



**Rocky Mountain Power
wattsmart ENERGY STAR®
New Homes Process and
Impact Evaluation for
2013–2014**

June 17, 2016

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Glossary of Terms

Billing Analysis

Statistical modeling methods that compare weather-normalized, pre- and post-participation energy consumption from billing data in a population to identify savings attributed to the installation and use of energy-efficient measures. Regression analysis is a technique frequently used for verifying energy savings.

Conditioned Space

A climate-controlled area within a building (includes heating and cooling). This space is generally defined by the building's thermal envelope, such that space inside of the envelope is conditioned and space outside of the thermal barrier is unconditioned.

Energy Intensity

A metric that represents annual consumption for a standard area. Values for electric energy are expressed in terms of kWh per year per square foot, usually shown as kWh/square foot. Energy intensity is useful for comparing energy usage across a range of home sizes.

Freeridership

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

RESNET-qualified lighting locations

Defined by the Residential Energy Services Network (RESNET): Light fixtures in kitchens, dining rooms, living rooms, family rooms, dens, bathrooms, hallways, stairways, entrances, bedrooms, garages, utility rooms, home offices, and all outdoor fixtures mounted on a building or pole. This excludes plug-in lamps, closets, unfinished basements, and landscape lighting.

Normalized Annual Consumption (NAC)

Normalized annual consumption (NAC) is the weather-normalized annual usage for each home developed through PRinceton Scorekeeping Method (PRISM) models.

Evaluated Gross Savings

Evaluated gross savings are the total savings resulting from a program, before adjusting for freeridership or spillover. They are most often calculated for a given measure, 'i,' as:

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



Evaluated Net Savings

Evaluated net savings are the total savings resulting from a program, net of what would have occurred in the program's absence. These savings can be attributed to the program and are calculated as:

$$Net\ Savings = Evaluated\ Gross\ Savings * Net - to - Gross$$

Net-to-Gross (NTG) Ratio

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

$$NTG\ ratio = \frac{Net\ savings}{Gross\ savings}$$

Realization Rate

Rocky Mountain Power calculates the realization rate by comparing evaluated gross savings to reported gross savings.

Spillover

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

Executive Summary

Rocky Mountain Power offers the wattsmart New Homes program in Utah. The program promotes the construction of energy-efficient homes that save money and energy and conserve natural resources through rebates for standalone measures and through the construction of an ENERGY STAR home. ENERGY STAR-qualified homes have been independently verified to be at least 15% more efficient than state energy code.

The program provides two paths to incentives, the first being to builders constructing ENERGY STAR homes. This incentive amount varies depending on the installation of additional standalone efficiency measures (such as lighting and appliances). The program has separate requirements for single-family and multifamily homes. In addition to ENERGY STAR certification, homes can receive International Energy Conservation Code (IECC) 2009 certification through the program. IECC 2009 is a more efficient energy code than the prevailing statewide code in effect during the program.

Standalone measures are the second path to program participation and incentives. The program offers rebates to builders of homes that do not meet ENERGY STAR standards but instead install measures eligible for rebates through the program.

In summary, the program has two participation paths:

- To earn the **ENERGY STAR home** designation, a home must meet strict energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA) in Version 3. Savings are typically achieved through a combination of measures (e.g., building envelope upgrades, high-efficiency windows, upgraded HVAC, weatherization).
- The program also offers rebates for high-efficiency, **standalone measures** to encourage builders to include more efficient measures in their homes without having to meet ENERGY STAR standards.

Nexant (the program administrator) implemented the program on Rocky Mountain Power's behalf from 2013 to 2014.

Evaluation activities included:

- Billing analysis for ENERGY STAR homes
- Engineering review for standalone measures
- Net-to-gross (NTG) analysis for standalone measures
- Participant and nonparticipant homeowner surveys
- Stakeholder interviews including program staff, administrators, builders, and HERs raters



Evaluation data included:

- Customer billing data from January 1, 2013, through August 31, 2015, for 4,479 participant households (1,265 ENERGY STAR Certified Homes, and 3,214 stand-alone measure participants).
- Customer billing data from January 1, 2013, through August 31, 2015, for 20,608 nonparticipant households.
- Program participant tracking data
- Telephone surveys with:
 - 22 participating home builders;
 - 17 active builders
 - 5 inactive builders (submitting fewer than 10 applications in 2013–2014)
 - 3 participating Home Energy Rating System (HERS) raters;
 - 70 homeowners of program homes, built during 2013 or 2014; and
 - 70 homeowners of non-program homes, built during 2013 or 2014.
- In-depth interviews with program management and program administration staff.

Cadmus used a dual approach in its methodology for estimating impacts. A billing analysis was conducted to estimate net savings for ENERGY STAR certified homes (with or without standalone measures). For homes that received incentives for standalone measures only, an engineering review was conducted to estimate gross savings. The results from interviews with participating builders provided the data used to estimate the NTG ratio, which was applied to the gross savings of the standalone measures to estimate the net savings for the measures.

For this evaluation, Cadmus utilized the approach used in previous evaluations (program years 2006-2010) for ENERGY STAR multifamily homes: Cadmus applied the savings realization rate established for single-family homes to reported savings for multifamily homes. For this evaluation, Cadmus proposed and attempted to use the same billing analysis methodology for ENERGY STAR multifamily homes and single-family homes, but could not identify a reliable square footage estimate for the participant and nonparticipant multifamily homes.

Summary of Key Findings

Key Impact Findings

The impact evaluation resulted in the following key findings:

- Evaluated participant-level, single-family certified ENERGY STAR home savings were 1,660 kWh and 1,655 kWh for program years 2013 and 2014, respectively.
- Overall program realization rates were 75% and 80% in program years 2013 and 2014, respectively.

- Cadmus used data from participating builder interviews to calculate a NTG ratio of 48% for the standalone measures. Cadmus calculated a freeridership rate of 52% and no spillover was reported. Because the billing analysis done for the ENERGY STAR homes yields a net savings value, this 48% NTG ratio is applied only to the standalone only measures.
- Cadmus coordinated with the program implementer over several inconsistencies in the original program tracking database. Several homes were classified as both single-family and multifamily, which resulted in miscounting of program homes. This change in classification of homes lowered the number of ENERGY STAR multifamily homes and homes with standalone measures (as shown in Table 1) in the program but did not significantly affect energy savings.

Table 1 shows reported and evaluated participation counts for homes for program years 2013 and 2014.

Table 1. 2013 and 2014 Reported and Evaluated Participation

Participant Home Type	Reported*	Evaluated	Reported*	Evaluated
	2013 Number of Homes		2014 Number of Homes	
ENERGY STAR Single-Family Homes	431	431	563	563
ENERGY STAR Multifamily Homes	285	284	238	238
ENERGY STAR Home Total	716	715	801	801
Standalone Measure Categories	2013 Number of Homes		2014 Number of Homes	
Number of Homes with Standalone Measures Only**	1,431	1,430	2,442	2,438
w/Appliances Measure	1,342	1,342	2,365	2,305
w/Lighting Measure	1,076	1,076	2,040	1,980
w/Code Enhancement Measure	882	882	1,253	1,253
w/Envelope Measure	765	765	1,594	1,535
w/HVAC Measure	331	331	280	279

* Source: Program Tracking Data

**Homes in these categories do not add up to total number of homes since most homes received multiple measures.

Table 2 summarizes program gross and net savings (reported and evaluated). Although the ENERGY STAR homes realized net savings of nearly 100%, and the standalone measures achieved higher gross savings than reported, the freeridership application to the standalone measures lowered the overall program realization rate to 78%. The program achieved 3,454,635 kWh in evaluated net savings during the 2013 and 2014 program periods.



Table 2. Program Gross and Net Energy Savings

Savings Type	Year	Reported Savings (kWh)	Gross Realization Rate	Evaluated Gross Savings (kWh)	NTG	Evaluated Net Savings	Total Net Savings Realization Rate
ENERGY STAR Homes	2013	1,055,605	95%	1,002,825	100%*	1,002,825	95%
	2014	1,056,732	103%	1,088,434		1,088,434	103%
Standalone Measures	2013	1,082,674	117%	1,267,266	48%	608,288	56%
	2014	1,250,056	126%	1,573,100		755,088	60%
Total		4,445,067	111%	4,931,625	70%	3,454,635	78%

*NTG for ENERGY STAR Homes is defined as 100% as the billing analysis yields a net number.

Key Net to Gross Analysis Findings

The overall freeridership (FR) score is largely driven by appliances and lighting measures, as shown in Table 3 below.

Table 3. Standalone Measure Freeridership Results by Measure Category

Measure Category	n	FR Score	Survey Sample Program kWh Savings	Survey Sample Freerider kWh Savings
Appliances	8	51%	195,575	99,310
Envelope	6	10%	274,976	27,240
HVAC	5	17%	50,921	8,699
Lighting	12	60%	1,667,087	1,002,871
Overall	31	52%	2,188,558	1,138,119

*Survey sample freerider kWh savings divided by survey sample program kWh savings.

Of the weighted 52% freeridership estimate, 51 percentage points are associated with measures that builders had already purchased before learning about the program and were estimated at 100% freeridership.¹ The freeridership score of one respondent with 41% of the total sampled kWh savings contributes 22 percentage points of the overall weighted 52% freeridership estimate for standalone measures.

Key Process Evaluation Findings

Cadmus conducted interviews and surveys with various stakeholders of the wattsmart New Homes program. Cadmus conducted interviews with managers from the program implementation team, home energy raters, and participating builders. Cadmus also conducted surveys with owners of homes built in 2013 and 2014 by participating and nonparticipating builders.

¹ Respondent Category 1 in Table 34.

The process evaluation resulted in the following key findings:

- According to Nexant, the program administrator, the program has a good working relationship with many builders and home energy raters.
- Program satisfaction was generally high among active participating builders and home energy raters. No major communication or management barriers were reported in the delivery of the wattsmart New Homes program.
- Nexant reports that the primary barrier to attracting builders to participate is persuading them to build their homes differently and more efficiently. Builders with limited activity, those that participated in the program fewer than 10 times in the 2013-2014 evaluation period, did not participate in the program more frequently primarily because they had no customer demand and thought participating would be burdensome. Active builders reported that their top two reasons for participating in the program were to obtain the program incentives and to be able to market their homes as energy efficient.
- Nine out of 19 builders surveyed stated that homebuyers infrequently asked about energy efficiency, leading some builders to suggest enhancing efforts to market the program to homebuyers to help increase demand.
- According to the nonparticipant homeowner surveys, the average nonparticipant new home had energy-efficient lighting installed in 68% of available sockets, and one half of these homes had energy-efficient lighting installed in at least 80% of available sockets.
- Owners of participating homes had an average satisfaction rating of 7.8 on a 1 to 10 satisfaction scale regarding the energy-efficient features of their homes. Almost two thirds of respondents rated their satisfaction 8 or greater, and less than 5% of respondents offered ratings lower than 5. Homeowners who offered lower ratings primarily cited that they would have liked more insulation, followed by a lack of energy-efficient lighting as well as unexpectedly high utility bills.

Cost-Effectiveness

Table 4 presents the results of the program cost-effectiveness analysis using evaluated net savings for all program measures during the evaluation period (2013–2014), not accounting for non-energy benefits other than those represented by the 10% conservation adder included in the PacifiCorp Total Resource Cost (PTRC) Test.

The program was cost-effective from the Utility Cost Test (UCT) and the Participant Cost Test (PCT) perspectives. The program did not prove cost-effective across the program years evaluated for three of the five primary cost tests: the PTRC test; the Total Resource Cost (TRC) test; and the Rate Impact Measure (RIM).



Table 4. 2013–2014 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.159	\$5,303,736	\$2,975,304	(\$2,328,432)	0.56
Total Resource Cost Test (TRC) No Adder	\$0.159	\$5,303,736	\$2,704,821	(\$2,598,915)	0.51
Utility Cost Test (UCT)	\$0.079	\$2,631,247	\$2,704,821	\$73,575	1.03
Rate Impact Test (RIM)	\$0.108	\$6,209,503	\$2,704,821	(\$3,504,681)	0.44
Participant Cost Test (PCT)	\$0.186	\$3,594,527	\$4,500,293	\$905,766	1.25
Lifecycle Revenue Impacts (\$/kWh)	\$0.000014094				
Discounted Participant Payback (years)	9.61				

Table 5 shows the program’s cost-effectiveness in 2013.

Table 5. 2013 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.162	\$2,656,774	\$1,441,457	(\$1,215,317)	0.54
Total Resource Cost Test (TRC) No Adder	\$0.162	\$2,656,774	\$1,310,415	(\$1,346,359)	0.49
Utility Cost Test (UCT)	\$0.082	\$1,346,080	\$1,310,415	(\$35,665)	0.97
Rate Impact Test (RIM)	\$0.106	\$3,069,786	\$1,310,415	(\$1,759,370)	0.43
Participant Cost Test (PCT)	\$0.188	\$1,731,100	\$2,144,112	\$413,012	1.24
Lifecycle Revenue Impacts (\$/kWh)	\$0.000007075				
Discounted Participant Payback (years)	9.52				

Table 6 shows the program’s cost effectiveness in 2014.

Table 6. 2014 Evaluated Net Program Cost-Effectiveness Summary

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.156	\$2,829,126	\$1,639,406	(\$1,189,720)	0.58
Total Resource Cost Test (TRC) No Adder	\$0.156	\$2,829,126	\$1,490,369	(\$1,338,757)	0.53
Utility Cost Test (UCT)	\$0.076	\$1,373,612	\$1,490,369	\$116,757	1.08
Rate Impact Test (RIM)	\$0.185	\$3,355,792	\$1,490,369	(\$1,865,423)	0.44
Participant Cost Test (PCT)	\$0.110	\$1,991,668	\$2,518,334	\$526,666	1.26
Lifecycle Revenue Impacts (\$/kWh)	\$0.000007502				
Discounted Participant Payback (years)	8.69				

Summary and Recommendations

In summary, Cadmus found the program administrators overall accounting of energy savings to adhere to best practices and found nothing beyond what is expected. Evaluated gross energy savings were in most instances similar to reported, and freeridership amongst participating builders is similar to other residential new home programs Cadmus has evaluated (see Table 37). The wattsmart New Homes Program has been operating for nine years, and this evaluation covers 2013-2014. It is likely that the program has had more influence on builder activities than what can be identified with a scope of two program years. This program, as well as other Rocky Mountain Power programs and other external factors, have likely contributed to builders adopting energy efficiency into their standard practices. For instance, nonparticipant homeowners reported that nearly 70% of their lighting was energy efficient and participating builders reported relatively high levels of standalone lighting freeridership (60%).

The program was only cost-effective using the UCT and PCT, and resulted in similar benefit-cost ratios presented in the Rocky Mountain Powers 2013 and 2014 annual reports.

Cadmus identified areas where incremental changes could improve program offerings and implementation, and are noted below.

Conclusion: Utah’s new residential energy code went into effect on July 1, 2014. While the Department of Energy (DOE) considers this code as “less efficient than IECC 2009,” the framework of the code is built around IECC 2012. The energy usage of the typical, non-ENERGY STAR new home will become more efficient due to this update.

Recommendation: While this code change did not impact homes built in program years 2013 and 2014, possible impacts should be considered in future program years. Cadmus recommends the program administrator evaluate the impact of this code change on the baseline of the new construction program.



Conclusion: Builders reported homebuyers have not been inquiring about the energy efficiency of new homes, and nonparticipant builders reported that homebuyers rarely request efficient measures or homes.

Recommendation: Consider a campaign to increase awareness of energy-efficient homes and the benefits of living in an ENERGY STAR certified home or a home with energy-efficient measures installed. Other markets have increased homebuyer awareness by engaging real estate professionals via realtor and appraiser trainings, and by incorporating energy efficiency designations and ratings into multiple listing services.

Conclusion: Many inactive builders believed that participation was not worth the effort.

Recommendation: Explore methods of encouraging inactive (and nonparticipant) builders to attend the workshops so that they can network with active participating builders to learn more about the benefits of the program.

Conclusion: A more rigorous NTG analysis on standalone measures can be conducted by incorporating a market effects analysis that would investigate long-term changes in the market thereby addressing builder activities beyond the evaluation period. Expert testimony² in the evaluation field provides a strong argument for the expansion of NTG analysis to improve NTG ratios. The testimony states that NTG values from any evaluation are a function of that state's evaluation policies, the definitions applied, the analysis approaches used, and the time period over which the studies are conducted.

This alternate approach including a market effects analysis would incorporate builder and stakeholder feedback beyond the timeframe of the evaluation and would likely yield more savings attributable to the wattsmart New Homes Program.

Cadmus followed standard protocol in assessing NTG values for this evaluation, but has experience in conducting expanded studies to better assess program savings attribution.

Recommendation: There is evidence that the majority of builders have adopted energy efficient techniques as standard practice (i.e., the nonparticipating homebuyer reported lighting saturation and the standalone lighting freeridership results). In order to quantify the full long-term impact the New Homes program has had on these practices over the years of the program, we recommend that Rocky Mountain Power consider conducting a market effects study.

Nick P. Hall testimony to Michigan Public Service Commission. November 7, 2012.

Program Description

Rocky Mountain Power offers the wattsmart New Homes program in Utah to promote the construction of energy-efficient homes that save money and energy and conserve natural resources. The program has two participation paths:

- To earn the **ENERGY STAR home 3.0** certification, a home must meet strict energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA). Savings are typically achieved through a combination of measures (e.g., building envelope upgrades, lighting, high-efficiency windows, upgraded HVAC, weatherization).
- The program also offers rebates for high-efficiency, **standalone measures** to encourage builders to include more efficient measures in their homes without having to meet ENERGY STAR standards.

On Rocky Mountain Power's behalf, Nexant (the program administrator) implemented the program during 2013 to 2014.

Eligibility Requirements and Incentives

The program applies to builders of all residential construction of new single and multifamily homes through Rocky Mountain Power's tariff schedule 110 for all newly constructed residential dwelling units located within Rocky Mountain Power service territory, individually metered and billed on Schedules 1, 2, and 3.

Measures and Incentives

ENERGY STAR certified homes must meet applicable ENERGY STAR version 3.0 guidelines³ and earn an ENERGY STAR certification from the EPA. A builder can install a combination of measures and building practices to meet the national program's guidelines such as:

- Performance-based duct sealing
- Air conditioner equipment minimum standards
- Air conditioning performance testing
- Equipment correct sizing
- Best practice installations
- Thermal bypass checklist
- Installation of energy-efficient lighting

Builders may be eligible for incentives for one or more standalone measures such as HVAC equipment and refrigerators for each newly constructed home. Builders can apply for additional energy-efficient

³³ http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_guidelines



measures with or without ENERGY STAR home certification. Table 7 lists the incentives for each of the measures offered.

Table 7. Program Measures and Incentives in 2013 and 2014

New Construction Whole Home Options	Cadmus Measure Category ⁴	Single-Family (1–4 Plex)	Multifamily (5 Plex or Greater)
High Performance ENERGY STAR Version 3 certified home	ENERGY STAR Home	\$500	\$200
ENERGY STAR Version 3 certified home	ENERGY STAR Home	\$250	\$150
Above Code Home	Code Enhancement	\$25	\$25
80% ENERGY STAR lighting (large home) square footage (sq. ft.) requirements: Single-family: > 3,500 sq. ft. Multifamily: > 1,500 sq. ft.	Lighting	\$80	\$40
80% ENERGY STAR lighting (medium home) square footage requirements: Single-family: 2,000 sq. ft. to 3,500 sq. ft. Multifamily: 850 to 1,500 sq. ft.	Lighting	\$60	\$30
80% ENERGY STAR lighting (small home) square footage requirements: Single-family: < 2,000 sq. ft. Multifamily: < 850 sq. ft.	Lighting	\$40	\$20
Furnace with ECM	HVAC	\$150	\$150
Central air conditioner* 15 SEER/12.5 EER minimum efficiency	HVAC	\$100	\$75
Premium evaporative equipment*	HVAC	\$500	\$150
Premium ducted evaporative equipment*	HVAC	\$750	\$300
Geothermal heat pump* Eligible only if gas is unavailable at the property line	HVAC	\$1,750	\$1,000
HVAC-Quality Installation – contractor certification	HVAC	\$50	\$25
HVAC-Quality Installation – rater certification	HVAC	\$100	\$50
2 x 6 exterior walls – R20 minimum	Envelope	\$50	\$4
R-5 windows	Envelope	\$0.12/sq. ft.	n/a
Qualified efficient refrigerator	Appliances	\$20	\$20
Qualified efficient dishwasher	Appliances	\$20	\$20

*Two rebates per home allowed for these measures.

Program Assumptions and Participation

Program participation refers to the construction of qualifying single-family or multifamily homes. Participation can include building an ENERGY STAR-certified home, or incorporating additional

⁴ Used in standalone measure analysis and summaries.

standalone measures to receive corresponding incentives, or applying for rebates for the standalone measures installed without ENERGY STAR certification. The evaluation defined reported participation and savings (kWh) as the values Rocky Mountain Power reported in its 2013 and 2014 annual program reports (provided to Cadmus).

Table 8 and Table 9 show reported participation and savings for all ENERGY STAR homes and standalone measures for the program in 2013 and 2014, respectively.

Table 8. 2013 Reported Participation and Energy Savings*

Participant Home Type	Savings Per Home (kWh/year)	Number of Homes	Total Reported Savings (kWh/Year)
ENERGY STAR Single-Family Homes	1,808	431	779,140
ENERGY STAR Multifamily Homes	970	285	276,465
Home Total	NA	716	1,055,605
Standalone Measure Category Savings	Savings Per Measure (kWh/year)	Number of Measures**	Total Reported Savings (kWh/year)
Appliances Measures	46	1,355	62,877
Lighting Measures	829	1,076	891,919
Code Enhancement Measures	40	883	35,453
Envelope Measures	40	767	30,637
HVAC Measures	185	334	61,788
Measure Total	NA	4,415	1,082,674
2013 Total			2,138,279

* Number of homes and total savings from annual reports

** Number of measures do not match up to the number of homes reported in Table 1 as multiple measures are allowed in a single home.



