC Survey respondents reported being either satisfied or very satisfied with the wattsmart Homes Program overall.
- **Bill inserts and the Rocky Mountain Power website were the top ways participants learned of Rocky Mountain Power energy kits.** Program participant survey respondents that received energy kits most commonly reported

learning about the energy kits through bill inserts (53%) or the Rocky Mountain Power website (16%).

- **Rocky Mountain Power representatives, bill inserts or messages printed on bills were the top ways participants learned of Rocky Mountain Power incentives for HVAC equipment.** Program participant survey respondents that received incentives for HVAC equipment most commonly reported learning about the HVAC incentives through Rocky Mountain Power representatives (44%), bill inserts (12%) or messages printed on bills (12%).
- **Energy efficiency, price and lifetime and brightness of bulbs were most important to customers when purchasing light bulbs.** General population survey respondents reported that the most important characteristics considered when purchasing light bulbs were energy efficiency (66%), price (61%), length of the bulb's life (56%), and brightness of the bulb (54%).
- **Saving money on utility bills was most important to participants receiving energy kits.** Almost 60% of Energy Kits Survey respondents reported that "saving money on utility bills" was the most important reason for requesting an energy kit and 27% reported this as the second most important reason. Additionally, 17% of survey respondents reported that "concern for the environment" was the most important reason for requesting an energy kit and 29% reported this as the second most important reason.

### **1.1.3 Cost-Effectiveness Results**

The Wyoming wattsmart Homes Program was cost-effective during the combined 2017-2018 evaluation period, across all cost-effectiveness tests except for the Total Resource Cost (TRC) and Ratepayer Impact Measure (RIM) tests. Table 1-4 below shows the results for the overall program for the combination of program years 2017 and 2018, based on the Wyoming evaluated net savings.

*Table 1-4: 2017-2018 Wyoming wattsmart Homes Program Level Cost-Effectiveness Results*

<b>Cost-Effectiveness Test</b>	<b>Levelized \$/kWh</b>	<b>Costs</b>	<b>Benefits</b>	<b>Net Benefits</b>	<b>Benefit/Cost Ratio</b>
PacifiCorp Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0520	\$2,612,549	\$2,851,441	\$238,891	1.09
Total Resource Cost Test (TRC) No Adder	\$0.0520	\$2,612,549	\$2,592,219	-\$20,330	0.99
Utility Cost Test (UCT)	\$0.0298	\$1,494,772	\$2,592,219	\$1,097,447	1.73
Rate Impact Test (RIM)		\$7,416,634	\$2,592,219	-\$4,824,415	0.35
Participant Cost Test (PCT)		\$2,336,797	\$8,039,471	\$5,702,674	3.44
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000020234
Discounted Participant Payback (years)					2.72

Table 1-5 below shows the Wyoming wattsmart Homes Program cost effectiveness results for 2017 and Table 1-6 shows cost-effectiveness results for 2018, based on the Wyoming evaluated net savings. The 2017 program passes the cost-effectiveness for all tests except the RIM test. The 2018 program passes the cost-effectiveness for the TRC, Utility Cost Test (UCT) and Participant Cost Test (PCT).

*Table 1-5: 2017 Wyoming wattsmart Homes Program Level Cost-Effectiveness Results*

<b>Cost-Effectiveness Test</b>	<b>Levelized \$/kWh</b>	<b>Costs</b>	<b>Benefits</b>	<b>Net Benefits</b>	<b>Benefit/Cost Ratio</b>
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0599	\$1,238,037	\$1,468,892	\$230,855	1.19
Total Resource Cost Test (TRC) No Adder	\$0.0599	\$1,238,037	\$1,335,356	\$97,319	1.08
Utility Cost Test (UCT)	\$0.0303	\$626,191	\$1,335,356	\$709,166	2.13
Rate Impact Test (RIM)		\$3,103,548	\$1,335,356	-\$1,768,192	0.43
Participant Cost Test (PCT)		\$1,175,003	\$3,442,481	\$2,267,478	2.93
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000015264
Discounted Participant Payback (years)					3.68

Table 1-6: 2018 Wyoming wattsmart Homes Program Level Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0465	\$1,374,512	\$1,382,549	\$8,037	1.01
Total Resource Cost Test (TRC) No Adder	\$0.0465	\$1,374,512	\$1,256,863	-\$117,650	0.91
Utility Cost Test (UCT)	\$0.0294	\$868,582	\$1,256,863	\$388,281	1.45
Rate Impact Test (RIM)		\$4,313,086	\$1,256,863	-\$3,056,224	0.29
Participant Cost Test (PCT)		\$1,161,794	\$4,596,991	\$3,435,197	3.96
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000024929				
Discounted Participant Payback (years)	2.09				

## 1.2 Conclusions and Recommendations

ADM provides the following conclusions and recommendations to improve the program and the evaluation of the program in future years.

- **Lighting Measure Category:**

Conclusion: ADM's calculation of a 5.4% leakage rate for lighting in Wyoming is on the low end of leakage rates for lighting and is likely due to the effective or strategic placement of participating retailer locations. The implementation contractor has indicated that the Retail Sales Allocation Tool (RSAT) may be a predictor of bulb leakage in Rocky Mountain Power territories and is used to determine allocations of bulbs to participating stores.

Recommendation: To understand further how the RSAT tool accounts for leakage and how the store allocations relate to the Program Tracking Data, ADM recommends that the next evaluation of subsequent program years includes a full life-cycle review of the lighting contracts, including the participation agreements with the implementation contractor and a sample of all associated invoices. This would allow the evaluation to follow the life-cycle of the bulbs from the original agreement to final installation.

- **Energy Kits Measure Category:**

Conclusion: The installation rate (ISR) for the first showerhead was 68% and the second showerhead was 52%. Respondents to the Energy Kits survey who did not install showerheads indicated that they already had high-efficiency showerheads installed (25%) or the showerhead provided did not integrate well with current plumbing (20%).

Recommendation: ADM recommends that Rocky Mountain Power consider including only one showerhead in the Best Kit – 2 Bath Energy Kits. Additionally, if not already done, Rocky Mountain Power could ask qualifying questions regarding showerheads during the energy kit request process.

- **Electronics Measure Category:**

Conclusion: The Advanced Power Strip (APS) measure was a new offering in 2018. The claimed savings value of 216 kWh/yr is based off a study that employed two methodologies, including simulation and post installation monitoring.

Recommendation: ADM recommends that if the APS measure is to be continued in subsequent program years and is expected to follow the participation trend from 2018, the next evaluation cycle includes primary data collection for this measure (e.g. installation rates and removal rates) that can be used to verify and supplement the previous completed studies.

## 2 Introduction and Purpose of Study

---

ADM Associates, Inc. (ADM) is under contract with PacifiCorp to perform evaluation, measurement and verification (EM&V) services to determine the ex-post verified energy (kWh) savings that are achieved through PacifiCorp's 2017-2018 Home Energy Savings Program in the states of California and Washington; and wattsmart Homes Program in Idaho, Utah and Wyoming.

This document is the Final Evaluation Report for the 2017-2018 wattsmart Homes Program in Wyoming. Henceforth in this document, ADM may refer to the Wyoming wattsmart Homes Program as "the Program." Program year 2017 (PY 2017) and program year 2018 (PY 2018) coincide with the respective calendar years. The purpose of this report is to present the results of the impact evaluation effort undertaken by ADM to verify the energy savings that resulted from the Program, as further described in subsequent sections. Additionally, this report presents the results of the process evaluation of the Program completed by ADM focusing on participant and program staff perspectives regarding the Program's implementation.

### 2.1 Description of the Programs

---

The Program in the state of Wyoming provides incentives for Rocky Mountain Power residential customers who purchase various eligible products or measures. Measures include energy-efficient appliances, lighting such as ENERGY STAR® light emitting diodes (LEDs), building shell measures, electronics, energy kits, heating, ventilation, and air conditioning (HVAC) equipment, and heat pump water heaters.

The Program is promoted by marketing teams at Rocky Mountain Power and CLEAResult (the program implementer) and cross-promoted with participating retailers and trade allies. There is also significant effort to provide information and educational opportunities to customers and participating market partners. The Program leverages relationships with manufacturers, distributors, and retailers to ensure effective program implementation and optimize participation.

Program incentives are provided to Rocky Mountain Power customers either at the point-of-sale as an instant incentive, or as a mail-in incentive application that upon approval is paid post-purchase. Point-of-sale incentives are also known as upstream or midstream incentives. A typical upstream incentive or 'upstream distribution method' is the instant incentive that the program provides for ENERGY STAR LEDs (this is also called an upstream measure). The LED incentive is provided to the LED manufacturer. Consumers benefit from upstream incentives by buying LEDs at discounted prices made possible by the incentive that was funded upstream. A point-of-sale incentive usually does not require

the consumer to use a coupon or provide an incentive form. This is an efficient and cost-effective means to provide consumers instant incentives for relatively high-volume, low-cost measures such as LEDs.

The ‘downstream distribution method’ pays the specified incentive amount per energy-efficiency measure directly to the Rocky Mountain Power customer after the customer completes an application form for an eligible measure. The application form is usually completed online or mailed in. Typical downstream measures include energy-efficient appliances and relatively high-cost HVAC equipment and services.

## **2.2 Distribution Methods and Measure Categories**

An overview of measure categories and measure types in the 2017-2018 Programs is shown in Table 2-1. For each measure type, the distribution method is indicated: upstream, midstream, or downstream.

*Table 2-1: 2017-2018 Wyoming Measure Categories and Distribution Methods*

Measure Category and Measure Type	Distribution Method	
	Upstream	Downstream
<b>Appliances</b>		
Clothes Washers		Yes
Freezers		Yes
Refrigerators		Yes
<b>Building Shell</b>		
Insulation		Yes
Windows		Yes
<b>Electronics</b>		
Advanced Power Strips		Yes
<b>Energy Kits</b>		
Lighting		Yes
Lighting and Plumbing		Yes
<b>HVAC</b>		
Cooling		Yes
Ducting		Yes
Heat Pump		Yes
Ventilation		Yes
<b>Lighting</b>		
General Service Fixtures	Yes	
General Service Lamps	Yes	
Specialty Lamps	Yes	
<b>Water Heating</b>		
Heat Pump Water Heater		Yes

## 2.3 Program Participation

During the 2017-2018 program years, Rocky Mountain Power provided incentives to residential customers that resulted in the quantity of measures shown in Table 2-2 and Table 2-3. Rocky Mountain Power also provided upstream discounts for 627 lighting fixtures and 155,349 lighting bulbs in 2017 and 37 lighting fixtures and 145,081 lighting bulbs in 2018. Table 2-2 and Table 2-3 also show the associated claimed savings for each measure during 2017 and 2018.

*Table 2-2: 2017 Claimed Program Quantity and Savings by Measure in Wyoming*

Measure Category	Measure Type	Claimed Quantity	Quantity Type	Claimed kWh Savings
Appliances	Clothes Washers	36	Measures	4,382
	Freezers	33	Measures	2,196
	Refrigerators	4	Measures	572
Building Shell	Insulation	25,847	Square Feet	35,371
	Windows	239	Square Feet	921
Energy Kits	Lighting	699	Kits	59,151
	Lighting and Plumbing	685	Kits	464,982
HVAC	Cooling	13	Measures	5,767
	Ducting	80	Measures	83,200
	Heat Pump	15	Measures	74,760
	Ventilation	13	Measures	5,766
Lighting	General Service Fixtures	627	Fixtures	18,791
	General Service Lamps	129,100	Bulbs	2,464,391
	Specialty Lamps	26,249	Bulbs	779,596
Water Heating	Heat Pump Water Heater	5	Measures	8,970
<b>2017 TOTAL</b>				<b>4,008,818</b>

Table 2-3: 2018 Claimed Program Quantity and Savings by Measure in Wyoming

Measure Category	Measure Type	Claimed Quantity	Quantity Type	Claimed kWh Savings
Appliances	Clothes Washers	24	Measures	3,141
	Freezers	12	Measures	798
	Refrigerators	6	Measures	858
Building Shell	Insulation	102,915	Square Feet	121,273
	Windows	40	Square Feet	83
Electronics	Advanced Power Strips	2,682	Measures	579,312
Energy Kits	Lighting	2,104	Kits	177,998
	Lighting and Plumbing	1,777	Kits	1,221,336
HVAC	Cooling	3	Measures	1,425
	Ducting	39	Measures	127,413
	Heat Pump	11	Measures	53,068
	Ventilation	11	Measures	4,762
Lighting	General Service Fixtures	37	Fixtures	1,109
	General Service Lamps	110,563	Bulbs	1,969,037
	Specialty Lamps	34,518	Bulbs	1,003,847
Water Heating	Heat Pump Water Heater	3	Measures	5,382
<b>2018 TOTAL</b>				<b>5,270,843</b>

## 2.4 Impact Evaluation Objectives

The primary objective of the impact evaluation is to determine ex-post verified gross energy (kWh) savings and net kWh savings. ADM executed the following steps to determine ex-post verified gross and net kWh savings.

- Reviewed and reconciled program tracking data to the claimed participation counts and ex-ante savings in the 2017 and 2018 annual reports.
- Administered participant surveys to determine actual installation rates at the measure level. Surveys were administered online and by phone in Wyoming.
- Determined gross unit energy savings (“UES”), which incorporate verified measure installation rates and employ engineering analyses for lighting and energy kits; or employ deemed savings reviews for appliances, electronics, HVAC, building shell, and new homes measures.
- Determined net savings by applying survey results for the upstream lighting, energy kits and HVAC measure categories.
  - Net-to-gross and realization values used to determine net savings by measure category and program level.
- Achieved a minimum precision of better than  $\pm 10\%$  with 90% statistical confidence (“90/10 precision”) for gross realized savings estimates by program.
- Provided comprehensive documentation and transparency for all evaluation tasks.
- Estimated leakage impacts utilizing geospatial analysis (i.e., ArcGIS or similar).

- Provided inputs for cost benefit analyses.
- Provided ongoing technical reviews and guidance throughout the evaluation cycle.
- There was no on-site verification or equipment monitoring.

## **2.5 Process Evaluation Objectives**

---

The overarching approach to process evaluation is the following.

- To gain an in-depth understanding of program operations and the challenges and evaluation needs through Rocky Mountain Power and implementation contractor key staff interviews, complemented with program documentation review and program participant surveys.

Specifically, the process evaluation was designed to answer the following research questions.

- How well did Rocky Mountain Power staff, implementation staff, participants, and trade allies work together?
- How do participants learn about the program? What percentage is contacted directly by Rocky Mountain Power or implementation staff? What percentage hears about the program through another avenue and then contacts Rocky Mountain Power?
- Were program participants satisfied with their experiences? What was the level of satisfaction with the work performed, the scheduling/application process, and other aspects of program participation? What are the perceived energy and non-energy impacts associated with the program?
- What are key barriers and drivers to program success within Rocky Mountain Power's service territories? How can those be addressed to improve program operations in the future

### 3 Impact Evaluation

This chapter presents the findings of the impact evaluation for the Wyoming wattsmart Homes Program. Table 3-1 and Figure 3-1 present the impact evaluation results, including the claimed savings, evaluated gross savings, realization rates, evaluated net savings and net-to-gross (NTG) values for each measure category across both program years, 2017 and 2018. Table 3-2 presents the same information for each individual year, 2017 and 2018.

*Table 3-1: Wyoming wattsmart Homes Program Claimed and Evaluated Savings for 2017-2018*

Year	Measure Category	Measure Type	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	NTG
2017-2018	Appliances	Clothes Washers	7,523	7,523	100%	6,026	80%
		Freezers	2,994	2,994	100%	2,383	80%
		Refrigerators	1,430	1,430	100%	1,155	81%
	Building Shell	Insulation	156,645	156,645	100%	127,426	81%
		Windows	1,005	1,005	100%	793	79%
	Electronics	Advanced Power Strips	579,312	579,312	100%	475,805	82%
	Energy Kits	LED Only	237,150	240,892	102%	226,965	94%
		Best Kit - 1 Bathroom	233,371	189,252	81%	178,310	94%
		Best Kit - 2 Bathroom	1,452,947	1,115,618	77%	1,051,119	94%
	HVAC	Cooling	7,192	7,192	100%	5,706	79%
		Ducting	210,613	210,613	100%	170,089	81%
		Heat Pump	127,828	127,828	100%	102,389	80%
		Ventilation	10,528	10,528	100%	8,446	80%
	Lighting	General Service Fixtures	19,900	12,875	65%	12,349	96%
		General Service Lamps	4,433,429	3,077,802	69%	2,327,606	76%
		Specialty Lamps	1,783,443	1,242,188	70%	939,412	76%
Water Heating	Heat Pump Water Heater	14,352	14,352	100%	11,476	80%	
<b>2017-2018 Total</b>			<b>9,279,661</b>	<b>6,998,048</b>	<b>75%</b>	<b>5,647,454</b>	<b>81%</b>

Figure 3-1: WY wattsmart Homes Program Energy Savings, 2017-2018

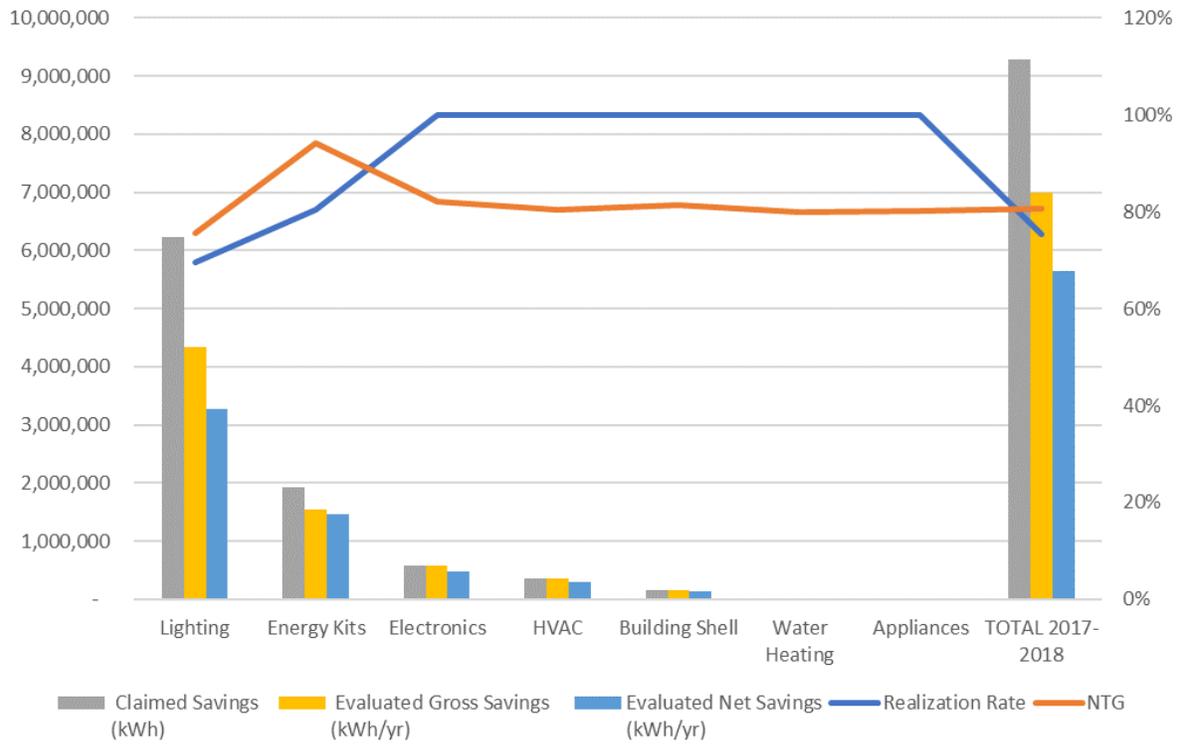


Table 3-2: Wyoming wattsmart Homes Program Claimed and Evaluated Savings for 2017 and 2018

Year	Measure Category	Measure Type	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	NTG
2017	Appliances	Clothes Washers	4,382	4,382	100%	3,447	79%
		Freezers	2,196	2,196	100%	1,727	79%
		Refrigerators	572	572	100%	450	79%
	Building Shell	Insulation	35,371	35,371	100%	27,821	79%
		Windows	921	921	100%	725	79%
	Electronics	Advanced Power Strips	-	-	0%	-	0%
	Energy Kits	LED Only	59,151	60,073	102%	56,599	94%
		Best Kit - 1 Bathroom	70,574	57,232	81%	53,923	94%
		Best Kit - 2 Bathroom	394,408	302,835	77%	285,327	94%
	HVAC	Cooling	5,767	5,767	100%	4,536	79%
		Ducting	83,200	83,200	100%	65,441	79%
		Heat Pump	74,760	74,760	100%	58,802	79%
		Ventilation	5,766	5,766	100%	4,535	79%
	Lighting	General Service Fixtures	18,791	12,158	65%	11,661	96%
		General Service Lamps	2,464,391	1,692,854	69%	1,280,231	76%
		Specialty Lamps	779,596	534,987	69%	404,587	76%
Water Heating	Heat Pump Water Heater	8,970	8,970	100%	7,055	79%	
<b>2017 Total</b>			<b>4,008,818</b>	<b>2,882,044</b>	<b>72%</b>	<b>2,266,868</b>	<b>79%</b>
2018	Appliances	Clothes Washers	3,141	3,141	100%	2,579	82%
		Freezers	798	798	100%	656	82%
		Refrigerators	858	858	100%	705	82%
	Building Shell	Insulation	121,273	121,273	100%	99,605	82%
		Windows	83	83	100%	68	82%
	Electronics	Advanced Power Strips	579,312	579,312	100%	475,805	82%
	Energy Kits	LED Only	177,998	180,819	102%	170,365	94%
		Best Kit - 1 Bathroom	162,797	132,020	81%	124,387	94%
		Best Kit - 2 Bathroom	1,058,540	812,782	77%	765,791	94%
	HVAC	Cooling	1,425	1,425	100%	1,170	82%
		Ducting	127,413	127,413	100%	104,648	82%
		Heat Pump	53,068	53,068	100%	43,586	82%
		Ventilation	4,762	4,762	100%	3,911	82%
	Lighting	General Service Fixtures	1,109	717	65%	688	96%
		General Service Lamps	1,969,037	1,384,948	70%	1,047,375	76%
		Specialty Lamps	1,003,847	707,201	70%	534,825	76%
Water Heating	Heat Pump Water Heater	5,382	5,382	100%	4,420	82%	
<b>2018 Total</b>			<b>5,270,843</b>	<b>4,116,003</b>	<b>78%</b>	<b>3,380,586</b>	<b>82%</b>

### **3.1 Impact Evaluation Approach**

---

#### **3.1.1 Data Collection and Measure Verification**

During the period of this evaluation, ADM reviewed and reconciled program tracking data to the participation counts and ex-ante savings indicated in the 2017 and 2018 annual reports. ADM reviewed a census of program tracking data. In concert with tracking data reviews, ADM also reviewed the savings values and measure savings assumptions and calculations contained in the Technical Resource Library (TRL) files provided by Rocky Mountain Power. ADM issued data requests as needed to ensure that all data was collected that could be reasonably expected or required for this evaluation.

