125
YEARS OF SERVICE
1889–2014

2013 Annual Report
Demand-Side Management
Washington

I. Table of Contents

II. EXECUTIVE SUMMARY

The 2013 Demand-Side Management (DSM) Annual Report summarizes the Company's annual energy efficiency achievements for its Washington electric and natural gas customers. These programs are intended to deliver a cost-effective, "least-cost" resource with the funding provided through Avista's Schedules 91 and 191, also known as the "Tariff Rider" which is a non-bypassable system benefit charge applied to all electric and natural gas retail sales.

In 2013, the electric DSM portfolio achieved 50,124 MWh and the natural gas portfolio delivered 613,788 therms in first year annual savings. Based on the 2013 target established by the 2011 Electric Integrated Resource Plan (IRP), the Company achieved 133 percent of the Washington target while acquiring 69 percent of the 2013 target from the 2012 Natural Gas IRP. The Natural Gas IRP target was established prior to the significant decline in natural gas commodity prices that resulted in the suspension of Idaho Schedule 191 and the subsequent suspension of the natural gas energy efficiency programs due to cost-effective challenges resulting from lower avoided costs.

At present, the Washington Utilities and Transportation Commission (WUTC) has requested that Avista operate its natural gas energy efficiency programs under the Program Administrator Cost (PAC) test, formerly known as the Utility Cost Test, rather than the traditional Total Resource Cost (TRC) test.

Furthermore, 2013 is the second year of the second Biennial Conservation Plan (BCP) for Washington's Energy Independence Act (or Initiative 937 or I-937). Avista's target as filed in its 2012-13 BCP was 108,589 MWh for the energy efficiency portion. In 2013, Avista acquired 46,457 MWh[1] in Washington, or 43 percent of its BCP two-year target, not including distribution efficiency.

The above mentioned acquisition has been delivered through local energy efficiency programs managed by the utility or third-party contractors. Avista also funds regional market transformation effort through the Northwest Energy Efficiency Alliance (NEEA), however, reported electric energy savings, cost-effectiveness and other related information is specific to local programs unless otherwise noted. The savings indicated above are gross savings based on all program participants.

Avista judges the effectiveness of the energy efficiency portfolio based upon a number of metrics. Two of the most commonly applied metrics are the TRC test, a benefit-to-cost test encompassing the entire utility ratepayer population, and the PAC test, a benefit-to-cost test from the perspective of achieving a minimization of the utility cost of delivering energy efficiency services. Benefit-to-cost ratios in excess of 1.00 indicate that the benefits exceed the costs. In 2013, the TRC benefit-to-cost ratios were 1.09 for electric and 0.29 for natural gas. The PAC test benefit-to-cost ratios were 1.72 for electric and 0.82 for natural gas. The low ratios for natural gas programs are due to the previously mentioned decline in natural gas avoided costs and proposed natural gas program suspension.

[1] Net of conversions in order to maintain consistency between the established target and the Northwest Power and Conservation Council's (Council) Sixth Plan. Actual electric savings acquisition for Washington was 50,124 MWh with fuel conversions included.

The measurement of portfolio energy savings has been independently verified through external third-party evaluators prior to being claimed as portfolio acquisition or being incorporated into the cost-effectiveness calculations. The Cadmus Group was retained as the Company's external evaluator to independently measure and verify 2012 and 2013 electric and natural gas portfolio results.

Though the nature of this report is to look backwards on past performance of the previous year, successes and lessons from this process are applied during the forward-looking business planning process to inform and improve program design, including program modification and termination where necessary. Avista remains committed to continuing to deliver responsible and cost-effective energy efficiency programs to our customers.

III. COST-EFFECTIVENESS

The 2013 Demand-Side Management (DSM) Annual Report summarizes the Company's annual energy efficiency achievements of its DSM programs.

Cost-effectiveness was reviewed using four of the five California Standard Practice Tests including the Total Resource Cost (TRC), Program Administrator Cost (PAC), Participant, and Rate Impact Measure (RIM) tests. For this annual report, cost-effectiveness of DSM programs is based on evaluated gross savings using the most recent applicable impact evaluation and methods consistent with those laid out in the *California Standard Practice Manual for Economic Analysis of Demand-Side Programs and Projects* as modified by the Council. Shown below in Tables 1 through 12 are results for these four California Standard Practice Tests - Total Resource Cost, Program Administrator Cost, Participant, and Rate Impact Measure for electric and natural gas.

For estimating cost-effectiveness, the only non-energy benefits that are included are those that can be documented and reliably quantified and, therefore, these estimates are conservative. There are a number of legitimate non-energy benefits that the Company was unable to quantify with sufficient rigor in order to include within the cost-effectiveness analysis.

Electric cost-effectiveness results within this report are based on savings derived from verification and impact evaluations conducted on the 2012-2013 programs while natural gas cost-effectiveness results are based on verification and impact evaluations conducted on 2013 programs. These savings estimates represent gross energy acquisition except as noted in the Impact Evaluation Measurement Designations section of this report.

Avoided costs used for the cost-effectiveness valuation of the 2013 programs are the avoided costs from the most recently filed electric and natural gas IRPs. In 2013, Avista's biennial IRP efforts, described a significant decrease in natural gas avoided costs. This also impacts electric avoided costs since thirty-five percent of Avista's generation is natural gas fueled. The decline in natural gas avoided costs and the corresponding impact on natural gas energy efficiency programs were communicated with the regulatory commissions of the three states in which Avista operates. The Washington Utilities and Transportation Commission approved continuation of Avista's natural gas energy efficiency programs under the PAC benefit-cost test.

In summary, electric and natural gas TRC is 1.09 and 0.29, respectively. Electric and natural gas PAC test benefit-cost ratios are 1.72 and 0.82, respectively. Tables 1 through 12 illustrate electric, natural gas, and combined fuel cost-effectiveness, respectively.

Electric Cost-Effectiveness

Table 1: Electric Total Resource Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$20,828,774	$421,462	$21,250,236
Natural Gas avoided cost	(167,098)	(101,890)	(268,988)
Non-Energy Benefits	468,166	376,096	844,262
TRC benefits	$21,129,842	$695,668	$21,825,510
Non-incentive utility cost	$5,079,648	$128,027	$5,207,674
Customer cost	13,737,470	1,043,260	14,780,730
TRC costs	$18,817,118	$1,171,286	$19,988,404
TRC ratio	**1.12**	**0.59**	**1.09**
Residual TRC benefits	**$2,312,724**	**($475,618)**	**$1,837,106**

Table 2: Electric Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$20,828,774	$421,462	$21,250,236
Natural Gas avoided cost	(167,098)	(101,890)	(268,988)
PAC benefits	$20,661,676	$319,572	$20,981,248
Non-incentive utility cost	$5,079,648	$128,027	$5,207,674
Incentive cost	5,941,019	1,046,333	6,987,352
PAC costs	$11,020,667	$1,174,359	$12,195,026
PAC ratio	**1.87**	**0.27**	**1.72**
Net PAC benefits	**$9,641,009**	**($854,788)**	**$8,786,221**

Table 3: Electric Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric Bill Reduction	$27,715,051	$790,050	$28,505,101
Gas Bill Reduction	(310,475)	(137,376)	(447,850)
Non-Energy benefits	468,166	376,096	844,262
Participant benefits	$27,872,741	$1,028,771	$28,901,512
Customer cost	$13,737,470	$1,043,260	$14,780,730
Incentive received	(5,941,019)	(1,046,333)	(6,987,352)
Participant costs	$7,796,450	($3,073)	$7,793,378
Participant ratio	**3.58**	**(334.82)**	**3.71**
Net Participant benefits	**$20,076,291**	**$1,031,844**	**$21,108,134**

Table 4: Electric Rate Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost savings	$20,828,774	$421,462	$21,250,236
Non-Participant benefits	$20,828,774	$421,462	$21,250,236
Electric Revenue loss	$27,404,576	$652,675	$28,057,250
Non-incentive utility cost	5,079,648	128,027	5,207,674
Customer incentives	5,941,019	1,046,333	6,987,352
Non-Participant costs	$38,425,243	$1,827,034	$40,252,277
RIM ratio	**0.54**	**0.23**	**0.53**
Net RIM benefits	**($17,596,469)**	**($1,405,572)**	**($19,002,041)**

Natural Gas Cost-Effectiveness Tests

Table 5: Natural Gas Total Resource Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost	$2,891,734	$144,029	$3,035,762
Electric avoided cost	20,655	45,782	66,438
Non-Energy Benefits	282	325,476	325,758
TRC benefits	$2,912,671	$515,287	$3,427,958
Non-incentive utility cost	$940,542	$29,236	$969,778
Customer cost	9,994,548	946,056	10,940,604
TRC costs	$10,935,090	$975,292	$11,910,382
TRC ratio	**0.27**	**0.53**	**0.29**
Residual TRC benefits	**($8,022,419)**	**($460,005)**	**($8,482,424)**

Table 6: Natural Gas Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost	$2,891,734	$144,029	$3,035,762
Electric avoided cost	20,655	45,782	66,438
PAC benefits	$2,912,389	$189,811	$3,102,200
Non-incentive utility cost	$940,542	$29,236	$969,778
Incentive cost	1,875,702	946,056	2,821,758
PAC costs	$2,816,244	$975,292	$3,791,536
PAC ratio	**1.03**	**0.19**	**0.82**
Net PAC benefits	**$96,145**	**($785,481)**	**($689,336)**

Table 7: Natural Gas Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas bill reduction	$5,170,640	$267,218	$5,437,858
Electric bill reduction	36,845	79,995	116,840
Non-energy benefits	282	325,476	325,758
Participant benefits	$5,207,767	$672,689	$5,880,456
Customer cost	$9,994,548	$946,056	$10,940,604
Incentive received	(1,875,702)	(946,056)	(2,821,758)
Participant costs	$8,118,846	$0	$8,118,846
Participant ratio	**0.64**	**NA**	**0.72**
Net Participant benefits	**($2,911,079)**	**$672,689**	**($2,238,390)**

Table 8: Natural Gas Rate Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost	$2,891,734	$144,029	$3,035,762
Non-Participant benefits	$2,891,734	$144,029	$3,035,762
Natural gas revenue loss	$5,207,485	$347,213	$5,554,698
Non-incentive utility cost	940,542	29,236	969,778
Customer incentives	1,875,702	946,056	2,821,758
Non-Participant costs	$8,023,729	$1,322,505	$9,346,234
RIM ratio	**0.36**	**0.11**	**0.32**
Net RIM benefits	**($5,131,995)**	**($1,178,476)**	**($6,310,472)**

Combined Fuel Cost-Effectiveness Tests

Table 9: Electric and Natural Gas Total Resource Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$20,849,429	$467,244	$21,316,674
Natural Gas avoided cost	2,724,636	42,139	2,766,774
Non-Energy Benefits	468,447	701,573	1,170,020
TRC benefits	$24,042,512	$1,210,955	$25,253,468
Non-incentive utility cost	$6,020,190	$157,263	$6,177,452
Customer cost	23,732,018	1,989,316	25,721,334
TRC costs	$29,752,208	$2,146,578	$31,898,786
TRC ratio	**0.81**	**0.56**	**0.79**
Residual TRC benefits	**($5,709,695)**	**($935,623)**	**($6,645,319)**

Table 10: Electric and Natural Gas Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$20,849,429	$467,244	$21,316,674
Natural Gas avoided cost	2,724,636	42,139	2,766,774
PAC benefits	$23,574,065	$509,383	$24,083,448
Non-incentive utility cost	$6,020,190	$157,263	$6,177,452
Incentive cost	7,816,721	1,992,389	9,809,110
PAC costs	$13,836,911	$2,149,651	$15,986,562
PAC ratio	**1.70**	**0.24**	**1.51**
Net PAC benefits	**$9,737,154**	**($1,640,269)**	**$8,096,886**

Table 11: Electric and Natural Gas Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric Bill Reduction	$27,751,896	$870,045	$28,621,941
Gas Bill Reduction	4,860,165	129,842	4,990,008
Non-Energy benefits	468,447	701,573	1,170,020
Participant benefits	$33,080,508	$1,701,460	$34,781,968
Customer cost	$23,732,018	$1,989,316	$25,721,334
Incentive received	(7,816,721)	(1,992,389)	(9,809,110)
Participant costs	$15,915,297	($3,073)	$15,912,224
Participant ratio	**2.08**	**(553.75)**	**2.19**
Net Participant benefits	**$17,165,212**	**$1,704,533**	**$18,869,744**

Table 12: Electric and Natural Gas Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Avoided Cost Savings	$23,720,508	$565,490	$24,285,998
Non-Participant benefits	$23,720,508	$565,490	$24,285,998
Revenue Loss	$32,612,061	$999,888	$33,611,949
Non-incentive utility cost	6,020,190	157,263	6,177,452
Customer incentives	7,816,721	1,992,389	9,809,110
Non-Participant costs	$46,448,972	$3,149,539	$49,598,511
RIM ratio	**0.51**	**0.18**	**0.49**
Net RIM benefits	**($22,728,464)**	**($2,584,048)**	**($25,312,512)**

IV. IMPACT EVALUATION MEASUREMENT DESIGNATIONS

For the 2012-2013 Biennium, the impact evaluation measurement methods relating to the Washington electric portfolio of energy efficiency measures were guided by a series of directives, discussions, and clarifications provided by the Washington Utilities and Transportation Commission (Commission) and Avista's Energy Efficiency Advisory Group. The Commission, in its Order UE-111882, stated that Avista "*…must use the Council's Regional Technical Forum's (RTF's) 'deemed' savings for electricity measures*" or otherwise establish estimates based on accepted impact evaluation or relevant source data with verified savings levels.

In consideration of this directive, Cadmus evaluated Avista's portfolio relative to the RTF evaluation library to identify measures that would allow for the application of an RTF unit energy savings (UES) value or methodology. This process included significant interaction with the Advisory Group regarding the alignment of the measures to the RTF library, available UES values, and the defined measure delivery methods. This involved and comprehensive task defined the allowable acquisition values as related to the various goal requirements when assessing gross and net savings.

As a result of this effort, Table 13 summarizes the evaluation and reporting methodology for the portfolio. The Designation column represents the identified evaluation methodology summarized by:

RTF: Acquisition savings based on a UES value provided by the RTF library, including consideration of the adjusted market baseline inherent in the analysis, or the acquisition as derived by the savings calculation methodology including appropriate factors and criteria.

Gross: Acquisition savings without the application of a NTG factor, using a traditional approach of code minimum or current standard practice as the evaluation baseline.

Net: Acquisition savings resulting from the application of an evaluated survey-based net-to-gross factor or as a fundamental net savings based on the applied analysis method.

Table 13: Impact Evaluation Methodology

Program	Designation	Reporting Method
Residential		
Appliance Recycling	Net	Net result inherent in analysis method
CFL Contingency	RTF	RTF methodology and inputs
ENERGY STAR Products	RTF	RTF UES with spillover
ENERGY STAR Homes	RTF	RTF UES with spillover
Geographic CFL Giveaway	RTF	RTF methodology and inputs
Heating and Cooling Efficiency	Gross	Billing analysis
Manufactured Home Duct Sealing	Gross	Direct install measures, NTG assumed as 1.00
Residential Behavior	Net	Billing analysis results net due to control group
Simple Steps, Smart Savings	RTF	RTF methodology and inputs
Space and Water Conversions	Gross	Billing analysis
Weatherization and Shell	Gross	Billing analysis
Water Heating Efficiency	RTF	RTF UES with spillover
Low Income	Gross	NTG assumed as 1.00
Nonresidential	Gross	Consistent with CPA, NTG assumed as 1.00
Notes: Regional Technical Forum (RTF) Unit Energy Savings (UES) Conservation Potential Assessment (CPA) Net-to-gross (NTG)		

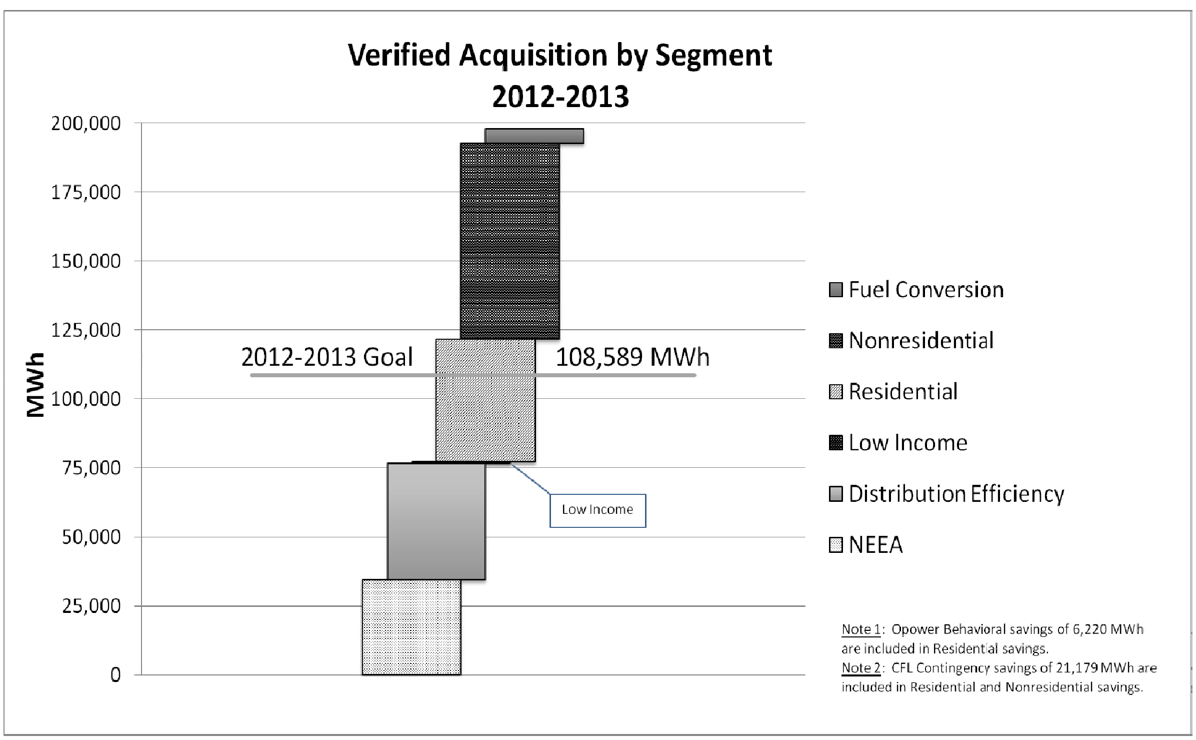
The application of freeridership and spillover are also important considerations. Gross savings do not have freeridership or spillover factors applied. Net savings include both freeridership and spillover considerations. The RTF adjusted market baseline definition of savings accounts for freeridership but not spillover, allowing for identified spillover savings to be applied to the appropriate results when based on the RTF UES.

V. WASHINGTON I-937 ACQUISITION OF CONSERVATION

In February 2012, the Commission approved the Company's ten year Achievable Potential and Biennial Conservation Target Report ("Conservation Report"). The Company's energy efficiency acquisition for the 2012-2013 Biennium is based upon a Conservation Potential Assessment (CPA) completed by a third-party consultant applying methodologies consistent with the Northwest Power and Conservation Council's (NWPCC) Sixth Power Plan. The Company intent was to acquire 108,589 MWh of energy efficiency as described in its approved Conservation Report during the 2012-2013 Biennium, the second I-937 compliance period. During this biennium, Avista acquired 197,391 MWh (162,964 MWh from local programs and 34,427 MWh from NEEA's regional ventures). Removing savings from dual efficiency (i.e. fuel switching), 4,642 MWh, and distribution efficiency, 42,292 MWh, Avista is claiming 116,030 MWh locally for I-937 energy efficiency purposes. Avista surpassed its I-937 end-use energy efficiency target by 7 percent, exceeding by 82 percent the total BCP target.

Avista's Biennial Conservation Target was approved with conditions as listed in an attachment. The conditions required Avista to use methodologies consistent with those used by the Northwest Power and Conservation Council and a need for a high degree of transparency, and communication and consultation with external stakeholders. Refer to Appendix 1 for a list of the conditions that were met by Avista for the 2012-2013 Biennium.

The following chart illustrates where the various I-937 savings components are derived as well as comparison to Avista's Biennial Conservation target of 108,589 MWh.



VI. EVALUATION, MEASUREMENT AND VERIFICATION (EM&V)

Cadmus was retained to provide impact and process evaluations for the 2012-2013 electric and 2013 natural gas programs. The Company has committed to a three-year cycle to evaluate all programs. By the time the Request for Proposal for Evaluation on Washington DSM programs was issued, it was decided that Avista would take a portfolio approach for the first biennium in order to provide a comprehensive benchmark to compare against in future years. As Avista continued through the second biennium, the Company continued this portfolio-wide approach for evaluation while leveraging the findings of past evaluations to inform future evaluation efforts that may require a “deeper dive.”

Evaluations for 2012-2013 are included as part of this DSM Annual Report. The following evaluation reports are included within the Appendices as noted:

- **Avista 2012-2013 Process Evaluation Report** prepared by Cadmus is included as Appendix 2. This report summarizes findings and recommendations resulting from the process evaluation on Avista’s 2012 and 2013 DSM programs.
- **Avista 2012-2013 Washington Electric Impact Evaluation Report** prepared by Cadmus is included as Appendix 3. This report summarizes the findings and recommendations resulting from the impact evaluation of Avista’s 2012-2013 electric programs.
- **Avista 2013 Washington Gas Portfolio Impact Evaluation** prepared by Cadmus is included as Appendix 4. This report summarizes the findings and recommendations resulting from the impact evaluation of Avista’s 2013 natural gas programs.
- **Avista Utilities’ Conservation Voltage Reduction Program Impact Evaluation** prepared by Navigant is included as Appendix 5. This report summarizes the findings related to the impact evaluation of Avista’s conservation voltage reduction program as deployed in 2013.

VII. PROGRAMS

Residential

Home Improvement/New Construction/Appliances

The Company's Residential portfolio includes two primary methods of program delivery to encourage customers to make energy efficiency choices for their home. The traditional rebate application approach is the main method of program implementation and the largest component of the residential portfolio. This process uses financial incentives to encourage customers to adopt a qualifying electric or natural gas energy efficiency measure. Program eligibility typically covers single family homes up to a 4-plex. Customers must complete the installation, apply for a rebate, include proper proof of purchase and/or other documentation to the Company typically within 90 days from project completion. Customers can submit the application in hard copy or on-line at http://www.avistautilities.com/savings/rebates/Pages/WashingtonCustomerRebates.aspx

Rebate programs offered to existing residential homes in 2013 included:

- High-efficiency equipment
  - Natural gas furnace
  - Natural gas boiler
  - Electric or natural gas water heater
  - Air source heat pump
  - Variable speed motor
- Electric space heat to natural gas conversion
- Electric water heat to natural gas conversion
- Electric resistance heat to air source heat pump conversion
- Insulation improvements for electric or natural gas heated homes:
  - Attic
  - Floor
  - Walls

For new construction homes, rebates were available for the same high efficiency equipment mentioned above as well as for homes built to the ENERGY STAR specification.

Notable changes to the residential portfolio in 2013 include:

- Continuation of natural gas rebates
- Discontinued rebates for ENERGY STAR appliances
- Discontinued rebates for ductless heat pump
- Reduction in rebate amounts offered for the following measures:
  - Air source heat pumps
  - ENERGY STAR Homes for both electric or natural gas space heat
  - High efficiency electric and natural gas water heaters;
- Increase rebate amount for electric to natural gas space heat conversion
- Increase rebate amount for electric to natural gas water heat conversion
- Change program eligibility for existing levels of attic insulation in either electric or natural gas heated homes:

- Reduced to R-12 from an R-19

Energy efficiency outreach continued in 2013 through a variety of channels. Annual bill inserts promoting rebate programs along with website messaging and a dedicated energy efficiency rebate page offers a consistent presence of the rebate programs available. The Company continued energy efficiency outreach at select community events, energy fairs and vendor meetings and teamed up with local media outlets to promote energy efficiency opportunities featured in the examples below.

In the early spring, the Company partnered with the local weekly paper The Inlander to encourage people to sign up for the Home Energy Advisor tool. This on-line audit tool provides customers with a way to evaluate their home to identify potential energy saving opportunities. People who sign up for the Home Energy Advisor tool are entered for a chance to win a gift card for a local home improvement store, an Avista Housewarming Gift Certificate and a personal photo shoot that will be featured in an Inlander advertisement announcing the winners. This engaged customers, built awareness around this on-line tool and offered suggestions to improve the energy efficiency in their home.

In the second quarter of the year, the Company teamed up with local CBS affiliate, KREM 2 as well as Toyota in support of energy efficiency. Throughout the campaign homeowners were informed what they can do to help manage their energy use. By watching KREM 2 news at 5pm or 6pm viewers could enter a chance to win a new Prius from Toyota.

Impact and process evaluations will continue on 2013 residential programs, providing an on-going opportunity to improve program design and delivery as well as optimizing the savings achieved for the dollars spent. As recommendations from these evaluations become available, the DSM team continues to evaluate, respond and implement changes, providing continuous improvement of program offerings.

Under the traditional rebate program, Washington residential customers completed over 1,600 electric and over 2,600 natural gas projects. Over **$**1.1 million in rebates were provided directly to Washington residential customers to offset the cost of implementing these energy efficiency measures. All programs within the residential portfolio contributed over 1,775 MWh and over 253,000 therms in annual first-year energy savings. Tables 14 and 15 summarize the results from the electric and natural gas home improvement and appliance program.

The following tables summarize residential electric and natural gas results through traditional DSM offerings operated in-house by Avista DSM staff. These include number of projects and savings acquisition, as well as interactive effects associated with electric and natural gas measures.

Table 14: Electric Residential Home Improvement and Appliances[2]

Measure	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
E Electric Water Heater	107	$4,130	12,764	0	$6,313	$0	$0	$5,350	$7,821
E Attic Insulation With Electric Heat	41	$9,649	36,848	0	$24,455	$0	$0	$33,520	$30,299
E Floor Insulation With Electric Heat	6	$2,650	13,190	0	$8,754	$0	$0	$9,583	$10,846
E Wall Insulation With Electric Heat	18	$6,436	43,740	0	$29,029	$0	$0	$45,522	$35,966
E ENERGY STAR Home - Stick Built	8	$5,950	20,080	0	$17,314	$0	$0	$30,330	$21,451
E Electric To Natural Gas Water Heater	56	$11,200	244,552	(9,288)	$177,259	($49,215)	$0	$19,530	$219,615
E Electric To Natural Gas Furnace	78	$57,654	745,914	(22,780)	$540,662	($120,707)	$0	$122,733	$669,850
X E Freezer	0	$200	0	0	$0	$0	$0	$0	$0
X E Refrigerator	277	$6,925	12,132	0	$8,794	$0	$0	$8,310	$10,895
X E Dishwasher With Elect Water Heater	0	$25	0	0	$0	$0	$0	$0	$0
X E Clothes Washer With Elect Water Heat	153	$3,825	6,376	216	$2,426	$692	$1,913	$11,475	$3,005
E Air Source Heat Pump	130	$24,700	43,748	0	$24,705	$0	$0	$39,432	$30,608
E Electric To Air Source Heat Pump	65	$48,750	287,235	0	$162,204	$0	$0	$106,972	$200,692
E Variable Speed Motor	697	$69,515	305,670	0	$172,615	$0	$0	$191,675	$213,860
E Estar Home - Manuf, Furnace	2	$1,550	2,108	400	$1,818	$2,372	$0	$2,753	$2,252
X E Ductless Heat Pump	8	$1,600	1,477	0	$834	$0	$0	$1,600	$1,003
Total Washington Electric	1,646	$254,759	1,775,834	(31,452)	$1,177,182	($166,858)	$1,913	$628,785	$1,458,462

Table 15: Natural Gas Residential Home Improvement and Appliances[3]

Measure	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
G Natural Gas Furnace	2,018	$806,048	0	207,853	$0	$1,101,372	$0	$8,026,292	$292,202
G Natural Gas Boiler	20	$8,000	0	1,861	$0	$9,862	$0	$16,000	$2,616
G 40 Gallon Natural Gas Water Heater	26	$920	0	229	$0	$901	$0	$1,300	$239
G 50 Gallon Natural Gas Water Heater	148	$5,320	0	1,337	$0	$5,267	$0	$7,400	$1,397
G Attic Insulation With Natural Gas Heat	190	$48,928	0	12,538	$0	$62,502	$0	$129,364	$16,582
G Floor Insulation With Natural Gas Heat	43	$11,720	0	8,860	$0	$52,532	$0	$49,243	$13,937
G Wall Insulation With Natural Gas Heat	80	$24,948	0	18,844	$0	$93,938	$0	$130,283	$24,922
X G Clothes Washer W/ Nat Gas Water Heat	139	$3,475	47,124	590	$17,929	$1,889	$177	$35,862	$501
G ENERGY STAR Home - Natural Gas Only	3	$1,950	3,162	1,017	$2,726	$6,030	$0	$4,500	$1,600
Total Washington Natural Gas	2,667	$911,310	50,286	253,129	$20,655	$1,334,294	$177	$8,400,244	$353,998

[2] All kWh and therm values reported in this table are gross, excluding the effect of applicable NTG ratios.
[3] *ibid.*

Simple Steps Smart Savings

Avista continues to participate in the regional manufacturer buy-down of CFL twists, specialty bulbs, LED bulbs, and showerheads through Northwest Energy Efficiency Alliance (NEEA) and its contactor. Over 417,000 bulbs and over 798 showerheads were purchased from participating retailers. The bulbs resulted in 9,001 MWh and the showerheads resulted in 62 MWh in annual first-year savings during 2013 (see Tables 16 and 17). The Company contributed over $385,000 in incentives toward this buy-down effort and $165,000 in non-incentive utility costs to offer this program.

Refrigerator/Freezer Recycling

Avista has partnered with JACO, one of the nation's leading appliance recyclers, to provide third-party administration of the refrigerator/freezer appliance recycling program. During 2013, nearly 1,100 appliances were recycled through this program. Customers received $30 per appliance for participating which equated to over $32,000 in incentives. This appliance recycling program resulted in over 1,115 MWh in annual first-year savings in 2013 (see Table 16). The Company contributed over $141,000 to cover the administrative costs for this program.

Customer Outreach (formerly Geographic Saturation)

Residential programs have benefited from continued customer outreach that promotes the availability of Avista's energy efficiency programs and encourages customers to take action through participation in currently offered programs. Outreach efforts have included targeted media, online, print and previously widespread participation at local community events. In 2013, Avista's DSM-led outreach participated in community workshops, energy fairs and vendor meetings. Avista continues to maintain DSM tools for other departments to leverage for use at public gatherings where a non-DSM employee leads the effort and wants to include energy efficiency messaging and materials. This approach, also known as "Outreach-in-a-Box" has been successful in increasing the availability of DSM messaging and support.

Mobile outreach also known as the Avista Energy Resource Van (ERV) travels to events and food banks where information is provided about Avista online tools, payment options, assistance resources and obtain low-cost/no-cost energy management information and light weatherization and energy savings items. During 2013, nearly 5,400 bulbs were distributed at events throughout Avista's Washington service territory which resulted in 81 MWh of annual first-year savings (see Table 16). The incentive cost of providing these bulbs to customers was over $12,000 and is offered at minimal utility cost.

Manufactured Home Duct Repair

The Manufactured Home Duct Repair program began in Fall 2012 and will be ended in June 2013. The primary measures included in this program are testing, repair and sealing of the ductwork on Avista heated homes in the following Washington counties served by Avista: Adams, Asotin, Ferry, Franklin, Garfield, Lincoln, Spokane, Stevens and Whitman. While this program began as an electric-only program, this program became eligible to Avista natural gas homes in early 2013. Measures offered may be as simple as sealing small holes and gaps in the ductwork to repair or replacing the cross-over ducts in double-wide manufactured home. This program, implemented through a third-party contractor

UCONS, is offered at no-cost to the customer. In cases where the ductwork in the manufactured home meets current leakage standards before any work is completed, measures such as showerheads and CFLs will be directly installed so that the customer and Avista realize immediate energy savings. Customers with disconnected or failed ducts may realize significant improvements in comfort and energy savings.

In 2013, UCONS treated 574 homes. This program acquired 1,913 MWh and nearly 30,000 therms in first-year energy savings (see Tables 16 and 17). The non-incentive utility cost for this effort, jointly funded by Washington State University's Extension Energy Program, was over $595,000.

Opower Home Energy Reports

Avista launched a Home Energy Reports program in June 2013, targeting 48,300 Washington and 25,200 Idaho high use electric customers. In an effort to reduce energy usage through behavioral changes, Home Energy Reports show personalized usage insights and energy saving tips. Customers also see a ranking of similar homes, comparison to themselves and a personal savings goal on the Reports. In addition to closely matching usage curves, the similar home comparisons are also based on the following four criteria, square footage, home type, heat type and proximity.

Opt-Outs: Customers have the choice of not receiving the reports and can opt-out at anytime. As of the end of 2013, 0.81% opted-out in Washington.

Attrition: At the end of 2013, 4,158 customers receiving Opower reports in Washington closed their Avista account and therefore are no longer counted in the Program.

Savings Results: The method for measuring energy savings in this program is to use a Randomized Control Trial method. Avista's control groups therefore include 13,000 customers in each state. Using this method for calculating savings, Avista's 3rd party evaluator has determined the energy savings results in Washington to be 6,220 MWh (see Table 16).

Table 16: Other Electric[4]

Measure	Unit Count	Incentives	kWh	Therms	Non-incentive Utility Costs
Customer Outreach CFLs (Low Income)	4,128	$9,265	61,920	0	$9,265
Customer Outreach CFLs (Residential)	1,262	$2,832	18,930	0	$2,832
Refrigerator/Freezer Recycling (Res)	1,067	$32,010	1,115,385	0	$141,597
Simple Steps CFL (Res)	395,010	$349,877	8,457,425	0	$150,195
Simple Steps LED (Res)	22,062	$32,251	543,492	0	$13,845
Simple Steps Showerheads (Res)	798	$3,074	62,316	0	$1,319
Manufactured Home Duct Sealing((Res)	1,122	$81,772	1,433,991	0	$323,137
Manufactured Home CFL (Res)	6,596	$2,508	151,708	0	$9,912
Manufactured Home Showerhead (Res)	1,057	$9,808	327,670	0	$38,757
Opower Home Energy Reports (Res)	48,300	$0	6,283,477	0	$557,700
Total Electric Washington (Low Income)	4,128	$9,265	61,920	0	$9,265
Total Electric Washington (Residential)	477,274	$514,132	18,394,394	0	$1,239,294

Table 17: Other Natural Gas[5]

Measure	Unit Count	Incentives	kWh	Therms	Non-incentive Utility Costs
Simple Steps Showerheads (Res)	798	$994	0	2,394	$427
Manufactured Home Duct Sealing((Res)	584	$85,311	0	24,935	$199,059
Manufactured Home Showerhead (Res)	458	$10,603	0	5,038	$24,741
Total Gas Washington (Residential)	1,840	$96,908	0	32,367	$224,226

[4] All kWh and therm values reported in this table are gross, excluding the effect of applicable NTG ratios.
[5] *ibid.*

Low Income and Outreach

The Company leverages the infrastructure of six Community Action Program (CAP) agencies to deliver energy efficiency programs for the Company's low income residential customers in the Washington service territory. CAP agencies have resources to income qualify, prioritize and treat clients homes based upon a number of characteristics. In addition to the Company's annual funding, the agencies have other monetary resources that they can leverage when treating a home with weatherization or other energy efficiency measures. The agencies either have in-house or contractor crews to install many of the efficiency measures of the program.

Eligible efficiency improvements are similar to those offered under the traditional residential rebate programs, as well as mirroring a variety of the same measures found on the state program priority list. A Company approved measure list is provided to the agencies in an attempt to manage the cost-effectiveness of the low income program. The agencies are given discretion to spend their allotted funds on either electric or natural gas efficiency improvement based on the need of the clients The program includes improvements to insulation, infiltration, ENERGY STAR® doors and refrigerators along with fuel conversion from electric resistance space and water heat to natural gas. Avista's funding covers the full cost of the improvement from the Approved Measures list.

Example of 2013 Low Income Program Approved Measure List

Electric measures	Natural gas measures
• Air infiltration • Duct sealing • Insulation for attic, walls and floors • ENERGY STAR doors • ENERGY STAR refrigerators (for replacement of a refrigerator that is not fully operational) • Variable speed motor • Electric to natural gas furnace conversion • Electric to natural gas combination (furnace and water heater)	• Air infiltration • Duct sealing • Insulation for attic, walls and floors • ENERGY STAR doors

If agencies identify other efficiency measures that are not on the approved measure list, those projects can be submitted to Avista for funding consideration on a case by case basis. The review process considers the program's overall cost-effectiveness in a near real-time basis as to whether or not those measures may be installed in the home.

Example of 2013 Need Approval Measure List

Electric measures	Natural gas measures
• Duct insulation • High efficiency water heaters (0.93 Energy Factor) • ENERGY STAR Refrigerators (*for replacement of refrigerator that is currently operating*) • ENERGY STAR Windows • Electric to air source heat pump (when gas is not available) • Electric to natural gas water heater • Other	• Duct insulation • High efficiency furnaces (> 90% AFUE) • Wall heaters • High efficiency water heaters (0.62 EF) • ENERGY STAR Windows • Other

The six Washington agencies collectively receive a total funding amount of $1.3 million dollars each year. Individually, the annual contract for each agency allows them to charge a 15 percent administration fee towards the cost of each measure. In addition, up to 15 percent of their annual funding allocation may be used towards Health and Safety improvements. It is at the agencies discretion whether or not to utilize their funds for health and safety and other home repairs to ensure the habitability of the home where the energy efficiency improvements were installed.

For the 2013 program year, Washington income-qualified homes nearly 1,000 individual measures were installed in 277 individual homes, acquiring more than 684,000 kWh and 31,000 therms while expending the $2 million in Washington contracts. Refer to Tables 18 and 19 for details on low income programs.

Table 18: Electric Low Income[6]

Measure	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
E Air Infiltration	45	$69,580	16,383	0	$10,570	$0	$0	$69,580	$3,114
E Duct Sealing	11	$11,427	18,670	0	$12,045	$0	$0	$11,427	$3,549
E ENERGY STAR Doors	20	$21,189	7,232	0	$8,046	$0	$14,440	$21,189	$2,371
E ENERGY STAR Refrigerator	37	$23,672	22,389	0	$14,444	$0	$0	$23,672	$4,256
E ENERGY STAR Windows	7	$31,671	530	0	$590	$0	$32,903	$31,671	$174
E He Air Hpump	5	$3,403	2,401	0	$1,364	$0	$7,500	$3,403	$402
E He Wh	7	$3,680	826	0	$364	$0	$3,500	$3,680	$107
E Ins - Ceil/Attic	25	$52,055	14,608	0	$16,253	$0	$0	$52,055	$4,788
E Ins – Floor	37	$111,588	66,529	0	$74,020	$0	$0	$111,588	$21,809
E Ins – Wall	6	$16,810	8,560	0	$9,524	$0	$0	$16,810	$2,806
E To G Furnace Conversion	82	$283,722	312,720	(8,483)	$177,518	($69,857)	$123,000	$283,722	$52,302
E To G H2O Conversion	87	$225,098	177,954	(5,854)	$57,942	($32,033)	$43,500	$225,098	$17,071
E To G Hpump Conversion	8	$45,641	35,865	0	$20,370	$0	$12,000	$45,641	$6,002
Variable Speed Motor	1	$265	83	0	$39	$0	$0	$265	$11
Health & Human Safety	0	$137,266	0	0	$0	$0	$139,253	$137,266	$0
Total Washington Electric	378	$1,037,068	684,750	(14,337)	$403,089	($101,890)	$376,096	$1,037,068	$118,762

Table 19: Natural Gas Low Income[7]

Measure	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
G Air Infiltration	132	$136,120	67,158	5,305	$39,576	$27,612	$0	$136,120	$5,605
G Duct Sealing	12	$5,934	181	505	$107	$2,628	$0	$5,934	$533
G ENERGY STAR Doors	60	$69,464	0	716	$0	$5,013	$43,320	$69,464	$1,018
G ENERGY STAR Windows	7	$20,724	462	44	$470	$307	$11,878	$20,724	$62
G He Boiler	2	$8,770	0	189	$0	$986	$1,000	$8,770	$200
G He Furnace	83	$104,722	0	7,826	$0	$40,732	$107,522	$104,722	$8,268
G He Wh 40G	21	$10,803	0	121	$0	$469	$10,500	$10,803	$95
G He Wh 50G	14	$8,893	0	90	$0	$347	$7,000	$8,893	$70
G Ins - Ceil/Attic	111	$182,424	1,494	1,914	$1,519	$13,405	$0	$182,424	$2,721
G Ins - Floor	83	$152,824	1,845	4,211	$1,875	$29,492	$0	$152,824	$5,986
G Ins – Wall	58	$103,182	2,200	3,289	$2,236	$23,039	$0	$103,182	$4,677
Health & Human Safety	0	$142,197	0	0	$0	$0	$144,255	$142,197	$0
Total Washington Natural Gas	583	$946,056	73,341	24,210	$45,782	$144,029	$325,476	$946,056	$29,236

In partnership with the Company's Demand-Side Management efforts, Avista's Consumer Affairs department conducts conservation education and outreach for our low income, senior and vulnerable customers. The company reaches the target population through workshops, energy fairs and mobile outreach. Each of these methods include demonstrations and distribution of low-cost and no-cost materials with a focus on energy efficiency, conservation tips and measures, and information regarding

[6] All kWh and therm values reported in this table are both gross and net, as the NTG ratio is assumed to be 100%.
[7] *ibid.*

energy assistance that may be available through agencies. Low income and senior outreach goals increase awareness of energy assistance programs such as LIRAP in Washington and LIHEAP and Project Share in all jurisdictions.

The company has recognized the following educational strategies as efficient and effective activities for delivering the energy efficiency and conservation education and outreach:

- Energy Conservation workshops for groups of Avista customers where the primary target audiences are seniors and low income participants.
- Energy Fairs where attendees can receive information about low-cost/no-cost methods to weatherize their home; this information is provided in demonstrations and limited samples. In addition, fair attendees can learn about billing assistance and demonstrations of the online account and energy management tools. Community partners that provide services to low income populations and support to increase personal self sufficiency are invited, at no cost, to host a booth to provide information about their services and how to access them.
- Mobile Outreach is conducted through the Avista Energy Resource Van (ERV) where visitors can learn about effective tips to manage their energy use, bill payment options and community assistance resources.
- Outreach of bill payment options and assistance resources in senior and low income publications. Outreach can also be accomplished by providing energy management information and resources at events that reach our target populations.

In Washington, Avista facilitated 10 workshops with 375 participants, two energy fairs that had 535 attendees, and 39 mobile outreach events touching 3,669 visitors for a total of 4,608 senior and low-income customers reached in 2013.

Nonresidential

Within the nonresidential segment, programs are offered to retail electric and natural gas customers through a combination of prescriptive rebates and site specific assessments. Prescriptive rebates are geared toward relatively uniform measures, applications and energy savings. This delivery method reduces implementation expense while simplifying the ease of participation for both customers and trade allies. The site specific offerings are available for all other efficiency measures and applications. In these situations, each energy efficiency project is individually analyzed based on the measure being installed and considers other variables that may be present in the building or in the process operation.

Site specific is the most comprehensive offering of the nonresidential segment and brings in more than a third of the nonresidential savings. Avista's Account Executives work with nonresidential customers to provide assistance in identifying energy efficiency opportunities. Customers receive technical assistance in determining potential energy and cost savings as well as identifying and estimating incentives for participation. Site specific incentives, in which the tier structure applies, are capped at seventy percent of the incremental project cost for lighting projects with simple paybacks of less than 3 years and non-lighting projects (or lighting projects with a verified life of 40,000 hours or more) with simple paybacks less than 5 years. All other project incentives calculated under the tier structure will be capped at fifty percent of the incremental project cost. Simple payback criteria for eligible projects is greater than 1 year and less than 8 years for lighting measures or less than 13 years for non-lighting and LED lighting measures. Site specific projects include appliances, compressed air, HVAC, industrial process, motors (non-prescriptive), shell and lighting with the majority being HVAC, lighting and shell.

In 2013, over 1,600 prescriptive and site specific nonresidential projects were incented. Avista contributed over $6 million for energy efficiency upgrades in nonresidential applications. Nonresidential programs contributed over 29,331 MWh and 304,000 therms in annual first-year energy savings. Tables 20 and 21 provide detail on the electric, natural gas, and dual fuel nonresidential programs.

Table 20: Electric Nonresidential[8]

Program	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Site Specific Shell	4	$1,970	(12,995)	0	$1,361	$0	$0	-$787	($236)
Prescriptive Food Service	63	$26,071	272,501	0	$126,429	$0	$2,401	$647,358	$20,879
Prescriptive Variable Frequency Drives	8	$100,220	1,307,187	0	$728,096	$0	$0	$148,497	$118,005
Prescriptive Standby Generator Block	23	$9,200	41,120	0	$22,904	$0	$0	$28,232	$3,712
EnergySmart Grocer Industrial Process	152	$503,253	4,371,211	0	$2,285,282	$0	$0	$1,184,373	$373,122
EnergySmart Grocer Case Lighting	84	$96,857	503,698	0	$111,825	$0	$0	$157,480	$18,124
Prescriptive Windows and Insulation	35	$69,626	380,165	0	$235,327	$0	$0	$153,607	$39,649
Prescriptive Exterior Lighting	248	$842,143	4,157,012	0	$1,771,836	$0	$43,233	$1,256,756	$287,166
Prescriptive Interior Lighting	719	$1,976,819	7,965,946	(64)	$3,395,749	($240)	$135,611	$3,536,166	$550,358
Site Specific Multifamily	1	$71,400	43,337	0	$118,808	$0	$0	$117,894	$18,256
Site Specific ENERGY STAR Freezer	1	$20	64	0	$51	$0	$0	$33	$8
Site Specific ENERGY STAR Refrigerator	4	$175	652	0	$337	$0	$0	$250	$55
Site Specific Renewable	1	$2,366	2,902	0	$8,916	$0	$0	$76,513	$1,445
Site Specific Appliances	3	$23,197	154,160	0	$94,129	$0	$0	$46,221	$15,371
Site Specific Compressed Air	2	$71,682	95,770	0	$242,907	$0	$0	$158,438	$39,369
Site Specific Industrial Process	9	$89,588	237,144	0	$558,447	$0	$0	$217,950	$90,509
Site Specific Motor Controls	1	$5,341	6,553	0	$16,621	$0	$0	$14,337	$2,294
Site Specific Motors	1	$5,148	9,773	0	$739	$0	$0	$3,267	$440
Site Specific HVAC Combined	11	$97,727	868,788	0	$288,290	$0	$159,048	$1,536,413	$52,512
Site Specific HVAC Cooling	9	$216,112	2,102,073	0	$643,447	$0	$0	$620,982	$115,198
Site Specific HVAC Heating	2	$3,425	41,189	0	$14,686	$0	$0	$8,598	$2,380
Site Specific Exterior Lighting	74	$249,537	1,718,369	0	$1,022,354	$0	$16,276	$639,038	$165,696
Site Specific Interior Lighting	59	$710,250	5,065,083	0	$2,876,370	$0	$109,684	$1,879,184	$466,181
Total Washington Electric	1,514	$5,172,128	29,331,703	(64)	$14,564,911	($240)	$466,253	$12,430,802	$2,3891,892

Table 21: Natural Gas Nonresidential[9]

Program	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Site Specific Shell	27	$185,825	0	55,796	$0	$308,270	$0	$445,506	$70,989
Prescriptive Food Service	5	$8,667	0	6,921	$0	$24,725	$0	$7,683	$6,549
EnergySmart Grocer Industrial Process	7	$4,950	0	13,953	$0	$35,094	$0	$10,200	$14,920
Prescriptive Windows and Insulation	55	$117,275	0	47,913	$0	$260,470	$0	$205,072	$63,276
Prescriptive HVAC Combined	36	$27,856	0	18,005	$0	$84,527	$0	$57,864	$19,202
Site Specific Appliances	3	$12,298	0	4,310	$0	$15,127	$0	$12,762	$3,752
Site Specific Industrial Process	1	$1,064	0	316	$0	$1,439	$0	$2,279	$327
Site Specific Motors	1	$37,181	0	10,232	$0	$43,210	$0	$7,252	$13,488
Site Specific HVAC Combined	5	$59,061	0	20,627	$0	$70,108	$0	$22,035	$25,190
Site Specific Cooling	5	$122,586	0	31,512	$0	$100,947	$0	$18,757	$40,162
Site Specific HVAC Heating	15	$290,721	0	94,496	$0	$459,846	$105	$768,399	$104,463
Total Washington Natural Gas	160	$867,484	0	304,081	$0	$1,403,765	$105	$1,557,809	$362,318

[8] All kWh and therm values reported in this table are gross, excluding the effect of applicable NTG ratios.
[9] *Ibid.*

VIII. CONSERVATION VOLTAGE REDUCTION

Avista Utilities implemented a conservation voltage reduction (CVR) program in 2013 as part of larger Smart Grid projects. CVR is a type of distribution efficiency, also known as conservation voltage regulation or voltage optimization. CVR is the long-term practice of controlling distribution voltage levels in the lower range of acceptable levels, as defined by the American National Standards Institute, to reduce demand and energy consumption. The CVR program is part of two Smart Grid projects. Both projects incorporate Integrated Volt Var Control (IVVC). The IVVC module issues commands to the station or midline regulators to maintain the minimum voltage set-point within a specified voltage dead-band. As deployed and commissioned in 2013 the CVR program resulted in 42,292 MWh of energy efficiency savings. The program impact evaluation is provided as Appendix 5.

IX. REGIONAL MARKET TRANSFORMATION

Avista's local energy efficiency portfolio consists of programs and supporting infrastructure designed to enhance and accelerate the saturation of energy efficiency measures through a combination of financial incentives, technical assistance, program outreach and education. It is not feasible for Avista to independently have a meaningful impact upon regional or national markets.