Table 9. 2014 Reported Participation and Energy Savings*

Participant Home Type	Savings Per Home (kWh/year)	Number of Homes	Total Reported Savings (kWh/Year)
ENERGY STAR Single-Family Homes	1,573	563	885,631
ENERGY STAR Multifamily Homes	719	238	171,101
Home Total	NA	801	1,056,732
Standalone Measures Savings	Savings Per Measure (kWh/year)	Number of Measures**	Total Reported Savings (kWh/year)
Appliances Measures	47	2,408	112,457
Lighting Measures	490	2,041	1,000,746
Code Enhancement Measures	41	1,254	51,506
Envelope Measures	25	1,595	39,245
HVAC Measures	163	282	46,102
Measure Total	NA	7,580	1,250,056
2014 Total			2,306,788

*Number of homes and total savings from annual reports. Savings per home calculated.

** Number of measures do not match up to the number of homes reported in Table 1 as multiple measures are allowed in a single home.

In addition to the detail shown in the tables above, Cadmus calculated average savings for single-family and multifamily homes each year. As shown in Table 10, these average values include the reported savings for the homes and the standalone measures.

Table 10. Reported Participation and Average Energy Savings by Year and Home Type

Program Year	Total Savings	Total Reported Savings (kWh/year)		Number of Homes		Savings Per Home (kWh/year)*	
		Single-Family	Multifamily	Single-Family	Multifamily	Single-Family	Multifamily
2013	2,138,279	1,603,635	534,644	1,141	1,006	1,405	531
2014	2,306,788	1,622,095	684,693	1,497	1,746	1,084	392

*Savings per home values have been rounded to whole numbers.

Impact Evaluation

Cadmus used a dual approach in its methodology for estimating impacts. A billing analysis was conducted to estimate net savings for ENERGY STAR-certified homes (with or without standalone measures). The billing analysis ultimately focused on single-family homes. Energy consumption per square foot for multifamily homes was more difficult to obtain because the square footage data for the nonparticipants are not readily available on realtor websites and the multifamily homes are not as homogenous as the single-family homes.⁵ After savings for single-family homes had been determined, Cadmus calculated a realization rate for each program year, and then applied the single-family program year realization rates to calculate the yearly savings for multifamily homes.⁶ Cadmus conducted the billing analysis in a manner that yields net savings so no net-to-gross (NTG) adjustment is applied to the ENERGY STAR-certified homes savings.

For homes that received incentives for standalone measures but did not receive the certified ENERGY STAR home incentive, an engineering review was conducted to estimate gross savings. The results from interviews with participating builders who received an incentive for standalone measures provided the data used to estimate the NTG ratio, which was applied to the gross savings of the standalone measures.

This chapter will provide the methodology and results for the billing analysis, engineering review, NTG, and overall program net savings.

Billing Analysis for Certified ENERGY STAR Homes

Methodology

Cadmus calculated evaluated net savings as the delta (change in quantity) between participant and nonparticipant electric energy intensity from ENERGY STAR home certification measures including any standalone measures that builders installed in the homes. Specifically, Cadmus followed the three steps shown in Table 11.

⁵ Energy consumption could not be as clearly-defined because some resources were potentially shared (e.g., shared walls, water heaters, laundry facilities, external lighting). Energy consumption might not have been as well-documented if homes were not separately metered. Accurate square footage sources were not available for multifamily homes.

⁶ An attempt to obtain square footage estimates for nonparticipant apartments and to estimate savings for multifamily homes produced inconclusive multifamily savings estimates: -0.44 kWh/sq. ft. in 2013; and 0.84 kWh/sq. ft. in 2014. The 2014 estimate showed a 129% realization. In 2013, however, unreliability of nonparticipant square footage estimates or dissimilarity between participant and nonparticipant apartment homes led to negative savings.



Table 11. Impact Evaluation Steps

Step	Action
1	Verify that participant and nonparticipant samples include appropriate data
2	Perform billing analysis to determine Normalized Annual Consumption (NAC)
3	Verify square footage for participant and nonparticipant homes

Step 1. Verify that Participant and Nonparticipant Samples Include Appropriate Data

Cadmus used three techniques to verify the program database characteristics, as discussed below.

Home Sample Selection and Data Collection

For participants that received an incentive during 2013–2014, the program participant database included measure-level data, home addresses, occupant names, contact information, floor areas, housing types (single-family or multifamily), numbers of floors, and space and water heating energy sources. Most new residential hookups provided much of this data through Rocky Mountain Power’s databases of billing and account data for all new residential hookups from January 2013 to January 2015. Cadmus used square footage estimates from other sources because 60% of the account data records did not include square footage information for participants and nonparticipants. Occupancy dates (the date the homeowner moved in) were determined for all new hookups, using information from the participant and billing datasets. Cadmus used a participant tracking dataset to identify participant homes from among the population of new hookups. After these participating residential homes were identified, the remaining homes could be assigned to the nonparticipating sample frame.

Cadmus obtained all square footage estimates from Property Shark and Realtor.com. These two sources produced square footage estimates very close to the Nexant square footage estimates recorded by the home energy raters.

Manual Review of Samples

The analysis from the previous impact evaluation for the wattsmart New Homes program found that savings per home decreased in 2009 and 2010. Following a review of these findings, Rocky Mountain Power identified home square footage as a parameter to be examined in greater depth because multiple databases contained conflicting values for square footage. Cadmus will therefore describe our process for determining the appropriate square footage source. Cadmus reviewed square footage data from the following four sources:

- The Nexant participant database where the value is recorded by the home energy rater (HERS) rating company.
- Zillow, “a home and real estate marketplace,” according to the company’s website.⁷
- Property Shark square footage.

⁷ <http://www.zillow.com/corp/About.htm>

- Realtor.com square footage.

Nexant, Property Shark, and Realtor.com tended to provide square footage approximately 500–600 square feet higher than Zillow square footage. The reasons for the differing values is not clear, but some differences might arise in the treatment of the parts of a residential structure. Most real estate industry definitions of square footage, for example, do not include unfinished basements, but because they qualify as conditioned spaces, HERS rater estimates may include them. Treatment of garages and porches could be a factor because these spaces are unconditioned but part of the structure. Property Shark and Realtor.com square footage closely matched Nexant estimates, which solved issues arising from using inconsistent sources (i.e., Zillow vs. HERS rater square footage). For consistency, the same square footage source was used for nonparticipants.

Cadmus first compared square footage for participant homes for which the Nexant square footage data was always available. Comparisons follow of average square footage to other square footage sources (as Nexant square footage was available).

Average square footage follows for all participants for which valid data were available:

- Nexant database: 2,614
- Property Shark and Realtor.com: 2,615
- Zillow: 2,005

The average square footage follows for all nonparticipants for which valid Zillow data were available:

- Property Shark and Realtor.com: 2,767
- Zillow: 2,292

For a group of nonparticipant homes, Zillow data were missing; only Property Shark and Realtor.com square footage data were available:

- Property Shark: 2,551
- Realtor.com: 2,598

A recommendation from the 2009–2010 billing analysis was to seek an alternative square footage source. Property Shark and Realtor.com offered average square footage estimates similar to the records in the Nexant database (which are based on HERS estimates) and historical average square feet; these estimates facilitated consistent energy intensity estimates for participants and nonparticipants—and hence savings—for this evaluation.

Correct Classification of Home Type

A detailed review of customer records during the square footage analysis identified 1,242 multifamily homes in the original nonparticipant sample of approximately 5,500 homes. Targeted searches for addresses with apartment and unit number suffixes identified many of the multifamily homes, and a manual review of all homes less than 1,200 square feet identified the rest.



In the future, this issue may be addressed through the addition of a “home type” field to the utility (billing) records for each account.⁸ In other, similar evaluations, Cadmus has successfully used the home-type fields in some utility records.

Step 2. Perform Billing Analysis to Determine Normalized Annual Consumption

The billing analysis calculated the evaluated savings by comparing the energy intensity of the participating homes with the energy intensity of similar non-participating new homes. The billing analysis included a comparison group (nonparticipant homes built in 2013 and 2014). The evaluated savings equaled the delta (change in quantity) between participant and nonparticipant electric energy intensity.

Using a billing analysis with a control group results in net evaluated savings.

Billing Data Weather Matching and Data Screening (Single-Family Homes)

Cadmus used zip codes associated with each new-residential hookup provided by Rocky Mountain Power to map homes to the nearest weather station. Cadmus then obtained historical weather data from 2013 through August 2015 for all associated Utah weather stations. From the average daily temperature, Cadmus obtained base 65 heating degree days (HDD) and cooling degree days (CDD), and matched associated HDDs and CDDs for each billing period record.

The screening process removed nonresidential and non-single-family homes. Program participation dates could then be used to assign program years to participants. In many cases, billing data associated with these participant homes were listed under builder account names. To ensure the use of only customer billing data, Cadmus selected billing data only after the first occupant moved into the home. To maximize the chance that the home was occupied, the analysis period encompassed only the most recent year with complete billing data (August 2014 through July 2015). Cadmus examined the billing data for this period after the household’s occupancy. Any customer with fewer than nine months (270 days) of billing data was removed from the analysis because the data would not be sufficient to run the PRInce-ton Scorekeeping Method (PRISM)-equivalent modeling approach. Cadmus reviewed each home’s monthly usage profile, and homes with vacancies in any months were removed from the analysis because they would not represent a fully occupied home. In addition, homes with solar rate codes were removed from the analysis.

Energy Analysis PRISM Modeling

For each participant and nonparticipant home, Cadmus estimated three PRISM models for the analysis period (August 2014 through July 2015) thus weather-normalizing the raw billing data usage. The default model estimated was the full heating and cooling model with the following specification:

$$ADC_{it} = \alpha_i + \beta_{1i} \text{AVGCDD}_{it} + \beta_{2i} \text{AVGHDD}_{it} + \varepsilon_{it}$$

⁸ For participants, program tracking data records the home type. For nonparticipants, Cadmus only had utility records, which do not include home types.

For each customer i and month t ,

α_i is the intercept for the participant (or nonparticipant), representing the base load.

β_{1i} is the model cooling slope.

β_{2i} is the model heating slope.

ADC_{it} is average daily consumption during the program period.

$AVGCDD_{it}$ is average daily CDDs for the specific location.

$AVGHDD_{it}$ is average daily HDDs for the specific location.

ε_{it} is the error term.

From the above model, weather-normalized NAC is computed as:

$$NAC_i = \alpha_i * 365 + \beta_{1i} * LRCDD_i + \beta_{2i} * LRHDD_i$$

Where, for each customer i ,

α_i is the intercept representing the average daily or base load for each participant (or nonparticipant); this also represents the average daily base load from the model.

NAC_i is the normalized annual consumption.

$LRCDD_i$ is the annual long-run CDDs, based on home location.

$LRHDD_i$ is the annual long-run HDDs, based on home location.

$\alpha_i * 365$ is the annual base load usage.

If the default heating and cooling model yielded any negative cooling or heating parameters, Cadmus estimated the NAC using either a cooling-only model (AVGCDD term only) or a heating-only model (AVGHDD term only) – selecting the model with the highest r-square. The analysis excluded models with negative parameters.

Step 3. Verify Square Footage for Participant and Nonparticipant Homes

Cadmus obtained Property Shark and Realtor.com square footage for all nonparticipant homes that had sufficient billing data. Both of these sources provided square footage estimates similar to Nexant's participant square footages from the tracking estimates. This method allowed inclusion of all customers with valid square footage estimates in the billing analysis.

Results

Single-Family ENERGY STAR Certified Home Savings

Cadmus calculated program savings using NAC values determined through billing analysis for participants and nonparticipants. Table 12 summarizes the results. Dividing these values by the Nexant (participants) or Property Shark/Realtor.com (nonparticipants) square footage values resulted in per-home single-family savings of 1,660 kWh/year for 2013 and 1,655 kWh/year for 2014.



Table 12. Energy Savings for Single-Family Homes

Description	Square Footage		NAC (kWh/year)		Energy Intensity (kWh/Sq. Ft.)	
	2013	2014	2013	2014	2013	2014
Participants	2,749	2,522	8,066	7,269	2.93	2.88
Nonparticipants	2,710	2,710	9,587	9,587	3.54	3.54
Savings*	NA	NA	1,660	1,655	0.60	0.66

*Participant savings were obtained by multiplying energy intensities by average participant square feet.

Table 13 summarizes single-family, square footage estimates and savings in reference to previous billing analyses conducted for this program. Savings per square foot for the current evaluation align with previous years. Only 2010 exhibited an unusually high reported estimate, low realization rates, and low savings per square foot.

Table 13. Energy Savings Historical Comparison for Single-Family Homes*

	2006	2007	2008	2009	2010	2013	2014
Expected Savings per Participant	1,931	1,623	1,431	2,200	3,345	1,751	1,609
Average Square Feet (Participants)	2,874	2,898	2,318	2,510	2,522	2,749	2,522
Expected Savings Per Square Foot	0.67	0.56	0.77	0.88	1.33	0.64	0.64
Savings Per Square Foot (Modeled)	0.69	0.52	0.52	0.65	0.49	0.60	0.66
Savings kWh (Modeled)	1,985	1,517	1,213	1,634	1,224	1,660	1,655
Savings RR (Modeled)	103%	93%	85%	74%	37%	95%	103%
90% Precision of Estimate (Modeled)	19%	23%	24%	**	**	28%	19%

* Due to program changes, no evaluation was conducted for the 2011 and 2012 program years.

** These estimates were not in the 2009–2010 report (billing analysis conducted by KEMA).

Multifamily Savings

Cadmus attempted to estimate multifamily savings using the same approach as for single-family savings. However, the multifamily savings and realization rates unexplainably differed significantly between 2013 and 2014. Estimated savings for multifamily homes produced inconclusive multifamily savings estimates:

- -0.44 kWh/sq. ft. in 2013
- 0.84 kWh/sq. ft. in 2014

The 2014 estimate showed a 129% realization rate. In contrast, in 2013 the unreliability of nonparticipant square footage estimates or dissimilarity between participant and nonparticipant apartment homes led to negative savings. Because of the inconsistent multifamily findings, Cadmus utilized the approach used in previous evaluations: the savings realization rate established for single-family homes was applied to reported savings for multifamily homes. Table 14 shows the resulting annual values for multifamily homes.

Table 14. Multifamily Per Home Savings

Description	Home Type	2013	2014
Reported Savings (kWh/year) ⁹	Single-Family	1,751	1,609
	Multifamily	1,162	719
Evaluated Savings (kWh/year)	Single-Family	1,660	1,655
	Multifamily	1,102	740
Realization Rate	Single-Family	94.8%	102.9%
	Multifamily		

Net Savings for ENERGY STAR Certified Homes

Table 15 shows the net energy savings for ENERGY STAR certified homes by home type for 2013 and 2014.

Table 15. ENERGY STAR Certified Homes Net Energy Savings

Savings Type	Home Type	2013	2014	Two-Year Total
Reported Savings (kWh)	Single-Family	779,140	885,631	1,664,771
	Multifamily	276,465	171,101	447,566
	Total	1,055,605	1,056,732	2,112,337
Evaluated Savings (kWh)	Single-Family	740,183	912,200	1,652,383
	Multifamily	262,642	176,234	438,876
	Total	1,002,825	1,088,434	2,091,259
Total Savings Realization Rate		95%	103%	99%

Engineering Review of Standalone Measures

Methodology

For this evaluation, standalone measures were those applied to homes not receiving ENERGY STAR certification. The engineering review included reviewing the Design Brief¹⁰ and calculating Cadmus savings. The program’s design brief outlined the program history, possible challenges for the program, measures the program offers, and cost-effectiveness inputs. The design brief used the REM/Rate software program to develop program energy savings and described the method and assumptions used in the development of the measures’ energy savings. To develop site-specific savings, Cadmus applied information available in the participant tracking database to update savings, accounting for location,

⁹ The per home reported savings for the single-family homes are from the billing analysis sample, while the multifamily savings are from the population from Tables 4 and 5.

¹⁰ Program Savings Design Brief, From Nexant, outlining program energy savings development.



home size, and the combinations of measures chosen by participant builders. As shown in Table 16, Cadmus divided each measure into one of five categories: lighting, HVAC, appliances, code enhancement, and envelope.

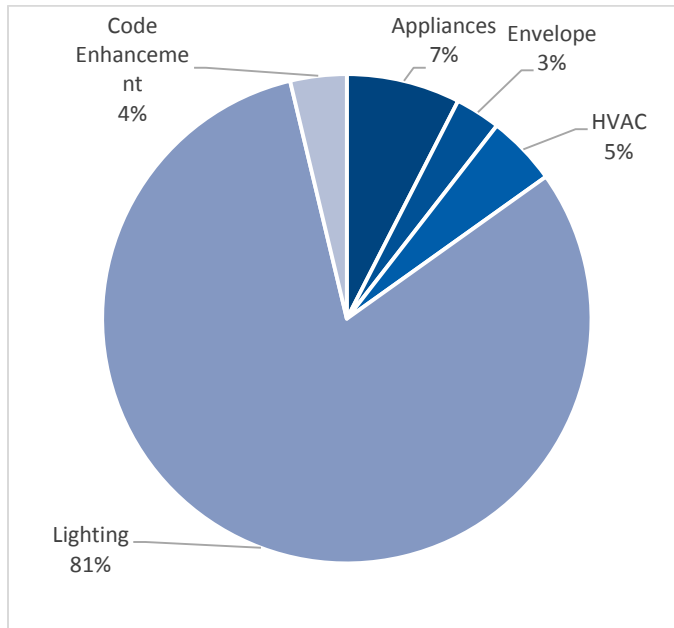
Table 16. Reviewed Measures

Lighting	HVAC	Code Enhancement
2012 EISA - 80% E* lighting < 2000 SF	15 SEER / 12 EER / TXV MF	IECC 2009 Builder cert MF
2012 EISA - 80% E* lighting > 3500 SF	15 SEER / 12 EER / TXV SF	IECC 2009 Builder cert SF
2012 EISA - 80% E* lighting 2000 to 3500 SF	Evap Prem Eff non-ducted SF	IECC 2009 Rater cert MF
2012 EISA - 80% E* lighting 850 to 1500 MF	GSHP E* 17 EEF 3.6 COP SF	IECC 2009 Rater cert SF
2012 EISA - 80% E* lighting < 850 MF	HVAC-QI Contractor cert SF	Envelope
2013 EISA - 80% E* lighting < 2000 SF	HVAC-QI Contractor cert w ECM SF	2X6 R-20 Walls MF
2013 EISA - 80% E* lighting < 850 MF	HVAC-QI Rater cert MF	2X6 R-20 Walls SF
2013 EISA - 80% E* lighting > 1500 MF	HVAC-QI Rater cert SF	R-5 Windows SF
2013 EISA - 80% E* lighting > 3500 SF	HVAC-QI Rater cert w ECM SF	
2013 EISA - 80% E* lighting 2000 to 3500 SF	Appliances	
2013 EISA - 80% E* lighting 850 to 1500 MF	Dishwasher EF 0.75+ MF	
2014 EISA - 80% E* lighting < 2000 SF	Dishwasher EF 0.75+ SF	
2014 EISA - 80% E* lighting < 850 MF	Refrigerator 10% > ENERGY STAR MF	
2014 EISA - 80% E* lighting > 1500 MF	Refrigerator 10% > ENERGY STAR SF	
2014 EISA - 80% E* lighting > 3500 SF		
2014 EISA - 80% E* lighting 2000 to 3500 SF		
2014 EISA - 80% E* lighting 850 to 1500 MF		

Note: Measures in this table are the measure names from the program tracking data and are consistent with the program savings design brief. Each measure is followed by an identifier SF or MF, representing single-family or multifamily homes.

Cadmus then prioritized the evaluation efforts based on measure categories with the greatest impact on program energy savings. As shown in Figure 1, of standalone measures, lighting measures had the greatest impact by far, accounting for 81% of gross kWh. Appliances, HVAC, code enhancement, and envelope measures accounted for the remaining 19% of gross kWh.

Figure 1. Measure Impact on Program Energy Savings for 2013 and 2014



Source: Cadmus analysis of program tracking data of all standalone measures

Lighting

To receive an incentive builders must install ENERGY STAR-qualified lamps or fixtures in 80% of RESNET-qualified lighting locations. RESNET-qualified lighting locations include all lighting in a home, except for plug-in lamps, closets, unfinished basements, and landscape lighting. The Design Brief calculated savings in REM/Rate for a medium-sized home, and then applied factors to scale the savings to large and small homes. The Design Brief estimated Energy Independence Act of 2007 (EISA)¹¹ impacts by reducing the impacts of incandescent lamps by 5% in 2012, 10% in 2013, and 27% in 2014.

Cadmus found the methods outlined in the Design Brief to be reasonable: it accounted for EISA’s impact on baseline lighting efficiency and restricted the requirement to RESNET-qualified fixture locations. Because builders generally sell houses without furnishings, lighting installed in lamps would be outside of their control. Closets and unfinished basements require minimal lighting usage, and this might not be worth the additional cost. An unknown factor in planning saving estimates for this measure is the

¹¹ Congress signed EISA into law on December 19, 2007. The law contains provisions for phasing in new efficiency requirements for residential lamps based on rated lumens. For example, a lamp with a rated output between 1,490 and 2,600 lumens was required to use 72 watts or less starting on January 1, 2012. There are 22 types of incandescent lamps that are exempt from the EISA 2007 standard, including heavy duty, reflector, and three-way incandescent lamps.



quantity of light fixtures per home. To address the number of fixtures per home, Nexant classified homes into size bins (by square footage) and assigned lighting savings.