ADM conducted surveys to verify measure installation and collected additional primary data from program participants, including data related to purchasing decisions which was utilized in the freeridership and spillover analyses. ADM surveyed a representative sample of known participants and employed a general population survey for unknown participants (those who purchased upstream measures).

The following provides additional detail regarding data collection and measure verification activities.

- **Review of the program tracking database** is an essential first step for verifying data integrity. ADM assessed the program data management system DSMC – which facilitates data collection and organization. ADM reviewed a census of program tracking data contained in DSMC. Each program year’s dataset was reviewed for completeness, consistency, and compliance with the provided TRL files.
- **Review of measure savings assumptions and calculations** occurred concurrent with the DSMC data reviews mentioned above. Savings values are maintained in the Technical Reference Library (TRL). The TRL files sometimes include measure savings assumptions, calculations, source papers or files (e.g. Regional Technical Forum versions), and additional documentation that together comprise the generally accepted rules and guidance for evaluating the Programs. ADM reviewed all TRL documentation and included in this report any errors, omissions, or inconsistencies identified during ADM’s review.
- **Data requests** related to EM&V activities occurred throughout the period of this evaluation. ADM provided Rocky Mountain Power various data requests for DSMC and TRL data pulls and reports, and other program data and verification, as necessary.

- **Online and phone surveys were developed/administered** to verify measure installation and collect additional primary data from program participants. ADM surveyed a representative sample of known participants, i.e., customers who implemented downstream measures, for which incentives are provided to specific Rocky Mountain Power customers. ADM also employed a general population survey for Rocky Mountain Power customers to survey the unknown upstream customers. A general population survey is an effective tool to identify the upstream participants. Surveys were administered online and by phone in Wyoming.

### **3.1.2 Sample Design**

A representative participant sample was developed for each of the following major measure categories in Wyoming: energy kits, HVAC, and lighting. These measures account for approximately 92% of total claimed savings in Wyoming during the program years 2017 and 2018. ADM achieved a sampling precision of  $\pm 10\%$  or better with 90% statistical confidence – or “90/10 precision” – for gross realized savings estimates at the measure category level for the energy kits and lighting measure categories, which account for approximately 88% of total claimed savings in Wyoming during the program years 2017 and 2018.

For measure categories for which program participants are known – i.e., downstream measures, including energy kit and HVAC measures – the sampling frame is the population of participants for a given measure category/state.

For upstream measure categories, including lighting measures, participants are not known. Therefore, for lighting measures in Wyoming, ADM employed a General Population Survey where the sampling frame is the population of Rocky Mountain Power residential customers in Wyoming excluding known participants in 2017-2018 Programs and known participants in other energy efficiency programs that Rocky Mountain Power implemented in 2017 or 2018.

Actual sample sizes were dependent on participant counts and specific measures installed. For the verification and evaluation activities listed below, ADM utilized the following sample sizes.

- Census review for all measures listed in the DSMC program tracking database to ensure appropriate use of deemed savings values (described in detail above).
- Review of a stratified sample of 41 lighting invoices associated with upstream lighting measures. The sampling precision was 6.91% at the 90% confidence interval.

- A sample of known program participants were surveyed for measure installation rates, net-to-gross (NTG) analyses, and process evaluation questions regarding the specific measures they implemented according to DSMC datasets. A sample of all other residential customers were surveyed using a general population survey. Survey sample sizes per measure category are provided in the following Table 3-3.

*Table 3-3: 2017-2018 WY Impact Evaluation Survey Sample Size*

Survey	Number of Survey Invites Sent	Number of Completed Surveys	Response Rate	Impact Evaluation Survey Sample (n)
General Population Survey	2,400	336	14%	293
Energy Kits Survey	1,193	83	7%	83
HVAC Survey	168	34	20%	33

### 3.1.3 Impact Evaluation Approach by Measure Category

Table 3-4 shows the methodology approach for each gross and net savings evaluation step for each measure. For the measure types with no adjustment made to the gross evaluated savings, ADM performed a review of the deemed savings values, savings assumptions and calculations, modeling files, and other information contained in the applicable TRL files, Regional Technical Forum (RTF) files and other sources of savings values. For the measures in which ADM did not have a NTG value resulting from participant surveys or did not have net savings results from a billing analysis, ADM applied the program level NTG values for each year. The program level NTG values are representative of approximately 88% of overall claimed program savings and thus are used as an approximation for a value for the measures that did not have a unique NTG value. This approach results in a more conservative net evaluated savings value than using an assumed NTG value of 1.

*Table 3-4: 2017-2018 WY Impact Evaluation Methodology Approach by Measure*

Measure Category	Measure Type	Impact Evaluation Methodologies	Inputs to Gross Evaluated Savings	Inputs to Evaluated NTG
Appliances	Clothes Washer, Freezers and Refrigerators	Deemed Savings Review	No adjustment	Program-level NTG
Building Shell	Insulation and Windows	Deemed Savings Review	No adjustment	Program-level NTG
Electronics	Advanced Power Strips	Deemed Savings Review / Literature Review	No adjustment	Program-level NTG
Energy Kits	Lighting, and Lighting and Plumbing	Engineering Analysis / Energy Kits Survey	Energy Kits Survey	Energy Kits Survey
HVAC	Cooling, Ducting, Heat Pump and Ventilation	Deemed Savings Review	No adjustment	Program-level NTG
Lighting	General Service Lamps and Fixtures and Specialty Lamps	Engineering Analysis / General Population Survey	General Population Survey	General Population Survey
Water Heating	Water Heater	Deemed Savings Review	No adjustment	Program-level NTG

## 3.2 Evaluated Savings

ADM determined gross unit energy savings (“UES”) and evaluated net energy savings by incorporating verified measure installation rates, including installation rates by room, freeridership scores, and spillover from participant surveys together with engineering analyses for lighting and energy kits; and deemed savings reviews and literature reviews for appliances, electronics, HVAC, building shell and water heating measures. The deemed savings reviews for HVAC measures were supplemented with participant surveys to benchmark installation rates and net savings values.

ADM’s estimation of verified UES per measure takes into consideration Wyoming’s deemed savings values and the measure savings assumptions and calculations contained in the provided TRL files. Wyoming deemed savings values often refer to the Regional Technical Forum (RTF), which maintains a library of UES measures.

### 3.2.1 Lighting

For lighting measure categories, Rocky Mountain Power claimed the following gross energy savings detailed in Table 3-5 for Wyoming in 2017 and 2018.

*Table 3-5: 2017-2018 Wyoming Claimed Gross Energy Savings for Lighting Measures*

Measure Category	Measure Type	2017 Quantity	2017 Savings (kWh)	2018 Quantity	2018 Savings (kWh)
Lighting	General Service Fixtures	627	18,791	37	1,109
	General Service Lamps	129,100	2,464,391	110,563	1,969,037
	Specialty Lamps	26,249	779,596	34,518	1,003,847
<b>TOTAL</b>		<b>155,976</b>	<b>3,262,779</b>	<b>145,118</b>	<b>2,973,993</b>

#### 3.2.1.1 Database Review

For all lighting measures in Wyoming in 2017 and 2018, ADM reviewed and reconciled the program tracking data to the claimed participation counts and ex-ante savings in the 2017 and 2018 annual reports. Further, ADM conducted the review activities detailed below for lighting measures.

##### 3.2.1.1.1 General Service Lamps and Specialty Lamps (ENERGY STAR® LEDs)

ADM conducted an ex-ante review of the Program’s 2017 and 2018 lighting measure data for general service lamps and specialty lamps. In this review, the following activities were performed:

- Verification of measure incentive requirements (e.g. ENERGY STAR® qualified status)

- Review of a sample of retailer and distributor invoices
- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source documents and calculations

ADM reviewed each of the 43 individual lighting lamp measures for 2017 and 49 individual lighting lamp measures for 2018, including both general service lamps and specialty lamps. ADM verified for all lighting measures that the claimed savings per measure and the savings assumptions and calculations were supported by the applicable TRL documents. Using the deemed values in conjunction with the total number of measures incentivized as provided in the program tracking database results in the claimed program energy savings. The TRL values for Lighting measures in Wyoming were updated and applied for part of the program year 2018 and thus ADM's review utilized two different TRL source documents for 2018 lighting measures.

#### 3.2.1.1.2 General Service Fixtures

ADM conducted an ex-ante review of the Program's 2017 and 2018 lighting data for general service fixtures. In this review, the following activities were performed:

- Verification of measure incentive requirements (e.g. ENERGY STAR® qualified status)
- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL documents and calculations

ADM reviewed the one individual lighting fixture measure for 2017 and the one individual lighting fixture measure for 2018. ADM verified for the general service fixtures that the claimed savings per measure and the savings assumptions and calculations were supported by the applicable TRL documents. Using the deemed values in conjunction with the total number of measures incentivized as provided in the program tracking database results in the claimed program energy savings.

### 3.2.1.2 *Inputs to Savings Calculation*

ADM acquired information from the General Population survey in order to calculate an ex-post installation rate (ISR) factor and hours-of-use (HOU) value to generate the evaluated gross lighting program energy savings for both lamps and fixtures. The resulting ISR factor of 82.0% for lamps and 97.7% for fixtures and the daily HOU value of 1.93 for lamps and 1.55 for fixtures are shown in Table 3-6 below. The HOU values are based on results derived from the General Population survey regarding installation percentage by room type and HOU values by room type contained in a KEMA Study on Residential Lighting End-Use Consumption.<sup>1</sup> Because ADM collected installation percentages by room type through the General Population survey, a study that includes HOU values by room type is appropriate to use in this case. Additionally, this is the most recent lighting study of its magnitude. The overall HOU values in the study are within the range of other HOU values and studies reviewed by ADM.

*Table 3-6: Ex-post ISR factor and HOU value for Wyoming*

<b>Measure Type</b>	<b>Evaluated ISR</b>	<b>Evaluated Daily HOU</b>
Lamps	82.0%	1.93
Fixtures	97.7%	1.55

ADM also determined the fraction of lighting measures that are installed in commercial premises or other non-residential premises (e.g., small medical or dental offices or schools, houses of worship, etc.). Although the Programs are designed to encourage residential customers to purchase discounted LEDs in participating retail outlets, a fraction of residential customers may purchase an additional quantity for a small office or school or various non-residential premises. The fraction of upstream lighting measures installed in non-residential premises is also called “cross-sector sales.” ADM determined the fraction of cross-sector sales in Wyoming in the 2017-2018 Programs as 0.09% for lamps and 0.0% for fixtures through the General Population Survey.

### 3.2.1.3 *Leakage Analysis*

Leakage refers to cross-territory sales that occur when program discounted bulbs are installed outside of Rocky Mountain Power’s service territory. When this occurs, the energy and demand impacts from the discounted bulbs are not being realized within the territory that paid for and claimed the savings. Leakage was estimated for each of the retailers in the program. Table 3-7 shows the number of stores in Wyoming by retail channel that were included in the leakage analysis. Discount stores would include stores

---

<sup>1</sup> Residential Lighting End-Use Consumption Study: Estimation Framework and Initial Estimates; DNV KEMA Energy and Sustainability, Pacific Northwest National Laboratory; December 2012.

like Dollar Tree and Bi-Mart, while Do-it-Yourself stores include stores like Ace Hardware or Home Depot. Lastly, Mass Merchant would include stores like Walmart and Costco.

*Table 3-7: Participating Wyoming Stores by Channel*

<b>Retail Channel</b>	<b>Number of Stores</b>
Discount	6
DIY	15
Mass Merchant	10
<b>TOTAL</b>	<b>31</b>

Estimates of leakage were assessed using an approach that combined online survey responses with Geo-mapping. The leakage analysis centered on the following approach:

- First, ADM developed a mapping of concentric circles (drive times) surrounding each participating retailer. The initial modeling assumed the “reach” of a retailer is a 60-minute drive. If drive times overlap between one or more retailer locations, the drive times are split between the stores with the assumption that customers will drive to the nearest store.
- Second, ADM used 2010 Census block data from Environmental System Research Institute (ESRI) to determine the proportion of the population that falls within each drive time circle (from Step 1), as well as the proportion of the population that falls within the Rocky Mountain Power territory and within the state of the participating retailer. Thus, for each drive time circle for each retail location, the Evaluators determined the proportion of the population within the Rocky Mountain Power territory and within state, outside of Rocky Mountain Power territory and within state, and outside of the state of the participating retailer. ADM utilized a shapefile (a format commonly used in GIS that geographically displays the underlying tabular data) showing the service areas of Rocky Mountain Power in the analyzed states from Platts/McGraw-Hill.<sup>2</sup>
- Third, ADM used the General Population Survey to assess the shopping habits of customers within the radius of participating retailers. This was used to assess the total and maximum drive time that consumers accepted when shopping for products incentivized by the retail channel. This was used in modifying the initial 60-minute drive assumption established in Step 1. An online survey was performed for Rocky Mountain Power in 2019 and the results of this survey are shown in Table 3-8. This approach uses a log transformation of the drive times to smooth the data and estimates the cumulative percent via a second order polynomial regression. The log transformation takes the log of the drive time and uses that as

---

<sup>2</sup> Source: [http://www.platts.com/IM.Platts.Content/ProductsServices/Products/gismetadata/iou\\_terr.pdf](http://www.platts.com/IM.Platts.Content/ProductsServices/Products/gismetadata/iou_terr.pdf).

the independent variable in the regression. A log transformation is common when the relationship between the variables is logarithmic and linear regression is being used, since linear regression assumes the data are linearly related.

- Lastly, ADM calculated the percentage of bulbs that leaked out of Rocky Mountain Power territory.

Table 3-8: Online Survey Drive Time Estimates in Wyoming

Channel/ Drive time (minutes)	0-4	5-9	10-14	15-19	20-24	25-29	30-39	40-49	50-59	60+	N
Discount	8%	23%	23%	21%	8%	1%	6%	1%	0%	8%	163
DIY	6%	11%	8%	12%	8%	1%	8%	11%	2%	33%	169
Mass Merchant	4%	16%	18%	18%	7%	2%	12%	6%	1%	16%	159
<b>TOTAL</b>	<b>6%</b>	<b>17%</b>	<b>16%</b>	<b>17%</b>	<b>8%</b>	<b>1%</b>	<b>9%</b>	<b>6%</b>	<b>1%</b>	<b>19%</b>	<b>169</b>

Table 3-9 shows the leakage estimate of 5.4% for Wyoming overall across all retailer channels and Table 3-10 provides leakage estimates by retail channel.

Table 3-9: Leakage Estimate in Wyoming

Quantity Sold	Leakage Quantity	Leakage Rate
145,114	7,899	5.4%

Table 3-10: Leakage Estimate by Retailer Type in Wyoming

Retailer Type	Quantity Sold	Leakage Quantity	Leakage Rate
Discount	2,939	131	4.5%
DIY	64,826	975	1.5%
Mass Merchant	77,349	6,793	8.8%
<b>TOTAL</b>	<b>145,114</b>	<b>7,899</b>	<b>5.4%</b>

Table 3-11 provides a benchmark comparison of the estimated Wyoming leakage rates with other leakage estimates for utilities ADM has evaluated in the past couple of years. The leakage estimates for these other states vary from a low of 10% overall leakage for OG&E Arkansas to a high of 50% for SWEPCO Arkansas. Rocky Mountain Power’s leakage rate of 5.4% in Wyoming is on the low end even though the Rocky Mountain Power territory in Wyoming is fragmented. This is likely due to the effective or strategic placement of participating retailer locations.

Table 3-11: Leakage Benchmarking

Utility	State	Year	Leakage (Overall)	Leakage (Discount)	Leakage (DIY)	Leakage (Mass Merchant)
SWEPCO	AR	2018	50%	41%	65%	48%
Cleco	LA	2018	33%	33%	-	-
OG&E	AR	2018	10%	28%	0%	10%
RMP	UT	2018	8%	11%	5%	10%
PP	WA	2018	6%	14%	4%	7%
RMP	WY	2018	5%	5%	2%	9%

### 3.2.1.4 Gross Energy Savings

#### 3.2.1.4.1 Engineering Calculation for Lighting Measure

For lamps and fixtures, the following formula is used to calculate annual energy (kWh) savings per measure:

#### *Formula 3.1 Energy Savings for LEDs*

$$LED \text{ kWh savings} = \left( \frac{\Delta Watts}{1000} \right) * ISR * Hours * IEF_E$$

Where:

$\Delta Watts$  = Watts, baseline bulb - Watts, LED

$ISR$  = “In Service Rate” or installation rate for LEDs purchased in 2017-2018 were determined from the TRL files for claimed savings and from ADM’s analysis of Rocky Mountain Power customers’ responses to lighting-related questions in the general population survey for evaluated savings; specifically, the general population survey contains various questions related to LED installation, including installation by room type

$Hours$  = Hours of use were determined from the TRL files for claimed savings and from ADM’s analysis of Rocky Mountain Power’s customers’ responses to lighting -related questions in the general population survey for evaluated savings; the hours input is hours of use per year or the product of 365.25 days per year and the average daily hours of use for lighting

$IEF_E$  = Interactive Effects Factor to account for cooling energy savings and heating energy penalties (a deemed value from the TRL files)

#### Example Calculation for Lighting Measure:

The following is an example of a 10 watt LED downlight bulb in 2017. The TRL source document for this measure indicates a UES of 39.7 kWh/yr. The TRL file specifies an hours of use value of 2.18, an installation rate of 100%, and a heat exchange factor of 90.6%. Inserting these inputs into the equation above verifies the claimed UES value. ADM verified the UES values for each individual lighting measure in 2017 and 2018.

#### *Example 3.1 Energy Savings for LEDs*

$$39.7 \text{ kWh} = \left( \frac{65-55}{1000} \right) * (1 - 0.0) * (2.18 * 365.25) * (1 - 0.094)$$

Using the deemed UES values from the TRL source documents in conjunction with the total quantity of measures incentivized as provided in the program tracking database

results in the ex-ante program energy savings. For this example of a 10 watt LED downlight bulb in 2017, the program tracking data indicates that this measure was incentivized 2,703 times in 2017. This results in ex-ante energy savings of 107,173.95 kWh/Yr for 2017. Appendix Table 7-1 shows the input values and UES savings for 2017 lighting measures.

### 3.2.1.4.2 Evaluated Gross Energy Savings for Lighting Measures

Table 3-12 below shows the claimed and evaluated gross savings by lighting measure category in addition to the realization rates. Appendix Table 7-2, Table 7-3 and Table 7-4 provide the claimed and evaluated gross savings for each individual lighting measure in 2017 and 2018 in addition to the realization rates. The realization rates for general service and specialty LED lamps in 2017 and 2018 were driven by a lower evaluated ISR of 82.0% compared to the TRL ISR assumption of 98% to 100%. The realization rate for general service fixtures was driven by a lower evaluated ISR of 97.7% compared to the TRL ISR assumption of 100% and a lower evaluated daily HOU of 1.55 compared to the TRL ISR assumption of 2.18.

*Table 3-12: 2017-2018 Claimed and Evaluated Wyoming wattsmart Homes Program Gross Lighting Savings*

Measure Category	Year	Measure Type	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate
Lighting	2017	General Service Fixtures	18,791	12,158	64.7%
		General Service Lamps	2,464,391	1,692,854	68.7%
		Specialty Lamps	779,596	534,987	68.6%
	2018	General Service Fixtures	1,109	717	64.7%
		General Service Lamps	1,969,037	1,384,948	70.3%
		Specialty Lamps	1,003,847	707,201	70.4%
<b>2017-2018 TOTAL</b>			<b>6,236,772</b>	<b>4,332,865</b>	<b>69.5%</b>

### 3.2.1.5 Evaluated Net Energy Savings

#### 3.2.1.5.1 Free Ridership and Spillover Survey Results

ADM calculated freeridership and non-participant spillover (NPSO) from the General Population survey results to arrive at the net program energy savings and the overall net-to-gross ratio presented in this section. Table 3-13 shows the freeridership and NPSO results for lighting measures in 2017 and 2018. Table 3-14 shows the net savings evaluation results, including the evaluated gross savings, evaluated net savings and the NTG for each lighting measure category in 2017 and 2018. The same information for each individual lighting measure in 2017 and 2018 is included in Appendix Table 7-5, Table 7-6

and Table 7-7. The methodology for calculating NTG for lighting measures is discussed in Appendix C.

*Table 3-13: 2017-2018 Wyoming Lighting Freeridership and Spillover*

Measure Type	Free Ridership	Non-Participant Spillover	NTG
Lamps	25.1%	0.8%	75.6%
Fixtures	4.9%	0.8%	95.9%

*Table 3-14: 2017-2018 Wyoming wattsmart Homes Program Net Lighting Savings and NTG*

Measure Category	Year	Measure Type	Evaluated Gross Savings (kWh/yr)	Evaluated Net Savings (kWh/yr)	NTG
Lighting	2017	General Service Fixtures	12,158	11,661	95.9%
		General Service Lamps	1,692,854	1,280,231	75.6%
		Specialty Lamps	534,987	404,587	75.6%
	2018	General Service Fixtures	717	688	95.9%
		General Service Lamps	1,384,948	1,047,375	75.6%
		Specialty Lamps	707,201	534,825	75.6%
<b>2017-2018 TOTAL</b>			<b>4,332,865</b>	<b>3,279,367</b>	<b>75.7%</b>

### 3.2.2 Energy Kits

Rocky Mountain Power made wattsmart Energy Kits available to customers in Wyoming who requested them. Energy Kit configurations varied according to the characteristics of customer’s homes and include ENERGY STAR® and WaterSense® certified products. All Kits included four 9.5 W LED light bulbs. If the customer’s home utilized an electric water heater, kits also included energy saving faucet aerator and showerheads.

Table 3-15 details the kit configurations and Rocky Mountain Power claimed savings for each kit type offered in 2017 and 2018 and Table 3-16 shows the quantity of Energy Kits and the total Rocky Mountain Power claimed savings attributed to each kit type in 2017 and 2018.

Table 3-15: 2017-2018 Wyoming wattsmart Energy Kit Configurations and Claimed Gross Energy Savings per Energy Kit

Configuration	Measure	Quantity per Energy Kit	2017 and 2018 (kWh/yr)
LED Only	9.5 W LED A-Lamp	4	84.6
Best Kit - 1 Bathroom	9.5 W LED A-Lamp	4	433.0
	1.5GPM Aerator Kitchen	1	
	0.5GPM Aerator Bath	1	
	1.5GPM Showerhead	1	
Best Kit - 2 Bathroom	9.5 W LED A-Lamp	4	755.6
	1.5GPM Aerator Kitchen	1	
	0.5GPM Aerator Bath	2	
	1.5GPM Showerhead	2	

Table 3-16: 2017-2018 Wyoming wattsmart Energy Kit Quantities and Total Claimed Gross Savings

Kit Type	2017 Quantity	2017 Total Claimed Savings (kWh/yr)	2018 Quantity	2018 Total Claimed Savings (kWh/yr)
LED Only	699	59,151	2,104	177,998
Best Kit – 1 Bathroom	163	70,574	376	162,797
Best Kit – 2 Bathroom	522	394,408	1,401	1,058,540
<b>TOTAL</b>	<b>1,384</b>	<b>524,133</b>	<b>3,881</b>	<b>1,399,335</b>

### 3.2.2.1 Database Review

ADM conducted an ex-ante review of the Program’s 2017 and 2018 energy kits measure data. In this review, the following activities were performed:

- Verification of measure incentive requirements (e.g. model numbers)
- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking data include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source documents and calculations
- Calculate energy savings for individual components of each Energy Kit measure

ADM reviewed each energy kit component in each energy kit measure. ADM verified that the Rocky Mountain Power claimed savings were based on the applicable source TRL documents. Using the UES values in the TRL documents in conjunction with the total number of measures incentivized as provided in the program tracking database results in the total claimed program energy savings shown in Table 3-16.