Consequently, utilities within the northwest have cooperatively worked together through the Northwest Energy Efficiency Alliance (NEEA) to address those opportunities that are beyond the ability or reach of individual utilities. Avista has been participating in and funding NEEA since the 1997 founding of the organization. NEEA is currently in its fourth funding cycle (2010-2014). This fourth five-year period saw a doubling of the contractual funding from $20 million to $40 million regionally. Concurrently, Avista's share of NEEA funding increased from 4.0% to 5.4% due to shifts in the distribution of regional retail end-use load.

Avista's criteria for funding NEEA's electric market transformation portfolio calls for the portfolio to deliver incrementally cost-effective resources beyond what could be acquired through the Company's local portfolio alone. Avista has historically communicated with NEEA the importance of NEEA delivering cost-effective resources to our service territory. The Company believes that NEEA will continue to offer cost-effective electric market transformation in the foreseeable future.

During 2013, Avista contributed nearly $1.5 million to fund NEEA's electric market transformation activities in Washington. The funding resulted in a corresponding 34,427 MWh in energy savings.

Avista will continue to play an active role in the organizational oversight of NEEA. This will be critical to insure that geographic equity, cost-effectiveness and resource acquisition continue to be primary areas of focus.

NEEA has initiated a preliminary investigation of the prospects for a natural gas market transformation portfolio. Avista has actively encouraged NEEA to explore this role and believes that regional market transformation may be a valuable addition to the delivery mechanisms available to the utility industry in the cost-effective acquisition of natural gas resources.

X. ENERGY EFFICIENCY EXPENDITURES

During 2013, Avista incurred over $18.6 million in costs for the operation of electric and natural gas energy efficiency programs, with $14.9 million for electric energy efficiency and $3.7 million for natural gas energy efficiency. Of this amount, $1.5 million was contributed to the Northwest Energy Efficiency Alliance to fund regional market transformation ventures.

Fifty-seven percent of expenditures were returned to ratepayers in the form of incentives or products (e.g. CFLs). During the 2013 calendar year, under $789 thousand, or 4.2 percent, was spent on evaluation in an effort to continually improve program design, delivery and cost-effectiveness.

Incentives are directly charged to the state where the customer resides and receives utility service. Nonresidential site-specific incentives tend to be somewhat "lumpy" in nature due to the size and longer installation lead times on these larger projects. Starting in 2012, there was a market transformation effort on the conversion of fluorescent T12 to T8 bulbs and this contributed to increased incentives toward the end of 2012 and continued into 2013. Prescriptive and site specific lighting incentives contributed significantly to the total incentives.

Evaluation, as well as other implementation expenditures, can be directly charged to the appropriate state and/or segment(s). In cases where the work benefits multiple states or segments, these expenditures are charged to a "general" category and are allocated based on avoided costs for cost-effectiveness purposes.

The expenditures illustrated in the following tables represent actual payments incurred in the 2013 calendar year and often differ from the cost-effectiveness section where all benefits and costs associated with projects completing in 2013 are evaluated in order to provide matching of benefits and expenditures resulting in a more accurate look at cost-effectiveness.

Tables 22 and 23 provide a summary of energy efficiency expenditures by fuel type.

Table 22: Electric Energy Efficiency Expenditures

Segment	Incentives	Implementation	EM&V	NEEA	Total
Residential	$861,969	$1,717,962	$118,857	$0	$2,698,788
Low Income	$1,065,502	$41,692	$17,327	$0	$1,124,522
Nonresidential	$5,889,712	$874,604	$132,534	$0	$6,896,851
Regional	$0	$13,272	$55,250	$1,870,956	$1,939,478
General	$0	$1,824,616	$420,180	$0	$2,244,796
	$7,817,184	$4,472,147	$744,148	$1,870,956	$14,904,434

Table 23: Natural Gas Energy Efficiency Expenditures

Segment	Incentives	Implementation	EM&V	Total
Residential	$1,007,916	$390,275	$5,997	$1,404,188
Low Income	$916,535	$12,798	$1,407	$930,739
Nonresidential	$896,268	$156,292	$9,001	$1,061,561
Regional	$0	$397	$0	$397
General	$0	$343,212	$28,345	$371,557
	$2,820,719	$902,974	$44,750	$3,768,443

XI. TARIFF RIDER BALANCES

As of the start of 2013, the Washington electric and natural gas (aggregate) tariff rider balances were underfunded by $2,055,901. During 2013, $14.6 million in tariff rider revenue was collected to fund energy efficiency while $18.7 million was expended to operate energy efficiency programs. The $4.1 million under-collection of tariff rider funding resulted in a year-end balance of $6.1 million underfunded balance.

During the first quarter of 2014, the underfunded balance has decreased to a total underfunded amount of $4.1 million. The bulk of this amount is attributable to Washington electric which ended the year with an underfunded balance of $5.5 million mostly due to the nonresidential prescriptive and site specific lighting programs.

Table 24 illustrates the 2013 tariff rider activity by fuel type.

Table 24: Tariff Rider Activity

	Washington	
	Electric	**Natural Gas**
Beginning Balance (*Underfunded*)	($1,593,629)	($462,272)
Energy Efficiency Funding	$11,038,644	$3,573,172
Net Funding for Operations	$9,445,015	$3,110,900
Energy Efficiency Expenditures	$14,904,339	$3,768,413
Ending Balances (*Underfunded*)	($5,459,325)	($657,513)

XII. ACTUAL TO BUSINESS PLAN COMPARISON

For 2013 operations, Avista exceeded budgeted electric energy efficiency expenditures by $192 thousand, or less than 2 percent and natural gas expenditures were $3.8 million with no budget. The biggest driver of expenditures is incentives. This demand for incentives was slightly higher than anticipated and its impact resulted in the underfunding in the Washington electric programs. Washington natural gas had no budget as it was anticipated natural gas would cease to exist, but natural gas was continued without a budget in 2013.

While the business plan provides an expectation for operational planning, Avista is required to incent all energy efficiency that qualifies under Schedules 90 and 190. Since customer incentives are the largest component of expenditures, customer demand can easily impact the funding level of the Tariff Riders.

Table 25 provides detail on the budget to actual comparison of energy efficiency expenditures by fuel type.

Table 25: Business Plan to Actual Comparison[10]

	Washington	
	Electric	**Natural Gas**
Incentives Budget	$7,586,440	$0
Non-incentives and Labor	$7,126,279	$0
Total Budgeted Expenditures	$14,712,719	$0
Actual 2013 Expenditures		
Incentives	$7,817,184	$2,820,719
Non-incentives and Labor	$7,087,251	$947,724
Total Actual Expenditures	$14,904,434	$3,768,443
Variance (*Unfavorable*)	($191,715)	($3,768,443)

[10] Budget values are from 2013 Business Plan

APPENDICES

Appendix 1

2012-2013 Washington Electric Conditions

Advisory Group

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, April 4, 2012, webinar	Technical Committee meeting, April 12th 2012, Portland, OR
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.		
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.		Overview of Conservation Potential Assessment, Integrated Resource Plan and Technical Reference Manual in relation to Biennial Conservation Plan. Overview of 2012 EM&V plan.
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.		Overview of Cconservation Potential Assessment, Integrated Resource Plan and Technical Reference Manual in relation to Biennial Conservation Plan.
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.		
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.		
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.		Presentation of natural gas business plan and possible changes.
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Committee meeting, April 26th 2012, webinar	Advisory Group meeting, May 22nd 2012, SeaTac Airport
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.		
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.		
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.		
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.		
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.		
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.		
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.		Cadmus presentation of impact and process evaluation results.

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, September 24-25th 2012, Spokane	Technical Committee meeting, December 10th 2012, webinar
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.		
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.	Update on developing CPA and 2013 EM&V plan.	Discussion on Avista's technical reference manual, TRM reference to the regional technical forum (RTF), and the basis for determining energy efficiency acquisition for the 2012-2013 biennium.
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	Update on developing CPA and 2013 EM&V plan.	
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.	Discussion on cost effectiveness and issues covered in Low Income Working Group in Washington.	
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.	Included with discussions on Conservation Potential Assessment.	
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.	Status update of developing 2013 Business Plan including possible elimination or reduction of gas programs.	
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.	Presentation of marketing including commercial campaign, KREM Efficiency Matters Campaign, and use of social media.	

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.				
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.	Yes	Various meetings, webinars, and phone calls.	6/1/12 Electrical filing. 12/20/12 WUTC presentation.	UE-111882
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.	Yes	Various meetings, webinars, and phone calls.	6/1/12 Electrical filing. 12/20/12 WUTC presentation.	UE-111882
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.	Yes	Various meetings, webinars, and phone calls.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Advisory Committee (for Electric Integrated Resource Plan)	Technical Committee meeting, February 22nd 2013, webinar
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.		
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.		
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	(November 7, 2012, Spokane) Advisory Group was informed of and invited to attend the TAC where CPA results were presented, including 2014-15 biennial targets as well as 10 and 20 year projections. (March 20, 2013, Spokane) The results of the CPA were presented to the TAC. Advisory Group was invited to attend to participate in the discussion of the results. This included 2014-15 biennial targets as well as 10 and 20 year projections.	EnerNOC gave overview of the developing new CPA for 2014-15 targets and 10 year projection.
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.		
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.		Included with discussions on Conservation Potential Assessment.
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.		
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, May 16th 2013, Portland	Technical Committee meeting, September 19th 2013, webinar	Advisory Group meeting, October 1st 2013, webinar
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.			Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection.
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.			Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection.
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.	Regional Technical Forum energy savings reconciliation with Avista's Technical Reference Manual		
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	Brief update on CPA	Discussion to achieve clarity on outstanding CPA items based on NEEA's projections for 2014-15.	Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection. CPA reviewed by EnerNOC.
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.			
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.			
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.	Brief update on upcoming filings for tariffs		
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.			

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Committee meeting, October 4th 2013, Portland	Advisory Group meeting, November 6-7, 2013, Spokane
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.		Review information for the 2014-15 Biennial Conservation Plan and information from the CPA and NEEA projections.
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.	Review and discuss Avista's Technical Reference Manual in conjunction with RTF's UES & CPA assumptions for evaluation of 2012-13 acquisition. Proposed updates to EMV Framework. Review Avista's residual general population survey & comparison to Residential Building Stock Assessment.	Two day meeting with topics including a review of residential, low income, and nonresidential programs, regulatory filings and issues, distribution efficiency, 2014 DSM Business Plan and EM&V Plan, BCP and CPA/NEEA projections and RTF/TRM information, marketing, energy assistance and outreach, and evaluation topics.
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.	Review and discuss Avista's Technical Reference Manual in conjunction with RTF's UES & CPA assumptions for evaluation of 2012-13 acquisition. Proposed updates to EMV Framework.	Review of 2014 EM&V Plan.
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	Review and discuss Avista's Technical Reference Manual in conjunction with RTF's UES & CPA assumptions for evaluation of 2012-13 acquisition.	Review of BCP and CPA/NEEA projections.
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.		Discussion of avoided costs and the impact on CPA and electric/natural gas portfolios and associated cost-effectiveness tests.
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.		
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.		
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.		Presentation on commercial and industrial campaign and outreach, small business outreach, and residential program outreach.

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	23	1	Biennial Conservation Target	2012-2021 Ten-Year Achievable Conservation Potential range of 600,653 to 1,181,544 MWh. 2012-2013 Biennial Conservation Target range of 108,589 to 197,557 MWh.	Yes	12-31-2013	File 2013 Annual Report, by June 1, 2014, including section on biennial target and achievement.	
DOCKET UE-111882 Order 01	25	3.a	Use of Advisory Group	Avista must maintain and use an external conservation advisory group of stakeholders to advise Avista Corporation on topics 25.3.a.i-ix and may use its Integrated Resource Planning Technical Advisory Committee.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.i	EM&V Protocol	Development and modification of protocols to evaluate, measure, and verify savings in Avista Corporation's programs.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.ii	Conservation Potential Assessment	Development of conservation potential assessments.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.iii	CE Methodology Inputs and Calculations	Guidance to Avista Corporation regarding methodology inputs and calculations for updating cost-effectiveness.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.iv	Supply Curves	Review of data sources and values used to update supply curves.	Yes	Various meetings and webinars.		
DOCKET UE-111882 Order 01	25	3.a.v	Tariff Modifications or Program Corrections	Consideration of the need for tariff modifications or mid-course program corrections.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.vi.1	Marketing	Review appropriate level of and planning for: Marketing conservation programs.	Yes	Various meetings, webinars, and phone calls.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, April 4, 2012, webinar
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Presented information on cost-effectiveness including key perspectives and metrics, customer prioritization, holistic treatment of dwellings, customer economic sustainability, cost-effective resource acquisition. Discussion on cost-effective calculation and metric improvements, capturing non-energy benefits, PCT and TRC discount rate modification, and federally funded non-energy investments.
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.	
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.	
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.	

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Committee meeting, April 12th 2012, Portland, OR	Technical Committee meeting, April 26th 2012, webinar
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	Cadmus reviewed savings results on CFLs, refrigerators, and clothes washers.	
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Presentation of program efforts towards low income, EnFocus update, and pilot.	
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.		Discussion on kWh savings to be claimed & timing of acquisition achieved through the Avista CFL Contingency Program.
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.		
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.		
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.		
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.		
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, May 22nd 2012, SeaTac Airport	Advisory Group meeting, September 24-25th 2012, Spokane
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	Cadmus presentation of impact and process evaluation results.	Presentation on non-residential programs including incentives and energy savings.
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Reviewed low income policy issues including cost effectiveness and working with local agencies who provide services to low income.	Discussion on cost effectiveness and issues covered in Low Income Working Group in Washington. Presentation on low income energy assistance through LIRAP and energy fairs.
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.		Presentation on non-residential, residential, and low income programs including incentives and energy savings.
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.		
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.		
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.		
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.		
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Committee meeting, December 10th 2012, webinar
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential anlaysis by November 1, 2013.	
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.	
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.	

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	Yes	Monthly report		2012 Annual Report
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	Yes	Monthly report		2012 Annual Report
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.				
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.				Newsletter is sent the first month of each quarter.

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Technical Advisory Committee (for Electric Integrated Resource Plan)	Technical Committee meeting, February 22nd 2013, webinar
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.		
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.		
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.		
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.		
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.		EnerNOC gave overview of the developing new CPA for 2014-15 targets and 10 year projection.
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.		EnerNOC gave overview of the developing new CPA for 2014-15 targets and 10 year projection.
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.		
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, May 16th 2013, Portland	Technical Committee meeting, September 19th 2013, webinar
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.		
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.		
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	Brief update on savings results versus targets	
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	Brief update on expenditure results versus budgets	
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.		
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.		Discussion to achieve clarity on outstanding CPA items based on NEEA's projections for 2014-15.
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.		
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, October 1st 2013, webinar	Technical Committee meeting, October 4th 2013, Portland
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.		
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.		
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.		
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.		
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.	Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection. CPA reviewed by EnerNOC.	
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection. CPA reviewed by EnerNOC.	
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.	Discuss and review information for the 2014-15 Biennial Conservation Plan and the 10 year projection, also conversion savings. CPA reviewed by EnerNOC.	
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.		

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Advisory Group meeting, November 6-7, 2013, Spokane
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	Some discussion included in review of the 2014 Business Plan and the discussion on cost-effectiveness tests and avoided costs.
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Low Income program review under the residential section, primarily concentrating on weatherization. Review of low-income rate design under regulatory section.
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.	Some discussion on CPA 2014-15 biennium target and 10 year projection included when the BCP was presented.
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	Some discussion on CPA 2014-15 biennium target and 10 year projection included when the BCP was presented.
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.	Some discussion on CPA 2014-15 biennium target and 10 year projection included when the BCP was presented. Discussion included distribution efficiency, NEEA savings, and fuel conversion savings.
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.	

Advisory Group

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	25	3.a.vi.2	Incentives	Review appropriate level of and planning for: Incentives to customers for measures and services.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.vii	Limited Income	Consideration of issues related to conservation programs for customers with limited income.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	25	3.a.viii	Results versus Targets	Comparing program achievement results with annual and biennial targets.	Yes	Monthly report		
DOCKET UE-111882 Order 01	25	3.a.ix	Expenditures versus Budgets	Review of conservation program budgets and actual expenditures compared to budgets.	Yes	Monthly report		
DOCKET UE-111882 Order 01	31	9.a	10-Year Conservation Potential Analysis	By July 1, 2013 Avista Corporation must consult with the Advisory Group to facilitate completion of a ten-year conservation potential analysis by November 1, 2013.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	31	9.b	Identification of Achievable Potential and Targets	Avista Corporation must consult with the Advisory Group between July 1, 2013 and October 31, 2013 to identify achievable conservation potential for 2014-2023 and set annual and biennial targets for the 2014-2015 biennium, including necessary revisions to program details.	Yes	Various meetings, webinars, and phone calls.		
DOCKET UE-111882 Order 01	31	9.c	Standard Efficiency Fuel Conversion Savings	During the consultation described in (9)(b) Avista corporation must review with the Advisory Group whether standard-efficiency fuel conversion savings should be included in the 2014-2015 Biennial Conservation Target.	Yes	Several meetings/webinars.		
			Newsletter	Quarterly newsletter is sent to the Advisory Group (and other stakeholders) which covers updates on changes in energy efficiency programs, stories about programs and outcomes, regulatory filings, tariff rider financial balances, YTD energy savings, and upcoming events.				

Documentation

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	26	4.a	Submit Annual Budgets	Avista Corporation must submit annual budgets to the Advisory Group and to the Commission no later than November 1st of each year. Submission must include reasonable program detail that shows planned expenses and the resulting projected energy savings. May be submitted in odd-numbered years as part of the Biennial Conservation Plan and in even-numbered years as part of the DSM Business Plan.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	26	4.b	Proposed Budget and Savings Levels	Avista Corporation must provide its proposed budget in a detailed format with a summary page indicating the proposed budget and savings levels for each electric conservation program and supporting spreadsheets providing further detail.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	27	5	Program Details	Avista Corporation must maintain its conservation tariffs with program descriptions on file with the Commission. Program details about specific measures, incentives and eligibility requirements must be filed as tariff attachments or as revisions to Avista Corporation's DSM Business Plan.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	28	6.a	Prudence & Cost-Effectiveness	Avista Corporation must demonstrate the prudence and cost-effectiveness of its conservation programs to the Commission after the savings are achieved.	Yes			Will file by June 1, 2014 per 30.8.f UE-111882 (Reporting & Filing).
DOCKET UE-111882 Order 01	28	6.b	RTF Deemed Savings	Except as provided in subparagraph (6)c, Avista Corporation must use the Council's Regional Technical Forum's (RTFs) "deemed" savings for electricity measures.	Yes		Ongoing	Discussion included in 12/10/2012 and 2/22/2013 Technical Committee meeting webinars.
DOCKET UE-111882 Order 01	28	6.c	Non-RTF savings estimates	If Avista Corporation uses savings estimates that differ from those established by the RTF, such estimates must be based on generally accepted impact evaluation data and/or other reliable and relevant source data that has verified savings levels, and be presented to the Advisory Group for comment.	Yes		Ongoing	Discussion included in 12/10/2012 and 2/22/2013 Technical Committee meeting webinars.
DOCKET UE-111882 Order 01	28	6.d	New Program	When Avista Corporation proposed a new program, it must present it to the Advisory Group for comment with program details fully defined. After consultation with the Advisory Group, Avista Corporation must file a revision to its DSM Business Plan in this Docket.	Yes		2013 Business Plan and the January Newsletter included information on new behavioral and manufactured home duct sealing programs.	Several phone calls with Public Counsel discussed contracts for behavioral program.

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	26	4.a	Submit Annual Budgets	Avista Corporation must submit annual budgets to the Advisory Group and to the Commission no later than November 1st of each year. Submission must include reasonable program detail that shows planned expenses and the resulting projected energy savings. May be submitted in odd-numbered years as part of the Biennial Conservation Plan and in even-numbered years as part of the DSM Business Plan.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	26	4.b	Proposed Budget and Savings Levels	Avista Corporation must provide its proposed budget in a detailed format with a summary page indicating the proposed budget and savings levels for each electric conservation program and supporting spreadsheets providing further detail.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	27	5	Program Details	Avista Corporation must maintain its conservation tariffs with program descriptions on file with the Commission. Program details about specific measures, incentives and eligibility requirements must be filed as tariff attachments or as revisions to Avista Corporation's DSM Business Plan.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	28	6.a	Prudence & Cost-Effectiveness	Avista Corporation must demonstrate the prudence and cost-effectiveness of its conservation programs to the Commission after the savings are achieved.	Yes		File 2013 Annual Report, by June 1, 2014, including section on biennial target and achievement.	Will file by June 1, 2014 per 30.8.f UE-111882 (Reporting & Filing).
DOCKET UE-111882 Order 01	28	6.b	RTF Deemed Savings	Except as provided in subparagraph (6)c, Avista Corporation must use the Council's Regional Technical Forum's (RTFs) "deemed" savings for electricity measures.	Yes	Ongoing		Discussion included in 12/10/2012 and 2/22/2013 Technical Committee meeting webinars.
DOCKET UE-111882 Order 01	28	6.c	Non-RTF savings estimates	If Avista Corporation uses savings estimates that differ from those established by the RTF, such estimates must be based on generally accepted impact evaluation data and/or other reliable and relevant source data that has verified savings levels, and be presented to the Advisory Group for comment.	Yes	Ongoing		Discussion included in 12/10/2012 and 2/22/2013 Technical Committee meeting webinars.
DOCKET UE-111882 Order 01	28	6.d	New Program	When Avista Corporation proposed a new program, it must present it to the Advisory Group for comment with program details fully defined. After consultation with the Advisory Group, Avista Corporation must file a revision to its DSM Business Plan in this Docket.	Yes	2013 Business Plan and the January Newsletter included information on new behavioral and manufactured home duct sealing programs.	Several phone calls with Public Counsel discussed contracts for behavioral program.	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	28	6.e	EM&V Protocols	Avista Corporation must provide opportunities for the Advisory Group to review and assist with the development of evaluation, measurement, and verification protocols for conservation programs.	Yes	See Advisory Group sheet paragraph 25 3.a.i		
DOCKET UE-111882 Order 01	28	6.f	Amount of Conservation Budget for EM&V	Avista Corporation must spend a reasonable amount of its conservation budget on evaluation, measurement and verification including a reasonable proportion on independent, third-party EM&V.	Yes	Filed 2012 DSM Annual Report on 5/31/13.	$822,124 spent on EM&V WA electrical programs in 2012, including $633,651 on third party EM&V.	
DOCKET UE-111882 Order 01	28	6.f	EM&V Schedule	Avista Corporation must perform EM&V annually on a multi-year schedule of selected programs such that, over the EM&V cycle, all major programs are covered. The EM&V function includes impact, process, market and cost test analysis. The results must verify the level at which claimed energy savings have occurred, evaluate the existing internal review processes and suggest improvements to the program and ongoing EM&V processes.	Yes	11-01-2012	Filed 2013 EM&V Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	28	6.f	Annual Independent, Third-Party EM&V Report	An annual independent, third-party EM&V report involving analysis of both program impacts and process impacts must be part of the reports on conservation acquisition described in paragraphs (8)(c) and (8)(f).	Yes		Reports from Cadmus	
DOCKET UE-111882 Order 01	28	6.g	Distribution Efficiency	For savings claimed from distribution efficiency, Avista Corporation must provide third-party verified values calculated using applicable parts of the RTFs Automated CVR Protocol No. 1, Voltage Optimization Protocol, or any other protocol recognized by the RTF following the date of this order. This requirement does not prevent Avista Corporation from developing an additional EM&V methodology for distribution efficiency and advocating at a future Commission proceeding for the recognition of third-party verified savings calculated using that additional methodology.	Yes		Reports from Cadmus	
DOCKET UE-111882 Order 01	29	7.a	All Sectors Included	Avista Corporation must offer a mix of tariff-based programs that ensure it is serving each customer sector, including programs targeted to the limited-income subset of residential customers. Modifications to the programs must be filed with the Commission as revisions to tariffs or as revisions to Avista Corporation's DSM Business Plan.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	29	7.b	Outreach on Programs	Avista Corporation must establish a strategy and proposed implementation budget for informing participants about program opportunities in the relevant market channels for each of its energy efficiency programs. Avista Corporation must share these strategies with the Advisory Group for review and comments, and provide updates at Advisory Group meetings.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	28	6.e	EM&V Protocols	Avista Corporation must provide opportunities for the Advisory Group to review and assist with the development of evaluation, measurement and verification protocols for conservation programs.	Yes	See Advisory Group sheet paragraph 25 3.a.i		
DOCKET UE-111882 Order 01	28	6.f	Amount of Conservation Budget for EM&V	Avista Corporation must spend a reasonable amount of its conservation budget on evaluation, measurement and verification including a resonable proportion on independent, third-party EM&V.	Yes	File 2013 DSM Annual Report by June 1, 2014	$744,148 spent on EM&V WA electrical programs in 2013, including $677,812 on third party EM&V.	
DOCKET UE-111882 Order 01	28	6.f	EM&V Schedule	Avista Corporation must perform EM&V annually on a multi-year schedule of selected programs such that, over the EM&V cycle, all major programs are covered. The EM&V function includes impact, process, market and cost test analysis. The results must verify the level at which claimed energy savings have occurred, evaluate the existing internal review processes and suggest improvements to the program and ongoing EM&V processes.	Yes	11-01-2013	Filed 2014 EM&V Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	28	6.f	Annual Independent, Third-Party EM&V Report	An annual independent, third-party EM&V report involving analysis of both program impacts and process impacts must be part of the reports on conservation acquisition described in paragraphs (8)(c) and (8)(f).	Yes		Reports from Cadmus	
DOCKET UE-111882 Order 01	28	6.g	Distribution Efficiency	For savings claimed from distribution efficiency, Avista Corporation must provide third-party verified values calculated using applicable parts of the RTFs Automated CVR Protocol No. 1, Voltage Optimization Protocol, or any other protocol recognized by the RTF following the date of this order. This requirement does not prevent Avista Corporation from developing an additional EM&V methodology for distribution efficiency and advocating at a future Commission proceeding for the recognition of third-party verified savings calculated using that additional methodology.	Yes		Engaged with NEEA to coordinate a RFP to identify and select a contractor to perform analysis of distribution efficiency and CVR activities.	
DOCKET UE-111882 Order 01	29	7.a	All Sectors Included	Avista Corporation must offer a mix of tariff-based programs that ensure it is serving each customer sector, including programs targeted to the limited-income subset of residential customers. Modifications to the programs must be filed with the Commission as revisions to tariffs or as revisions to Avista Corporation's DSM Business Plan.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	29	7.b	Outreach on Programs	Avista Corporation must establish a strategy and proposed implementation budget for informing participants about program opportunities in the relevant market channels for each of its energy efficiency programs. Avista Corporation must share these strategies with the Advisory Group for review and comments, and provide updates at Advisory Group meetings.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	29	7.c	Incentives and Conservation Program Implementation	Avista Corporation must offer a cost-effective portfolio of programs in order to achieve all available conservation that is cost-effective, reliable and feasible. Programs and incentives may be directed to consumers, retailers, or trade allies, as appropriate for measures that save energy. Incentive levels and other methods of encouraging energy conservation need to be periodically examined to ensure that they are neither too high nor too low. Incentive levels and implementation methods should not unnecessarily limit the acquisition of all achievable energy conservation.	Yes	11-01-2012	Filed 2013 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	29	7.d	Conservation Efforts without Approved EM&V Protocol	Avista Corporation may spend up to 10 percent of its conservation budget on programs whose savings impact has not yet been measured, as long as the overall portfolio of conservation passes the Total Resource Cost test as modified by the Council.	Yes			Avista has elected to not implement this option. Avista does not consider "Every Little Bit" to be a conservation program.
Cost Effectiveness Tests								
DOCKET UE-111882 Order 01	32	10.a	Primary CE Test is TRC	The primary cost effectiveness test is the Total Resource Cost (TRC) test as modified by the Council.	Yes		2012 Annual Report and 2012 Business Plan. _Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	
DOCKET UE-111882 Order 01	32	10.b	Additional CE Tests	In addition to the Council-modified TRC, Avista Corporation must provide calculations of the Program Administrator Cost test (also called the Utility Cost test), Ratepayer Impact Measure test and Participant Cost test described in the National Action Plan for Energy Efficiency's study "Understanding cost-effectiveness of energy efficiency programs."	Yes		2012 Annual Report and 2012 Business Plan. _Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
Budget Savings								
DOCKET UE-111882 Order 01	29	7.c	Incentives and Conservation Program Implementation	Avista Corporation must offer a cost-effective portfolio of programs in order to achieve all available conservation that is cost-effective, reliable and feasible. Programs and incentives may be directed to consumers, retailers, or trade allies, as appropriate for measures that save energy. Incentive levels and other methods of encouraging energy conservation need to be periodically examined to ensure that they are neither too high nor too low. Incentive levels and implementation methods should not unnecessarily limit the acquisition of all achievable energy conservation.	Yes	11-01-2013	Filed 2014 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	29	7.d	Conservation Efforts without Approved EM&V Protocol	Avista Corporation may spend up to 10 percent of its conservation budget on programs whose savings impact has not yet been measured, as long as the overall portfolio of conservation passes the Total Resource Cost test as modified by the Council.				
Cost Effectiveness Tests								
DOCKET UE-111882 Order 01	32	10.a	Primary CE Test is TRC	The primary cost effectiveness test is the Total Resource Cost (TRC) test as modified by the Council.	Yes		2013 Annual Report and 2013 Business Plan. Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	
DOCKET UE-111882 Order 01	32	10.b	Additional CE Tests	In addition to the Council-modified TRC, Avista Corporation must provide calculations of the Program Administrator Cost test (also called the Utility Cost test), Ratepayer Impact Measure test and Participant Cost test described in the National Action Plan for Energy Efficiency's study "Understanding cost-effectiveness of energy efficiency programs."	Yes		2013 Annual Report and 2013 Business Plan. Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2012 Action Taken	Notes (Docket#, Report, etc.)
Cost Effectiveness Tests								
DOCKET UE-111882 Order 01	32	10.c	Portfolio Level CE	Overall conservation cost-effectiveness must be evaluated at the portfolio level. Costs included in the portfolio level analysis include conservation related administrative costs. Avista Corporation must continue to evaluate measure and program level cost tests.	Yes		2012 Annual Report and 2012 Business Plan. Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	
			Net-to-Gross Evaluation	Perform net-to-gross evaluation as a management tool.			Filed 2012 DSM Annual Report on 5/31/13	
Electric Rate Tariffs								
DOCKET UE-111882 Order 01	33	11.a	Annual Filing	Avista's annual tariff rider filing, required under Paragraphs (8)(a) and (d) will recover the future year's budgeted expenses and any significant variances between budgeted and actual income and expenditures during the previous period.	Yes	05-31-2012	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	33	11.b	Scope of Expenditures	Funds collected through the rider must be used on approved conservation programs and their administrative costs.	Yes	05-31-2012	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	33	11.c	Recovery for Each Customer Class	Rate spread and rate design must match Avista's underlying base volumetric rates.	Yes	05-31-2012	Filed tariff revisions with WUTC and emailed to Stakeholders	

Budget Savings, Cost Effectiveness Tests, and Electric Rate Tariffs

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
Cost Effectiveness Tests								
DOCKET UE-111882 Order 01	32	10.c	Portfolio Level CE	Overall conservation cost-effectiveness must be evaluated at the portfolio level. Costs included in the portfolio level analysis include conservation related administrative costs. Avista Corporation must continue to evaluate measure and program level cost tests.	Yes		2013 Annual Report and 2013 Business Plan. _Discussed in various Advisory Group and Technical Committee meetings and WUTC Open Meeting in Olympia 4/11/13.	
			Net-to-Gross Evaluation	Perform net-to-gross evaluation as a management tool.			File 2013 DSM Annual Report by 6/1/14	
Electric Rate Tariffs								
DOCKET UE-111882 Order 01	33	11.a	Annual Filing	Avista's annual tariff rider filing, required under Paragraphs (8)(a) and (d) will recover the future year's budgeted expenses and any significant variances between budgeted and actual income and expenditures during the previous period.	Yes	by 06-1-2013	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	33	11.b	Scope of Expenditures	Funds collected through the rider must be used on approved conservation programs and their administrative costs.	Yes	by 06-1-2013	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	33	11.c	Recovery for Each Customer Class	Rate spread and rate design must match Avista's underlying base volumetric rates.	Yes	by 06-1-2013	Filed tariff revisions with WUTC and emailed to Stakeholders	

Reporting and Filing

Reporting and Filing

	Paragraph #	Item #	Item Label	Item Description	2012 Condition Met?	Date Met	Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	30	8.a	Cost Recovery Tariff	Avista Corporation must file a cost recovery tariff by June 1, 2012 with requested effective date of August 1, 2012	Yes	05-31-2012	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	30	8.b	2013 DSM Business Plan	Avista Corporation must file a 2013 DSM Business Plan containing any changes to program details and an annual budget by November 1, 2012	Yes	11-01-2012	Filed 2013 Business Plan with WUTC, sent to IPUC, and emailed to Stakeholders	
DOCKET UE-111882 Order 01	30	8.c	2012 Annual Report	Avista Corporation must file a 2012 Annual Report on Conservation Acquisition including an evaluation of cost effectiveness and comparing budgets to actuals by June 1, 2013	Yes	05-31-2013	Filed 2012 Annual Report with WUTC and sent to IPUC	
DOCKET UE-111882 Order 01	30	8.d	Cost Recovery Tariff	Avista Corporation must file a cost recovery tariff by June 1, 2013 with requested effective date of August 1, 2013.				
DOCKET UE-111882 Order 01	30	8.e	Biennial Conservation Plan	Avista Corporation must file a Biennial Conservation Plan including revised program details and program tariffs together with identification of 2014-2023 achievable conservation potential by November 1, 2013, requesting effective date of January 1, 2014.				
DOCKET UE-111882 Order 01	30	8.f	Conservation Program Achievement	Avista Corporation must file a two-year report on conservation program achievement by June 1, 2014.				

			Low Income	Process review on low income.				Discussion on cost effectiveness and issues covered in Low Income Working Group in Washington. Presentation on low income energy assistance through LIRAP and energy fairs. (Advisory Group mtg 9/24-25/2012, Spokane)

Reporting and Filing

	Paragraph #	Item #	Item Label	Item Description	Condition Met?	Date Met	2013 Action Taken	Notes (Docket#, Report, etc.)
DOCKET UE-111882 Order 01	30	8.a	Cost Recovery Tariff	Avista Corporation must file a cost recovery tariff by June 1, 2012 with requested effective date of August 1, 2012				
DOCKET UE-111882 Order 01	30	8.b	2013 DSM Business Plan	Avista Corporation must file a 2013 DSM Business Plan containing any changes to program details and an annual budget by November 1, 2012				
DOCKET UE-111882 Order 01	30	8.c	2012 Annual Report	Avista Corporation must file a 2012 Annual Report on Conservation Acquisition including an evaluation of cost effectiveness and comparing budgets to actuals by June 1, 2013				
DOCKET UE-111882 Order 01	30	8.d	Cost Recovery Tariff	Avista Corporation must file a cost recovery tariff by June 1, 2013 with requested effective date of August 1, 2013.	Yes	05-31-2013	Filed tariff revisions with WUTC and emailed to Stakeholders	
DOCKET UE-111882 Order 01	30	8.e	Biennial Conservation Plan	Avista Corporation must file a Biennial Conservation Plan including revised program details and program tariffs together with identification of 2014-2023 achievable conservation potential by November 1, 2013, requesting effective date of January 1, 2014.	Yes	11-01-2013	Filed Biennial Conservation Plan with WUTC	
DOCKET UE-111882 Order 01	30	8.f	Conservation Program Achievement	Avista Corporation must file a two-year report on conservation program achievement by June 1, 2014.	Yes	by 06-01-2014	Filed 2013 Annual Report containing two-year report on conservation program achievement with WUTC	

			Low Income	Process review on low income.				

Appendix 2

Avista 2012-2013 Process Evaluation Report

May 15, 2014

The Cadmus Group, Inc.

AVISTA 2012-2013
PROCESS EVALUATION REPORT

May 15, 2014

Avista Corporation
1411 E Mission Ave
Spokane, WA 99220

The Cadmus Group, Inc.
An Employee-Owned Company • www.cadmusgroup.com

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CADMUS

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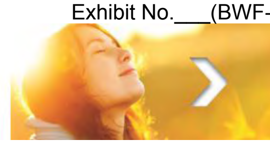

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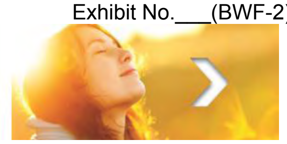
Table of Contents



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Portfolio Executive Summary

Avista Corporation contracted with The Cadmus Group, Inc., to perform a portfolio-wide evaluation for the 2012-2013 demand-side management programs. This report presents the process evaluation findings for the residential and nonresidential sectors.

Evaluation Activities

Table ES-1 summarizes the process evaluation activities conducted by sector.

Table ES-1. PY 2012-2013 Process Evaluation Activities

Activity	Residential	Nonresidential
Avista Program Staff Interviews*	7	12
Third-Party Implementer Interviews	1	-
Contractor Interviews	-	20
Participant Surveys	1,005	210
Nonparticipant Surveys	2,160	140
Assessment of Tracking Databases	✓	✓
Review of Program Documentation	✓	✓
Review of Marketing Materials	✓	✓
Review of Stakeholder Reports	✓	✓

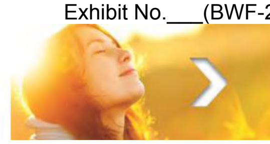
*Multiple representatives present for some interviews.

Key Residential Findings

The residential process evaluation resulted in the following key findings for the programs examined (listed in Table ES-2).

Table ES-2. PY2012 - PY2013 Residential Programs

Program Name
Natural Gas and Electric Programs
ENERGY STAR® Homes
ENERGY STAR Products
High-Efficiency Equipment
Home Audit
Manufactured Home Duct Sealing
Residential Behavior
Weatherization and Shell
Electric-Only Programs
Second Refrigerator and Freezer Recycling
Simple Steps, Smart Savings
Space and Water Conversions



- Participation levels in many of Avista's residential programs trended downward during PY2012 and PY2013. Many factors contributed to the downward trend, including reduced measure offerings and the 2013 discontinuation of natural gas incentives in Idaho. The trend experienced by Avista's programs is similar to participation trends in other regional utility DSM programs.
- The Simple Steps, Smart Savings program saw increased participation, partly due to new measure offerings. Energy-efficient showerheads were added in 2012 and LEDs were added in 2013.
- Avista's overall program design is effective, but there is room for improvement around internal communication between Avista staff.
- Avista staff showed a strong commitment to customer satisfaction, achieving fast rebate processing despite increasing complexity of applications. Avista staff have also taken steps to improve data tracking, such as integrating additional program data into a central database. In addition, program marketing through mass media channels had to be tailored to avoid customer confusion about different incentive offerings in Idaho and Washington.
- Key sources of program information for customers included contractors (17% in 2012; 28% in 2013), bill inserts (16%; 16%), and word of mouth (10%; 14%). Changes in information sources reflected changing program offerings such as the elimination of appliance rebates in 2013.
- General population awareness of Avista's rebates decreased from 63% in 2012 to 54% in 2013. Bill inserts are the most common way for the general population to learn about Avista's rebates.
- Participant satisfaction increased since the 2011 process evaluation, with 89% of 2013 participants being "very satisfied" with their program experience. Only a small number of customers expressed any level of dissatisfaction across the three years in which Cadmus conducted surveys.
- Avista's appliance rebates experienced a high level of freeridership, likely due to high market penetration of ENERGY STAR appliances and comparatively low incentive amounts—as a percent of incremental cost. Avista adjusted their program offerings to reflect this market, discontinuing appliance rebates in 2013.
- Many of Avista's customers – both participants and nonparticipants – reported installing additional energy-saving improvements without receiving any rebate because of Avista's programs' influence. These actions contribute to program spillover. Out of the 3,215 customers Cadmus surveyed in 2012 and 2013, 113 (or roughly one in every 28 customers) reported a spillover measure.

Residential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the residential programs.

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Program Participation

Conclusion: Avista's implementation of new and continued support for existing third-party implemented programs such as Simple Steps, Smart Savings and Residential Behavior effectively captures energy savings in the residential market segments.

- ***Recommendation:*** Continue exploring new measures, program designs, and delivery mechanisms that leverage the national expertise of experienced third-party implementation firms. Possible programs may include additional partnership with ENERGY STAR in the form of the Home Performance with ENERGY STAR program.

Conclusion: Avista's continued investment in pilot programs provides a low-risk way test the effectiveness of new measure offerings, delivery channels, and implementation partners.

- ***Recommendation:*** Continue testing new program designs and measure offerings through the use of pilots—even if secondary sources of funding or local partners are not available.

Conclusion: While still early, evaluation findings indicate the Residential Behavior program is an effective way to capture savings in the residential market and Opower is a strong partner for program implementation.

- ***Recommendation:*** If determined to be cost-effective, consider expanding the Residential Behavior program (for example, lowering the energy consumption threshold for participation) and implementing measures to track the methods these customers use to save energy. Given that Avista has already included all cost-effective customers in their target population for this program, future opportunities for expansion may be limited.

Program Design

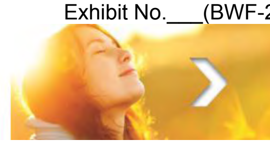
Conclusion: Inconsistencies continue to exist in measure and program naming and organization across program planning, tracking and reporting activities which result in less transparency in program operations and limit effective program evaluation.

- ***Recommendation:*** As part of the transition to the new data tracking system, consider aligning program and measure names with offerings articulated in annual business plans and other planning materials.

Conclusion: Reduction in Avista natural gas rebates and elimination of appliance rebates give customers fewer ways to participate in Avista energy-efficiency rebate programs.

- ***Recommendation:*** Consider ways to encourage repeat participation (such as marketing targeted at previous participants and online profiles that reduce application paperwork).

Conclusion: Considering self-report customer freeridership scores and market baseline data from the RTF is an effective way to assess the appropriateness of measure offerings.



- ***Recommendation:*** Continue use of customer freeridership and market assessments as a way to assess the appropriateness of measure offerings.

Conclusion: Many ongoing changes in Avista's program design and measure offerings are driven by the need to continue to meet cost-effectiveness requirements. Avista's examination of measure and program-level cost-effectiveness will determine the character of its portfolio in future program years.

- ***Recommendation:*** Develop a transparent process for assessing measure or program cost-effectiveness and communicating results internally. Consider ways to ensure high-quality cost-effectiveness analysis that aligns with industry best practices, such as obtaining an objective third-party review of current cost-effectiveness screening processes.

Program Implementation

Conclusion: Avista prioritization of customer satisfaction has been very successful and overall participant experience is very positive across all rebate programs.

- ***Recommendation:*** Continue Avista's commitment to customer satisfaction, but monitor:
  - Increased staffing costs; and
  - Impacts of the 90-day participation window on freeridership.

Marketing and Outreach

Conclusion: Avista implements a strong general awareness campaign around energy-efficiency, but some room exists in market segmentation and targeting specific customer groups.

- ***Recommendation:*** Utilize survey results from this evaluation and other data collection activities to understand which audiences are more likely to participate in Avista programs.

Key Nonresidential Findings

The nonresidential process evaluation resulted in the following key findings for the programs examined (listed in Table ES-3).

Table ES-3. PY2012 - PY2013 Nonresidential Programs

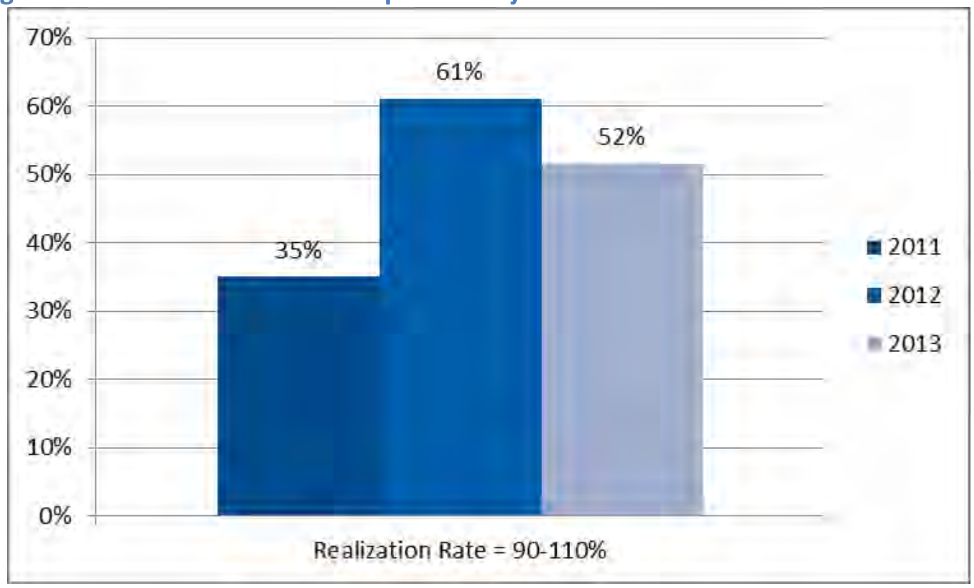
Program or Measure Name
Prescriptive Program
Lighting
PC Network Controls
Clothes Washers
Food Service
Motors
Variable Frequency Drives
Windows/Insulation
HVAC (natural gas only)

Standby Generator Block Heater
Green Motors Program
Site-Specific Program
Custom Projects Meeting Program Criteria
EnergySmart Grocer Program
Compressors
Controls
Motors
Night Covers for Refrigerated Cases
Case Lighting
Strip Curtains for Refrigerated Spaces
Insulation for Suction Lines
Hot Water Tanks

- Program participants were more likely than nonparticipants to own their facilities: according to surveys (78% of participants owned their facilities, compared with 67% of nonparticipants).
- Overall, participants reported high satisfaction ratings. The vast majority were “very satisfied”: 87% for Prescriptive, 75% for Site-Specific, and 88% for EnergySmart Grocer. Only a handful of customers (roughly 1%) reported any level of dissatisfaction.
- All three nonresidential programs received the same satisfaction ratings or better than they did in 2011, with the EnergySmart Grocer program showing a 23% increase in “very satisfied” customers over 2011.
- Though still showing high overall satisfaction, the Washington Site-Specific program had the lowest level of “very satisfied” participants at 69%. Among these participants, lower levels of satisfaction stemmed from inadequate information included in the program materials, and a lower-than-desired rebate amount. However, satisfaction with Avista’s staff remained high despite these minor issues: 90% or more of participants in every category were “very satisfied” with staff.
- Contractors were the primary source of program information for nonresidential program participants (37%. Other common sources of information were word of mouth (23%) and direct contact with Avista (17%).
- Among nonparticipants, awareness of Avista’s energy-efficiency rebates has remained fairly constant since 2010, with around 4 in 10 nonparticipants being aware of the programs (38% in 2013).
- Avista’s management and implementation of DSM programs has had some persistent organizational challenges, which may have impacted the effectiveness of implementation processes. While not limited to any specific part of Avista’s DSM staff, many of the issues have primarily affected the nonresidential program processes.
- Cadmus’ review of Avista’s implementation and QA/QC processes showed that the accuracy of project savings estimates has increased since 2011, there is still room for improvement. Figure

ES-1 shows the percentage of electric realization rates for site-specific projects that fell within the range of 90% to 110%. This range indicates a good level of accuracy in reported savings.

Figure ES-1. Nonresidential Site-Specific Project Electric Realization Rates 2011-2013



- Cadmus' interviews with lighting contractors – conducted as a supplement to the ongoing Panel Study research – revealed that Avista's programs increase sales of energy-efficient lighting equipment for both participating and nonparticipating contractors: 16 out of 20 reported that their sales increased because of Avista's programs.
- The prescriptive program showed 9% freeridership in 2013, showing a large decrease in freeridership as compared to the 2011 result. The site-specific program showed 30% freeridership in 2013, showing an increase as compared to 2011.

Nonresidential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the nonresidential programs.

Program Management and Implementation

Conclusion: Several parties over several years, internal and external to Avista, have observed the need for greater data quality assurance, in both documentation and input tracking. Quantitative inputs to the savings and rebate calculations have repercussions for tariff compliance,[1] incentive payments, and savings realization rates.

[1] As noted in Idaho Public Utilities Commission Order Number 33009 on Avista Corporation's Application for a Finding that it Prudently Incurred its 2010-2012 Electric and Natural Gas Energy Efficiency Expenditures.

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- ***Recommendation:*** Avista should continue efforts to improve program processes. Cadmus understands that a reorganization of the DSM group has occurred concurrent to the delivery of this report. This change may be an opportunity for fresh perspectives, clarified responsibilities, and improved coordination within and between teams. We believe unifying the organizational structure under central leadership is a step in the right direction and may help alleviate some previously documented issues with internal communications.

  In addition to the reorganization, Cadmus recommends that Avista develop standardized processes within the DSM group, including clear delineation of roles and precise description and assignment of all processes and responsibilities for both residential and nonresidential programs. All affected parties should be included in formalizing and standardizing the DSM group's processes, roles, and responsibilities. Further, all parties must formally agree to clearly delineated responsibilities under the new organizational structure. While these activities need to be prescriptive and precise, we caution that the resulting structure should still allow some flexibility: increased clarity, transparency, and accountability should serve to enhance program delivery and customer satisfaction.

Customer Feedback

Conclusion: Customers were highly satisfied with the program overall and with individual components. Customer satisfaction has increased since 2011, which had in turn increased from 2010.

- **Recommendation:** Continue to prioritize and monitor program satisfaction.

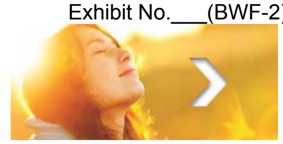
Conclusion: Customers appeared to be slightly less satisfied with the Washington Site-Specific program than with other programs. The largest source of lower satisfaction was the participants' reactions to program materials. Many customers said they received no program materials, and many participants learned about the program from their trade allies.