Cadmus used the following equation to determine the energy usage of lighting fixtures. This is the same calculation used in REM/Rate as required by RESNET protocols:

$$\text{Lighting} \frac{kWh}{\text{year}} = \left[\frac{(4 - 3 * qFFIL)}{3.7} \right] * (445 + 0.8 * CFA) + 0.2 * (455 + 0.8 * CFA)$$

Where¹²:

CFA = Conditioned square feet of home

qFFIL = The ratio of qualifying interior light fixtures to all interior light fixtures in RESNET-qualified interior light fixture locations

Cadmus also developed estimates of EISA impacts on baseline lighting for qualified fixture locations in new homes. Using data from the Northwest Energy Efficiency Alliance’s Residential Building Stock Assessment,¹³ Building America House Simulation Protocols,¹⁴ and the EISA legislation, the team estimated lighting usage of typical new homes, finding reductions in baseline energy consumption of 5% in 2012, 6% in 2013, and 27% in 2014—figures very consistent with those in the Design Brief.

Cadmus used the equation above to calculate lighting reductions, assuming the program target of 80% ENERGY STAR-qualified lighting fixtures, and applied the baseline reduction factors. Evaluated energy consumption was calculated for each home in the program tracking database that received a lighting measure.

Appliances

The program provided rebates for dishwashers and refrigerators if they met the program’s minimum efficiency requirements (e.g., 0.75 Energy Factor and 10% better than ENERGY STAR). Details were not provided in the Design Brief on how reported energy savings had been calculated.

Measures: Dishwasher Energy Factor 0.75+

Cadmus calculated energy savings for dishwashers based on prevailing minimum energy standards and DOE usage assumptions, as detailed by the federal test procedure for dishwashers¹⁵. The standard changed on May 30, 2013, affecting the baseline efficiency for equipment built after that date. The

¹² The terms 4, 3, 3.7, and 445 are constant coefficients as determined by RESNET/ANSI 301-2014 Table 4.2.2.5 for calculating lighting annual energy usage. Available online: http://www.resnet.us/standards/ANSI-RESNET_301-2014.pdf

¹³ Northwest Energy Efficiency Alliance (NEEA). Residential Building Stock Assessment. 2011.

¹⁴ Office of Energy Efficiency & Renewable Energy. Building America House Simulation Protocols. 2010.

¹⁵ Federal Register 10 CFR Part 430 “Energy Conservation Program for Consumer Products: Test Procedure for Dishwashers” 2003 <https://www.gpo.gov/fdsys/pkg/FR-2003-08-29/pdf/03-22120.pdf>

tracking database only recorded one date: when the certificate of occupancy was issued. Consequently, for homes that received a certificate after that date, Cadmus calculated energy savings based on the new federal standard. The baseline shift affected 2,954 of the 3,713 program dishwashers. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Measures: Refrigerator 10% > ENERGY STAR

Refrigerator energy savings were calculated based on the findings of the Home Energy Savings¹⁶ program evaluation. In that evaluation the energy consumption for each refrigerator that received a rebate through the program was calculated by checking model numbers in the ENERGY STAR database of efficient products. The federal minimum efficiency standard changed in September 2014, so the average refrigerator energy savings was estimated for all products sold before and after the baseline shift. To account for the baseline shift, the average energy savings amount was applied to the participant tracking database using the certificate of occupancy. The baseline shift affected 14 of the 56 program refrigerators¹⁷. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

HVAC

HVAC measures included high-efficiency cooling systems, evaporative cooling, ground-sourced heat pumps, quality installations, and quality installations with electronically commutated fan motors.

Measures: 15 SEER / 12 EER / TXV

High-efficiency cooling systems must meet a 15 SEER minimum efficiency and have a central duct system and thermostatic expansion valve to be eligible for a program rebate. Cadmus calculated energy savings for each IECC climate zone using billing data cooling consumption found in the design brief and the percentage savings attained when moving from a 13 SEER AC to a 15 SEER AC. Homes in the participant tracking database were cross-referenced to the same IECC climate zones and assigned the deemed savings based on that climate zone. Our calculated savings matched very closely to the energy savings documented in the tracking database. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Measures: Evap Prem Eff non-ducted

The program provides rebates for evaporative cooling systems. The team calculated this measure's energy savings through a weather bin analysis that used Salt Lake City typical metrological year version 2(TMY2) weather data. Only five homes received this measure in the standalone measure sample frame. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Measures: GSHP E* 17 EEF 3.6 COP

Geothermal heat pumps must be ENERGY STAR certified, with a minimum of 17 EER and 3.6 COP efficiency. The team developed several energy savings calculations using REM/Rate and the Northwest

¹⁶ CADMUS, Final Report: 2013-2014 Utah Home Energy Savings Program Evaluation April, 2016.

¹⁷ While more refrigerators than 56 were rebated through the wattsmart New Homes program this analysis was restricted to Non-Energy Star Homes for sampling reasons.



Power and Conservation Council’s Region Technical Forum (RTF),¹⁸ these ranged between 50% and 150% of the energy savings documented in the tracking database. Geothermal heat pumps can vary in performance depending on the size of the system installed, the ground coupling used, or how well a home has been insulated. Cadmus found the savings detailed in the program tracking data to be reasonable and saw no reason to update savings based on the data available. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Measures: HVAC-QI

Quality installations require a HERS rater or contractor to verify that HVAC systems have been installed according to ACCA Standard 5, and that the home receives a properly sized HVAC system. Up to two HVAC systems per home are eligible for rebates.

Quality installations can provide significant energy savings in a market with poor installation practices. In theory, every installation should be a quality endeavor. To maintain a positive brand image, many HVAC manufacturers require dealers to follow quality installation protocols. This measure assumes poor quality as the baseline, and the program offers rebates to persuade contractors to perform high-quality work. Without evidence of local market conditions and installation practices, Cadmus cannot provide updated energy savings for this measure. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Code Enhancement

Homes receive certification that they meet IECC 2009 requirements. IECC 2009 is a set of design criteria that typically reduces the energy usage of newly built homes by 12–15%¹⁹ over the required Utah energy code, IECC 2006. Code compliance can be certified by builders, using a signed checklist or by a RESNET-certified energy rater. Other program measures can interact with IECC 2009 requirements, such as lighting and wall insulation, driving the energy savings down. The Design Brief describes how Nexant mitigated these possible interactions by assuming that homes would include both lighting and wall insulation measures. As a result, energy savings for those measures are not accounted for in the code-enhancement measure.

Cadmus calculated savings for the code-enhancement measure with REM/Rate simulations in each weather zone using model details described in the Design Brief. Employing program tracking data, Cadmus separately modeled homes that already had the lighting or wall insulation measures, precluding measures from receiving savings twice. Cadmus modeled homes that had installed only the code enhancement measure, without lighting or wall insulation; those homes received higher than reported savings for code enhancement. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

¹⁸ Northwest Power and Conservation Council. “Regional Technical Forum.”

¹⁹ <http://media.iccsafe.org/news/eNews/2009v6n2/icfsummary.pdf>

Envelope

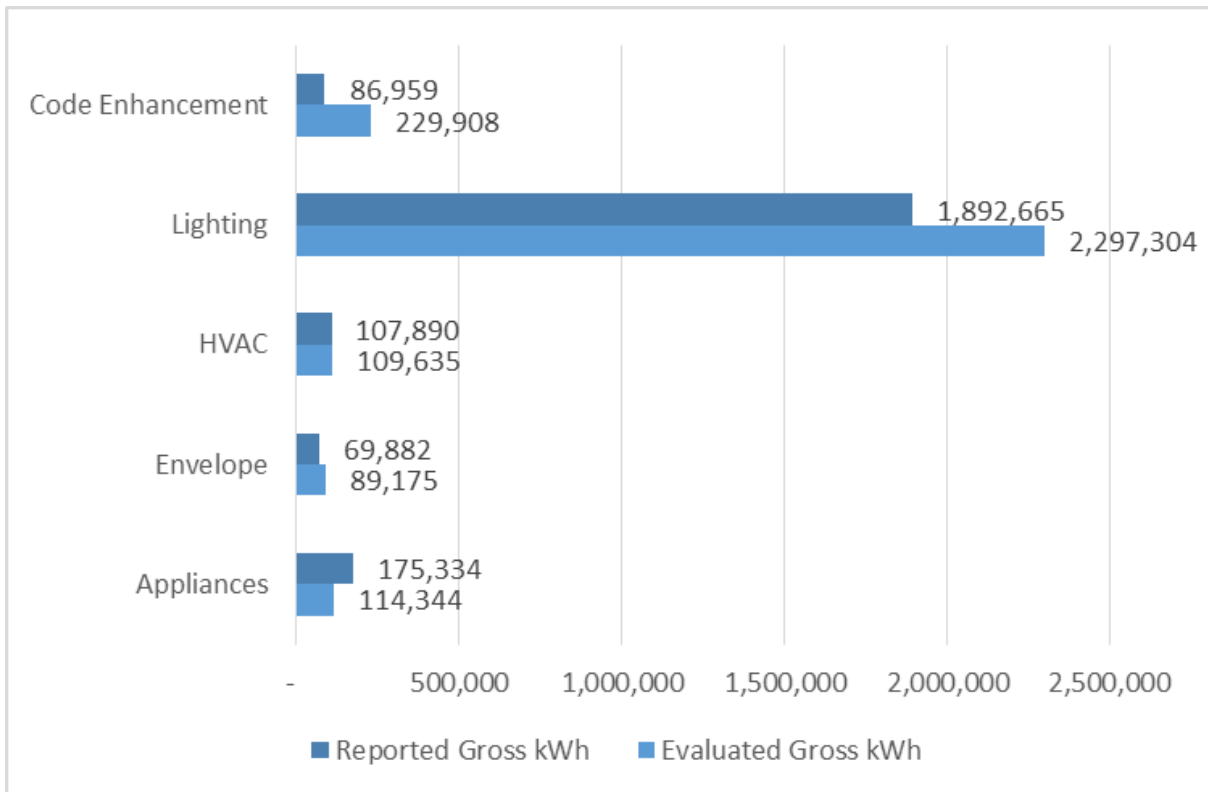
The program includes two envelope measures: homes built to R-20 wall specifications and R-5 windows. Since the IECC 2006 program took effect, baseline wall systems required by code were R-13 walls (i.e., in most cases, 2x4 walls). R-20 walls generally required builders to switch to 2x6 exterior walls to maintain sufficient space for R-20 insulation. R-5 windows follow an unconventional naming scheme because windows are usually rated in U-values, the inverse of an R-value. An R-5 window has a U-value of 0.2 (the program allows a U-value of 0.22 for operable windows).

Cadmus calculated wall insulation savings using REM/Rate simulations and assigned a savings value to each home receiving the measure, which was based on the home’s climate zone. Calculation details are shown in Appendix H: Evaluated Savings Calculations.

Results

This engineering review covers all homes that received rebates but did not receive ENERGY STAR certification through the program. The evaluated energy savings for the engineering review are detailed below in Figure 2.

Figure 2. Engineering Review Results



Detailed evaluated savings by home type and year are shown below in Table 17.



Table 17. Evaluated Gross kWh Savings for Standalone Measures

Savings Type	Home Type	2013	2014	Two-Year Total
Reported Savings (kWh)	Single-Family	824,495	736,153	1,560,648
	Multifamily	258,179	513,903	772,082
	Total	1,082,674	1,250,056	2,332,730
Evaluated Gross Savings (kWh)	Single-Family	963,425	982,464	1,945,889
	Multifamily	303,841	590,636	894,477
	Total	1,267,266	1,573,100	2,840,366
Realization Rate (Gross/Reported Savings)		117%	126%	122%

Net-to-Gross

Freeridership Methodology

Freeridership, the portion of savings that would have occurred in the program’s absence, is an important but challenging aspect of most impact evaluations. A common approach uses survey questions to estimate the percentages of energy-efficient improvements that participants would have made in the program’s absence.

The evaluation’s new homes billing analysis and energy intensity model resulted in a net savings estimate that did not require the application of an additional freeridership adjustment. The exclusion of a freeridership adjustment is appropriate if the comparison group includes nonparticipating builders (used as the baseline) who are building homes that have naturally energy-efficient features. In this case, differences in consumption between participants and comparison group households were already mitigated by the energy-efficient actions of nonparticipants in the comparison group.

Cadmus calculated the freeridership percentage for standalone measures through telephone surveys with participating builders. Cadmus conducted surveys with 22 builders (17 active builders and 5 inactive builders²⁰). Thirteen of the active builders who installed standalone measures in non-ENERGY STAR homes and were responsible for 68% of standalone measure evaluated savings in non-ENERGY STAR homes that received incentives through the program in 2013 and 2014. Participant builders were ranked by the amount of standalone measure energy savings, and builders with the most savings were approached for interviews. Builders’ standalone measure freeridership results were weighted by the amount of energy savings they represented resulting in a single standalone-measure freeridership value for the two-year evaluation period. Results from this standalone-measure freeridership analysis are in Appendix A: Freeridership and Spillover.

²⁰ Active builders submitted over 30 applications in 2013 and 2014. Inactive builders submitted fewer than 10 applications in 2013 and 2014.

Spillover Methodology

Spillover represents additional energy-efficiency measures that have been installed, which were motivated by the program but did not receive incentives. The results of the billing analysis of new homes captured participant spillover. To the extent that participants installed additional measures, related savings lowered participant consumption and increased savings relative to the comparison group.

To check for spillover activity related to energy-efficient products or improvements integrated into homes that did not receive a wattsmart program rebate, Cadmus also conducted telephone interviews with participating builders who installed standalone measures that received incentives through the program. Cadmus qualitatively assessed additional energy-efficient measures that did not receive incentives if builders reported that their participation in the wattsmart program was “very influential” on the purchasing decisions. Findings from this standalone measure spillover analysis are in Appendix A: Freeridership and Spillover.

Overall Program Net Savings

Table 18 shows the overall program net savings from the billing analysis and engineering review. Overall, the program achieved 78% net savings from the reported savings, at 3,454,635 kWh for the two-year period.

Table 18. Overall Program Net Energy Savings

Savings Type	Year	Reported Savings (kWh)	Realization Rate	Evaluated Savings (kWh)	NTG	Net Evaluated Savings (kWh)	Total Savings Realization Rate
ES Homes	2013	1,055,605	95%	1,002,825	100%*	1,002,825	95%
	2014	1,056,732	103%	1,088,434		1,088,434	103%
Standalone Measures	2013	1,082,674	117%	1,267,266	48%	608,288	56%
	2014	1,250,056	126%	1,573,100		755,088	60%
Total		4,445,067	111%	4,931,625	70%	3,454,635	78%

* NTG for ENERGY STAR Homes is defined as 100% as the billing analysis yields a net number.



Cost-Effectiveness

To assess cost-effectiveness, Cadmus analyzed program costs and benefits from five perspectives, using Cadmus' DSM Portfolio Pro²¹ model. The California Standard Practice Manual for assessing DSM program cost-effectiveness describes the benefit/cost ratios Cadmus used for the following five tests:

1. **PacifiCorp Total Resource Cost (PTRC) Test:** This test examined program benefits and costs from Rocky Mountain Power's and its customers' perspectives, combined. On the benefit side, the test included avoided energy costs, capacity costs, and line losses, plus a 10% adder to reflect non-quantified benefits. On the cost side, it included costs incurred by the utility and participants.
2. **Total Resource Cost (TRC) Test:** This test examined program benefits and costs from Rocky Mountain Power and its customers' perspectives, combined. On the benefit side, the test included avoided energy costs, capacity costs, and line losses. On the cost side, it included costs incurred by the utility and participants.
3. **Utility Cost Test (UCT):** This test examined program benefits and costs solely from Rocky Mountain Power's perspective. The benefits were avoided energy, capacity costs, and line losses. The costs included program administration, implementation, and incentive costs associated with program funding.
4. **Ratepayer Impact Measure (RIM) Test:** All ratepayers (participants and nonparticipants) could experience rate increases designed to recover lost revenues. The benefits were avoided energy costs, capacity costs, and line losses. This test included all Rocky Mountain Power program costs and lost revenues.
5. **Participant Cost Test (PCT):** From this perspective, program benefits were bill reductions and incentives received. Costs included a measure's incremental cost (compared to the baseline measures), plus installation costs incurred by the customer.

Table 19 summarizes the five tests' components.

²¹ DSM Portfolio Pro has been independently reviewed by various utilities, their consultants, and regulatory bodies including the Iowa Utility Board, the Public Service Commission of New York, the Colorado Public Utilities Commission, and the Nevada Public Utilities Commission.

Table 19. Benefits and Costs Included in Various Tests

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

* Includes avoided line losses.

Table 20 provides selected cost analysis inputs, including evaluated energy savings for each year, the discount rate, line loss, and program costs. Rocky Mountain Power provided all of these values, except for energy savings. The discount rate was derived from Rocky Mountain Power’s 2013 Integrated Resource Plan. Rocky Mountain Power also provided values for line loss and program costs.

Table 20. Selected Cost Analysis Inputs

Input Description	2013	2014	Total
Program Net Savings (kWh/year)	1,611,112	1,843,522	3,454,634
Discount Rate	6.88%	6.88%	6.88%
Line Loss	9.32%	9.32%	9.32%
Inflation Rate	1.90%	1.90%	1.90%
Net Customer Costs*	\$1,731,100	\$1,991,668	\$3,722,768
Total Program Incentives	\$420,406	\$536,154	\$956,560
Total Program Costs (non-incentives)	\$925,674	\$837,458	\$1,763,132

* Represents gross customer costs adjusted by the program NTG ratio. Customer costs provided by Rocky Mountain Power in the annual report data.

Program benefits included energy savings and their associated avoided costs. The cost-effectiveness analysis used energy savings derived from this study’s evaluated kWh and the measure lives²² provided by Rocky Mountain Power in the annual report data. All analyses used avoided costs associated with Rocky Mountain Power’s 2013 IRP *East Residential House 35% Load Factor Decrements*.²³

Table 21 presents program cost-effectiveness analysis results using evaluated net savings for all program measures during the evaluation period (2013–2014), but did not account for non-energy benefits

²² Measure lives decreased to approximately 13 years for this evaluation cycle from over 20 years in previous cycles.

²³ The IRP decrements are detailed in Appendix N of PacifiCorp’s 2013 Integrated Resource Plan: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2013IRP/PacifiCorp-2013IRP_Vol2-Appendices_4-30-13.pdf



(except those represented by the 10% conservation adder included in the PTRC). The program was cost-effective from the UCT and PCT perspectives during the evaluation period. The program did not prove cost-effective from the PTRC test, the TRC test, and the RIM test perspectives.

Table 21. Program Cost-Effectiveness Summary for 2013-2014

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.159	\$5,303,736	\$2,975,304	(\$2,328,432)	0.56
Total Resource Cost Test (TRC) No Adder	\$0.159	\$5,303,736	\$2,704,821	(\$2,598,915)	0.51
Utility Cost Test (UCT)	\$0.079	\$2,631,247	\$2,704,821	\$73,575	1.03
Rate Impact Test (RIM)	\$0.108	\$6,209,503	\$2,704,821	(\$3,504,681)	0.44
Participant Cost Test (PCT)	\$0.186	\$3,594,527	\$4,500,293	\$905,766	1.25
Lifecycle Revenue Impacts (\$/kWh)	\$0.000014094				
Discounted Participant Payback (years)	9.61				

Table 22 shows the program's cost-effectiveness in 2013.

Table 22. Program Cost-Effectiveness Summary for 2013

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.162	\$2,656,774	\$1,441,457	(\$1,215,317)	0.54
Total Resource Cost Test (TRC) No Adder	\$0.162	\$2,656,774	\$1,310,415	(\$1,346,359)	0.49
Utility Cost Test (UCT)	\$0.082	\$1,346,080	\$1,310,415	(\$35,665)	0.97
Rate Impact Test (RIM)	\$0.106	\$3,069,786	\$1,310,415	(\$1,759,370)	0.43
Participant Cost Test (PCT)	\$0.188	\$1,731,100	\$2,144,112	\$413,012	1.24
Lifecycle Revenue Impacts (\$/kWh)	\$0.000007075				
Discounted Participant Payback (years)	9.52				

Table 23 shows the program’s cost-effectiveness in 2014.

Table 23. Program Cost-Effectiveness Summary for 2014

Cost-Effectiveness Test	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.156	\$2,829,126	\$1,639,406	(\$1,189,720)	0.58
Total Resource Cost Test (TRC) No Adder	\$0.156	\$2,829,126	\$1,490,369	(\$1,338,757)	0.53
Utility Cost Test (UCT)	\$0.076	\$1,373,612	\$1,490,369	\$116,757	1.08
Rate Impact Test (RIM)	\$0.185	\$3,355,792	\$1,490,369	(\$1,865,423)	0.44
Participant Cost Test (PCT)	\$0.110	\$1,991,668	\$2,518,334	\$526,666	1.26
Lifecycle Revenue Impacts (\$/kWh)	\$0.000007502				
Discounted Participant Payback (years)	8.69				



Process Evaluation

This section presents findings from in-depth interviews with three program staff, home energy raters, and participating builders, and surveys with homeowners living in participating and nonparticipating homes built in 2013–2014.

Program Staff Interviews and Operations

Program staff interviews explored experiences with the wattsmart New Homes program. Program staff members discussed the program and described how the program worked during 2013 and 2014. Cadmus conducted interviews with the program manager at Rocky Mountain Power and the Nexant program administrator and program outreach coordinator:

- Rocky Mountain Power’s program manager oversees the entire program, receiving and reviewing reports from Nexant, and serves as the main communication point for program administrators at Nexant.
- The program administrator at Nexant oversees the program team, processes the applications, and oversees marketing and outreach activities. In addition, she works with builders and Home Energy Raters on quality control activities.
- The program outreach coordinator at Nexant works with builders and allied organizations, such as home builder associations and other organizations that the program might want to partner with to provide program-focused training.
- A business processing coordinator at Nexant also oversees all applications and receives all e-mails and phone calls from the public regarding the program. (At the time of the interviews, a new person had been assigned to the position, so Cadmus did not conduct an interview). Public contact mainly comes from home energy raters asking for a review of applications to ensure that they meet the requirements. Another department at Nexant processes applications and sends rebate checks.