### 3.2.2.2 Inputs to Savings Calculation

ADM acquired information from the Energy Kits survey in order to calculate ex-post ISR factors to generate the evaluated gross program energy savings for Energy Kits. The resulting installation rates for each kit component are shown in Table 3-17 below.

*Table 3-17: 2017-2018 Ex-Post Installation Rates for Wyoming Kit Components*

Energy Kit Component	Installation Rate
LED Lamps	93.4%
Showerheads	59.7%
Bathroom Aerator	68.8%
Kitchen Aerator	54.6%

### 3.2.2.3 Gross Energy Savings

#### 3.2.2.3.1 Engineering Calculation for Energy Kit Measures

Ex-ante and ex-post energy savings can be calculated for the individual components of each measure using engineering formulas, inputs from the TRL source documents and inputs gathered from primary surveying. Appendix B includes Table 7-8 and Table 7-9 that list the TRL, RTF, or other source documents or primary data used for each input in the formula for ex-post evaluated savings. LED annual energy (kWh) savings per lamp are calculated using the same formulas as provided above for lighting lamps and fixtures.

Faucet aerator annual energy (kWh) savings are calculated using the following formula:

#### *Formula 3.4 Energy Savings for Aerators*

$$\text{Savings (kWh)} = \text{ISR} \times (\text{F}_B - \text{F}_P) \times \text{T}_{\text{Person-Day}} \times \text{N}_{\text{Persons}} \times 365.25 \times \Delta T_L \times U_H \times U_E \times \text{WH}_E \div \text{Eff} \div (\text{F/home})$$

Where:

*ISR* = In-Service Rate determined from Energy Kits surveys

*F<sub>B</sub>* = Average Baseline Flow Rate of aerator, (gallons per minute)

*F<sub>P</sub>* = Average Post Measure Flow Rate, (gallons per minute)

*T<sub>Person-Day</sub>* = Average time of hot water usage per person per day (minutes)

*N<sub>Persons</sub>* = Average number of persons per household (state-specific values)

*ΔT* = Average temperature differential between hot and cold water (°F)

*U<sub>H</sub>* = Unit Conversion: 8.33BTU/(Gallons-°F)

*U<sub>E</sub>* = Unit Conversion: 1 kWh/3413 BTU

*WH<sub>E</sub>* = Fraction of Homes with Electric Water Heaters

*Eff* = Efficiency of Electric Water Heater

F/home = Average number of faucets in the home

Showerhead annual energy (kWh) savings are calculated using the following formula:

**Formula 3.5 Energy Savings for Showerheads**

$$\text{Savings (kWh)} = \text{ISR} \times [(F_B - F_P) \div F_B] \times G_{\text{Shower}} \times N_{\text{Persons}} \times 365 \times \Delta T \times U_H \times U_E \div \text{Eff} \div S$$

Where:

- ISR = In-Service Rate determined from Energy Kits surveys
- F<sub>B</sub> = Average Baseline Flow Rate, (gallons per minute)
- F<sub>P</sub> = Average Post Measure Flow Rate, (gallons per minute)
- G<sub>Shower</sub> = Average gallons of hot water used per person per shower per day
- N<sub>Persons</sub> = Average number of persons per household (state-specific values)
- ΔT = Average temperature differential between hot and cold water (°F)
- U<sub>H</sub> = Unit Conversion: 8.33BTU/(Gallons-°F)
- U<sub>E</sub> = Unit Conversion: 1 kWh/3413 BTU
- Eff = Efficiency of Electric Water Heater
- S = Average number of showers in the home

**Example Ex-Ante Calculation for Energy Kits Measures:**

The following example demonstrates the energy savings calculations for aerators and showerheads in the ‘Best Kit – 1 Bathroom’ wattsmart Energy Kit that includes four 9.5 W LED A-Lamps, one 1.5 GPM Kitchen Aerator, one 0.5 GPM Bathroom Aerator, and one 1.5 GPM Showerhead. ADM’s calculations are based on inputs obtained from the applicable TRL and RTF source documents.

***LED Energy Savings in Best Kit – 1 Bathroom wattsmart Energy Kit:***

$$84.6 \text{ kWh (per kit)} = 21.15 \text{ kWh (per bulb)} * 4$$

***Aerator Energy Savings in Best Kit – 1 Bathroom wattsmart Energy Kit:***

$$50.37 \text{ kWh (kitchen)} = 0.76 * (2.2 - 1.5) * 1.807 * 2.59 * 365.25 * (128 - 53) * 8.345 * \left(\frac{1}{3413.14}\right) * 0.32 \div 1 \div 1$$

and

$$42.96 \text{ kWh (bathroom)} = 0.76 * (2.2 - 0.5) * 1.294 * 2.59 * 365.25 * (128 - 53) * 8.345 * \left(\frac{1}{3413.14}\right) * 0.32 \div 1 \div 2.16$$

*Showerhead Energy Savings in Best Kit – 1 Bathroom wattsmart Energy Kit:*

$$263.12 \text{ kWh} = 0.76 * [(2.5-1.35)/2.5] * 8.51 * 2.35 * 365.25 * (128 - 53) * 8.345 * \left(\frac{1}{3413.14}\right) \div 1 \div 1.78$$

*Total Energy Savings in Best Kit – 1 Bathroom wattsmart Energy Kit:*

$$456.27 \text{ kWh} = 84.6 + 50.37 + 42.96 + 263.12$$

ADM's calculated ex-ante savings values for each individual energy kit component were not exactly matched to the deemed UES values found in the Energy Kits source TRL documents. For instance, ADM was not able to reverse engineer the values for kitchen and bathroom aerators contained in the TRL documents from the known input values in the TRL source documents. ADM calculated 2018 ex-ante values of 50.37 kWh/yr for kitchen aerators and 42.96 kWh/yr for bathroom aerators compared to the deemed 2018 UES values of 25.77 kWh/yr for kitchen aerators and 62.59 kWh/yr for bathroom aerators. The deemed UES values for these energy kit components are based on hardcoded values in the implementation contractor's savings calculation that ADM was not able to trace back to its source, and thus was not able to determine with certainty what is driving the difference in savings values. The difference may be partially attributed to the water temperature differential utilized in the engineering calculation. For the example of the 'Best Kit – 1 Bathroom' Energy Kit calculated above, the ADM calculated ex-ante savings of 456.27 kWh/Yr does not exactly match the Energy Kits TRL UES value and the Rocky Mountain Power claimed savings value of 432.96 kWh/Yr. Appendix B includes Table 7-8 and Table 7-9 that list the TRL, RTF, or other source documents or primary data used to calculate the evaluated savings for each individual component of the Energy Kits.

### 3.2.2.3.2 Evaluated Gross Energy Savings for Energy Kits Measures

Table 3-18 below shows claimed and evaluated gross savings as well as realization rates for each Energy Kit component. Table 3-19 shows claimed and evaluated gross savings for all Energy Kits in 2017 and 2018, as well as realization rates on the Energy Kit level. To calculate ex-post evaluated gross savings, ADM incorporated the ISR obtained through the Energy Kits Survey and utilized vetted inputs from the most recent TRL and RTF files for each kit component available prior to the evaluation cycle.

The drivers of realization rates for the lighting Energy Kit component are the ISR and the HOU inputs. In 2017 and 2018, both the evaluated ISR of 93% and the evaluated HOU of 1.93 for LED lamps are close to the claimed input values, leading to a realization rate of 101.6%. For the showerheads Energy Kit component, the evaluated ISR was 59.7%, compared to the 76.0% ISR input to the claimed savings value. For both the kitchen and bathroom aerator Energy Kit components, the respective evaluated ISRs of 55% and 69% impact the realization rates compared to the assumed ISR input of 76% to the claimed

savings values. However, because the input values to the claimed UES values for aerators are not transparent ADM was not able to determine with certainty what else specifically is driving the realization rates. The difference may be partially attributed to the water temperature differential utilized in the engineering calculation.

*Table 3-18: 2017-2018 Energy Kits Claimed and Evaluated Per-Component Gross Savings and Realization Rates in Wyoming*

Year	Energy Kit Component	Claimed Gross Savings Per Unit (kWh)	Evaluated Gross Savings Per Unit (kWh)	Realization Rate
2017 - 2018	LED Lamps	21.15	21.49	101.6%
	Showerheads	260.00	190.16	73.1%
	Bathroom Aerator	62.59	38.87	62.1%
	Kitchen Aerator	25.77	36.15	140.3%

*Table 3-19: 2017-2018 Energy Kits Claimed and Evaluated Gross Savings and Realization Rates in Wyoming*

Year	Configuration	Claimed Gross Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate
2017	LED Only	59,151	60,073	101.6%
	Best Kit - 1 Bathroom	70,574	57,232	81.1%
	Best Kit - 2 Bathroom	394,408	302,835	76.8%
2018	LED Only	177,998	180,819	101.6%
	Best Kit - 1 Bathroom	162,797	132,020	81.1%
	Best Kit - 2 Bathroom	1,058,540	812,782	76.8%
<b>2017-2018 TOTAL</b>		<b>1,923,468</b>	<b>1,545,762</b>	<b>80.4%</b>

**3.2.2.4 Evaluated Net Energy Savings**

ADM calculated freeridership and spillover from the Energy Kits Survey results to arrive at the net program energy savings and the overall net-to-gross ratio presented in this section. Table 3-20 shows the freeridership, spillover and NTG results for Energy Kits measures and Table 3-21 shows the net savings evaluation results, including the evaluated gross savings, evaluated net savings and NTG for each Energy Kit configuration. The methodology for calculating NTG for Energy Kits measures is discussed in Appendix C.

*Table 3-20: 2017-2018 Freeridership, Spillover and NTG for Energy Kits in WY*

Measure Category	Free Ridership	Spillover	Non-Participant Spillover	NTG
Energy Kits	10.9%	4.3%	0.8%	94.2%

Table 3-21: 2017-2018 WY Energy Kits Evaluated Net Energy Savings and NTG

Year	Configuration	Evaluated Gross Savings (kWh/yr)	Evaluated Net Savings (kWh/yr)	NTG
2017	LED Only	60,073	56,599	94.2%
	Best Kit - 1 Bathroom	57,232	53,923	94.2%
	Best Kit - 2 Bathroom	302,835	285,327	94.2%
2018	LED Only	180,819	170,365	94.2%
	Best Kit - 1 Bathroom	132,020	124,387	94.2%
	Best Kit - 2 Bathroom	812,782	765,791	94.2%
<b>2017-2018 TOTAL</b>		<b>1,545,762</b>	<b>1,456,394</b>	<b>94.2%</b>

### 3.2.3 Electronics

The electronics measure category included an advanced power strip (APS) measure in Program year 2018 only and consisted of 2,682 advanced power strips incentivized for a total of 579,312 kWh of savings in 2018. This represented approximately 6.2% of overall claimed program savings in 2018.

#### 3.2.3.1 Database Review

ADM conducted an ex-ante review of the Program's 2018 electronics measure data. In this review, the following activities were performed:

- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source document

ADM reviewed the one individual electronics measure in 2018. ADM verified that the UES values claimed by Rocky Mountain Power were supported by the applicable TRL documents. Further, ADM verified that the total claimed savings for the measure accurately reflected the quantity of the measure installed in 2018.

#### 3.2.3.2 Inputs to Savings Calculation

The APS measure was a new offering in 2018 and ADM did not collect primary data to verify an ISR for this measure. ADM applied a 100% ISR for the electronics measure category because there was not a measure-specific ISR for this measure in Wyoming. ADM recommends that if the APS measure is to be continued in subsequent program years and is expected to follow the participation trend from 2018, the next evaluation cycle

includes primary data collection for this measure (e.g. installation rates and removal rates) that can be used to verify and supplement the savings values.

### 3.2.3.3 *Evaluated Gross Energy Savings*

ADM conducted a deemed savings review and literature review of the electronics measure claimed savings value on Wyoming, including the TRL files provided, the RTF source savings documents and the studies informing the savings values. The new electronics measure in Wyoming was for an infrared (IR)-sensing advanced power strip and the claimed savings value of 216 kWh/yr is sourced from the RTF version 1.3 file for IR-sensing APS. The savings value is a weighted average of two estimates from studies that use two different methodologies. The first methodology used a CalPlug approved method that simultaneously collected baseline data and simulated the controlled state of 42 residential sites for an average of 13 days and produced a savings value of 234 kWh/yr. The second methodology was based on post-installation monitoring performed at 9 residential sites and was designed to gain insight into the behavioral effects not entirely captured by the CalPlug methodology. This methodology produced a savings value of 134 kWh/yr.<sup>3</sup> While each methodology has uncertainties, with either behavioral uncertainties or with varying use patterns between the pre and post installation, the methodologies do complement each other to potentially account for the uncertainties. Thus, ADM concludes that the UES values in the TRL files for electronics measures are within the bounds of reasonable estimates and thus did not adjust the savings values. This results in a 100% realization rate and the evaluated gross energy savings for 2018 shown in Table 3-22.

*Table 3-22: 2018 WY Evaluated Gross Energy Savings and Realization Rates for Electronics Measures*

<b>Measure</b>	<b>Claimed Gross Savings (kWh)</b>	<b>Evaluated Gross Savings (kWh)</b>	<b>Realization Rate</b>
2018 Advanced Power Strips	579,312	579,312	100%
<b>2018 TOTAL</b>	<b>579,312</b>	<b>579,312</b>	<b>100%</b>

### 3.2.3.4 *Evaluated Net Energy Savings*

To determine net savings, ADM applied the 2018 program-level NTG value of 82.1% to the 2018 electronics measure. Table 3-23 shows the evaluated net savings and NTG for the electronics measure in 2018.

---

<sup>3</sup> AESC, 2014] Valmiki, M., and A. Corradini, (AESC, Inc.), 2014. *Tier 2 Advanced Power Strips in Residential and Commercial Applications*, Prepared for SDG&E Emerging Technologies Program. Available at: [http://www.aesc-inc.com/download/Tier2\\_Adv\\_%20Pow\\_Strips\\_Res\\_and\\_Com\\_Apps.pdf](http://www.aesc-inc.com/download/Tier2_Adv_%20Pow_Strips_Res_and_Com_Apps.pdf)

Table 3-23: 2018 WY Net Energy Savings and NTG for Electronics Measures

Measure	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	NTG
2018 Advanced Power Strips	579,312	475,805	82.1%
<b>2018 TOTAL</b>	<b>579,312</b>	<b>475,805</b>	<b>82.1%</b>

### 3.2.4 HVAC

The HVAC measure category included cooling, ducting, heat pump, and ventilation measures across the Program years 2017 and 2018. The following Table 3-24 shows the quantity of HVAC measures installed and the claimed savings attributed to each HVAC measure in 2017 and 2018. The ducting and heat pump measures accounted for 97% of total HVAC measure savings in 2017 and 93% of total HVAC measure savings in 2018.

Table 3-24: 2017-2018 WY HVAC Measure Quantities and Claimed Savings

Measure Type	2017 Quantity	2017 Claimed Savings (kWh)	2018 Quantity	2018 Claimed Savings (kWh)
Cooling	13	5,767	3	1,425
Ducting	80	83,200	39	127,413
Heat Pump	15	74,760	11	53,068
Ventilation	13	5,766	11	4,762
<b>TOTAL</b>	<b>121</b>	<b>169,493</b>	<b>64</b>	<b>186,668</b>

#### 3.2.4.1 Database Review

ADM conducted an ex-ante review of the Program's 2017 and 2018 HVAC measure data. In this review, the following activities were performed:

- Verification of measure incentive requirements for a sample of HVAC measure items (e.g. AHRI numbers and model numbers)
- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source documents and calculations

ADM reviewed all eight individual HVAC measures in 2017 and all seven individual HVAC measures in 2018 and verified for all individual measures that the UES values claimed by Rocky Mountain Power were supported by the applicable TRL documents. Further, ADM verified that the total claimed savings for each of these measures accurately reflected the quantity of that measure installed in 2017 and 2018.

*3.2.4.2 Inputs to Savings Calculation*

ADM applied a 100% ISR for the HVAC measure categories, supported by the results obtained through the Wyoming HVAC survey.

*3.2.4.3 Evaluated Gross Energy Savings*

ADM conducted a deemed savings review of the HVAC measure claimed savings values in Wyoming, including the TRL files provided, the RTF source savings documents and any additional documentation informing the savings values. ADM concludes that the UES values in the TRL files for HVAC measures are within the bounds of reasonable estimates and thus did not adjust the savings values. This results in a 100% realization rate and the evaluated gross energy savings for 2017 and 2018 shown in Table 3-25. The ducting and heat pump measure types are discussed in more detail below.

*Table 3-25: 2017-2018 WY HVAC Measure Gross Evaluation Results*

<b>Year</b>	<b>Measure Category</b>	<b>Claimed Savings (kWh)</b>	<b>Evaluated Gross Savings (kWh/yr)</b>	<b>Realization Rate<sup>1</sup></b>
2017	Cooling	5,767	5,767	100%
	Ducting	83,200	83,200	100%
	Heat Pump	74,760	74,760	100%
	Ventilation	5,766	5,766	100%
2018	Cooling	1,425	1,425	100%
	Ducting	127,413	127,413	100%
	Heat Pump	53,068	53,068	100%
	Ventilation	4,762	4,762	100%
<b>2017-2018 TOTAL</b>		<b>356,161</b>	<b>356,161</b>	<b>100%</b>

*3.2.4.3.1 Ducting*

ADM conducted a deemed savings review of the ducting measure claimed savings values, including the TRL files provided, the RTF source savings documents and the savings modeling documentation and results. The ducting measures in Wyoming were duct sealing measures specific to manufactured homes and multifamily homes. The claimed savings values for the manufactured homes measures are sourced from the RTF version 2.4 for manufactured homes duct sealing and the claimed savings values for multifamily homes are sourced from the TRL file provided. The measure covered improvements made to ducts in existing manufactured homes to reduce air leakage and must be carried out in accordance with Performance Tested Comfort Sealing specifications. The savings values in the RTF source document for manufactured homes are based off of simulations run in the Simplified Energy Enthalpy Model (SEEM). Simulations were run for baseline and efficient case scenarios across five cities in three climate zones based on three house floor areas and three heating/cooling system types. ADM did not have access to the SEEM model used for this measure. However, ADM did

not adjust the savings values for this measure type. The savings values in the TRL file for multifamily homes are based off modeling baseline and upgrade conditions in EnergyGauge USA software. The baseline insulation conditions of R-0 and upgrade insulation conditions of R-8 appear reasonable. ADM did not adjust the savings values for this measure type.

#### 3.2.4.3.2 Heat Pump

ADM conducted a deemed savings review of the heat pump measure claimed savings values, including the TRL files provided and any additional documentation provided. The claimed savings values are sourced from the TRL file provided and are based off modeling baseline and upgrade conditions in EnergyGauge USA software. ADM did not adjust the savings values for this measure type.

#### 3.2.4.4 *Evaluated Net Energy Savings*

To determine net savings for the HVAC measures, ADM applied the 2017 program-level NTG value of 78.7% to the 2017 HVAC measures and the 2018 program-level NTG value of 82.1% to the 2018 HVAC measures. Table 3-27 shows the evaluated net savings and NTG for HVAC measures in 2017 and 2018.

Additionally, ADM acquired information from the Pacific Power Washington HVAC survey in order to benchmark the yearly program-level NTG values applied to this measure category. ADM calculated freeridership and spillover from the HVAC survey results in Washington to arrive at the net-to-gross ratio presented in Table 3-26 below. The methodology for calculating NTG for HVAC measures is discussed in Appendix C. ADM used this calculated net-to-gross value as a benchmark to the yearly program-level NTG values applied to this measure category. The NTG value of 94.1% calculated from the Washington HVAC survey is not a direct comparison to the program-level NTG values applied to the HVAC measures in Wyoming, however it does show that the program-level NTG values are likely a conservative estimate for HVAC measures in Wyoming.

*Table 3-26: 2017-2018 WA Freeridership, Spillover and NTG for HVAC Measures*

<b>Measure Category</b>	<b>Free Ridership</b>	<b>Spillover</b>	<b>Non-Participant Spillover</b>	<b>NTG</b>
HVAC	6.9%	0.5%	0.5%	94.1%

Table 3-27: 2017-2018 WY HVAC Measure Gross and Net Evaluation Results

Year	Measure Category	Evaluated Gross Savings (kWh/yr)	Evaluated Net Savings (kWh/yr)	NTG
2017	Cooling	5,767	4,536	79%
	Ducting	83,200	65,441	79%
	Heat Pump	74,760	58,802	79%
	Ventilation	5,766	4,535	79%
2018	Cooling	1,425	1,170	82%
	Ducting	127,413	104,648	82%
	Heat Pump	53,068	43,586	82%
	Ventilation	4,762	3,911	82%
<b>2017-2018 TOTAL</b>		<b>356,161</b>	<b>286,630</b>	<b>80%</b>

### 3.2.5 Building Shell

The building shell measure category included insulation and windows measures across the Program years 2017 and 2018. The following Table 3-28 shows the quantity of building shell measures installed and the claimed savings attributed to each building shell measure in 2017 and 2018. The building shell measure category represented approximately 1.7% of overall claimed program savings in 2017 and 2018.

Table 3-28: 2017-2018 WY Building Shell Measure Quantities and Claimed Savings

Measure Type	2017 Quantity (sq. ft.)	2017 Claimed Savings (kWh)	2018 Quantity (sq. ft.)	2018 Claimed Savings (kWh)
Insulation	25,847	35,371	102,915	121,273
Windows	239	921	40	83
<b>TOTAL</b>	<b>26,086</b>	<b>36,293</b>	<b>102,955</b>	<b>121,356</b>

#### 3.2.5.1 Database Review

ADM conducted an ex-ante review of the Program's 2017 and 2018 building shell measure data. In this review, the following activities were performed:

- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source documents and calculations

ADM reviewed each of the eight individual building shell measures incentivized in 2017 and the six individual building shell measures incentivized in 2018. ADM verified that the UES values claimed by Rocky Mountain Power were supported by the applicable TRL

documents. Further, ADM verified that the total claimed savings for each measure accurately reflected the quantity of that measure installed in 2017 and 2018.

### 3.2.5.2 *Inputs to Savings Calculation*

Due to the low savings attributed to building shell measures, ADM did not survey these program participants separately to calculate an ISR. ADM applied a 100% ISR for the building shell measure category. It is uncommon for participants to not install or remove building shell measures.