- ***Recommendation:*** Consider taking action to strengthen the use of program materials. Consider providing trade allies with printed program information flyers or brochures to give to customers. Maintaining up-to-date information for trade allies is critical when they are the key party delivering the program's message and participation details.

Market Feedback

Conclusion: According to commercial lighting contractor feedback, the nonresidential programs are successful in driving incremental energy-efficient equipment sales, and the market has not yet transformed to make energy efficiency standard practice.

- ***Recommendation:*** Continue to monitor market transformation indicators to measure programs' market impact over time.



Marketing and Outreach

***Conclusion**:* The characteristics of Cadmus' survey respondents indicate that the office / professional services and local government sectors may be underserved by the programs relative to their incidence in the nonparticipant population. Further research is necessary to determine whether this is true.

- ***Recommendation**:* Identify underserved industries, and seek opportunities to target outreach to specific underserved industries:
  - Investigate overall customer industry distribution
  - Compare to participant industry distribution
  - Develop targeted outreach strategies for any underserved sectors

Quality Assurance and Verification

Conclusion: Avista monitored its site-specific project review process and instituted refinements during the evaluation period in response to feedback from users. While this has led to improvements, including notably improved reliability of reported savings in 2012, quality assurance problems may persist.

- ***Recommendation**:* Continue to monitor the effectiveness of the site-specific project review process and refine as needed. Cadmus recommends implementing the following to ensure continued improvement:
  - All large prescriptive or site-specific projects reporting savings over a threshold of 300,000 kWh or 10,000 therms should undergo a complete QA/QC review prior to incentive payment in addition to the standard Top Sheet review process. Typically, a QA/QC process reviews engineering calculations, verifies inputs, checks payback period and incentive payments for reasonableness, and ensures compliance with program requirements and tariff rules. In order to align with the above recommendation regarding program management and implementation, Cadmus recommends that Avista determine and document the specific requirements and steps in the QA/QC process through a collaborative process that will ensure accountability and balance needs for efficiency and customer satisfaction.
  - Conduct an external third-party review of Top Sheets, including reviewing a random sample of completed Top Sheets for completeness and accuracy. These were not reviewed as part of the current process evaluation, but should be included in the next process evaluation. Review should not only verify the presence of the Top Sheets, but also the quality and accuracy of the information provided.

Residential Process Report

Introduction

This residential process evaluation focuses on ten Avista programs offered to Idaho and Washington natural gas and electric customers during program years 2012 and 2013 (PY2012 and PY2013).[2] In this evaluation, Cadmus sought to address the following researchable questions:

- What are the major trends in measure offerings and program uptake, and how do they compare to other utilities?
- What barriers exist to increased customer participation, and how effectively do the programs address those barriers?
- How satisfied were customers with the programs?
- What changes to design and delivery would improve program performance?

In assessing these topics, Cadmus relied on three main data collection efforts:

- Review of program tracking data, documents, and invoice materials;
- Interviews with Avista and third-party program implementation staff; and
- Telephone surveys with participating and general population[3] customers.

In this effort, Cadmus sought to align evaluation resources with evaluation objectives and focus on areas of uncertainty and programs with higher reported gross savings. Therefore, as indicated in Table 1, evaluation activities generally centered on programs implemented directly by Avista (rather than a regional partner) and established programs rather than pilots. Table 3 provides additional detail on the scope of evaluation activities applied to each program.

Table 1. PY2012 - PY2013 Process Evaluation Scope

Program Name	Process Evaluation Scope
Natural Gas and Electric Programs	
ENERGY STAR® Homes	*Limited*
ENERGY STAR Products	Full
High-Efficiency Equipment	Full
Home Audit	*Limited*
Manufactured Home Duct Sealing	*Limited*

[2] Not all programs are offered to customers in both states. For example, the Home Audit program operated only in Spokane Washington. Avista's programs operate on calendar years, with program years running from January through December.

[3] In 2012 and 2013, Cadmus surveyed a random sample of Avista Washington and Idaho customers. Cadmus did not implement any screens for program participation when sampling, so it follows that some percentage of respondents have at one time participated in an Avista energy-efficiency program.

Program Name	Process Evaluation Scope
Residential Behavior	*Limited*
Weatherization and Shell	Full
Electric-Only Programs	
Second Refrigerator and Freezer Recycling	Full
Simple Steps, Smart Savings	*Limited*
Space and Water Conversions	Full

In addition to the programs identified in Table 1, Avista offers energy-saving opportunities to residential customers through CFL Geographic Saturation events and Aclara® Software Applications. As energy savings from these activities are generally low (CFL Geographic Saturation events) or not tracked (Aclara), Cadmus did not review them as part of this evaluation.

Program Overview

The following section briefly describes the programs reviewed in this evaluation.

ENERGY STAR® Homes

The Northwest Energy Efficiency Alliance (NEEA) administers a regional ENERGY STAR Homes Program, which Avista supports. When a home in Avista's territory makes it through the program and is certified as ENERGY STAR-compliant, Avista pays a rebate to the homebuilder. The amount of the rebate is based on Avista fuel-service(s) used in the home.

ENERGY STAR Products

This program offers direct financial incentives to motivate customers to purchase and install energy-efficient appliances. The program indirectly encourages market transformation by increasing demand for ENERGY STAR products—specifically, appliances such as refrigerators and clothes washers.

High-Efficiency Equipment

This program offers four incentive categories for electric and gas customers seeking to purchase:

- High-efficiency water heaters;
- High-efficiency natural gas furnaces or natural gas boilers;
- High-efficiency air-source central heat pumps; and
- Primary heating systems incorporating a variable-speed motor.

Prior to 2011, these measures were offered under the Water Heating and Heating and Cooling Efficiency Programs.

Home Audit

The Home Audit Program, launched in May 2010 and implemented with support from municipal partners, sought to determine home energy audits' cost-effectiveness for capturing electric and gas savings. Eligible Avista customers must have resided in single-family homes, duplexes, or manufactured homes located in Spokane County. The program offered energy audits to customers, conducted by Building Performance Institute (BPI)-certified auditors, at no cost to eligible customers. An Energy-Efficiency Community Block Grant (EECBG), under the American Recovery and Reinvestment Act (ARRA), partially funded this program. The program operated through PY2012.

Manufactured Home Duct Sealing

This program, launched in October 2012, provides duct testing, sealing, and repair to Washington customers in electrically heated homes located in Adams, Asotin, Ferry, Franklin, Garfield, Lincoln, Spokane, Stevens, and Whitman counties. This program is offered free of charge to customers, with 60% of the funding coming from Avista's DSM funds and 40% provided through the Washington State University (WSU) Community Energy Efficiency Program (CEEP). All work is performed by UCONS LLC (UCONS), a third-party contractor.

Residential Behavior

The Residential Behavior Program is a peer-comparison program that began in spring 2013 and is scheduled to continue through 2015. Through the program, residential customers receive regular reports on their energy usage and comparisons to the usage of other customers in their immediate vicinity. Avista expects the program to increase the participation in their residential rebate programs and encourage behavior changes that result in kWh and therm savings. The program is offered at no cost to a sample of customers preselected by Avista (with assistance from Cadmus and Opower) and is implemented by Opower.

Weatherization and Shell

This program offers incentives for attic, wall, and floor insulation measures, and is available to residential electric and gas customers with homes heated with an Avista fuel.

Second Refrigerator and Freezer Recycling

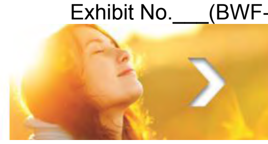
This program, available to Washington and Idaho electric customers, provides financial incentives to customers recycling refrigerators and freezers. The program seeks to reduce energy consumption by recycling up to two inefficient secondary refrigerators or freezers per home. JACO Environmental, Inc. (JACO), the implementation contractor, is responsible for scheduling, pick-up, recycling, rebate payment, and data tracking.

Simple Steps, Smart Savings

Avista sponsors an upstream, buy-down program, administered by the Bonneville Power Authority (BPA) and implemented by CLEAResult (formally Fluid Market Strategies). The program, available to customers in Washington and Idaho, offers discounted twist and specialty CFLs, LEDs, and energy efficient showerheads at many large retail locations.

Space and Water Conversions

This program offers incentives for three types of conversion:



- Replacement of electric resistance heating equipment as a primary heat source (either electric forced-air furnaces or electric baseboard heat), with central, natural gas heating systems;
- Replacement of electric resistance heating equipment with central heat pumps; and
- Replacement of electric water heaters with new, natural gas water heaters.

Table 2 lists the residential energy-efficiency programs offered in PY2012 and PY2013—along with their associated measures and incentives.

Table 2. PY2012 - PY2013 Residential Programs and Incentives

Natural Gas and Electric Saving Programs and Measures	2012 Incentive	2013 Incentive
ENERGY STAR Homes		
ENERGY STAR Home with Electric-Only or Electric and Gas	$900	$650
ENERGY STAR Home with Gas-Only	$650	$650
ENERGY STAR Products		
ENERGY STAR Freezer	$20	*N/A*
ENERGY STAR Refrigerator	$25	*N/A*
ENERGY STAR Dishwasher	$25	*N/A*
ENERGY STAR Clothes Washer	$25	*N/A*
High-Efficiency Equipment		
High-Efficiency Natural Gas Boiler or Furnace	$400	$400
High-Efficiency Air Source Heat Pump	$400	$100
Ductless Heat Pump	$200	*N/A*
Variable Speed Motor	$100	$100
High-Efficiency Electric Water Heater	$50	$30
High-Efficiency Natural Gas Water Heater	$50	$30
Home Energy Audit		
Home Audit	No cost to customer	*N/A*
Manufactured Home Duct Sealing		
Duct Testing, Sealing, and Repair	No cost to customer	
Residential Behavior		
Participating Customer	No cost to customer	
Weatherization and Shell		
Attic Insulation	$0.25 per sq. ft.	$0.25 per sq. ft.
Wall Insulation	$0.50 per sq. ft.	$0.50 per sq. ft.
Floor Insulation	$0.50 per sq. ft.	$0.50 per sq. ft.
Fireplace Damper	$100	*N/A*
Electric-Only Programs and Measures		
Space and Water Conversions		
Electric to Natural Gas Furnace	$750	$750
Electric to Air Source Heat Pump	$750	$750
Electric to Natural Gas Water Heater	$200	$200

Second Refrigerator and Freezer Recycling		
Appliance Recycled	$30	$30
Simple Steps, Smart Savings		
Showerhead	Variable upstream buy-down	
Light-Emitting Diode (LED)		
Compact Fluorescent Bulb (CFL)		

"*N/A*" indicates measure offering was eliminated. However, some rebates may have been paid in the early months of the year, as Avista offers customers a 90-day grace period between project completion and when rebate materials must be submitted.

Evaluation Methodology and Information Sources

Cadmus' approach to this residential portfolio-wide process evaluation relied on three main reviews and data-collection efforts. Table 3 indicates which data-collection activities we applied to each program.

Table 3. Data Collection Activities Applied to Each Program

Program Name	Materials Review	Staff Interview	Customer Surveys*
Natural Gas and Electric Programs			
ENERGY STAR Homes	✓	✓	
ENERGY STAR Products	✓	✓	✓
High-Efficiency Equipment	✓	✓	✓
Home Audit	✓		
Manufactured Home Duct Sealing	✓		
Opower	✓	✓	
Weatherization and Shell	✓	✓	✓
Electric-Only Programs			
Second Refrigerator and Freezer Recycling	✓		✓
Simple Steps, Smart Savings	✓		
Space and Water Conversions	✓	✓	✓

*Customer surveys asking specifically about program participation. All residential customers groups targeted in general population studies.

A description of each activity follows below.

Materials and Database Review

Cadmus' document review focused gaining an up-to-date understanding of PY2012 - PY2013 program offerings, planning assumptions, participation, and marketing methods. Our review centered on the following materials:

- Avista's in-house tracking database;

- UCONS' duct sealing tracking data;
- JACO's appliance recycling tracking database;
- CLEAResult invoice summaries;
- Avista's PY2012 and PY2013 DSM Business Plans;
- An internal Avista program implementation manual;
- Avista marketing collateral;
- The Everylittlebit.com website; and
- The Avistautilities.com website.

Program Staff and Market Actor Interviews

Interviews with program staff and market actors provided first-hand insights into program design and delivery processes, and helped evaluation staff interpret the information collected. We conducted program staff interviews in two rounds, one in January 2013 and another in January and February 2014.

Table 4 provides a summary of interview data collection.

Table 4. PY2012 - 2013 Program Staff Interviews

Interviewee Role In Program Delivery	Completed Interviews	
	2013	2014
Avista Program Implementation Staff	2*	2
Avista Policy, Planning, and Analysis Staff	1*	1*
Avista Marketing Staff		1*
Residential Behavior Implementation (Opower) Staff		1

* Multiple non-Cadmus staff participated in interview.

Cadmus interviewed six members of Avista's Washington and Idaho program staff, including:

- Demand-side management (DSM) program managers;
- Planning, Policy, and Analysis (PPA) team members; and
- Marketing staff.

Cadmus conducted these interviews in person in 2012 and by phone in 2013, using prepared interview guides. When necessary, Cadmus requested clarifying information via phone or e-mail. Staff interviews addressed the following topics:

- Changes in measure offerings;
- Goals;
- Program design;

- Implementation:
  - Marketing
  - Target markets
- Tracking; and
- Quality assurance and control (QA/QC) procedures.

Cadmus conducted only one interview with staff representing third-party implementation companies. We determined that this was appropriate for the following reasons:

- Cadmus interviewed representatives from Opower, the Residential Behavior Change program implementer, as this is a new program with high levels of participation.
- Staff from JACO and CLEAResult participated in in-depth interviews in 2012 (to inform the PY2011 evaluation effort) and interviews with Avista staff identified few program changes and limited issues.
- Cadmus did not interview staff implementing the Home Audit or the Manufactured Home Duct Sealing program. The Home Audit program completed in PY2013, and the Manufactured Home Duct Sealing Program is not expected to continue beyond PY2014.

The interview centered on the following topics:

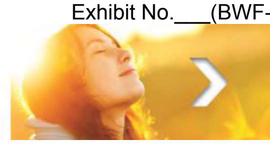
- Goals;
- Program design;
- Implementation;
- Marketing; and
- QA/QC.

Participating and General Population Customer Telephone Surveys

Telephone surveys constituted a large part of PY2012 - PY2013 evaluation data collection activities, informing both impact and process evaluations of several programs. When conducting surveys, we took special care to address potential issues of bias in the following areas:

- Sample selection (which customers to include in the survey sample frames);
- Responses (are customers answering the survey as a group representative of the sample frame); and
- Data analysis and reporting (analysis conducted with an appreciation for the sample selection and limitation of survey data collection).

We conducted all surveys with the assistance of several subcontracted market research firms, selected for their experience with different data collection techniques and market segments.



Participating Customer Surveys

Participant telephone surveys offered important insights into program experiences for six residential measure categories (five programs),[4] exploring the following topics:

- Source(s) of program awareness;
- Satisfaction;
- Awareness of energy efficiency;
- Participation barriers;
- Freeridership and spillover; and
- Customer characteristics.

Cadmus conducted the participating customer surveys in two rounds, one in March and April 2013 and a second in February 2014. This approach ensured that respondents would have a clear recollection of their participation experience. Table 5 provides a summary of unique customers (identified using Avista account number) and surveys completed in each effort.

Table 5. Residential Participant Details and Survey Sample (ID and WA)

Measure Type	2012			2013		
	Participants	Surveys	Percent	Participants	Surveys	Percent
Natural Gas and Electric Programs						
ENERGY STAR Products	6,429	149	2%	782	65	8%
Heating and Cooling Efficiency	3,747	142	4%	2,490	70	3%
Water Heating	629	88	14%	316	60	19%
Weatherization and Shell Measures	692	102	15%	313	60	19%
Electric-Only Programs						
Second Refrigerator and Freezer Recycling	1,351	133	10%	1,319	65	5%
Space and Water Conversions	171	34	20%	156	37	24%
Total	**13,019**	**648**	**5%**	**5,376**	**357**	**7%**

Cadmus designed participant survey completion targets to yield results with 90% confidence and ±10% precision levels, for measure-category level survey results. In 2012, we expanded this approach to yield results at the measure category and state level. Cadmus deemed this necessary as data collected through these surveys—specifically installation rates—were used to inform an impact assessment of

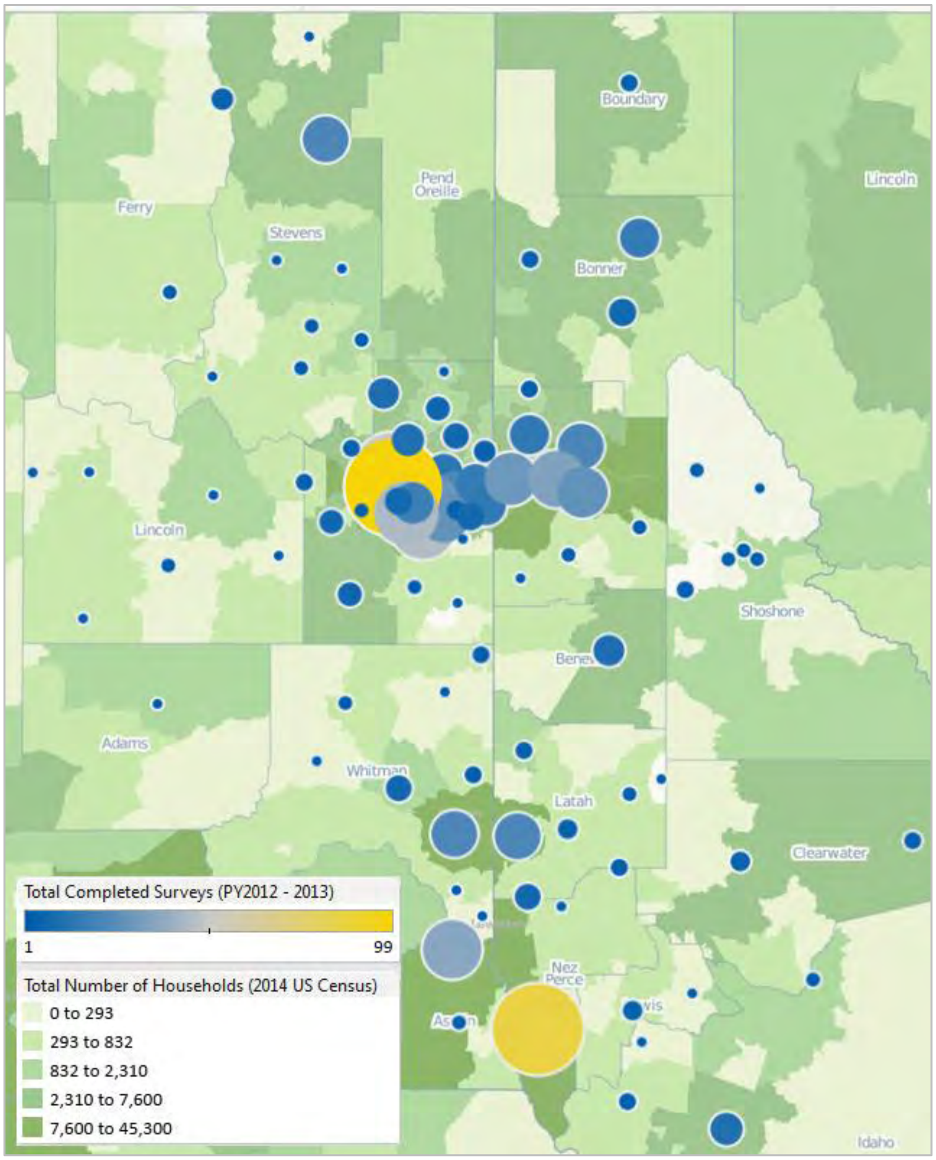
[4] In 2011, Avista combined the Heating and Cooling Efficiency and Water Heating Programs into a single program, High Efficiency Equipment. Given the differences in these measure types and to ensure comparability to survey data collected for earlier evaluations, survey targets and analysis for these respondents remain separated.

Avista's residential programs. The participant survey sampling plan also drew upon multiple factors, including feasibility of reaching customers, program participant populations, and research topics of interest.

Cadmus did not conduct participant surveys with Simple Steps, Smart Savings customers, as that program has an upstream focus and therefore does not track participant contact information. Similarly, for ENERGY STAR New Homes, Cadmus did not survey residential customers purchasing rebated homes because the program paid rebates to builders, not to end-use customers. Cadmus also did not focus evaluation resources on new programs that are subject to review by their own implementation organizations (i.e., Residential Behavior) or temporary programs (e.g., Home Audit).

Within each program stratum, Cadmus randomly selected program participant contacts included in survey sample frames. A review of collected data shows geographic distribution of survey respondents clustered around urban centers, specifically the cities of Spokane, Coeur d'Alene, Pullman, Moscow, and Lewiston. This aligns with population distributions in Avista's service territory. Figure 1 provides the distribution of participating customer survey respondents.

Figure 1. Geographic Distribution of PY2012 - PY2013 Participating Customer Survey Respondents



Given the wide range in program sizes, we weighted survey responses by participation (i.e., unique customers in each measure category) when reporting responses in aggregate, thus ensuring feedback represented the overall population. Table 6 shows the weighting scheme applied to PY2012 - PY2013 survey frequencies. Findings from PY2011 surveys included in comparisons also include post-survey weightings.[5]

[5] *Avista 2011 Multi-Sector Process Evaluation Report*. Cadmus. 2012.

Table 6. PY2012 - 2013 Participant Survey Sample Design and Weights by Program

Measure Type	Participants " A"	Surveys " B"	Weight "A / B"
2012 Population and Achieved Surveys			
ENERGY STAR Products	6,429	149	43.15
Heating and Cooling Efficiency	3,747	142	26.39
Water Heating	629	88	7.15
Weatherization and Shell Measures	692	102	6.78
Second Refrigerator and Freezer Recycling	1,351	133	10.16
Space and Water Conversions	171	34	5.03
2013 Population and Achieved Surveys			
ENERGY STAR Products	782	65	12.03
Heating and Cooling Efficiency	2,490	70	35.57
Water Heating	316	60	5.27
Weatherization and Shell Measures	313	60	5.22
Second Refrigerator and Freezer Recycling	1,319	65	20.29
Space and Water Conversions	156	37	4.22

General Population Customer Surveys

Cadmus conducted two market characterization studies to build on previous evaluation findings and supplement data from available regional resources, such as NEEA's Residential Building Stock Assessment (RBSA). The purpose of this data collection was to help strengthen Avista's understanding of:

- Saturation of key energy-efficiency measures;
- Key demographic and housing characteristics; and
- Energy-use awareness, attitudes, and behaviors.

Our primary market research activity consisted of a multi-method survey that leveraged direct mail, online web interface, and telephone calls to allow customer to complete the survey in the most convenient way. The goal of these surveys was to characterize Avista's residential customers and allow Avista to identify savings opportunities and possible new measure offerings. Cadmus also used this data collection as a way to quantify nonparticipant customer spillover. We provide additional discussion on this topic below.

Table 7. Residential General Population Surveys Completed in 2012 and 2013

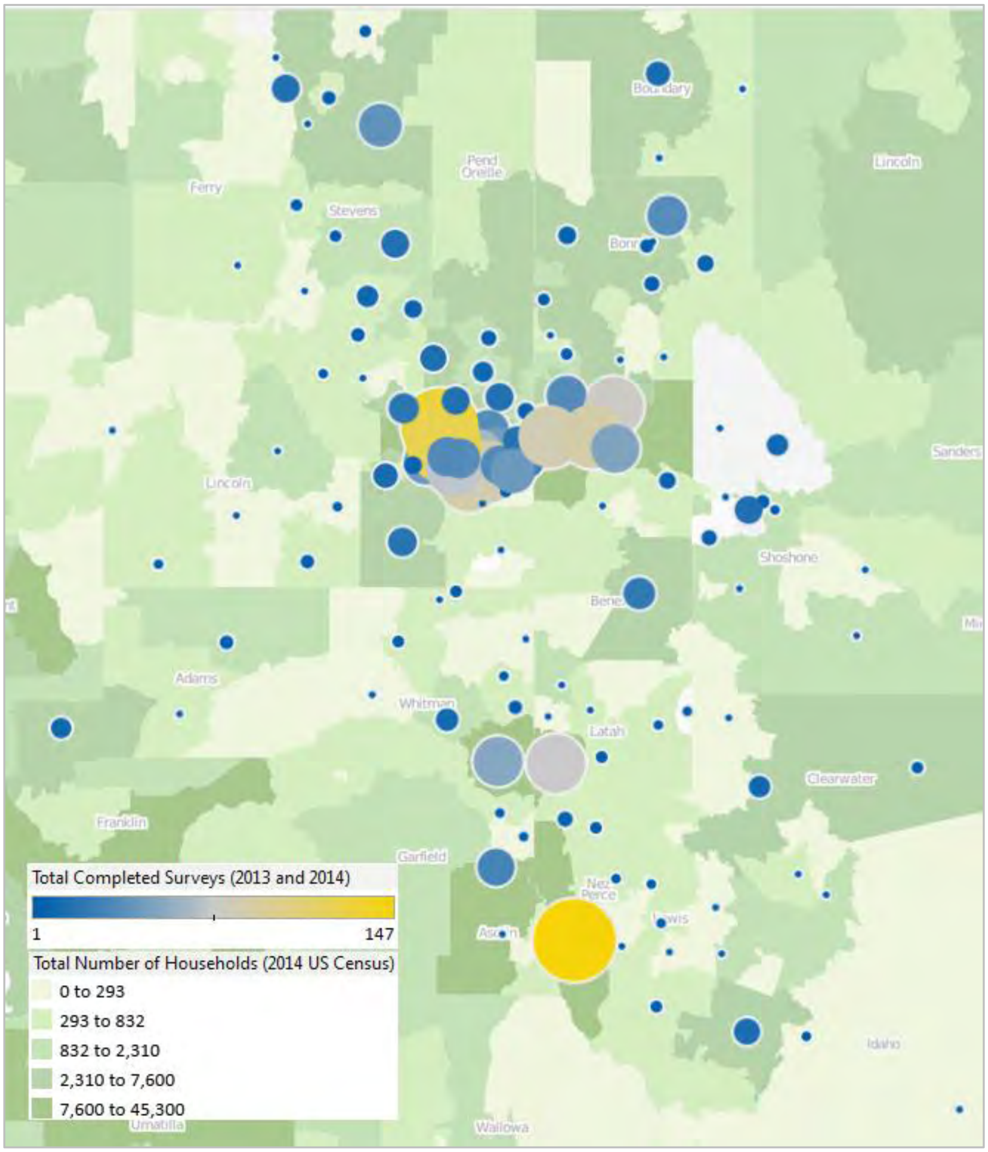
Measure Type	Completed Surveys		Total
	Washington	Idaho	
2012 Survey Effort (n=1,051)			
Paper Survey	544	313	857
Online Survey	58	36	94
Telephone Survey	69	31	100
2013 Survey Effort (n=1,109)			
Paper Survey	589	330	919
Online Survey	60	30	90
Telephone Survey	65	35	100
Total	**1,385**	**775**	**2,160**

Cadmus did not apply weights to survey frequencies during analysis. We based this decision on the following rationale:

- Customers included in the general population survey sample frames were chosen at random from Avista's entire residential population.
- The only screening was for completeness of customer contact information and removal of customers targeted as part of other EM&V surveys conducted in 2011 and 2012.
- Cadmus concluded that there is no correlation between an inherent customer trait or characteristic and the method of responding to the survey chosen.

Similar to the participant survey, the geographic distribution of survey respondents is clustered around urban centers. Figure 2 provides the distribution of general population survey respondents.

Figure 2. Geographic Distribution of 2013 and 2014 General Population Survey Respondents



All participating customer and general population survey proportions reported below only include feedback from respondents who could provide feedback—i.e., “don’t know” and “refuse” responses are not included in our reporting unless noted.

Status of Evaluation Recommendations

Avista retained Cadmus to perform annual process and impact evaluations of their residential program portfolio beginning PY2010. These evaluation activities, findings, conclusions, and recommendations are articulated in the following reports: Avista 2010 Multi-Sector Process Evaluation Report and Avista 2011 Multi-Sector Process Evaluation Report.[6]

In this evaluation effort, Cadmus reviewed the recommendations offered in these documents and assessed to what degree Avista had adopted these recommendations (by the end of PY2013). As indicated in Table 8, Avista made significant progress toward addressing these recommendations.

Table 8. Status of PY2010 and PY2011 Residential Process Recommendations

Status	PY2010 Evaluation	PY2011 Evaluation
Complete	8	4
In Progress	5	6
Limited Activity	2	2

A complete summary of recommendations and activity for addressing these recommendations is provided in Appendix A: Status of PY2010 and PY2011 Residential Evaluation Recommendations.

Program Participation

Savings and Incentives

Table 9 provides the number of incentive-based measures and reported savings. The PY2012 and PY2013 Avista Impact Evaluation Reports explore the savings shown in Table 9 in detail.

[6] *Avista 2010 Multi-Sector Process Evaluation Report*. Cadmus. 2011.
Avista 2011 Multi-Sector Process Evaluation Report. Cadmus. 2012.

Table 9. PY2012 - PY2013 Program Populations and Adjusted Gross Savings

Measure Type	PY 2012 Measures	PY 2013 Measures	PY 2012 - PY 2013 Reported Savings	
			MWh	Therms
Natural Gas and Electric Programs				
ENERGY STAR Homes	42	18	92	5,478
ENERGY STAR Products	7,233	857	898	13,204
High-Efficiency Equipment	5,906	3,670	1,029	555,076
Home Audit	477	0	0	0
Manufactured Home Duct Sealing	574	1,719	2,594	41,978
Opower	0	73,497	9,091	239*
Weatherization and Shell	928	421	251	89,100
Electric-Only Programs				
Second Refrigerator and Freezer Recycling	1,438	1,415	1,580	0
Simple Steps, Smart Savings	435,561	596,828	49,373	0
Space and Water Conversions	187	168	3,839	0
Total	**452,346**	**678,593**	**68,747**	**705,075**

*Therm savings from the Opower program were very small and were not statistically significant.

A thorough discussion of the adjusted gross savings provided in Table 9 can be found in PY2012 - PY2013 impact evaluation reports.

Participation Trends

A review of Avista's residential portfolio over the past several years indicates several significant transitions, specifically:

- A sharp increase and subsequent decrease in participation in the ENERGY STAR Products and Weatherization and Shell Programs (between 2008 and 2013);
- Elimination of natural gas rebates in Idaho (November 1, 2012);
- Reduction in the number of rebates offered for appliances (March 1, 2013); and
- Commitment to developing and implementing new programs.

Cadmus combined historical participation data from PY2008 through PY2013 to assess participation in Avista's rebate programs at the program level. These data, shown in Figure 3, clearly indicate increased participation from PY2008 to PY2010, followed by a similarly abrupt decline in participation between PY2011 and PY2013.

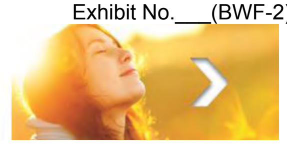
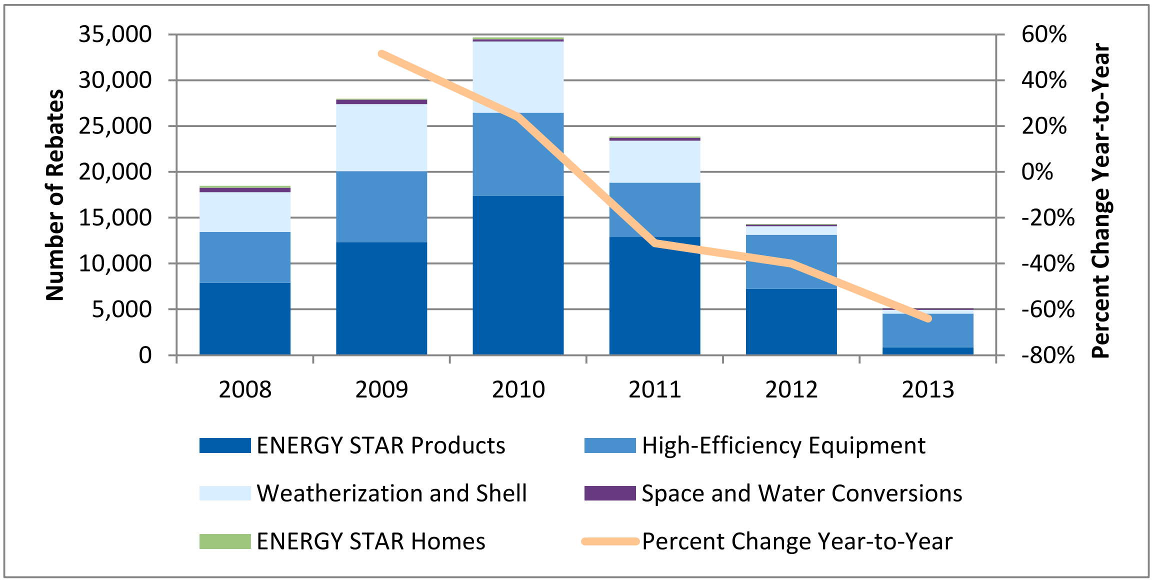
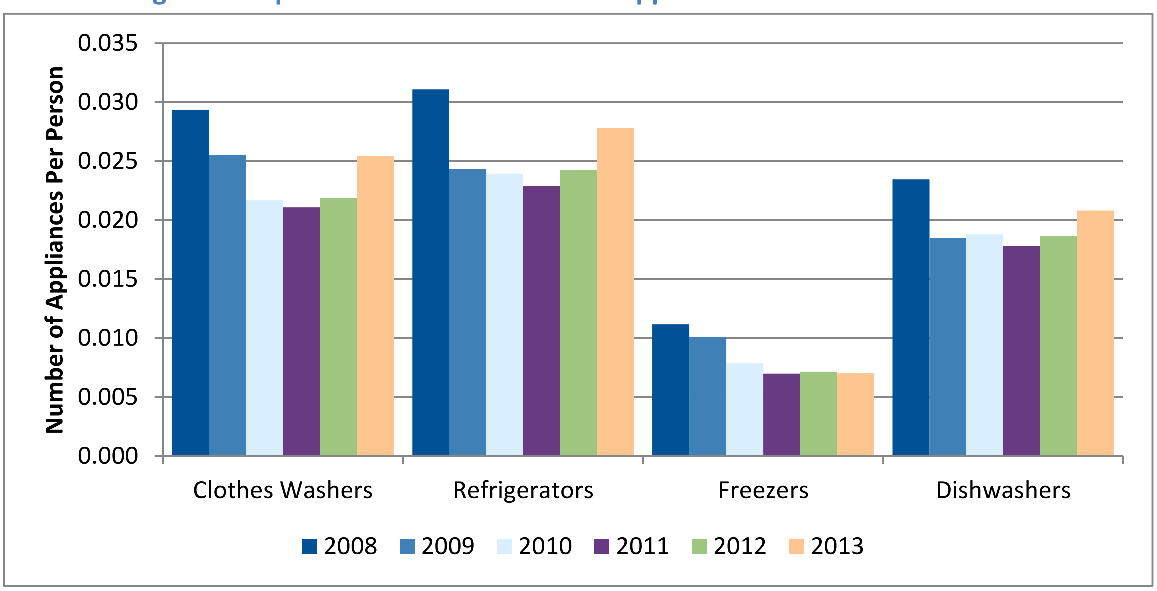


Figure 3. Reported Number of Rebates by Avista-Implemented Program: PY2008 - PY2013



This trend runs against trends observed in appliance sales data in Washington and Idaho for the same period. Overall sales generally dipped at the height of the recession and have since rebounded. Figure 4 shows population-normalized sales of several appliances in the ENERGY STAR Products Program (both code and high-efficiency) as reported by the Association of Home Appliance Manufacturers (AHAM) for Washington and Idaho from 2008 through 2013. This indicated that during this time period, a higher percent of appliance sold were likely high-efficiency.

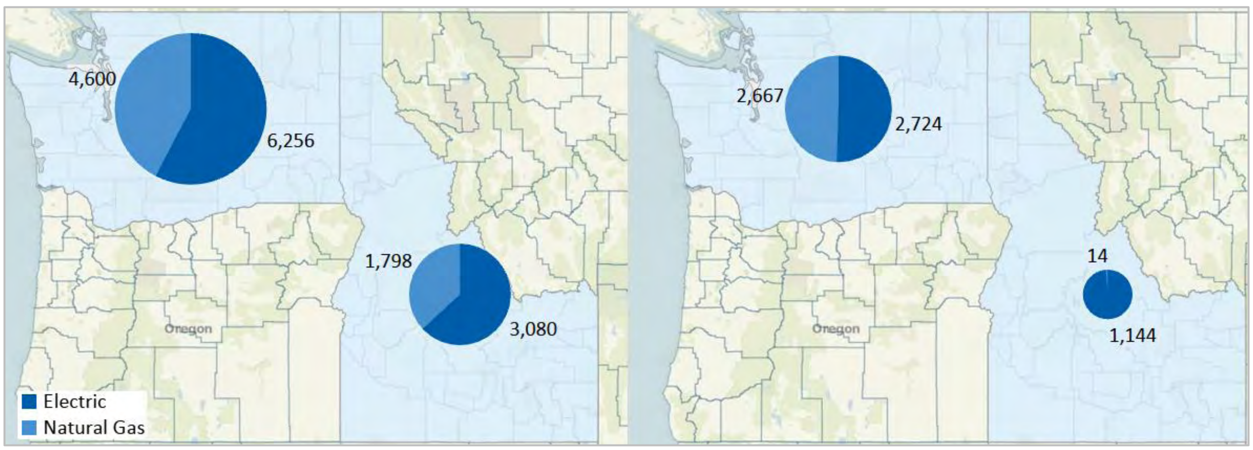
Figure 4. Population-Normalized AHAM Appliance Sales Data: 2008 - 2013



Several explanations account for this decline in program participation. During interviews conducted to inform the PY2011, PY2012, and PY2013 evaluations, Avista staff reported that a major driver of the change was the expiration of many federal and state tax credits for energy-efficiency renovations and high-efficiency appliances offered under the American Recovery and Reinvestment Act of 2009. Staff reported these tax credits prompted increased participation in late 2009 and 2010, and beginning in 2011, participation slowed without that influence. This effect was particularly noticeable in the Weatherization and Shell Program.

Another main cause of decline was the suspension of Avista's natural gas program in Idaho beginning November 1, 2012 and plans to suspend natural gas programs filed in Washington. These changes led to a dramatic change in the fuel composition of the residential programs between PY2012 and PY2013. Figure 5 provides a graphical depiction of this change. The few natural gas incentives paid in Idaho in PY2013 were for applications submitted prior to the program change.

Figure 5. Distribution of Rebates from Avista-Implemented Program Fuel Type: PY2012 - PY2013



Finally, in 2013 Avista also eliminated the ENERGY STAR appliance rebates (e.g., refrigerators, clothes washers, etc.). A primary driver of this decision was increasingly high observed customer freeridership in these measures and decreasing measureable gross savings. While Avista implemented this change in the beginning of PY2013, Avista continued to process appliance rebates for projects installed within the established 90-day grace period. This resulted in numerous units incented in the first half of 2013. Avista took this approach to limit customer confusion and dissatisfaction around termination of the measure offerings.

Not surprisingly, these changes had a large impact on the most common types of measures incented through Avista's program. Table 10 shows the most common measures incented in PY2011 - PY2013 by state, and the percent of rebates they represented.

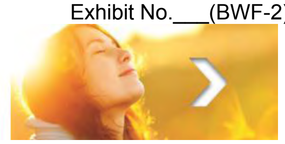


Table 10. Most Common Incented Measures: PY2011 - PY2013

Rank	2011		2012		2013*	
	Measure	Pct.	Measure	Pct.	Measure	Pct.
Washington Measures						
1	Refrigerator	15%	Natural Gas Furnace	22%	Natural Gas Furnace	47%
2	Natural Gas Furnace	12%	Refrigerator	17%	Variable Speed Motor	16%
3	Clothes Washer, Electric H20	11%	Clothes Washer - Electric Water Heater	12%	Refrigerator	6%
4	Clothes Washer, Natural Gas water Heater	11%	Clothes Washer - Natural Gas Water Heater	11%	Attic Insulation - Natural Gas Heat	4%
5	Window Replacement	8%	Variable Speed Motor	8%	Clothes Washer - Electric Water Heater	4%
Idaho Measures						
1	Refrigerator	16%	Furnace	23%	Variable Speed Motor	31%
2	Clothes Washer, Electric H20	14%	Refrigerator	19%	Clothes Washer - Electric Water Heater	20%
3	Furnace	13%	Clothes Washer - Electric Water Heater	14%	Refrigerator	14%
4	Clothes Washer, Natural Gas Water Heater	10%	Variable Speed Motor	10%	Air Source Heat Pump	12%
5	Dishwasher, Electric H2O	8%	Clothes Washer - Natural Gas Water Heater	8%	Air Source Heat Pump - Electric Heat	6%

= Natural Gas Measure

* Avista eliminated refrigerator and clothes washer measures March 1, 2013, but allowed rebates for projects completed in the 90-day grace period. This resulted in numerous rebates processed in the first half of the year.

Despite cancelling natural gas rebates in Idaho, a review of program tracking data indicates only a small decrease in the percentage of Avista customers applying for multiple program rebates in a given program year. Over the past three years, PY2011 - PY2013, approximately one-quarter of participants applied for more than one rebate. Table 11 shows the results, which exclude participants in the lighting, refrigerator recycling, and behavior programs, as these are not rebate programs.

Table 11. Number of Measures Installed

Number of Rebates in a Given Year	Count 2011		Count 2012		Count 2013	
	Count	Percent	Count	Percent	Count	Percent
One	14,062	77%	8,953	78%	2,813	74%
Two	3,127	17%	1,936	17%	815	21%
Three	784	4%	424	4%	153	4%
Four	172	1%	91	1%	27	1%
Five or more	75	0%	46	0%	15	0%
Total	**18,220**	**100%**	**11,450**	**100%**	**3,823**	**100%**

It is not uncommon for customers to participate multiple times over several years, although, as indicated in Table 12, this is becoming less common. This downtick is likely the result of more limited rebate offerings, particularly in Idaho, than in previous years.

Table 12. Percent of Participants that Participated the Previous Year

Category	Percent
2011 participants that participated in 2010	13%
2012 participants that participated in 2011	10%
2013 participants that participated in 2012	4%
2013 participants that participated in 2011 and 2012	1%

Customer intentions expressed in PY2013 and PY2012 participant surveys show that the decline is not likely due to lack of customer interest. As indicated in Figure 6, when asked if they thought they would apply for additional rebates in the future, more than half of PY2013 respondents in every program answered in the affirmative. Further, we see a strong increase in the respondent interest in participation compared to results from PY2012 across all programs.

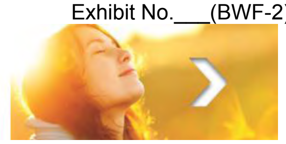
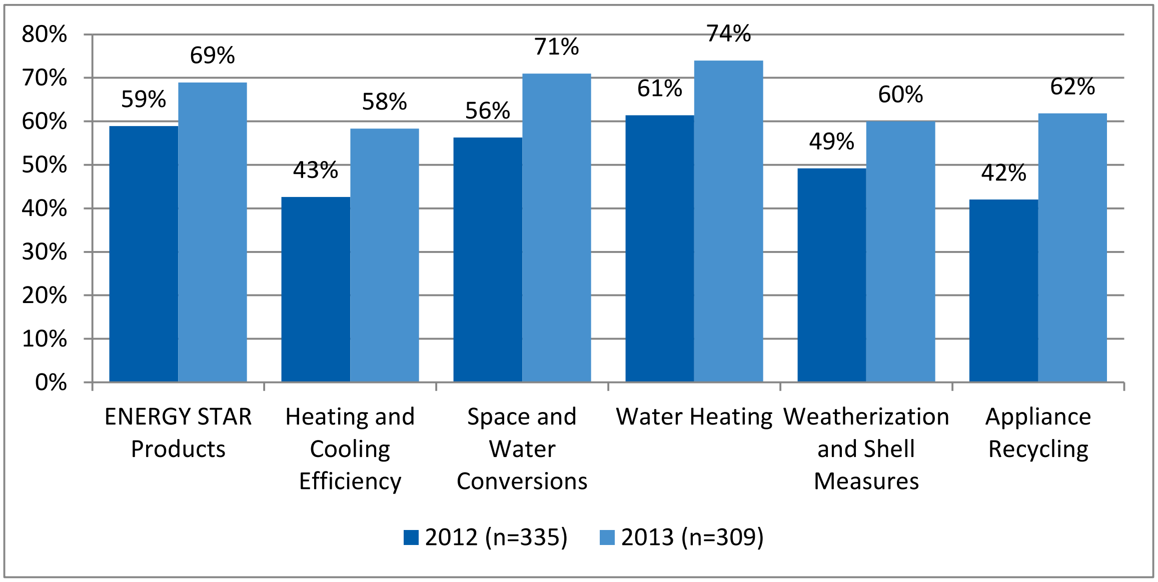


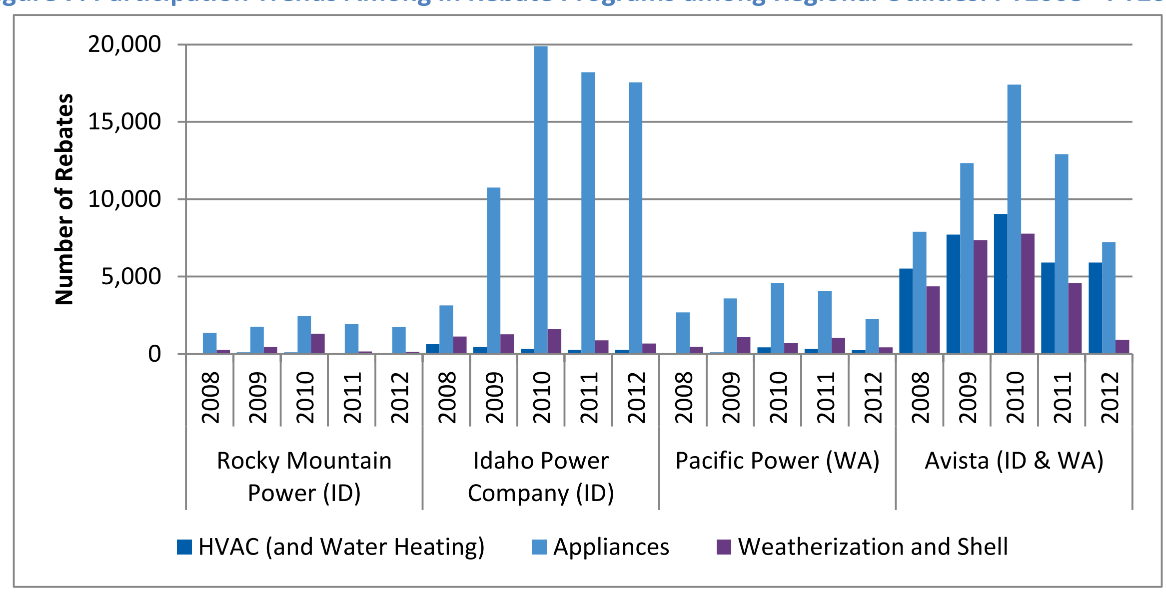
Figure 6. Customer Interest in Repeat Program Participation



The decline in rebate program participation is significant, but review of annual reports from other utilities in the region—Pacific Power in Washington, and Rocky Mountain Power and Idaho Power Company in Idaho—indicate similar reductions in participation in their electric rebate programs with comparable measure offerings.

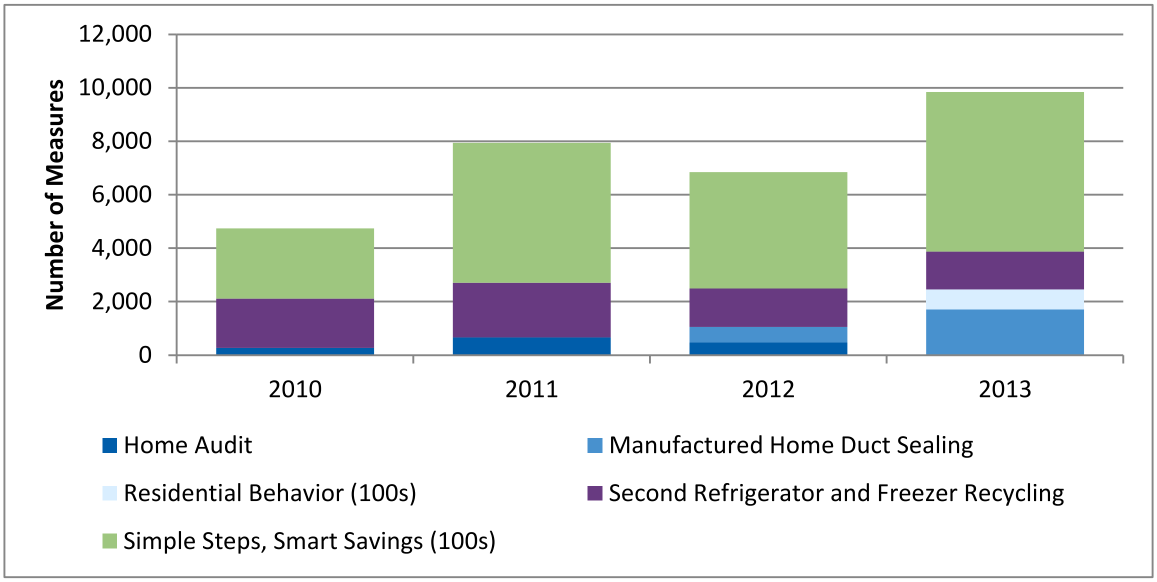
Figure 7 provides the number of reported rebates, by category, from year to year. All three utilities have experienced net negative growth, without exception, in the number of participants in these measure categories since 2011.