Participating homes can be certified as ENERGY STAR homes, or they can be built with standalone measures. In July 2012, the program added standalone measures in response to many builders’ response to the changes to ENERGY STAR in Version 3 (which were not well-accepted by builders at the time). The program’s standalone portion was added to encourage program and builder participation. Builders could add standalone measures such as high-efficiency lighting, 2x6 walls, energy-efficient HVAC, and R-20 windows to the home, and the home would likely qualify for ENERGY STAR whole-home certification. In this case, builders could receive incentives for standalone measures that surpassed whole-home certification.

Home energy raters submit the incentive applications to Nexant after confirming that a home meets the program’s requirements; applications are processed every two weeks, with reports sent to Rocky Mountain Power monthly, quarterly, and annually. Nexant meets with Questar (the area’s gas utility) every two weeks to ensure that the utilities remain unified in the marketplace. Meetings cover

discussion of methods to engage more builders and achieve higher savings. Nexant and Rocky Mountain Power have collaborated with Questar to have a program application submission for both utilities (i.e., Questar and Rocky Mountain Power). This helped home energy raters reduce the amount of paperwork required and aided builders in working directly with the program.

Nexant reported a lack of changes to program requirements or incentives during 2013 or 2014, which proved helpful; the longer the program remains the same, the easier it is for builders and raters to participate without confusion. However, one well-received change did occur: the deadline for applications was extended from 120 days to 180 days, making it easier for raters to submit paperwork within deadlines.

In 2013, the program won an American Council for an Energy-Efficient Economy “Exemplary Program” award for program changes during 2012 in response to ENERGY STAR Version 3.

Program Goals

The program originally sought to achieve a savings goal of 4.8 million kWh for 2013, and it reported 2.1 million kWh in savings. Expected savings were adjusted by program administrators to align more closely with program participation history and with the adjustments necessitated by EISA.²⁴ For 2014, program administrators adjusted the savings goal down to 4.0 million kWh, and the program reported 2.3 million kWh—an average savings of 711 kWh per home. Program managers reported that the expected savings were not met because of multiple factors: more standalone measures installed, fewer whole-home certifications, and lighting baseline movement due to EISA.

A little more than half of the reported program savings are from standalone measures. About 75% of all program homes consisted of standalone measures only. The remainder were ENERGY STAR certified homes with higher average savings per home.

Program Marketing

Nexant directly works with the builders and home energy raters to recruit builders into the program. In the past, Nexant representatives would attend home shows to encourage home buyers to purchase ENERGY STAR homes, but that led to homeowners asking about the incentives, although the program was designed to provide incentives to the builders so Nexant no longer markets at home shows. Nexant advertised through billboards, television advertising, and radio, but recently stopped because it was marketing “to a million people to get the message to the 10,000 people in the market for a new home that year.” Instead, Nexant has moved to its current strategy of marketing directly to builders.

²⁴ The Energy Independence and Security Act of 2007 phased out high-wattage bulbs, and therefore altered the baseline assumptions for high-efficiency lighting.



In working with builders and home energy raters, Nexant has found that staying within about 50 miles of Salt Lake City is the most effective strategy because most new homes are being built within this area. According to Nexant, this keeps the marketing and outreach efforts cost-effective.

Nexant networks with nonparticipating builders to increase the number of participating builders. This includes Nexant attending the VIP night for builders and placing its logo on the awards provided at the events to gain market recognition from builders. In addition, Rocky Mountain Power provides Nexant with a list of new meter connections in the area, which allows Nexant to determine which builders actively build but are not involved with the program. Nexant also networks with builders through home builders associations and sponsors events that attract builders. Nexant representatives regularly meet with decision makers.

Nexant also provides training sessions for builders that feature top builders to show how the program works and how builders can benefit from it. Building scientists and sales professionals²⁵ present at the trainings and interviewees reported that this has created a great deal of value for the builders.

Relationship with Builders and Home Energy Raters

According to Nexant, the program administrators have a good working relationship with many builders and home energy raters. Nexant has a rater agreement that raters must sign, which states that raters will submit homes that fulfill the program's requirements and that they are properly certified and licensed to perform the work. Nexant reported that raters understand the program well.

Nexant often does not work directly with builders in the territory, but builders must complete a builder application, which states that they will follow the program rules and they understand the program requirements.

Barriers to Participation

Nexant reported that the primary barrier to attracting builders to participate is motivating them to build their homes differently and more efficiently. According to Nexant, many builders became unhappy with ENERGY STAR Version 3 changes, but Nexant is confident they can demonstrate to builders that energy-efficient homes offer advantages for everyone. Still, persuading builders to fill out the program's paperwork presents a different challenge that can be difficult to overcome. To this end, the home energy rater usually applies the incentive from the program, but according to Nexant, the builders still view the program participation process to be burdensome.

Builder and Home Energy Rater Interviews

²⁵ To view videos from one of the top participating builders in Utah who presents at builder training sessions: <https://www.youtube.com/watch?v=1SrSLGcg3Gc>; <https://www.youtube.com/watch?v=vCaTmNR7me0>; <https://www.youtube.com/watch?v=Zy5b9xXlpqA>; <https://www.youtube.com/watch?v=sglrwiSD8bg>.

Cadmus interviewed three participant home energy raters and 22 participant builders on topics such as reasons for participation, observations about customer awareness, program changes, program satisfaction, challenges encountered, and general program experience. The builders were divided into two groups, active and inactive, as presented in Table 24.

Table 24. Summary of Active and Inactive Builders

Builder Group	Definition	Number Surveyed
Active	Built more than 30 participating homes in the 2013–2014 evaluation period.	17
Inactive	Built fewer than 10 participating homes in the 2013–2014 evaluation period.	5

Participation and Awareness

Cadmus asked participant builders how they initially heard about the program, and 20 out of 22 could recall how they heard about the program. The four primary ways that participant builders learned of the program were through their colleagues, Rocky Mountain Power, mass media, and home energy raters. Table 25 displays participant builders’ responses.

Table 25. How Participant Builders Learned of Program (n = 20, multiple responses allowed)

Category	Response Count
From a colleague or company already participating in the program	6
Rocky Mountain Power	4
Mass media (radio, TV, newspaper ad)	3
Home energy rater	3
Customer demand	2
Event	1
Through ENERGY STAR	1
Transition to “green” construction	1
Utah Housing Corporation	1
Rocky Mountain Power website	1

Active builders decided to participate in the program for a variety of reasons, but primarily because of the incentives offered. Table 26 lists reasons that participant builders chose to participate in the program.



Table 26. Reasons Active Builders Participated in the Program (n = 17, multiple responses allowed)

Category	Response Count
For the incentives	11
Wanted to market energy efficiency	7
Increase energy savings for customers	3
Environmental reasons	3
HERS	2
Add value to customers' homes	1
Customer demand	1
Difficulty selling non-energy-efficient homes	1

Cadmus asked inactive builders what their main reasons were for not participating more frequently in the program. The primary reasons were that the builders had no customer demand (three inactive builders) and thought participating would be too much of a hassle (two inactive builders). Other reasons were that the incentive was not high enough for one inactive builder and another was not very aware of the program's incentive structure.²⁶

To increase participation among inactive builders, two respondents offered recommendations:

- “[Rocky Mountain Power] needs to increase rebates to the level of cost. People won’t pay for the energy efficiency cost and don’t want to pay for the costs. [They] want the benefits without the costs.”
- “Put something in it for the home builder and divide the rebate between the builder and homeowner.”

Two other inactive builders did not offer any recommendations because they thought the program did not need improvement, and their participation depended on the demands of their clients. One respondent refused to answer the question.

Marketing and Outreach

Several active and inactive builders agreed that there could be more emphasis on marketing the program, especially among home buyers. Most participant builders (nine out of 19 who responded), said that home buyers ask about energy efficiency when visiting builders’ model homes “not very often,” five said “occasionally,” five said “very frequently,” and two did not have any model homes. When Cadmus asked 12 active builders what percentage of buyers were familiar with the wattsmart New Homes program, their responses ranged from “almost none” to 50%. Cadmus asked five inactive builders the same question, and their responses ranged from 0 to 80% of homebuyers being familiar with the program.

²⁶ Multiple responses were allowed for inactive builders’ reasons for not participating more frequently in the wattsmart New Homes program.

To understand why some builders had lower participation rates than their active counterparts, Cadmus asked inactive builders whether they market their model homes as energy efficient. Two out of five inactive builders said that they did so, mainly through face-to-face interactions with their clients; another builder did so by promoting various energy-efficient standalone measures, and one inactive builder did not market energy efficiency.²⁷

Cadmus also spoke with home energy raters to understand their perspective on how successfully the program has been marketed to builders and homebuyers, and whether they actively recruit builders to participate. Two out of the three home energy raters interviewed said that they actively recruited builders to participate in the program through face-to-face interactions, and the other rater did not recruit because builders usually approached that rater for assistance.

All three home energy raters understood that the program promotes energy efficiency because they saw program staff engaging with builders, training code officials, and generally promoting energy-efficient new construction. However, the raters believed that the program administrators could enhance their promotional efforts. Two raters identified some barriers inhibiting effective promotion of energy efficiency through the program:

- “I think the challenge is that home owners want the cheapest home as possible. The added cost keeps people from building those homes, and builders are not keeping pace with energy codes. It hasn’t been much of a priority for the state. A lot of builders really fight code changes.”
- “I think that their competitors... the builders who want to build an energy-efficient house, they’re afraid of hiding energy-efficient measures in walls because the guy down the street is not doing it because the code is not enforced.”

In other words, home energy raters believe that energy codes have not been consistently enforced in Rocky Mountain Power’s service territory. They see the current code enforcement as a patchwork system in which some jurisdictions enforce energy codes and some do not, leaving a system of enforcement in which many builders would rather build a cheaper, less-efficient home because they do not have to abide by the code. In addition, home energy raters offered a few suggestions to better promote energy-efficiency through the program:

- “It would be nice if Rocky Mountain Power could get involved with the code update.”
- “[Rocky Mountain Power] is wasting our time selling to builders, we need to sell to home buyers. Until there’s a demand we’re not going to get builders. The homebuyer needs to demand it.”

Satisfaction

²⁷ One inactive builder does not have any model homes, and therefore Cadmus did not ask about this builder’s marketing of model homes.



Program satisfaction was generally high among participant active builders and home energy raters. Active participant builders were asked about their satisfaction with different aspects of the program such as the HVAC checklist, training from Nexant staff, communication with wattsmart staff, and home energy raters. Satisfaction was highest with the service provided by home energy raters and lowest with communication with wattsmart staff due to lack of communication and a lengthy rebate application process. Table 27 displays active builders’ responses.

Table 27. Active Builders’ Satisfaction with Program Components

Category	Response Count			
	Very Satisfied	Somewhat Satisfied	Not too Satisfied	Not at all Satisfied
Satisfaction with HVAC checklist (n = 10)	8	1	1	0
Satisfaction with training from Nexant staff (n = 8)	4	4	0	0
Satisfaction with communication with wattsmart Staff (n = 13)	7	4	2	0
Satisfaction with interactions with home energy raters (n = 13)	12	1	0	0

Home energy raters’ satisfaction with the wattsmart New Homes program was high. Raters were asked about their overall program satisfaction and two said that they were “very satisfied with their overall program experience and one said that they were “somewhat satisfied.”

Implementation Barriers

No major communication or management barriers occurred in the delivery of the wattsmart New Homes program. Home energy raters stated that the program had provided rebates for most homes they certified that contained energy efficient measures or construction. Active builders’ responses echoed this finding, with only three out of 13 active builders reporting that they installed qualified wattsmart measures and did not receive a rebate, primarily because of the paperwork required.

One active builder identified one major implementation barrier. This builder did not use home energy raters to certify homes because the cost of hiring a rater was greater than the rebate from the program. Therefore, the incentive was insufficient to outweigh the cost of hiring a rater.

Suggestions for Improvement

Program delivery generally proceeded smoothly between participant builders and home energy raters. However, several builders identified many different areas of the program that administrators could improve.

Two builders (one active and one inactive) were adamant that the program needs to begin focusing its marketing efforts on buyers rather than builders. Those builders believed that by shifting some marketing to buyers, the program would increase end-user demand by making buyers aware of the many benefits of building energy-efficient homes, and would thereby increase participation in the wattsmart New Homes program.

Beyond increasing marketing to homebuyers, builders’ had various ideas for improvement, as follows:

- Improve the clarity of and training on guidelines for measures for different construction (i.e., single-family homes vs. multifamily homes).
- Improve communication between program staff members and builders. One builder was not very satisfied with the communication with program staff members.
- Implement an online rebate tracking system and send rebate checks faster.
- Increase the incentive amounts and expand the list of measures eligible for rebates. One builder believed that incentives could be higher for LED lighting to lessen the disparity in price between CFLs and LEDs.
- Simplify and streamline the program and paperwork.

Three builders said that there was no need for improvements to the program.

Homeowner Surveys

Cadmus surveyed 70 homeowners of participating homes²⁸ (participants) and 70 new homeowners of non-ENERGY STAR homes (nonparticipants) who had homes built in 2013 and 2014. Approximately 34% of the participants had heard of the Rocky Mountain Power wattsmart New Homes program. Among them, about one half learned about the program from Rocky Mountain Power or through direct mailing. Another 43% learned about the program through various media sources, including television, radio, newspaper, and movie theater advertising.

Among participants who had heard of wattsmart, about 48% of participants who had heard of wattsmart (16% overall) knew that their home was ENERGY STAR certified. More than 43% (15% overall), however, did not know whether their home was ENERGY STAR certified. The homeowners’ lack of knowledge regarding the ENERGY STAR certification of their homes indicates that builders are perhaps not using certification as a selling point or communicating the certification to the homeowner effectively.

Table 28. Home Type

	Participants		Nonparticipants	
	#	%	#	%
Single-family home	43	61%	56	80%
Townhouse or duplex	11	16%	7	10%
Apartment building (4+ units)	16	23%	6	9%
Retirement home	0	0%	1	1%

wattsmart New Homes program participants and nonparticipants surveys, 2015. Q3: “Which of the following best describes your home?” (n = 70)

²⁸ Includes homes with standalone measures installed and ENERGY STAR-certified homes.



Of nonparticipants, 90% lived in either single-family homes (80%) or townhouses or duplexes (10%) compared to 77.1% of participants. Nonparticipants were more likely to live in single-family homes, whereas participants were more likely to inhabit townhouses, duplexes, or apartment buildings.

Square Footage of Homes

The sample mean of square-footage estimates of single-family homes, townhouses, and duplexes equaled 3,509 square feet for participants and 5,367 square feet for nonparticipants. The standard error of square-footage estimates is wider for nonparticipant new homes than ENERGY STAR certified new homes, indicating a wider distribution of square-footage estimates for the former.

Table 29. Home Size Estimates (sq. ft.)

	Participants (n = 54)	Nonparticipants (n = 63)
Lowest	1,010	1,000
Median	2,760	3,080
Highest	23,000	36,000

wattsmart New Homes program participants and nonparticipants surveys, 2015. Q4: “What is the square footage of your home, counting all conditioned space?”

Additions to Homes

About 90% of ENERGY STAR certified new homes and 95% of nonparticipant new homes had basements with insulated walls. ENERGY STAR new home basements were far less likely to have air conditioning or furnace vents to cool and heat the space (32.0%) than nonparticipant new homes (47.4%).

Table 30. Frequency of Additions to Home

	Participants		Nonparticipants	
	#	%	#	%
Yes	3	4%	4	6%
No	67	96%	66	94%

wattsmart New Homes program participants and nonparticipants surveys, 2015. Q9: “Was additional square footage added after the home was built?” (n = 70)

Lighting in New Homes

Two thirds of nonparticipant new homes were built with ENERGY STAR lighting (such as CFLs or LEDs). Nonparticipants estimated the percentage of available sockets installed with energy-efficient lighting in their new homes. These estimates indicated that 68% of available sockets were installed with energy-efficient lighting in the average nonparticipant new home, and one half of nonparticipant new homes had energy-efficient lighting installed in an estimated 80% (or more) of available sockets.

Table 31. Nonparticipant ENERGY STAR Lighting

	Percentage
Mean	67.8% of sockets
Standard deviation	33.4%
Lowest	1%
Median	80%
Highest	100%
100% energy-efficient lighting	31.0% of nonparticipants

wattsmart New Homes program nonparticipants survey, 2015. Q21: “Approximately what percentage of the available sockets had efficient lighting?” (n = 44)

There was a high retention rate of energy efficient lighting among participants and nonparticipants who knew whether ENERGY STAR lighting had been originally installed and/or remained installed in their homes. More than 88% of nonparticipants whose homes were built with at least some ENERGY STAR lighting retained the original lightbulbs, and the remainder replaced the original bulbs with other CFLs or LEDs. This behavior almost mirrors that of participants, 90% of which retained the home’s original ENERGY STAR lighting; the remainder replaced original bulbs with other LEDs.

Table 32. Participant Reasons for Replacing Bulbs

	Percentage
Bulb(s) burned out	16.7%
Quality of light	33.3%
Not bright enough	50.0%
Too bright	0.0%
Wrong color of light	33.3%
Dissatisfied	33.3%

wattsmart New Homes program participants survey, 2015. Q22: “What were your reasons for removing the lights?” (n = 6)
 Respondents could indicate more than one answer.

The six participants who removed their homes’ original lightbulbs primarily did so because the homeowner thought the lighting was not bright enough or did not like the bulbs’ color or quality. A majority of these participants removed the original lighting as soon as they moved in, and the remainder had done so within the last year.

Upgrades and Changes to New Homes

Twenty percent of nonparticipants made major changes or upgrades to their homes (e.g., heating or cooling systems, windows, insulation, major appliances) compared to less than 10% of participants.



Table 33. Frequency of Major Upgrades or Changes

	Participants		Nonparticipants	
	#	%	#	%
Yes	5	7%	14	20%
No	64	91%	56	80%

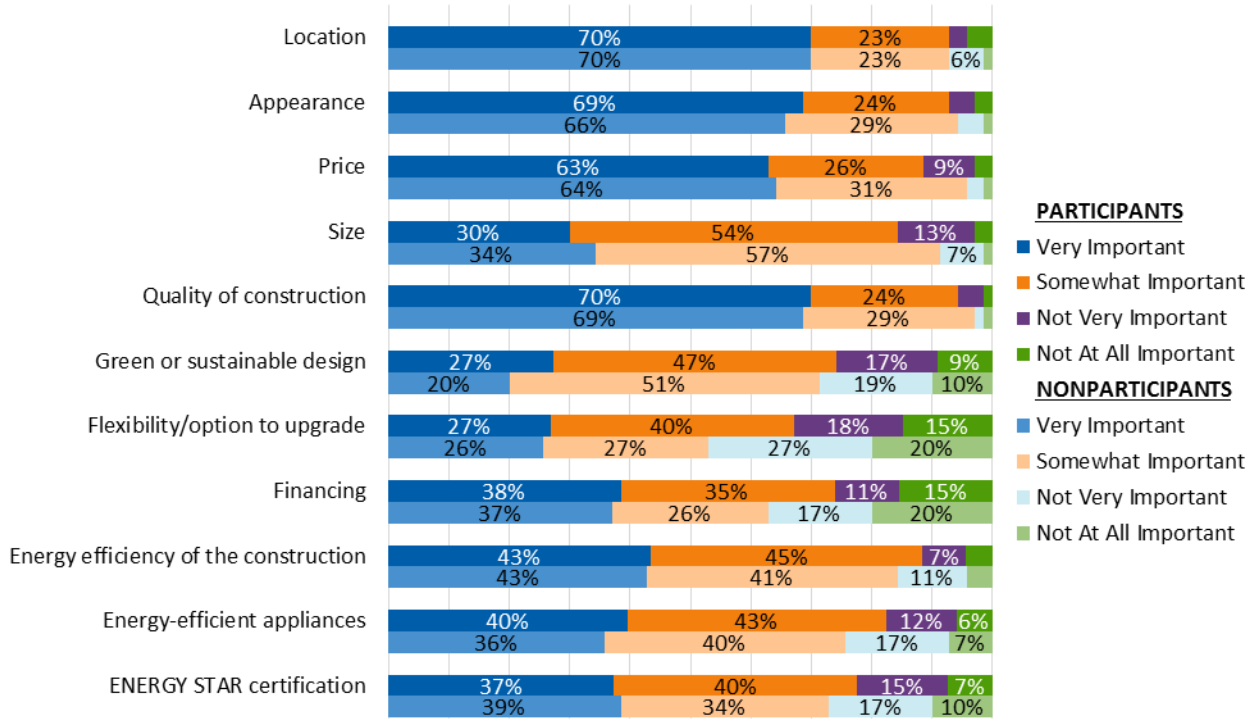
wattsmart New Homes program participants and nonparticipants surveys, 2015. Q25/Q33: “Have you made any major upgrades or changes to the house such as changing the heating or cooling systems, windows, insulation, or major appliances since you purchased your home?” (n = 70)

Nonparticipants most frequently reported changes or upgrades to insulation, refrigerators, solar panels, stoves and clothes washers or dryers; less frequently, they reported changes to dishwashers, LEDs, and ceiling fans. Two participants who reported changes or upgrades installed additional insulation, and another participant replaced his thermostat. A participant who installed solar panels did so to decrease energy usage and energy bills, and indicated that Rocky Mountain Power had influenced this change. This respondent also reported not receiving Rocky Mountain Power’s home energy report. None of the five participants making major changes or upgrades to their homes received rebates or incentives for doing so.

Factors in Home Purchasing Decisions

Cadmus asked homeowners to rate the importance of the role of certain factors in their purchasing decisions.

Figure 3. Importance of Factors in Purchasing Decisions



wattsmart New Homes program participants and nonparticipants surveys, 2015. Q53/Q34: “I’d like to ask you about some aspects of your new home that led to your purchase decision. First off, I will read some factors about new homes, and please tell me how important they were in your purchasing decision. Please share whether each factor was *very important*, *somewhat important*, *not too important*, or *not at all important*.” (n = 70) Labels are omitted for response rates of 5% or less.