### 3.2.5.3 *Evaluated Gross Energy Savings*

ADM conducted a deemed savings review of the building shell measure claimed savings values, including the TRL files provided and the RTF source savings documents and any additional documentation provided. ADM's review included an analysis of the baseline and efficient case conditions for each insulation building shell measure. The insulation baselines and efficient cases vary for each type of insulation. For floor insulation, the baseline is R-0 insulation and the efficient case is R-30 insulation. For attic insulation, the baseline is established through a weighted average of pre-installed levels and the efficient case is R-49 insulation. For wall insulation, the baseline is R-0 insulation and the efficient case is R-13 insulation. ADM concludes that the baseline and efficient case assumptions and the UES values in the TRL files for building shell measures are within the bounds of reasonable estimates and did not find any reasons to adjust the savings values for building shell measures. This results in a 100% realization rate for building shell measures and the evaluated gross energy savings for 2017 and 2018 shown in Table 3-29.

*Table 3-29: 2017-2018 WY Evaluated Gross Energy Savings and Realization Rates for Building Shell Measures*

Year	Measure	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate
2017	Insulation	35,371	35,371	100%
	Windows	921	921	100%
2018	Insulation	121,273	121,273	100%
	Windows	83	83	100%
<b>2017-2018 TOTAL</b>		<b>157,649</b>	<b>157,649</b>	<b>100%</b>

### 3.2.5.4 *Evaluated Net Energy Savings*

To determine net savings, ADM applied the 2017 program-level NTG value of 78.7% to 2017 building shell measures and the 2018 program-level NTG value of 82.1% to 2018 building shell measures. Table 3-30 shows the evaluated net savings and NTG for building shell measures in 2017 and 2018.

Table 3-30: 2017-2018 WY Net Energy Savings and NTG for Building Shell Measures

Year	Measure	Evaluated Gross Savings (kWh/yr)	Evaluated Net Savings (kWh/yr)	NTG
2017	Insulation	35,371	27,821	78.7%
	Windows	921	725	78.7%
2018	Insulation	121,273	99,605	82.1%
	Windows	83	68	82.1%
<b>2017-2018 TOTAL</b>		<b>157,649</b>	<b>128,219</b>	<b>81.3%</b>

### 3.2.6 Water Heating

The following Table 3-31 shows the quantity of water heating measures installed and the claimed savings in each year 2017 and 2018. The water heating measure category represented approximately 0.2% of overall claimed program savings in 2017 and 2018.

Table 3-31: 2017-2018 Wyoming Water Heating Quantities and Claimed Savings

Measure Category	Quantity	Claimed Savings (kWh)
2017 Water Heating	5	8,970
2018 Water Heating	3	5,382
<b>TOTAL</b>	<b>8</b>	<b>14,352</b>

#### 3.2.6.1 Database Review

ADM conducted an ex-ante review of the Program’s 2017 and 2018 water heating measure data. In this review, the following activities were performed:

- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source document and calculations

ADM reviewed the two individual water heating measures in 2017 and the one individual water heating measures in 2018. ADM verified that the UES values claimed by Rocky Mountain Power were supported by the applicable TRL documents. Further, ADM verified that the total claimed savings for each measure accurately reflected the quantity of that measure installed in 2017 and 2018.

### 3.2.6.2 Inputs to Savings Calculation

Due to the low savings attributed to water heating measures, ADM did not survey these program participants separately to calculate an ISR. ADM applied a 100% ISR for the water heating measure category. It is uncommon for participants to not install or remove water heater purchases.

### 3.2.6.3 Evaluated Gross Energy Savings

ADM conducted a deemed savings review of the water heating measure claimed savings values, including the TRL files provided and the RTF source document, Heat Pump Water Heater RTF version 1.3. Due to the low savings attributed to this measure, ADM’s review was limited to verifying that the TRL and RTF values were properly applied to claimed savings values. This results in a 100% realization rate for water heating measures and the evaluated gross energy savings for 2017 and 2018 shown in Table 3-32.

*Table 3-32: 2017-2018 Wyoming Evaluated Gross Energy Savings and Realization Rates for Water Heating Measures*

Measure Category	Claimed Gross Savings (kWh)	Evaluated Gross Savings (kWh)	Realization Rate
2017 Water Heating Measures	8,970	8,970	100%
2018 Water Heating Measures	5,382	5,382	100%
<b>2017-2018 TOTAL</b>	<b>14,352</b>	<b>14,352</b>	<b>100%</b>

### 3.2.6.4 Evaluated Net Energy Savings

To determine net savings, ADM applied the 2017 program-level NTG value of 78.7% to 2017 water heating measures and the 2018 program-level NTG value of 82.1% to 2018 water heating measures. Table 3-33 shows the evaluated net savings and NTG for water heating measures in 2017 and 2018.

*Table 3-33: 2017-2018 Wyoming Net Energy Savings and NTG for Water Heating Measures*

Measure Category	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	NTG
2017 Water Heating Measures	8,970	7,055	78.7%
2018 Water Heating Measures	5,382	4,420	82.1%
<b>2017-2018 TOTAL</b>	<b>14,352</b>	<b>11,476</b>	<b>80.0%</b>

## 3.2.7 Appliances

The appliance measure category included clothes washers and clothes dryers measures across the Program years 2017 and 2018. The following Table 3-34 shows the quantity of appliance measures installed and the claimed savings attributed to each appliance

measure in 2017 and 2018. The appliance measure category represented 0.1% of overall claimed program savings in 2017 and 2018.

*Table 3-34: 2017-2018 Wyoming Appliance Measure Quantities and Total Claimed Savings*

Measure Type	2017 Quantity	2017 Claimed Savings (kWh)	2018 Quantity	2018 Claimed Savings (kWh)
Clothes Washers	36	4,382	24	3,141
Freezers	33	2,196	12	798
Refrigerators	4	572	6	858
<b>TOTAL</b>	<b>73</b>	<b>7,150</b>	<b>42</b>	<b>4,797</b>

### 3.2.7.1 Database Review

ADM conducted an ex-ante review of the Program’s 2017 and 2018 appliances measure data. In this review, the following activities were performed:

- Verification of measure incentive requirements for a sample of appliances (e.g. model numbers)
- Verification that the program tracking dataset does not include duplicate or erroneous data entries
- Confirmed data entries in the program tracking dataset include all necessary fields for savings calculations
- Verification that all energy savings are claimed in accordance with the applicable TRL source documents and calculations

ADM reviewed each of the five individual appliance measures incentivized in 2017 and the five individual appliance measures incentivized in 2018. ADM verified that the UES values claimed by Rocky Mountain Power were supported by the applicable TRL documents. Further, ADM verified that the total claimed savings for each measure accurately reflected the quantity of that measure installed in 2017 and 2018.

### 3.2.7.2 Inputs to Savings Calculation

Due to the low savings attributed to appliance measures, ADM did not survey these program participants separately to calculate an ISR. ADM applied a 100% ISR for the appliance measure category. It is uncommon for participants to not install or remove large appliance purchases.

### 3.2.7.3 Evaluated Gross Energy Savings

ADM conducted a deemed savings review of the appliance measure claimed savings values, including the TRL files provided and the source savings documents, including the

Clothes Washers RTF version 5.4. ADM reviewed the baseline Modified Energy Factor (MEF) of 2.36, which is a weighted value from the California Energy Commission (CEC) database and the efficient case requirement of an MEF of 2.75 or higher. ADM also benchmarked the RTF assumption of an average of 295 laundry cycles a year to the average of 231 laundry cycles a year acquired from the General Population Survey in Wyoming. Although the RTF assumption is approximately 20% greater than the results of the General Population Survey, ADM concludes that the UES values in the TRL files for appliance measures are within the bounds of reasonable estimates and did not adjust the savings values for appliance measures. This results in a 100% realization rate for appliance measures and the evaluated gross energy savings for 2017 and 2018 shown in Table 3-35.

*Table 3-35: 2017-2018 Wyoming Evaluated Gross Energy Savings and Realization Rates for Appliance Measures*

Year	Measure	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate
2017	Clothes Washers	4,382	4,382	100%
	Freezers	2,196	2,196	100%
	Refrigerators	572	572	100%
2018	Clothes Washers	3,141	3,141	100%
	Freezers	798	798	100%
	Refrigerators	858	858	100%
<b>2017-2018 TOTAL</b>		<b>11,947</b>	<b>11,947</b>	<b>100%</b>

#### 3.2.7.4 Evaluated Net Energy Savings

To determine net savings, ADM applied the 2017 program-level NTG value of 78.7% to 2017 appliance measures and the 2018 program-level NTG value of 82.1% to 2018 appliance measures. Table 3-36 shows the evaluated net savings and NTG for appliance measures in 2017 and 2018.

*Table 3-36: 2017-2018 Wyoming Appliance Measure Net Savings and NTG*

Year	Measure	Evaluated Gross Savings (kWh/yr)	Evaluated Net Savings (kWh/yr)	NTG
2017	Clothes Washers	4,382	3,447	78.7%
	Freezers	2,196	1,727	78.7%
	Refrigerators	572	450	78.7%
2018	Clothes Washers	3,141	2,579	82.1%
	Freezers	798	656	82.1%
	Refrigerators	858	705	82.1%
<b>2017-2018 TOTAL</b>		<b>11,947</b>	<b>9,564</b>	<b>80.1%</b>

## 4 Process Evaluation

---

This chapter presents the findings of the process evaluation for the Wyoming wattsmart Homes Program. ADM's process evaluation included a review of the program materials, in-depth interviews with program staff, and general population and participant surveys.

### **4.1 Review of Program Materials and In-depth Interviews with Program Staff**

---

#### **4.1.1 Roles and Responsibilities**

ADM evaluators interviewed program staff from Rocky Mountain Power, which included the wattsmart Homes Program manager. The wattsmart Homes Program manager is responsible for overseeing the program in Utah, Wyoming and Idaho, which includes assessing cost effectiveness of the program, regulatory recovery, review and approving marketing campaigns, program participation and procedures, and design and implementation of procedures. ADM evaluators also spoke with a senior account manager and marketing account manager from CLEARResult. The program manager's responsibilities included implementation, contract management, client management, and overseeing day-to-day operations.

#### **4.1.2 Program Design and Goals**

The program saving goals and spend targets vary for each state and channel (lighting and non-lighting). Each implementer has individual goals for each channel. The program in Wyoming is implemented and managed by CLEARResult.

The following key findings are related to the wattsmart Homes Program performance and changes to the program:

- Rocky Mountain Power program staff indicated they were not able to hit all the goals in Wyoming in PY 2017. There were no changes to the savings target. There was also a lot of changes in personnel.
- In PY 2018, Rocky Mountain Power program staff indicated that the program hit all lighting and non-lighting targets in Wyoming. Wyoming had increased its targets in 2018.
- The Rocky Mountain Power website (<https://www.wattsmarthomes.com/state/WY>) was enhanced in 2018 and there will be further improvements in 2019.

- CFLs were eliminated from the program in 2017, with Rocky Mountain Power program staff indicating that LEDs have demonstrated savings and good participation.
- CLEAResult staff believed there is a need for additional customer education about LEDs and their benefits, especially in rural areas.
- CLEAResult staff indicated there were changes to the participating lighting retailers between 2017 and 2018. They also stated they may try to recruit online retailers (e.g., Amazon) since all brick and mortar stores have an agreement.
- For most of the program, there is an established trade ally network, which was described as “good and ample” by implementation staff.
- CLEAResult staff indicated that customer satisfaction is high.

The following key findings are related to wattsmart Homes Program participation:

- Rocky Mountain Power staff indicated that overall participation in 2017 and 2018 remained consistent from past program years but there is some variability among specific measures.
- CLEAResult staff indicated they are continuing to move away from paper applications and towards self-validation tools at the point-of-purchase.

#### **4.1.3 Tracking and Reporting**

Rocky Mountain Power tracks program activity for the wattsmart Homes Program, including the following data indicators:

- Non-lighting measures are captured through customer application (e.g. account number, address);
- Builder and/or contractor information;
- Technical requirements (appliance model and specifications);
- Lighting sales data (weekly or monthly) from retailers.

Rocky Mountain Power staff indicated that they are collecting all the necessary information and that the information is kept current enough to effectively manage the program. No significant improvements were suggested. One staff member stated they would like to collect email addresses from customers.

#### **4.1.4 Communication**

Rocky Mountain Power staff have regularly scheduled weekly conference calls with implementation staff. Topics include program status and performance, field operations, changes to the website, program enhancements, marketing and outreach activities, customer issues, barriers to participation, and program enhancements. There are also monthly meetings where program staff discuss forecasts, budgets, and future program adjustments to hit targets. There were no concerns raised about the current communication structure.

#### **4.1.5 Marketing and Outreach**

Rocky Mountain Power provides a marketing budget to CLEAResult, which is designed to be measure-specific. CLEAResult's marketing team designs the marketing campaigns and presents a proposal to Rocky Mountain Power for approval. Rocky Mountain Power will conduct email blasts and manages social media posts and CLEAResult provides content.

Marketing activities in Wyoming for 2017 and 2018 included:

- Bill inserts and postal mailers
- Email campaigns
- Social media (Facebook, Instagram, and Twitter)
- Program website (<https://www.wattsmarthomes.com/state/WY>)
- Mass media advertisement
- Monthly newsletters (print or electronic)
- Cross promotion
- Outreach events (e.g., home shows)
- Policy interactions/referrals with relevant agencies
- Point-of-purchase signage

Program staff did not express any immediate concerns about marketing. There are no planned changes to the marketing approach for the upcoming program year.

## **4.2 General Population Survey Results**

---

This section presents key findings from surveys administered online by ADM Associates from April to May 2019 completed by 336 Rocky Mountain Power customers in Wyoming State. The surveys gathered information regarding these customers' energy efficient lighting purchases, incentive program awareness, measures installed and in-service rates, decision making and satisfaction. Survey efforts were designed to collect data for both the process evaluation and impact analyses.

### 4.2.1 Respondent LED Purchases

Survey respondents were surveyed on multiple aspects of their LED purchases. Approximately 77% of survey respondents indicated that they or someone in their household purchased LED light bulbs in 2017 or 2018 and approximately 22% of respondents indicated that they or a member of their household purchased an LED fixture in 2017 or 2018. Approximately 21% of respondents reported that no one in their household purchased LED light bulbs or LED fixtures in 2017 or 2018 or they did not recall whether a purchase had been made.

Almost half of survey respondents (49%) reported making their LED lighting purchase from Walmart. An additional 38% reported purchasing their LED lighting at Home Depot. Respondents also reported purchasing LED bulbs from retailers including Ace Hardware and Lowe’s and Sam’s Club. Table 4-1 summarizes which retailers survey respondents reported purchasing LED lighting from in 2017 or 2018.

*Table 4-1: Where did respondents purchase LED lighting?*

<b>From which of the following retail stores did you purchase your LED lighting?</b>	<b>Response</b>	<b>Percent of Responses (n = 264)</b>
	Walmart	49%
	The Home Depot	38%
	Ace Hardware	27%
	Other	22%
	Lowe’s	7%
	Sam’s Club	6%
	Costco	6%
	I do not recall	2%
	Target	2%
	Batteries Plus	0%

Note: The sum of percentages may not be 100% because respondents could choose more than one response.

Respondents provided information regarding their decision to purchase an LED bulb or fixture. Survey respondents provided the reasons they purchased LED lighting (LED light bulbs and LED fixtures). Table 4-2 summarizes survey respondents’ reported reasons for purchasing LED lighting in 2017 or 2018. Respondents had a variety of reasons for purchasing LED lighting, including the desire to improve the lighting in a room (38%), to replace burnt out bulbs (32%) and to reduce energy use (31%) .

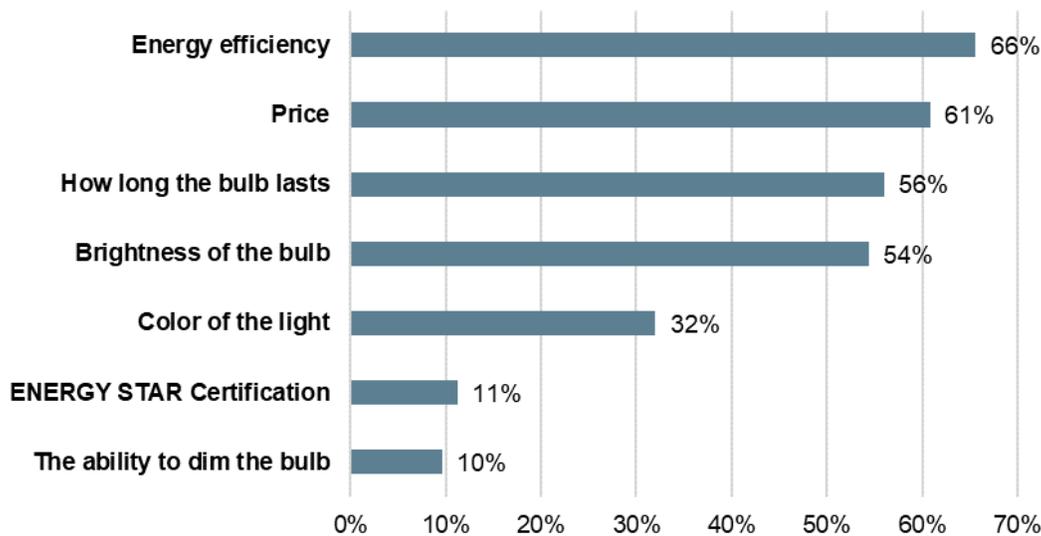
Table 4-2: Why did respondents purchase LED lighting?

Please select the reasons that best describe your decision to purchase LED lighting in 2017 or 2018.	Response	Percent of Responses (n = 255)
	Improve lighting/brighten room	38%
	Replaced burned out bulbs or non-working fixture	32%
	Wanted to lower energy use	31%
	Replaced working bulbs or fixture	27%
	Installed new light fixture or lamp socket	17%
	Stock up	15%
	Good deal	14%
Other	1%	

Note: The sum of percentages is not 100% because respondents could choose more than one response.

Respondents reported the most important characteristics they consider when they purchase light bulbs. Over half of respondents reported that energy efficiency (66%), price (61%), longevity (56%) and brightness (54%) were important characteristics. Fewer respondents reported that the color of the light (32%), ability to dim the light (10%), and Energy Star Certification (11%) impacted their decision to purchase light bulbs. Figure 4-1 displays the reasons respondents gave for purchasing light bulbs.

Figure 4-1: What are the most important characteristics when purchasing light bulbs?



n = 250

Note: The sum of percentages is not 100% because respondents could choose more than one response.

Respondents were surveyed on the types of bulbs and fixtures that their new LED bulbs replaced, or if they were for a new fixture/socket. Approximately 49% of survey respondents indicated that at least one of the new LED bulbs they purchased was bought to replace a traditional incandescent or halogen bulb and 22% responded they were to replace CFLs and another 22% to replace LEDs.

#### **4.2.2 Respondent Awareness of Incentives**

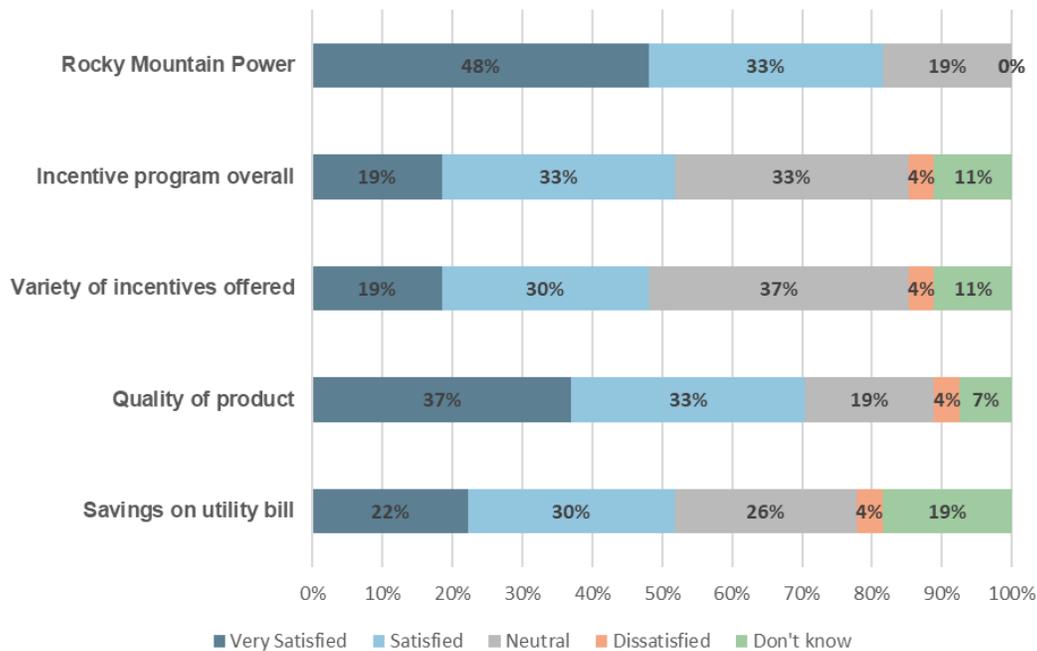
ADM asked survey respondents about LED pricing and whether they recalled whether their LED bulb or LED fixture purchase was discounted. Most respondents reported that they did not recall whether the LED bulbs (83%) or LED fixtures (84%) they purchased were discounted. Approximately 11% of respondents were aware that Rocky Mountain Power provided discounts on certain LED bulbs or fixtures.

Survey respondents who indicated they were aware of Rocky Mountain Power's discount on LED lighting were surveyed on how they learned of the discount. Approximately one fifth learned about the discount through print media (21%), approximately 5% from a friend or relative, 4% via bill inserts, and approximately 4% through the Rocky Mountain Power website. Approximately 54% did not recall the source of information or reported hearing from another source.

#### **4.2.3 Respondent Satisfaction**

ADM asked survey respondents who were aware of the lighting program about their satisfaction with different aspects of the incentive program and with their utility provider overall. The majority of respondents (52%) reported they were either very satisfied (19%) or satisfied (33%) with the incentive program overall. Respondents reported large levels of satisfaction with the quality of the product (70% were "satisfied" or "very satisfied"). Roughly half of participants (52%) were satisfied or very satisfied with the resulting savings on their utility bill since participating in the program. A large share of respondents (81%) were either very satisfied (48%) or satisfied (33%) with Rocky Mountain Power overall. Figure 4-2 displays the responses to the satisfaction questions.

Figure 4-2: Respondent satisfaction



n = 27

#### 4.2.4 Survey Respondent Home Characteristics

ADM gathered information from respondents regarding their home characteristics which is summarized in Table 4-3. Approximately 56% of respondents report living in single-family detached homes. The majority (73%) of respondents indicated that they owned their home. Respondents' reported approximate household income was roughly even across the possible survey response options. The majority of respondents reported that electricity was their primary fuel for home heating (61%), and water heating purposes (75%). The typical number of residents in respondents' homes were 2.7 (average) and 2 (median). Survey respondents reported their square footage of the home was on average about 1,844 square feet, and the median was 1,750 square feet.