Figure 7. Participation Trends Among in Rebate Programs among Regional Utilities: PY2008 - PY2012



While participation in Avista's rebate programs has steadily declined for the last three years, Avista has maintained its commitment to third-party implemented programs—such as Second Refrigerator and Freezer Recycling—and regional programs such as Simple Steps, Smart Savings. Due to this support, participation in these programs has generally remained level or increased. In addition, in PY2012 - PY2013 Avista successfully implemented two pilot programs and a large, fully developed behavior change program. Figure 8 provides a summary of customer participation in these programs. For some programs, participation is shown in "100s" as participation in these programs is significantly higher than others.

Figure 8. Reported Number of Rebates by Non-Avista-Implemented Program: PY2010 - PY2013

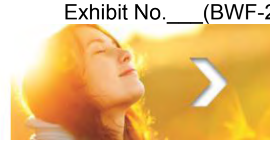


A possible reason for growth in the Simple Steps, Smart Savings Program is the recent introduction of two additional measures: energy-efficient showerheads (introduced in PY2012); and LEDs (introduced in PY2013). Table 13 provides additional detail on uptake of these new measures.

Table 13. Simple Steps, Smart Savings Measures Incentives in PY2012 - PY2013

Program Year	Showerheads		CFLs		LEDs		Total	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
2012	1,784	0%	426,894	100%	0	0%	428,678	100%
2013	1,011	0%	564,300	95%	31,517	5%	596,828	100%

Another possible reason is the increase in the number of participating locations. According to invoice materials, 92 locations participated in PY2012 compared to 125 in PY2013. These additional locations give Avista customer greater access to incented measures.



Program Design, Management, and Implementation

This section discusses Cadmus' observations regarding design of Avista's residential programs. These observations focused on program definition and organization, logic, and implementation approach.

Overview

Overall, we found Avista's the residential program designs work well and are generally well-documented, primarily in the PY2012 and PY2013 DSM Business Plans. Further, we found Avista management and implementation organization staff to be knowledgeable about the programs and invested in their ongoing success. In general, the PY2012 and PY2013 the programs operated smoothly, with few significant issues.

However, Cadmus did find one persistent program design issue. First noted in Cadmus' 2010 residential program process evaluation,[7] the naming convention of programs composing the residential portfolio is somewhat inconsistent across Avista Business Plans, marketing materials, and internal documents. In reviewing materials, it became clear that programs are often referred to with different names, and are organized differently within the portfolio. Table 14 identifies several programs as examples.

Table 14. Example of Residential Program Naming Convention

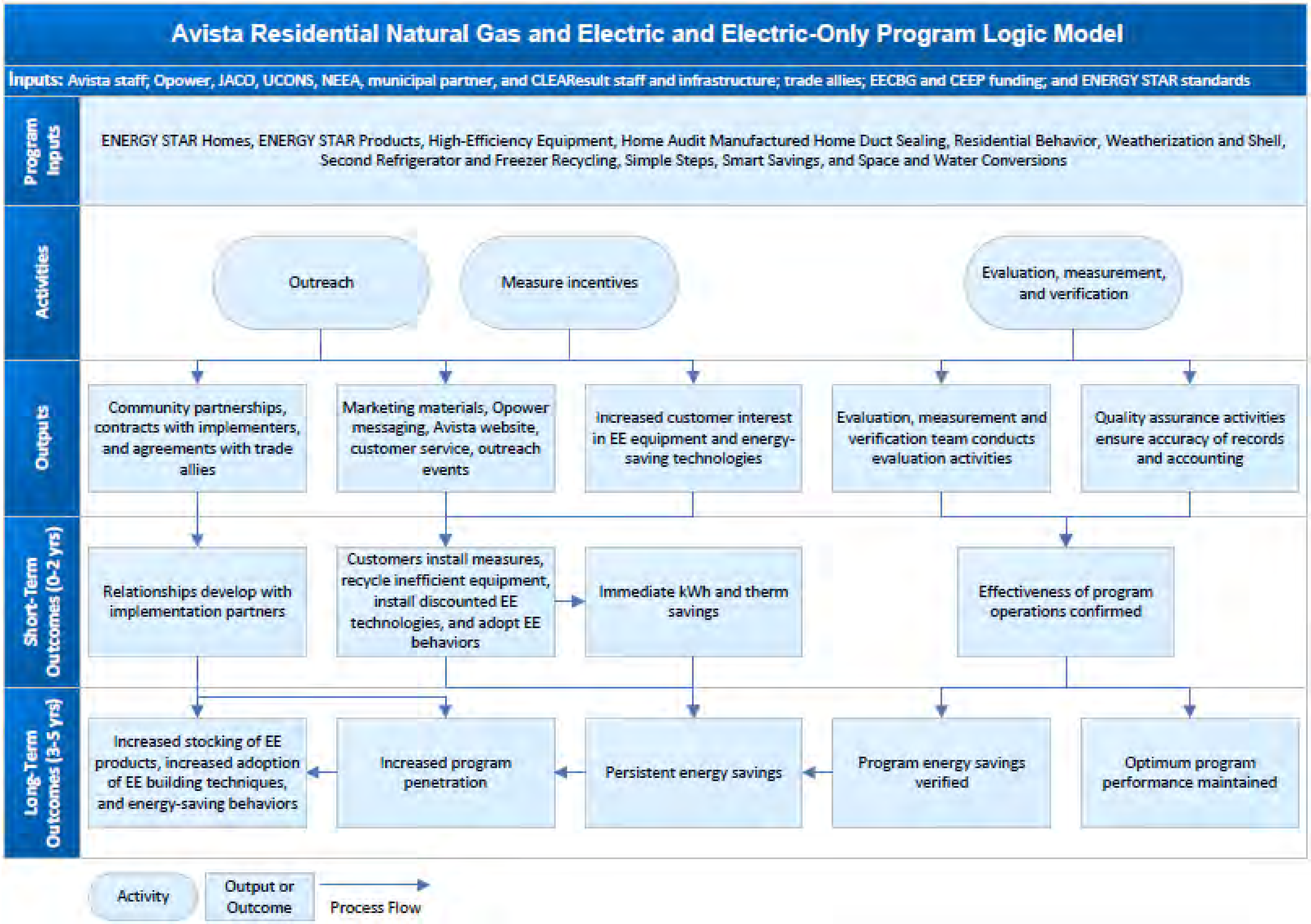
2013 DSM Plan		Customer-Facing Materials	
Group	**Program Name**	**Group**	**Program Name**
Residential Programs	HVAC	New Construction / Home Improvement	High Efficiency Equipment
	Shell	Home Improvement	Weatherization
	Fuel-Efficiency		Conversion from Electric
	ENERGY STAR Homes	ENERGY STAR Homes	ENERGY STAR / ECO-Rated Homes

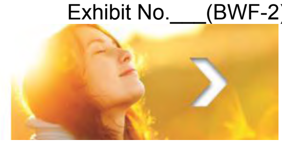
Program Logic

Camus developed the logic model provided as Figure 9 to articulate the logic behind the residential programs included in this evaluation.

[7] *Avista 2011 Multi-Sector Process Evaluation Report*. Cadmus. 2012.

Figure 9. Avista Residential Program Logic Model





Implementation Approaches

The residential portfolio includes programs with Avista administers, programs with third-party implementers, and programs operated as partnerships. This section summarizes our observations regarding Avista's implementation decisions for each residential program.

Avista residential programs are implemented both internally and with the assistance of several third-party organizations. Table 15 provides a summary.

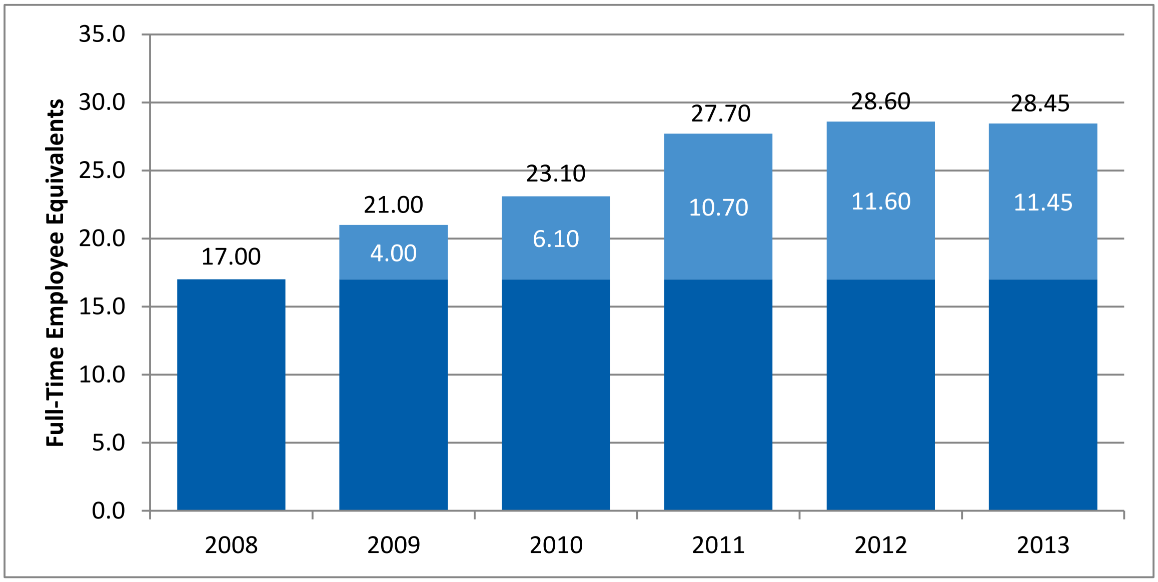
Table 15. Avista Residential Program Implementation Approach

Program	Implementer	Avista's Role / Responsibilities
Natural Gas and Electric Programs		
ENERGY STAR Homes	Avista and NEEA	Mgmt., marketing, QA/QC, and rebate payment
ENERGY STAR Products	Avista	All implementation activities
High-Efficiency Equipment	Avista	
Home Audit	Municipal Partners	Mgmt., marketing, QA/QC, and funding
Manufactured Home Duct Sealing	UCONS	
Residential Behavior	Opower	Mgmt. QA/QC, and invoice payment
Weatherization and Shell	Avista	All implementation activities
Electric-Only Programs		
Second Refrigerator and Freezer Recycling	JACO	Mgmt. QA/QC, and invoice payment
Simple Steps, Smart Savings	CLEAResult	
Space and Water Conversions	Avista	All implementation activities

Staffing

Despite these implementation partnerships, over the past several years, Avista has continued to invest in the implementation and management of its energy-efficiency portfolio. A review of Avista DSM labor projections articulated in the 2012 and 2013 DSM Business Plans indicates a generally increasing number of full-time-equivalent (FTE) staff dedicated to program implementation and management activities (Figure 10).

Figure 10. Avista DSM Labor Projections: PY2008 - PY2013



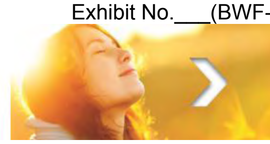
Also reflected in this staffing increase is the addition of a third and fourth Avista program manager in 2012. Avista added these program managers for the additional work associated with the Residential Behavior and Manufactured Home Duct Sealing Programs. Both staff had previous experience with Avista's residential energy-efficiency programs. Interviews with Avista staff indicate staffing levels during PY2012 and PY2013 were adequate and no significant implementation staffing issues arose.

The four program managers have responsibilities beyond residential program management. To support these program managers, a team of staff contributed to day-to-day program operations, including customer outreach, application review and processing, and data management. In addition to oversight, the program managers also conduct regular quality-assurance tasks. For example, the program manager responsible for Simple Steps, Smart Savings regularly visited participating retail stores to ensure correct prices and correct display of point-of-purchase signage.

As Cadmus did not study Avista's costs in administering these programs, this report does not address their relative efficiency. However, following a recommendation in the PY2011 process evaluation report, Avista and Cadmus staff discussed the possible benefits of contracting elements of the program implementation (e.g., rebate processing). The conversations, while focused, identified no compelling reasons for Avista to consider transferring additional program elements to third-parties at that time.

Customer Interaction

Feedback from Avista staff indicates customer satisfaction is a high priority for the organization, and energy-efficiency programs are viewed as a powerful method to engage with customers. To ensure customer satisfaction, Avista staff take care in program marketing to limit messaging that might confuse customers—such as why natural gas rebates are available in Washington but not Idaho—and to process rebate applications promptly—a common area for customer dissatisfaction in utility rebate programs.



A review of program data indicates Avista has a strong record of processing rebates within days of receipt, although in PY2013 processing time slipped slightly (Table 16). This increased processing time is likely related to the elimination of the appliance rebates, leaving only the more complicated rebate applications that may take longer to process.

The increase in processing time shown in Table 16, two days on average in PY2013 compared to less than a day in PY2012 and PY2011, is also primarily the result of a few applications with processing times far outside the normal range (e.g., greater than 100 days) skewed the average processing time upward. Many of these database entries contain notes indicating issues with customer application completeness.

Table 16. Rebate Processing Times: PY2011 - PY2013

Rebate Processing Time (Days)	2011	2012	2013
Average number of days	**0.43**	**0.61**	**2.12**
Less than one day	73%	80%	56%
One day	19%	10%	17%
Two days	2%	2%	4%
Three days	4%	3%	4%
Four days	1%	2%	5%
Five or more days	1%	2%	14%

To achieve these quick application reviews, Avista implements a structured review process supported by several internal staff. Review staff also regularly follow up directly with customers via telephone calls in the evening, when customers are likely to be home, to address application issues directly. In addition, an increased percent of participants are submitting their application paperwork in electronic format online (Table 17).

Table 17. Percent of Applications Submitted In Electronic Format Online by Program

Program	2012	2013
All programs	**5%**	**14%**
ENERGY STAR Homes	2%	6%
ENERGY STAR Products	2%	2%
High-Efficiency Equipment	8%	17%
Weatherization and Shell	7%	8%
Space and Water Conversions	5%	12%

To inform both the impact and process assessments, Cadmus conducted desk reviews of more than two hundred applications in 2013 and 2014. Table 18 provides a summary.

CADMUS

Table 18. Summary of Cadmus Desk Reviews

Application Type	PY2012 Evaluation	PY2013 Evaluation
ENERGY STAR Homes	20	18
ENERGY STAR Products	106	119
Home Improvement *(HE equipment, weatherization, and conversion)*	100	102
Total	**226**	**239**

While application processing is generally quick, Cadmus' review of original application materials from PY2012 and PY2013 identified some issues with completeness of documentation. Table 19 lists elements that were missing in original application materials, as identified in our application review. No issues were identified in ENERGY STAR Home applications.

Table 19. Summary of Missing Application Elements

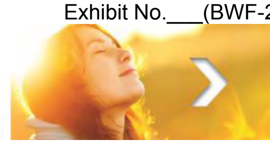
	Invoice	Energy Guide Label	AHRI Certificate
PY2012 Review			
ENERGY STAR Products	1	36	
Home Improvement	1		19
PY2013 Review			
ENERGY STAR Products	2	23	
Home Improvement			14

Internal Communication

During the PY2011 process evaluation effort, Cadmus identified different perspectives among Avista staff around program planning and goal setting. In the PY2011 report, we noted: *"program managers depicted the Planning, Policy, and Analysis (PPA) team as the driver of the planning processes, while the PPA team noted program planning was the responsibility of the program managers. This disconnect appeared to result in unmet expectations for both teams, and may have impeded effective collaboration."*

To address this and other collaboration issues, between PY2012 and PY2013, Avista invested heavily in a self-evaluation of internal communication protocols (primarily between engineers, account executives, program managers, and PPA staff), and staff roles and responsibilities. To facilitate this assessment, Avista retained the services of Milepost Consulting, a third-party consulting firm specializing in process improvement. Cadmus was not directly involved in these activities.

According to Avista staff, this self-evaluation effort has had a limited impact in addressing the issues, and communication and collaboration between groups continues to present challenges. Further, Avista initiated a reorganization of the DSM team in April 2014, which placed program implementation and PPA staff under one common Senior Director. Cadmus strongly supports Avista's commitment to internal process improvements and decision to adjust the internal organization.



Third-Party Program Implementation

Avista uses third-party implementation contractors for four programs, not including the Home Audit Program: (1) Manufactured Home Duct Sealing; (2) Residential Behavior; (3) Second Refrigerator and Freezer Recycling; and (4) Simple Steps, Smart Savings. We provide a summary of these arrangements and an assessment of their effectiveness in the Effectiveness of Implementers section, below.

Effectiveness of Implementers

Using third-party implementers presents advantages and disadvantages. Generally, utilities maintain direct implementation of programs requiring intimate knowledge of unique customers (e.g., large commercial and industrial customers). Programs benefitting from a uniform approach involve national accounts, or require certain market expertise available from a third-party firm. Research conducted for this—and previous—Avista evaluation efforts leads us to conclude that Avista has succeeded in identifying which programs are most suitable for third-party contracting and partnering.

The PY2011 evaluation report provides the results of detail interviews conducted with implementation staff at JACO and CLEAResult. As few changes have been made to these programs since these interviews took place in late spring 2012, we focused our evaluation efforts on Opower. Opower implements the Residential Behavior Program, which began in June 2013.

Opower

Opower is a publicly held (as of April 4, 2014) software-as-a-service company that partners with utilities to implement behavior-change programs. Based in Arlington, Virginia, Opower has been involved in the energy-efficiency space since 2007 and currently partners with nearly 100 utilities in the United States and abroad.[8] In April 2014, Cadmus staff interviewed the Opower sales and engagement manager responsible for Avista's program.

Residential Behavior Program Description

The Residential Behavior Program encourages electric customers to implement free or low-cost measures and adopt energy use practices and behaviors that reduce electric consumption. Program participants were selected by Avista (with support from Opower and Cadmus) and receive a Home Energy Report from Opower in the mail. All customer calls are addressed by Avista's call center. The Home Energy Reports include the following information:

- Comparisons of a customer's usage in the current year to consumption in the same months in the previous year.
- Comparison of a customer's consumption to consumption of other, comparable customers in the same geographical area. This is known as the "Neighbor Comparison."
- Tips about how to save energy and reduce demand during peak times. These tips include:

[8] Opower. April 8, 2014. http://opower.com/company.

- General conservation tips such as turning down the thermostat, turning off lights, shortening showers, etc.
- Low-cost energy-efficiency tips, such as replacing incandescent bulbs with CFLs, installing weather stripping, and using power strips.
- Tips about ways to reduce peak loads during peak load season and shift energy use to off-peak periods.
- Information on other Avista residential programs.

No financial incentives are provided through this program.

According to the program theory, by educating customers about their energy use and conservation strategies, customers will gain knowledge to increase their energy efficiency and achieve cost savings. In addition, customers will become more engaged with Avista.

Currently Opower reports only electric savings to Avista, although some customers may also have natural gas service and may take actions to reduce their use of this fuel as well. Avista and Opower may take steps to quantify these savings in the future.

Residential Behavior Program Implementation

Avista implemented this program using an experimental research design with random assignment of customers eligible for the program to treatment and control groups. From their residential customer population, Avista, with support from Opower and Cadmus, selected approximately 70,000 customers for inclusion in a treatment group and 13,000 customers in two, state-specific, control groups (a total of 26,000 customers). Avista did not consider natural gas-only customers. Based on initial cost-effectiveness analysis for program planning, Avista set a minimum energy consumption threshold of 18,000 kWh per year for targeted households. In order to fully populate the participant and control groups in both Washington and Idaho, Avista reduced this threshold to approximately 16,000 kWh as the program was deployed.

Treatment group customers received Home Energy Reports beginning in June 2013 and then according to the schedule provided in Table 20. To use implementation resources such as printing and call center staff as efficiently as possible, Opower mails reports in batches staggered throughout the month. Control group customers did not receive Home Energy Reports and were not informed that they belonged to the control group. Opower uses this general approach for most of the programs it implements.

Table 20. Home Energy Report Deliver Schedule

	PY2013						PY2014				
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Home Energy Reports sent	✓	✓	✓		✓		✓		✓		✓

Opower works with Avista's billing department to access customer billing data. Using these data, Opower staff quantify program kWh savings. Cadmus reviewed the saving estimates as part of the PY2013 impact assessment and performed an independent billing analysis to determine gas and electric savings.[9]

According to Opower implementation staff, the Residential Behavior Program has operated as anticipated since inception with only minor challenges. Staff report a very strong relationship with Avista, noting the Avista team is: *"super responsive, very polite, and very nice to deal with…overall it's one of the health[iest] client relationships we have."* The only challenge noted has been with the customer usage data used to populate the Home Energy Reports, but both Opower and Avista are aware of the issue and are working to streamline the process.

Participant feedback to the program has been positive. While data were not readily available for this evaluation, implementation staff estimated that—so far—less than one percent of participants have contacted Avista expressing dissatisfaction in the program, and opt-out rates are lower than expected. Only 1.0% of customers in Washington and 1.1% of customers in Idaho have requested to be removed from program mailings as of April 2014.

Future of the Residential Behavior Program

Given the success of the program, in terms of both implementation and achieved energy savings, Avista and Opower have discussed the possibility of either expanding the program or fine-tuning by targeting specific customer groups. No firm plans are in place, but discussions around this topic are scheduled for later in spring 2014 in order to consider results of Cadmus' impact evaluation of the program. Given that Avista has already included all cost-effective customers in their target population for this program, future opportunities for expansion may be limited.

Data Tracking

For each residential program evaluated, Avista or the program implementer provided Cadmus with tracking data. Tracking data were contained in five separate files:

- Avista's internal, multi-program tracking database;
- Manufactured Home Duct Sealing tracking spreadsheets;
- JACO tracking database;
- Opower tracking database; and
- Simple Steps, Smart Savings invoice material.

Cadmus examined each dataset to:

[9] *Avista 2012-2013 Washington Electric Impact Evaluation Report.* Cadmus. 2014.
Avista 2012-2013 Idaho Electric Impact Evaluation Report. Cadmus. 2014.

- Determine data fields tracked;
- Inform process and impact evaluation activities; and
- Assess the data-tracking processes' effectiveness.

The assessment also sought to identify potential evaluability barriers presented by current tracking processes.

Data Tracking Summary

Avista's Internal Multi-Program Tracking Database

The tracking database included participant, measure-level data for the following programs:

- ENERGY STAR Homes;
- ENERGY STAR Products;
- High-Efficiency Equipment;
- Home Audit;
- Weatherization and Shell; and
- Space and Water Conversions.

The internal, multi-program database serves as the electronic repository for customer data collected from application forms, including data for programs Avista implements internally. The two annual extracts provided for this evaluation effort contained 38 variables, constituting six kinds of information. Table 21 summarizes these data.

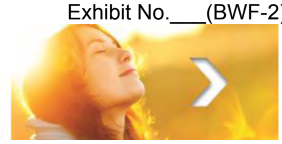
Table 21. Avista Internal Tracking Database Fields

Database Fields	Data Type	Example Field Names
Customer Information	Number / Text	*"State, CUSTOMER_NME, Home Sq Ftg, Year Built"*
Incented Equipment Information	Date / Number / Text	*"Cost, Efficiency Rating, New R Value, Install Date"*
Measure / Rebate Quantities	Number	*"Number of Rebates"*
Measure and Program Designation	Number / Text	*"Marketing Measure Type, Marketing Measure Desc"*
Payment and Savings	Number	*"Rebate Amount, Est KWH Saved, Est Therms Saved"*
Processing Date-Stamps and Notes	Date / Text	*"App Rcvd Date, Payment Processed Date"*

We also know from *ad hoc* requests that Avista tracks several other data in addition to the items outlined above. These variables include a "Do Not Solicit" customer flag and several customer contact and billing information fields with additional detail and formatting.

Manufactured Home Duct Sealing Tracking Spreadsheets

The Manufactured Home Duct Sealing data extract reviewed in this evaluation contained three quarterly summaries. Tracking data contained 36 fields, including: customer address; Avista account information;



duct-sealing services performed; and energy savings estimates. We understand from conversations with program staff that information on each job are provided in bulk by UCONS, the implementer and additional fields are then added by Avista staff during the QC process.

JACO Tracking Database

JACO tracks data on participating customers, their pick-up orders, and refrigerators and freezers recycled through the program. These data are provided in three separate, integrated spreadsheets, allowing comprehensive tracking of customers' and units' movements through the program.

Through our experience evaluating Avista's Second Refrigerator and Freezer Recycling program and other similar utility-sponsored appliance recycling programs implemented by JACO, we know these data files are consistent in content and format with JACO's standard program tracking. While these data are detailed, providing extensive information on the customer, pick-up, and equipment recycled, Cadmus noted the absence of an Avista customer account number. JACO assigned customers their own unique customer identification numbers.[10] This made it difficult to match customers participating in this program to other program tracking databases.

Opower Tracking Database

Opower, the Residential Behavior program implementer, provided the program tracking data we reviewed for this program. The tracking database contained only 10 fields for each participating customer, listed in Table 22.

Table 22. Opower Data Tracking Fields

Opower Database Fields
"opower_customer_id"
"utility_customer_id"
"customer_name"
"service_address"
"recipient_status"
"opt_out_date"
"inactive_date"
"include_in_test_analysis"
"deployment_wave"
"first_generated_date"

Through our experience evaluating other residential behavior programs implemented by Opower, we know these data files are consistent in content and format with their standard program tracking.

[10] Customers sign up for the program, either online via Avista's website or by calling JACO's toll-free number. They are asked a few questions to verify eligibility, they must be Avista electric customers, and their refrigerator or freezer must meet certain criteria to participate.

However, unlike tracking data from other third-party program implementers, this dataset includes Avista customer account number (utility_customer_id).

Simple Steps, Smart Savings Invoice Material

Cadmus received data on the Simple Steps, Smart Savings Program. This program tracks monthly reporting from CLEAResult. In interviews conducted to inform both this and the PY2011 evaluation, Avista and CLEAResult staff noted monthly reporting for this program often involved delays and adjustments, caused by difficulties in obtaining sales data from retailers in a timely manner. CLEAResult monthly invoices contained detailed data at the measure level, reporting adjustments to previous months, and current monthly sales at each participating retailer by Stock Keeping Unit code (SKU). Data reviewed for this evaluation contained slightly different fields, but both provided information on:

- Participating retailer (e.g., name and location);
- Measures (e.g., manufacturer, type, SKU, watts/GPM, etc.);
- Sales and sales adjustments; and
- Reporting period.

Planned Changes in Avista Data Tracking

In addition to maintaining the internal tracking database discussed above, Avista is currently engaged in a large, multi-year transition to an advanced customer care and billing system, supported by Oracle®. This transition has been in progress since 2012. In July 2014, Avista hopes to begin moving some aspects of its energy-efficiency program tracking to this new system. Anticipated benefits with this new system include improved access to complete customer account information, enhanced market segmentation tools, and targeted marketing campaigns.

Marketing and Outreach

Marketing Approach

Avista develops, executes, and oversees the marketing efforts to promote its residential rebate programs in Washington and Idaho. These efforts include paid media, social media, earned media, direct mail, website, and broad-based awareness building through the *"When it comes to energy efficiency, every little bit adds up" (Every Little Bit)* campaign, along with the *Efficiency Matters* campaign. Most of the outreach tactics include general promotion of the residential rebates, with individual measure or program promotion as needed. Additionally, some program implementers supplement Avista's marketing through their own turnkey efforts. Avista's energy-efficiency marketing efforts are also coordinated with regional efforts.

Cadmus conducted a review of Avista's residential energy-efficiency rebate program marketing efforts to:

- Gain an understanding of PY2012 and PY2013 energy-efficiency and program marketing strategies and processes;
- Understand customer response and gauge effectiveness of marketing efforts; and
- Identify gaps and/or opportunities for consideration in future marketing efforts.

As part of this effort, Cadmus conducted a marketing materials review. We also reviewed marketing-related survey results and Avista marketing staff interview findings.

Marketing Objectives and Strategies

As found through review of the 2013 marketing plan and as supported through the interview with Avista marketing staff, the overarching outreach objectives are to increase awareness of and participation in Avista's energy-efficiency programs for residential customers. The outreach strategy is to use varied media to highlight customer success stories and communicate program benefits through engaging and interactive promotions and partnerships. Avista's DSM plan also indicates that residential programs have a strong presence and coordination with regional efforts, such as those offered by NEEA.

In our interview with Avista's key marketing staff, we discussed energy efficiency marketing successes and challenges in the PY2013 year. Overall, Avista staff reported the marketing efforts had been successful—specifically the online *Every Little Bit* and *Efficiency Matters* campaigns and high-performing targeted online advertisements. Staff indicated the crossover between Washington and Idaho (and offerings, based on fuel type and regulations) continues to prove challenging with regard to messaging and delivery of mass media. Staff reported they believe the *Every Little Bit* and *Efficiency Matters* campaigns are helping to increase broad-based reach to audiences without the use of mass media. In looking forward, staff indicated a need to enhance energy-efficiency awareness and participation through deeper and more meaningful customer engagement. Avista staff hope to learn more about customer motivators and how staff can increase customer engagement along the path to participation in residential energy-efficiency programs.

Planning and Processes

Avista staff conducts the planning, design, and execution of the residential rebate program marketing efforts. As indicated in the PY2012 and PY2013 DSM plans, there is an internal collaborative process to develop general energy-efficiency marketing and promotions. This process incorporates feedback from the Energy Solutions, Services Development and Marketing, and PPA teams. Some of the turn-key programs, such as the Second Refrigerator and Freezer Recycling Program, include supplemental marketing as part of their program design and implementation plans.

Avista's marketing staff uses the Avista Design System Guidelines to ensure that energy-efficiency marketing and outreach materials deliver a consistent look, feel, and message. The guidelines address items such as logos, color palettes, and fonts, and give an overview of applications, with examples of properly branded materials and collateral. All PY2012 and PY2013 general energy-efficiency marketing materials appear to be aligned with the guidelines. The *Every Little Bit* and *Efficiency Matters* campaigns and Online Energy Advisor tool present slightly varied creative assets, although generally appear to follow the brand guidelines (i.e., fonts, logos, etc.).

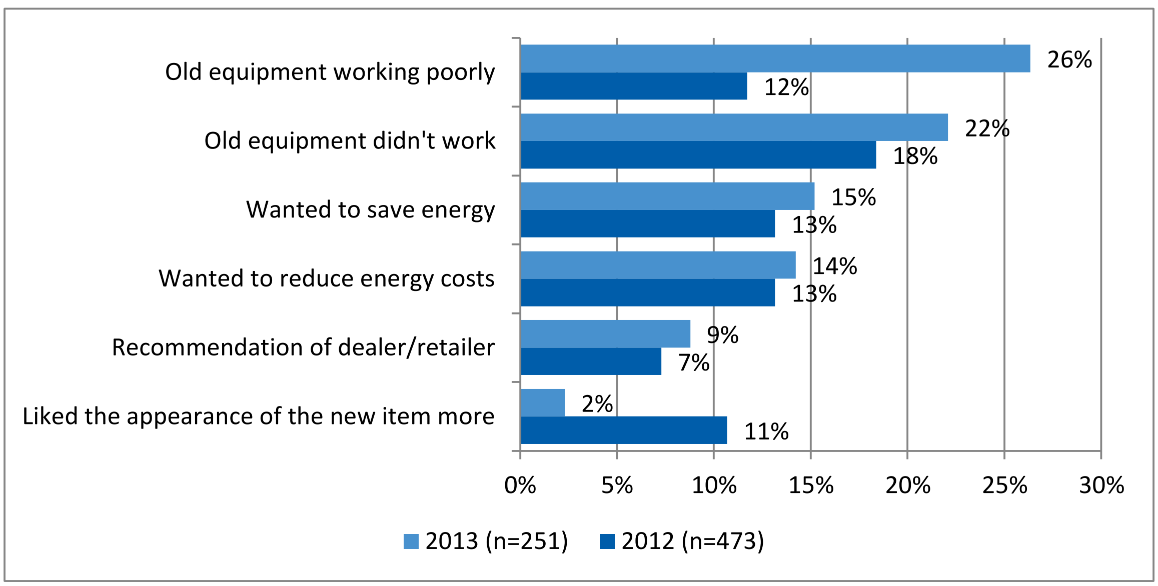
Target Audience and Customer Motivators

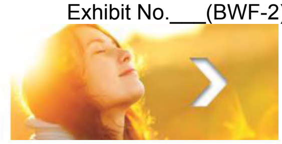
The target audience for Avista's residential rebate programs is general, and Avista has not specifically segmented customers or targeted outreach efforts. However, based on interviews with Avista staff, the marketing strategy uses a variety of outreach channels to reach a mix of demographics. For example, print ads are used to reach an older customer audience, while online advertisements are aimed at a younger demographic. Although segmentation efforts have been limited to date, Avista staff hopes to have a better grasp of customer segments and preferences in the future.

Avista reported conducting a residential customer market research survey in 2013 with 400 customers in both Washington and Idaho. The purpose of the research was to gauge awareness of Avista's programs and to gain insights to key motivators and messages. Avista will use these data to develop its PY2014 marketing and messaging strategies.

The participant surveys conducted by Cadmus also explored motivations for program participation. The most common responses from PY2012 and PY2013 are provided in Figure 11. The most commonly reported deciding factors were old equipment working poorly (26%, up from 12% in 2012) and old equipment not working (22% up from 18% in 2012). The two responses totaled 48% in 2013. Responses reflect the changing composition of residential rebate offerings. The response "like the appearance of the new item more" is a common response amount customers who received a rebate for an energy-efficient appliance—which were eliminated in PY2013.

Figure 11. Most Commonly Reported Measure Purchase and Installation Motivations





Outreach Channels

Avista conducts residential energy-efficiency marketing through a variety of channels. In addition to the general energy-efficiency marketing tactics outlined below, Avista conducts broad-based awareness efforts through its *Every Little Bit* campaign, as described in the following section. Besides the *Efficiency Matters* campaign (which are implemented in partnership with KREM 2, a CBS affiliates), there are no mass media or cross-cutting promotional efforts related directly to program offerings, to avoid potential customer confusion across state lines.[11] Notable outreach tactics used in PY2012 and PY2013 include:

- Paid media: print and online (targeted SEO) banner advertisements;
- Social media: Facebook, specifically for campaign and ticket giveaway;
- Earned media: local public relations as available;
- Direct mail and bill inserts: general and (targeted) program-specific;
- Newsletters and e-mail blasts: general outreach;
- Website: website (avistautilities.com) was built in 2012; and
- Vendor outreach meetings: general overview about programs, application process, project qualifications and customer eligibility.

Every Little Bit and *Efficiency Matters* Campaigns

The *Every Little Bit* campaign launched in 2007 and was informed by findings from market research efforts that gauged customer awareness, willingness to participate, and barriers to participation. The broad-based, multi-media awareness campaign was designed to increase customer engagement and drive awareness of Avista's energy-efficiency program offerings. Over the years, the campaign has used multiple channels, including website, web banners, print and broadcast outreach (radio and television), print material (brochures, signage, etc.), outdoor billboards, social media, and community events. The objective of the campaign is to educate and inform customers about general energy efficiency programs, with the goal of driving participation. The call-to-action drives customers to Avista's campaign website (www.everylittlebit.com) to take advantage of energy saving programs from Avista.

During subsequent years, the program design shifted to become progressively more specific. Most recently, KREM 2's Project Green, Toyota and Avista have teamed up in support of energy efficiency, and initiated the *Efficiency Matters* campaign. Through this campaign, customers entered to win a Toyota Prius by pledging a commitment to energy efficiency. Objectives of the most recent campaign were to:

- Increase awareness of and participation in Avista's energy conservation measures and rebate programs;
- Increase traffic to www.everylittlebit.com;

[11] Avista also partnered with the *Inlander* newspaper and ACE Hardware to promote its Home Energy Advisor online audit tool.

- Increase traffic and "likes" to the *Efficiency Matters* Facebook page; and
- Allows people to receive ongoing energy-efficiency tips.

Through its partnership with KREM TV and Toyota, Avista's campaign garnered more than 103,000 entries in 2013, with 4,159 people searching for the *Every Little Bit* keyword. There were 66,907 total entries the previous year.

Materials and Messaging

Cadmus reviewed all residential energy-efficiency marketing materials provided by Avista. Overall, the general marketing materials present a consistent look and feel, and follow the Avista Design System Guidelines (e.g., fonts, colors, layout, and applications). Materials typically include the Avista logo (appropriately) and a call-to-action, which is usually one of Avista's websites (or campaign URL). The online advertisements direct customers to the program webpage, which serves as a portal for customer engagement, education and interaction and provides links to rebates and tips. Several of the general marketing materials also include program-appropriate imagery, which may help customers understand and relate to the promoted offerings.

Through our review of PY2012 and PY2013 materials, we found there are several uniform resource locators (URLs) included in the collateral, and some items including more than one URL (e.g., www.everylittlebit.com, www.everylittlebit.com/findrebates, www.avistautilities/resrebates). Inconsistent use or use of more than one URL may distract customers and possibly cause confusion.

While the materials reviewed focused primarily on the general residential rebate marketing materials, Cadmus also reviewed *Every Little Bit* and *Efficiency Matters* campaign outreach materials and Avista's energy-efficiency web pages, and conducted a high-level review of the Online Energy Advisor materials as a point of reference. Based on this cursory overview of the suite of programs and platforms, Cadmus found that there are varied creative assets across the channels and platforms. While the general energy-efficiency promotional materials present a look and feel consistent with the brand guidelines, the *Every Little Bit* and *Efficiency Matters* campaigns and Online Energy Advisor platforms leverage additional assets. For example, the *Every Little Bit* landing page (www.everylittlebit.com) also includes assets from the Online Energy Advisor personas (with the "shield" creative) and creative developed by a third-party implementer.

Marketing Execution and Measurement

Avista tracks metrics for its individual campaigns and ties results back to awareness and website traffic. In PY2013, Avista staff reported tracking online advertisements (click-through rates), *Every Little Bit* and *Efficiency Matters* campaign metrics (participants and traffic), estimated impressions through paid media and response to direct mail (as applicable).

Sources of Participant Awareness

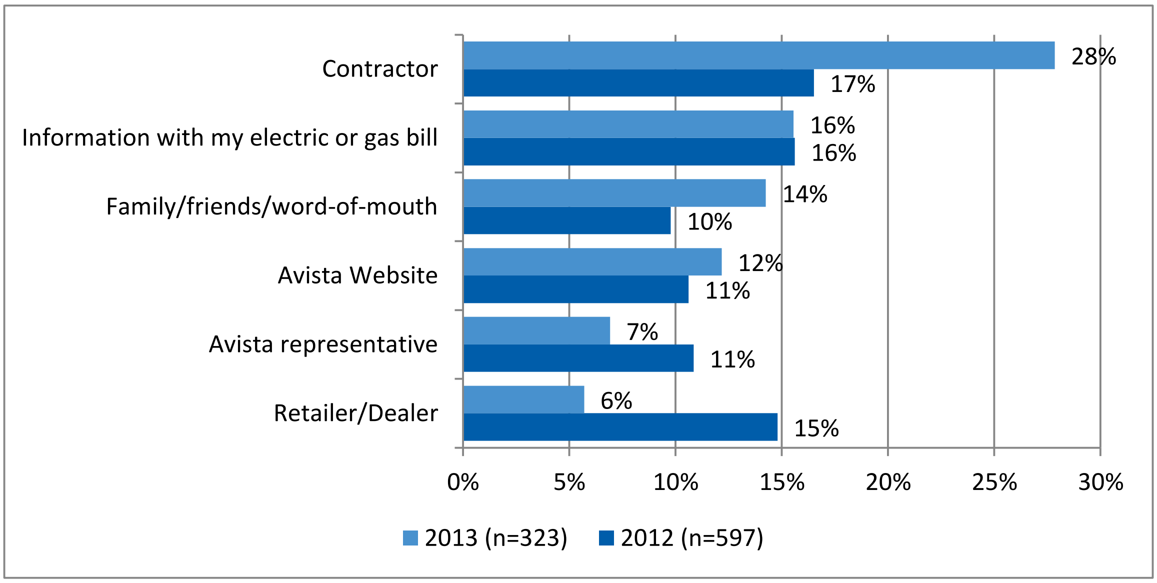
To help assess the effectiveness of Avista's and the implementer's marketing; Cadmus asked participants how they heard of the program in which they participated. Respondents cited a variety of sources of program awareness. Figure 12 lists the top ways respondents said they first heard about the program in both the PY2012 and PY2013 surveys.

PY2013 respondents who could provide an answer reported hearing about the program through their contractor (28%), with other responses fairly evenly distributed across information from electric or gas bill (16%), word of mouth (14%), and the Avista website (12%). When Cadmus compared 2012 and 2013 findings, a few key differences emerged:

- More respondents heard about the program from a contractor in 2013 (17% in 2012, 28% in 2013).
- Fewer respondents heard about the program from a retailer/distributor in 2013 (15% in 2012, 6% in 2013).
- Fewer respondents heard about the program from an Avista representative in 2013 (11% in 2012, 7% in 2013).

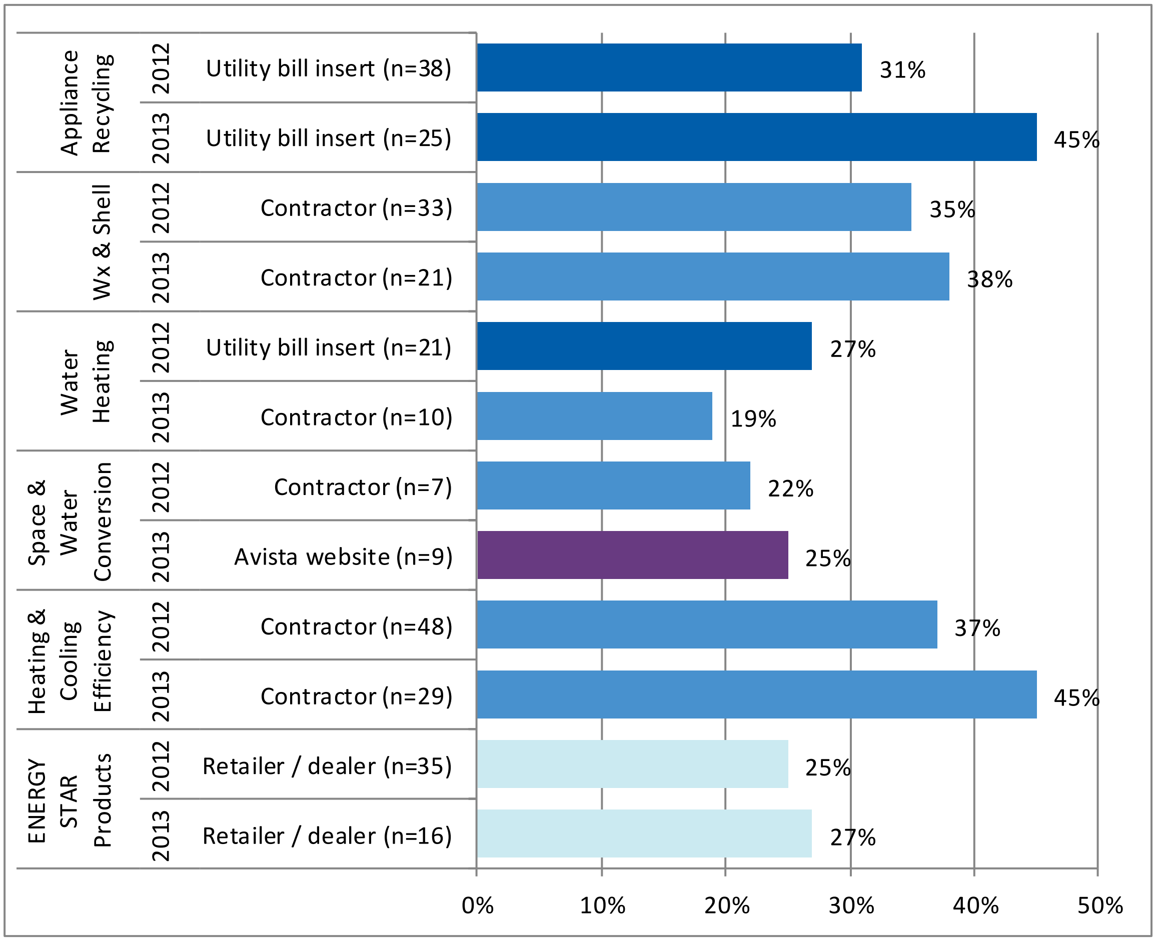
Figure 12 provides additional customer responses.

Figure 12. Most Commonly Reported Ways Participants First Heard About the Program



Not surprisingly, the ways participating customers first learned of the Avista rebates differs by program. For example, we would expect customers seeking HVAC and weatherization rebates heard of the program from their contractor, while ENERGY STAR Products customers more commonly heard of the rebate from a retailer. Figure 13 provides the most common responses by program.

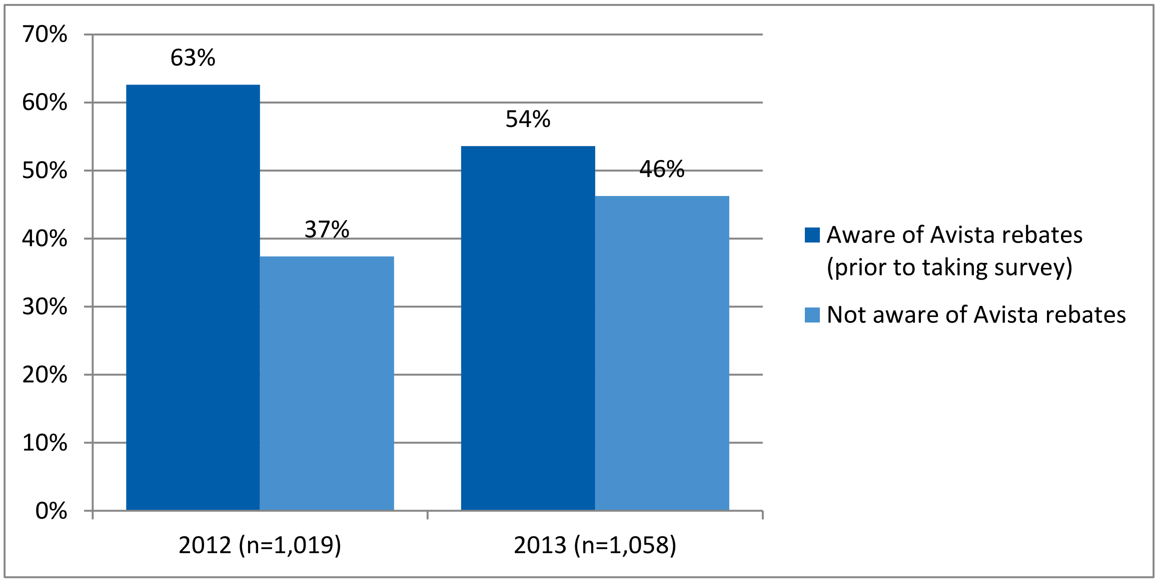
Figure 13. Most Commonly Reported Ways Participants First Heard About the Program by Program



Avista Customer Awareness of Energy-Efficiency Rebates

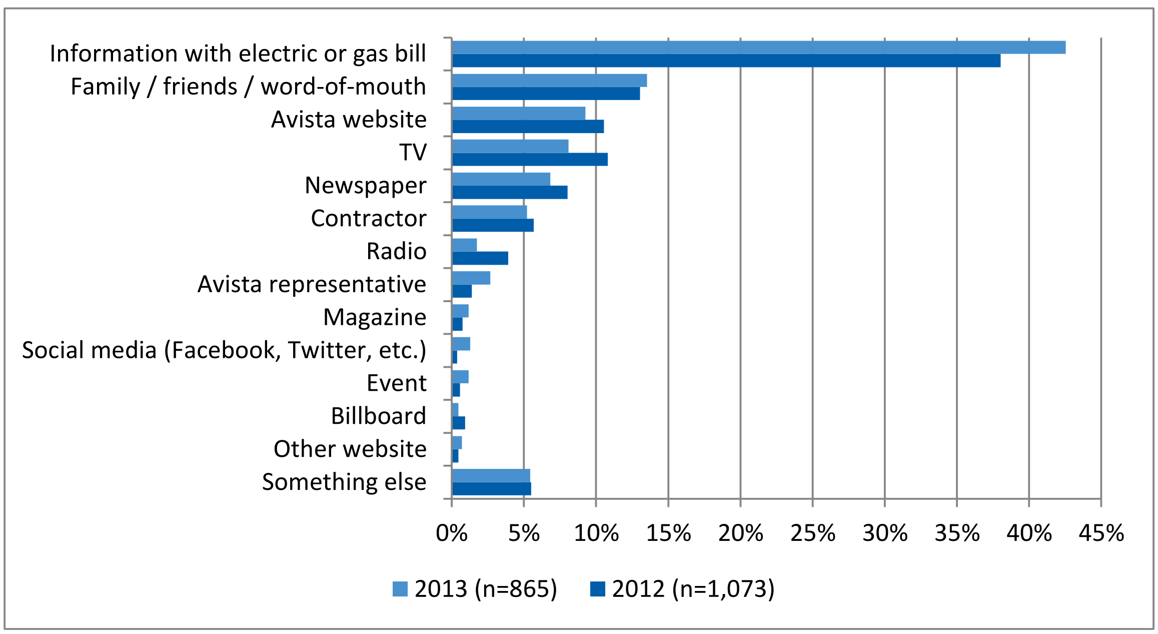
More than half of Avista's residential customers report being aware Avista offers rebates for energy-saving equipment and weatherization improvements when asked as part of the Avista general population studies. Indicated in Figure 14, 63% of customer surveys in 2012 and 54% of customers surveyed in 2013 reported being aware of Avista rebates (prior to completing the survey). The decrease in awareness reported in 2013 compared to 2012 may reflect the reduction in rebate offerings in Idaho as well as the challenges Avista faced in marketing dissimilar measure offerings across the two states.