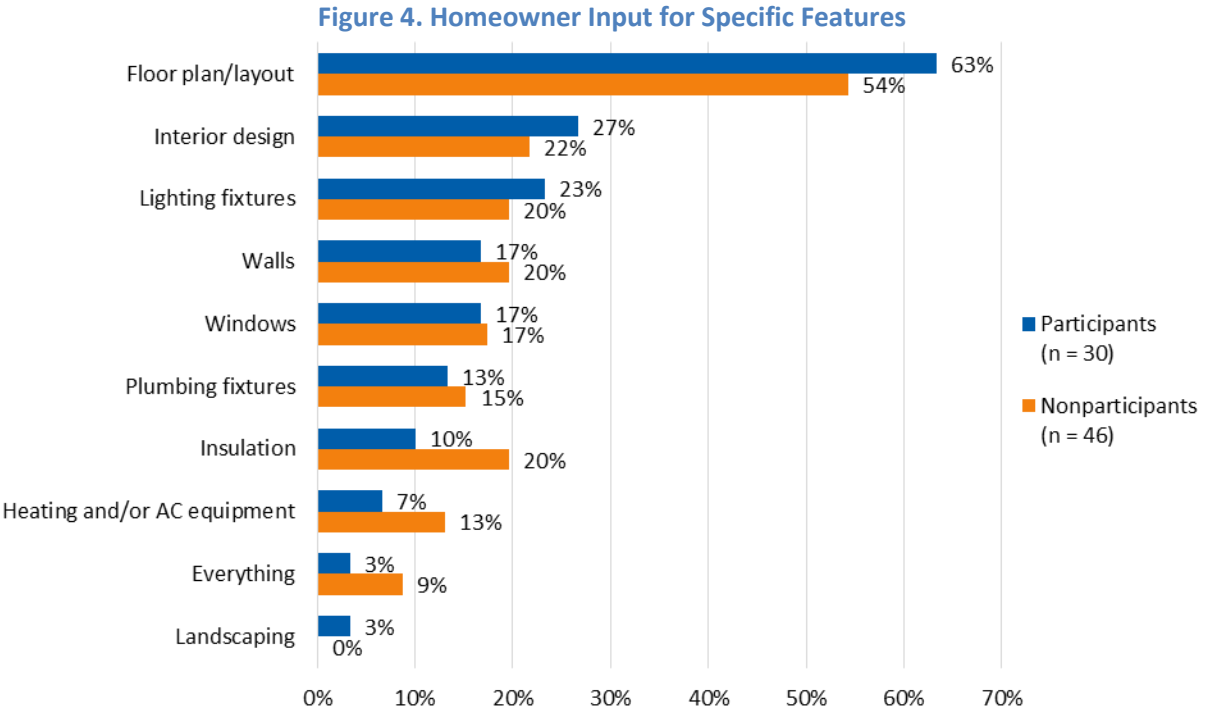
Participants and nonparticipants behaved similarly regarding certain aspects of their new homes; for instance, more than 90% of participants and nonparticipants considered location, appearance, and quality of construction at least somewhat important. Homeowner preference for construction quality indicates it could be leveraged as an effective messaging strategy for marketing ENERGY STAR certified homes. However, nonparticipants appeared to value size more than participants: compared to nonparticipants, about twice as many participants deemed home size to be not very or not at all important.

Participants did not consider factors pertaining to energy efficiency (e.g., green or sustainable home design, energy-efficient construction, energy-efficient appliances, ENERGY STAR certification) to be important significantly more frequently than nonparticipants. Nonparticipants valued energy-efficient factors only 3% to 6% less frequently than participants – a difference of only two to four respondents.

Almost three times as many participants as nonparticipants believed price to be not very or not at all important. Participants considered financing to be at least somewhat important about 10% more frequently than nonparticipants did. More participants than nonparticipants valued flexibility or options



to upgrade and customize design features: more than two thirds of participants judged flexibility to be at least somewhat important (versus about one half of nonparticipants). Still, participants more often did not experience this flexibility, despite their stated preferences, because 57% did not have any influence on home design compared to 34% of nonparticipants.



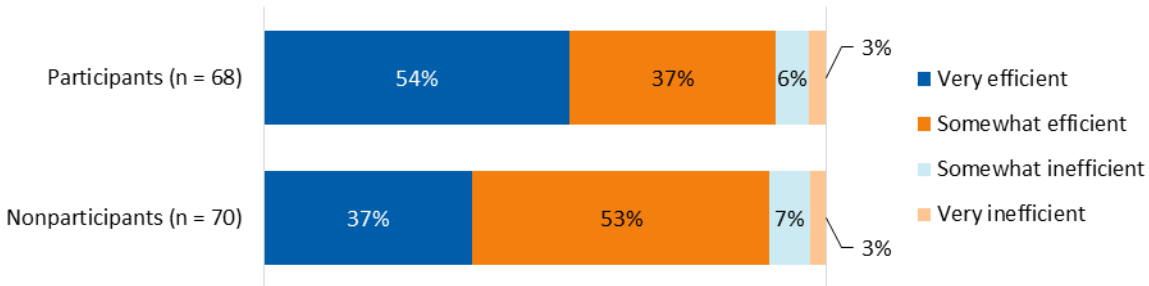
wattsmart New Homes program participants and nonparticipants surveys, 2015. Q55/Q36: “What specific features did you discuss that determined the final design of your home?” Respondents could indicate more than one answer.

In the determination of final home designs, floor plans were the most frequently customized feature for participants and nonparticipants. Participants and nonparticipants least frequently cited heating and cooling equipment as a prominent customizable feature.

Energy Efficiency of Homes

More participants than nonparticipants characterized their homes as having greater energy efficiency: more than one half of participants considered their homes very efficient, whereas more than one half of nonparticipants considered their homes somewhat efficient. A lack of ENERGY STAR certification did not altogether preclude energy efficiency: no more than 10% of participants or nonparticipants perceived their homes as somewhat or very inefficient.

Figure 5. Perceived Home Energy Efficiency



wattsmart New Homes program participants and nonparticipants surveys, 2015. Q56/Q37: “How energy efficient would you say your home is currently?”

Among respondents considering their homes very energy efficient, 37% of participants cited the homes’ insulation and/or windows (compared to slightly less than one half of nonparticipants). About one fourth of participants cited construction, design, and appliances as supplementary reasons (compared to about two thirds of nonparticipants).

Participants and nonparticipants who said that their homes were somewhat efficient generally cited the same reasons as respondents who believed that their homes were very efficient. Respondents identified better insulation, better windows, better HVAC systems, unfinished basements, and solar panel installation as areas for improvement. The few respondents who considered their homes somewhat or very inefficient cited insulation, HVAC systems, and energy consumption as the primary problems.

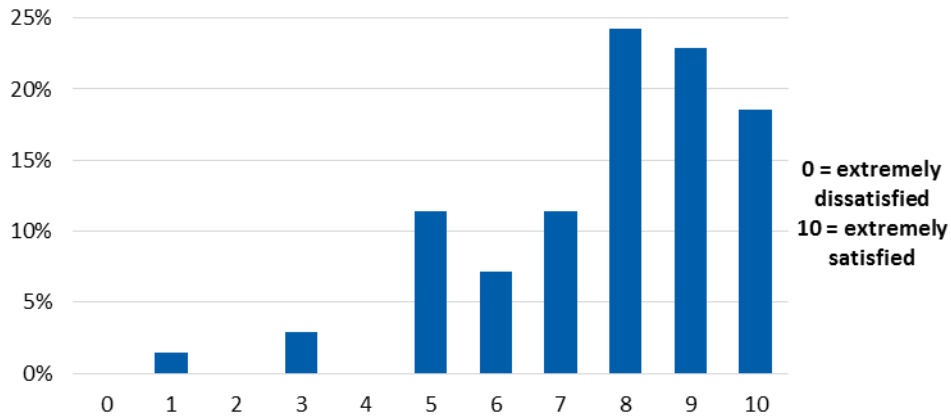
About 87% of nonparticipants who considered their homes somewhat or very efficient cited lower costs among the benefits they received from living in an efficient home. Supplemental benefits included environmental friendliness and energy efficiency.

Satisfaction with Home Features

Cadmus asked participants to rate their satisfaction with the energy-efficient features of their new homes on a scale of zero to 10, where zero represents *extremely dissatisfied* and 10 represents *extremely satisfied*. Respondents offered an average rating of 7.8 and a median rating of 8. Almost two thirds of respondents rated their satisfaction 8 or greater and less than 5% of respondents offered ratings lower than 5.



Figure 6. Participant Satisfaction with Energy-Efficient Features



wattsmart New Homes program participants survey, 2015. Q58: “On a scale of 0–10, where 0 is extremely dissatisfied and 10 is extremely satisfied, how satisfied are you with the energy-efficient features of your new home?” (n = 70)

Eleven of 13 respondents who rated their satisfaction a 10 cited lower utility bills, better insulation, and improved energy efficiency as reasons for their satisfaction. One half of the 24 respondents who rated their satisfaction 7 or lower indicated desires for lower utility bills, better insulation, and improved energy efficiency (e.g., by means of better windows and the addition of solar panels) as reasons for their ratings.

Appendix A: Freeridership and Spillover

Freeridership Results

Cadmus' freeridership analysis is based on a previously developed approach for Rocky Mountain Power, in which freeridership is ascertained using patterns or responses to a series of survey questions. These questions—answered as “yes,” “no,” or “don't know”—ask whether participants would have installed the same equipment in the program's absence, at the same time, in the same amount, and at the same efficiency. Question response patterns are assigned freerider scores, and the confidence and precision estimates are calculated based on score distributions.

Cadmus asked 13 builders freeridership questions regarding standalone measures for which they received program rebates. Cadmus asked seven of the thirteen builders freeridership questions for more than one measure type, which resulted in 31 sets of freeridership responses included in the standalone measure analysis.

The surveyed builders exhibited a few common response patterns to the freeridership questions, which represents all of the 31 sets of standalone freeridership responses:

1. Fourteen respondents had already purchased the measure before they heard about the wattsmart New Homes program, and were therefore assigned a freeridership score of 100%. Two questions were used to confirm this score.
2. In the incentive's absence, one respondent would have purchased the same amount of the standalone measures at the same time and installed it at the same level of efficiency, but did not have plans to purchase the measure before learning about the wattsmart New Homes program incentives. This was estimated as a 50% freerider.
3. In the incentive's absence, one respondent would have purchased the standalone measure at the same time and installed it at the same level of efficiency, but did not have plans to purchase the measure before learning about the wattsmart NewHomes program incentives and would have purchased a lower quantity of the measure in the program's absence. This builder was estimated as a 12.5% freerider.
4. Twelve respondents reported that they would have purchased less efficient options of the standalone measure in the absence of the program incentives; they were estimated as 0% freeriders.
5. One builder would not have installed the standalone measures at all in the absence of the program incentives and was estimated as a 0% freerider.
6. One respondent did not have plans to purchase the standalone measures before learning about the wattsmart New Homes program and would not have purchased the same amount of



the measure in the absence of the program. This builder did not know if they would have purchased measures at the same level of efficiency or within the same year in the absence of the program. Because of the uncertainty regarding this builder’s purchasing intentions in the absence of the program, Cadmus assigned 0% freeridership.

7. One builder responded “don’t know” to the freeridership questions and are being estimated as a 25% freerider.

Table 34 presents these seven respondent categories, along with the freeridership score assigned, the total survey sample program energy savings, and total survey sample freerider savings for each respondent category. The overall survey sample freerider savings divided by the overall survey sample program kWh savings results in the 52% overall freeridership estimate in Table 34.

Table 34. Standalone Measure Freeridership Results by Respondent Category

Respondent Category	n	FR Score	Survey Sample Program kWh Savings	Survey Sample Freerider kWh Savings
1	14	100%	1,109,453	1,109,453
2	1	50%	31,938	15,969
3	1	12.5%	648	81
4	12	0%	877,290	0
5	1	0%	77,444	0
6	1	0%	41,321	0
7	1	25%	50,465	12,616
Overall	31	52%*	2,188,558	1,138,119

*Survey sample freerider kWh savings divided by survey sample program kWh savings.

Table 35 below shows standalone measure freeridership by measure category.

Table 35. Standalone Measure Freeridership Results by Measure Category

Measure Category	n	FR Score	Survey Sample Program kWh Savings	Survey Sample Freerider kWh Savings
Appliances	8	51%	195,575	99,310
Envelope	6	10%	274,976	27,240
HVAC	5	17%	50,921	8,699
Lighting	12	60%	1,667,087	1,002,871
Overall	31	52%	2,188,558	1,138,119

*Survey sample freerider kWh savings divided by survey sample program kWh savings.

Of the weighted 52% freeridership estimate, 51 percentage points are associated with measures that builders had already purchased before learning about the program and were estimated at 100%

freeridership.²⁹ The freeridership score of one respondent with 41% of the total sampled kWh savings contributes 22 percentage points of the overall weighted 52% freeridership estimate for standalone measures.

Spillover Results

To qualitatively assess spillover potential among participant builders who installed standalone measures, Cadmus asked builders whether they had installed additional energy efficiency technologies in new homes without receiving incentives since participating in the program. If the respondent answered affirmatively, Cadmus asked: “How influential was the program in your decision to install these additional measures?”

For 2012 and 2014, three respondents indicated that they installed additional energy-efficient measures in participating homes without receiving an incentive. Only two of these three builders indicated that the program proved “highly influential” in their decision to install additional lighting, appliance, and envelope measures. Cadmus is qualitatively reporting this additional spillover activity because respondents did not know the quantity of measures or homes for which this occurred.

NTG Results

Table 36 below summarizes the standalone measure NTG components and the program savings-weighted NTG estimate of 28%.

Table 36. Standalone Measure NTG

n	FR Score	Spillover	NTG
31	52%	0%	48%

Table 37 presents freeridership, spillover, and NTG estimates from other recent residential new homes program evaluations. All benchmarked programs have freeridership estimates over 50%; the wattsmart New Homes Program freeridership estimate of 52% is within this range. Three of the four benchmarked NTG estimates are associated with an analysis that was focused on whole homes, not individual measures. The benchmarked program that is most comparable to the 2013–2014 wattsmart New Homes is the 2014 Entergy Arkansas prescriptive rebate measure NTG, although this analysis was based on interviews with only two builders.

²⁹ Respondent Category 1 in Table 34.



Table 37. wattsmart New Homes Program NTG Benchmarking

Utility	Year	FR	SO	NTG	Notes
Entergy Arkansas*	2014	61%	6%	45%	Prescriptive rebated measure focus; based off interviews with 2 builders
Entergy Arkansas*	2014	71%	0%	29%	Whole house focus; based off interviews with 4 builders
Georgia Utility	2014	51%	0%	49%	Whole house focus; based off interviews with 28 builders
Ameren Illinois**	2013	58%	0%	42%	Whole house focus; based off interviews with 6 builders

*<http://www.apscservices.info/EEInfo/EEReports/Entergy%202014.pdf> ; Table 109.

**http://ilsagfiles.org/SAG_files/Evaluation_Documents/Ameren//AIU%20Evaluation%20Reports%20EPY6/AIC_PY_6_ES_New_Homes_Report_FINAL_2015-3-17.pdf; Table 24.

Appendix B: Program Management Interview Instrument

Introduction

The purpose of the interview is to explore your experience with the wattsmart New Homes Program. Cadmus used input from a variety of staff involved with the program to describe how the program worked during 2013 and 2014, what made it successful, and any opportunities for improvement. Please feel free to let me know if there are questions that may not apply to your role so that can focus on the areas you have worked most closely in.

Program Overview, Management Roles, and Responsibilities

1. To start, please tell me about your role and associated responsibilities with the wattsmart New Homes Program.
 - a. How long have you been involved?
 - b. Who were the other key PacifiCorp staff involved in the 2013 and 2014 program period and what were their roles?
2. Please walk me through how the program works from the customers' perspective. For example, how would a customer hear about the program, how would participation be initiated, and what steps would I go through as a customer?
 - a. Can you walk me through how they receive incentives for standalone measures?
3. Please tell me about how the program worked with the builders. What are their roles and responsibilities?

Program Goal and Objectives

4. How would you describe the main objective of the 2013–2014 program?
5. What were the savings and participation goals of the program for 2013–2014? How did the program do with respect to those goals?
6. Did the program have any informal or internal goals/Key Performance Indicators for this year, such as level of builder engagement, participant satisfaction, participation in certain regions, etc.?
 - a. How or why were these goals developed?
 - b. How did the program perform in terms of reaching the internal goals?
 - c. How has the program performed in the context of the Utah new homes market overall?
7. Has the number of participating builders changed since last year? What about the number of homes per builder? Why?
8. Has the number of participating HERS raters changed since last year? What about the number of homes per rater? Why?
9. Where are you seeing participation occur within PC's Utah territory and does that differ from previous years?
10. What is the new home market like in PC's Utah territory? How has that changed and how do you foresee it for the next 2 years?



Program Design

11. Please tell me about how the program works with raters. Do raters have to be “program approved” to participate? If yes, what is required? If no, what benefits do program-approved raters get that others do not?
 - a. Have you recruited new raters? Lost any? Why or why not?
 - b. Do you require training of the raters?
12. Do builders have to be “program approved” to participate? If yes, what is required? If no, what benefits do program-approved builders get that others do not?
 - a. Have you recruited any new builders? Lost any? Why or why not?
13. Please describe any trainings or meetings held with builders and raters. Did you update any of the materials you provide?
14. How would you describe any barriers to builder/rater participation? What about homebuyers?
15. What outside factors, if any, do you think may be influencing the program this year?
16. Overall, how well do the program’s processes work? What opportunities exist for improvement?
17. Who is your target market for this program?
18. How well did the current program design meet customer needs? (measures, incentive levels, documentation required, etc.)
19. What worked well in the 2013–2014 period?
20. Conversely, what was not working as well as anticipated?
21. What barriers or challenges did the program face in 2013–2014? What was done/what is planned to address them?
22. What changes are planned or now in place for the program?
23. What was the program’s QA/QC process like in 2013–2014? Would you please describe that?
24. In your opinion, what other ways can the program design be improved?

Program Marketing

25. Please describe how the program was marketed (through the website, one-on-one outreach, through builders, etc.)?
26. Do you have a marketing plan from 2013–2014 you could share with me? What were the primary marketing activities during that time period?
 - a. How much of the marketing is wattsmart vs program specific (New Homes)?
 - b. Who is the primary target audience for the program?
27. Did you track marketing effectiveness? What did you track?
 - a. What was the most effective marketing approach? (Why do you say this?)

Customer Experience

28. Did you have a process by which you receive customer feedback about the program? What is that process and how frequently does it happen, what happens to the information, and if a response is required who does that?
29. What feedback did you receive from customers about the program? What did they say?

Builder Experience

30. How did the program recruit builders?
31. Do you feel you had sufficient builders to support the program? Why or why not?
32. What barriers have the builders said they encounter with the program?
 - a. What steps have been taken to address these?
 - b. What remains to be done to remove these barriers?
33. Did the program provide marketing resources or training to builders?

Data Tracking and Savings

34. What was the program budget this year? Was the program budget sufficient to support implementation and achievement of program goals?
35. How do you track home data? How is the data tracking system working this year? Have you made any changes to the way you track data or the kind of data tracked in the last year?
36. Did the data tracking systems in place meet your needs? Why or why not?
37. How were savings deemed for each program measure? How often were the unit energy savings values updated?

Closing

38. Looking forward, what are the program's biggest challenges?
39. Are there specific topics you are interested in learning more about from our evaluation this year?
40. For the purposes of our customer survey, what should we call the program? Will customers recognize ENERGY STAR New Homes, or should we use wattsmart/bewattsmart?

Thank you very much for your time today!



Appendix C: Participant Builder Survey

1. Interviewer instructions are in green **[LIKE THIS]**.
2. Skip patterns are in red **[LIKE THIS]**.
3. Items that should not be read by the interviewer are in parentheses like this ().

Business name _____

Respondent name _____

Date _____

Interviewer _____

Introduction

Hello, my name is **[NAME]** from Cadmus. We are conducting a study on behalf of Rocky Mountain Power (ROCKY MOUNTAIN POWER) on the wattsmart New Homes program. We are talking to builders about their experience providing services through this program. I was wondering if I could speak with the owner or someone who is knowledgeable about your company’s construction practices. Is that person available?

[If the builder would like to verify that this call is authorized by Rocky Mountain Power, they are welcome to call Nikki Karpavich at 801-220-4439 for confirmation.]

Screening

1. Are you the person responsible for making decisions regarding wattsmart New Homes at your company?
 1. (Yes)
 2. (No, but person can come to phone) **[START OVER AT 1 WITH NEW RESPONDENT]**
 3. (No, not available) **[SCHEDULE CALLBACK]**
 98. (Don’t know) **[ASK TO SPEAK WITH SOMEONE WHO WOULD KNOW AND START AGAIN]**
 99. (Refused) **[THANK AND TERMINATE]**

2. The interview will take approximately 30 minutes of your time, and for completing the survey we will send you a \$50 gift card for your time and input. Do you have time right now for us to complete the interview?
 - a. **[IF YES]** Thank you. Your individual answers will be kept confidential and only summary information will be shared with ROCKY MOUNTAIN POWER.
 - b. **[IF NO]** What would be the best time for me to call back and talk with you?

[IF NEEDED] I am not selling anything; we are interested in your opinions of the wattsmart New Homes program as it was operating in 2013 and 2014. Our goal is to help improve the program and to understand how to assist customers in saving money on their utility bills. Your responses will remain confidential.