Table 4-3: General Population Home Characteristics

Home Characteristics	Percentage of Respondents (n = 313)
Single Family, detached from any other house	56%
Apartment in a building with 4 or more units	15%
Single Family Home, mobile home	7%
Apartment in building with 2 to 3 units	7%
Single-family house attached to one or more other houses (e.g. duplex, row	7%

Home Characteristics	Percentage of Respondents (n = 313)
Single Family Home, factory manufactured/modular	5%
Other	2%
Prefer not to answer	1%
<b>Own or Rent</b>	
Own	73%
Rent	27%
<b>Year Built</b>	
Before 1950	14%
1950 to 1959	9%
1960 to 1969	4%
1970 to 1979	17%
1980 to 1989	15%
1990 to 1999	6%
2000 to 2009	12%
2010 to 2018	9%
Don't know	12%
<b>What is the main fuel used for heating your home?</b>	
Natural Gas	62%
Electricity	25%
Propane	6%
Other - Please Write In:	5%
Don't know	2%
<b>What fuel does your main water heater use?</b>	
Natural Gas	54%
Electricity	35%
Propane	4%
Other	1%
Don't know	5%
<b>What is your approximate household income?</b>	
Less than \$10,000	7%
\$10,000 to \$29,999	13%
\$30,000 to \$49,999	18%
\$50,000 to \$69,999	17%
\$70,000 to \$89,999	15%
\$90,000 to \$99,999	7%
\$100,000 to \$149,999	9%
\$150,000 or more	5%
Don't know	8%

### 4.3 Energy Kits Participant Survey Results

This section presents key findings from energy kit surveys, which were administered online by ADM. The surveys were completed by 83 customers who received energy kits in 2017 or 2018. Of these respondents, two reported that they had not received an energy

kit or did not recall receiving an energy kit. The survey gathered information regarding program awareness, measures installed and in-service rates, decision making and overall satisfaction.

### **4.3.1 Program Awareness**

Respondents provided information and feedback regarding how they learned about the energy kits and their experience enrolling in the program. Over half of participants reported hearing about the program through a utility bill insert (53%), with approximately 16% through the Rocky Mountain Power website and 11% through a message printed on their bill. A summary of survey responses appears in Table 4-4.

*Table 4-4: How did respondents learn about the program?*

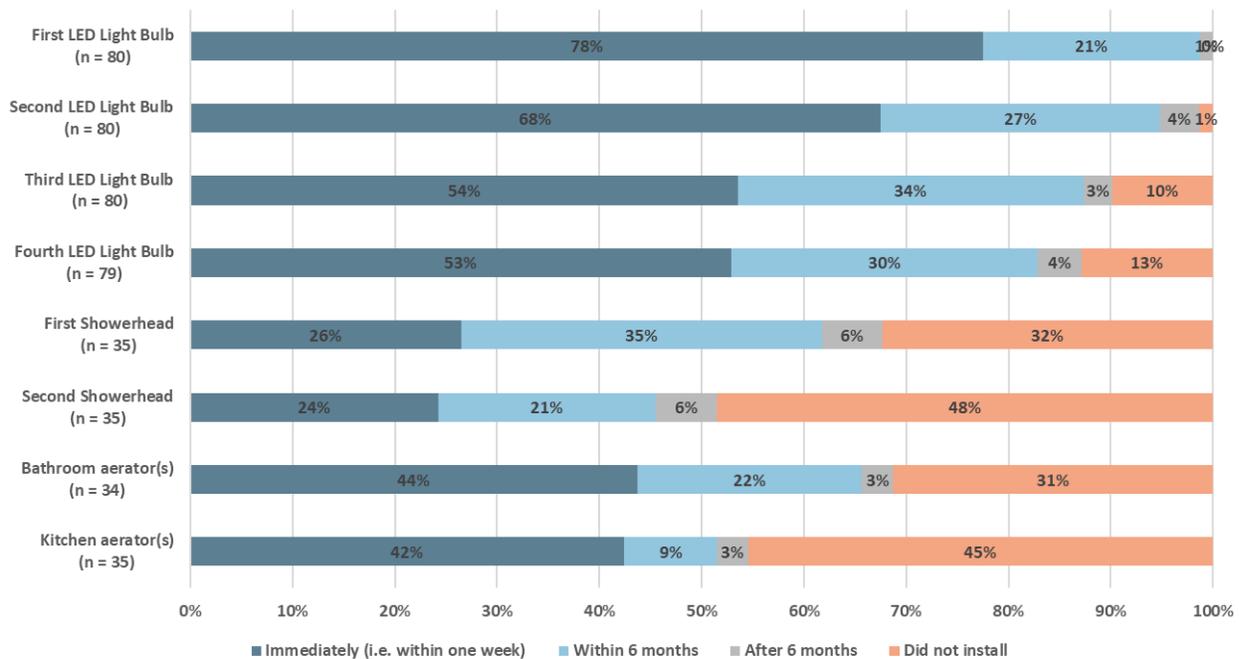
<b>How did you hear about these kits?</b>	<b>Percent of Responses (n = 79)</b>
Utility bill insert	53%
Rocky Mountain Power Website	16%
Message printed on your bill	11%
Rocky Mountain Power newsletter	10%
Don't know	5%
Home Energy Report	4%
Other	4%
Word of mouth (friend, relative, coworker,	3%
Social Networking site	1%

Note: The sum of percentages is not 100% because respondents could choose more than

### **4.3.2 Participant Experience and Installation of Measures**

Survey respondents answered questions regarding if and when they installed the energy kit components. Most respondents reported installing the first LED light bulb (78%) and second LED light bulb (68%) immediately (within one week). No customers reported that they had not installed their first LED light bulb and only a small portion of survey respondents reported that they had not installed their second LED light bulb (1%). A larger portion of respondents reported that the third and fourth LED bulbs they received were not installed, but respondents still most often reported installing these lightbulbs within one week of receiving them. Over half (55%) of respondents that reported installing kitchen aerators and 69% reported installing bathroom aerators. Approximately 68% of respondents reported installing the first showerhead and 52% reported installing the second showerhead. Figure 4-3 displays respondents' timeline for installing various energy kit measures.

Figure 4-3: Respondent Timeline for Installing Energy Kit Measures



Energy kit recipients who reported that they had not installed certain measures provided the reasons that these measures were not installed. See Table 4-5 for complete results. Of the respondents that reported they did not install one or more of the LED bulbs they received in their kit, the most common reason why was that they are waiting for their current lights to burn out, with 83% reporting this reason. Of the respondents who reported a different reason for not installing their LED bulbs, approximately one third disliked the color and another third reported that the bulbs were not the correct wattage. Regarding uninstalled high efficiency showerheads, respondents frequently cited already having high efficiency showerheads installed throughout their home (25%). Approximately 20% reported that the showerheads in their kit did not integrate well with their home's plumbing. Of the respondents who reported having uninstalled faucet aerators, approximately 39% reported that the faucet aerators did not integrate well with their plumbing and 17% mentioned they already had aerators installed in all of their sinks.

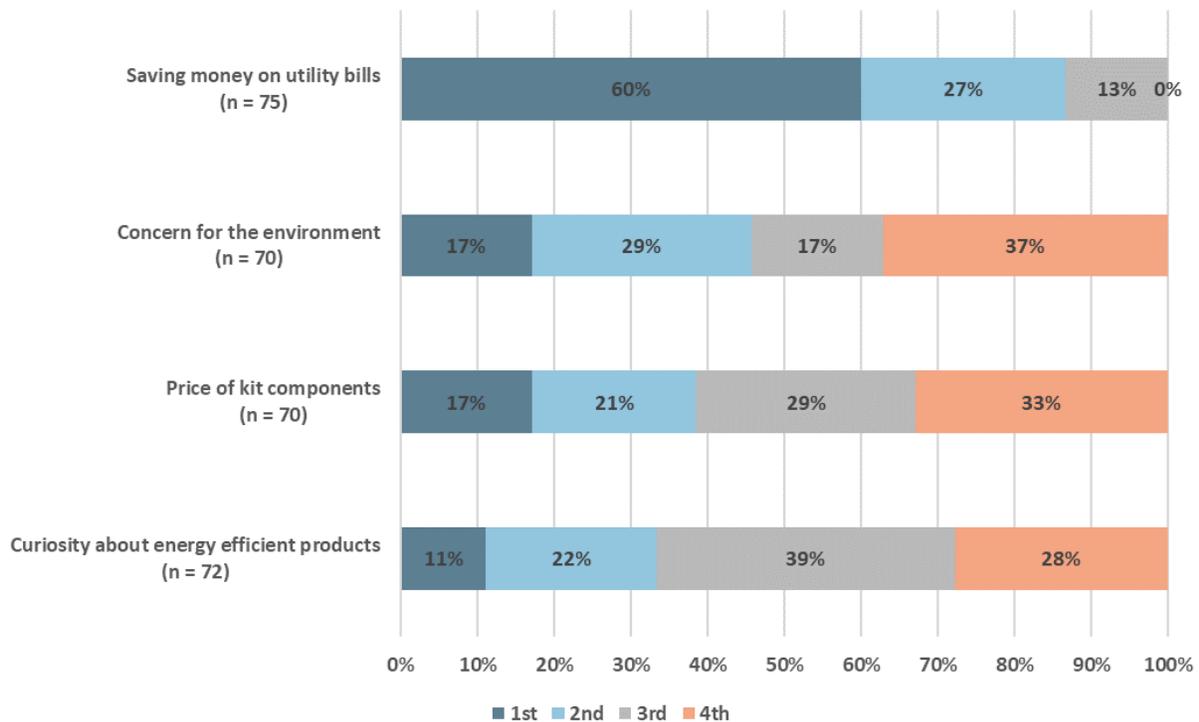
Table 4-5: Reasons for not Installing Energy Kit Components

Reason for not installing measure	Percentage of Responses
LEDs (n = 18)	
Waiting for current lights to burn out	83%
No time to install	6%
Not the correct wattage	6%
Disliked the color tone/quality of the emitted light	6%
Did not fit into my fixtures	6%
Showerheads (n = 20)	
Other	40%
High-efficiency shower-heads already installed in all showers	25%
Did not integrate well with current plumbing	20%
Don't know	10%
Disliked the way it looked	5%
Faucet Aerators (n = 18)	
Did not integrate well with current plumbing	39%
Other	33%
Faucet aerators already installed in all sinks	17%
Disliked the pressure/water volume	6%
Don't know	6%

### 4.3.3 Participant Motivations

Respondents provided feedback regarding what influenced them to request the energy kit. Nearly 60% of respondents ranked “saving money on utility bills” as their strongest motivation to request a kit, while a further 27% ranked it as their second strongest motivation. Another finding from the survey is that participants are motivated to request energy kits due to having concerns about the environment. Approximately 46% of participants ranked this motivation as being first or second most important to them. Figure 4-4 displays respondents’ ranking of different reasons for requesting an energy kit.

Figure 4-4: Survey Respondents' Ranking of Reasons for Requesting an Energy Kit



Most respondents also indicated that they did not have plans to purchase and install aerators (88%) or high-efficiency showerheads (76%) before participating in the program, but most respondents did plan to purchase and install LED bulbs (76%). A summary of participant responses as to whether they were already planning on purchasing energy kit components appears in Table 4-6.

Table 4-6: Were Respondents Already Planning on Purchasing Energy Kit Components?

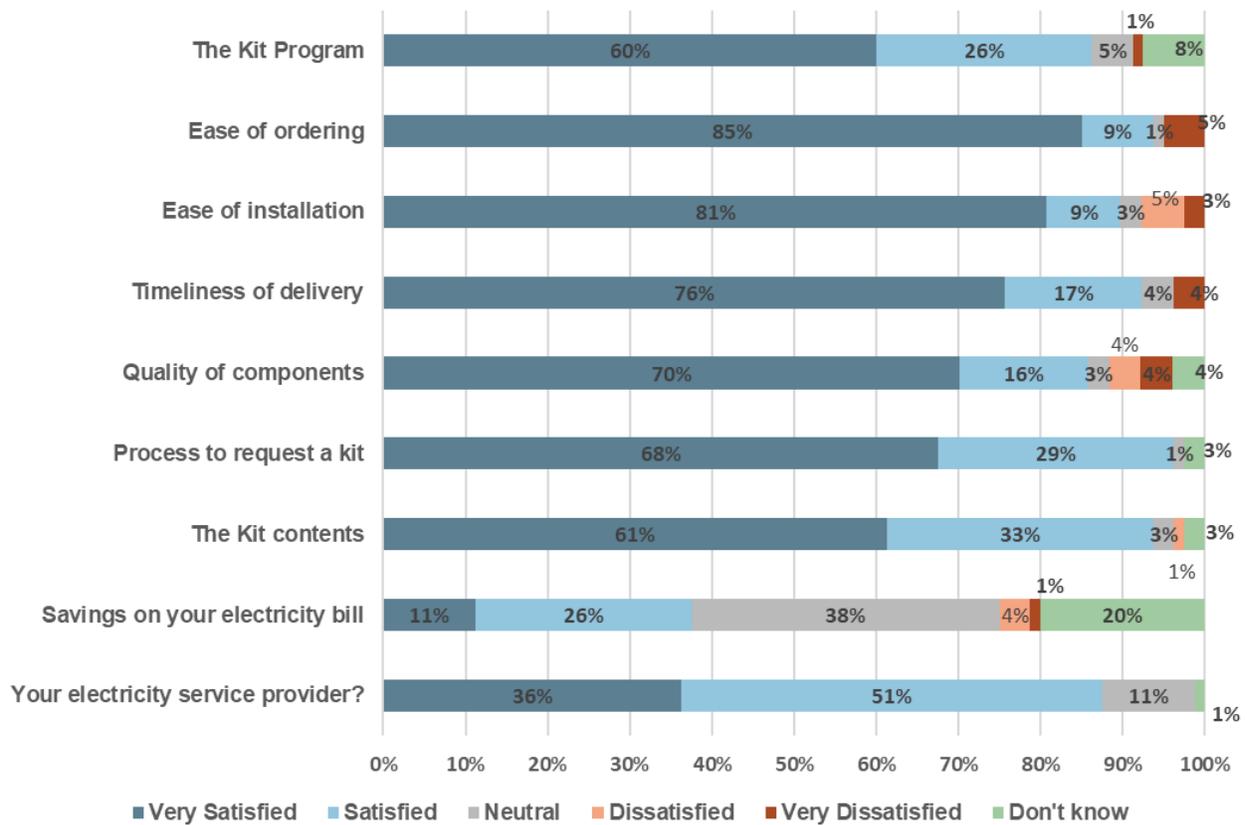
Before you learned that the Kits were available, were you planning to purchase and install the following energy efficient measures?	Measure	Yes	No	Don't Know
	Faucet Aerator(s)	5%	88%	8%
	Showerhead(s)	20%	76%	4%
	LED Light Bulbs	76%	20%	4%

#### 4.3.4 Participant Satisfaction

Respondents provided feedback regarding their level of satisfaction with specific aspects of the program, as well as their overall experience with the program. Respondents found that the most satisfying aspects (i.e. either satisfied or very satisfied) of the program were the process to request a kit (96%), the ease of ordering (94%), and the quality of the kit components (86%). Overall satisfaction with the program was 86%, and overall satisfaction with Rocky Mountain Power was 88%. Figure 4-5 displays survey

respondents' satisfaction with the program as well as their satisfaction with specific aspects of their experience with the program.

Figure 4-5: Customer Satisfaction with Energy Kit Program



n = 80

#### 4.3.5 Home Characteristics

Respondents' home characteristics are summarized in Table 4-7. Respondents most often reported living in single-family, detached homes (73%) and most often owned their home (88%). The decade in which respondents' homes were built are spread fairly evenly across each time interval included in the survey, with the largest segments of respondents' homes being built between 1970-1979 (26%) and 1980-1989 (18%). Approximately 62% of respondents indicated natural gas is their primary home heating fuel and 49% indicated natural gas is their primary water heating fuel. Most respondents reported that two or three people lived in their home. Survey respondents reported their square footage of the home was on average about 1,985 square feet.

Table 4-7: Energy Kit Participants Home Characteristics

Home Characteristics	Percentage of Respondents
Single Family, factory manufactured/modular	73%
Single Family, mobile home	8%
Single Family attached to one or more other houses	8%
Apartment in building with 2 to 3 units	6%
Other	5%
<b>Own or Rent</b>	
Own	88%
Rent	10%
Own and rent to someone else	2%
<b>Year Built</b>	
Before 1950	10%
1950 to 1959	5%
1960 to 1969	7%
1970 to 1979	26%
1980 to 1989	18%
1990 to 1999	12%
2000 to 2009	9%
2010 to 2018	9%
Don't know	5%
<b>What is the main fuel used for heating your home?</b>	
Natural Gas	62%
Electricity	26%
Propane	12%
<b>What fuel does your main water heater use?</b>	
Natural Gas	49%
Electricity	45%
Propane	6%
<b>What is your approximate household income?</b>	
\$10,000 to \$29,999	10%
\$30,000 to \$49,999	18%
\$50,000 to \$69,999	28%
\$70,000 to \$89,999	11%
\$90,000 to \$99,999	9%
\$100,000 to \$149,999	13%
Don't know	13%

#### 4.4 HVAC and Appliance Participant Survey Results

This section presents key findings from HVAC and appliance program surveys administered by ADM, completed by 34 participants who reported receiving an incentive for an air source heat pump, a ductless heat pump, duct sealing/insulation, an evaporative cooler, clothes washer or freezer in 2017 or 2018 through Rocky Mountain Power's

wattsmart Homes Program. The survey gathered information regarding program awareness, decision making and overall satisfaction.

#### **4.4.1 Program Awareness**

Respondents provided information regarding how they first learned about the incentive program as well as sources of information they utilized while they were making the decision to purchase the HVAC and appliance equipment. Approximately 44% of survey respondents reported that they learned about it from a Rocky Mountain Power representative, while 12% of respondents indicated that they learned of the program via bill inserts and another 12% by messages printed on bills. Table 4-8 summarizes how survey respondents first learned about the program.

*Table 4-8: How did respondents first learn about the program?*

<b>How did you first learn about the Program?</b>	<b>Percent of Responses (n = 34)</b>
Rocky Mountain Power representative	44%
Bill inserts	12%
Message printed on your bill	12%
Program website	9%
I don't know	9%
Friend, neighbor, relative, or colleague	6%
Other (Please specify)	6%
Newspaper/magazine/print media	3%

Regarding where respondents found information about the incentives offered by Rocky Mountain Power when they were deciding to implement the energy saving equipment, most respondents found information through retailers (40%) or the program website (40%). A summary of responses to this question appears in Table 4-9.

Table 4-9: How did respondents get information about the incentive?

When you were deciding to implement the energy saving equipment, from where did you get information about the incentives offered by Rocky Mountain Power?	Percent of Responses (n = 34)
Retailer	40%
Program website	40%
Installation contractor	7%
Friend, neighbor, relative or co-worker	7%
Other	7%

Note: Totals can exceed 100% because respondents could select more than one response.

#### 4.4.2 Participant Motivation

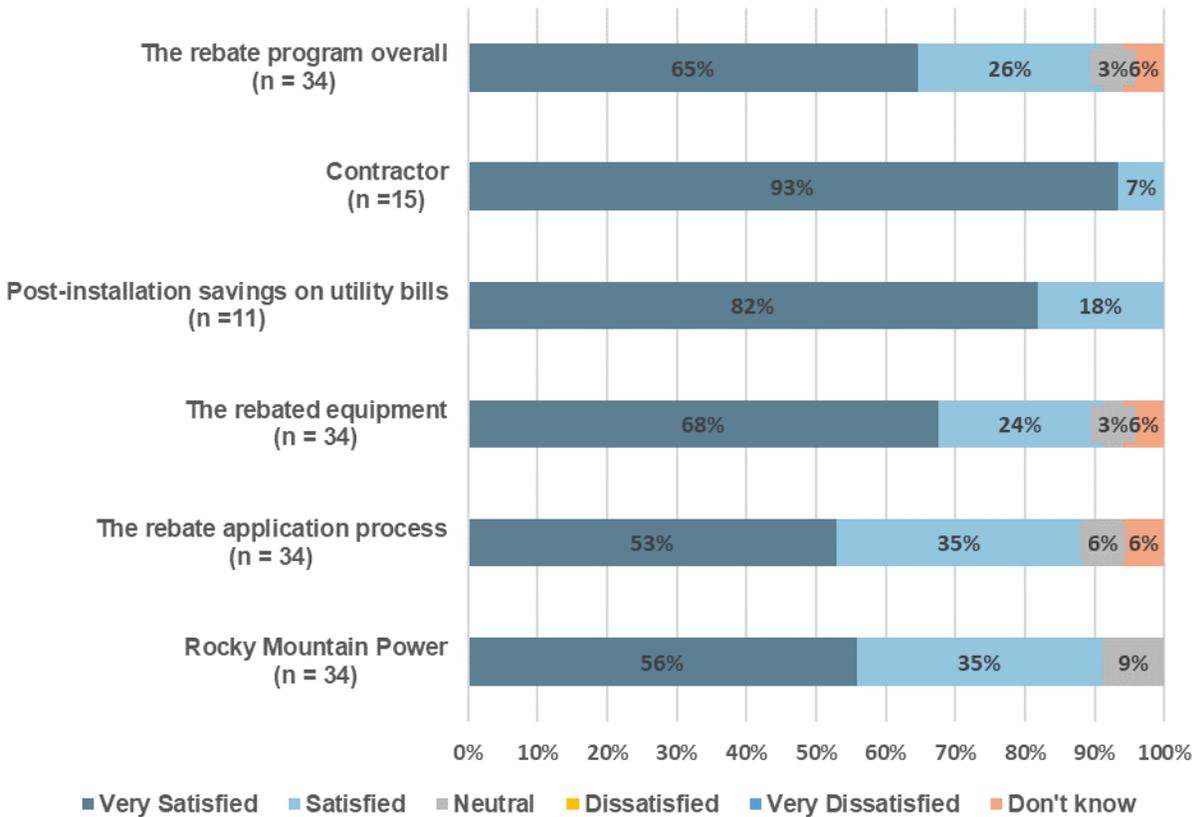
Survey respondents provided feedback regarding their decision-making process. Almost two-thirds (64%) indicated they did not have plans to integrate the HVAC measures before they learned about Rocky Mountain Power’s Program. Approximately one-third (32%) reported that they did have plans to purchase the HVAC equipment and very few (3%) reported that they did not know.

Respondents reported that the incentive was important or extremely important in driving their decision to install the energy efficiency equipment 84% of the time. Only three percent of survey participants reported that the incentive was “not important” or “not important at all.” These results corroborate earlier results that the incentive was influential in driving program participation.

#### 4.4.3 Participant Satisfaction

Survey respondents provided feedback regarding their level of satisfaction with specific aspects of Rocky Mountain Power’s wattsmart Homes Program as well as the program overall. Approximately 91% of respondents reported being satisfied or very satisfied with the program and 91% of respondents reported being satisfied or very satisfied with Rocky Mountain Power overall. No respondents reported being dissatisfied or very dissatisfied with Rocky Mountain Power. Respondents were satisfied or very satisfied with all aspects of the program. Figure 4-6 displays survey respondents’ overall satisfaction with Rocky Mountain Power and the wattsmart Homes Program, as well as their satisfaction with specific aspects of their experience with the program.