Figure 14. Avista General-Population Customer Awareness



Customers who reported being aware of Avista rebates indicated that information in their utility bill was the most common way they learned of the measure offerings (38% in 2012 and 43% in 2013). Word of mouth (13% and 14%), the Avista website (11% and 9%) and TV advertisements (11% and 8%) were the next-most-common responses, although feedback was diverse. Figure 15 provides additional detail.

Figure 15. Source of General-Population Customer Awareness



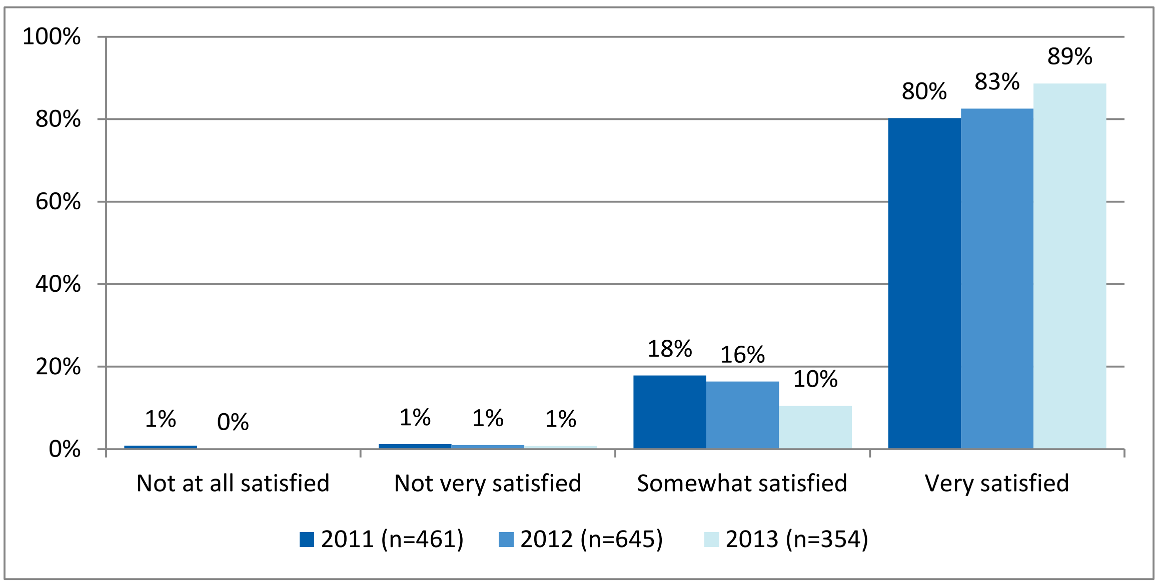
Participant Experience and Satisfaction

To assess customer satisfaction in the residential program and program elements, Cadmus included questions around these topics in participant customer surveys. Overall, as in past evaluations, Cadmus observed generally very high customer satisfaction across the programs and program elements. The sections below provide additional detail.

Overall Program Satisfaction

Cadmus asked surveyed participants to rate their overall satisfaction with the program as well as their satisfaction with various program aspects. As Figure 16 shows, overall satisfaction with the programs in PY2013 was very high, with 99% of participants describing themselves as somewhat satisfied or very satisfied with the program in which they participated. This finding closely resembles findings from PY2011 and PY2012, where 98% and 99% of respondents reported satisfaction, respectively. While general satisfaction remained the same across program years, the proportion of participants that were very satisfied rose steadily each year from PY2011 through PY2013.

Figure 16. Overall Participant Satisfaction across All Programs



As Figure 17 shows, participants expressed generally consistent, high overall satisfaction across programs, with an appreciable increase in very satisfied Heating and Cooling Efficiency Program participants from 2012 (82%) to 2013 (93%).

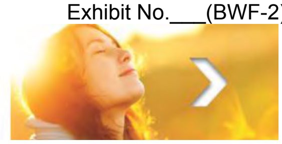
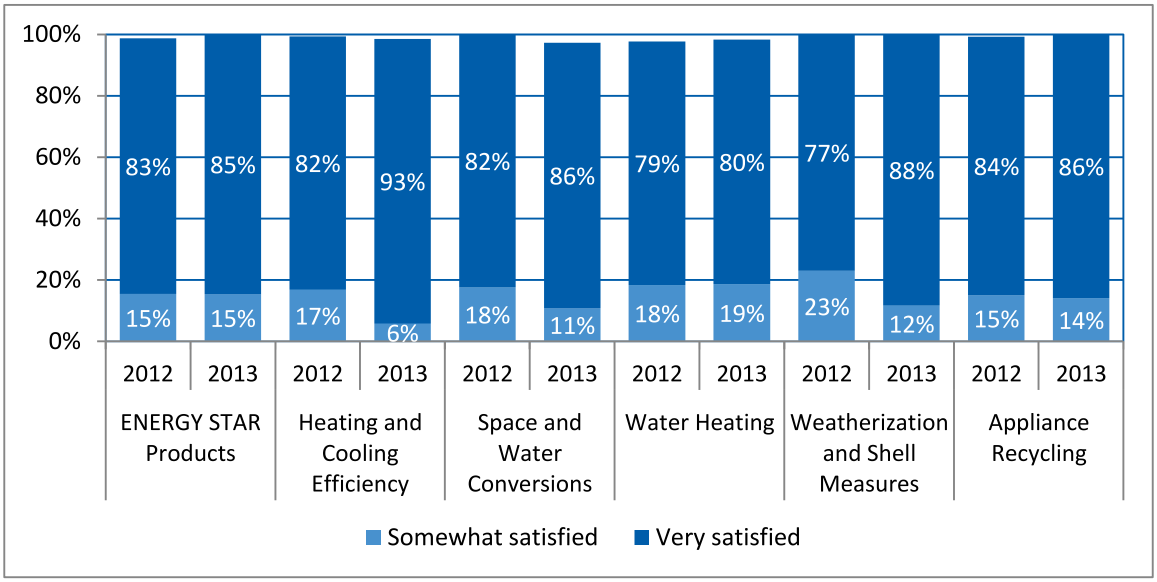


Figure 17. Overall Participant Satisfaction by Program and Year



Rebate Amount and Promptness Satisfaction

In the survey, Cadmus asked participants how satisfied they were with the amount of the rebate they received and how quickly they received the rebate.

Rebate Amount

As shown in Figure 18, respondents reported slightly lower satisfaction levels with rebate amounts than with the overall program. This is not uncommon, as most peopled feel they would be made happier if provided with a larger rebate. As shown in Figure 19, participants expressed generally consistent satisfaction with rebate amounts across all programs. However, participant satisfaction (those who said they were somewhat or very satisfied) with the Water Heating Program decreased slightly from 97% in 2012 to 90% in 2013. It is unclear what prompted this decline.

Figure 18. Weighted Rebate Amount Satisfaction for all Programs

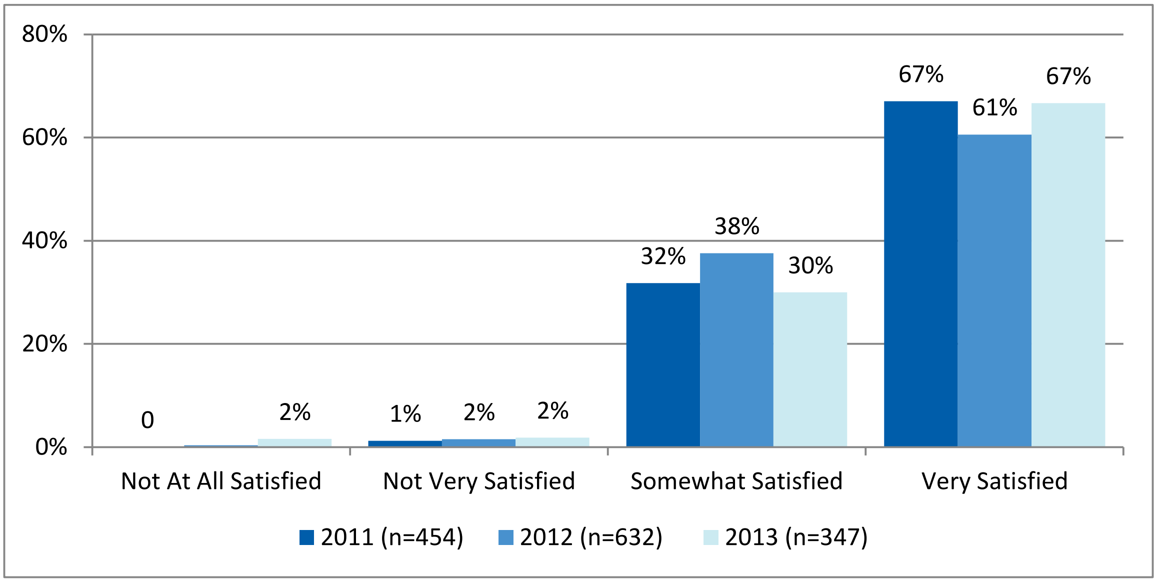
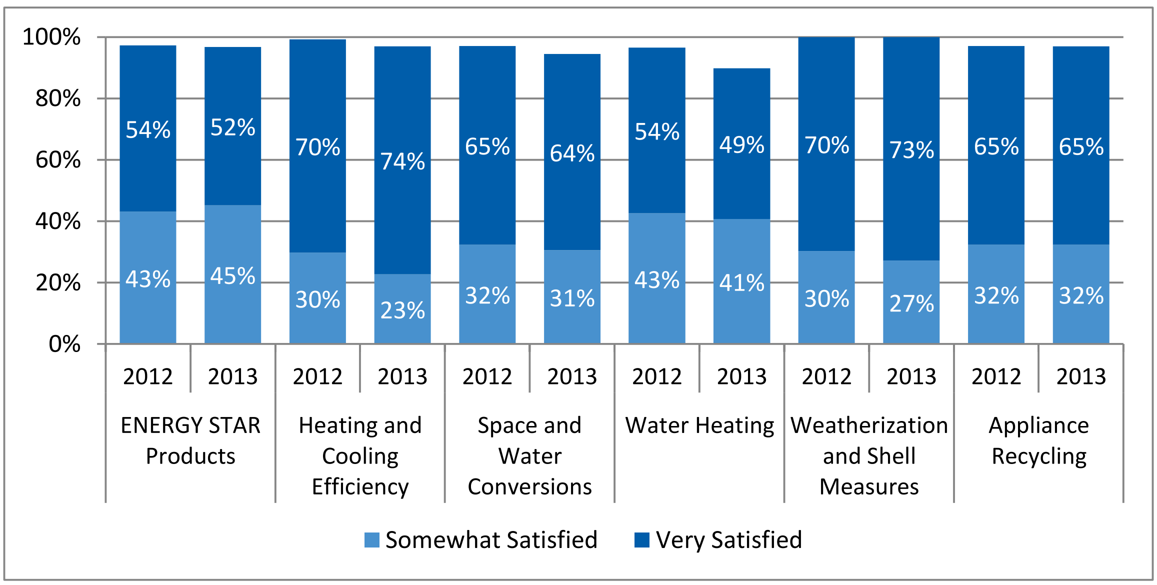


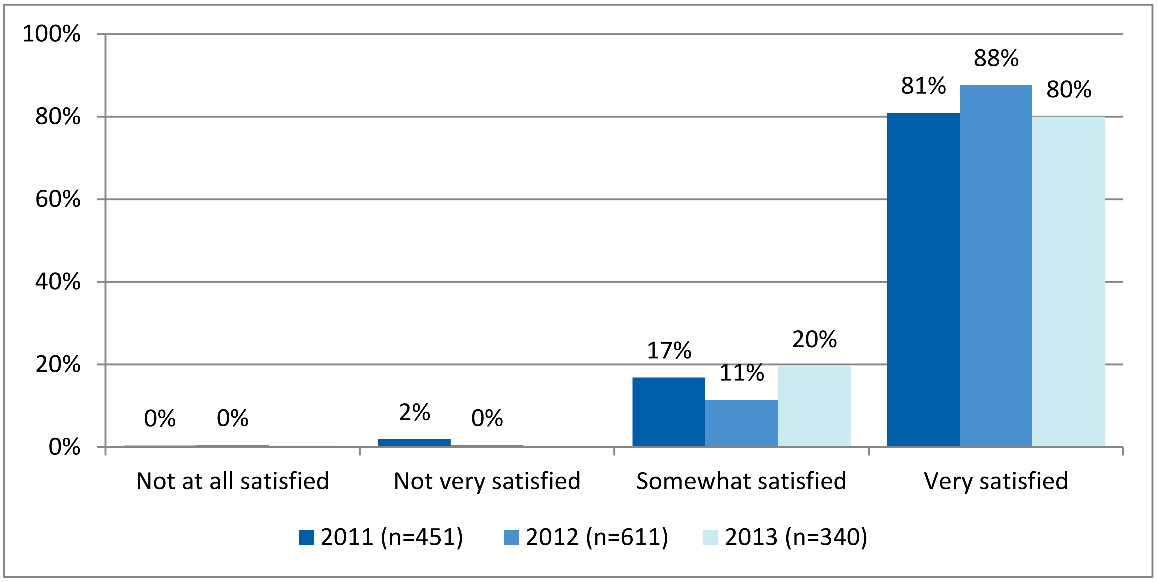
Figure 19. Rebate Amount Satisfaction by Program and Year



Promptness of Rebate Payment

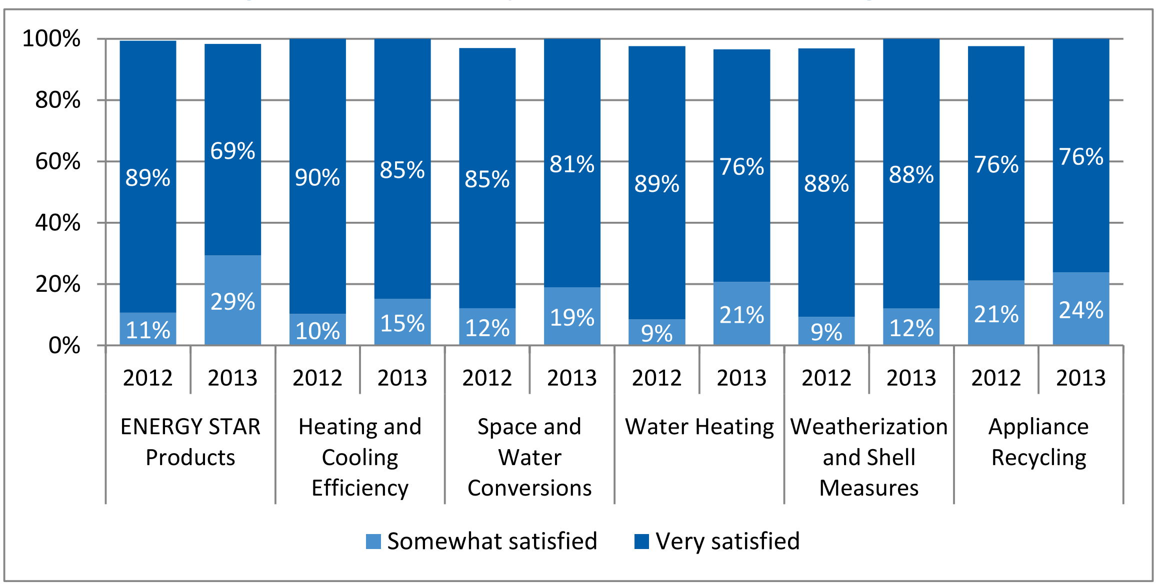
As shown in Figure 20, respondents reported slightly lower satisfaction with rebate promptness than overall program satisfaction, but slightly higher satisfaction than with the rebate amount. The proportion of respondents who were very satisfied with rebate promptness increased slightly from 81% in 2011 to 88% in 2012, but decreased to 80% in 2013. This may reflect the minor uptick in rebate processing times identified in Table 16.

Figure 20. Weighted Rebate Promptness Satisfaction for All Programs



As Figure 21 shows, respondent satisfaction with rebate promptness was relatively high across programs. However, the proportion of respondents who were very satisfied with the promptness of their Energy Star product rebates decreased from 89% in 2012 to 69% in 2013.

Figure 21. Rebate Promptness Satisfaction for All Programs



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Residential Program Freeridership and Spillover

Freeridership

Freeridership, the percentage of savings likely to have occurred in the program's absence, traditionally refers to participants who would have undertaken an action promoted by a program had the incentive or other program activities not been available. Full freeriders would have undertaken exactly the same action at the same time (i.e., the program had no effect on the degree or timing of their actions). Partial freeriders would have taken some action, but would not have undertaken the action to the level promoted by the program, or would not have taken the action at the time they did.

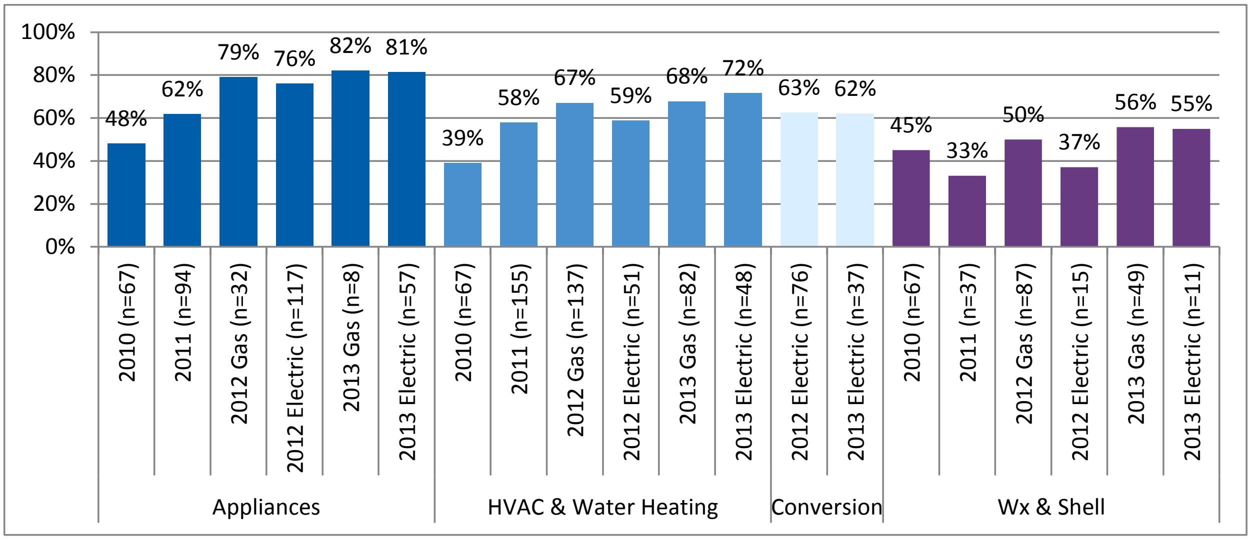
For the PY2012 - PY2013 evaluation, Cadmus estimated freeridership by measure type: appliances; HVAC and water heating; and weatherization and shell using data from surveys with participating customers. We established this grouping based on the needs of the impact evaluation. The customer self-report approach to estimating freeridership adheres to standard industry methodologies. However, the approach does present a potential shortcoming: it may not always be entirely appropriate for capturing the market transformation impacts of multiyear programs. For example, a multiyear program may alter the availability of higher-efficiency products in a region by influencing dealers' and retailers' stocking practices. In addition, by increasing dealer experience and comfort with more efficient products, or by impacting demand for efficient products, a program may influence the mix of products manufactured. Customers, when choosing between various makes and models of a given product, may not be aware that a program affected their efficiency selection.

Therefore, while a customer may correctly state that he or she would have chosen a particular product in the program's absence, the availability of that product may have been a result of the program. While the customer would count as a freerider, the customer may have had less-efficient options without the program. A more thorough description of the freeridership methodology is provided in: Avista 2012-2013 Washington Electric Impact Evaluation Report; and Avista 2012-2013 Idaho Electric Impact Evaluation Report.[12]

Figure 22 show the freeridership results for the PY2012 and PY2013 program, by fuel type. Estimates from previous evaluations are also provided for context. Further, due to limited participants, before PY2012, Cadmus did not break out freeridership scores by fuel. Cadmus did not calculate separate freeridership estimates for conversion measures in PY2010 and PY2011 for the same reason.

[12] *Avista 2012-2013 Washington Electric Impact Evaluation Report.* Cadmus. 2014.
Avista 2012-2013 Idaho Electric Impact Evaluation Report. Cadmus. 2014.

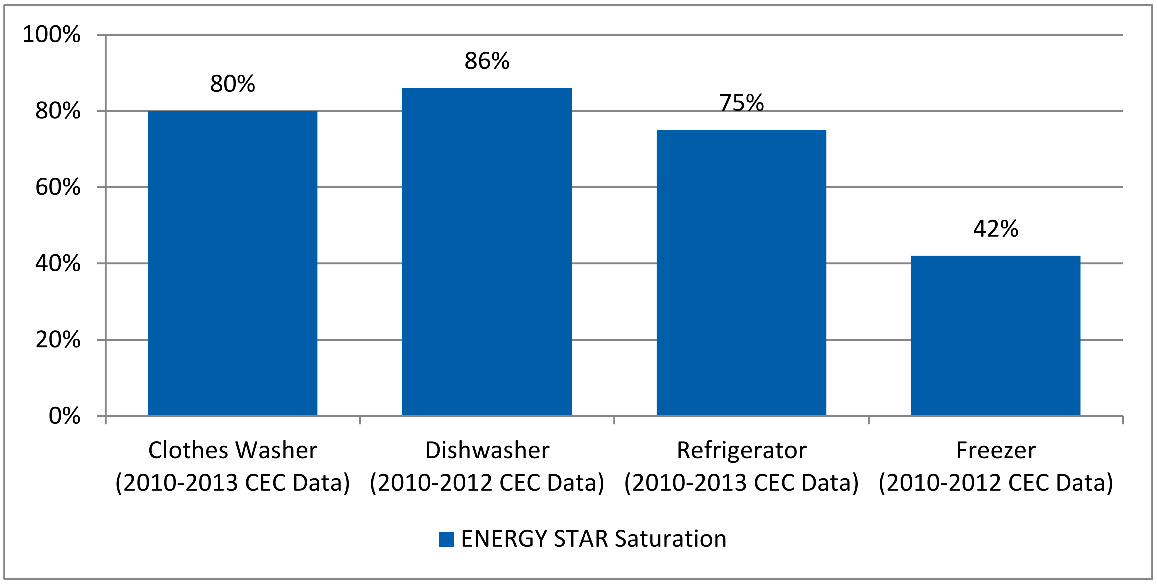
Figure 22. Observed Participating Customer Freeridership (Washington & Idaho)



A review of freeridership scores over the past four evaluation efforts indicates a clear upward trend in self-report freeridership—particularly among appliance and HVAC measures. This finding suggests the market for these equipment types may be transformed, and incentives from Avista are less of a factor in customer decision-making. This supposition is supported by a review of available secondary data. As indicated in Figure 23, which shows assumed appliance saturation in Washington and Idaho provided by the NWPCC Regional Technical Forum[13], there is little opportunity for customers to purchase and install non-ENERGY STAR certified equipment. The NWPCC Regional Technical Forum estimates are derived from the California Energy Commission (CEC) Appliance Database.

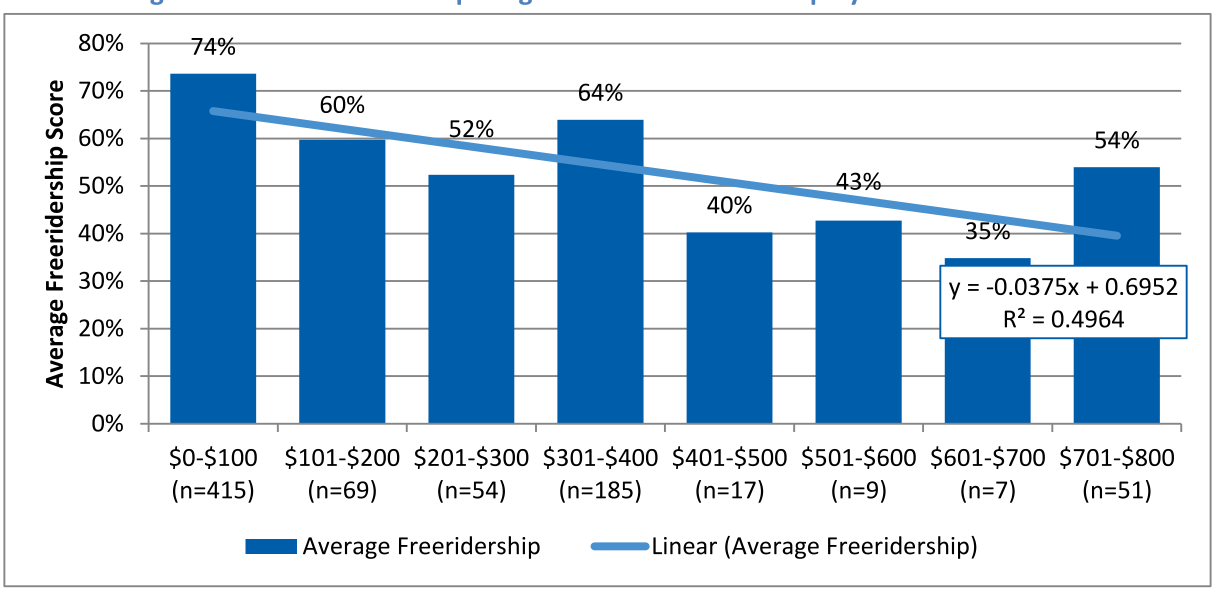
[13] 2014 NWPCC Regional Technical Forum Unit Energy Savings (UES) Measures and Supporting Documentation http://rtf.nwcouncil.org/measures/Default.asp

Figure 23. ENERGY STAR Appliance Saturation



Further, indicated in Figure 24 which shows average freeridership scores across all measures by incentive amount (in $100 bins), customers receiving smaller incentive payments are most likely to be freeriders. As all Avista rebates for appliances were less than $50, it follows that freeridership is highest in these measures.

Figure 24. Observed Participating Customer Freeridership by Incentive Amount



Avista has already responded to high levels of observed freeridership in the appliance measure category by discontinuing these measure offerings (Table 2).

Spillover

Spillover refers to additional savings generated by program participants due to their program participation, but not captured by program records. Spillover also includes savings from actions non-participating customers take because of program messaging or market effects. These savings are also not captured in program tracking.

Energy-efficiency programs' spillover effects can be considered an additional impact that gets credited to program results. In contrast, freeriders' impacts reduce the net savings attributable to a program.

In this evaluation, Cadmus measured spillover achieved through the installation of measures without utility rebates through surveys with participant end-users and general population customer surveys (representing nonparticipating customers). We found these savings to be the easiest to quantify through self-report surveys, an approach in-line with evaluation best-practice.

In these surveys, we asked customers whether they had installed any other energy-efficient equipment or had services performed in their homes for which they did not receive an incentive from Avista or another organization. Next we cross-checked respondents against PY2012 - PY2013 Avista and third-party implementer databases to confirm that the customers had not received a utility incentive for the reported measure. From this subset, Cadmus removed participants who did not indicate rebates or information from Avista was "somewhat" or "very important" to their decision(s) to purchase additional measures and general population customers who did not indicate rebates or information from Avista was "very important" to their decision(s) to purchase additional measures. Cadmus did not consider appliances when calculating spillover savings due to saturation in the market of high-efficiency models (Figure 23).

Table 23 summarizes the measures considered in PY2012 and PY2013 spillover estimates.

Table 23. Technologies Considered in Spillover Analysis and Number of Completed Surveys

2012		
Equipment Types	**Participant (n=648)**	**General Population (n=1,051)**
Air Conditioner	4	15
Air Sealing	3	
Clothes Dryer	2	
Clothes Washer	2	
Gas Furnace	2	2
Heat Pump	2	6
Insulated Doors		4
Insulation	3	3
Programmable Thermostat	1	
Weather Stripping		4
Windows	4	2
Total	**23**	**36**

Survey respondents per measure	28.2	29.2
2013		
Equipment Types	Participant (n=357)	General Population (n=1,109)
Air Conditioner		4
Air Sealing	2	
Clothes Dryer	1	
Clothes Washer	1	
Electric baseboard / Wall heater		1
Electric Furnace		1
Electric Water Heater		8
Gas Furnace		3
Gas Water Heater		5
Insulated Doors		3
Insulation	2	6
Lighting	1	
Refrigerator	1	
Weather Stripping		6
Windows	4	4
Wood/Pellet stove		1
Total	**12**	**42**
Survey respondents per measure	***29.8***	***27.6***

As indicated in Table 23, the number of spillover measures reported by respondents is consistent across the various surveys fielded, with one measure reportedly being installed for 27.6 to 29.8 survey respondents.

As a final step, Cadmus estimated energy savings from these additional measures installed, and matched those savings to evaluated gross savings calculated for the sample of survey respondents. This led to spillover ratios at the program levels. The spillover results for the PY2012 and PY2013 are provided in the Avista 2012-2013 Washington Electric Impact Evaluation Report; and Avista 2012-2013 Idaho Electric Impact Evaluation Report.

Residential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the residential programs.

Program Participation

Conclusion: Avista's implementation of new and continued support for existing third-party implemented programs such as Simple Steps, Smart Savings and Residential Behavior effectively captures energy savings in the residential market segments.

- *Recommendation:* Continue exploring new measures, program designs, and delivery mechanisms that leverage the national expertise of experienced third-party implementation firms. Possible programs may include additional partnership with ENERGY STAR in the form of the Home Performance with ENERGY STAR program.

Conclusion: Avista's continued investment in pilot programs provides a low-risk way test the effectiveness of new measure offerings, delivery channels, and implementation partners.

- ***Recommendation:*** Continue testing new program designs and measure offerings through the use of pilots—even if secondary sources of funding or local partners are not available.

Conclusion: While still early, evaluation findings indicate the Residential Behavior program is an effective way to capture savings in the residential market and Opower is a strong partner for program implementation.

- ***Recommendation:*** If determined to be cost-effective, consider expanding the Residential Behavior program (for example, lowering the energy consumption threshold for participation) and implementing measures to track the methods these customers use to save energy. Given that Avista has already included all cost-effective customers in their target population for this program, future opportunities for expansion may be limited.

Program Design

Conclusion: Inconsistencies continue to exist in measure and program naming and organization across program planning, tracking and reporting activities which result in less transparency in program operations and limit effective program evaluation.

- ***Recommendation:*** As part of the transition to the new data tracking system, consider aligning program and measure names with offerings articulated in annual business plans and other planning materials.

Conclusion: Reduction in Avista natural gas rebates and elimination of appliance rebates give customers fewer ways to participate in Avista energy-efficiency rebate programs.

- ***Recommendation:*** Consider ways to encourage repeat participation (such as marketing targeted at previous participants and online profiles that reduce application paperwork).

Conclusion: Considering self-report customer freeridership scores and market baseline data from the RTF is an effective way to assess the appropriateness of measure offerings.

- ***Recommendation:*** Continue use of customer freeridership and market assessments as a way to assess the appropriateness of measure offerings.

Conclusion: Many ongoing changes in Avista's program design and measure offerings are driven by the need to continue to meet cost-effectiveness requirements. Avista's examination of measure and program-level cost-effectiveness will determine the character of its portfolio in future program years.

- ***Recommendation:*** Develop a transparent process for assessing measure or program cost-effectiveness and communicating results internally. Consider ways to ensure high-quality cost-effectiveness analysis that aligns with industry best practices, such as obtaining an objective third-party review of current cost-effectiveness screening processes.

Program Implementation

Conclusion: Avista prioritization of customer satisfaction has been very successful and overall participant experience is very positive across all rebate programs.

- ***Recommendation:*** Continue Avista's commitment to customer satisfaction, but monitor:
  - Increased staffing costs; and
  - Impacts of the 90-day participation window on freeridership.

Marketing and Outreach

Conclusion: Avista implements a strong general awareness campaign around energy-efficiency, but some room exists in market segmentation and targeting specific customer groups.

- ***Recommendation:*** Utilize survey results from this evaluation and other data collection activities to understand which audiences are more likely to participate in Avista programs.

Nonresidential Process Report

Introduction

This nonresidential process evaluation focuses on three Avista programs offered to Idaho and Washington residential natural gas and electric customers during PY2012 and PY2013.[14] In this evaluation, Cadmus sought to address the following researchable questions:

- What barriers exist to increased customer participation, and how effectively do the programs address those barriers?
- How satisfied were customers with the programs?
- What changes to design and delivery would improve program performance?

In assessing these topics, Cadmus relied on three main data-collection efforts:

- Review of program tracking data, documents, and invoice materials;
- Interviews with Avista and implementation staff; and
- Telephone surveys with participating and nonparticipating customers.

Program Overview

Avista's nonresidential programs encourage commercial and industrial customers to install energy-efficient equipment in their facilities. To accomplish this goal, Avista offers incentives directly to customers who install qualifying equipment. This report provides findings and recommendations based on a process evaluation of the three nonresidential energy-efficiency programs: Prescriptive; Site-Specific; and EnergySmart Grocer.

Avista implements the Prescriptive and Site-Specific Programs. Avista account managers assist customers and determine project eligibility for the Site-Specific Programs, while program engineers are responsible for measuring and verifying project savings and costs. Trade allies also submit project information and rebate applications on behalf of customers.

A third-party vendor, PECI, implements the EnergySmart Grocer Program. EnergySmart Grocer is a turnkey program available across the Northwestern United States.

The following sections provide descriptions of each program.

[14] Similar to the residential portfolio, Avista's non-residential programs operate on calendar years, with program years running from January through December.

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Prescriptive Program

The Prescriptive program incents a variety of highly efficient electric and natural gas technologies, including:

- PC network controls;
- Clothes washers;
- Food service equipment;
- Lighting;
- Motors;
- Variable frequency drives (VFDs);
- Windows and insulation;
- Heating, ventilation, and air-conditioning (HVAC) equipment; and
- Standby Generator Block Heaters.

Site-Specific Program

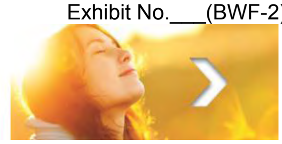
The Site-Specific Program offers incentives for energy-efficiency measures not included in the Prescriptive Programs. All commercial, industrial, and water pumping customers with electric or retail natural gas service from Avista are eligible for the Site-Specific Program. Site-specific measures consist of electric and gas-saving technologies including:

- Appliances;
- HVAC equipment;
- Industrial processes;
- Custom lighting,
- Motors, and
- Building shell improvements.

For a measure to be eligible under the Site-Specific Program, it must have demonstrable kWh or therm savings.

The Site-Specific Program is responsible for a large portion of Avista's overall energy-efficiency portfolio savings. This program generally offers an incentive for any energy-saving measure that has a payback of more than one year and under eight years for lighting, and more than one year and under 13 years for other measures. The incentive typically covers up to 50% of the incremental cost of the efficiency investment.

Key drivers to delivering on program objectives include: direct incentives to customers, marketing efforts, account executives relationships with large customers, and ongoing work with trade allies. The Avista website is also used to communicate program requirements and incentives, and to provide



application materials. The *Every Little Bit* and *Efficiency Matters* marketing and outreach campaign (described in the Residential Process Report above) also focuses on commercial customers and is designed to increase awareness of energy efficiency among commercial and industrial customers.

EnergySmart Grocer Program

The EnergySmart Grocer Program is a regional program that offers prescriptive rebates for a variety of energy-saving food-sales and refrigeration equipment for nonresidential electric and gas customers, with an emphasis on grocery stores. Eligible equipment incentives include:

- Compressors;
- Controls;
- Motors;
- Night covers for refrigerated cases;
- Case lighting;
- Strip curtains for refrigerated spaces;
- Insulation for suction lines; and
- Hot water tanks.

This program helps customers with refrigeration loads to upgrade equipment, streamline operations, and save energy. Customers receive a complete energy analysis of their facility's refrigeration and lighting, as well as a detailed report showing ways to reduce energy use. The customized report outlines potential energy savings, incentive amounts, retrofit costs, and simple paybacks, and is offered at no cost to the customer.

EnergySmart Grocer Program offers 77 prescriptive measures. The average program incentive covers 45% of the customer incremental cost of the efficiency investment—although in some cases the program incentive covers up to 100% of the measure cost. Similar to the Site-Specific Program, key drivers to delivering on the objectives of the program include: direct incentives to customers, marketing efforts, account executives relationships with large customers, and ongoing work with trade allies. Avista website is also used to communicate program requirements and incentives, and to provide application materials

Evaluation Methodology and Information Sources

Cadmus' approach to this non-residential portfolio-wide process evaluation relied on four main reviews and data-collection efforts. These activities and the program years they focused on are provided in Table 24. We applied activities to all three non-residential programs.

Table 24. Data Collection Activities Applied to Each Program

Program Group	PY2012	PY2013
Program Materials Review	✓	✓
Staff Interviews	✓	✓

Participating Customer surveys		✓
Nonparticipating Customer Surveys		✓
Realization Rate and Database Review	✓	

Materials Review

This process evaluation analyzes primary and secondary program data. Cadmus conducted the following primary data-collection activities:

- Program staff interviews;
- Program participant[15] surveys;
- Nonparticipant customer[16] surveys;
- Database review; and
- Interviews with lighting contractors.

Secondary data included the following program and marketing materials:

- Avista's PY2012 and PY2013 DSM Business Plans;
- An internal Avista program implementation manual;
- Avista marketing collateral;
- Everylittlebit.com website; and
- Avistautilities.com website.

Information from Avista's reports for internal and external stakeholders, documents of public record, and information about best practices also informed this evaluation.

Program Staff and Market Actor Interviews

Interviews with program staff provided first-hand insights into program design and delivery processes, and helped evaluation staff interpret the information collected. We conducted interviews with Avista's Washington and Idaho program staff in two rounds, one in January 2013 and another in December and January 2014.

Cadmus also conducted interviews with participating and nonparticipating lighting contractors in the Avista service territory. These interviews were conducted in late 2013 as part of an ongoing Panel Study Cadmus is conducting for Avista. The interviews included several questions designed to provide feedback on Avista's programs from the perspective of participant and nonparticipant market actors. Cadmus defined participating contractors as those with over 10% of their customers receiving Avista incentives. Cadmus reached out to contractors on a list of 275 contacts provided by Avista, and offered

[15] Customers who received a program rebate in 2012 or 2013.
[16] Eligible nonresidential customers that did not participate in the programs during 2012 or 2013

an incentive for participating in the study. Of the 275 contacts, 167 were ineligible for the study either because they were not commercial lighting contractors or because they operated outside of Avista's service territory. Cadmus completed interviews with 20 of the remaining 108 contacts.

Table 25 provides a summary of interview data collection.

Table 25. PY2012 - 2013 Program Staff and Market Actor Interviews

Interviewee Role In Program Delivery	Completed Interviews	
	PY2012	PY2013
Avista Program Implementation Staff	3*	5
Avista Policy, Planning and Analysis Staff	1*	2
Avista Marketing Staff		1*
Lighting Contractors		9 *(participant)* 11 *(nonparticipant)*

* Multiple non-Cadmus staff participated in interview.

Participant Surveys

Telephone surveys constituted a large part of PY2013 evaluation data collection activities. We conducted all surveys with the assistance of several subcontracted market research firms, selected for their experience with the commercial market segment. To minimize the burden on customers, ensure a more satisfactory experience, and ensure high response rates, Cadmus designed the survey to take approximately 15 minutes to complete.

The primary research objectives for participant surveys were to:

- Determine participant satisfaction with key program components and delivery;
- Understand participant decision-making influences;
- Identify:
    - Information sources and channels' effectiveness for outreach;
    - Participants' perceptions of market barriers;
    - Participant freeridership and spillover;
    - Potential areas for program improvements and future offerings; and
- Compiling profile information about Avista's C&I target markets.

The process evaluation team used a single survey instrument for participants in all three programs, maximizing survey efficiency by combining process- and impact-related questions into a single survey.

Cadmus designed participant survey samples to represent the programs proportionately according to reported kWh savings. We adjusted survey targets to account for the number of survey respondents available for a given program.

Table 26. Participant Survey Summary Details

Program Group	Survey Completes
Washington	
Prescriptive	79
Site Specific	41
Energy Smart Grocer	14
Idaho	
Prescriptive	33
Site Specific	23
Energy Smart Grocer	11
Total	**201**

Surveys were not conducted with PY2012 program participants because after conducting a large number of surveys with nonresidential customers in 2010 and 2011, Cadmus and Avista elected not to conduct surveys in 2012 to avoid survey fatigue in this population.

Nonparticipant Surveys

The primary research objectives for nonparticipant surveys were to:

- Determine program awareness levels and information sources;
- Understand decision-making influences regarding energy-using equipment;
- Identify:
    - Information sources and channels' effectiveness for outreach;
    - Participation barriers or reasons customers aware of programs did not participate;
    - Nonparticipant spillover;
    - Potential areas for program improvements and future offerings; and
- Compiling profile information about Avista's C&I target markets.

2011-2012 Database and Realization Rate Review

As part of the PY2012 process evaluation, Cadmus reviewed Avista's PY2012 nonresidential project database and project-level realization rates identified in Cadmus' PY2011 and PY2012 impact evaluation. The materials reviewed and our associated research questions are listed in Table 27.

Table 27. Database and Realization Rate Review Activities

Review Activity	Materials Reviewed	Research Questions
Database Review	PY2012 SalesLogix Database Extract	Are data being tracked accurately and consistently?
		Are contracts issued in accordance with Avista policy?

		Do incentives comply with tariff rules for Washington and Idaho?
Realization Rate Review	PY2011 - PY2012 Impact Evaluation Sample	Why do some projects have a very low or very high realization rate?
		Are there opportunities for Avista to improve the process of calculating reported savings to improve the realization rates?

Database Review

Avista's tariff Schedules 90 and 190 govern how Avista can spend funds from the Energy Efficiency Rider Adjustment paid by Washington and Idaho ratepayers.[17] To assess compliance with these Tariff Schedules, we examined two main indicators:

1. Project incentive amount: electric and natural gas project incentives should not exceed 50% of the incremental cost of the project (p. 3 of Schedule 90; p. 2 of Schedule 190).
2. Project simple payback:
    a. For lighting measures, the simple payback period must be a minimum of one year and should not exceed eight years. (p. 2 of Schedule 90); and
    b. For non-lighting electric and natural gas measures, the simple payback period must be a minimum of one year and should not exceed 13 years. (p. 2 of Schedule 90; p. 2 of Schedule 190).

The tariff rules make exceptions for the following programs or projects (p. 3 of Schedule 90; p. 2 of Schedule 190):

- DSM programs delivered by community action agencies contracted by Avista to serve limited income or vulnerable customer segments, including agency administrative fees and health and human safety measures;
- Low-cost electric/natural gas efficiency measures with demonstrable energy savings (e.g., compact fluorescent lamps); and
- Programs or services supporting or enhancing local, regional, or national electric/natural gas efficiency market transformation efforts. (In 2012, Avista considered new construction fuel conversions in multifamily building projects and T12 to T8 commercial lighting conversion projects as market transformation efforts.)

[17] Schedule 90: Electric Energy Efficiency Programs, Washington. Available at: http://www.avistautilities.com/services/energypricing/wa/elect/Documents/WA_090.pdf; Schedule 190: Natural Gas Energy Efficiency Programs, Washington. Available at: http://www.avistautilities.com/services/energypricing/wa/gas/Documents/WA_190.pdf; and Schedule 90: Electric Energy Efficiency Programs, Idaho. Available at: http://www.avistautilities.com/services/energypricing/id/elect/Documents/ID_090.pdf

Status of Evaluation Recommendations

Avista retained Cadmus to perform annual process and impact evaluations of Avista's non-residential program portfolio beginning in PY2010. These evaluation activities, findings, conclusions, and recommendations are articulated in the following reports: Avista 2010 Multi-Sector Process Evaluation Report; and Avista 2011 Multi-Sector Process Evaluation Report.[18]

In this evaluation effort, Cadmus reviewed the recommendations offered in these documents and assessed to what degree Avista had adopted these recommendations (by the end of PY2013). As indicated in Table 28, Avista has made significant progress toward addressing these recommendations.

Table 28. Status of PY2010 and PY2011 Nonresidential Process Recommendations

Status	PY2010 Evaluation	PY2011 Evaluation
Complete	6	8
In Progress	4	11
Limited Activity	3	1

A complete summary of recommendations and activity for addressing these recommendations is provided in Appendix B: Status of PY2010 and PY2011 Nonresidential Evaluation Recommendations.

Program Participation

Savings and Incentives

Table 29 provides the number of incentive-based measures and reported savings. The PY2012 and PY2013 Avista Impact Evaluation Reports explore the reported savings in detail.

Table 29. PY2012 - PY2013 Program Populations and Reported Savings[1]

Measure Type	PY 2012 Measures	PY 2013 Measures	PY 2012 - PY 2013 Reported Savings	
			MWh	Therms
Prescriptive	3,363	1,813	56,884	212,525
Site Specific	332	328	39,050	504,571
Energy Smart Grocer	338	329	10,858	0
Total	**4,317**	**2,470**	**106,792**	**717,096**

[18] *Avista 2010 Multi-Sector Process Evaluation Report*. Cadmus. 2011.
Avista 2011 Multi-Sector Process Evaluation Report. Cadmus. 2012.

Program Design, Management, and Implementation

This section discusses the Cadmus' observations regarding design and management of Avista's nonresidential programs. These observations focused on program definition and organization, logic, and implementation approach.

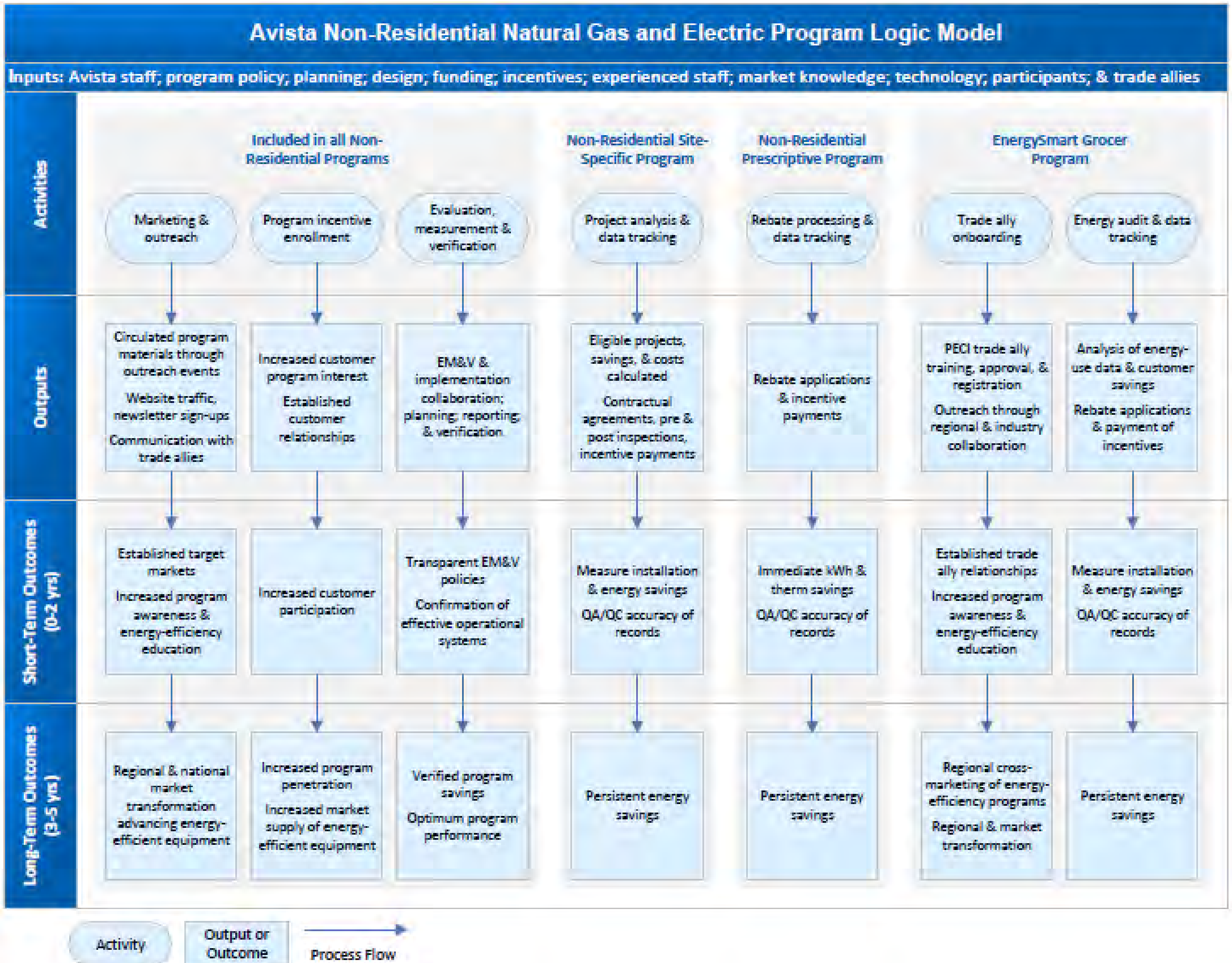
Overview

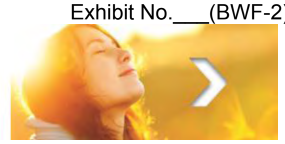
Overall, we found Avista's the non-residential program designs work well and are generally well-documented, primarily in the PY2012 and PY2013 DSM Business Plans. Further, we found that Avista has taken actions to improve internal communications and review processes.

Program Logic

Camus developed the logic model provided to articulate the logic behind the nonresidential program. The nonresidential program's logic has not changed substantially since the previous process evaluation.