3. In 2013 and 2014, did your company build homes other than single-family homes?
 - a. (Yes) [RECORD WHAT TYPES]
 - i. What percentage of homes that your company built in 2013 and 2014 were single-family homes?
 1. [Record response]: _____
 - ii. What percentage of the homes you built in 2013 and 2014 were [OTHER, AS RECORDED ABOVE]?
 1. [Record response]: _____
 - b. (No)

4. [IF 3 = 1] In 2013 and 2014, did the percentage of single-family versus OTHER/multifamily homes change?
 - a. [IF YES] Why did this change? [Record response]: _____

Awareness and Participation Information

5. How did you learn about the program? [Do not read. Multiple responses ok]
 1. (Program contact/outreach specialist called or met with me)
 2. (Marketing package from ENERGY STAR New Homes Program)
 3. (From Rocky Mountain Power) Ask: Do you recall how you heard about this program from ROCKY MOUNTAIN POWER? [Record response]: _____
 4. (Rocky Mountain Power Website)
 5. (Newspaper Ad)
 6. (At an event)
 - i. What event? [Record response]: _____
 7. (From another builder)
 8. (From a vendor or contractor)
 9. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)

6. What are the reasons you decided to become a participant builder?
 1. (Interest in building a better home)
 2. (For the incentives)
 3. (Integrity of home)



4. (Already using many of the measures or practices)
 5. (Wanted to market energy efficiency)
 6. (Wanted to separate myself from other builders)
 7. (The people involved in the program are good/knowledgeable people)
 8. (Like to keep up with new techniques/try new things)
 9. (Homeowner requested it)
 10. (It's difficult to sell non-certified homes)
 11. (Have to be ENERGY STAR or energy efficient to be competitive in the market)
 12. (Can get a higher price for an ENERGY STAR certified home)
 13. (House sells better if it's an ENERGY STAR home)
 14. (Environmental reasons)
 15. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)
7. Did you change your participation levels in response to the ENERGY STAR 3.0 standards?
- a. (Yes) What changed? [Record response – get details!]: _____
 - b. (No)
 98. (Don't Know)
 99. (Refused)
8. Could you briefly give me your thoughts on the changes that came with the ENERGY STAR 3.0 standards, what you like and didn't like?
- a. [Record response – get details!]: _____
 98. (Don't Know)
 99. (Refused)

Building Energy-Efficient Homes and Installing Standalone Measures

9. How many total homes did you build in Utah
- a. In 2013? [Record response]: _____
 - b. In 2014? [Record response]: _____
10. Of those homes you built in 2013, what percentage were wattsmart New Homes?
- a. [Record response]: _____
 - i. Of those homes, would you say that some were built to meet the program guidelines for an ENERGY STAR New Home, but were not rated? If so, how many?
 1. [Record response]: _____
 - ii. Why were they not rated?
 1. [Record response]: _____

11. Of those homes you built in 2014, what percentage were wattsmart New Homes?
 - a. [Record response]: _____
Of those homes, would you say that some were built to meet the program guidelines for an ENERGY STAR New Home, but were not rated? If so, how many?
 1. [Record response]: _____
 - ii. Why were they not rated?
 1. [Record response]: _____

12. Of the homes you built in 2013–2014, what percentage of those homes that were not rated as a wattsmart New Home contained one or more wattsmart New Homes standalone measures?
 - a. [Record response]: _____
 - i. When you installed a standalone measure, did you always apply for the rebate offered?
 1. (Yes)
 2. (No)
 - a. Approximately how many standalone measures did you install in 2013–2014 without applying for the rebate?
[Record response]: _____
 3. (Don't know)
 4. (Refused)

13. Have you installed any ENERGY STAR products or made other energy-efficient improvements in your homes for which you did not receive a rebate from the wattsmart program?
 1. (Yes)
 2. (No)
 3. (Don't know)
 4. (Refused)

14. What type of other improvements or ENERGY STAR products did you install?
 - a. [Record response]: _____
 - i. How many products did you install? [Record response]: _____
 - ii. Was it standard efficiency or high-efficiency?
 1. Standard
 2. High

15. On a 1 to 4 scale, with 1 meaning “not at all influential” and 4 meaning “highly influential,” how influential were each of the following on your decision to install ENERGY STAR products or make efficiency improvements without receiving a rebate?



Item	Enter 1-4 Score	Don't know	Not applicable
	0-10	99	96
Information about energy savings from Rocky Mountain Power marketing, program staff, or contractors			
Your satisfaction with the ENERGY STAR products			
Participating in the program			

16. How many incandescent “rough service” bulbs do you typically install in a home?

A. [Record response]: _____

98. (Don't Know)

99. (Refused)

17. [Ask if 22 > 0] In which areas of the homes do you install these bulbs?

A. [Record response]: _____

98. (Don't Know)

99. (Refused)

Freeridership

[IDEALLY WE WOULD ASK A1 TO A12 FOR EACH MEASURE TYPE]

[IF ONLY ASKED ABOUT ONE MEASURE TYPE, ASK ABOUT MEASURE TYPE WITH MOST TOTAL SAVINGS]

Now I'd like to talk with you a little more about the standalone **[MEASURE](S)** you purchased and installed in homes.

A1. When you first heard about the incentive from the wattsmart New Homes program, had you already been planning to purchase the **[INSERT MEASURE](S)**?

1. Yes

2. No **[SKIP TO A4]**

98. Don't Know **[SKIP TO A4]**

99. Refused **[SKIP TO A4]**

A2. Ok. Had you already purchased or installed the new **[INSERT MEASURE](S)** before you learned about the incentive from the wattsmart New Homes program?

1. Yes

2. No **[SKIP TO A4]**

98. Don't Know **[SKIP TO A4]**

99. Refused **[SKIP TO A4]**

A3. Just to confirm, you learned about the wattsmart New Homes program after you had already purchased or installed the **[INSERT MEASURE](S)** ?

- 1. Yes **[SKIP TO 33]**
- 2. No
- 98. Don't Know
- 99. Refused

[IF A3 SKIP TO 18]

A4. Would you have purchased the same **[INSERT MEASURE](S)** without the incentive from the wattsmart New Homes program?

- 1. Yes **[SKIP TO A6]**
- 2. No
- 98. Don't Know
- 99. Refused

[IF A4 = 1 THEN SKIP TO A6]

A5. **[ASK IF A4 = 2, -98 OR -99]** Help me understand, would you have purchased **[INSERT MEASURE](S)** without the wattsmart New Homes program incentive? **[DO NOT READ RESPONSES]**

- 1. Yes, I would have purchased something
- 2. No, I would not have purchased anything **[SKIP TO A9]**
- 98. Don't Know **[SKIP TO 18]**
- 99. Refused **[SKIP TO 18]**

[IF A5 = 2 SKIP TO A9. IF A5 = -98 OR -99 SKIP TO 18]

A6. **[ASK IF A4= 1 OR A5 = 1]** Let me make sure I understand. When you say you would have purchased **[A] [MEASURE](S)** without the program incentive, would you have purchased **[A] [INSERT MEASURE](S) THAT [WAS/WERE] JUST AS ENERGY EFFICIENT?**

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

A7. **[ASK IF A4= 1 OR A5 = 1 AND MEASURE QUANTITY >1]** Without the program incentive would you have purchased the same amount of **[INSERT MEASURE](S)**?

- 1. Yes, I would have purchased the same amount
- 2. No, I would have purchased less
- 98. Don't Know
- 99. Refused



A8. **[ASK IF A4= 1 OR A5 = 1]** Without the program incentive would you have purchased the **[INSERT MEASURE](S)**... **[READ]**

- 1. At the same time
- 2. Within one year?
- 3. In more than one year?
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

[SKIP TO 18]

A9. **[ASK IF A5=2]** To confirm, when you say you would not have purchased the same **[INSERT MEASURE](S)** without the program incentive, do you mean you would not have purchased the **[INSERT MEASURE](S)** at all?

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

[IF A9 = 1 SKIP TO 18]

A10. **[ASK IF A9 = 2, -98, -99]** Again, help me understand. Without the program incentive, would you have purchased the same type of **[INSERT MEASURE](S)** but **[A] [INSERT MEASURE](S) THAT [WAS/WERE] NOT AS ENERGY EFFICIENT?**

- 1. Yes
- 2. No
- 98. Don't Know
- 99. Refused

A11. **[ASK IF A9= 2, -98, -99 AND QTY MEASURE>1]** Without the program incentive would you have purchased the same amount of **[INSERT MEASURE](S)**?

- 1. Yes, I would purchase the same amount
- 2. No, I would have purchased less
- 98. Don't Know
- 99. Refused

A12. **[ASK IF A9 = 2, -98, -99]** And, would you have purchased the **[INSERT MEASURE](S)**... **[READ]**

- 1. At the same time
- 2. Within one year?
- 3. In more than one year?
- 98. **[DO NOT READ]** Don't Know
- 99. **[DO NOT READ]** Refused

Building Practices

18. Did your company change construction practices in 2013 or 2014?
 1. (Yes)
 2. (No)
 3. (Don't Know)

19. [If Q18=1] Can you describe the change in construction practice?
 - a. [Record response]: _____

20. [If Q18=1] Which of the changes, if any, resulted from your participation in the wattsmart New Homes program?
 - a. [Record response]: _____

Program Design

21. Did the program changes in 2013–2014 make it easier for your company to participate?
 1. (Yes) In what way? [Record response]: _____
 2. (No) Why is that? [Record response]: _____
 3. (Don't know)
 4. (Not aware of the changes)
 5. (Refused)

22. What about the wattsmart New Homes Program works well?

[Record response]: _____

23. In what ways could the program be improved?
 1. (No improvement needed)
 2. [Record response]: _____
 3. (Don't know)
 4. (Refused)

Marketing and Outreach

Now I'd like to talk about how the wattsmart New Homes Program is marketed to home buyers.

24. How frequently do buyers ask about energy efficiency when they visit your model homes?
Would you say they asked
 1. Very frequently,
 2. Occasionally,
 3. Not very often, or
 4. Not at all?



- 5. (Don't know)
- 6. (Refused)

25. About what percentage of homebuyers would you say are familiar with the ENERGY STAR New Homes Program?

a. [Record response]: _____

26. How about the wattsmart New Homes Program?

a. [Record response]: _____

Program Satisfaction

27. The Home Energy Raters use an HVAC checklist when they are certifying homes. Do you use the HVAC checklists in any way? [\[link to checklist\]](#)

- a. (Yes)
- b. (No) Why not? [Record response]: _____ [SKIP TO Q30]

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

28. How satisfied are you with the HVAC checklist? Would you say you are:

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied
- 4. Not at all satisfied

44a. Why do you give that rating? [Record response]: _____

29. Have you received any sales training from Rocky Mountain Power or Nexant?

- a. (Yes)
 - 1. Approximately when did you take the training?

[Record response]: _____

- b. (No) [SKIP TO Q32]

30. How satisfied are you with the sales training you received? Would you say you are:

- 1. Very satisfied
- 2. Somewhat satisfied
- 3. Not too satisfied
- 4. Not at all satisfied

31. [IF 30 > 1] How could the sales training be improved?

a. [Record response]: _____

32. How satisfied are you with your communication with staff at the wattsmart New Homes program? Would you say you are:

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not at all satisfied

33. [IF 32 > 1] What could be improved in regards to your communication with Program staff?
[Record response]: _____

34. How satisfied are you with your interactions with the HERS raters? [Record response]:

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not at all satisfied

Why do you give that rating? [Record response]: _____

Thank you for your time. Do you have anything you'd like to add regarding the wattsmart New Homes Program?



Appendix D: Inactive Participant Builder Survey

1. Inactive Builder = A builder on the Participating Builder list that has participated 0–5 times in 2013 and/or 2014.
2. Interviewer instructions are in green **[LIKE THIS]**.
3. Skip patterns are in red **[LIKE THIS]**.
4. Items that should not be read by the interviewer are in parentheses like this ().

Introduction

Hello, my name is **[NAME]** from Cadmus. We are conducting a study on behalf of Rocky Mountain Power (Rocky Mountain Power) on the wattsmart New Homes program. It was formerly called ENERGY STAR New Homes. I was wondering if I could speak with the owner or someone who is knowledgeable about your company’s construction practices and involvement with Rocky Mountain Power’s wattsmart New Homes program. Is that person available?

[If the builder would like to verify that this call is authorized by Rocky Mountain Power, they are welcome to call Nikki Karpavich for confirmation.]

Screening

1. Are you the person responsible for making decisions regarding building practices at your company?
 1. (Yes)
 2. (No, but person can come to phone) **[START OVER WITH NEW RESPONDENT]**
 3. (No, not available) **[SCHEDULE CALLBACK]**
 98. (Don’t know) **[ASK TO SPEAK WITH SOMEONE WHO WOULD KNOW AND START AGAIN]**
 99. (Refused) **[THANK AND TERMINATE]**

2. The interview will take approximately 20 minutes of your time, and for completing the survey we will send you a \$50 gift card for your time and input. Do you have time right now for us to complete the interview?
 1. **[IF YES]** Thank you. Your individual answers will be kept confidential and only summary information will be shared with Rocky Mountain Power.
 2. **[IF NO]** What would be the best time for me to call back and talk with you?

[IF NEEDED] I am not selling anything; we are interested in your feedback and opinions of the building market in Utah during 2013 and 2014. Our goal is to help improve the wattsmart New Homes program offered by Rocky Mountain Power and to better understand how to assist customers in saving money on their utility bills. Your responses will remain confidential.

3. In 2013 and 2014, did your company build homes other than single-family homes?

1. (Yes) [RECORD WHAT TYPES]
 - i. What percent of homes that your company built in 2013 and 2014 were single-family homes?
 1. [Record response]: _____
 - ii. What percent of the homes you built in 2013 and 2014 were [OTHER, AS RECORDED ABOVE]?
 1. [Record response]: _____
2. (No)
4. [IF 3 = 1] In 2013 and 2014, did the percentage of single-family versus OTHER/multi-family homes change?
 3. [IF YES] Why did this change? [Record response]: _____

Awareness and Participation Information

5. Has your company ever received an incentive through Rocky Mountain Power's ENERGY STAR New Homes/wattsmart New Homes program?
 1. (Yes)
 2. (No)
 98. (Don't Know) [THANK AND TERMINATE]
 99. (Refused) [THANK AND TERMINATE]
6. [IF 5 = 2] Have you heard of Rocky Mountain Power's ENERGY STAR New Homes/wattsmart New Homes program?
 1. (Yes)
 2. (No)
 98. (Don't Know) [THANK AND TERMINATE]
 99. (Refused) [THANK AND TERMINATE]
7. [IF 6 = 1 or 2] Our records show that you're listed as a participating builder for the wattsmart New Homes program. Specifically, that you received rebates for [list measures]. Is that correct?
 1. (Yes)
 2. (No) [THANK AND TERMINATE – Notify PC]
 98. (Don't Know) [THANK AND TERMINATE]
 99. (Refused) [THANK AND TERMINATE]
8. [IF 5 = 1] How did you learn about the program? [Do not read. Multiple responses ok]
 1. (Program contact/outreach specialist called or met with me)
 2. (Marketing package from ENERGY STAR New Homes Program)
 3. (From Rocky Mountain Power) Ask: Do you recall how you heard about this program from Rocky Mountain Power? [Record Response]: _____



4. (Rocky Mountain Power Website)
 5. (Newspaper Ad)
 6. (At an event)
 - a. What event? [Record response]: _____
 7. (From another builder)
 8. (From a vendor or contractor)
 9. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)
9. [IF 6 or 7 = 1] Can you briefly tell me what you know about this program and what it offers to builders?
1. [Record response]: _____
 98. (Don't Know)
 99. (Refused)
10. What are your main reasons for not participating in the program more frequently? [Multiple responses possible]
1. (Too much hassle)
 2. (No customer demand)
 3. (Geographic limits—build in non-Rocky Mountain Power areas)
 4. (Too busy)
 5. (Customer did not want to build to ENERGY STAR home specifications)
 6. (Paperwork is too time consuming/have deadlines to meet)
 7. (Cost, Adds to price)
 8. (Not really sure what we were getting into)
 9. (Bad experience with prior programs)
 10. (Incentives were not high enough)
 11. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)
11. Did you change your participation levels in response to the ENERGY STAR 3.0 standards?
1. (Yes) What changed? [Record response – get details!]: _____
 2. (No)
 98. (Don't Know)
 99. (Refused)
12. Could you briefly give me your thoughts on the changes that came with the ENERGY STAR 3.0 standards, what you like and didn't like?
1. [Record response – get details!]: _____
 98. (Don't Know)

99. (Refused)

13. What can the program change or do to increase the likelihood that you would participate more often?

1. [Record response]: _____

98. (Don't Know)

99. (Refused)

Building Practices

14. How many total homes did you build in Utah

1. In 2013? [Record response]: _____ How many of these were multifamily homes? [Record response]: _____

2. In 2014? [Record response]: _____ How many of these were multifamily homes? [Record response]: _____

15. What percentage of the new homes in your building territory would you estimate were ENERGY STAR certified in 2013 and 2014?

1. In 2013 _____%

2. In 2014 _____%

98. (Don't Know)

99. (Refused)

16. Of the homes you built in 2013–2014, what percentage of those homes contained one or more energy efficient measures, not including lighting measures?

1. [Record response]: _____ What percentage of homes included energy-efficient lighting measures? [Record response]: _____

i. [IF 5 = 1] When you installed an energy-efficient measure, did you consider getting a rebate through the wattsmart program?

1. (Yes)

2. (No)

ii. [IF 16 > 0%] Not counting lighting measures, approximately how many energy-efficient measures did you install in 2013–2014?

[Record response]: _____

1. (Don't know)

2. (Refused)

17. Which of the following types of heating systems did you typically install in the homes you built back in 2013 and 2014? [Read list. Multiple answers ok.]

1. Forced air furnace

2. Standard efficiency gas



3. High efficiency gas with an AFUE 90 or higher
 4. Electric resistance
 5. Standard efficiency heat pump
 6. High efficiency heat pump with an HSPF of 8.0 or higher
 7. Standard hot water heating
 8. High efficiency hot water heating or tankless system
 9. Gas/oil fired boiler
 10. Wood-burning stove
 11. (Other) **[Record response]**: _____
 98. (Don't Know)
 99. (Refused)
18. Which of the following types of cooling systems did you typically install in the homes you built back in 2013 and 2014? **[Read list. Multiple answers ok.]**
1. Standard efficiency heat pump
 2. High efficiency heat pump with SEER 14.0 or higher
 3. Standard efficiency air conditioner
 4. High efficiency air conditioner with SEER of 14.0 or higher
 5. Swamp/evaporative cooler
 6. No cooling system
 7. (Other) **[Record response]**: _____
 98. (Don't Know)
 99. (Refused)

The next set of questions are about lighting. This includes various types of incandescent, compact fluorescent lamps (CFLs), dedicated CFL fixtures, LEDs, and any fixtures and lamps with the ENERGY STAR label.

19. Back in 2013–2014, how did you typically decide on the type of lighting that went into a home? **[Do not read. Prompt if necessary]**
1. (Buyer has lighting budget, they choose lighting features within the budget)
 2. (Buyer chooses everything, no preset budget or lighting packages)
 3. (Builder has different lighting package options, buyer chooses one)
 4. (Builder installs all standard efficiency fixtures)
 5. (Builder installs all fixtures but uses CFLs in some or all sockets)
 6. (Builder gives general instructions, electricians pick specifics)
 7. (Other) **[Record response]**: _____
 98. (Don't Know)
 99. (Refused)
20. Which of the following types of lighting, if any, did you install in the homes you built in 2013 and 2014? **[Read list if necessary. Multiple answers ok]**

1. Incandescent bulbs
 2. Compact fluorescent lamps [CFLs]
 3. Dedicated compact fluorescent fixtures
 4. Halogen light
 5. T-5's [Long slender fluorescent tubes]
 6. T-8's [Long slender fluorescent tubes]
 7. LEDs [light emitting diode]
 8. None of these
 9. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)
21. [Ask if Q20 = 1, 8, and 9 (if "other" isn't energy efficient bulb)] What are the reasons you didn't install high efficiency lighting options? [Do not read. Multiple answers ok]
1. (Adds too much to home price)
 2. (Lamps burn out)
 3. (Can't find fixtures)
 4. (Poor light quality or weak light)
 5. (Customers don't request it)
 6. (Equipment problems with fixtures)
 7. (Energy savings not high enough to justify extra cost)
 8. (Other) [Record response]: _____
 98. (Don't Know)
 99. (Refused)
22. How many incandescent "rough service" bulbs do you typically install in a home?
1. [Record response]: _____
 98. (Don't Know)
 99. (Refused)
23. [Ask if 22 > 0] In which areas of the homes do you install these bulbs?
2. [Record response]: _____
 98. (Don't Know)
 99. (Refused)

The next questions are about appliances.

24. Which of the following ENERGY STAR appliances did you install in the homes you built in 2013 and 2014? [Read list]
1. ENERGY STAR dishwasher
 2. ENERGY STAR refrigerator



- 3. ENERGY STAR clothes washer
 - 4. ENERGY STAR clothes dryer
 - 5. Install all ENERGY STAR appliances [\[Go To 26\]](#)
 - 6. (Other) [\[Record response\]](#): _____
 - 7. (None)
 - 98. (Don't Know)
 - 99. (Refused)
25. [\[IF 24 = 7\]](#) What are the reasons for not installing ENERGY STAR appliances in the homes that you build? [\[Do not read. Multiple answers ok\]](#)
- 1. (Poor quality)
 - 2. (Adds too much to home price)
 - 3. (Can't find qualifying appliances)
 - 4. (Customers don't request it)
 - 5. (Energy savings not high enough to justify extra cost)
 - 6. (Other) [\[Record response\]](#): _____
 - 98. (Don't Know)
 - 99. (Refused)

The next set of questions relate to high efficiency windows. These are defined as ENERGY STAR-certified and have a U-value of 0.30 or better.