Figure 4-6: Customer Satisfaction with Rocky Mountain Power’s HVAC and Appliance Incentive Program



#### 4.4.4 Home Characteristics

Respondents’ home characteristics are summarized in Table 4-10. Most participants reported living in a single-family home, with an almost equal distribution among mobile, detached and manufactured home type. Almost all of them (94%) reported owning their home. Electricity was the most common type of fuel used for heating homes (45%) and for fueling the homes’ main water heaters (64%). The average size of respondents’ homes was 1,794 square feet, and the average number of inhabitants was approximately 3 people.

Table 4-10: HVAC Participant Home Characteristics

Home Characteristics	Percentage of Respondents (n = 34)
Single Family, mobile home	36%
Single Family, detached from any other house	30%
Single Family, factory manufactured/modular	30%
Apartment	3%
<b>Own or Rent</b>	
Own	94%
Rent	6%
<b>Year Built</b>	
Before 1950	12%
1950 to 1959	3%
1960 to 1969	3%
1970 to 1979	9%
1980 to 1989	18%
1990 to 1999	6%
2000 to 2009	15%
2010 to 2018	24%
Don't know	9%
<b>What is the main fuel used for heating your</b>	
Electricity	45%
Natural Gas	33%
Propane	15%
Don't know	6%
<b>What fuel does your main water heater use?</b>	
Electricity	64%
Natural Gas	24%
Propane	6%
Don't know	6%
<b>What is your approximate household</b>	
\$10,000 to \$29,999	11%
\$30,000 to \$49,999	4%
\$50,000 to \$69,999	11%
\$70,000 to \$89,999	11%
\$150,000 or more	4%
Don't know	59%

## 5 Cost-Effectiveness

Rocky Mountain Power contracted with Navigant to calculate the Program cost-effectiveness based on the net savings evaluated by ADM. ADM also provided the measure life and incremental cost inputs needed to calculate the cost-effectiveness of the Program. Measure life and incremental cost values were assigned on an individual measure basis and were sourced from the TRL files provided by Rocky Mountain Power.

Table 5-1 provides the cost-effectiveness analysis inputs for each year, including evaluated net energy savings, discount rate, residential line loss, residential energy rate, inflation rate, and total utility costs and gross customer costs.

*Table 5-1: WY wattsmart Homes Program Cost-Effectiveness Inputs*

Parameter	2017	2018
Evaluated Net Savings (kWh/year)	2,266,868	3,380,586
Discount Rate	6.66%	6.57%
Residential Line Loss	9.51%	9.51%
Residential Energy Rate (\$/kWh)	\$0.1117	\$0.1088
Inflation Rate	1.90%	2.20%
Total Utility Costs	\$626,191	\$868,582
Gross Customer Costs	\$1,175,003	\$1,161,794

Table 5-2 shows the cost-effectiveness results for the overall program for the combination of program years 2017 and 2018, based on the evaluated net savings in Wyoming. The Wyoming wattsmart Homes Program was cost-effective during the combined 2017-2018 evaluation period, across all cost-effectiveness tests except for the TRC and RIM tests. The overall program achieved a 1.73 benefit/cost ratio for the combined years using the UCT.

*Table 5-2: 2017-2018 WY wattsmart Homes Program Level Cost-Effectiveness Results*

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0520	\$2,612,549	\$2,851,441	\$238,891	1.09
Total Resource Cost Test (TRC) No Adder	\$0.0520	\$2,612,549	\$2,592,219	-\$20,330	0.99
Utility Cost Test (UCT)	\$0.0298	\$1,494,772	\$2,592,219	\$1,097,447	1.73
Rate Impact Test (RIM)		\$7,416,634	\$2,592,219	-\$4,824,415	0.35
Participant Cost Test (PCT)		\$2,336,797	\$8,039,471	\$5,702,674	3.44
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000020234
Discounted Participant Payback (years)					2.72

Table 5-3 shows the Wyoming wattsmart Homes Program cost-effectiveness results for 2017 and Table 5-4 shows cost-effectiveness results for 2018, based on the evaluated net savings in Wyoming. The 2017 program passes the cost-effectiveness for all tests except the RIM test. The 2018 program passes the cost-effectiveness for the TRC, UCT, and PCT.

Table 5-3: 2017 WY wattsmart Homes Program Level Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0599	\$1,238,037	\$1,468,892	\$230,855	1.19
Total Resource Cost Test (TRC) No Adder	\$0.0599	\$1,238,037	\$1,335,356	\$97,319	1.08
Utility Cost Test (UCT)	\$0.0303	\$626,191	\$1,335,356	\$709,166	2.13
Rate Impact Test (RIM)		\$3,103,548	\$1,335,356	-\$1,768,192	0.43
Participant Cost Test (PCT)		\$1,175,003	\$3,442,481	\$2,267,478	2.93
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000015264				
Discounted Participant Payback (years)	3.68				

Table 5-4: 2018 WY wattsmart Homes Program Level Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0465	\$1,374,512	\$1,382,549	\$8,037	1.01
Total Resource Cost Test (TRC) No Adder	\$0.0465	\$1,374,512	\$1,256,863	-\$117,650	0.91
Utility Cost Test (UCT)	\$0.0294	\$868,582	\$1,256,863	\$388,281	1.45
Rate Impact Test (RIM)		\$4,313,086	\$1,256,863	-\$3,056,224	0.29
Participant Cost Test (PCT)		\$1,161,794	\$4,596,991	\$3,435,197	3.96
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000024929				
Discounted Participant Payback (years)	2.09				

Table 5-5 presents the benefit/cost ratio results for the Program for each cost-effectiveness test by program year.

Table 5-5: WY wattsmart Homes Program Benefit/Cost Ratios by Program Year

Program Year	PTRC	TRC	UCT	RIM	PCT
2017	1.19	1.08	2.13	0.43	2.93
2018	1.01	0.91	1.45	0.29	3.96
<b>2017-2018</b>	<b>1.09</b>	<b>0.99</b>	<b>1.73</b>	<b>0.35</b>	<b>3.44</b>

Navigant also completed cost-effectiveness tests at the measure-category level for each individual program year. The benefit/cost ratio results by measure-category are presented in Table 5-6 and Table 5-7, based on the evaluated net savings in Wyoming. Further information on the cost-effectiveness test results for each measure category is presented in Appendix D.

Table 5-6: Wyoming wattsmart Homes Program Benefit/Cost Ratios by Measure Category, 2017

Measure Group	PTRC	TRC	UCT	RIM	PCT
Appliances	0.62	0.56	0.57	0.27	2.84
Building Shell	1.12	1.02	1.08	0.35	5.88
Energy Kits - DHW	2.48	2.26	2.23	0.40	38.26
Energy Kits - Lighting	3.24	2.94	2.84	0.46	16.98
HVAC	0.92	0.83	0.75	0.30	5.80
Lighting	1.12	1.02	2.72	0.46	2.41
Water Heating	0.53	0.48	0.80	0.31	1.89
<b>Total</b>	<b>1.19</b>	<b>1.08</b>	<b>2.13</b>	<b>0.43</b>	<b>2.93</b>

Table 5-7: Wyoming wattsmart Homes Program Benefit/Cost Ratios by Measure Category, 2018

Measure Group	PTRC	TRC	UCT	RIM	PCT
Appliances	0.62	0.56	0.60	0.24	2.93
Building Shell	1.52	1.39	1.39	0.41	4.84
Electronics	0.30	0.27	0.28	0.14	3.50
Energy Kits - DHW	2.86	2.60	2.57	0.29	41.02
Energy Kits - Lighting	2.82	2.57	2.50	0.31	16.87
HVAC	1.68	1.53	1.50	0.41	7.78
Lighting	0.79	0.72	1.86	0.29	2.67
Water Heating	0.49	0.44	0.91	0.27	1.88
<b>Total</b>	<b>1.01</b>	<b>0.91</b>	<b>1.45</b>	<b>0.29</b>	<b>3.96</b>

## 6 Conclusions and Recommendations

The results from this evaluation study of Rocky Mountain Power’s 2017-2018 wattsmart Homes Program in Wyoming are summarized by measure category in Table 6-1:

*Table 6-1: Wyoming wattsmart Homes Program Claimed and Evaluated Savings by Measure Category, 2017-2018*

Year	Measure Category	Claimed Savings (kWh)	Evaluated Gross Savings (kWh/yr)	Realization Rate	Evaluated Net Savings (kWh/yr)	Net to Gross
2017-2018	Appliances	11,947	11,947	100%	9,564	80%
	Building Shell	157,649	157,649	100%	128,219	81%
	Electronics	579,312	579,312	100%	475,805	82%
	Energy Kits	1,923,468	1,545,762	80%	1,456,394	94%
	HVAC	356,161	356,161	100%	286,630	80%
	Lighting	6,236,772	4,332,865	69%	3,279,367	76%
	Water Heating	14,352	14,352	100%	11,476	80%
<b>2017-2018 TOTAL</b>		<b>9,279,661</b>	<b>6,998,048</b>	<b>75%</b>	<b>5,647,454</b>	<b>81%</b>

ADM provides the following conclusions and recommendations to improve the program and the evaluation of the program in future years.

- **Lighting Measure Category:**

Conclusion: ADM’s calculation of a 5.4% leakage rate for lighting in Wyoming is on the low end of leakage rates for lighting and is likely due to the effective or strategic placement of participating retailer locations. The implementation contractor has indicated that the Retail Sales Allocation Tool (RSAT) may be a predictor of bulb leakage in Rocky Mountain Power territories and is used to determine allocations of bulbs to participating stores.

Recommendation: To understand further how the RSAT tool accounts for leakage and how the store allocations relate to the Program Tracking Data, ADM recommends that the next evaluation of subsequent program years includes a full life-cycle review of the lighting contracts, including the participation agreements with the implementation contractor and a sample of all associated invoices. This would allow the evaluation to follow the life-cycle of the bulbs from the original agreement to final installation.

- **Energy Kits Measure Category:**

Conclusion: The ISR for the first showerhead was 68% and the second showerhead was 52%. Respondents to the Energy Kits survey who did not install showerheads indicated that they already had high-efficiency showerheads

installed (25%) or the showerhead provided did not integrate well with current plumbing (20%).

Recommendation: ADM recommends that Rocky Mountain Power consider including only one showerhead in the Best Kit – 2 Bath Energy Kits. Additionally, if not already done, Rocky Mountain Power could ask qualifying questions regarding showerheads during the energy kit request process.

- **Electronics Measure Category:**

Conclusion: The Advanced Power Strip (APS) measure was a new offering in 2018. The claimed savings value of 216 kWh/yr is based off a study that employed two methodologies, including simulation and post installation monitoring.

Recommendation: ADM recommends that if the APS measure is to be continued in subsequent program years and is expected to follow the participation trend from 2018, the next evaluation cycle includes primary data collection for this measure (e.g. installation rates and removal rates) that can be used to verify and supplement the previous completed studies.

## 7 Appendices

---

The following appendices accompany this Final Evaluation Report:

**APPENDIX A: Lighting Tables**

**APPENDIX B: Energy Kits Individual Component Savings Calculations**

**APPENDIX C: NTG Analysis Approaches**

**APPENDIX D: Measure Category Cost-Effectiveness Results**

## 7.1 Appendix A: Lighting Tables

Table 7-1: TRL Input Values and Engineering Calculation Ex-Ante UES Savings for 2017 WY Lighting Measures

Lighting Measures	Upgrade Wattage	Baseline Wattage	ΔWatts	ISR	HOU	IEF	Engineering Calculation Savings
CFL General Purpose - A-Lamp: 15 watts - Retail - WY	15	43	28	0.72	2.18	0.91	14.62
CFL General Purpose - A-Lamp: 9 watts - Retail - WY	9	29	20	0.72	2.18	0.91	10.45
CFL General Purpose - Spiral: 10 watts - Retail - WY	10	29	19	0.72	2.18	0.91	9.92
CFL General Purpose - Spiral: 13 watts - Retail - WY	13	43	30	0.72	2.18	0.91	15.67
CFL General Purpose - Spiral: 14 watts - Retail - WY	14	43	29	0.72	2.18	0.91	15.15
CFL General Purpose - Spiral: 19 watts - Retail - WY	19	53	34	0.72	2.18	0.91	17.76
CFL General Purpose - Spiral: 23 watts - Retail - WY	23	72	49	0.72	2.18	0.91	25.59
CFL General Purpose - Spiral: 9 watts - Retail - WY	9	29	20	0.72	2.18	0.91	10.45
CFL Specialty - Daylight: 13 watts - Retail - WY	13	40	27	0.72	2.18	0.91	14.10
CFL Specialty - Daylight: 14 watts - Retail - WY	14	43	29	0.72	2.18	0.91	15.15
CFL Specialty - Daylight: 22 watts - Retail - WY	22	72	50	0.72	2.18	0.91	26.11
LED Downlight: 10 watts - Retail - WY	10	65	55	1.00	2.18	0.91	39.68
LED Downlight: 11 watts - Retail - WY	11	65	54	1.00	2.18	0.91	38.96
LED Downlight: 12 watts - Retail - WY	12	65	53	1.00	2.18	0.91	38.23
LED Downlight: 13 watts - Retail - WY	13	65	52	1.00	2.18	0.91	37.51
LED Downlight: 14 watts - Retail - WY	14	65	51	1.00	2.18	0.91	36.79
LED Downlight: 15 watts - Retail - WY	15	65	50	1.00	2.18	0.91	36.07
LED Downlight: 16 watts - Retail - WY	16	75	59	1.00	2.18	0.91	42.56
LED Downlight: 17 watts - Retail - WY	17	75	58	1.00	2.18	0.91	41.84
LED Downlight: 18 watts - Retail - WY	18	75	57	1.00	2.18	0.91	41.12
LED Downlight: 6 watts - Retail - WY	6	30	24	1.00	2.18	0.91	17.31
LED Downlight: 7 watts - Retail - WY	7	30	23	1.00	2.18	0.91	16.59
LED Downlight: 8 watts - Retail - WY	8	45	37	1.00	2.18	0.91	26.69
LED Downlight: 9 watts - Retail - WY	9	45	36	1	2.18	0.91	25.97
LED Fixture - ENERGY STAR - WY	-	-	41	1	2.18	0.91	29.58
LED General: 10 watts - Retail - WY	10	43	33	1	2.18	0.91	23.81
LED General: 11 watts - Retail - WY	11	43	32	1	2.18	0.91	23.08
LED General: 12 watts - Retail - WY	12	43	31	1	2.18	0.91	22.36
LED General: 14 watts - Retail - WY	14	43	29	1	2.18	0.91	20.92
LED General: 15 watts - Retail - WY	15	43	28	1	2.18	0.91	20.20
LED General: 16 watts - Retail - WY	16	53	37	1	2.18	0.91	26.69
LED General: 17 watts - Retail - WY	17	53	36	1	2.18	0.91	25.97
LED General: 18 watts - Retail - WY	18	72	54	1	2.18	0.91	38.96
LED General: 6 watts - Retail - WY	6	29	23	1	2.18	0.91	16.59
LED General: 7 watts - Retail - WY	7	29	22	1	2.18	0.91	15.87
LED General: 8 watts - Retail - WY	8	29	21	1	2.18	0.91	15.15
LED General: 9 watts - Retail - WY	9	29	20	1	2.18	0.91	14.43
LED Specialty - 3-Way: 3,8,18 watts - Retail - WY	8	60	52	1	2.18	0.91	37.51
LED Specialty - Candelabra: 4 watts - Retail - WY	4	25	21	1	2.18	0.91	15.15
LED Specialty - Candelabra: 5 watts - Retail - WY	5	40	35	1	2.18	0.91	25.25
LED Specialty - Candelabra: 7 watts - Retail - WY	7	40	33	1	2.18	0.91	23.81
LED Specialty - Globe: 4 watts - Retail - WY	4	20	16	1	2.18	0.91	11.54
LED Specialty - Globe: 5 watts - Retail - WY	5	20	15	1	2.18	0.91	10.82
LED Specialty - Globe: 6 watts - Retail - WY	6	40	34	1	2.18	0.91	24.53

Table 7-2: 2017 Wyoming Homes Energy Savings Program Claimed and Evaluated Gross Lighting Savings

Lighting Measures	Reported Savings (kWh)	Evaluated Gross Savings (kWh)	Realization Rate
CFL General Purpose - A-Lamp: 15 watts - Retail - WY	44	42	94.7%
CFL General Purpose - A-Lamp: 9 watts - Retail - WY	167	158	94.7%
CFL General Purpose - Spiral: 10 watts - Retail - WY	327	310	94.6%
CFL General Purpose - Spiral: 13 watts - Retail - WY	877	830	94.7%
CFL General Purpose - Spiral: 14 watts - Retail - WY	4,058	3,840	94.7%
CFL General Purpose - Spiral: 19 watts - Retail - WY	1,704	1,613	94.7%
CFL General Purpose - Spiral: 23 watts - Retail - WY	6,035	5,714	94.7%
CFL General Purpose - Spiral: 9 watts - Retail - WY	1,044	988	94.7%
CFL Specialty - Daylight: 13 watts - Retail - WY	1,184	1,121	94.7%
CFL Specialty - Daylight: 14 watts - Retail - WY	121	115	94.7%
CFL Specialty - Daylight: 22 watts - Retail - WY	1,044	988	94.7%
LED Downlight: 10 watts - Retail - WY	107,174	73,462	68.5%
LED Downlight: 11 watts - Retail - WY	330,282	226,385	68.5%
LED Downlight: 12 watts - Retail - WY	2,942	2,017	68.5%
LED Downlight: 13 watts - Retail - WY	12,147	8,325	68.5%
LED Downlight: 14 watts - Retail - WY	45,448	31,149	68.5%
LED Downlight: 15 watts - Retail - WY	13,735	9,413	68.5%
LED Downlight: 16 watts - Retail - WY	1,914	1,312	68.6%
LED Downlight: 17 watts - Retail - WY	7,108	4,872	68.5%
LED Downlight: 18 watts - Retail - WY	7,314	5,014	68.5%
LED Downlight: 6 watts - Retail - WY	3,841	2,633	68.6%
LED Downlight: 7 watts - Retail - WY	40,505	27,765	68.5%
LED Downlight: 8 watts - Retail - WY	39,365	26,986	68.6%
LED Downlight: 9 watts - Retail - WY	27,715	18,999	68.6%
LED Fixture - ENERGY STAR - WY	18,791	12,158	64.7%
LED General: 10 watts - Retail - WY	1,371,256	939,921	68.5%
LED General: 11 watts - Retail - WY	47,870	32,811	68.5%
LED General: 12 watts - Retail - WY	27,334	18,734	68.5%
LED General: 14 watts - Retail - WY	1,025	702	68.5%
LED General: 15 watts - Retail - WY	40,097	27,478	68.5%
LED General: 16 watts - Retail - WY	7,228	4,955	68.6%
LED General: 17 watts - Retail - WY	3,348	2,295	68.6%
LED General: 18 watts - Retail - WY	3,854	2,642	68.5%
LED General: 6 watts - Retail - WY	72,620	49,780	68.5%
LED General: 7 watts - Retail - WY	42,854	29,374	68.5%
LED General: 8 watts - Retail - WY	1,453	996	68.5%
LED General: 9 watts - Retail - WY	831,198	569,669	68.5%
LED Specialty - 3-Way: 3,8,18 watts - Retail - WY	5,324	3,649	68.5%
LED Specialty - Candelabra: 4 watts - Retail - WY	35,503	24,334	68.5%
LED Specialty - Candelabra: 5 watts - Retail - WY	35,347	24,230	68.5%
LED Specialty - Candelabra: 7 watts - Retail - WY	38,421	26,335	68.5%
LED Specialty - Globe: 4 watts - Retail - WY	657	451	68.6%
LED Specialty - Globe: 5 watts - Retail - WY	16,085	11,029	68.6%
LED Specialty - Globe: 6 watts - Retail - WY	6,422	4,402	68.5%
<b>TOTAL</b>	<b>3,262,779</b>	<b>2,239,998</b>	<b>68.7%</b>

Table 7-3: 2018 Wyoming Homes Energy Savings Program Claimed and Evaluated Gross Lighting Savings, prior to new TRL version

Lighting Measures	Reported Savings (kWh)	Evaluated Gross Savings (kWh)	Realization Rate
LED Downlight: 10 watts - Retail - WY	94,010	64,439	68.5%
LED Downlight: 11 watts - Retail - WY	358,974	246,051	68.5%
LED Downlight: 12 watts - Retail - WY	13,144	9,009	68.5%
LED Downlight: 13 watts - Retail - WY	43,151	29,576	68.5%
LED Downlight: 14 watts - Retail - WY	52,581	36,038	68.5%
LED Downlight: 15 watts - Retail - WY	6,020	4,126	68.5%
LED Downlight: 16 watts - Retail - WY	6,294	4,315	68.6%
LED Downlight: 17 watts - Retail - WY	711	487	68.5%
LED Downlight: 18 watts - Retail - WY	6,985	4,788	68.5%
LED Downlight: 19 watts - Retail - WY	5,571	3,819	68.5%
LED Downlight: 23 watts - Retail - WY	1,739	1,192	68.5%
LED Downlight: 5 watts - Retail - WY	50	35	68.5%
LED Downlight: 6 watts - Retail - WY	3,045	2,087	68.6%
LED Downlight: 7 watts - Retail - WY	47,369	32,471	68.5%
LED Downlight: 8 watts - Retail - WY	30,350	20,806	68.6%
LED Downlight: 9 watts - Retail - WY	13,546	9,286	68.6%
LED Fixture - ENERGY STAR - WY	1,109	717	64.7%
LED General Purpose: 10.5 watts - Retail - WY	10,363	7,420	71.6%
LED General: 10 watts - Retail - WY	607,002	416,067	68.5%
LED General: 11 watts - Retail - WY	53,246	36,496	68.5%
LED General: 12 watts - Retail - WY	34,218	23,453	68.5%
LED General: 13 watts - Retail - WY	1,903	1,261	66.3%
LED General: 15 watts - Retail - WY	26,287	18,015	68.5%
LED General: 16 watts - Retail - WY	16,082	11,025	68.6%
LED General: 17 watts - Retail - WY	4,334	2,971	68.6%
LED General: 18 watts - Retail - WY	2,180	1,494	68.5%
LED General: 6 watts - Retail - WY	50,718	34,766	68.5%
LED General: 7 watts - Retail - WY	166,720	114,278	68.5%
LED General: 8 watts - Retail - WY	52,672	36,102	68.5%
LED General: 9 watts - Retail - WY	620,882	425,527	68.5%
LED Specialty - Candelabra: 3 watts - Retail - WY	143	98	68.5%
LED Specialty - Candelabra: 4 watts - Retail - WY	46,964	32,190	68.5%
LED Specialty - Candelabra: 5 watts - Retail - WY	34,187	23,435	68.5%
LED Specialty - Candelabra: 7 watts - Retail - WY	14,893	10,208	68.5%
LED Specialty - Globe: 4 watts - Retail - WY	11,265	7,724	68.6%
LED Specialty - Globe: 5 watts - Retail - WY	11,145	7,642	68.6%
LED Specialty - Globe: 6 watts - Retail - WY	25,270	17,322	68.5%
<b>TOTAL</b>	<b>2,475,123</b>	<b>1,696,734</b>	<b>68.6%</b>