Figure 25. Avista Nonresidential Program Logic Model





Internal Communication

Avista's management and implementation of DSM programs has had some persistent organizational challenges. While not limited to any specific part of Avista's DSM staff, many of the issues noted here and in previous studies have primarily affected the nonresidential program internal review processes. Several external documents and processes have addressed these problems, including:

- 2008 Ecotope Impact Evaluation – cited potential for improved quality control
- 2009-2010 Moss Adams Process Evaluation Report – expressed need for central management role and QA/QC checks in the nonresidential program
- 2010-2011 Cadmus Process Evaluation Report – recommended QA/QC checks at certain threshold
- August 2013 Cadmus Memo (see Appendix C) – review of 2012 program data noted some lack of documentation, possible issue with application of tariff rules regarding payback periods and incentive payment caps, and large variations between project-level realization rates
- December 2013–January 2014 Cadmus interviews with Avista – noted internal disagreement regarding whether the Top Sheet process was working
- March 2014 Idaho Public Utilities Commission staff comments on Avista Corporation's Application for a Finding that it Prudently Incurred its 2010-2012 Electric and Natural Gas Energy Efficiency Expenditures – noted program implementation issues including a "lack of formal follow-through on program management issues," "insufficient controls around engineering assumptions and the basis for site-specific incentive payments, [and] incorrect interpretation of Schedule 90 regarding implementation of prescriptive projects"
- April 2014 Idaho Public Utilities Commission Order Number 33009 on Avista Corporation's Application for a Finding that it Prudently Incurred its 2010-2012 Electric and Natural Gas Energy Efficiency Expenditures – approved expenditures as prudent with the exception of incentives for two projects for which recovery was deferred due to incomplete documentation, reiterated need for a central decision maker

These documents focused on a variety of issues, but all documents agreed that there were concerns with Avista's internal QA/QC process, especially for large nonresidential projects. These efforts agreed that the definition of roles and responsibilities for Avista's DSM staff were not sufficiently clear. Further, several documents noted that Avista's DSM staff was split into two completely separate teams: the implementation team and the PPA team reported to separate directors. This separation may have fueled internal communication problems.

Avista has taken significant steps internally to address these issues:

- 2009 Avista Internal Audit Department review of DSM processes
- 2013 Avista retained Milepost Consulting for review of DSM team's roles and responsibilities
- 2013 Avista's implementation of Top Sheets – instituted peer review QA/QC system; associated internal follow-up was completed to verify Top Sheet standard processes

- July 2013 Avista Internal Audit Department memo – noted that previously identified issues need further attention
- April 2014 Internal Audit Department memo – found that 70 out of 75 Top Sheets were present and on-site verification is happening for 100% of site-specific projects completed to date in 2014, but noted there is no policy on how many prescriptive projects should get on-site verification

As of April 2014, Avista has begun a restructuring process to improve internal communication and delivery of DSM programs. Both the implementation team and the PPA team now report to the same Senior Director.

Effectiveness of Implementers

As noted in the Residential Process Report, using third-party implementers presents advantages and disadvantages. Generally, utilities maintain direct implementation of programs requiring strong relationships with unique customers (e.g., large commercial and industrial customers). Programs benefitting from a uniform approach involve national accounts, or require certain market expertise available from a third-party firm. Research conducted for this—and previous—Avista evaluation efforts leads us to conclude that Avista has succeeded in identifying which program (EnergySmart Grocer) is most suitable for third-party partnering.

The PY2011 evaluation report provides the results of detail interviews conducted with implementation staff at PECI staff. As few changes have been made to this program since the interviews took place in spring 2012, and the program has been the subject of other recent regional Cadmus evaluations,[19] we did not conduct additional evaluation in this area.

Data Tracking, Verification, and Quality Assurance

Cadmus reviewed the PY2012 program tracking database for data accuracy and completeness, and issued a memo in August 2013 describing in detail the methods, findings, and conclusions (Appendix C: 2012 Nonresidential Process Evaluation Memorandum). In summary, we found some documentation was lacking and that there were issues with the application of tariff rules regarding project costs and energy savings specific to prescriptive projects.

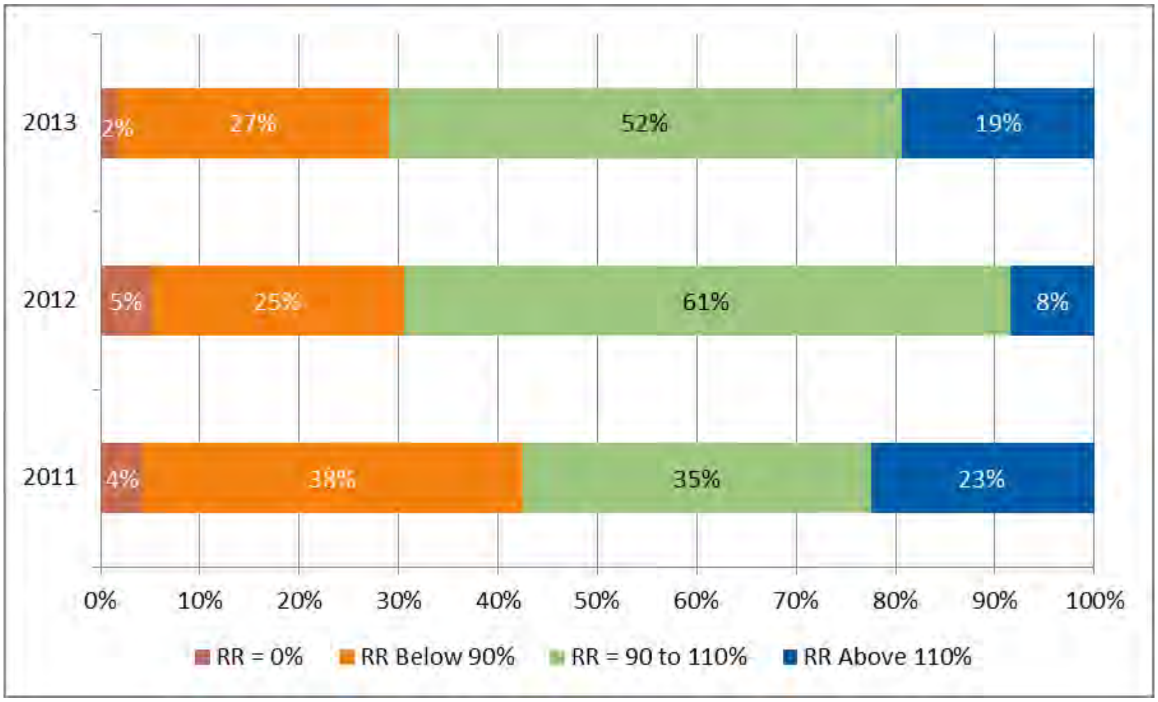
We also examined the accuracy of Avista's claimed savings, measured by realization rates, and found that accuracy improved significantly from 2011 to 2012. Three of the four main reasons for savings adjustments in 2012 were largely outside Avista's control. However, based on the review of 2012 data,

[19] Cadmus recently completed an impact assessment and a market potential assessment of the EnergySmart Grocer program in 2013. The results of this work are documented in reports available here:
http://www.bpa.gov/energy/n/reports/evaluation/commercial/pdf/Cadmus_ESG_Impact_Evaluation_Report_Final.pdf
http://www.bpa.gov/energy/n/reports/evaluation/commercial/pdf/BPA_Grocery_Opp_Assessment_05JUN13.pdf

we concluded that Avista could still improve the reliability of claimed savings estimates by avoiding calculation errors in reported savings.

Cadmus reviewed achieved realization rates in each year, as summarized in Figure 26. This review showed that the accuracy of claimed savings declined slightly in 2013, with 52% of electric project realization rates falling within the 90% to 110% range. This range reflects a high degree of accuracy, with realization rate adjustments of 10% or less. It is expected that some portion of projects will fall outside of this range due to factors beyond Avista's control. Though the proportion of projects with realization rates that fall below 90% is greater than that above 110%, the magnitude of those projects has been steadily decreasing over the years, falling from 42% in 2011 to 29% in 2013.

Figure 26. Summary of Avista Nonresidential Project Electric Realization Rates



In July 2013, Avista instituted a new process for site-specific project reviews. A major feature of the new review process was the addition of Top Sheets to track and verify applications' completeness and correctness. Cadmus did not perform a review of the information contained within Top Sheets as part of this process evaluation, but rather gathered information about the Top Sheet process through interviews with staff.

Participant Characteristics, Experience and Satisfaction

To assess customer satisfaction with Avista's nonresidential programs, Cadmus included questions around these topics in participant customer surveys. Overall, as in past evaluations, Cadmus observed very high customer satisfaction across the programs and program elements. The sections below provide additional detail.

Participant Characteristics

Cadmus surveyed a total of 210 participating and 140 nonparticipating nonresidential customers. These respondents represented a variety of business sectors, as shown in Table 30.

Table 30. Participant and Nonparticipant Survey Respondents' Industries, By State

Industry Breakdown	Idaho		Washington	
	Participants	Nonparticipants	Participants	Nonparticipants
Retail / personal services	22%	27%	16%	20%
Office / professional services	6%	17%	7%	20%
Manufacturing	7%	13%	11%	3%
Auto repair or service station	14%	6%	11%	17%
Warehouse / distribution center	10%	6%	9%	6%
Religious	6%	4%	4%	1%
Government building	1%	9%	1%	3%
Medical	6%	3%	6%	4%
Education (K-12)	7%	0%	1%	0%
Restaurant	4%	1%	9%	4%
Hospitality	0%	3%	1%	3%
Dormitory / multifamily housing	1%	0%	4%	3%
Education (college / university)	-	-	3%	1%
Agricultural	-	-	0%	3%
Other	14%	11%	16%	10%

Program participant respondents were more likely than nonparticipant respondents to own their facilities. Indicated in Figure 27, 78% of participants owned their facilities, compared with 67% of nonparticipants.

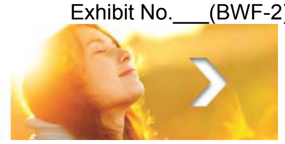
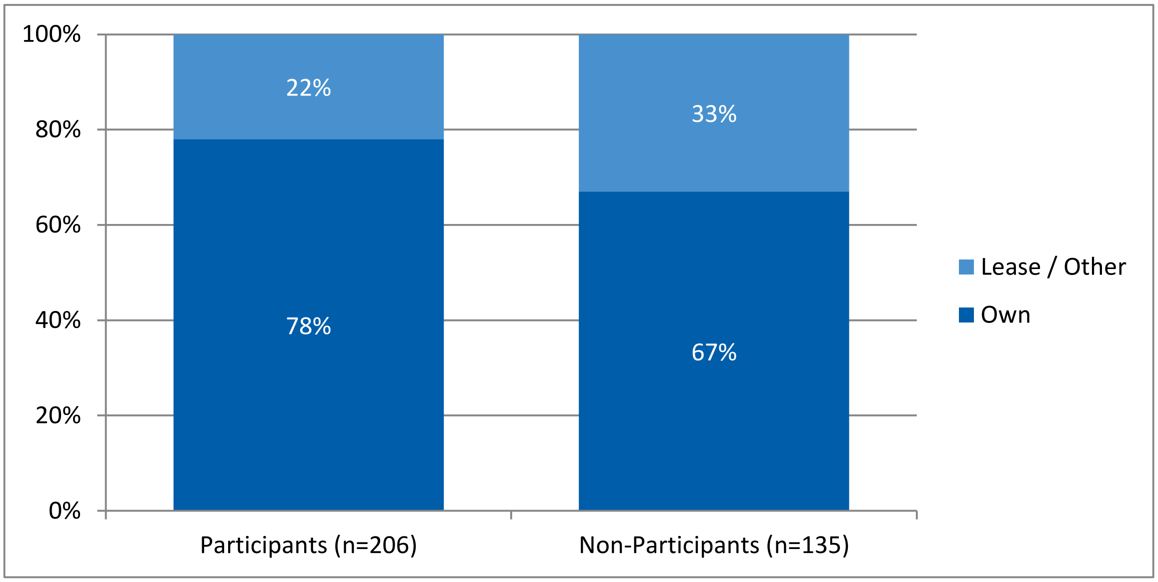
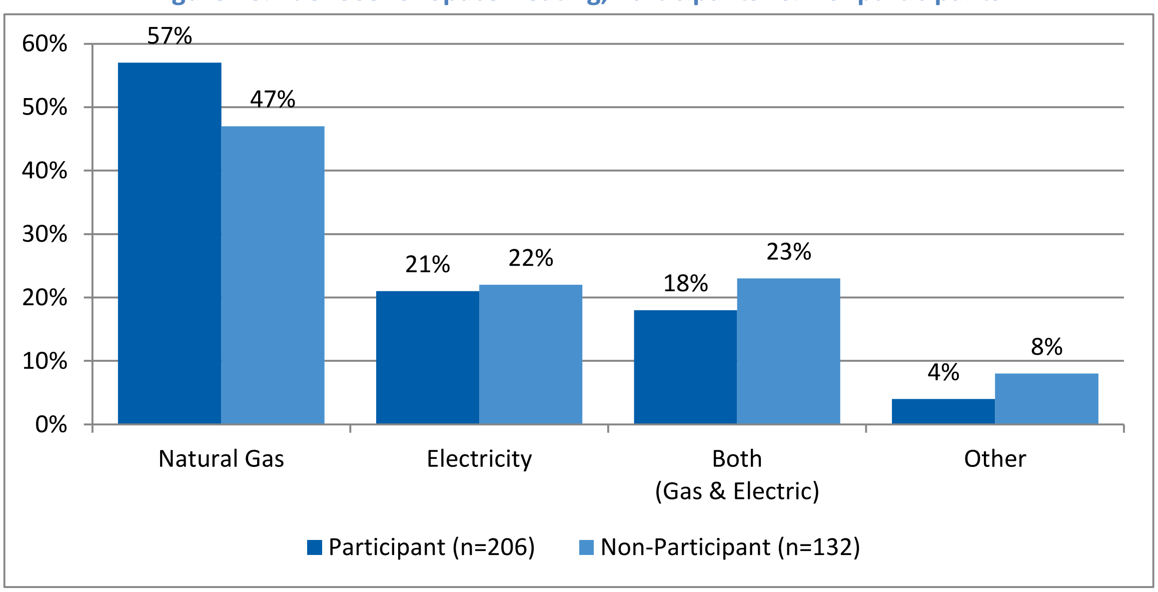


Figure 27. Facility Ownership Status, Participants vs. Nonparticipants



Most survey respondents, both participants and nonparticipants, used gas heating. Figure 28 shows fuel use for space heating by customer type.

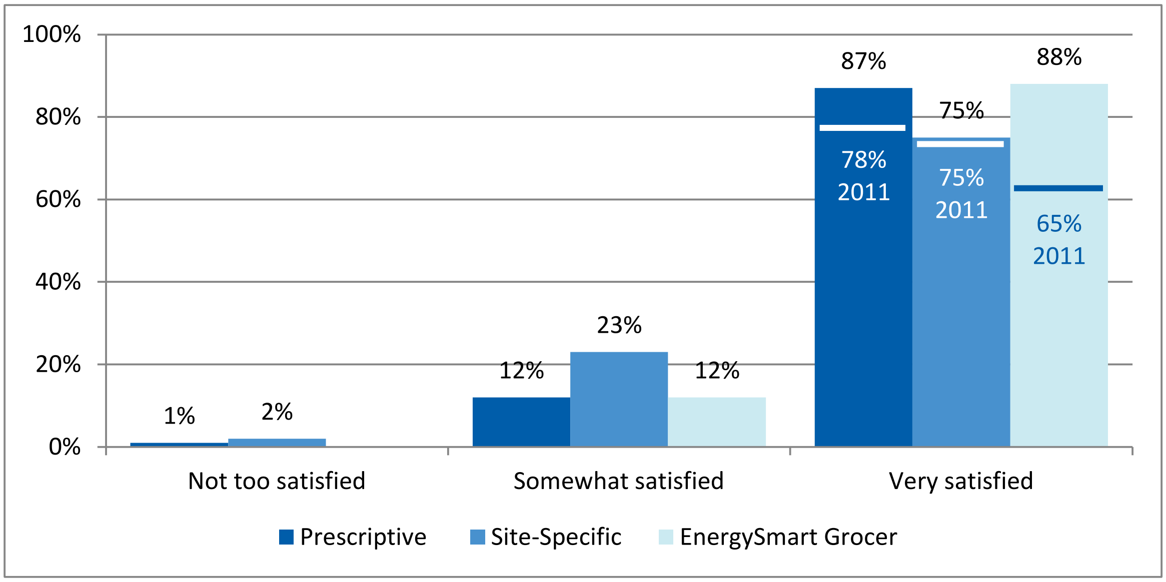
Figure 28. Fuel Use for Space Heating, Participants vs. Nonparticipants



Participant Satisfaction

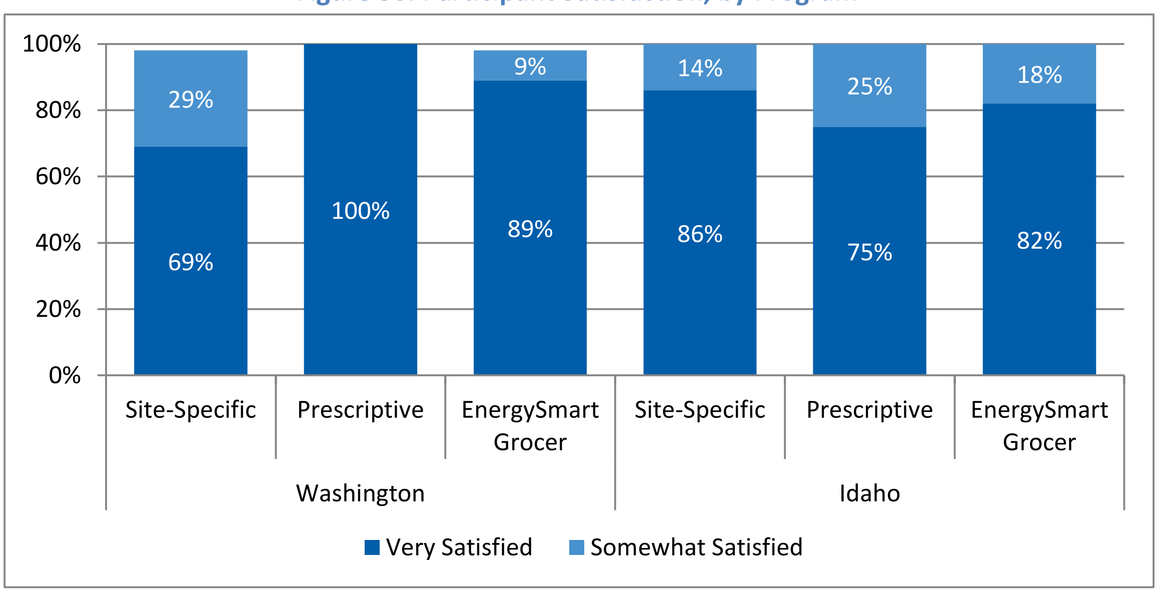
Overall, participants reported high satisfaction with the programs: 84% of all respondents said they were “very satisfied” in the program overall. Figure 29 shows respondents’ satisfaction ratings by program. In contrast to the 2011 survey, when EnergySmart Grocer participants were less satisfied than other participants, EnergySmart Grocer participants reported the highest satisfaction levels in the PY2013 survey.

Figure 29. Overall Participant Satisfaction



Satisfaction levels were generally similar across programs, as Figure 30 shows. However, the Washington Site-Specific Program received slightly lower ratings than the other programs.

Figure 30. Participant Satisfaction, by Program

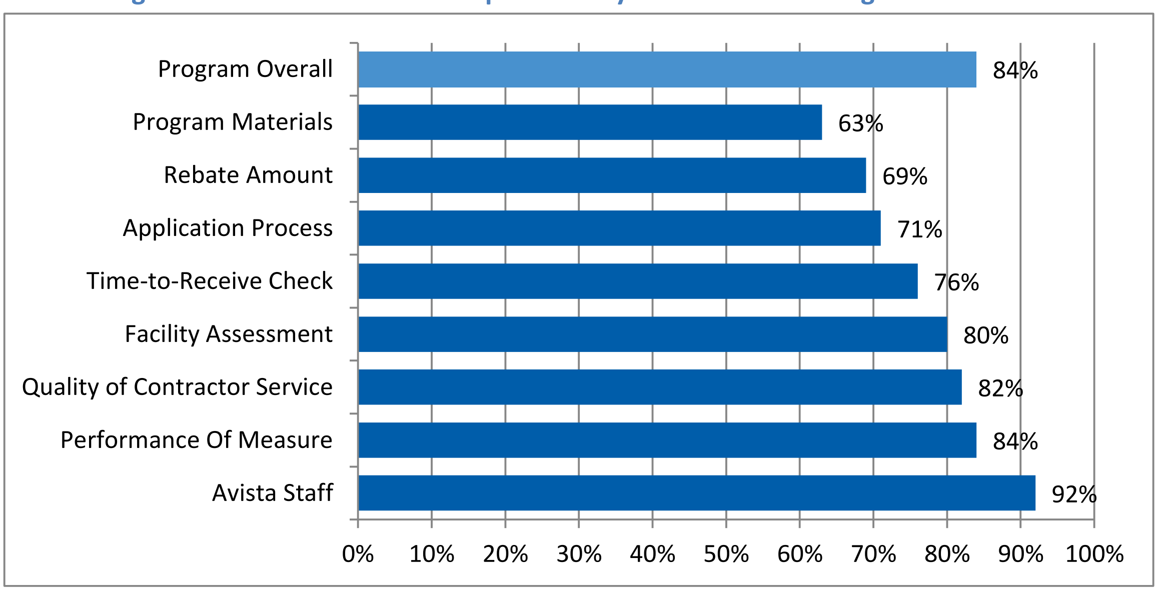


When asked how Avista could improve the program participation experience, Washington Site-Specific participants suggested increased responsiveness and improved program information. Responses included:

- “It would be nice if they could have recommend known heating and lighting and steered us to the best installers.”
- “Contact me the first time I call.”
- “Find a way to do this sooner for better information.”
- “Just shorten the timeframe on the initial inquiry.”
- “Improve the responsiveness of the technical team.”
- “Send me information that I need to finish the rebate process.”

Participants also reported generally high satisfaction with individual program elements. As Figure 31 shows, at least 63% of survey respondents indicated they were “very satisfied” with each program element. Avista staff received the highest satisfaction ratings, with 92% of respondents “very satisfied.” Program materials were the element that received the lowest satisfaction rating, with 63% of respondents “very satisfied.” Participant satisfaction with the facility audit improved markedly since the 2011 survey, rising from approximate 50% “very satisfied” in 2011 to 80% “very satisfied” in 2012-2013.

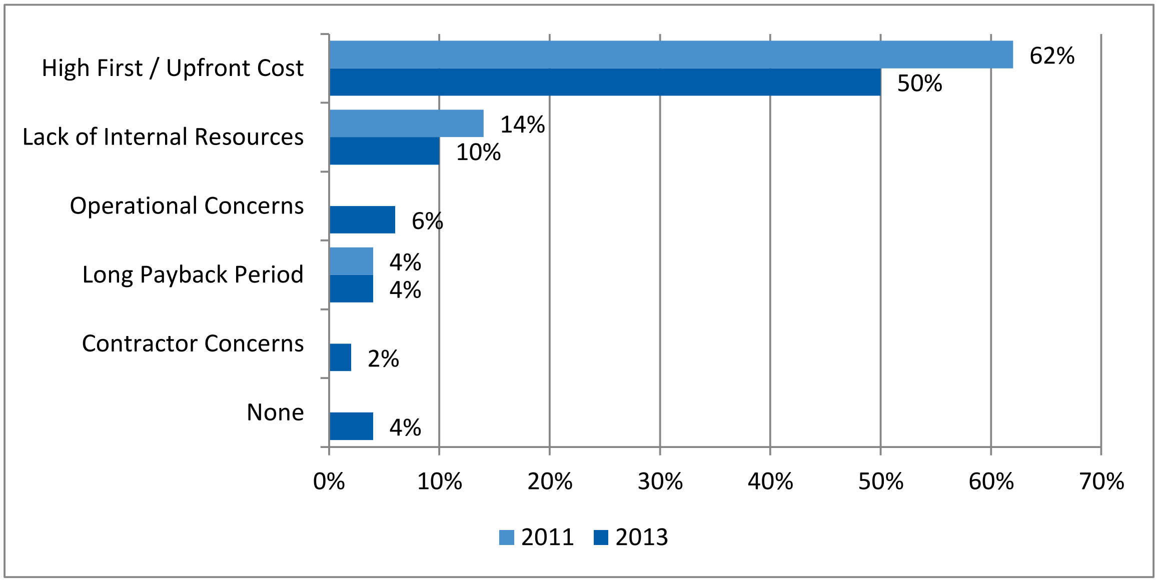
Figure 31. Percent of All Participants “Very Satisfied” with Program Elements



Program Barriers

Participants reported facing several barriers to installing energy-efficient equipment. The most common barriers cited are shown in Figure 32. The high up-front cost of energy-efficient equipment was the most commonly cited obstacle; 50% of participants said it was a challenge. Next, 6% of participants reported operational concerns, such as the inconvenience of having to work around customers and employees during business hours, and a new oven that made the surrounding space too hot. Long return on investment, lack of technical knowledge, and lack of staff time were obstacles according to 4% of respondents. An additional 4% said there were no obstacles at all. A small group of participants (five participants, or 2%) had difficulty finding competent and trustworthy contractors and vendors. One said, "The vendors twist information for their own benefit. If they have different lights, they say [energy-efficient lights are] not going to fit in there, so they install what they want to install."

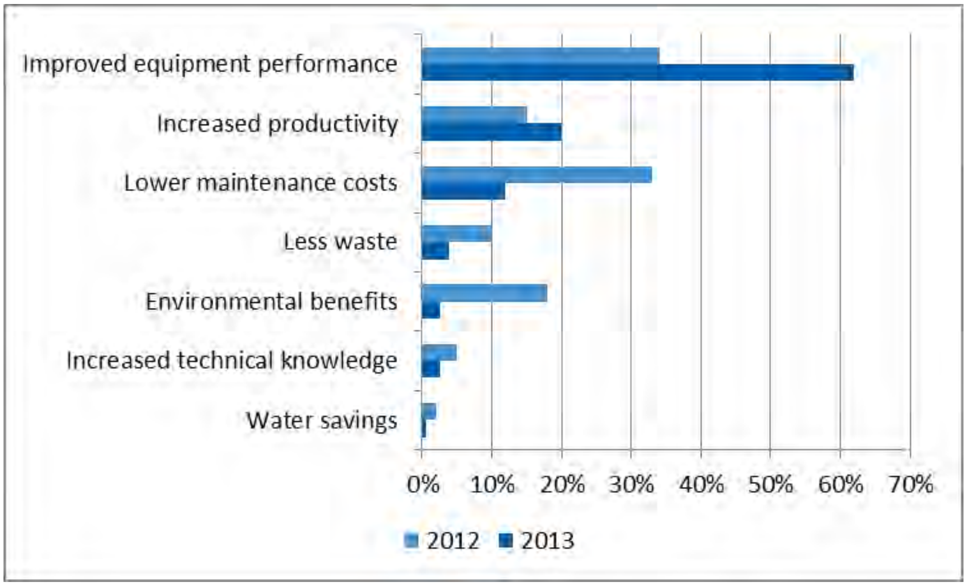
Figure 32. Obstacles to Installing Energy-Efficient Equipment



Program Benefits

Two-thirds (67%) of participants said the energy-efficient measures they took resulted in benefits beyond energy savings. As Figure 33 shows, the most common non-energy benefit participants cited was better equipment performance, such as improved comfort, better lighting quality, and less noise. Additionally, 20% of respondents said the project increased productivity (including increased sales, for retail facilities), while 12% cited lower maintenance costs. Other benefits that respondents mentioned were less waste, environmental benefits, increased technical knowledge, and water savings.

Figure 33. Non-Energy Benefits of Participation



Market Feedback

Cadmus interviewed 20 commercial lighting contractors to obtain feedback on how Avista's programs affected the overall market for energy-efficient lighting. Significant findings from these interviews are provided below.

Contractor Awareness

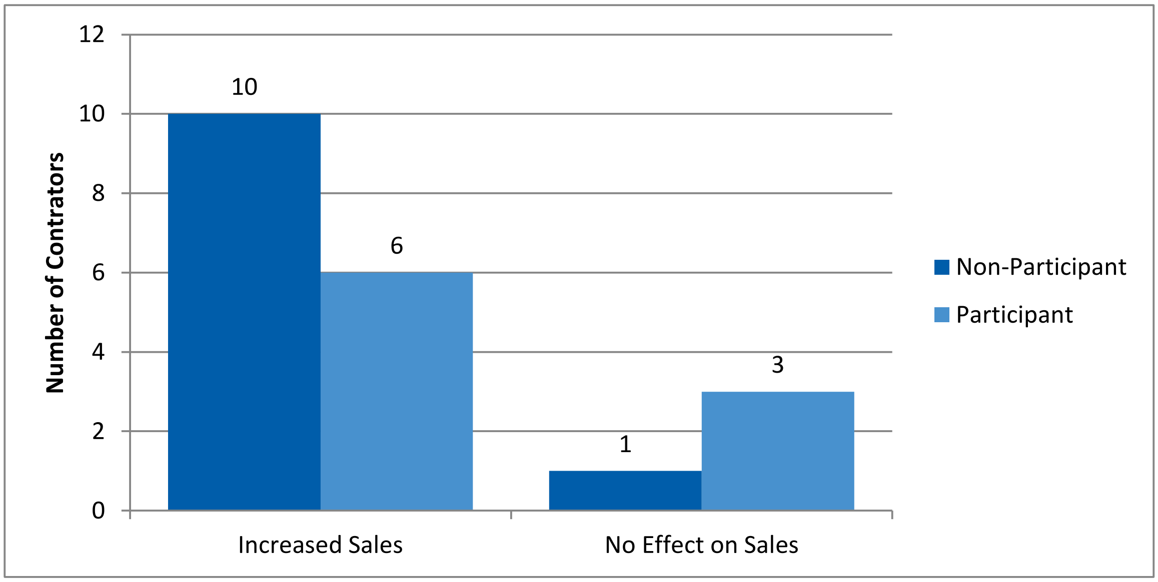
The most common way the lighting contractors said they had heard about Avista's energy-efficiency programs was through an Avista mailing. Figure 34 shows the sources of awareness the trade allies reported.

Figure 34. How Lighting Contractors Heard About the Programs

Program Impact on Sales

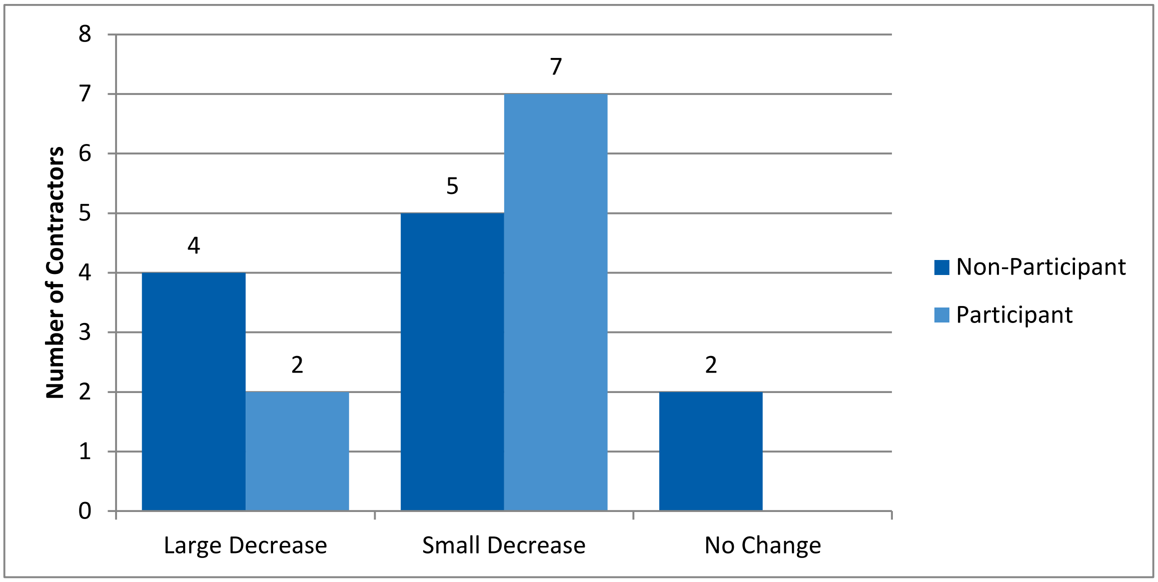
Cadmus asked the lighting contractors what impact Avista's rebate programs had on their business. As Figure 35 shows, 16 of the 20 contractors said their sales had increased, while four said they had seen no effect. (None of the contractors said their sales had decreased due to the programs.) Two contractors said they had noticed large increases in previous years, but that sales had dropped in 2013. One said, "[the programs] increased sales when the T12-to-T8 rebate existed, but now it has no effect on sales."

Figure 35. Avista Programs' Impact on Lighting Contractors' Sales



Nearly all contractors said energy-efficient sales would decrease if Avista's rebates were eliminated, as shown in Figure 36.

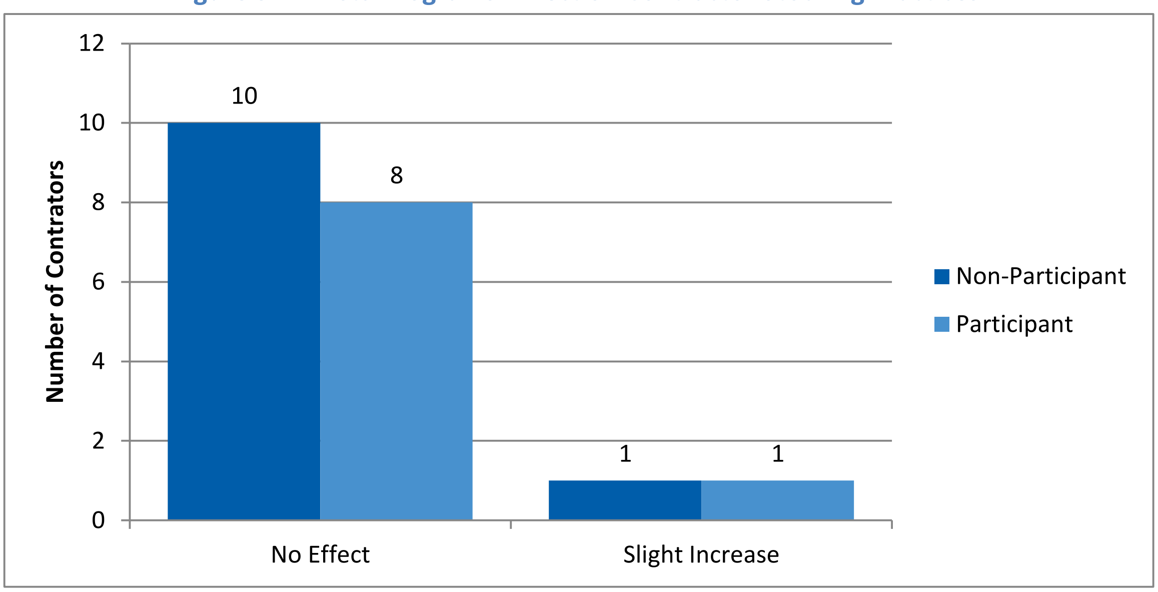
Figure 36. Hypothetical Effect of Avista Rebate Elimination on Contractors' Sales



Market Transformation

Most contractors reported Avista's programs do not affect their stocking practices, as shown in Figure 37.

Figure 37. Avista Programs' Effect on Contractor Stocking Practices



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Marketing and Outreach

Program Marketing Approach

Marketing Objectives and Strategies

Avista's marketing approach for 2013 was to increase awareness and participation in Avista's energy efficiency programs for commercial and industrial customers using customer endorsements, and showcasing additional value through non-energy benefits.

Planning and Processes

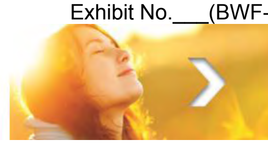
Avista staff plan, design, and execute nonresidential program marketing initiatives. As indicated in the PY2012 and PY2013 DSM plans, an internal collaborative process exists to develop general energy-efficiency marketing and promotions. This process incorporates feedback from the Energy Solutions, Services Development and Marketing, and Programs, Planning, and Analysis teams. The EnergySmart Grocer Program includes supplemental marketing as part of its program design and implementation plan.

Avista's marketing staff use the Avista Design System Guidelines to ensure that energy-efficiency marketing and outreach materials deliver a consistent look, feel, and message. This document includes guidelines for usages of items such as logos, color palettes, and fonts. It also includes an overview of applications, with examples of properly branded materials and collateral. All PY2012 and PY2013 general energy-efficiency marketing materials appear to be aligned with the guidelines. The *Efficiency Matters* campaign and Online Energy Advisor tool present slightly varied creative assets, although generally appear to follow the brand guidelines (i.e., fonts, logos, etc.).

Outreach Channels

Avista conducts residential energy-efficiency marketing through a variety of channels. In addition to the general energy-efficiency marketing tactics outlined below, Avista also conducts broad-based awareness efforts through its *Efficiency Matters* campaign, as described in the following section. Besides the *Efficiency Matters* campaign (which is implemented in partnership with KREM 2, a CBS affiliates), there are no mass media or cross-cutting promotional efforts, to avoid potential customer confusion across state lines. Notable outreach tactics used in PY2012 and PY2013 include:

- Paid media: print advertisements in local and regional magazines and newspapers;
- Earned media: local public relations as available;
- Direct mail and bill inserts: general and (targeted) program-specific;
- Newsletters and e-mail blasts: general outreach;
- Website (avistautilities.com): case studies added in 2013; and
- Vendor outreach meetings: general overview about programs, application process, project qualifications, and customer eligibility.



Print Advertising

The programs used print advertising to highlight customer success stories with call to learn more information at two specialized webpages:

- avistautilities.com/bizrebates
- avistautilities.com/casestudies

Figure 38: Example Case Study Print Advertisement

The ads appeared in select local and regional print publications, as shown in Table 31, targeted to reach key business decision makers. The ads ran from May through December 2013, and delivered over 1,041,000 gross impressions.

Table 31. Print Advertisement Publications

Business Journals	Trade Publications	Magazines

- Spokane Journal of Business - North Idaho Business Journal - Coeur d' Alene Press - Spokesman Review - The Wall Street Journal (zoned)	- HVAC/R Insider - The News (HVAC) - Today's Facility Manager	- Alaska Airlines - Horizon Airlines

Materials and Messaging

Cadmus reviewed *Efficiency Matters* campaign outreach materials and Avista's energy efficiency web pages, and conducted a high-level review of the Online Energy Advisor materials as a point of reference. The evaluation team found that there are varied creative assets and look and feel across channels and platforms. While the general energy efficiency promotional materials present a look and feel consistent with the brand guidelines, the Efficiency Matters campaign and Online Energy Advisor platforms leverage additional assets. For example, the Efficiency Matters landing page (www.everylittlebit.com) also includes assets from the Online Energy Advisor personas (with the "shield" creative) and creative developed by a 3rd party implementer.

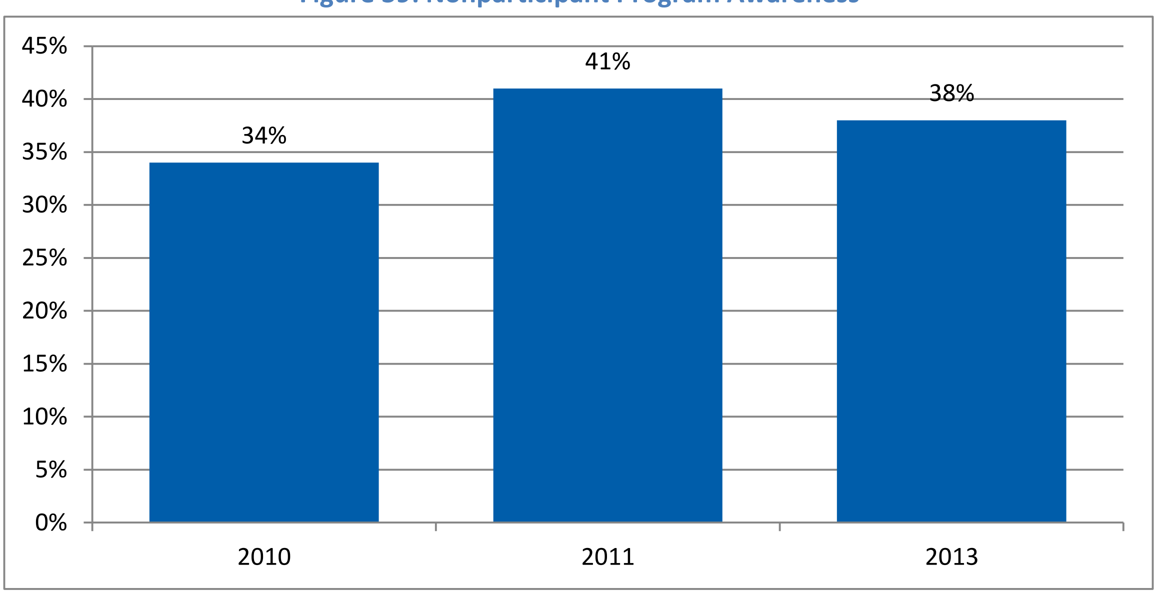
Marketing Execution and Measurement

Avista tracks metrics for its individual campaigns and ties results back to awareness and website traffic. In PY2013, Avista staff reported tracking *Efficiency Matters* campaign metrics (participants and traffic), estimated impressions through paid media, and response to direct mail.

Customer Awareness

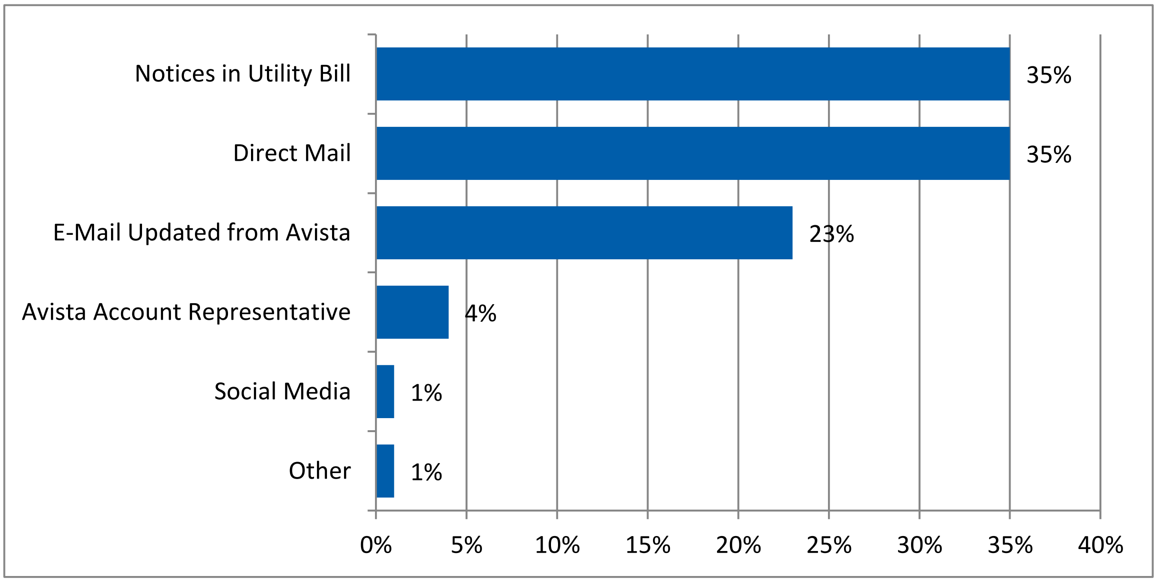
Most of the customers surveyed had not heard of Avista's nonresidential programs; 38% of nonparticipants recalled having heard about the programs. As Figure 39 shows, nonparticipants' awareness has remained relatively stable since 2010.

Figure 39: Nonparticipant Program Awareness



As shown in Figure 40, nonparticipants who were not previously aware of Avista's nonresidential programs overwhelmingly say they want to hear about them through the mail – bill inserts or direct mail. Nearly a quarter reported wanting to hear about the programs through e-mail.

Figure 40. How Nonparticipants Want to Hear about the Programs

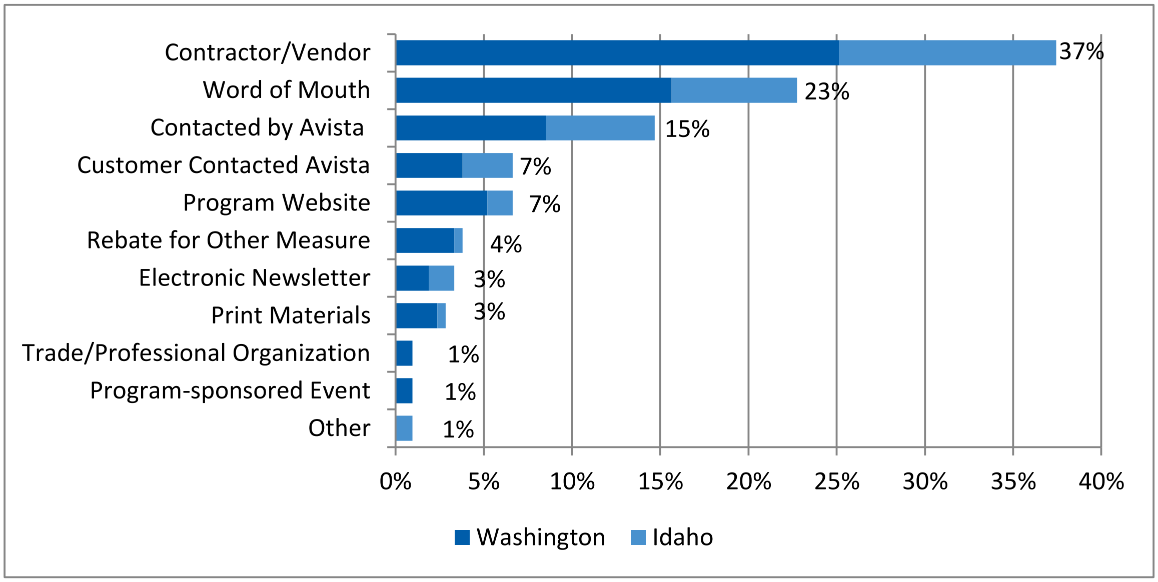


Sources of Participant Awareness

In both Washington and Idaho, most participating customers reported hearing about the program from a contractor or vendor, as shown in Figure 41. Contact from Avista and word-of-mouth were also commonly reported sources of awareness in both states.

Among Avista's marketing efforts, the program website was the most commonly cited source of awareness, with 7%. Three percent each said they learned about the program from printed materials (such as flyers or brochures) and the electronic newsletter. No participants reported they heard about the program through magazine or newspaper advertisements.

Figure 41. How Respondents Heard About the Program (Participants - Idaho)[20]



Nonresidential Program Freeridership and Spillover

Freeridership

Freeridership, the percentage of savings that are likely to have occurred in the program's absence, traditionally refers to participants who would have undertaken an action promoted by a program had the incentive or other program activities not been available. Full freeriders would have undertaken exactly the same action at the same time (i.e., the program had no effect on the degree or timing of their actions). Partial freeriders would have taken some action, but would not have undertaken the action to the level promoted by the program, or would not have taken the action at the time they did.

Table 32 shows overall nonresidential freeridership results for 2013, including gas and electric projects and participants in both Washington and Idaho. These results are based on 2013 participant survey response data and weighted by project savings.

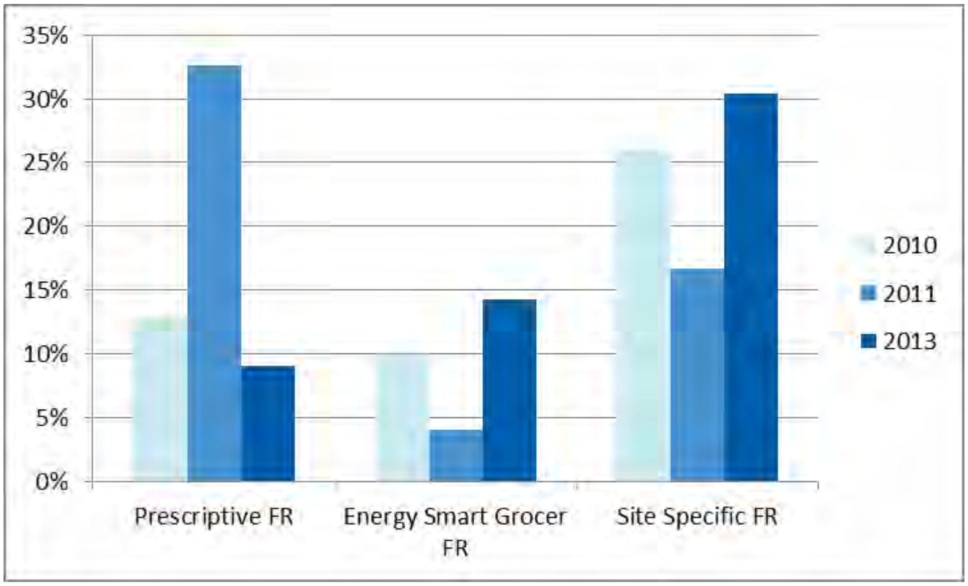
Table 32. Nonresidential Freeridership Estimates PY2013

Program Category	n	PY2013 Freeridership Estimate
Prescriptive	119	9.1%
Energy Smart Grocer	26	14.3%
Site-Specific	65	30.4%
Total	**210**	**19.5%**

[20] Percentages may add up to more than 100% because respondents were permitted to give multiple answers.

The PY2013 prescriptive program showed a low level of freeridership, while the site-specific program showed slightly over 30% freeridership. As shown in Figure 42, these results differ from 2011 freeridership results, but are fairly similar to the results found in 2010.

Figure 42. 2010, 2011, and 2013 Nonresidential Program Freeridership



Because nonresidential projects can be very large, and freeridership results are weighted by savings, the highest saving projects in the sample can have a strong influence on year-to-year results. To further examine the difference between the 2013 and 2011 analysis, Cadmus identified the top three savers in each program category and their freeridership scores.