26. Which type of windows did you install in the homes that you built in 2013 and 2014? [\[READ. Multiple answers ok\]](#)
- 1. Windows with a U-value of .30 or lower [high efficient window] [\[Go to Q29\]](#)
 - 2. Windows with a U-value of .30 or greater [standard efficient window]
 - 3. Both types of u-values
 - 4. (Other) [\[Record response\]](#): _____
 - 98. (Don't Know)
 - 99. (Refused)
27. Did you consider installing high efficiency windows in the homes you built in 2013 and 2014?
- 1. (Yes)
 - 2. (No)
28. Why didn't you install more efficient windows? [\[Do not read. Multiple answers ok\]](#)
- 1. (Adds too much to home price)
 - 2. (Can't find windows)
 - 3. (Poor quality)
 - 4. (Customers don't request it)
 - 5. (Energy savings not high enough to justify extra cost)

- 6. (Good double pane windows are as good as ENERGY STAR windows)
- 7. (Other) [Record response]: _____
- 98. (Don't Know)
- 99. (Refused)

Duct Testing and Sealing

- 29. Are you familiar with duct testing and duct sealing protocols for ducted heating and cooling systems?
 - 1. (Yes)
 - 2. (No) [Go To Q35]
 - 98. (Don't Know)
 - 99. (Refused)

- 30. Did you have duct tests performed for the homes you built in 2013 and 2014?
 - 1. (Yes) [Go To Q35]
 - 2. (No)
 - 98. (Don't Know)
 - 99. (Refused)

- 31. Did you consider having the ducts tested in some or any of the homes you built?
 - 1. (Yes)
 - 2. (No)

- 32. [Ask if Q31 = 2] Why didn't you have the ducts tested in (some of/all) the homes you built?
 [Do not read. Multiple answers ok]
 - 1. (Time consuming)
 - 2. (Tests inaccurate, do not reflect actual equipment performance)
 - 3. (Too expensive)
 - 4. (Not worth hassle)
 - 5. (Customers do not consider testing valuable)
 - 6. (Delays in scheduling testers)
 - 7. (Certified testers not available)
 - 8. (Lack of competence among testers)
 - 9. (Don't know who to call)
 - 10. (Not familiar enough with duct testing)
 - 11. (Ducted systems as installed are tight enough)
 - 12. (Other) [Record response]: _____
 - 98. (Don't Know)
 - 99. (Refused)

- 33. Did your company change construction practices in 2013 or 2014?



- 1. (Yes)
- 2. (No)
- 3. (Don't Know)

34. [If Q33=1] Can you describe the change in construction practice?

- 1. [Record response]: _____

Program Participation

35. Has your firm participated in any other Rocky Mountain Power or other utility energy efficiency programs?

- 1. (Yes)
- 2. (No) [Go To Q40]
- 98. (Don't Know)
- 99. (Refused)

36. Which ones?

- 1. (Questar's Thermwise Builder Program)
- 2. (Other) [Record response]: _____
- 98. (Don't Know)
- 99. (Refused)

Marketing and Outreach

I have just a few more questions. I'd like to talk about how your homes are marketed to home buyers.

37. How frequently do buyers ask about energy efficiency when they visit your model homes?

Would you say they asked:

- 1. Very frequently,
- 2. Occasionally,
- 3. Not very often, or
- 4. Not at all?
- 5. (Don't know)
- 6. (Refused)

38. Do you market your homes as energy efficient?

- 1. (Yes) Would you please tell me how you market your homes as energy efficient? [Record response]: _____
- 2. (No)
- 98. (Don't Know)
- 99. (Refused)

39. About what percentage of buyers in Utah would you say are familiar with the wattsmart New Homes Program?

1. [Record response]: _____

40. Do you have any other comments or concerns? [Record response]: _____

Thank you for your time today. What is the exact name and address to which we should send this gift card? [Record response]: _____



Appendix E: Home Energy Rater Survey

- Interviewer instructions are in green **[LIKE THIS]**.
- Skip patterns are in red **[LIKE THIS]**.
- Items that should not be read by the interviewer are in parentheses like this ().

Interview Introduction

Hello, my name is [NAME] and I am calling from Cadmus on behalf of Rocky Mountain Power. We are evaluating the wattsmart New Homes program, and as part of that process we are talking to Home Energy Raters that participate in the program. This interview will provide key insights into how the program is operating that will help Rocky Mountain Power improve the program. Your individual responses will be kept confidential and only reported in aggregate.

Program Involvement

1. To start, please describe your role in the Rocky Mountain Power wattsmart New Homes program.
 - a. **[Record Response]:** _____
2. How long has your company been rating homes for the wattsmart New Homes program?
 - a. **[Record Response]:** _____
3. How many total homes did your company rate in 2013?
 - a. **[Record Response]:** _____
4. How many total homes did your company rate in 2014?
 - a. **[Record Response]:** _____
5. What percentage of the homes you rated through the wattsmart New Homes program received ENERGY STAR certification vs. certification for installed standalone measures?
 - a. **[Record Response]:** _____

Attribution-Related Questions

6. In what percentage of homes do you find energy-efficient measures or construction in homes that you're certifying that are not being rebated through the wattsmart program?
 - a. **[Record Response]:** _____
 - b. **[IF HAPPENING]:** What kinds of measures are you finding in these homes?
[Record Response]: _____
 - c. **[IF HAPPENING]:** What kinds of construction are you finding in these homes?
[Record Response]: _____
 - d. **[IF HAPPENING]:** Why are the builders not getting rebates for these measures?
[Record Response]: _____

- i. [IF NOT IN THE APPROVED MEASURES LIST]: Do you think this should be added to the rebated items offered through the program?

[Record Response]: _____

Energy Code

- 7. What are the three most common code jurisdictions you do rating in? [Record Response]:

- 8. In each of those jurisdictions what is the current energy code? [Record Response]:

- 9. Do building inspectors inspect or enforce?

- a. Wall, ceiling, and floor insulation levels? [Record Response]: _____

- b. Window U-values? [Record Response]: _____

- c. If envelope leakage is tested with a blower door test? [Record Response]:

- d. If duct leakage is tested with a duct blaster test? [Record Response]:

- e. (If none of the above or enforcement sounds weak) What do building inspectors inspect or enforce in the energy code? [Record Response]: _____

Program Processes and Communication

- 10. What challenges exist to achieving ENERGY STAR certification for homes built through the program?

- a. [Record Response]: _____

- 11. How do you receive information (from builders or Nexant) about the status of projects you have in the program?

- a. [Record Response]: _____ [Probe for frequency and from whom]

- 12. How do you receive general information about the program, such as information about changes to the program?

- a. [Record Response]: _____ [Probe for frequency and from whom]

- 13. Is communication between your company and Nexant sufficient to give you the information you need to successfully participate in the program? If not, how could it be improved?

- a. [Record Response]: _____

Program Delivery

- 14. Please walk me through the typical steps you go through when working with a builder who is participating in the program.

- a. [Record Response]: _____



- 15. Is verifying a program home any different than verifying an energy-efficient home with standalone measures?
 - a. [Record Response]: _____
- 16. What parts of the program process are working particularly well?
 - a. [Record Response]: _____
- 17. What could be improved?
 - a. [Record Response]: _____
- 18. Are current incentive levels sufficient to motivate builders to build homes that qualify for the program?
 - a. (Yes)
 - b. (No) What would be an appropriate incentive? [Record Response]: _____
- 19. How many builders do you work with? _____ Has this number changed since the change to ENERGY STAR 3.0?
 - a. (Yes) How has it changed? [Record Response]: _____
 - i. Why did it change? [Record Response]: _____
 - b. (No)
 - c. Don't Know

Marketing

- 20. Do you actively recruit builders to participate? If so, how do you market the program to builders?
 [Record Response]: _____ [Probe for marketing channels and tactics]
- 21. Overall, how effectively do you think the wattsmart New Homes program promotes energy-efficient new construction?
 - a. [Record Response]: _____
- 22. Are there any changes that you would suggest to more effectively promote energy-efficient new construction?
 - a. [Record Response]: _____

Satisfaction and Barriers

- 23. Overall, how satisfied are you with the wattsmart New Homes program? Would you say very satisfied, somewhat satisfied, not too satisfied, or not at all satisfied? Why?
 - a. [Record Response]: _____
- 24. What could be done to make participating easier for you?
 - a. [Record Response]: _____

25. What could be done to make participating easier for the builder?
a. [Record Response]: _____
26. What challenges or barriers do builders face in constructing energy-efficient new homes in Rocky Mountain Power's Utah territory?
a. [Record Response]: _____
27. How well have the builders you work with handled implementation of ENERGY STAR 3.0?
a. [Record Response]: _____

Wrap-Up

28. Those are all of the questions I have today. Do you have any other comments or suggestions for improving the program?
a. [Record Response]: _____



Appendix F: Participant Homeowner Survey

Hello, my name is [Name] and I’m calling on behalf of Rocky Mountain Power. I was wondering if it would be possible to speak with the owner or someone who is knowledgeable about your home’s characteristics such as the square footage and the appliances in your home.

[If right person]: I have some questions about your home. As a thank you for your assistance, at the end of the survey you will be offered a \$20 VISA gift card, which will be mailed to you. Do you have some time available to answer them?

[If “No—Not a convenient time”]: ask if respondent would like to arrange a more convenient time we can call back. Emphasize that: “It is important for Rocky Mountain Power to include your opinions in this study, so they can serve your needs better.”

[If needed]: This survey is for research purposes only, and this is not a marketing call. Your responses will remain confidential.

[Reintroduce if necessary]: Rocky Mountain Power is gathering information regarding what home options are offered to customers shopping for new homes. As a thank you for your assistance, at the end of the survey you will be offered a \$20 VISA gift card, which will be mailed to you. Do you have some time to answer some questions?

A. SCREENING QUESTIONS

1. First, I’d like to make sure that I’m speaking with the right person. Were you one of the primary decision-makers in purchasing or designing your home?
 1. (Yes)
 2. (No) [Ask to speak to correct person. If not available, schedule callback]
 99. (REFUSED) [THANK AND TERMINATE]

2. According to our records, your home was built in 2013 or 2014, is that correct?
 1. (Yes)
 2. (No) [Thank and Terminate]

- 98. (DON'T KNOW) [IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. IF NO, THANK AND TERMINATE]
- 99. (REFUSED) [THANK AND TERMINATE]

B. SQUARE FOOTAGE

- 3. Which of the following best describes the home? Is it a
 - 1. Single-family home,
 - 2. Townhouse or duplex,
 - 3. Mobile home or trailer, or an [TERMINATE SURVEY]
 - 4. Apartment building with 4 or more units?
 - 5. (Other) [Record response]: _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

I have a few questions related to the square footage of your home.

- 4. [IF 3 = 1 or 2] What is the square footage of your home, counting all conditioned space? If needed: define conditioned space as all home space that is heated or air conditioned, so this usually excludes the garage.
 - 1. Record square footage _____
 - 98. (DON'T KNOW) [ASK: IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. [RETURN TO INTRO] IF NO, ASK FOR THEIR BEST GUESS.]
 - 99. (REFUSED)
- 5. [IF 3 = 4] What is the square footage of the building, counting all conditioned space? If needed: define conditioned space as all home space that is heated or air conditioned, so this usually excludes the garage.
 - 1. Record square footage _____
 - 98. (DON'T KNOW) [ASK: IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. IF NO, ASK FOR THEIR BEST GUESS.]
 - 99. (REFUSED)
- 6. [IF 3 = 1 or 2] How many people live in the home full time?
 - 1. [Record response]: _____
 - 2. (None)
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
- 7. [IF 3 = 4] How many apartments are in the building?
 - 1. [Record response]: _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
- 8. [IF 7 = 1] How many of those apartments are occupied?



- 1. [Record response]: _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
9. Was any additional square footage added after the home was built?
- 1. (Yes)
 - 2. (No)
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
10. [IF 9 = YES] About how much square footage was added?
- 1. Record square footage _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
11. [IF 9 = YES] When was the work on the addition completed?
- 1. Record month and year _____ [YEAR IS MOST IMPORTANT, MONTH IS OPTIONAL]
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
12. [IF 9 = YES] And was this square footage included in your previous answer of [REFERENCE NUMBER GIVEN IN 4 ABOVE]?
- 1. (Yes)
 - 2. (No)
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
13. Do you recall where the square footage number(s) you provided came from? [DO NOT READ LIST [THERE COULD BE MORE THAN ONE SOURCE SINCE WE ASKED FOR OVERALL AREA AND ADDITION AREA, OK TO RECORD MORE THAN ONE RESPONSE]
- 1. (Realtor)
 - 2. (Builder or Architect)
 - 3. (Tax Assessment)
 - 4. (ENERGY STAR Home documentation)
 - 5. (Homeowner calculation from floor plan)
 - 6. (Homeowner measurement)
 - 7. (Other) Record response _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)
14. Does your home have a basement?
- 1. (Yes)
 - 2. (No) [SKIP TO 20]
 - 98. (DON'T KNOW)
 - 99. (REFUSED)

15. [IF 14 = YES] Is the basement finished? That is, does it have drywall, a finished ceiling, insulation, and a finished floor?
1. (Yes, it is finished space)
 2. (No, it is not finished space)
 98. (DON'T KNOW)
 99. (REFUSED)
16. [IF 15 = 1] Did the square footage number [REFERENCE NUMBER GIVEN IN 4 ABOVE] you gave earlier include the basement?
3. (Yes)
 4. (No)
 98. (DON'T KNOW)
 99. (REFUSED)
17. [IF 16= 2] What would you estimate is the square footage of the basement?
1. Record square footage of basement: _____
 98. (DON'T KNOW)
 99. (REFUSED)
18. [IF 15 = 2] Does the basement have insulation on the foundation walls?
1. (Yes)
 2. (No)
 98. (DON'T KNOW)
 99. (REFUSED)
19. [IF 18= Yes] Is your basement ducted to cool and heat the space? Are there air-conditioning or furnace vents (or registers) present in the basement?
1. (Yes)
 2. (No)
 98. (DON'T KNOW)
 99. (REFUSED)

C. USAGE AND IMPACT

20. [IF LIGHTING WAS INSTALLED] According to our records, ENERGY STAR lighting such as CFLs or LEDs were installed in most of the available light sockets when the home was built. Are these light bulbs still installed?
1. (Yes)
 2. (No)
 3. (Some of them)
 4. (Other) Record response _____
 98. (DON'T KNOW)
 99. (REFUSED)



21. [IF 20 = 2 or 3] What were your reasons for removing the lights? [DO NOT READ, MULTIPLE RESPONSE, SELECT UP TO 3]
1. (Bulb(s) burned out)
 2. (Quality of light)
 3. (Not bright enough)
 4. (Too bright)
 5. (Wrong color of light)
 6. (Other) Record response _____
 98. (DON'T KNOW)
 99. (REFUSED)
22. [IF 20 = 2 or 3] Approximately how many did you remove?
- a. Record response: _____
23. [IF 20=2 or 3] When did you remove them?
- a. Record response: _____
24. [IF 20=2 or 3] What type of bulbs did you install to replace the bulbs you removed?
1. (Incandescents)
 2. (Other CFLs)
 3. (LEDs)
 4. (Varies) Ask: What was the most common type of bulb you installed: was it an incandescent bulb, a CFL, or LEDs? Record response _____
 5. (Other) Record response _____
 98. (DON'T KNOW)
 99. (REFUSED)
25. Have you made any major upgrades or changes to the house such as changing the heating or cooling systems, windows, insulation, or major appliances since you purchased your home? [DO NOT READ LIST]
1. (Yes) Ask: What changes were made?
 - A1a. Furnace with EMC was changed [ASK 26-28]
 - A1b. Central Air was changed [ASK 29-31]
 - A1c. Air Source Heat Pump was changed [Ask 32-34]
 - A1d. Premium Evaporative Equipment was changed [ASK 35-37]
 - A1e. High Efficiency Dishwasher was changed [ASK 38-40]
 - A1f. High Efficiency Refrigerator was changed [ASK 41-43]
 - A1g. Windows were changed [ASK 44-46]
 - A1h. Insulation was changed [ASK 47-48]
 2. (No changes made) [SKIP TO 53]
 3. (Other) Record response _____[SKIP TO 53]
 98. (DON'T KNOW) [SKIP TO 53]
 99. (REFUSED) [SKIP TO 53]
26. [25 = 1: FURNACE WITH ECM WAS CHANGED] Why was it replaced?

- a. Record response _____
- 27. [25 = 1: FURNACE WITH ECM WAS CHANGED] When was it replaced?
 - a. Record response _____
- 28. [25 = 1: FURNACE WITH ECM WAS CHANGED] What was it replaced with?
 - a. Record response _____
- 29. [25 = 1: CENTRAL AIR WAS CHANGED] Why was it replaced?
 - RECORD RESPONSE _____
- 30. [25 = 1: CENTRAL AIR WAS CHANGED] WHEN WAS IT REPLACED?
 - RECORD RESPONSE _____
- 31. [25 = 1: CENTRAL AIR WAS CHANGED] What was it replaced with?
 - a. Record response _____
- 32. [25 = 1: AIR SOURCE HEAT PUMP WAS CHANGED] Why was it replaced?
 - RECORD RESPONSE _____
- 33. [25 = 1: AIR SOURCE HEAT PUMP WAS CHANGED] WHEN WAS IT REPLACED?
 - RECORD RESPONSE _____
- 34. [25 = 1: AIR SOURCE HEAT PUMP WAS CHANGED] What was it replaced with?
 - a. Record response _____
- 35. [25 = 1: PREMIUM EVAPORATIVE EQUIPMENT WAS CHANGED] Why was it replaced?
 - RECORD RESPONSE _____
- 36. [25 = 1: PREMIUM EVAPORATIVE EQUIPMENT WAS CHANGED] WHEN WAS IT REPLACED?
 - RECORD RESPONSE _____
- 37. [25 = 1: PREMIUM EVAPORATIVE EQUIPMENT WAS CHANGED] What was it replaced with?
 - a. Record response _____
- 38. [25 = 1: HIGH EFFICIENCY DISHWASHER WAS CHANGED] Why was it replaced?
 - RECORD RESPONSE _____
- 39. [25 = 1: HIGH EFFICIENCY DISHWASHER WAS CHANGED] WHEN WAS IT REPLACED?
 - RECORD RESPONSE _____
- 40. [25 = 1: HIGH EFFICIENCY DISHWASHER WAS CHANGED] What was it replaced with?
 - a. Record response _____
- 41. [25 = 1: HIGH EFFICIENCY REFRIGERATOR WAS CHANGED] Why was it replaced?
 - RECORD RESPONSE _____
- 42. [25 = 1: HIGH EFFICIENCY REFRIGERATOR WAS CHANGED] WHEN WAS IT REPLACED?



RECORD RESPONSE _____

43. [25 = 1: HIGH EFFICIENCY REFRIGERATOR WAS CHANGED] What was it replaced with?
a. Record response _____

44. [25 = 1: R-5 WINDOWS WERE CHANGED] Why were they replaced?
RECORD RESPONSE _____

45. [25 = 1: R-5 WINDOWS WERE CHANGED]WHEN WERE THEY REPLACED?
RECORD RESPONSE _____

46. [25 = 1: R-5 WINDOWS WERE CHANGED]What was it replaced with?
a. Record response _____

47. [25 = 1: INSULTATION WAS CHANGED] What changes were made to the insulation?
RECORD RESPONSE _____

48. [25 = 1: INSULTATION WAS CHANGED] WHEN WAS THIS DONE?
RECORD RESPONSE _____

49. [IF 25 = 1] WAS THIS CHANGE INFLUENCED BY ROCKY MOUNTAIN POWER?

- 1. (Yes) Ask: What influenced you? Record response _____
- 2. (No)
- 3. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

50. [IF 49 = 1] Do you receive a home energy report from Rocky Mountain Power? [If needed: If you received the Home Energy report, it provides you with detailed information about your home's energy use, offers advice on ways to save money and make your home more energy efficient, and compares your energy usage to other households in your area]

- 1. (Yes) Ask: Did this report influence you? Record response _____
- 2. (No)
- 3. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

51. [IF 25 = 1] Did you receive a rebate or incentive for this [change or installation]?

- 1. (Yes) Ask: Where did the rebate come from? Record response _____
- 2. (No)
- 3. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

52. [IF 49 = 1] ON A FOUR POINT SCALE, HOW IMPORTANT WAS THE PROGRAM IN YOUR DECISION TO MAKE THE ENERGY EFFICIENCY IMPROVEMENT OF [RESPONSE TO 49]? WAS IT NOT AT ALL IMPORTANT, NOT VERY IMPORTANT, SOMEWHAT IMPORTANT, OR VERY IMPORTANT?

- 1. Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

D. PURCHASING AND SATISFACTION

53. I'd like to ask you about some aspects of your new home that led to your purchase decision. First off, I will read some factors about new homes, and please tell me how important they were in your purchase decision. Please share whether each factor was (1) very important, (2) somewhat important, (3) not too important, (4) not at all important:

- 1. Location
- 2. Appearance
- 3. Price
- 4. Size
- 5. Quality of construction
- 6. Green or sustainable design
- 7. Flexibility or option to upgrade and customize design features
- 8. Financing
- 9. Energy efficiency of the construction
- 10. Energy efficient appliances
- 11. ENERGY STAR certification

54. Were you able to give the builder any input on the final design of your home?

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

55. [Ask if 54=1] What specific features did you discuss that determined the final design of your home? [Accept multiple answers, DO NOT READ]

- 1. (Floor plan/layout)
- 2. (Heating and/or AC equipment)
- 3. (Insulation)
- 4. (Windows)
- 5. (Lighting fixtures)
- 6. (Plumbing fixtures)
- 7. (Walls)
- 8. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

56. How energy-efficient would you say your home is currently? Would you say...

- 1. Very inefficient
- 2. Somewhat inefficient
- 3. Somewhat efficient, or
- 4. Very efficient



- 98. (DON'T KNOW)
- 99. (REFUSED)

57. [ASK IF 56 = 1 OR 2 OR 3 OR 4] What makes your home [56 RESPONSE (INCLUDE ONLY THE FIRST TWO WORDS)]?

- 1. [Record response]: _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

58. On a scale of 0–10 where 0 is extremely dissatisfied and 10 is extremely satisfied, how satisfied are you with the energy-efficient features of your new home?

- 1. [Record response]: _____

59. Why did you give it this rating?

- 1. [Record response]: _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

60. [if 58 < 5] What would make you more satisfied with these energy-efficient features?