Table 7-4: 2018 Wyoming Homes Energy Savings Program Claimed and Evaluated Gross Lighting Savings, post new TRL version

Lighting Measures	Reported Savings (kWh)	Evaluated Gross Savings (kWh)	Realization Rate
LED Downlight: 10 watts - Retail - WY	12,982	10,311	79.4%
LED Downlight: 11 watts - Retail - WY	51,880	41,203	79.4%
LED Downlight: 12 watts - Retail - WY	7,023	5,578	79.4%
LED Downlight: 13 watts - Retail - WY	9,439	7,496	79.4%
LED Downlight: 14 watts - Retail - WY	10,560	8,387	79.4%
LED Downlight: 15 watts - Retail - WY	552	439	79.4%
LED Downlight: 16 watts - Retail - WY	2,484	1,973	79.4%
LED Downlight: 18 watts - Retail - WY	3,698	2,937	79.4%
LED Downlight: 19 watts - Retail - WY	1,778	1,412	79.4%
LED Downlight: 23 watts - Retail - WY	324	257	79.4%
LED Downlight: 5 watts - Retail - WY	145	115	79.4%
LED Downlight: 6 watts - Retail - WY	99	79	79.4%
LED Downlight: 7 watts - Retail - WY	7,003	5,560	79.4%
LED Downlight: 8 watts - Retail - WY	23,573	18,720	79.4%
LED Downlight: 9 watts - Retail - WY	3,529	2,802	79.4%
LED General Purpose: 10 watts - Retail - WY	92,168	73,187	79.4%
LED General Purpose: 11 watts - Retail - WY	31,169	24,750	79.4%
LED General Purpose: 12 watts - Retail - WY	5,821	4,622	79.4%
LED General Purpose: 13 watts - Retail - WY	1,284	1,020	79.4%
LED General Purpose: 15 watts - Retail - WY	6,070	4,819	79.4%
LED General Purpose: 16 watts - Retail - WY	19,155	15,211	79.4%
LED General Purpose: 17 watts - Retail - WY	3,181	2,526	79.4%
LED General Purpose: 18 watts - Retail - WY	820	651	79.4%
LED General Purpose: 6 watts - Retail - WY	20,517	16,289	79.4%
LED General Purpose: 7 watts - Retail - WY	18,140	14,411	79.4%
LED General Purpose: 8 watts - Retail - WY	17,736	14,089	79.4%
LED General Purpose: 9 watts - Retail - WY	106,370	84,501	79.4%
LED Specialty - 3-Way: 3,8,18 watts - Retail - WY	1,912	1,454	76.0%
LED Specialty - Candelabra: 3 watts - Retail - WY	197	157	79.4%
LED Specialty - Candelabra: 4 watts - Retail - WY	12,012	9,543	79.4%
LED Specialty - Candelabra: 5 watts - Retail - WY	16,960	13,468	79.4%
LED Specialty - Globe: 4 watts - Retail - WY	2,109	1,675	79.4%
LED Specialty - Globe: 5 watts - Retail - WY	2,546	2,023	79.4%
LED Specialty - Globe: 6 watts - Retail - WY	5,633	4,473	79.4%
<b>TOTAL</b>	<b>498,869</b>	<b>396,133</b>	<b>79.4%</b>

Table 7-5: 2017 Wyoming wattsmart Homes Program Net Lighting Savings and NTG

Lighting Measures	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	NTG
CFL General Purpose - A-Lamp: 15 watts - Retail - WY	42	31	75.6%
CFL General Purpose - A-Lamp: 9 watts - Retail - WY	158	120	75.6%
CFL General Purpose - Spiral: 10 watts - Retail - WY	310	234	75.6%
CFL General Purpose - Spiral: 13 watts - Retail - WY	830	628	75.6%
CFL General Purpose - Spiral: 14 watts - Retail - WY	3,840	2,904	75.6%
CFL General Purpose - Spiral: 19 watts - Retail - WY	1,613	1,220	75.6%
CFL General Purpose - Spiral: 23 watts - Retail - WY	5,714	4,321	75.6%
CFL General Purpose - Spiral: 9 watts - Retail - WY	988	747	75.6%
CFL Specialty - Daylight: 13 watts - Retail - WY	1,121	848	75.6%
CFL Specialty - Daylight: 14 watts - Retail - WY	115	87	75.6%
CFL Specialty - Daylight: 22 watts - Retail - WY	988	747	75.6%
LED Downlight: 10 watts - Retail - WY	73,462	55,556	75.6%
LED Downlight: 11 watts - Retail - WY	226,385	171,205	75.6%
LED Downlight: 12 watts - Retail - WY	2,017	1,525	75.6%
LED Downlight: 13 watts - Retail - WY	8,325	6,296	75.6%
LED Downlight: 14 watts - Retail - WY	31,149	23,557	75.6%
LED Downlight: 15 watts - Retail - WY	9,413	7,119	75.6%
LED Downlight: 16 watts - Retail - WY	1,312	992	75.6%
LED Downlight: 17 watts - Retail - WY	4,872	3,685	75.6%
LED Downlight: 18 watts - Retail - WY	5,014	3,792	75.6%
LED Downlight: 6 watts - Retail - WY	2,633	1,991	75.6%
LED Downlight: 7 watts - Retail - WY	27,765	20,998	75.6%
LED Downlight: 8 watts - Retail - WY	26,986	20,408	75.6%
LED Downlight: 9 watts - Retail - WY	18,999	14,368	75.6%
LED Fixture - ENERGY STAR - WY	12,158	11,661	95.9%
LED General: 10 watts - Retail - WY	939,921	710,821	75.6%
LED General: 11 watts - Retail - WY	32,811	24,814	75.6%
LED General: 12 watts - Retail - WY	18,734	14,168	75.6%
LED General: 14 watts - Retail - WY	702	531	75.6%
LED General: 15 watts - Retail - WY	27,478	20,781	75.6%
LED General: 16 watts - Retail - WY	4,955	3,747	75.6%
LED General: 17 watts - Retail - WY	2,295	1,735	75.6%
LED General: 18 watts - Retail - WY	2,642	1,998	75.6%
LED General: 6 watts - Retail - WY	49,780	37,646	75.6%
LED General: 7 watts - Retail - WY	29,374	22,214	75.6%
LED General: 8 watts - Retail - WY	996	753	75.6%
LED General: 9 watts - Retail - WY	569,669	430,816	75.6%
LED Specialty - 3-Way: 3,8,18 watts - Retail - WY	3,649	2,759	75.6%
LED Specialty - Candelabra: 4 watts - Retail - WY	24,334	18,403	75.6%
LED Specialty - Candelabra: 5 watts - Retail - WY	24,230	18,324	75.6%
LED Specialty - Candelabra: 7 watts - Retail - WY	26,335	19,916	75.6%
LED Specialty - Globe: 4 watts - Retail - WY	451	341	75.6%
LED Specialty - Globe: 5 watts - Retail - WY	11,029	8,341	75.6%
LED Specialty - Globe: 6 watts - Retail - WY	4,402	3,329	75.6%
<b>TOTAL</b>	<b>2,239,998</b>	<b>1,696,478</b>	<b>75.7%</b>

Table 7-6: 2018 Wyoming wattsmart Homes Program Net Lighting Savings and NTG, prior to new TRL version

Lighting Measures	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	NTG
LED Downlight: 10 watts - Retail - WY	64,439	48,732	75.6%
LED Downlight: 11 watts - Retail - WY	246,051	186,078	75.6%
LED Downlight: 12 watts - Retail - WY	9,009	6,813	75.6%
LED Downlight: 13 watts - Retail - WY	29,576	22,367	75.6%
LED Downlight: 14 watts - Retail - WY	36,038	27,254	75.6%
LED Downlight: 15 watts - Retail - WY	4,126	3,120	75.6%
LED Downlight: 16 watts - Retail - WY	4,315	3,263	75.6%
LED Downlight: 17 watts - Retail - WY	487	368	75.6%
LED Downlight: 18 watts - Retail - WY	4,788	3,621	75.6%
LED Downlight: 19 watts - Retail - WY	3,819	2,888	75.6%
LED Downlight: 23 watts - Retail - WY	1,192	901	75.6%
LED Downlight: 5 watts - Retail - WY	35	26	75.6%
LED Downlight: 6 watts - Retail - WY	2,087	1,579	75.6%
LED Downlight: 7 watts - Retail - WY	32,471	24,556	75.6%
LED Downlight: 8 watts - Retail - WY	20,806	15,735	75.6%
LED Downlight: 9 watts - Retail - WY	9,286	7,023	75.6%
LED Fixture - ENERGY STAR - WY	717	688	95.9%
LED General Purpose: 10.5 watts - Retail - WY	7,420	5,611	75.6%
LED General: 10 watts - Retail - WY	416,067	314,653	75.6%
LED General: 11 watts - Retail - WY	36,496	27,600	75.6%
LED General: 12 watts - Retail - WY	23,453	17,736	75.6%
LED General: 13 watts - Retail - WY	1,261	954	75.6%
LED General: 15 watts - Retail - WY	18,015	13,624	75.6%
LED General: 16 watts - Retail - WY	11,025	8,338	75.6%
LED General: 17 watts - Retail - WY	2,971	2,247	75.6%
LED General: 18 watts - Retail - WY	1,494	1,130	75.6%
LED General: 6 watts - Retail - WY	34,766	26,292	75.6%
LED General: 7 watts - Retail - WY	114,278	86,423	75.6%
LED General: 8 watts - Retail - WY	36,102	27,302	75.6%
LED General: 9 watts - Retail - WY	425,527	321,808	75.6%
LED Specialty - Candelabra: 3 watts - Retail - WY	98	74	75.6%
LED Specialty - Candelabra: 4 watts - Retail - WY	32,190	24,344	75.6%
LED Specialty - Candelabra: 5 watts - Retail - WY	23,435	17,723	75.6%
LED Specialty - Candelabra: 7 watts - Retail - WY	10,208	7,720	75.6%
LED Specialty - Globe: 4 watts - Retail - WY	7,724	5,842	75.6%
LED Specialty - Globe: 5 watts - Retail - WY	7,642	5,779	75.6%
LED Specialty - Globe: 6 watts - Retail - WY	17,322	13,100	75.6%
<b>TOTAL</b>	<b>1,696,734</b>	<b>1,283,311</b>	<b>75.6%</b>

Table 7-7: 2018 Wyoming wattsmart Homes Program Net Lighting Savings and NTG, post new TRL version

Lighting Measures	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	NTG
LED Downlight: 10 watts - Retail - WY	10,311	7,797	75.6%
LED Downlight: 11 watts - Retail - WY	41,203	31,160	75.6%
LED Downlight: 12 watts - Retail - WY	5,578	4,218	75.6%
LED Downlight: 13 watts - Retail - WY	7,496	5,669	75.6%
LED Downlight: 14 watts - Retail - WY	8,387	6,342	75.6%
LED Downlight: 15 watts - Retail - WY	439	332	75.6%
LED Downlight: 16 watts - Retail - WY	1,973	1,492	75.6%
LED Downlight: 18 watts - Retail - WY	2,937	2,221	75.6%
LED Downlight: 19 watts - Retail - WY	1,412	1,068	75.6%
LED Downlight: 23 watts - Retail - WY	257	194	75.6%
LED Downlight: 5 watts - Retail - WY	115	87	75.6%
LED Downlight: 6 watts - Retail - WY	79	60	75.6%
LED Downlight: 7 watts - Retail - WY	5,560	4,205	75.6%
LED Downlight: 8 watts - Retail - WY	18,720	14,157	75.6%
LED Downlight: 9 watts - Retail - WY	2,802	2,119	75.6%
LED General Purpose: 10 watts - Retail - WY	73,187	55,348	75.6%
LED General Purpose: 11 watts - Retail - WY	24,750	18,717	75.6%
LED General Purpose: 12 watts - Retail - WY	4,622	3,495	75.6%
LED General Purpose: 13 watts - Retail - WY	1,020	771	75.6%
LED General Purpose: 15 watts - Retail - WY	4,819	3,645	75.6%
LED General Purpose: 16 watts - Retail - WY	15,211	11,503	75.6%
LED General Purpose: 17 watts - Retail - WY	2,526	1,910	75.6%
LED General Purpose: 18 watts - Retail - WY	651	492	75.6%
LED General Purpose: 6 watts - Retail - WY	16,289	12,318	75.6%
LED General Purpose: 7 watts - Retail - WY	14,411	10,898	75.6%
LED General Purpose: 8 watts - Retail - WY	14,089	10,655	75.6%
LED General Purpose: 9 watts - Retail - WY	84,501	63,905	75.6%
LED Specialty - 3-Way: 3,8,18 watts - Retail - WY	1,454	1,099	75.6%
LED Specialty - Candelabra: 3 watts - Retail - WY	157	119	75.6%
LED Specialty - Candelabra: 4 watts - Retail - WY	9,543	7,217	75.6%
LED Specialty - Candelabra: 5 watts - Retail - WY	13,468	10,185	75.6%
LED Specialty - Globe: 4 watts - Retail - WY	1,675	1,267	75.6%
LED Specialty - Globe: 5 watts - Retail - WY	2,023	1,530	75.6%
LED Specialty - Globe: 6 watts - Retail - WY	4,473	3,383	75.6%
<b>TOTAL</b>	<b>396,133</b>	<b>299,578</b>	<b>75.6%</b>

**7.2 Appendix B: Energy Kits Individual Component Savings Calculations**

*Table 7-8: Energy Kits Individual Component Savings Calculation Inputs, Aerators*

Energy Kit Component	Input to Savings Calculation	Input Value for Evaluated Savings	Source for Evaluated Savings Calculation
Kitchen Aerator	In-Service Rate (%)	55%	ADM Energy Kits surveys
	Average Baseline Flow Rate (GPM)	2.2	Federal rated max flow rate
	Average Post Measure Flow Rate (GPM)	1.5	Program materials
	Average time of hot water usage per person per day (minutes)	1.8073	Aerators_v1_1
	Average number of persons per household (state-specific values)	2.59	Aerators_v1_1
	Average temperature differential between hot and cold water (degrees)	75	Aerators_v1_1
	Unit Conversion (BTU/gallon)	8.345	N/A
	Unit Conversion (BTU/kWh)	3,412.14	N/A
	Fraction of Homes with Electric Water Heaters (%)	32%	Wyoming Aerator TRL
	Efficiency of Electric Water Heaters (%)	100%	Aerators_v1_1
	Average number of faucets in the home	1.06	Aerators_v1_1
Bathroom Aerator	In-Service Rate (%)	69%	ADM Energy Kits surveys
	Average Baseline Flow Rate (GPM)	2.2	Federal rated max flow rate
	Average Post Measure Flow Rate (GPM)	0.5	Program materials
	Average time of hot water usage per person per day (minutes)	1.2936	Aerators_v1_1
	Average number of persons per household (state-specific values)	2.59	Aerators_v1_1
	Average temperature differential between hot and cold water (degrees)	75	Aerators_v1_1
	Unit Conversion (BTU/gallon)	8.345	N/A
	Unit Conversion (BTU/kWh)	3,412.14	N/A
	Fraction of Homes with Electric Water Heaters (%)	32%	Aerators_v1_1
	Efficiency of Electric Water Heaters (%)	100%	Wyoming Aerator TRL
	Average number of faucets in the home	2.16	Aerators_v1_1

Table 7-9: Energy Kits Individual Component Savings Calculation Inputs, Showerheads

Energy Kit Component	Input to Savings Calculation	Input Value for Evaluated Savings	Source for Evaluated Savings Calculation
Showerhead	In-Service Rate (%)	60%	ADM Energy Kits surveys
	Average Baseline Flow Rate (GPM)	2.2	Federal rated max flow rate
	Average Post Measure Flow Rate (GPM)	1.35	Program materials
	Average gallons of hot water usage per person per day	7.76	ResShowerheads_v3.0
	Average number of persons per household (state-specific values)	2.37	ResShowerheads_v3.0
	Average temperature differential between hot and cold water	75	ResShowerheads_v3.0
	Unit Conversion (BTU/gallon)	8.345	N/A
	Unit Conversion (BTU/kWh)	3,412.14	N/A
	Fraction of Homes with Electric Water Heaters (%)	62.0%	ResShowerheads_v3.0
	Efficiency of Electric Water Heaters	100%	ResShowerheads_v3.0
	Average number of showers in the home	1.78	ResShowerheads_v3.0

## 7.3 Appendix C: NTG Analysis Approaches

---

### 7.3.1 General Population Survey and Lighting NTG Methodology

Rocky Mountain Power customers were surveyed by ADM through the General Population survey to determine a program attribution estimation for the NTG calculation. The attribution scoring system for this survey is broken down into two components: free-ridership score and non-participant spillover score. Each component is described individually in the subsequent subsections.

An objective of the net-to-gross analysis is to estimate the share of program activity that would have occurred in the absence of the program. To accomplish this, the Evaluators administered survey questions to program participants that contained questions regarding the participants' plans to implement the lighting measures and the likelihood of implementing those measures had they not been provided through the program.

#### 7.3.1.1 Freeridership

First, the percentage of light types replaced was found by using the question:

*Did the [LED BULB/LED FIXTURE] replace traditional incandescent, old LED, some other type of bulb/fixture, or a combination? Please provide an estimate of the number of LED light bulbs that replaced each bulb type.*

Each light type was divided by the total number reported replaced.

The importance score was calculated by averaging the responses to this question:

*How important was the discount on your decision to purchase [LED BULBS/LED FIXTURES] at [STORE NAME]?*

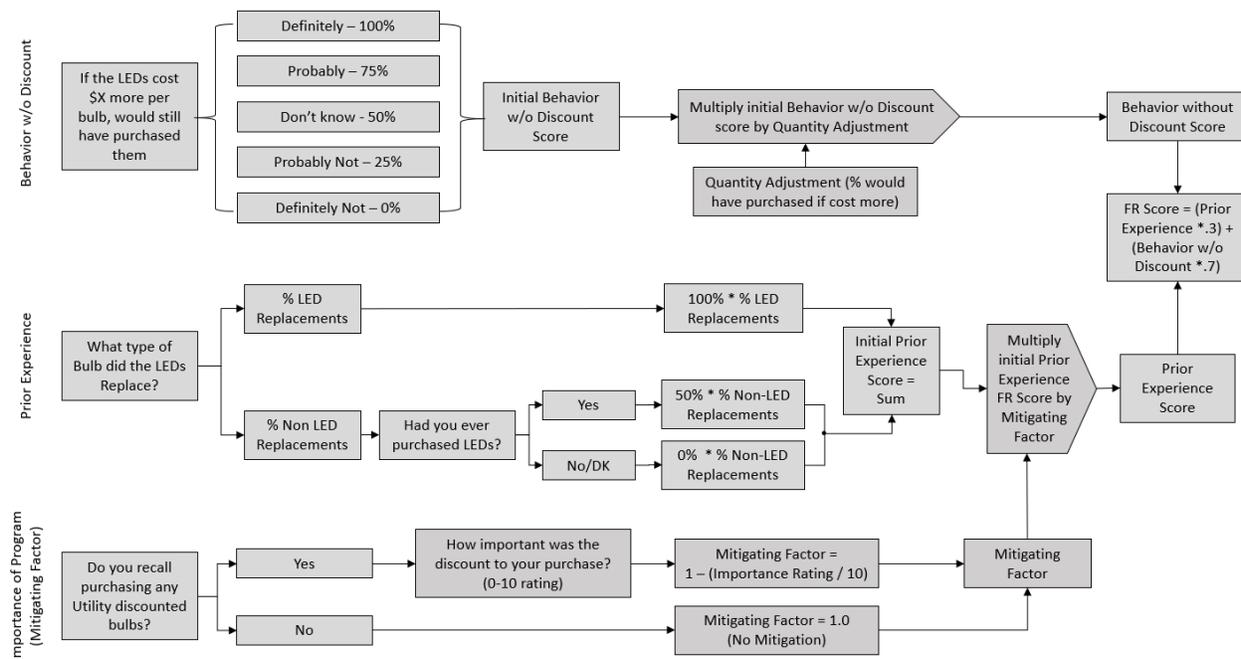
The total LED bulbs was calculated using the following questions:

*How many of those [LED Bulbs/LED Fixtures] would you estimate you installed within one week of purchase?*

*How many of those [LED Bulbs/LED Fixtures] did you save to install at a later date?*

*Approximately how many do you have left?*

Figure 7-1: Freeridership Methodology for Lighting



### 7.3.1.2 Spillover

Rocky Mountain Power customers may implement additional energy saving measures without receiving a program incentive because of their participation in the lighting program or because of the utility’s general and program marketing efforts. In both cases, the energy savings resulting from these additional measures constitute program non-participant spillover effects.

To assess non-participant spillover savings, survey respondents were asked whether they implemented any additional energy saving measures for which they did not receive a program incentive. Respondents were also asked to provide information on the attributes of the measures implemented for use in estimating the associated energy savings.

Participants who report implementing one or more efficiency measures are then asked two questions for use in developing a spillover score:

SO1: On a scale of 1 to 5, where 1 represents “not important” and 5 represents “very important”, how important was your experience with the wattsmart program (if a lighting participant) or how important were sources of information such as emails from the utility, television or radio advertisements, information on the utility’s website, bill inserts, or information from friends or family (if not a lighting participant) in your decision to purchase the items you just mentioned?

SO2: On a scale of 1 to 5, where 1 represents “very unlikely” and 5 represents “very likely” how likely would you have been to make the additional purchases you just mentioned even if you had not participated in the wattsmart program (if a lighting participant) or even if you had not received that information (if not a lighting participant)?

The response to these questions were used to develop a spillover score as follows:

Spillover = Average (SO1, 5 – SO2)

All of the associated measure savings were considered attributable to the program if the resulting score was equal or greater than 4.

### **7.3.2 Energy Kit Survey and NTG Methodology**

Rocky Mountain Power customers who receive energy kits through the wattsmart Homes Program were surveyed by ADM to determine a program attribution estimation for the NTG calculation. The attribution scoring system is broken down into two components: free-ridership score and spillover score. Each component is described individually in the subsequent subsection, followed by a paragraph discussing how the scores will be weighted to extrapolate the survey results to the program level.

The objective of the net-to-gross analysis is to estimate the share of program activity that would have occurred in the absence of the program. To accomplish this, the Evaluators administered a survey to program participants that contained questions regarding the participants’ plans to implement the energy kit items and the likelihood of implementing those measures had they not been provided through the program. Program participants were asked questions regarding:

- Whether they had plans to purchase and install the energy kit item;
- When would they have implemented the energy kit item in the absence of the program;
- The likelihood of purchasing and installing the energy kit item had they not received it for free.