- **Prescriptive showed a decrease in freeridership:** A key driver of the decrease is that in the 2011 analysis, the three respondents with the highest gross energy savings accounted for 34% of the survey sample's total gross savings. The top energy saver was estimated as a 75% freerider, and represented 19% of the total survey sample savings, while the second and third highest energy savers were estimated as 0% freeriders. In 2013, the three participants who achieved the greatest savings accounted for 38% of the total gross savings for the survey sample and all three respondents were estimated to have 0% freeridership. As such, the high level of savings achieved by these three 2013 participants, relative to the rest of the 2013 survey sample, resulted in these participants' freeridership scores greatly reducing the overall freeridership estimate reported in 2013 compared to what was observed through the 2011 evaluation efforts.
- **Energy Smart Grocer showed an increase in freeridership:** A key driver of increase is that in the 2012 analysis, the three respondents with the highest gross energy savings accounted for 72% of the survey sample's total gross savings and all three respondents were estimated to have 0% freeridership. As such, the high level of savings achieved by these three participants, relative to

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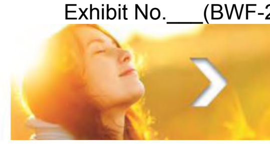
the rest of the survey sample, resulted in these participants' freeridership scores greatly reducing the overall freeridership estimate reported in 2011. In 2013, the three participants who achieved the greatest savings only accounted for 64% of the total gross savings for the survey sample and the top energy saver was estimated as a 0% freerider. The second largest energy saver, representing 16% of 2013 survey sample savings, was estimated as a 75% freerider and the third highest energy saver as a 0% freerider. As such, the high level of savings achieved by these three 2013 participants, relative to the rest of the survey sample, resulted in these participants' freeridership scores greatly increasing the overall freeridership estimate reported in 2013 compared to what was observed through the 2011 evaluation efforts.

- **Site-specific showed an increase in freeridership:** A key driver of the increase is that in the 2011 analysis, the three respondents with the highest gross energy savings accounted for 35% of the survey sample's total gross savings, and first and second highest energy savers were estimated as 0% freeriders, and represented 28% of the total survey sample savings, while the third highest energy saver (7% of total survey sample savings) was estimated as a 100% freerider. In 2013, the three participants who achieved the greatest savings accounted for 41% of the total gross savings for the survey sample. The top energy saver, representing 21% of the survey sample savings, was estimated as a 0% freerider. The second highest energy saver was estimated as a 50% freerider and the third largest saver as a 100% freerider. As such, the high level of savings achieved by these three participants, relative to the rest of the survey sample, resulted in these participants' freeridership scores increasing the overall freeridership estimate reported in 2013 compared to what was observed through the 2011 evaluation efforts.

These year to year variations accurately reflect the activity of participants within each program year, but they can reduce clarity when observing year-to-year trends. For example, since the site-specific program did not change substantially between 2011 and 2013, the large change in freeridership may reflect differences between individual customers, rather than changes in the market or in the program's implementation. Therefore, Cadmus also calculated combined freeridership values that reflect the aggregated survey data from 2011 and 2013. These values may portray a more reasonable estimate of the programs' overall level of freeridership that could be expected in future years if programs do not change substantially.

Table 33. Nonresidential Freeridership Estimates: Combined PY2011 and PY2013

Program Category	n	Combined Freeridership Estimate
Prescriptive	189	16.2%
Energy Smart Grocer	43	12.7%
Site-Specific	128	24.3%
Total	**360**	**19.5%**



Spillover

Participant spillover refers to additional savings generated by program participants due to their program participation, but not captured by program records. Spillover occurs when participants choose to purchase energy-efficient measures or adopt energy-efficient practices due to a program, but choose not to participate (or are otherwise unable to participate) in an incentive program. These customers' savings are not automatically credited to the utility program. Energy-efficiency programs' spillover effects can be considered an additional impact that gets credited to program results. In contrast, freeriders' impacts reduce the net savings attributable to a program.

In this evaluation, Cadmus measured spillover achieved through the installation of measures without utility rebates through surveys with participant end-users. We have found these savings to be the easiest to quantify through self-report surveys.

As shown in Table 34, Cadmus found a small amount of participant spillover for PY2013, equivalent to 0.05% of total program gross savings. The reported measures included in the spillover savings included LEDs (350 total units) and energy-efficient light fixtures (10 total units).

Table 34. Nonresidential Spillover Estimates for PY2013

Program Category	Spillover BTU Savings	Program Sample BTU Savings	Spillover % Estimate
Prescriptive	204,728	7,812,790,682	0.00%
Energy Smart Grocer	0	2,885,093,921	0.00%
Site-Specific	14,148,104	19,838,919,241	0.07%
Total	**14,352,833**	**30,536,803,843**	**0.05%**

Nonresidential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the nonresidential programs.

Program Management and Implementation

Conclusion: Several parties over several years, internal and external to Avista, have observed the need for greater data quality assurance, in both documentation and input tracking. Quantitative inputs to the savings and rebate calculations have repercussions for tariff compliance,[21] incentive payments, and savings realization rates.

- ***Recommendation:*** Avista should continue efforts to improve program processes. Cadmus understands that a reorganization of the DSM group has occurred concurrent to the delivery of this report. This change may be an opportunity for fresh perspectives, clarified responsibilities,

[21] As noted in Idaho Public Utilities Commission Order Number 33009 on Avista Corporation's Application for a Finding that it Prudently Incurred its 2010-2012 Electric and Natural Gas Energy Efficiency Expenditures.

and improved coordination within and between teams. We believe unifying the organizational structure under central leadership is a step in the right direction and may help alleviate some previously documented issues with internal communications.

In addition to the reorganization, Cadmus recommends that Avista develop standardized processes within the DSM group, including clear delineation of roles and precise description and assignment of all processes and responsibilities for both residential and nonresidential programs. All affected parties should be included in formalizing and standardizing the DSM group's processes, roles, and responsibilities. Further, all parties must formally agree to clearly delineated responsibilities under the new organizational structure. While these activities need to be prescriptive and precise, we caution that the resulting structure should still allow some flexibility: increased clarity, transparency, and accountability should serve to enhance program delivery and customer satisfaction.

Customer Feedback

***Conclusion**:* Customers were highly satisfied with the program overall and with individual components. Customer satisfaction has increased since 2011, which had in turn increased from 2010.

- **Recommendation:** Continue to prioritize and monitor program satisfaction.

***Conclusion**:* Customers appeared to be slightly less satisfied with the Washington Site-Specific program than with other programs. The largest source of lower satisfaction was the participants' reactions to program materials. Many customers said they received no program materials, and many participants learned about the program from their trade allies.

- ***Recommendation**:* Consider taking action to strengthen the use of program materials. Consider providing trade allies with printed program information flyers or brochures to give to customers. Maintaining up-to-date information for trade allies is critical when they are the key party delivering the program's message and participation details.

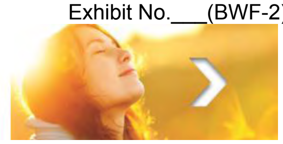
Market Feedback

***Conclusion**:* According to commercial lighting contractor feedback, the nonresidential programs are successful in driving incremental energy-efficient equipment sales, and the market has not yet transformed to make energy efficiency standard practice.

- ***Recommendation**:* Continue to monitor market transformation indicators to measure programs' market impact over time.

Marketing and Outreach

***Conclusion**:* The characteristics of Cadmus' survey respondents indicate that the office / professional services and local government sectors may be underserved by the programs relative to their incidence in the nonparticipant population. Further research is necessary to determine whether this is true.



- ***Recommendation:*** Identify underserved industries, and seek opportunities to target outreach to specific underserved industries:
  - Investigate overall customer industry distribution
  - Compare to participant industry distribution
  - Develop targeted outreach strategies for any underserved sectors

Quality Assurance and Verification

Conclusion: Avista monitored its site-specific project review process and instituted refinements during the evaluation period in response to feedback from users. While this has led to improvements, including notably improved reliability of reported savings in 2012, quality assurance problems may persist.

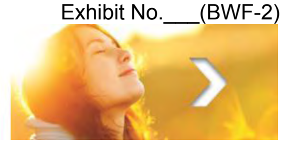
- ***Recommendation:*** Continue to monitor the effectiveness of the site-specific project review process and refine as needed. Cadmus recommends implementing the following to ensure continued improvement:
  - All large prescriptive or site-specific projects reporting savings over a threshold of 300,000 kWh or 10,000 therms should undergo a complete QA/QC review prior to incentive payment in addition to the standard Top Sheet review process. Typically, a QA/QC process reviews engineering calculations, verifies inputs, checks payback period and incentive payments for reasonableness, and ensures compliance with program requirements and tariff rules. In order to align with the above recommendation regarding program management and implementation, Cadmus recommends that Avista determine and document the specific requirements and steps in the QA/QC process through a collaborative process that will ensure accountability and balance needs for efficiency and customer satisfaction.
  - Conduct an external third-party review of Top Sheets, including reviewing a random sample of completed Top Sheets for completeness and accuracy. These were not reviewed as part of the current process evaluation, but should be included in the next process evaluation. Review should not only verify the presence of the Top Sheets, but also the quality and accuracy of the information provided.

CADMUS

Appendix A: Status of PY2010 and PY2011 Residential Evaluation Recommendations

Table 35. Implementation of PY2010 Residential Evaluation Recommendations

Recommendations Offered in PY2010 Residential Evaluation Report	Activity
Program Participation	
Research market saturation and participation to track achievement of potential.	Complete
Using the Avista Electric Conservation Potential Assessment Study completed in August 2011, along with available data sources such as ENERGY STAR and additional primary research, Avista should track the residential portfolio's progress toward capturing projected realistic achievable potential. This effort will inform program planning and design decisions to allow for the long-term success of the residential portfolio.	
Discontinue rebate for ENERGY STAR dishwashers.	Complete
ENERGY STAR data shows that 78 percent of dishwashers sold nationally are ENERGY STAR models. Therefore, this measure is likely to suffer from high freeridership, and the Avista rebate is unlikely to affect market transformation.	
Emphasize ease of participation in marketing.	In Progress
In order to address the nonparticipant perception that program participation may be difficult, Avista should emphasize the ease of participating in residential marketing	
Program Design	
Simplify and document program organization structure.	In Progress
Cadmus recommends grouping programs in logical clusters, in order to reduce complexity of documentation and tracking. While streamlining program organization, Avista should also document institutional knowledge of programs to avoid loss of continuity.	
Assess viability of redesigning some programs to include contractor rebates.	In Progress
Avista should consider the suggestion from HVAC trade allies to provide rebates direct to contractors. Other utilities have seen success with this model, which reduces the administrative burden on customers, allows for batch processing of rebates by Avista, and ensures close communication with trade allies. Anti-fraud provisions (such as requiring customer information and signature on rebate forms, or conducting site visits to verify installation) must be included in any such program adaptation.	
Data Tracking	
Consider enhancing uniformity of program tracking by standardizing data formats.	Complete
Wherever possible, Avista should develop tracking methods that support consistent analysis across programs. For example, a standardized format for customer address data across separate databases would ease database combination or integration.	
Track follow-through on audit recommendations.	In Progress
In planning for future Audit program implementation, Avista should consider additional tracking of customer follow-through on recommendations, both through other Avista rebate programs, and independently without rebates.	
Marketing and Outreach	
Continue pursuing diverse marketing and outreach strategies.	Complete
Avista should maintain its multi-faceted approach to reaching a broad range of customers, while targeting difficult-to-reach customers where appropriate.	
Continue enhancing social media marketing.	Complete

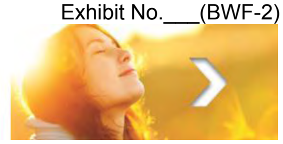


Recommendations Offered in PY2010 Residential Evaluation Report	Activity
Since Avista reported that younger customers can be more difficult to reach, the marketing team should continue to enhance its social media marketing efforts.	
Ensure contractors have adequate information to disseminate.	Limited Activity
Since trade allies were one of the commonly reported ways that participants learned about the program, Avista must focus on providing trade allies with adequate and accurate information. This can be achieved by distributing updated materials regularly, holding trainings for contractors, or formalizing the trade ally network to ensure frequent communication. For example, Avista should consider providing printable online information sheets that trade allies can print and disseminate to their customers.	
Participant Experience and Satisfaction	
Continue emphasizing good customer service and offering customer-friendly programs.	Complete
These areas should be maintained as priorities in future program planning and implementation.	
Effectiveness of Implementers	
Consider expanding offerings of Simple Steps program.	Complete
Avista should consider the benefits of adding measures to the Simple Steps program. Additional measure offerings may increase potential participation and savings.	
Require [CLEAResult] to ensure evaluators have access to retailers.	Limited Activity
Upstream program evaluation often requires access to retail locations, for shelf-stocking studies and in-store intercepts, for example. In order to ensure future evaluability of the Simple Steps program, [CLEAResult] should require participating retailers to grant such access to evaluators when necessary.	
Trade Ally Participation and Satisfaction	
Enhance and formalize trade ally network.	In Progress
Avista should offer additional training and informational materials to contractors who serve the HVAC program, to ensure high-quality program information reaches customers, and to encourage program promotion through contractors.	
Residential Portfolio	
Consider various opportunities for expansion.	Complete
Avista should regularly assess the viability of expanded program and measure offerings. Avista may consider various possible expansions including: *- Adding showerheads to Simple Steps* *- Additional cost-effective measures in HVAC program* *- Behavioral programs, energy education programs*	

Table 36. Implementation of PY2010 Residential Evaluation Recommendations

Recommendations Offered in PY2011 Residential Evaluation Report	Activity
Program Participation	
Renew emphasis on customer outreach and mass marketing, including refreshing campaign messaging and using trade allies.	Complete
Consider using lessons learned from the Home Energy Audit Pilot Program to design and implement a full-scale program that employs audits or a similar whole-house approach.	Limited Activity
Program Design	
Consider additional program requirements to ensure measure savings remain in line with expectations.	Limited Activity

Recommendations Offered in PY2011 Residential Evaluation Report	Activity
For example, Avista should revisit program eligibility for multiple measures, where savings are interactive (particularly for HVAC equipment), and consider adjusting savings to reflect interactive effects, or incenting specific packages of complementary measures. Avista may also consider not offering heat pump incentives when natural gas is available.	
Explore possible benefits of outsourcing simple rebate processing for ENERGY STAR appliances and hot water heaters in order to allow program managers to focus on long-term program considerations.	In Progress
Market Characteristics	
Ensure future program effectiveness by continuing to update program offerings and design to reflect changes in market conditions	Complete
Data Tracking	
Ensure consistency in data tracked across multiple databases including: the multi-program database; the JACO database; the Home Energy Audit database; and Avista's central customer information database.	In Progress
If Avista continues the Home Energy Audit Program, audit tracking should be enhanced to include: integration into the central participant rebate database; and more robust tracking of data collected through the audit, and of follow-through installations.	In Progress
Marketing and Outreach	
Avista should maintain its multifaceted approach to reaching a broad range of customers, while targeting difficult-to-reach customers, where appropriate. Possible website enhancements include:	In Progress
- Exploring relationships between the corporate website and EveryLittleBit.com. Explore the Entrance-, Exit- and In- Page analytics to achieve a deeper understanding of the paths people take within the website. *- Adding a content-sharing toolbar to the EveryLittleBit.com website to promote referrals. This toolbar would allow users to share content via email, RSS feeds, or social media platforms.*	
Participant Experience and Satisfaction	
Continue to prioritize customer satisfaction, and take advantage of high satisfaction by targeting past participants for future participation.	Complete
Residential Program Freeridership	
Continue conducting research to inform decision making about future program improvements/continuation.	Complete
Effectiveness of Implementers	
Explore possible benefits of third-party program implementation.	In Progress
Avista's newly launched online rebate application system may alleviate staff burden associated with rebate processing. However, that transferring responsibility for rebate processing to a third-party contractor could convey further benefits. Specifically, this option should be explored for the ENERGY STAR Appliance Rebate Program and water heaters, as the application reviews for these measures do not require a high level of expertise.	
Trade Ally Participation and Satisfaction	
Avista should investigate the possibility of a more formal relationship with trade allies.	In Progress
This would allow increased program marketing through trade ally channels, while ensuring accountability and professionalism. Disseminating simple program information sheets to contractors and retailers would be a low-cost, first step toward developing relationships with key trade allies. More involvement might include, for example, hosting trade-ally training events.	



Appendix B: Status of PY2010 and PY2011 Nonresidential Evaluation Recommendations

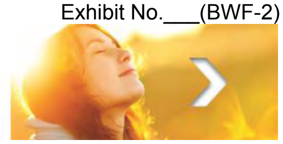
Table 37. Implementation of PY2010 Nonresidential Evaluation Recommendations

PY 2010 Recommendation	Activity
Program Documentation	
Developing a program manual, with implementation plans, operational procedures, marketing strategies, and verification protocols aggregated into a single program handbook, could help to establish a link between EM&V policies found in the high level planning documents and the program's operational management.	Complete
Customer Feedback	
Address customers' perceived lack of information about program offerings.	In Progress
• *Enhance outreach and communication efforts for participants, nonparticipants, and partial participants.* • *Develop additional printed program materials to educate customers about program opportunities.* • *Consider regularly scheduled online Webinars to assist customers with questions about program incentives, eligibility, and application processing.*	
Trade Ally Participation and Satisfaction	
Provide regular trade ally communications through targeted outreach efforts, such as a Website, monthly e-mails, or a newsletter.	Complete
A Website dedicated for trade allies could enable registration, thereby providing a method for compiling (and updating) trade ally profiles and contact information.	
Consider providing additional promotional materials that would highlight various program technologies available to customers. This would not require that Avista endorse any one contractor.	Complete
Explore ways to leverage strong working relationships forged between customers and contractors within the community by sponsoring additional program working sessions, luncheons, or Webinars that provide guidance for trade ally outreach efforts.	Complete
Application Processing and Data Tracking	
Offer site-specific application forms online.	Limited Activity
Although it would be ideal to enable submission of forms online, simply making the forms downloadable and mail-in would provide a good first step. In addition, consider including guidelines for completing site-specific forms.	
Gather additional feedback from customers and trade allies about how site-specific form enrollment and processing could be streamlined.	In Progress
Gathering more detail about program and project measures in the participant database would enable a better understanding of the kinds of projects done in the past (by different types of customers and end-uses).	In Progress
Additional information could be used to market specific types of projects to other customers who have the same end-use equipment.	
Marketing and Outreach	
Ensure allocation in future marketing budgets dedicated for nonresidential program marketing and outreach efforts.	Complete
Develop additional marketing materials targeted specifically for trade ally outreach to customers.	Complete
These materials would enable Avista staff to leverage existing trade ally relationships in the community. Make them available at a trade ally website for printing.	
Conduct marketing surveys, and targeted marketing research that would gather additional	Limited Activity

PY 2010 Recommendation	Activity
information about customer facilities and technology end-uses.	
Conduct targeted marketing research of largest 100 customers with hourly demand data.	Limited Activity
Use such data to analyze demand patterns, identify opportunities, and provide account executives with needed intelligence to market energy efficiency measures.	
Quality Assurance and Verification	
Consider developing a verification protocol to document pre- and post-inspection procedures for prescriptive programs, and ensure data tracking for project installation. In addition, protocols should highlight any differences in verification procedures used for prescriptive and site-specific programs.	In Progress

Table 38. Implementation of PY2011 Nonresidential Evaluation Recommendations

PY2011 Recommendation	Activity
Program Management and Implementation	
Consider a method for prioritizing management tasks, thus enabling allocation of more time for planning and development of program documentation.	In Progress
Revisit the staffing needs for delivering the current programs.	In Progress
Revisit the option of using third-party implementers for some programs.	Limited Activity
Consider round tables with the program implementation, management, and policy team to facilitate additional communication regarding planning and evaluation.	Complete
Consider designating a central leadership role for the Site-Specific Program to oversee future planning and vision, and ensure that it continues to deliver cost-effective energy savings to the C&I portfolio.	In Progress
Further investigate contractor issues to ensure high satisfaction levels of EnergySmart Grocer program participants	Complete
Customer Feedback	
Continue to leverage contractors to reinforce the program’s messages, particularly in communicating program offerings to small-to-medium customers.	Complete
Further explorations could determine if contractors offer better market coverage, are more likely to connect with customers when purchases are being contemplated, provide a more compelling value proposition, or offer other lessons Avista could apply, both with contractors and across other communications channels.	
Strategies should be developed to penetrate leased C&I spaces, targeting building owners, managers, and brokers of leased space. Examples could include:	In Progress
• *Tailored messages, delivered through presentations or workshops in conjunction with the Building Owners and Managers Association and commercial real estate associations.* • *Designated point-of-contact and web information for building managers and brokers.* • *Incentive and financing solutions, such as on-bill financing, green lease arrangements, and bonus incentives targeting retrofits when new tenants move in.*	
Cadmus recommends Avista evaluate alternative strategies for reaching small-to-medium businesses cost-effectively via contractors, direct install, or more Prescriptive, “self-serve” options via the Avista website. Such strategies could include:	In Progress
• *Promote newsletter sign-ups and exploration of program information on the website.* • *In program information, cross-reference sources or the availability of answer lines.* • *Evaluate measures installed by small customers in the Site-Specific Program for inclusion in a Prescriptive program.*	



PY2011 Recommendation	Activity
Where customers expressed lower satisfaction levels, program elements should be investigated. Such investigations might include:	In Progress
• *Review audit program communications and supporting collateral to improve customers' understanding of the depth of audits, and recommendations. Consider providing information about economic advantages to energy efficiency such as improved benefits to costs ratios, and simple payback.* • *Determine/track cycle times for customer follow-up after audits and for rebate applications; if reasonable times are exceeded, consider implementing follow-up communications to keep customers informed and ensure internal follow-up, if needed.* • *Confirm issues identified in the EnergySmart Grocer program have been resolved.*	
Trade Ally Feedback	
Explore more formalized ways to aid trade allies in promoting nonresidential programs to customers. Avista should continue efforts to expand outreach to trade allies, through sponsored events and workshops, breakfast meetings, focus groups, and other targeted communications.	Complete
Given trade allies' requests for a dedicated Avista contact, more one-on-one communication, and additional materials to inform customers about the programs, more timely feedback could be achieved through online resources. These resources may also help to reinforce the program's messages, offering resources through multiple channels by providing the following services:	Complete
• *Offering a dedicated website, containing guidance through webinars and video presentations.* • *Online registration for events or information requests.* • *An online help desk or phone hotline, which would direct customers to answers for frequently asked questions, or would reserve more complicated questions for program staff.* • *Other, additional promotional materials, posted online, such as handouts regarding costs and benefits of energy-efficiency equipment.*	
Special Report: Lighting	
Take a more proactive role in communicating with customers:	Complete
• *Upcoming changes in lighting product availability* • *Avista's program availability to offer them help* • *When the T-12 program will end* • *Communications should also offer help in identifying T-12 lamps (descriptions or illustrations of size), and inform customers about the lighting quality of alternatives.*	
To motivate contractors and accelerate customer action, Avista may consider creating a lighting contractor partnership program, with incentives paid to contractors (or rebates paid directly to contractors) for encouraging customers to update lighting fixtures while incentives remain available.	Complete
Avista should consider a new program, targeting replacements of T-12s in inventory, to help customers upgrade to more efficient new fixtures and lamps, and to move toward realization of energy savings in their facilities.	In Progress
Marketing and Outreach	
To ensure the recognition and longevity of focused outreach efforts, Cadmus recommends Avista continue expanded annual market campaigns to enable more focused targeted marketing for the nonresidential programs. In addition, nonresidential programs may benefit from these additional suggestions:	Complete
• *Develop a detailed marketing plan enabling annual tracking and assessment of activities. The marketing plan would identify target audiences, clarify marketing objectives, and identify evaluation metrics.* • *Continue efforts to enhance the business website through promotions and featured business*	

PY2011 Recommendation	Activity
information tools (such as Efficiency Avenue), testimonials, general program brochures; and encourage easier access for trade allies through featured guidelines and tips.	
Application Processing and Data Tracking	
Drawing upon the review of application forms and databases, interviews with staff, and survey results, Cadmus recommends the following:	In Progress
• *Track missing data fields in Sales Logix, and include these in extract databases.* • *Document QA procedures or checklists to reduce missing or inconsistent data entry.* • *In addition to checking for missing data, Avista staff may benefit from developing a checklist for staff entering participant data into databases, ensuring all data are collected consistently.*	
Work toward integrating customer information tracking databases, thus enhancing efficiency and reducing error.	In Progress
Consider incorporating changes to forms to account for new data collected through calculators.	In Progress
QA and Verification	
Cadmus recommends Avista continue strengthening feedback loops for performance review of large projects. To achieve greater consistency, Avista should consider documenting pre- and post-inspection protocols, which could include the following, recommended, industry best practices for C&I programs:	In Progress
• *Establish inspection frequency, based on a program's relationship with vendors, number of vendors, types of measures, project volume, variability, and size of projects.* • *Obtain a random sample of vendor and measure types.* • *Clearly define pre- and post-inspection policies and procedures.* • *Require random, on-site inspections of 10% to 20% of projects in lower-incentive prescriptive programs.* • *Require pre-project inspections for all large projects with highly uncertain baseline conditions.*	

Appendix C: 2012 Nonresidential Process Evaluation Memorandum

This section provides the text from the nonresidential process evaluation memo drafted by Cadmus and sent to Avista on August 2, 2013.

CADMUS

MEMORANDUM

To:	Lori Hermanson, Avista
From:	Danielle Kolp and Hope Lobkowicz, Cadmus
Subject:	2012 Process Evaluation Memorandum
Date:	August 2, 2013

Cadmus' 2012 process evaluation activities for the Avista nonresidential portfolio included the following:

- A *Best Practice Comparative Review* (memo delivered in February 2013);
- In-person interviews with program stakeholders; and
- Database and realization rate review.

Because Cadmus is not developing a formal process evaluation report for Avista until 2014, this memo presents the findings of the staff interviews and database and realization rate review conducted for the 2012 program year. Our objective is to provide key personnel at Avista with findings now to assist them in improving program processes in real-time.

Key Findings

Interview Findings: Large Project Review Challenges and Changes

In August 2011, Avista instated a new internal system to independently review site-specific projects with incentives greater than $50,000. This review stemmed from a recommendation in the 2010 Moss Adams process report, pursuant to the 2010 Washington Utilities and Transportation Commission (UTC) rate case settlement terms. The objective of the independent review was to examine project evaluation reports prior to entering into contract with the customer, to ensure that:

- All supporting documentation was in place,
- Savings calculations were reasonable and well supported, and
- The project complied with tariff rules.

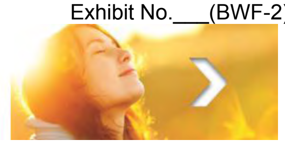
Avista staff who participated in the review process experienced multiple challenges, which are discussed in more detail below. By the end of 2012, staff concluded that the review process was not functioning efficiently, nor did it align with the intention of the Moss Adams report recommendation. Avista suspended the review process on January 1, 2013. In 2013, Avista intends to implement a new approach for reviewing site-specific projects, with the goal of balancing customer service and expediency with a sound review. In June 2013, Avista demand-side management (DSM) staff were finalizing this new approach.

Review Process Challenges Identified by Avista

Cadmus interviewed five Avista DSM staff who were involved in the review process. During the interviews, we discussed several core areas of concern with the process and determined that the intended protocol was not being followed. The process dictated that the Planning, Policy, and Analysis (PPA) team independently review the energy savings and proposed incentive levels of all site-specific projects with incentives greater than $50,000, to ensure these impacts were calculated reasonably. In 2012, only one-third of projects that met the criterion were sent to PPA for review.

When Cadmus asked staff about the challenges with this review process, the following four main issues surfaced:

3. ***Different focused attention across teams.*** One staff person reported that the key personnel within the DSM department involved in the review had different focused attention, which in some cases translated to varying objectives for reviewing and approving projects. This is a problem across many organizations and is, by no means, limited to Avista. While implementation teams are most concerned with customer satisfaction and speedy and efficient delivery, planning and evaluation teams are most concerned with compliance. At Avista, the Implementation team was focused heavily on the customer relationship, while PPA was focused on ensuring compliance with the tariff, minimizing the risk of uncertainty associated with claimed savings, and navigating relationships with regulatory bodies and stakeholders. This is not to say that neither team was unconcerned with the other's objectives. While staff agreed that their roles support the comprehensive functions and *all* overarching goals of Avista's DSM programs, specific daily priorities added to misunderstandings about the value of the review and, in some cases, differing opinions on how and when to resolve issues.
4. ***Transparency.*** Some staff who were heavily involved in Avista's site-specific projects reported not understanding the purpose, actions, or outcomes of the review. Without program-stakeholder buy-in at all levels of the process, successful implementation was challenging. One particular concern was a lack of information regarding how long the review would take to complete for each project; this made it difficult to communicate accurate information to customers on the status of their projects and the expected timeline.
5. ***Time lag and time commitment***. A common obstacle cited by all staff interviewed by Cadmus was that the review process took too long to complete for each project. Often, the issues identified during the review required further discussion to understand the assumptions behind



the savings estimation, new data or information requests from the customer, or new analysis, which caused delays. Another challenge was the volume of the projects and limited staff resources. Having only one engineer dedicated to reviewing the large projects was problematic and often caused bottlenecks.

6. ***Linking review with concrete actions.*** The review process lacked a formal follow through procedure for problems uncovered during the review. This caused frustration as, at times, findings and recommendations were not implemented. Interviews and documentation of the review process indicated that the extent to which the issues were resolved varied. For enhanced delivery of DSM services, there needs to be an agreement regarding the best path forward for calculating savings.

Issues Identified Through the Large Project Review

One of the major findings of the review was the overall reliance on customer-supplied data and the need for a reliable and replicable approach to source that data. Avista staff were in agreement that increasing the clarity and transparency about where engineering assumptions and inputs were coming from was a needed improvement and a successful outcome of the review process.

Cadmus reviewed the communication logs for 22 projects that underwent the internal review. In addition to the above issue of reliance on customer-supplied data or assumptions (which was inaccurate in some cases), the following issues were documented for these projects:

- Interactive effects were accounted for incorrectly;
- Projects had missing documentation, such as invoices; and
- Engineering errors resulted in incorrect claimed savings and incentive amounts (the significance of these errors varied in size).

Planned Process Improvements

In 2013, Avista staff worked together to design a new system to address the challenges cited and issues discovered with the 2012 review process. The staff is currently implementing a two-step review process for all site-specific projects that entails a technical review by the engineering team and an administrative review by program staff.

- ***Technical Review:*** Ensures that savings and incentive calculations in a project's *Evaluation Report* are well-supported, and calculated according to tariff terms and Dual Fuel Incentive Calculator policy. The new system includes a checklist with questions that guide the review, along with instructions and policy guidelines. The Technical Review will be completed before the evaluation report is sent to the customer, which contains estimated energy savings and the corresponding incentive level.
- ***Administrative Review:*** Ensures that minimum requirements are met before a contract is issued with a customer and before an incentive is paid.

In the new process, PPA conducts random spot-checks to QA/QC projects, and ensures that the review process is smooth and effective. A main distinction between the 2012 and 2013 process is that this random spot-check is intended to happen after the project has entered contract, or, in some cases, after the incentive has been paid. According to implementation staff, this will help overcome bottleneck challenges.

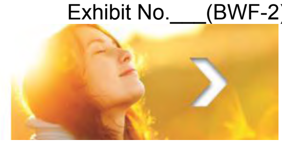
Both checklists (the Technical Review and Administrative Review) will be formalized documents known as Top Sheets, which will be attached to project documentation through the life of the project. Avista intends to synchronize the Top Sheet information with Tracker, the engineering database, and with SalesLogix, the customer information system that houses nonresidential rebate and incentive information. In June 2013, the Implementation team began using Top Sheets for all projects.

2011-2012 Database and Realization Rate Review

As part of the 2012 process evaluation, Cadmus reviewed Avista's 2012 nonresidential project database and the 2011 and 2012 realization rates for the nonresidential portfolio. The documents that were part of each effort and our associated research questions are listed in Table 39.

Table 39. Database and Realization Rate Review Activities

Review Activity	Documents Reviewed	Research Questions
Database Review	2012 SalesLogix Database Extract	Are data being tracked accurately and consistently?
		Are contracts issued in accordance with Avista policy?
		Do incentives comply with tariff rules for Washington and Idaho?
Realization Rate Review	2011 and 2012 Impact Evaluation Sample	Why do some projects have a very low or very high realization rate?
		Are there opportunities for Avista to improve the process of calculating reported savings to improve the realization rates?



Database Review

Tariff Schedules 90 and 190 govern how Avista can spend funds from the Energy Efficiency Rider Adjustment paid by Washington and Idaho ratepayers.[22] To assess compliance with these Tariff Schedules, we examined two main indicators:

1. Project incentive amount: electric and natural gas project incentives should not exceed 50% of the incremental cost of the project (p. 3 of Schedule 90; p. 2 of Schedule 190).
2. Project simple payback.
    a. For lighting measures, the simple payback period must be a minimum of one year and should not exceed eight years. (p. 2 of Schedule 90).
    b. For non-lighting electric and natural gas measures, the simple payback period must be a minimum of one year and should not exceed 13 years. (p. 2 of Schedule 90; p. 2 of Schedule 190).

The tariff rules make exceptions for the following programs or projects (p. 3 of Schedule 90; p. 2 of Schedule 190):

- DSM programs delivered by community action agencies contracted by Avista to serve limited income or vulnerable customer segments, including agency administrative fees and health and human safety measures;
- Low-cost electric/natural gas efficiency measures with demonstrable energy savings (e.g., compact fluorescent lamps); and
- Programs or services supporting or enhancing local, regional, or national electric/natural gas efficiency market transformation efforts. (In 2012, Avista considered new construction fuel conversions in multifamily building projects and T12 to T8 commercial lighting conversion projects as market transformation efforts.)

Applicability of Tariff to Prescriptive Projects

At the time of this memo, Avista's tariff was undergoing revisions and a new tariff was filed on June 26, 2013.

Avista uses the tariff provisions to: 1) design prescriptive measure offerings and incentive amounts and 2) evaluate the eligibility of site-specific projects on a project-by-project basis to ensure compliance before approving them. Cadmus does not believe the tariff language was clear enough on the topic of

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[22] Schedule 90: Electric Energy Efficiency Programs, Washington. Available at: http://www.avistautilities.com/services/energypricing/wa/elect/Documents/WA_090.pdf; Schedule 190: Natural Gas Energy Efficiency Programs, Washington. Available at: http://www.avistautilities.com/services/energypricing/wa/gas/Documents/WA_190.pdf; and Schedule 90: Electric Energy Efficiency Programs, Idaho. Available at: http://www.avistautilities.com/services/energypricing/id/elect/Documents/ID_090.pdf

compliance to conclude whether individual *prescriptive* projects should be subject to the simple payback period and incentive cap restrictions at the time of rebate application approval. Internally, Avista staff also expressed disagreement on this matter.

For purposes of this review, Cadmus evaluated both prescriptive and site-specific projects against the provisions of the tariff described above, to allow Avista to review the findings and incorporate them into their planning. It should be clear that by presenting the prescriptive findings below, Cadmus is simply suggesting that better clarity is needed and not necessarily that these projects were out of compliance.

Avista's proposed tariff clarifies that moving forward, site-specific projects are subject to the incentive cap and simple payback periods at the time of project approval, while these parameters will be used in the planning process for prescriptive measure offerings and incentive amounts.

Simple Payback Findings

The majority of projects were in compliance with simple payback rules. Cadmus found that all site-specific projects met the 13-year and eight-year payback periods, with the exception of some legacy projects that were initiated before the new tariff rules took effect on January 1, 2011.

Less than 10% of prescriptive projects exceeded tariff simple payback periods. Table 40 summarizes our findings.

Table 40. 2012 Projects Exceeding Simple Payback Periods

Measure Type	Projects Exceeding Tariff Payback Period		Savings Impact		Cost Impact (incentive payments)	
	Frequency	%	Amount	%	Amount	%
Site-Specific Projects	0	0	n/a	n/a	n/a	n/a
Prescriptive Lighting (includes market transformation and T12 projects)*	281	9%	4,438,942 kWh	13%	$855,535	10%
Prescriptive Non-Lighting (excludes multifamily)	39	6%	113,398 kWh	2%	$72,131	7%
			7,810 therms	7%		
Total	**320**	**8%**	**4,552,340 kWh**	**12%**	**$927,666**	**10%**
			7,810 therms	**7%**		

* Avista's database extract does not denote which projects involved T12-T8 lighting conversions.

Upon reviewing a sample of 10 prescriptive lighting projects that exceeded the eight-year simple payback period, Avista found that five projects involved a T12 to T8 conversion and three projects contained database errors that inflated the simple payback period. In these cases, what should have been entered as months were assumed to be years, and multiplied by 12.

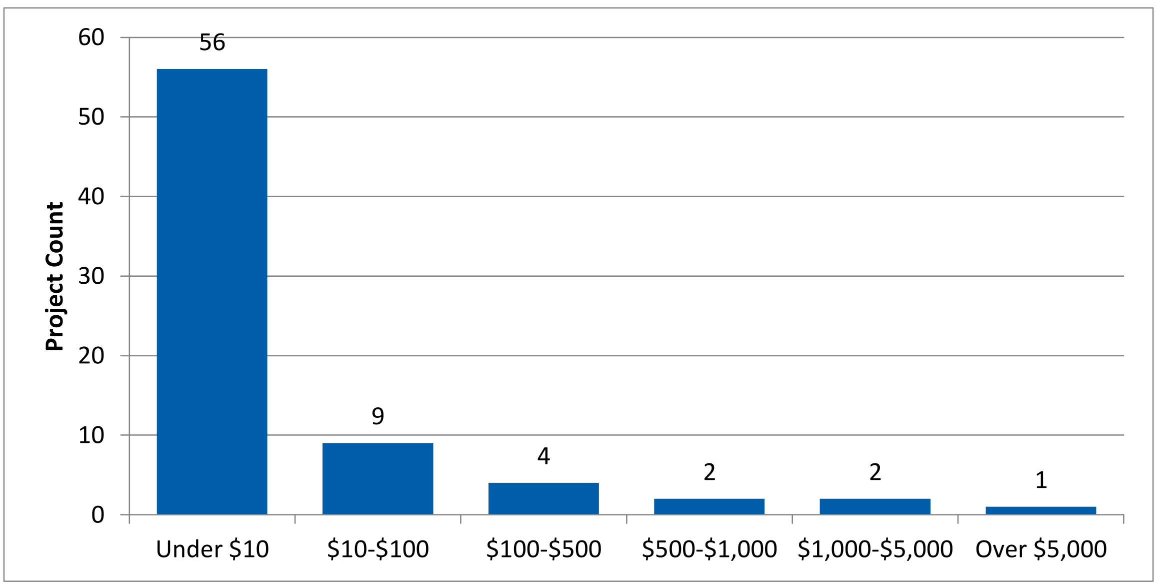
The sample size for this manual review was not large enough to extrapolate findings to the full population. However, based on the review findings, it is probable that a large proportion of the projects included in Table 40 involved T12 to T8 conversions and/or experienced database errors, thus significantly lowering the impact on energy savings and incentive costs.

Project Incentive Findings

Site Specific

The vast majority of site-specific projects had incentive costs that were compliant with the tariff rule not to exceed 50% of the incremental project cost. Initially, Cadmus found 74 site-specific projects (19%) that exceeded this cap. Upon reviewing these projects, however, we found that nearly half experienced a rounding error from Avista’s Dual Fuel Incentive Calculator that put them over the 50% limit by just $0.25 (see Figure 43). Avista staff reviewed the remaining projects to understand why they exceeded the incentive cap, and found that the majority were incorrectly entered in SalesLogix. Avista reported that these projects had been calculated and processed as prescriptive projects, but incorrectly entered into the database as site-specific.

Figure 43. Range of Incentive Amounts Exceeding 50% of Incremental Costs, 2012 Site-Specific Projects



Prescriptive

Significantly more prescriptive projects (74%) exceeded the 50% cap. As noted above, this finding was expected because Avista’s program design and delivery strategy did not consider prescriptive payments as being subject to the tariff rules, and the lighting market transformation effort exceeded 50% by design. Table 41 outlines the incentive payment and energy savings impacts from projects that exceeded the 50% incentive cap.

Table 41. 2012 Prescriptive Projects Exceeding 50% Incentive Cap

Measure Type	Projects Exceeding 50% cap		Savings Impact		Cost Impact (incentive payments)*	
	Frequency	%	Amount	%	Amount	%
Prescriptive Lighting (includes market transformation and T12 projects)**	2,574	80%	26,747,965 kWh	81%	$2,290,031	28%
Prescriptive Non-Lighting (excludes multifamily)	349	50%	3,220,704 kWh	58%	$475,437	45%
			16,684 therms	14%		
Total Prescriptive	**2,923**	**74%**	**29,968,669 kWh**	**77%**	**$2,765,468**	**30%**
			16,684 therms	**14%**		

* Cost impact represents the aggregate amount exceeding 50% of the incremental cost.

** Avista's database extract does not denote which projects involved T12-T8 lighting conversions.

Again, Avista manually reviewed 10 lighting projects that were over the 50% cap, and found that eight were T12 to T8 conversion projects, considered market transformation. Based on these findings, it is probable that a large proportion of the lighting projects listed in Table 3 involved T12 to T8 conversions, which would greatly reduce the cost impacts and energy saving impacts of from lighting projects over the 50% cap.

Data Entry and Data Tracking

In addition to assessing policy conformance, Cadmus reviewed the 2012 database for data accuracy and completeness. We found that:

- 8 projects were recorded as paid before construction was completed (most of these were entry errors)
- 12% of all projects were missing Construction Complete dates
- 44 projects (1% of all projects) were missing incremental cost data
- 18% of site-specific projects were missing contract date fields in SalesLogix
- 44% of site-specific projects were missing post-verification dates (and it is Avista's policy to conduct post-installation inspections of all site-specific projects)

Avista reviewed 20 prescriptive lighting projects to determine whether they were market-transformation projects (as noted above). They also uncovered several data errors with these specific projects. In all 20 projects, at least one of the following issues was found:

- Simple payback periods were entered in the database in years instead of months,
- Simple payback periods were entered incorrectly (SalesLogix data fields were not consistent with calculations),
- Prescriptive projects were entered as site-specific projects,

- Information from invoices regarding quantity and type of light fixtures was not transferred to prescriptive incentive forms and SalesLogix correctly,
- Ineligible measures were rebated, and
- Incentives were calculated incorrectly.

Realization Rate Review

Cadmus' impact evaluation methodology consisted of validating the reported savings for a sample of projects by conducting independent metering, simulation, or regression analysis and by visiting the project sites to verify that equipment was installed and operating as intended. The result of our project-level measurement and verification tasks is a verified, or *ex post,* savings value for each project in the sample. The ratio of verified savings to reported savings is the project's *realization rate*. A realization rate of 100% indicates that no adjustments were made to the reported savings value.

In 2011, Cadmus' nonresidential impact evaluation sample consisted of 179 electric and gas projects.[23] Of those , the majority (n=112) required a saving adjustment by more than 10%. That is, 63% of projects had realization rates of either 110% or greater, or 90% or lower. Specifically, just 35% of electric projects and 42% of gas project realization rates ranged between 90% and 110%. This changed in 2012, when the majority of projects (64 of 101)[24] experienced realization rates between 90% and 110% (see Figures 4 and 5 below).

Cadmus analyzed how frequently the evaluation resulted in an upward or downward adjustment of reported savings, by how much, and the reasons behind the discrepancy between reported and evaluated savings. The purpose of this review is to provide Avista with information to assist in improving the reliability of the reported savings in the future, thereby improving realization rates for the nonresidential portfolio.

Direction, Frequency, and Magnitude of Verified Savings Adjustments

Cadmus determined that when savings needed to be adjusted by more than 10%, they were more likely to decrease than increase. In other words, most reported savings for projects in this group were being overestimated, and the verification process resulted in a downward adjustment. This was true for all 2011 projects, and for all 2012 electric projects. In 2012, gas projects required more upward adjustments.

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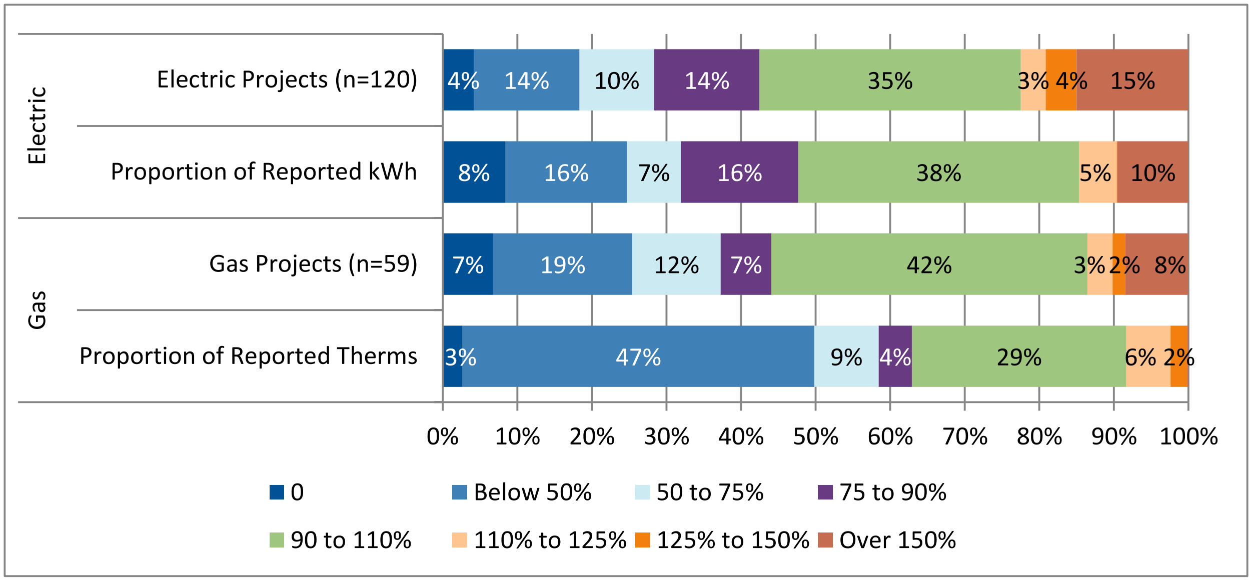
23 This number reflects projects with gas savings and electric savings. We actually evaluated 157 unique projects, some of which achieved dual-fuel savings. For the purpose of the realization rate review, we treated gas savings separately from electric savings.

24 The full 2012 impact evaluation sample contained 109 projects. We excluded eight projects from our analysis that still had measurement and verification activities occurring at the time of writing this report.

2011 Projects

Figure 44 illustrates the distribution of realization rates in increments for 2011 projects. In 2011, 51 electric projects had a realization rate below 90% (42%), while 27 electric projects had a realization rate above 110% (23%). Gas projects exhibited a similar pattern, with 26 projects having a realization rate below 90% (44%) and eight having a realization rate above 110% (14%).

Figure 44. Distribution of 2011 Realization Rates by Increments for Electric and Gas Projects*



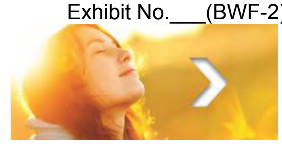
*Note: Percentages may not match above text exactly due to rounding

For electric projects, the relative proportion of reported kWh savings in each increment was relatively consistent with the number of projects in that increment. However, for gas projects, the relative proportion of reported therm savings in each increment did not accurately represent the corresponding number of projects. For example, while just 19% of gas projects experienced a realization rate of below 50% (but more than 0%), these projects represented 47% of reported savings.

Dividing the projects by increments revealed that a large portion of the projects with realization rates below 90% were in fact below 50%, and most of the projects with realization rates over 110% were actually over 150%. This indicates that not only was the range of realization rates large, but a significant portion of reported savings values were *substantially* different from verified savings, requiring an adjustment of 50% or greater.

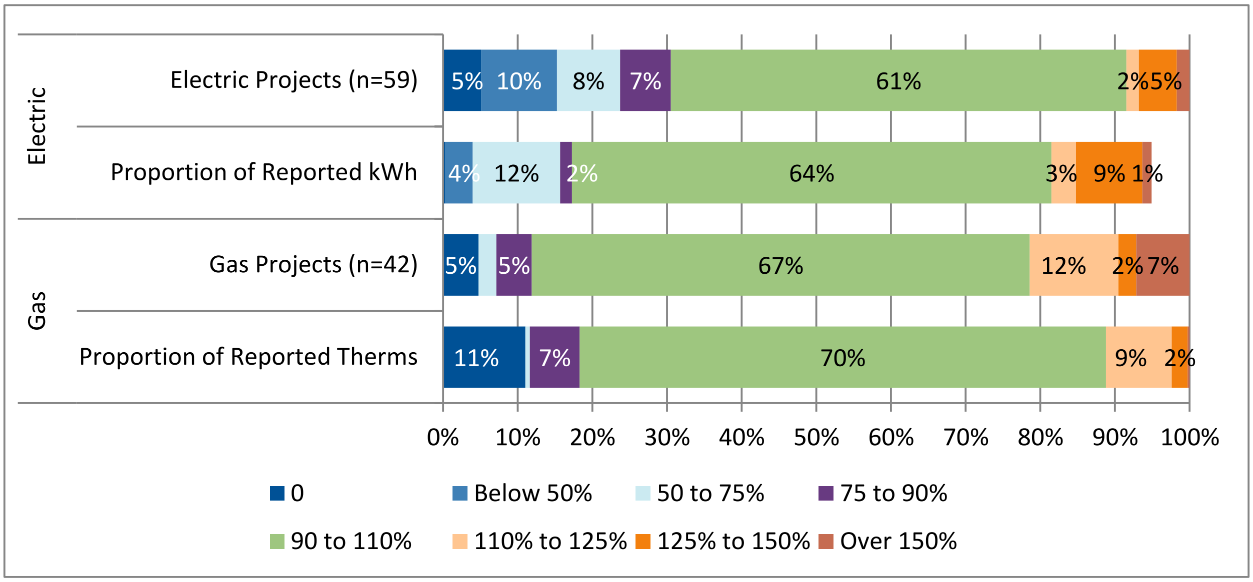
2012 Projects

In 2012, realization rates improved. Rates were less variable, and projects required smaller reported savings adjustments than those in 2011. For example, 61% of electric projects and 67% of gas projects had a realization rate between 90% and 110%, leaving only approximately one-third of projects that required an adjustment over 10% (see Figure 45).