- 1. [Record responses pertaining to energy-efficient features]: _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

61. Have you ever heard about the Rocky Mountain Power wattsmart New Homes Program?

- 1. (Yes)
- 2. (No) [skip to 63]
- 98. (DON'T KNOW)
- 99. (REFUSED)

62. [ASK IF 61 = 1] How did you learn about the program? (MULTIPLE RESPONSES, DO NOT READ)

- 1. (Builder)
- 2. (Realtor)
- 3. (Mailing/direct mail (e.g., bill insert))
- 4. (Rocky Mountain Power)
- 5. (Word of mouth: family, friends, colleagues) [Use for any reference to a specific individual except a Rocky Mountain Power employee]
- 6. (Event)
- 7. (Other) [RECORD: _____]
- 98. (DON'T KNOW)
- 99. (REFUSED)

63. [ASK IF HOME IS ENERGY STAR CERTIFIED] Is your home an ENERGY STAR certified home?

- 1. (Yes)
- 2. (No)
- 98. (DON'T KNOW)

99. (REFUSED)

That's all the questions I have. We appreciate you taking the time to answer our questions. [Confirm name and address for gift card]. We will send you a \$20 Visa gift card for your time today. You should receive this within 4 weeks.



Appendix G: Nonparticipant Homeowner Survey

Hello, my name is [Name] and I’m calling on behalf of Rocky Mountain Power. I was wondering if it would be possible to speak with the owner or someone who is knowledgeable about your home’s characteristics such as its square footage.

[If right person]: I have some questions about a few characteristics of your new home. As a thank you for your assistance, at the end of the survey you will be offered a \$20 VISA gift card, which will be mailed to you. Do you have some time available to answer them?

[If “No – Not a convenient time”]: ask if respondent would like to arrange a more convenient time we can call back. Emphasize that: “It is important for Rocky Mountain Power to include your opinions in this study, so they can serve your needs better.”

[If needed]: This survey is for research purposes only, and this is not a marketing call. Your responses will remain confidential.

[Reintroduce if necessary]: Rocky Mountain Power is gathering information regarding what home options are offered to customers shopping for new homes. As a thank you for your assistance, at the end of the survey you will be offered a \$20 VISA gift card, which will be mailed to you. Do you have some time to answer some questions?

SCREENING QUESTIONS

1. First, I’d like to make sure that I’m speaking with the right person. Were you one of the primary decision-makers in purchasing or designing this home?
 1. Yes
 2. No [Ask to speak to correct person. If not available, schedule callback]
 99. REFUSED [THANK AND TERMINATE]

2. According to our records your home was built in 2013 or 2014, is that correct?
 1. (Yes)
 2. (No) [Thank and Terminate]
 98. (DON’T KNOW) [IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. IF NO, THANK AND TERMINATE]
 99. (REFUSED) [THANK AND TERMINATE]

SQUARE FOOTAGE

3. Which of the following best describes the home? Is it a
 3. Single-family home,
 4. Townhouse or duplex,
 5. Mobile home or trailer, or an
 6. Apartment building with 4 or more units?
 7. (Other) [Record response]: _____

- 98. (DON'T KNOW)
- 99. (REFUSED)

I have a few questions related to the square footage of your home.

- 4. [IF 3 = 1 or 2] What is the current square footage of your home, counting all conditioned space? *If needed: define conditioned space as all home space that is heated or air conditioned, so this usually excludes the garage.*
 - 1. Record square footage _____ [allowable range for numeric input 100–99999]
 - 98. (DON'T KNOW) [ASK: IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. [RETURN TO INTRO] IF NO, ASK FOR THEIR BEST GUESS.]
 - 99. (REFUSED)

- 5. [IF 3 = 1 or 2] How many people live in the home full time?
 - 1. [Record response]: _____
 - 2. (None)
 - 98. (DON'T KNOW)
 - 99. (REFUSED)

- 6. [IF 3 = 4] What is the current square footage of the building, counting all conditioned space? *If needed: define conditioned space as all home space that is heated or air conditioned, so this usually excludes the garage.*
 - 1. Record square footage _____ [allowable range for numeric input 100–99999]
 - 98. (DON'T KNOW) [ASK: IS THERE SOMEONE THAT WOULD KNOW THIS ANSWER? IF YES, ASK TO SPEAK WITH THAT PERSON. IF NO, ASK FOR THEIR BEST GUESS.]
 - 99. (REFUSED)

- 7. [IF 3 = 4] How many apartments are in the building?
 - 1. [Record response]: _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)

- 8. [IF 7=1] How many of those apartments are occupied?
 - 1. [Record response]: _____
 - 98. (DON'T KNOW)
 - 99. (REFUSED)

- 9. Was any additional square footage added after the home was built?
 - 1. (Yes)
 - 2. (No)
 - 98. (DON'T KNOW)
 - 99. (REFUSED)



10. [IF 9 = YES] About how much square footage was added?
1. Record square footage _____
 98. (DON'T KNOW)
 99. (REFUSED)
11. [IF 9 = YES] When was the work on the addition completed?
1. Record month and year _____ [YEAR IS MOST IMPORTANT, MONTH IS OPTIONAL]
 98. (DON'T KNOW)
 99. (REFUSED)
12. [IF 9 = YES] And was this square footage included in your previous answer of [REFERENCE NUMBER GIVEN IN 4 ABOVE]?
1. (Yes)
 2. (No)
 98. (DON'T KNOW)
 99. (REFUSED)
13. Do you recall where the square footage number(s) you provided came from? [DO NOT READ LIST] [THERE COULD BE MORE THAN ONE SOURCE SINCE WE ASKED FOR OVERALL AREA AND ADDITION AREA. OK TO RECORD MORE THAN ONE RESPONSE]
1. (Realtor)
 2. (Builder or Architect)
 3. (Tax Assessment)
 4. (ENERGY STAR Home documentation)
 5. (Homeowner calculation from floor plan)
 6. (Homeowner measurement)
 7. (Other) Record response _____
 98. (DON'T KNOW)
 99. (REFUSED)
14. Does your home have a basement?
1. (Yes)
 2. (No) [SKIP TO 20]
 98. (DON'T KNOW)
 99. (REFUSED)
15. [IF 14 = YES] Is the basement finished? That is, does it have drywall, a finished ceiling, insulation, and a finished floor?
1. (Yes, it is finished space)
 2. (No, it is not finished space)
 98. (DON'T KNOW)
 99. (REFUSED)
16. [IF 15 = 1] Did the square footage number [REFERENCE NUMBER GIVEN IN 4 ABOVE] you gave earlier include the basement?

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

17. [IF 16 = 2] What is the square footage of the basement?

- 1. Record square footage of basement: _____ [allowable range for numeric input 100–999999]
- 98. (DON'T KNOW)
- 99. (REFUSED)

18. [IF 15 = 2] Does the basement have insulation on the foundation walls?

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

19. [IF 18 = Yes] Is your basement ducted to cool and heat the space? Are there air-conditioning or furnace vents (or registers) present in the basement?

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

USAGE AND IMPACT

20. Was your home built with ENERGY STAR lighting such as CFLs or LEDs installed in any of the available light sockets?

- 1. (Yes) Ask: Did you remove any of those bulbs? If yes, mark as response 2.
- 2. (Yes, but I removed them)
- 3. (No)
- 4. (Some of them)
- 5. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

21. [IF 20 = 1, 2, or 4] Approximately what percentage of the available sockets had efficient lighting?

a. Record response: _____

22. [IF 20 = 2] What were your reasons for removing the lights? [DO NOT READ, MULTIPLE RESPONSES, SELECT UP TO 3]

- 1. (Bulb(s) burned out)
- 2. (Quality of light)
- 3. (Not bright enough)
- 4. (Too bright)
- 5. (Wrong color of light)



6. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)
23. [IF 20 = 2] Approximately how many did you remove?
1. Record response: _____
98. (DON'T KNOW)
99. (REFUSED)
24. [IF 20 = 2] When did you remove them?
1. Record response: _____
98. (DON'T KNOW)
99. (REFUSED)
25. [IF 20 = 2] What type of bulbs did you install to replace the bulbs you removed? [SELECT ALL THAT APPLY]
1. (Incandescents)
2. (Other CFLs)
3. (LEDs)
4. (Varies) Ask: What was the most common type of bulb you installed: was it an incandescent bulb, a CFL, or LEDs? Record response _____
5. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)
26. Did your new home come with a furnace with an electronically commutated motor installed?
1. (Yes)
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)
27. Did your new home come with a 15-SEER or better central air conditioner installed?
1. (Yes)
2. (No, that was not installed)
3. (There was no cooling system installed)
4. (The home has an evaporative cooler) [also known as a swamp cooler]
5. (Yes, but it was replaced)
6. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)
28. Did your new home come with a 15-SEER or better air source heat pump installed?

1. (Yes) Do you know the Heat Seasonal Performance Factor (or HSPF) of your heat pump?
Record response _____
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)

29. Did your new home come with premium evaporative equipment installed?

1. (Yes)
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)

30. Did your new home come with a high efficiency dishwasher installed?

1. (Yes)
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)

31. Did your new home come with a high efficiency refrigerator installed?

1. (Yes)
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)

32. Did your new home come with high efficiency windows installed?

1. (Yes) Do you know what the U-Value is for your windows? Record response _____
2. (No, that was not installed)
3. (Yes, but it was replaced)
4. (Other) Record response _____
98. (DON'T KNOW)
99. (REFUSED)

33. Have you made any major upgrades or changes to the house such as changing the heating or cooling systems, windows, insulation changes, or major appliances since you purchased your home?

1. (Yes) Ask: What changes were made? Record response _____



- 2. (No)
- 3. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

PURCHASING AND SATISFACTION

34. I'd like to ask you about some aspects of your new home that led to your purchase decision. First, I will read some factors about new homes, and please tell me how important they were in your purchase decision. Please share whether each factor was (1) very important, (2) somewhat important, (3) not too important, (4) not at all important: [RECORD RESPONSE FOR EACH]

- 1. Location
- 2. Appearance
- 3. Price
- 4. Size
- 5. Quality of construction
- 6. Green or sustainable design
- 7. Flexibility or option to upgrade and customize design features
- 8. Financing
- 9. Energy efficiency of the construction
- 10. Energy efficient appliances
- 11. ENERGY STAR certification

35. Were you able to give the builder any input on the final design of your home?

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

36. [Ask if 54 = 1] What specific features did you discuss that determined the final design of your home? [Accept multiple answers, DO NOT READ]

- 1. (Floor plan/layout)
- 2. (Heating and/or AC equipment)
- 3. (Insulation)
- 4. (Windows)
- 5. (Lighting fixtures)
- 6. (Plumbing fixtures)
- 7. (Walls)
- 8. (Other) Record response _____
- 98. (DON'T KNOW)
- 99. (REFUSED)

37. How energy efficient would you say your home is currently? Would you say...

- 1. Very inefficient,
- 2. Somewhat inefficient,
- 3. Somewhat efficient, or

- 4. Very efficient?
- 98. (DON'T KNOW)
- 99. (REFUSED)

38. [IF 56 = 3 or 4] What are the benefits you feel you are getting by living in an efficient home?

- 1. (Other) Record response _____
- 2. (DON'T KNOW)
- 3. (REFUSED)

39. [ASK IF 56 = 1 OR 2 OR 3 OR 4] What makes your home [56 RESPONSE (INCLUDE ONLY THE FIRST TWO WORDS)]?

- 1. [RECORD RESPONSE: _____]
- 99. (DON'T KNOW)
- 99. (REFUSED)

That's all the questions I have. We appreciate you taking the time to answer our questions. [Confirm name and address for gift card]. We will send you a \$20 Visa gift card for your time today. You should receive this within 4 weeks.



Appendix H: Evaluated Savings Calculations

15 SEER / 12 EER / TXV

AC Upgrade (15 SEER / 12 EER / TXV)			
Baseline: 13SEER / Non-TXV			
Measure: 15SEER/ 12 EER / TXV			
<i>Efficiency Improvement %</i> =		$\frac{\text{Efficient SEER} - \text{Baseline SEER}}{\text{Baseline SEER}}$	
Parameter	Value	Source	
Efficiency Improvement %	=	15%	Calculation
Cooling Billing Consumption C23 kWh Single Family	=	2996	WSNH DESIGN BRIEF
Cooling Billing Consumption C25 kWh Single Family	=	2076	WSNH DESIGN BRIEF
Cooling Billing Consumption C26 kWh Single Family	=	364	WSNH DESIGN BRIEF
Cooling Billing Consumption C25 kWh Multi Family	=	775	WSNH DESIGN BRIEF
<i>Cooling Savings = Cooling Billing Consumption × Efficiency Improvement %</i>			
Cooling Savings C23 kWh Single Family	=	461	Calculation
Cooling Savings C25 kWh Single Family	=	319	Calculation
Cooling Savings C26 kWh Single Family	=	56	Calculation
Cooling Savings C25 kWh Multi Family	=	119	Calculation
Weighting C23 Single Family	=	0%	Tracking Data Zip Codes
Weighting C25 Single Family	=	59%	Tracking Data Zip Codes
Weighting C26 Single Family	=	41%	Tracking Data Zip Codes
Weighting C25 Multi Family	=	100%	Tracking Data Zip Codes
Notes: Billing calibration data in the WSNH Design Brief is a very good source for baseline cooling energy consumption. % Savings is a good approximation of energy savings for this measure. Calculated energy consumption aligns very closely with tracking data.			
Weighted Single Family Savings(kWh)	=	212 kWh	
Multifamily Savings (kWh)	=	119 kWh	

GSHP E* 17 EEF 3.6 COP

GSHP E* 17 EEF 3.6 COP			
Baseline: 13SEER / 7.7 HSPF Air Source Heat Pump Heating and Cooling System			
Measure: Ground Sourced Heat Pump Energy Star Certified 17 EER and 3.6 COP			
Parameter		Value	Source
Ground source heat pump savings CZ5	=	8,285	(RTF) 2.2 RESIDENTIAL GSHP UPGRADES
Ground source heat pump savings CZ6	=	2,632	(RTF) 2.2 RESIDENTIAL GSHP UPGRADES
REM Rate Savings	=	5,160	REM/Rate Simulations
% of Houses in HZ1 CZ3	=	40%	Tracking Data Zip Codes
% of Houses in HZ2 CZ3	=	60%	Tracking Data Zip Codes
Notes: Significant variation among sources for Ground Sourced Heat Pump savings. The energy savings documented in the tracking data appear to be a median values. Data available not sufficient to provide updated savings.			
Estimated Savings GSHP 2013 (kWh)	=	3,526	Pacific Corp New Homes Tracking Data
Estimated Savings GSHP 2014 (kWh)	=	5,289	Pacific Corp New Homes Tracking Data



Evap Prem Eff non-ducted

Evap Prem Eff non-ducted SF			
Baseline:		13SEER Central Air Conditioner	
Measure:		Evap Cooler Non Ducted	
Parameter		Value	Source
Cooling Billing Consumption CZ5 kWh Single Family	=	2,076	WSNH DESIGN BRIEF
Evap cooler fan hp	=	0.75	Assumption
Hours of Operation	=	1,858	TMY3 Weather Data(SLC) - Hours above 75F DB
$\text{Consumption of Evap Cooler} = \text{Evap Cooler Fan hp} \times 0.746 \frac{\text{kW}}{\text{hp}} \times \text{Hours of Operation}$			
Consumption of the Evap Cooler	=	1,040	Calculation
$\text{Estimated Evaporative Cooler Savings} = \text{Cooling Billing Consumption CZ5 Single Family} - \text{Consumption of the Evap Cooler}$			
Estimated Evap Cooler Savings (kWh)	=	1,036	Calculation

HVAC Quality Install

HVAC Quality Install				
	Baseline	Standard Install(Not well defined)		
	Measure	Quality Install	Quality Install with ECM	motor
Parameter		Value		Source
Parts of Quality Install				
Proper Sizing	=		5%	Energy Star (Not a Study)
Proper Airflow	=		3%	Energy Star (Not a Study)
Proper Charge	=		4%	Energy Star (Not a Study)
Sealed Ducts	=		15%	Energy Star (Not a Study)
SF or MF	CZ	Count		Percentage
MF	CZ3		0	0%
MF	CZ5		820	100%
MF	CZ6		0	0%
SF	CZ3		14	1%
SF	CZ5		972	96%
SF	CZ6		22	2%
Evaluation of Retrofit Variable-Speed Furnace Fan				
ECM motor savings kWh/year	=		163	Motors, NREL
ECM motor savings kWh/year	=		415	Wisconsin Focus on Energy
Notes: Variation among sources. Weather dependency is for savings will be significant but occupant usage patterns can also be significant for ECM measures. ENERGY STAR advertises significant savings for these savings however our internal experts are skeptical and because savings are very dependent on market baseline practices and cannot be assumed to unknown markets.				
HVAC-QI Contractor cert SF	=		94	Pacific Corp New Homes Tracking Data
HVAC-QI Contractor cert w ECM SF	=		417	Pacific Corp New Homes Tracking Data
HVAC-QI Rater cert MF	=		79	Pacific Corp New Homes Tracking Data
HVAC-QI Rater cert SF	=		188	Pacific Corp New Homes Tracking Data
HVAC-QI Rater cert w ECM SF	=		511	Pacific Corp New Homes Tracking Data



Dishwasher EF 0.75+

Dishwasher EF 0.75+		
Baseline Before May 30 2013	Standard dishwasher 355kWh/year 6.5 gal/cycle	
Baseline After May 30 2013	Standard dishwasher 307kWh/year 5.0 gal/cycle	
Measure	Dishwasher EF 0.75+	
Baseline Before May 30 2013	5/30/2013	
$Savings = Baseline Consumption - \frac{Cycles\ Per\ Year}{Efficient\ EF}$		
Parameter	Value	Source
Converting EF to kWh/year		Source
Cycles per year	=	215 http://www.gpo.gov/fdsys/pkg/FR-2003-08-29/pdf/03-22120.pdf
Baseline Consumption	=	355 https://www1.eere.energy.gov/buildings/appliances_standards/product.aspx/productid/67
Measure EF	=	0.75 Measure
Measure Consumption	=	287 Calculated
Savings	=	68 Calculated
Baseline After May 30 2013		
Converting EF to kWh/year		Source
Cycles per year	=	215 https://www.energystar.gov/index.cfm?c=dishwasher_pr_crit_dishwashers
Baseline Consumption	=	307 https://www1.eere.energy.gov/buildings/appliances_standards/product.aspx/productid/67
Measure EF	=	0.75 Measure
Measure Consumption	=	287 Calculated
Savings	=	20 Calculated
Dishwasher Before May 30 2013	=	68 Calculated
Dishwasher After May 30 2013	=	20 Calculated

Refrigerator 10%> Energy Star

Refrigerator 10%> Energy Star			
Baseline	Federal Baseline		
Measure	10% Better than Energy Star		
Year Bins	1/1/2014	10/1/2014	
Parameter		Value	Source
2013	=	145	HES Savings
2014 (Jan-Sep)	=	148	HES savings
2014 (Oct-Dec)	=	59	HES savings
Refrigerator savings before 2014	=	145	Calculated
Refrigerator savings 1/1/2014 - 10/1/2014	=	148	Calculated
Refrigerator savings after 10/1/2014	=	59	Calculated



Wall Insulation Measures

Wall Insulation		
Baseline	R-13 Wall insulation	
Efficient	R-20 Wall insulation	
Parameter	Value	Source
Single Family Savings Climate Zone 5(kWh)	=	75 REM Rate Modeling based on design paramaters in WSNH design brief
Single Family Savings Climate Zone 6(kWh)	=	59 REM Rate Modeling based on design paramaters in WSNH design brief
Multifamily Savings Climate Zone 6(kWh)	=	29 REM Rate Modeling based on design paramaters in WSNH design brief
Multifamily Savings Climate Zone 5(kWh)	=	11 REM Rate Modeling based on design paramaters in WSNH design brief

Code Enhancement

IECC 2009 Certified							
Baseline	Efficient	Type	Single Family		Multi Family		Sources
			CZ5	CZ6	CZ5	CZ6	
R-13	R-20	Wall Insulation Savings(kWh)	75	59	29	11	WSNH Design Brief and REM/Rate Modeling
0.00036SLA	7 ACH 50	Infiltration Savings(kWh)	-52	-2	-27	-53	WSNH Design Brief and REM/Rate Modeling
Not Required	Programmable Thermostat	Thermostat Savings(kWh)	29	0	2	0	WSNH Design Brief and REM/Rate Modeling
Not Required	50% CFL or high efficacy	Lighting Savings(kWh)	584	651	371	362	WSNH Design Brief and REM/Rate Modeling
80% Efficient distribution efficiency	8CFM25/100sq-ft	Duct Leakage Savings(kWh)	21	3	22	31	WSNH Design Brief and REM/Rate Modeling
<i>Savings for all homes = Infiltration Savings+Thermostat Savings+Duct Leakage Savings</i>							
	Type	Single Family		Multi Family		Sources	
		CZ5	CZ6	CZ5	CZ6		
	Wall Savings (kWh)	75	59	29	11	WSNH Design Brief and REM/Rate Modeling	
	Lighting Savings (kWh)	584	651	371	362	WSNH Design Brief and REM/Rate Modeling	
	Savings for all homes (kWh)	-2	1	-3	-22	WSNH Design Brief and REM/Rate Modeling	
				Category	Weight	Sources	
				% of Homes with 80% Estar Measure	76%	Pacific Corp New Homes Tracking Data	
				% of Homes with Wall Insulation Measure	85%	Pacific Corp New Homes Tracking Data	
<i>Weighted Home Savings = Wall Savings × (1 – % of Homes with wall insulation measure) + Lighting Savings × (1 – % of homes with 80% Estar Lighting) + savings for all homes</i>							
	Type	Single Family		Multi Family		Sources	
		CZ5	CZ6	CZ5	CZ6		
	Weighted Home Savings(kWh)	150	166	90	66	Calculated	