Participant responses to these questions will be used to calculate two scores corresponding to the presence of prior plans and the likelihood of installing the items in the absence of the program.

#### *7.3.2.1 Prior Plans Score*

The prior plans score was calculated as follows:

- Respondents who indicated that they did not have plans to install the energy kit item were scored as 0.
- Respondents who indicated that they did have plans to install the energy kit item were scored as 1.

This score is adjusted based on the timing of the planned installation. The timing adjustment is based on when they will have likely installed the items. For respondents that say they would have likely installed the items immediately, no timing adjustment is made. Respondents who indicate that they would have likely installed the item within 6 months, the plans score is multiplied by 0.5. For those that would install after 6 months, the plan score is set to 0.

#### *7.3.2.2 Likelihood of Project Completion Score*

The score reflecting the likelihood of completing the project in the absence of the program was based on the following question:

- Using a scale where 1 is “very unlikely” and 5 is “very likely” how likely is it that you would have purchased and installed one of the below items had it not been in your energy kit?

A score was assigned to each response for this question as follows:

- Very likely: 1
- Slightly likely: 0.75
- Either: 0.5
- Slightly unlikely: 0.25
- Very unlikely: 0

#### *7.3.2.3 Final Freeridership Score*

The final free ridership score is equal to the following:

Free Ridership = Average (Plans Score, Likelihood Score) \* Previous experience adjustment

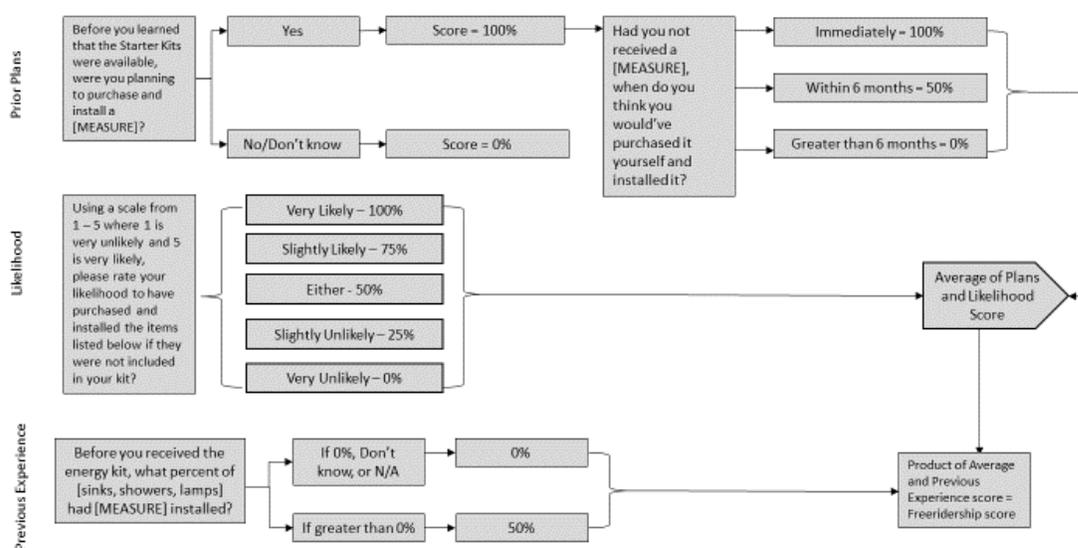
The previous experience adjustment was based on a question about whether the respondent had similar items currently installed in the home. The freeridership score for those that answer zero percent, “Not Applicable” or “Don’t know” to this question was multiplied by 0. The freeridership score for those that answer greater than zero percent to this question was multiplied by 0.5.

The free ridership questions are arranged as follows:

1. Indicator one: prior planning
2. Indicator two: stated likelihood in absence of program incentives
3. Mitigating factor one: reported prior experience with energy conservation measure

How these questions work together to determine a measure level free ridership score is displayed in Figure 7-2 on the following page. Note that the scoring algorithm requires the respondent to indicate a “burden of proof” that they are a free rider. They must state that either 1) they had prior plans to install the measure or 2) they would have likely installed the measure in the absence of the program.

Figure 7-2: Freeridership Methodology for wattsmart Energy Kit Program



### 7.3.2.4 Methodology for Estimating Spillover

Program participants may implement additional energy saving measures without receiving a program incentive because of their participation in the program. The energy savings resulting from these additional measures constitute program participant spillover effects.

To assess participant spillover savings, survey respondents were asked whether they implemented any additional energy saving measures for which they did not receive a program incentive. Respondents were also asked to provide information on the attributes of the measures implemented for use in estimating the associated energy savings.

Participants who report implementing on one or more efficiency measures are then asked two questions for use in developing a spillover score:

SO1: On a scale of 1 to 5, where 1 represents “not important” and 5 represents “very important”, how important was your experience with *wattsmart* in your decision to purchase the items you just mentioned?

SO2: On a scale of 1 to 5, where 1 represents “very unlikely” and 5 represents “very likely” how likely would you have been to make the additional purchases you just mentioned even if you had not participated in the *wattsmart* program?

The response to these questions were used to develop a spillover score as follows:

Spillover = Average(SO1, 5 – SO2)

All of the associated measure savings were considered attributable to the program if the resulting score was equal or greater than 3.

#### *7.3.2.5 Determination of Program Level NTG*

The free ridership scores for each respondent will be weighted by the ex-ante kWh savings per energy kit type to determine the final weighted average free-ridership estimate per customer in the sample. This estimate will be applied to the program level verified gross savings to determine net savings.

### **7.3.3 HVAC Survey and NTG Methodology**

The following section presents the methodology that was used for estimating the net energy impacts resulting from the HVAC and appliance measures in 2017 and 2018.

#### *7.3.3.1 Survey Data Collection*

A survey of program participants was administered to collect data for use in estimating participant free ridership and spillover. Responses to the free ridership questions were collected through an online survey.

#### *7.3.3.2 Methodology for Estimating Ex-Post Net Energy Savings*

The net savings analysis is used to determine what part of the gross energy savings achieved by program participants can be attributed to the effects of the program. The net savings attributable to program participants are the gross savings less free ridership, plus spillover. ADM estimated free ridership and participant spillover through a survey of

program participants. Non-participant spillover was estimated through a survey of non-participants.

### *7.3.3.3 Methodology for Estimating Freeridership*

Survey respondents were asked a series of questions designed to elicit information regarding the following factors:

- Financial ability and plans and intentions to implement the efficiency measure;
- The program influence on the decision to implement the efficiency measure;
- The program's influence on the timing of the measure installation.

The calculation of a free ridership score was based on the responses to questions about the participants' prior plans and intentions, program influence on measure selection, and program influence on timing of measure implementation.

#### *7.3.3.3.1 Financial Ability and Plans and Intentions*

Two indicator variables were developed based on responses to the survey questions on plans and intentions. The first corresponds to financial ability. Respondents were considered to have not been financially able to install the efficient equipment if they answer "no" to the question below:

FR1: Would you have been able to afford to purchase the efficient [EFF\_MEASURE1] if the rebate was not available from the program?

The second indicator variable is related to whether the customer had plans to implement the efficiency measure. Respondents were considered to have had plans if they answer "yes" to the following question:

FR2: Were you planning to purchase [EFF\_MEASURE1] before you learned of [UTILITY] wattsmart rebate program?

Respondents who were found to not have plans or the financial ability to implement the measures were deemed to not be free riders.

#### *7.3.3.3.2 Program Influence on Decision to Implement Energy Efficiency Measure*

Participants were asked about the direct influence of the program on their decision to implement the energy efficiency measures. Specifically, participants were asked:

FR3: On a scale of 1-5 where 1 is "not at all likely" and 5 is "very likely", how likely is it that you would have purchased and installed the [EFF\_MEASURE1] if you had not received the financial or information assistance through the program?

A program influence score was developed based on this response in the following manner:

- A response of “1” = 0% Free Ridership
- A response of “2” = 25% Free Ridership
- A response of “3” = 50% Free Ridership
- A response of “4” = 75% Free Ridership
- A response of “5” = 100% Free Ridership

#### 7.3.3.3.3 Program Influence on Project Timing

To account for deferred free ridership due to the program’s effect on the timing of the implementation of the efficiency measure, respondents were asked the following two questions:

FR4: Did you purchase and install the [EFF\_MEASURE] sooner than you would have if the information and financial assistance from the program had not been available?

FR5: When might you have purchased or installed the same [EFF\_MEASURE] if you had not participated in the program?

If the survey participant responds “yes” to question FR4 then a timing adjustment was calculated based on the answer to FR5 as shown in Table 7-10.

*Table 7-10: Timing Adjustment Score*

Likely Timing of Project in Absence of the Program	Timing Score
Within 6 months	1
Between 6 months and 1 year	0.67
In more than 1 year to 2 years	0.33
In two years or more	0

#### 7.3.3.3.4 Freeridership Scoring

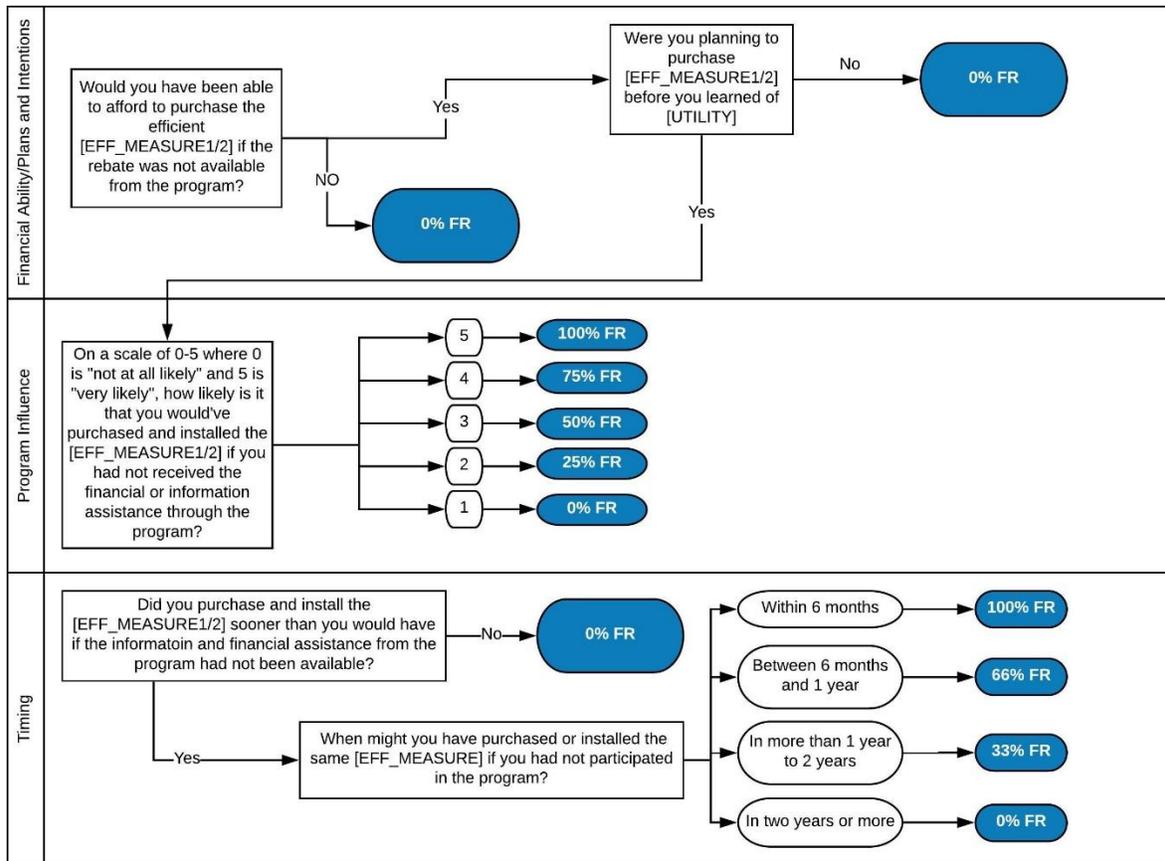
For respondents that did not have plans or intentions, an overall free ridership score was developed based on the program influence score and timing score. An overall project free ridership score is based by combining the scores described above using the following equation:

$$\text{Free Ridership} = \text{Program Influence} * \text{Timing Score}$$

The flowchart illustrating the methodology used to calculate free ridership can be found in the diagram in Figure 7-3.

Figure 7-3: Freeridership Methodology for wattsmart Homes HVAC and Appliance Measures

Free Ridership Scoring for wattsmart Appliance/HVAC Survey



7.3.3.4 Methodology for Estimating Spillover

Program participants may implement additional energy saving measures without receiving a program incentive because of their participation in the program. The energy savings resulting from these additional measures constitute program participant spillover effects.

To assess participant spillover savings, survey respondents were asked whether they implemented any additional energy saving measures for which they did not receive a program incentive. Respondents were also asked to provide information on the attributes of the measures implemented for use in estimating the associated energy savings.

Participants who report implementing on one or more efficiency measures are then asked two questions for use in developing a spillover score:

SO1: On a scale of 1 to 5, where 1 represents “not important” and 5 represents “very important”, how important was your experience with *wattsmart* in your decision to purchase the items you just mentioned?

SO2: On a scale of 1 to 5, where 1 represents “extremely likely” and 5 represents “extremely likely” how likely would you have been to make the additional purchases you just mentioned even if you had not participated in the *wattsmart* program?

The response to these questions were used to develop a spillover score as follows:

- $\text{Spillover} = \text{Average}(\text{SO1}, 5 - \text{SO2})$

All of the associated measure savings were considered attributable to the program if the resulting score was equal to or greater than 3.

## 7.4 Appendix D: Measure Category Cost-Effectiveness Results

The following tables show the cost-effectiveness results for each measure category in the Program for each program year, based on the evaluated net savings in Wyoming. The 2017 cost-effectiveness was tested using the 2015 IRP east residential whole house 31%, east residential lighting 47%, and east water heating – 53% decrements. The 2018 cost-effectiveness was tested using the 2017 IRP decrement for all measure categories.

*Table 7-11: 2017 WY wattsmart Homes Program Appliances Measure Category Cost-Effectiveness Results*

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1109	\$6,877	\$4,254	-\$2,624	0.62
Total Resource Cost Test (TRC) No Adder	\$0.1109	\$6,877	\$3,867	-\$3,010	0.56
Utility Cost Test (UCT)	\$0.1086	\$6,732	\$3,867	-\$2,865	0.57
Rate Impact Test (RIM)		\$14,167	\$3,867	-\$10,300	0.27
Participant Cost Test (PCT)		\$4,533	\$12,872	\$8,339	2.84
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000000638				
Discounted Participant Payback (years)	1.77				

*Table 7-12: 2017 WY wattsmart Homes Program Building Shell Measure Category Cost-Effectiveness Results*

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0603	\$27,211	\$30,413	\$3,202	1.12
Total Resource Cost Test (TRC) No Adder	\$0.0603	\$27,211	\$27,648	\$437	1.02
Utility Cost Test (UCT)	\$0.0567	\$25,567	\$27,648	\$2,080	1.08
Rate Impact Test (RIM)		\$79,866	\$27,648	-\$52,218	0.35
Participant Cost Test (PCT)		\$13,223	\$77,791	\$64,568	5.88
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000001744				
Discounted Participant Payback (years)	1.39				

*Table 7-13: 2017 WY wattsmart Homes Program Energy Kits - DHW Measure Category Cost-Effectiveness Results*

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0259	\$68,528	\$170,134	\$101,606	2.48
Total Resource Cost Test (TRC) No Adder	\$0.0259	\$68,528	\$154,667	\$86,139	2.26
Utility Cost Test (UCT)	\$0.0262	\$69,481	\$154,667	\$85,187	2.23
Rate Impact Test (RIM)		\$386,621	\$154,667	-\$231,954	0.40
Participant Cost Test (PCT)		\$9,045	\$346,076	\$337,030	38.26
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000022789				
Discounted Participant Payback (years)	n/a				

Table 7-14: 2017 WY wattsmart Homes Program Energy Kits - Lighting Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0225	\$11,453	\$37,052	\$25,599	3.24
Total Resource Cost Test (TRC) No Adder	\$0.0225	\$11,453	\$33,684	\$22,230	2.94
Utility Cost Test (UCT)	\$0.0233	\$11,840	\$33,684	\$21,844	2.84
Rate Impact Test (RIM)		\$72,731	\$33,684	-\$39,047	0.46
Participant Cost Test (PCT)		\$4,054	\$68,833	\$64,779	16.98
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000003207				
Discounted Participant Payback (years)	n/a				

Table 7-15: 2017 WY wattsmart Homes Program HVAC Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0716	\$121,351	\$111,426	-\$9,925	0.92
Total Resource Cost Test (TRC) No Adder	\$0.0716	\$121,351	\$101,296	-\$20,055	0.83
Utility Cost Test (UCT)	\$0.0799	\$135,507	\$101,296	-\$34,211	0.75
Rate Impact Test (RIM)		\$339,080	\$101,296	-\$237,784	0.30
Participant Cost Test (PCT)		\$54,471	\$315,818	\$261,347	5.80
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000011841				
Discounted Participant Payback (years)	n/a				

Table 7-16: 2017 WY wattsmart Homes Program Lighting Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0652	\$993,078	\$1,110,570	\$117,492	1.12
Total Resource Cost Test (TRC) No Adder	\$0.0652	\$993,078	\$1,009,609	\$16,531	1.02
Utility Cost Test (UCT)	\$0.0244	\$371,309	\$1,009,609	\$638,300	2.72
Rate Impact Test (RIM)		\$2,196,407	\$1,009,609	-\$1,186,798	0.46
Participant Cost Test (PCT)		\$1,082,832	\$2,608,147	\$1,525,315	2.41
Lifecycle Revenue Impacts (\$/kWh)	\$0.0000097471				
Discounted Participant Payback (years)	5.02				

Table 7-17: 2017 WY wattsmart Homes Program Water Heating Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1281	\$9,539	\$5,044	-\$4,495	0.53
Total Resource Cost Test (TRC) No Adder	\$0.1281	\$9,539	\$4,585	-\$4,953	0.48
Utility Cost Test (UCT)	\$0.0773	\$5,755	\$4,585	-\$1,169	0.80
Rate Impact Test (RIM)		\$14,677	\$4,585	-\$10,091	0.31
Participant Cost Test (PCT)		\$6,845	\$12,943	\$6,098	1.89
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000000666
Discounted Participant Payback (years)					7.56

Table 7-18: 2018 WY wattsmart Homes Program Appliances Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0819	\$3,662	\$2,255	-\$1,406	0.62
Total Resource Cost Test (TRC) No Adder	\$0.0819	\$3,662	\$2,050	-\$1,611	0.56
Utility Cost Test (UCT)	\$0.0764	\$3,413	\$2,050	-\$1,363	0.60
Rate Impact Test (RIM)		\$8,630	\$2,050	-\$6,579	0.24
Participant Cost Test (PCT)		\$2,896	\$8,481	\$5,585	2.93
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000000403
Discounted Participant Payback (years)					1.78

Table 7-19: 2018 WY wattsmart Homes Program Building Shell Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0489	\$80,562	\$122,843	\$42,280	1.52
Total Resource Cost Test (TRC) No Adder	\$0.0489	\$80,562	\$111,675	\$31,113	1.39
Utility Cost Test (UCT)	\$0.0487	\$80,346	\$111,675	\$31,329	1.39
Rate Impact Test (RIM)		\$273,660	\$111,675	-\$161,985	0.41
Participant Cost Test (PCT)		\$58,563	\$283,251	\$224,688	4.84
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000005333
Discounted Participant Payback (years)					0.96

Table 7-20: 2018 WY wattsmart Homes Program Electronics Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1168	\$244,863	\$73,591	-\$171,272	0.30
Total Resource Cost Test (TRC) No Adder	\$0.1168	\$244,863	\$66,901	-\$177,963	0.27
Utility Cost Test (UCT)	\$0.1149	\$240,791	\$66,901	-\$173,890	0.28
Rate Impact Test (RIM)		\$484,500	\$66,901	-\$417,599	0.14
Participant Cost Test (PCT)		\$109,452	\$382,550	\$273,097	3.50
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000080382
Discounted Participant Payback (years)					0.45

Table 7-21: 2018 WY wattsmart Homes Program Energy Kits - DHW Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0148	\$113,023	\$323,602	\$210,578	2.86
Total Resource Cost Test (TRC) No Adder	\$0.0148	\$113,023	\$294,183	\$181,160	2.60
Utility Cost Test (UCT)	\$0.0150	\$114,390	\$294,183	\$179,794	2.57
Rate Impact Test (RIM)		\$1,005,290	\$294,183	-\$711,107	0.29
Participant Cost Test (PCT)		\$23,629	\$969,198	\$945,569	41.02
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000062804
Discounted Participant Payback (years)					n/a

Table 7-22: 2018 WY wattsmart Homes Program Energy Kits - Lighting Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0158	\$24,725	\$69,810	\$45,085	2.82
Total Resource Cost Test (TRC) No Adder	\$0.0158	\$24,725	\$63,464	\$38,738	2.57
Utility Cost Test (UCT)	\$0.0162	\$25,431	\$63,464	\$38,033	2.50
Rate Impact Test (RIM)		\$207,886	\$63,464	-\$144,423	0.31
Participant Cost Test (PCT)		\$12,203	\$205,855	\$193,651	16.87
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000011712
Discounted Participant Payback (years)					n/a

Table 7-23: 2018 WY wattsmart Homes Program HVAC Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0425	\$82,915	\$139,500	\$56,585	1.68
Total Resource Cost Test (TRC) No Adder	\$0.0425	\$82,915	\$126,818	\$43,903	1.53
Utility Cost Test (UCT)	\$0.0433	\$84,474	\$126,818	\$42,344	1.50
Rate Impact Test (RIM)		\$312,573	\$126,818	-\$185,755	0.41
Participant Cost Test (PCT)		\$40,156	\$312,260	\$272,104	7.78
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000009599
Discounted Participant Payback (years)					0.33

Table 7-24: 2018 WY wattsmart Homes Program Lighting Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0564	\$819,948	\$648,614	-\$171,335	0.79
Total Resource Cost Test (TRC) No Adder	\$0.0564	\$819,948	\$589,649	-\$230,300	0.72
Utility Cost Test (UCT)	\$0.0218	\$317,398	\$589,649	\$272,251	1.86
Rate Impact Test (RIM)		\$2,012,617	\$589,649	-\$1,422,968	0.29
Participant Cost Test (PCT)		\$910,788	\$2,427,689	\$1,516,902	2.67
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000115394
Discounted Participant Payback (years)					4.42

Table 7-25: 2018 WY wattsmart Homes Program Water Heating Measure Category Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1005	\$4,813	\$2,335	-\$2,478	0.49
Total Resource Cost Test (TRC) No Adder	\$0.1005	\$4,813	\$2,123	-\$2,690	0.44
Utility Cost Test (UCT)	\$0.0488	\$2,340	\$2,123	-\$217	0.91
Rate Impact Test (RIM)		\$7,930	\$2,123	-\$5,807	0.27
Participant Cost Test (PCT)		\$4,107	\$7,706	\$3,599	1.88
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000000378
Discounted Participant Payback (years)					7.44