Of the 2012 electric projects that required an adjustment over 10%, most required a downward adjustment (18 projects; 31%). This is consistent with 2011 results. Of those 2012 gas projects that required an adjustment over 10%, the direction was upward (eight projects; 19%).

Figure 45. Distribution of 2012 Realization Rates by Increments for Electric and Gas Projects



*Note: Percentages may not match above text exactly due to rounding

Cataloging Projects with High and Low Realization Rates

To understand more about the projects that had severe adjustment factors (very high or very low realization rates), we conducted a desk review of the project files and engineering analyses for a sample of projects from 2011 and 2012. Specifically, this sample entailed projects with electric savings that had been adjusted by over 25% in either direction (a realization rate below 75% or above 125%).

The original sample size was 75 projects; 57 from 2011 and just 18 from 2012. Upon reviewing the 2011 project files, we found that seven projects did not have sufficient reported savings documentation to accurately conclude the reason for the savings adjustment. Therefore, the final 2011 sample size was 50, leading to an overall sample size of 68.

Based on our review, Cadmus concluded that there were nine main reasons for the savings adjustments; these are outlined in Table 42.

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Table 42. Reason Categories for Variable Realization Rates

Reason for Savings Adjustment	Description
1. Participant Operator Error	Savings required adjustment due to customer actions, such as installing or operating equipment incorrectly
2. Calculation Error in Reported Savings	Reported savings calculations or assumptions were incorrect
3. ENERGY STAR® Appliances Deemed Savings Update	Cadmus used updated deemed savings values for ENERGY STAR clothes washers, dishwashers, freezers, and refrigerators to verify savings, requiring an adjustment from the reported values, which relied on older deemed savings estimates
4. Cadmus Metering Results vs. Avista Simulation or Analysis	Cadmus used metering results to inform verified savings, while Avista used other tools to generate reported savings estimates
5. Cadmus Metering Results vs. Avista Metering Results	Both Cadmus and Avista used metering results to inform savings values; however, the companies' parameters or timing differed
6. Database Error	Some values in the database extract were erroneous due to a database error, not a human error, and savings needed adjustment to reflect the accurate value
7. Cadmus Calculation Methodology vs. Avista Calculation Methodology	Cadmus and Avista used different methodologies to calculate savings (i.e., regression analysis versus simulation), creating different results
8. Inaccurate Lighting Hours-of-Use (HOU) Estimates	The reported savings for some lighting projects were based on incorrect HOU assumptions
9. Equipment Verification	The on-site equipment parameters (size and efficiency) differed from the assumptions used in the original savings estimate

In 2011, the most frequent reasons for savings adjustments of 25% or greater were due to metering results being over the original estimates formed using simulation or analysis (n=10) and calculation or assumption errors in the reported savings values (n=10). Other top reasons included ENERGY STAR deemed savings updates (n=9) and differences in Cadmus' and Avista's calculation methodology (n=8). In 2012, there were far fewer projects with adjustment factors of 25% or greater. The top reason categories in 2012 stayed relatively consistent with those in 2011, excluding the ENERGY STAR deemed savings updates.

Figure 46 illustrates the number of projects in each of the reason categories outlined in Table 42, across both years. Table 46 at the end of the memo, lists the specific projects included in the review and a description of each project's specific savings adjustment.

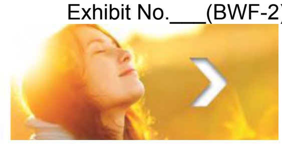
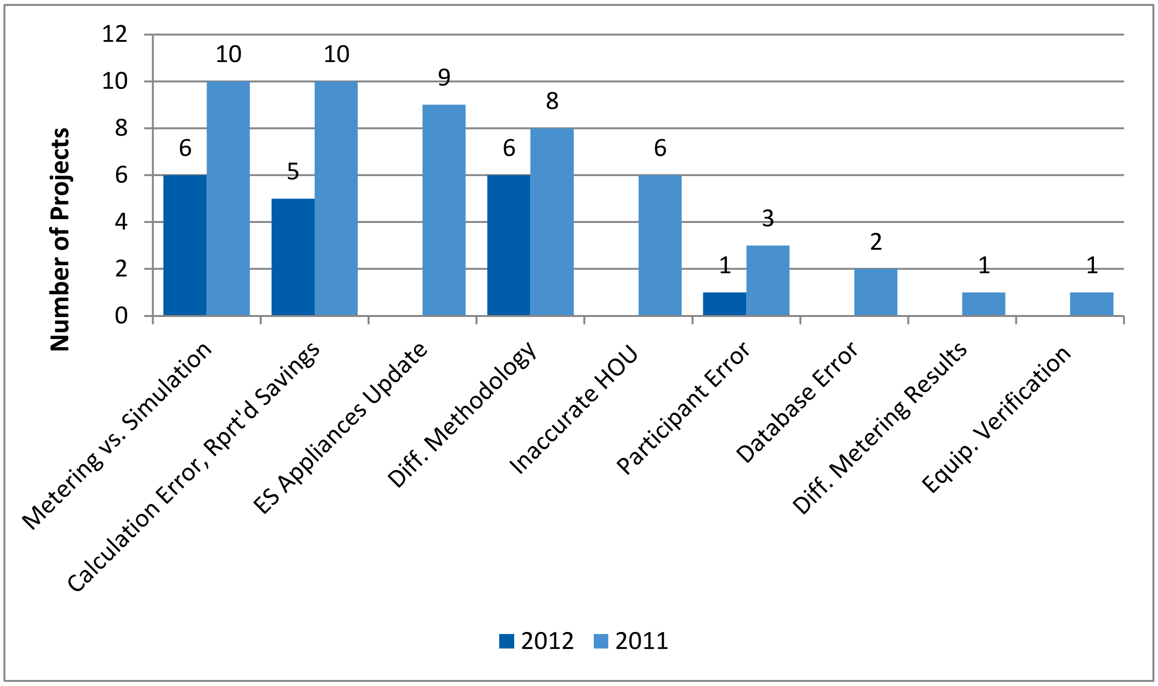


Figure 46. Number of Projects with Savings Adjustments of 25% or Greater by Category, 2011-2012



Impact on Gross Savings

While the majority of savings adjustments in 2011 resulted in decreased savings, certain reason categories experienced realization rates higher than 100%, on average. For example, three reason categories (Cadmus Metering Results vs. Avista Simulation or Analysis, ENERGY STAR Appliances Deemed Savings Update, and Equipment Verification) resulted in increased savings. In other words, the projects in these groups experienced realization rates higher than 100%, on average.

In 2012, just one reason category (Cadmus Metering Results vs. Avista Simulation or Analysis) resulted in increased savings. Projects in the other 2012 reason categories (Calculation Error in Reported Savings, Cadmus Calculation Methodology vs. Avista Calculation Methodology, and Participant Operator Error) resulted in decreased savings.

The aggregate kWh impact for each 2011 reason category is listed in Table 43. The aggregate kWh impact for each 2012 reason category is listed in Table 44.

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Table 43. 2011 Reported and Verified Savings Associated with Reason Categories for Projects with Savings Adjustments of 25% or Greater

Reason	Count	Reported Savings	Verified Savings	kWh Loss	Percent of Verified Savings	kWh Gain	Percent of Verified Savings	Net Impact (kWh)	Percent of Verified Savings*
Cadmus Metering Results vs. Avista Simulation or Analysis	10	1,563,768	3,189,989	-326,768	3%	1,952,989	16%	**1,626,221**	**13%**
Calculation Error in Reported Savings	10	1,377,230	547,131	-859,210	7%	29,111	0.2%	**-830,099**	**7%**
ENERGY STAR Appliances Deemed Savings Update	9	892	2,043	-55	0%	1,206	0%	**1,151**	**0%**
Cadmus Calculation Methodology vs. Avista Calculation Methodology	8	151,231	143,709	-57,262	0%	49,740	0.4%	**-7,522**	**0%**
Inaccurate Lighting HOU Estimates	6	394,977	128,449	-267,472	2%	944	0%	**-266,528**	**2%**
Participant Operator Error	3	788,713	0	-788,713	7%	-	0%	**-788,713**	**7%**
Database Error	2	186,832	111,571	-75,261	1%	-	0%	**-75,261**	**1%**
Cadmus Metering Results vs. Avista Metering Results	1	637,534	477,180	-160,354	1%	-	0%	**-160,354**	**1%**
Equipment Verification	1	869	1,111	-	0%	242	0%	**242**	**0%**
Total	**50**	**5,102,046**	**4,601,183**	**-2,535,095**	**21%**	**2,034,232**	**17%**	**-500,863**	**4%**

* This is the net difference as a percent of the total verified savings in the impact evaluation sample.

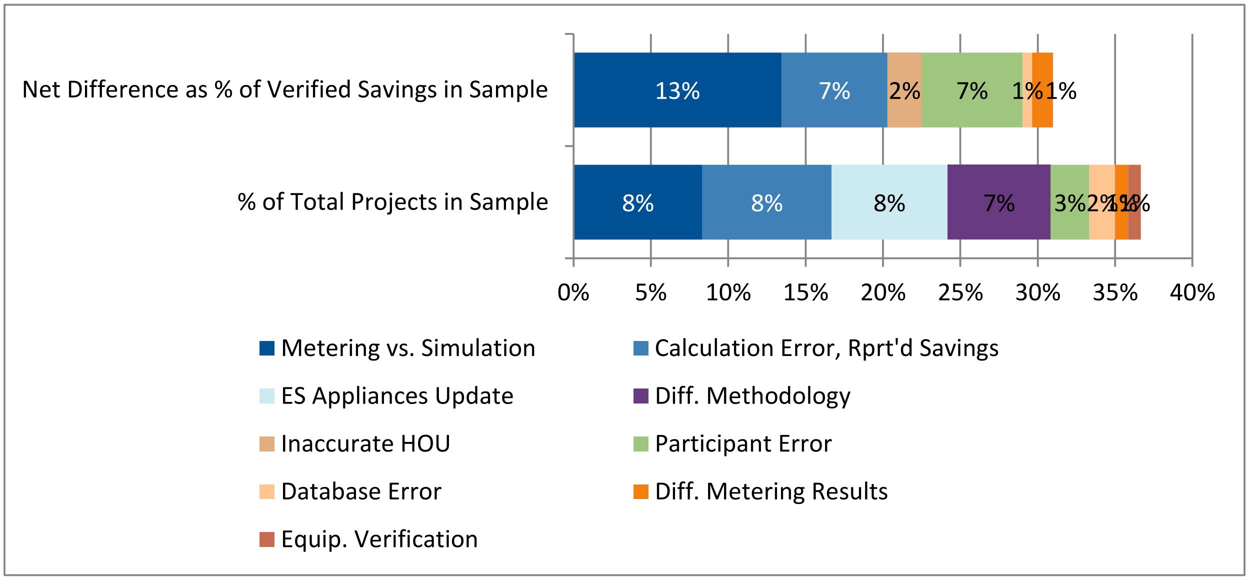
Table 44. 2012 Reported and Verified Savings Associated with Reason Categories for Projects with Savings Adjustments of 25% or Greater

Reason	Count	Reported Savings	Verified savings	kWh Loss	Percent of Verified Savings	kWh Gain	Percent of Verified Savings	Net Impact	Percent of Verified Savings*
Cadmus Metering Results vs. Avista Simulation or Analysis	6	1,544,211	1,768,173	-243,923	2%	499,241	4%	**255,318**	**2%**
Cadmus Calculation Methodology vs. Avista Calculation Methodology	6	1,491,355	968,424	-534,120	4%	24,777	0%	**-509,343**	**4%**
Calculation Error in Reported Savings	5	420,208	340,768	-173,092	1%	93,652	1%	**-79,440**	**1%**
Participant Operator Error	1	21,000	-	-21,000	0%	-	-	**-21,000**	**0%**
Total	**18**	**3,476,774**	**3,077,365**	**-972,135**	**8%**	**617,670**	**5%**	**-354,465**	**3%**

* This is the net difference as a percent of the total verified savings in the impact evaluation sample.

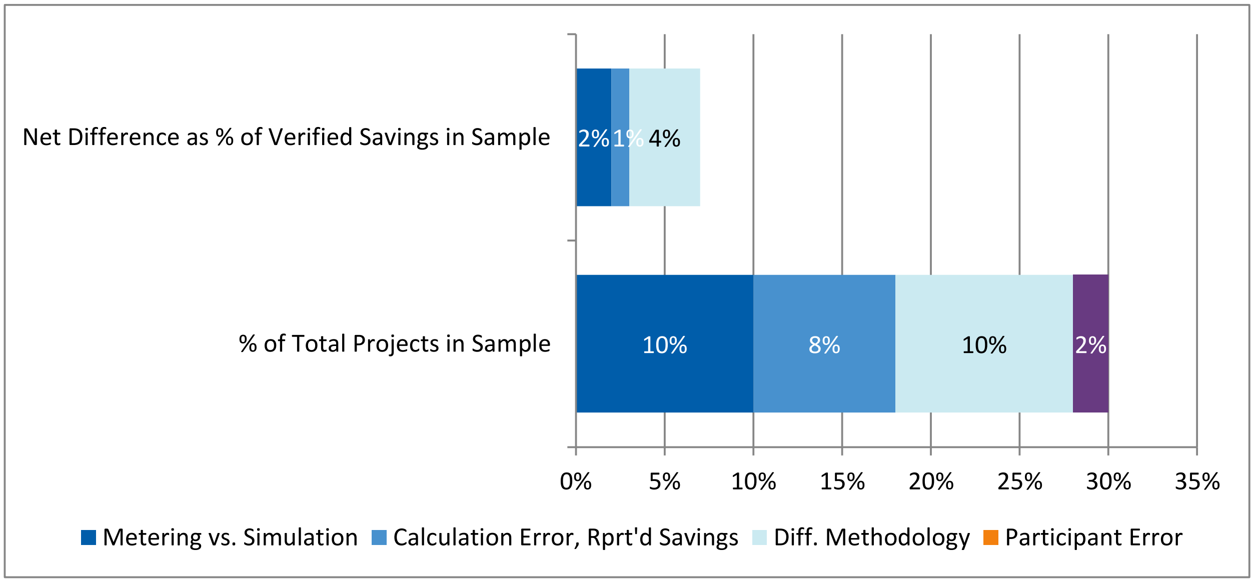
Figure 47 illustrates 2011 projects in each reason category as a percentage of the total sample compared to the percentage of each categories' net kWh impact. While the ENERGY STAR Appliances Deemed Savings Update category contained nine projects (representing about 8% of the total sample), the net difference in *ex ante* and *ex post* savings was actually minimal: a gain of 1,151 kWh (see Table 43), less than 0.07% of savings in the impact evaluation sample. The Cadmus Calculation Methodology vs. Avista Calculation Methodology category had similarly minimal savings despite containing a relatively large number of projects (eight). On the other hand, the Cadmus Metering Results vs. Avista Simulation or Analysis and Participant Operator Error categories represented 8% and 3% of projects, respectively, but the net differences in *ex ante* and *ex post* savings represented 13% and 7% of the total verified savings in the impact sample, respectively.

Figure 47. Relative Proportions of Projects and Savings Impacts by Reason Category, 2011



In 2012, the percentage of projects in each category was higher than the respective percentage of kWh savings in each category (see Figure 48). For example, the Cadmus Metering Results vs. Avista Simulation or Analysis and the Cadmus Calculation Methodology vs. Avista Calculation Methodology categories both represented 10% of all projects in the evaluation sample, but their net differences in *ex ante* and *ex post* savings were relatively small, representing only 2% and 4% of the total verified savings in the sample, respectively.

Figure 48. Relative Proportions of Projects and Savings Impacts by Reason Category, 2012



Conclusions and Recommendations

Based on the above findings, we offer the following conclusions and encourage Avista consider the recommendations listed below to improve their internal processes.

Large Project Review Process

Conclusion: Avista's 2011 Large Project Review process was not implemented successfully due to a series of communication issues and the absence of a mechanism to address concerns about project parameters and correct mistakes. In the first half of 2013, Avista has been designing a new process for all site-specific projects. While this process is underway, we have several recommendations may assist Avista with successful implementation and an effective process.

Recommendations:

- ***Effectively communicate the new project review process to all key team members.*** Many of the issues identified through Avista staff interviews regarding the prior review process centered on communication challenges. When implementing the new process, ensure that all stakeholders have a clear understanding of the review goals and correct protocol.
- ***Ensure there are clear protocols in place for addressing issues identified during the review and the spot-check.*** To ensure that Avista and its customers are benefiting from the time and resources dedicated to this process, consider implementing some check-points and policies to clarify how and when to alter project savings and incentive levels if issues arise during the review. This may include designating a senior-level point person to serve as the decision-maker for questions or disagreements regarding a project or its calculation methodology. Consider identifying methods to ensure that all issues are discussed and resolved before incentive amounts are communicated to the customer.

- ***Establish a goal for the number or percentage of projects that should undergo a random spot-check***. Avista's new process dictates that the PPA team will independently review a sample of projects, in addition to the peer review process. We suggest establishing a clear metric for the number or percentage of projects this sample will include, such as five projects or 10% of all projects.
- ***Establish a reasonable goal for how long the review process should take.*** A core challenge with the prior review process was the time lag. Keeping in mind that any process aimed at improving the quality and accuracy of incentive payments and claimed savings will add time to existing procedures, Avista should internally discuss the amount of delay that is reasonable. It may be beneficial to create objectives for how long various steps of the process should reasonably take. For example, Avista could establish one goal to complete the first Top Sheet review within a certain timeframe, then establish another goal to guide how long it should take to resolve any issues, if identified.
- ***Consider adopting a tiered approach to the review so that larger, high-risk projects receive more scrutiny before contracts are issued and incentives are paid.*** Under the planned approach, all site-specific projects will undergo peer review. Often, utilities employ a risk-mitigation approach to ensure that the largest and most expensive projects receive the most rigorous review before they are approved. Avista might explore adjusting their review process to focus the most time and resources on larger projects. An example of this type of approach is provided in Table 45.

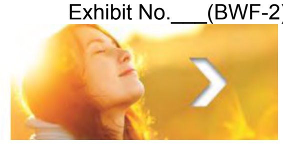
Table 45. Example of Tiered Approach to Large Project Review

Level of Review	Description
Peer Review	All projects
Second Engineering Review	Projects above $50,000
Third Engineering Review	Projects above $75,000
PPA Review	Projects above $100,000
Pre-Installation Visits	Projects above $100,000, plus others as needed
Random Audit (spot-check)	5 projects or 10% of all projects

- ***Consider structuring random spot-checks, or "audits," to occur at various times of the process.*** The current review structure plans to have some projects receive independent review after the project evaluation report is complete or after the project is paid, so that any mistakes can be corrected for future projects. However, it may be beneficial to stagger projects so that a random portion also receives independent audits before incentive information is communicated to the customer.

Database and Realization Rate Review

Conclusion: The accuracy of Avista's claimed savings, measured by realization rates, improved significantly from 2011 to 2012. Three of the four main reasons for large savings adjustments in 2012



are largely outside Avista's control. However, Avista can still improve the reliability of claimed savings estimates falling into the reason category of Calculation Error in Reported Savings.

- ***Recommendation:*** Continue to move forward implementing the new review process to identify and resolve savings calculation errors.

Conclusion: Most of the nonresidential projects were compliant with the 2012 tariff rules, but disagreement among DSM staff on tariff interpretation makes it difficult to draw conclusions about prescriptive projects. Avista has already begun updating the tariff to address this concern and create a more coherent policy. There are several improvements Avista can make to data tracking activities to clarify policy compliance on a project-by-project basis and improve data collection overall.

Recommendations:

- ***Clearly document legacy projects or market transformation projects in SalesLogix.*** Avista's tracking system specifies measure type, but lacks detailed information such as whether the project involved a T12 to T8 lighting conversion. This makes it challenging to understand which projects are considered market transformation. Further, legacy projects are not specified. To streamline internal tracking, auditing, and evaluation, consider adding a field to denote which projects are eligible for transition policy (legacy projects) and which projects are considered market transformation, as well as any other project characteristics that warrant exception to tariff rules under Avista's new policy.
- ***Continue to improve data entry in SalesLogix to reduce missing or incorrect fields and enhance the comprehensive dataset.***

Memo Appendix A

Table 46 catalogues the projects requiring a savings adjustment of 25% or greater.

Table 46. Projects Included in Realization Rate Review Cataloging

Year	Project ID	State	Measure Description	Reported kWh	Verified kWh	Realization Rate	Project Category
2011	36888	WA	Industrial Process	59,728	105,220	176%	Diff. Methodology
2011	34681	ID	Shell	1,957	2,699	138%	Diff. Methodology
2011	34682	ID	Shell	983	198	20%	Diff. Methodology
2011	35372	ID	Shell	48,950	5,988	12%	Diff. Methodology
2011	36974	WA	Appliances	211	20	9%	Diff. Methodology
2011	33651	WA	HVAC Combined	4,015	6,660	166%	Diff. Methodology
2011	35820	WA	Appliances	32,760	19,436	59%	Diff. Methodology
2011	35838	ID	Prescriptive Lighting Interior	2,627	3,488	133%	Diff. Methodology
2011	36170	ID	Prescriptive LED Traffic Signals	53,784	27,973	52%	Calculation Error, Rprt'd Savings
2011	30481	WA	Industrial Process	283,902	117,823	42%	Calculation Error, Rprt'd Savings
2011	29129	WA	Industrial Process	571,750	283,747	50%	Calculation Error, Rprt'd Savings
2011	34262	ID	Shell	209	26	12%	Calculation Error, Rprt'd Savings
2011	36341	WA	Prescriptive Commercial Shell	2,411	10,682	443%	Calculation Error, Rprt'd Savings
2011	36628	WA	Prescriptive Commercial Shell	1,124	0	0%	Calculation Error, Rprt'd Savings
2011	36315	WA	Prescriptive Motors	438	274	63%	Calculation Error, Rprt'd Savings
2011	23335	WA	Industrial Process	308,652	0	0%	Calculation Error, Rprt'd Savings
2011	35540	ID	Prescriptive Lighting Exterior	20,417	41,257	202%	Calculation Error, Rprt'd Savings
2011	32654	WA	HVAC Combined	134,543	65,349	49%	Calculation Error, Rprt'd Savings
2011	37395	WA	HVAC Combined	32,570	16,285	50%	Database Error
2011	37396	WA	Lighting Interior	154,262	95,286	62%	Database Error
2011	37074	WA	Energy Star Clothes Washer	14	322	2301%	ES Appliances Update
2011	37075	WA	Energy Star Dishwasher	36	22	62%	ES Appliances Update
2011	37070	WA	Energy Star Clothes Washer	240	494	206%	ES Appliances Update

Year	Project ID	State	Measure Description	Reported kWh	Verified kWh	Realization Rate	Project Category
2011	37385	WA	Energy Star Clothes Washer	240	322	134%	ES Appliances Update
2011	36616	WA	Energy Star Dishwasher	36	22	62%	ES Appliances Update
2011	35371	Idaho	Energy Star Dishwasher	36	22	62%	ES Appliances Update
2011	35841	ID	Energy Star Dishwasher	36	22	62%	ES Appliances Update
2011	37089	WA	Energy Star Clothes Washer	14	322	2301%	ES Appliances Update
2011	37025	WA	Energy Star Clothes Washer	240	494	206%	ES Appliances Update
2011	36894	WA	Prescriptive Comm Clothes Washer	869	1,111	128%	Equip. Verification
2011	36140	ID	Industrial Process	637,534	477,180	75%	Diff. Metering Results
2011	33889	WA	HVAC Combined	230,543	58,277	25%	Metering vs. Simulation
2011	33510	WA	HVAC Cooling	188,879	34,377	18%	Metering vs. Simulation
2011	34653	WA	Motor Controls HVAC	25,550	73,193	286%	Metering vs. Simulation
2011	33334	WA	Motor Controls HVAC	81,760	234,219	286%	Metering vs. Simulation
2011	33424	ID	HVAC Combined	16,414	25,557	156%	Metering vs. Simulation
2011	33432	ID	HVAC Combined	10,644	32,997	310%	Metering vs. Simulation
2011	37477	ID	Motor Controls HVAC	168,630	483,076	286%	Metering vs. Simulation
2011	37471	ID	Motor Controls HVAC	296,380	849,042	286%	Metering vs. Simulation
2011	37478	ID	Motor Controls HVAC	419,020	1,200,370	286%	Metering vs. Simulation
2011	29646	WA	HVAC Cooling	125,948	198,881	158%	Metering vs. Simulation
2011	36137	WA	Lighting Interior	20,207	3,160	16%	Inaccurate HOU
2011	36470	WA	Prescriptive Lighting Interior	5,676	1,765	31%	Inaccurate HOU
2011	36559	WA	Prescriptive Lighting Interior	353,228	113,298	32%	Inaccurate HOU
2011	37187	ID	Prescriptive Lighting Interior	9,108	3,803	42%	Inaccurate HOU
2011	36016	WA	Lighting Interior	4,218	2,939	70%	Inaccurate HOU
2011	36017	WA	Prescriptive Lighting Interior	2,540	3,484	137%	Inaccurate HOU
2011	31378	ID	HVAC Heating	48,173	0	0%	Participant Error
2011	21278	ID	Compressed Air	648,560	0	0%	Participant Error
2011	35430	WA	Motor Controls HVAC	91,980	0	0%	Participant Error

Year	Project ID	State	Measure Description	Reported kWh	Verified kWh	Realization Rate	Project Category
2012	37981	WA	SS Multifamily	692,700	448,232	65%	Diff. Methodology
2012	35602	WA	SS Multifamily	692,700	448,232	65%	Diff. Methodology
2012	33914	WA	HVAC Combined	59,549	24,472	41%	Diff. Methodology
2012	39533	WA	SS HVAC Heating	7,986	0	0%	Diff. Methodology
2012	38992	WA	PSC EnergySmart- Case Lighting	3,720	2,236	60%	Diff. Methodology
2012	38397	WA	PSC EnergySmart- Industrial Proc	34,700	45,252	130%	Diff. Methodology
2012	40766	WA	SS HVAC Combined	53,250	7,650	14%	Calculation Error, Rprt'd Savings
2012	34998	WA	SS Appliances	91,823	38,934	42%	Calculation Error, Rprt'd Savings
2012	39118	WA	SS Compressed Air	8,413	0	0%	Calculation Error, Rprt'd Savings
2012	35000	WA	Lighting Interior	165,141	258,793	157%	Calculation Error, Rprt'd Savings
2012	39794	WA	SS Shell	101,581	35,391	35%	Calculation Error, Rprt'd Savings
2012	35972	ID	SS Industrial Process	1,047,737	1,406,904	134%	Metering vs. Simulation
2012	39969	WA	SS Industrial Process	115,911	165,636	143%	Metering vs. Simulation
2012	38236	WA	SS Lighting Interior	177,934	103,425	58%	Metering vs. Simulation
2012	38276	WA	SS Lighting Interior	185,688	86,794	47%	Metering vs. Simulation
2012	39750	WA	PSC Lighting Interior	6,318	3,953	63%	Metering vs. Simulation
2012	39411	WA	PSC Lighting Interior	10,623	1,461	14%	Metering vs. Simulation
2012	32376	ID	PSC PC Network Controls	21,000	0	0%	Participant Error

Appendix 3

Avista 2012-2013 Washington Electric Impact Evaluation Report

May 15, 2014

The Cadmus Group, Inc.

Avista 2012-2013 Washington Electric Impact Evaluation Report

May 15, 2014

Avista Corporation
1411 E Mission Avenue
Spokane, WA 99252

The Cadmus Group, Inc.
An Employee-Owned Company • www.cadmusgroup.com

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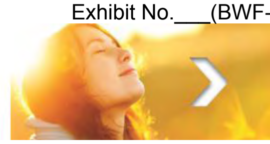

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Table of Contents

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Definitions

Reported Savings – Electricity savings that are reported in Avista's tracking database.

Gross Evaluated Savings – Electricity savings that have been verified through evaluation activities such as records review, verification surveys or site visits, and engineering analysis.

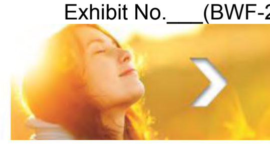
Realization Rate – The ratio of gross evaluated savings over the reported savings.

Net Evaluated Savings – Net savings signify the portion of savings directly attributable to the program; savings that would have otherwise not occurred without program influence. These also include participant and nonparticipant spillover.

Net-to-Gross – The ratio of net evaluated savings to gross evaluated savings.

Savings Goal – The DSM End-Use portion of I-937, Integrated Resource Planning (IRP), or Avista Business Plan savings goal.

Achievement Rate – The ratio of evaluated savings over the savings goal.



Portfolio Executive Summary

For several decades, Avista Corporation has been administering demand-side management (DSM) programs to reduce electricity and natural gas energy use for its portfolio of customers. Most of these programs have been implemented in-house, but for a few Avista uses external implementers. Avista performed a potential study for Washington in 2011 to determine the savings goals for program year (PY) 2012 and PY 2013. Avista contracted with Cadmus to complete process and impact evaluations of the company's PY 2012 and PY 2013 electric DSM programs in Washington; this report presents our impact findings.

Evaluation Activities

We conducted the evaluation using a variety of methods and activities shown in Table 1.

Table 1. PY 2012-PY 2013 Electric Programs' Evaluation Activities

Sector	Program	Document/ Database Review	Verification/ Metering Site Visit	Survey	Billing Analysis	Modeling
Residential	Simple Steps, Smart Savings™	✓				
	Second Refrigerator and Freezer Recycling	✓		✓		
	ENERGY STAR® Products	✓		✓		
	Heating and Cooling Efficiency	✓		✓		
	Weatherization/Shell	✓		✓	✓	
	Water Heater Efficiency	✓		✓		
	ENERGY STAR Homes	✓				
	Space and Water Conversions	✓		✓	✓	
	Manufactured Homes Duct Sealing	✓			✓	
	Behavior Program	✓			✓	
Nonresidential	Prescriptive programs	✓	✓	✓		
	Site-Specific	✓	✓	✓	✓	✓
	EnergySmart Grocer	✓	✓	✓		
Low Income	Low Income programs	✓		✓	✓	
Residential/ Nonresidential	CFL Contingency	✓		✓		

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Savings Results

Overall, the Washington portfolio achieved a 97.0% realization rate, and acquired 120,635,914 kWh in annual gross savings (Table 2).

Table 2. PY 2012-PY 2013 Reported and Gross Evaluated Savings

Segment*	Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Residential	26,655,717	24,070,178	90.3%
Nonresidential	70,809,941	67,649,637	95.5%
Low Income	1,111,766	1,516,238	136.4%
CFL Contingency**	21,179,368	21,179,368	100.0%
Residential Behavior	4,636,392	6,220,493	134.2%
Total	**124,393,184**	**120,635,914**	**97.0%**

* Note that residential Behavior Program and Second Refrigerator and Freezer Recycling Program savings are inherently calculated as net, and are therefore presented here as net.

** Program did not have reported savings, so the verified savings are duplicated as reported savings, thus giving the 100% realization rate.

Goal Achievement

Evaluation of the 2012-2013 portfolio was challenging due to:

- Multiple statements and sources of goals (I-937, Avista's Integrated Resource Plan, and Avista Business Plan).
- Varying definitions of savings (e.g., gross versus net, Regional Technical Forum versus evaluation based estimates).
- Different means of achieving the goals (e.g., fuel conversion counts toward the IRP electric savings but not toward I-937).
- Different programs are not included under certain goals (e.g., Avista Business Plan does not include Contingency CFL savings).

Additional information on these designations can be found in the Portfolio Savings and Goals section.

Table 3 through Table 5 show achieved savings toward each of the three goals. All goals were exceeded. The goals are portfolio-level targets, so in order to conduct sector-level comparisons, Cadmus adopted the Avista Business Plan goals by sector, and applied those proportions to the I-937 and IRP targets. The tables also show saving achievements for the portfolio excluding the CFL Contingency and residential Behavior programs. I-937 and IRP goals are still met, but the more aggressive Business Plan goal falls slightly short.

Table 3. PY 2012-PY 2013 I-937 DSM End-Use Goals and Achieved Savings

Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	22,596,781	44,586,457	197.3%
Nonresidential	51,209,063	70,993,666	138.6%
Low Income	2,396,157	450,233	18.8%
Total	**76,202,000**	**116,030,356**	**152.3%**
Excluding CFL Contingency and Behavior Programs	**76,202,000**	**88,630,495**	**116.3%**

* Achieved savings do not include fuel switching measures.

Table 4. PY 2012-PY 2013 IRP Goals and Achieved Savings

Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	22,483,207	46,617,306	207.3%
Nonresidential	50,951,680	72,539,206	142.4%
Low Income	2,384,113	1,516,238	63.6%
Total	**75,819,000**	**120,672,750**	**159.2%**
Excluding CFL Contingency and Behavior Programs	**75,819,000**	**93,272,889**	**123.0%**

* Achieved savings includes all savings.

Table 5. PY 2012-PY 2013 Avista Business Plan Goals and Achieved Savings

Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	28,391,942	30,327,507	106.8%
Nonresidential	64,342,119	67,649,637	105.1%
Low Income	3,010,674	1,516,238	50.4%
Total	**95,744,735**	**99,493,382**	**103.9%**
Excluding Behavior Program	**95,744,735**	**93,272,889**	**97.4%**

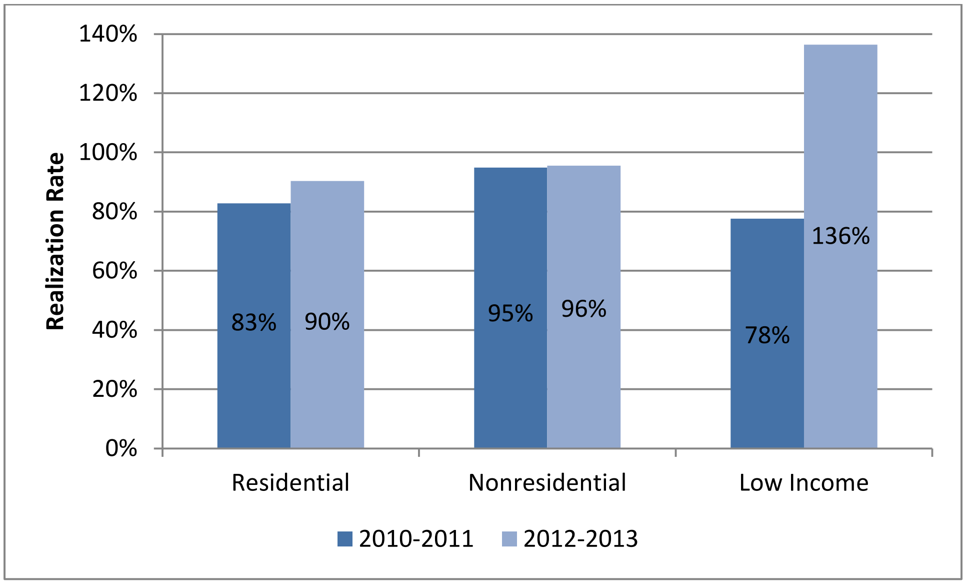
* Achieved savings do not include CFL Contingency.

Key Findings and Conclusions

Portfolio Level

As shown in Figure 1, realization rates have remained steady or increased over the last and current biennia across the various program sectors. Details on the realization rates are given in subsequent chapters.

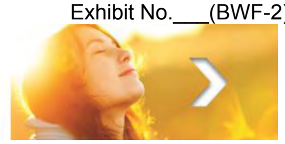
Figure 1. Realization Rates of Portfolio Savings



The national environment for demand side management (DSM) is becoming more challenging with the implementation of EISA, and more stringent codes and standards. Avista is meeting these challenges with new and innovative measure and program ideas. On the residential side, LEDs have been added to their upstream lighting program, and they are implementing a second year of a direct install manufactured homes duct sealing program. For the nonresidential portfolio in 2014, Avista is starting a large fleet engine block heater program, targeting gas station canopy LED lighting, and an exterior LED signage program.

In future years, Avista may consider devoting additional resources to investigate new technologies and program offerings, and comparing to other utilities. Some initial examples include the following:

- Home Performance with Energy Star; http://www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showsplash,
- Central air conditioners for residential application (as our general population research supports a sizable load with stated intentions of increasing),
- A refresh of commercial direct install measures (either new, or measures that were done 5-10 years ago),
- Investigate the upcoming Tenant Star for leased commercial space,
- Commercial retrocommissioning or continuous commissioning (primarily for larger, complex facilities such as hospitals and college campuses; for example, http://www.pge.com/en/mybusiness/save/rebates/retrocommissioning/index.page),
- Comprehensive compressed air system audits and upgrades to address both demand and supply-side operation (based on Compressed Air Challenge best practices; http://www.compressedairchallenge.org/),



- Strategic energy management (similar to Energy Trust of Oregon's SEM program; http://energytrust.org/library/GetDocument/1876).

Residential

For PY 2012 and PY 2013, Avista's residential electric programs produced 46,617,306 kWh in savings, yielding a 98% overall realization rate of reported savings, and 207% of equivalent residential IRP goals.

- Overall, residential electric customers responded well to the programs, often installing several measures within the same year.
- Tracking databases proved adequate for evaluation purposes, providing sufficient contact information and measure and savings information. During the database review, Cadmus confirmed the information was reliable and accurate.
- All rebated measures had been installed and continued to operate.
- For the residential Behavior Program, homes in Washington saved an average 0.764 kWh (1.56%) per day. The percentage savings were significantly higher than expected (1%).

Nonresidential

For PY 2012-PY 2013, Avista's nonresidential electric programs produced 72,539,206 kWh in savings, yielding a 96% overall realization rate of reported savings, and 142% of equivalent nonresidential IRP goals.

In general, Cadmus determined that Avista implemented the programs well. Cadmus identified the following key issues that led to adjusted energy savings:

- Metering on several industrial process measures indicated that post-installation power consumption was different than expected, leading to adjustments to the energy savings estimates.
- Some participants did not operate the incented equipment correctly or did not complete expected improvements.
- Some participant post-installation heating or cooling loads did not achieve the level of projected consumption.
- Simulation models sometimes did not accurately represent the actual as-built building or system operation.
- Avista implementation staff sometimes may not have conducted a thorough analysis of energy-savings calculations provided by participants or third-party contractors for all projects, and sometimes made errors on entering data to characterize building or measure performance.

Low Income

For PY 2012-PY 2013, Avista's low-income electric programs produced 1,516,238 kWh in savings, yielding a 136% overall realization rate of reported savings and 64% of equivalent low income IRP goals.

Compared to PY 2010, Avista's PY 2013 low-income program demonstrated an increase in average electric savings per participant, in addition to an increase in the overall program realization rate (from 78% to 136%). Several factors may have contributed to the increase in participant savings, including:

- An increased frequency of installing high-saving measures (e.g., shell) in the evaluation period,
- Changes in agency delivery protocols or energy-saving installations made with non-utility funding, and
- Exogenous effect (e.g., economic, rate changes) that may have occurred simultaneous to program activity.

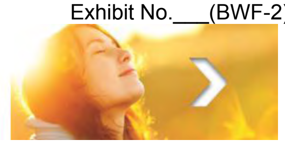
One factor contributing to higher realization rates are lower average reported savings occurring in the evaluation period compared to previous years.

Recommendations and Further Analysis

Residential

Cadmus recommends the following changes to Avista's residential electric programs:

- Consider updating its per-unit assumptions of recycled equipment to reflect this evaluation in order to ensure that planning estimates of program savings are in line with evaluated savings.
- If clothes washer rebates are reinstated, Avista should track them all within the electric program unless there is a large penetration of gas dryers.
- Increase measure level detail capture on applications and include in the database. Specific additional information should include energy factors or model numbers, baseline information for insulation, and home square footage, particularly for the ENERGY STAR Homes program.
- Consider tiered incentives by SEER rating as higher SEER systems generally require ECM fan motors to achieve certain SEER ratings.
- Avista should consider completing a lighting logger study within its territory if Avista believes the results of the forthcoming RBSA study do not accurately represent usage in their territory.
- Avista should consider researching the percentage of Simple Steps, Smart Savings bulb purchase that are installed in commercial settings. This could increase the average installed hours of use and increase program savings.
- Perform a billing analysis on ENERGY STAR homes using a non-participant comparison group once enough homes have participated under the new requirements to justify performing the work. This research could be used to demonstrate the achieved savings through energy efficiency construction practices.
- Consider researching the current variable speed motor market activity to determine if this measure should continue as a stand-alone rebate or be packaged with other equipment purchases.



Nonresidential

We have the following recommendations for improving program energy-savings impacts and evaluation effectiveness:

- Create a quality control system to double-check all projects with savings over 300,000 kWh.
- Consider working with participants to accelerate the process of claiming energy savings and paying the project incentive. Preferably this should happen within one year of measure installation, depending on Avista's requirements for post-installation data on the particular project.
- Avista may want to consider tracking and reporting demand reduction to better understand measure load profiles and peak demand reduction opportunities.
- Update prescriptive measure assumptions and sources on a regular basis.
- Streamline its file structure to enable reviewers more easily identify the latest documentation.
- Continue to perform follow-up measure confirmation and/or site visits on a random sample of projects (at least 10%).
- Consider flagging sites for additional scrutiny when the paid invoice does not include installation labor.
- Avista may consider adding a flag to their tracking database to automatically calculate the unit of energy savings per dollar (kWh/$ or therm/$) to provide a quick check to identify extreme outliers.
- In the case of redundancy, Avista may want to consider incenting pump projects through the Site-Specific Program to more accurately characterize the equipment operating hours.
- Avista may want to adopt modeling design guidelines to set minimum standards, such as The Energy Trust of Oregon guidelines.

Low Income

Cadmus recommends the following enhancements in order to improve low-income program impact results:

- Consider including a control/comparison group in future billing analyses.
- Consider options for increasing the analysis sample size due to small program populations (such as combining Washington and Idaho program participants).
- Obtain a full list of weatherization measures from agencies.
- Consider targeting high-use customers.
- Track and compile additional data from agency audits.
- Consider performing quantitative, non-energy benefit analyses.

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1. Residential Impact Evaluation

1.1. Introduction

We designed our impact evaluation to verify reported program participation and energy savings. We used data collected and reported in the tracking database, online application forms, phone surveys, billing analyses, RTF savings review, and applicable updated deemed savings values.

1.2. Methodology

1.2.1. Sampling

Record Review Sampling

To determine the percentage of measures incented that qualified for the program, Cadmus designed sample sizes to yield result at the 90% level of confidence and ±10% precision level for each application type, across both states and both fuel types. Cadmus randomly selected participant measures for a record qualification review from the 2012 and 2013 gas and electric program populations. We sampled participants using a single measure record. However, if a customer applied for multiple rebates on the same application form during the program year, we checked all measures included in the application for qualification, whether the fuel was electric or gas.

Table 6 shows the number of record reviews we completed of unique accounts and unique measures.

Table 6. Measure-Level Record Reviews Completed

Record Review	Count
Total Participants Reviewed	445
Total Measures Qualified	554

Survey Sampling

Cadmus conducted the participating customer surveys in two rounds, one in March and April 2013 and a second in February 2014. This approach ensured that respondents would have a clear recollection of their participation experience. Table 7 provides a summary of unique customers (identified using Avista account number) and surveys completed in each effort.

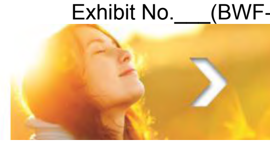


Table 7. Residential Participant Details and Survey Sample—Combined Washington and Idaho

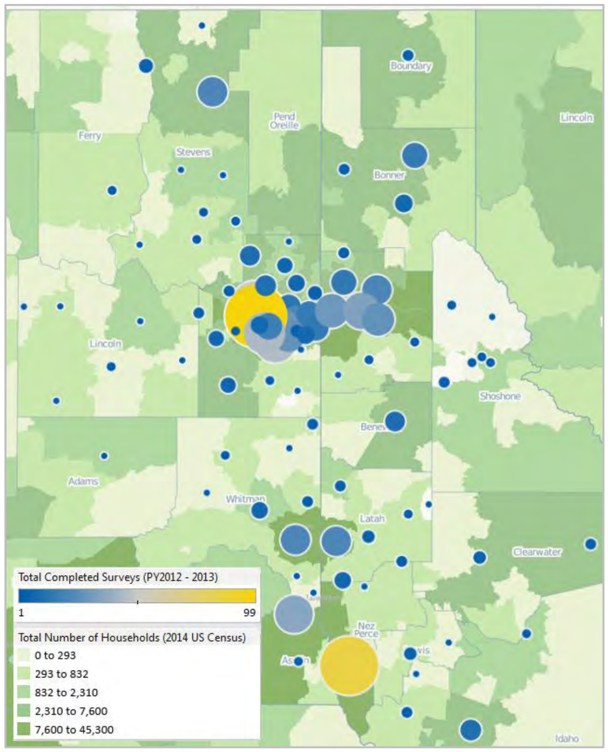
Measure Type	2012			2013		
	Participants	Surveys	Percent	Participants	Surveys	Percent
Natural Gas and Electric Programs						
ENERGY STAR Products	6,429	149	2%	782	65	8%
Heating and Cooling Efficiency	3,747	142	4%	2,490	70	3%
Water Heating	629	88	14%	316	60	19%
Weatherization and Shell Measures	692	102	15%	313	60	19%
Electric-Only Programs						
Second Refrigerator and Freezer Recycling	1,351	133	10%	1,319	65	5%
Space and Water Conversions	171	34	20%	156	37	24%
Total	**13,019**	**648**	**5%**	**5,376**	**357**	**7%**

Cadmus designed participant survey completion targets to yield results with 90% confidence and ±10% precision levels at the measure-category level. In 2012, we expanded this approach to yield results at the measure category and state level. Cadmus deemed this necessary as data collected through these surveys—specifically installation rates—were used to inform an impact assessment of Avista's residential programs. The participant survey sampling plan also drew upon multiple factors, including feasibility of reaching customers, program participant populations, and research topics of interest.

Cadmus did not conduct participant surveys with Simple Steps, Smart Savings customers, as that program has an upstream focus and therefore does not track participant contact information. Similarly, for ENERGY STAR New Homes, Cadmus did not survey residential customers purchasing rebated homes as the rebates were paid to the builders. Cadmus also did not survey new program participants (i.e., Residential Behavior) or temporary programs (e.g., Home Audit and Manufactured Homes Duct Sealing).

Within each program stratum, Cadmus randomly selected program participant contacts included in survey sample frames. A review of collected data shows geographic distribution of survey respondents clustered around urban centers, specifically the cities of Spokane, Coeur d'Alene, Pullman, Moscow, and Lewiston. This aligns with population distributions in Avista's service territory. Figure 2 provides the distribution of participating customer survey respondents.

Figure 2. Geographic Distribution of PY2012 - PY2013 Participating Customer Survey Respondents



1.2.2. Data Collection and Analysis

Record Review

Cadmus reviewed all records for the selected sample of accounts, checking them for completeness and program compliance using the data they contained. Measures qualified if all data found in the application complied with the program specifications. As Cadmus randomly sampled customers by application type (and several measures can be found on different application forms), we tracked qualification rates by the type of application.

The review revealed one improperly issued insulation rebate on a home improvement application, as it had an existing R-value above the participation requirements (the applied qualification rates included this result).

Surveys

Cadmus contracted with market-research firm Discovery Research Group (DRG) to conduct surveys with the selected participants. To minimize response bias, DRG called customers during various hours of the day and evening, as well as on weekends, and made multiple attempts to contact selected participants. Cadmus monitored survey phone calls to ensure accuracy, professionalism, and objectivity. We analyzed the survey data at the program level, rather than at the measure level. Survey results at the portfolio level are weighted by program participation to ensure proper representation.

Database Analysis

Cadmus reviewed the participant database provided by Avista to check for inconsistencies in reported savings and measure duplications. This review is necessary as Avista uses the database to track both achieved savings and rebates paid. Our review revealed multiple cases for the tracked savings did not follow the 2012 Avista TRM. These differences are described later in the report.

Unit Energy Savings

Cadmus reviewed every high impact prescriptive measure except the weatherization and shell measures for which we determined savings from a billing analysis. During each program year, Avista updates unit energy savings (UES) to reflect the gross energy savings achieved by a measure's installation. Details on each measure are included in the program sections below.

Billing Analysis

Cadmus conducted a statistical billing analysis of monthly meter data to determine the adjusted gross savings and realization rates for the following electric measures: weatherization, conversions to air source heat pump, conversions to natural gas, and manufactured homes duct sealing. We used a pre- and post-installation combined Conditional Savings Analysis (CSA) and Princeton Score Keeping Method (PRISM) approach. Verification Rates

Cadmus determined verification rates for each program. Where applicable, we administered verification site visits and surveys, which included:

- Checking correct measures were tracked in the database;
- Correct quantities were accounted for; and
- Units remained in place and were operable.

We equally weighted site visit and survey observations. All measures researched were in place and operable, resulting in 100% verification rates for the programs.

1.2.3. Measure Qualification Rates

Cadmus considered a measure qualified if it met the requirements in its category, such as being ENERGY STAR-certified or meeting the minimum efficiency standards for the program. We ensured all qualifications were met and, when necessary, conducted online database searches of the model numbers and noted qualifying characteristics.

Only two non-qualified measures were found of the entire qualification sample. One was a floor insulation project in which the base case condition listed on the application should have prevented the project from qualifying. The second was a high-efficiency heat pump installation for which the installed equipment did not meet the required efficiency threshold. Neither project impacted the overall residential qualification rate. Any savings for these two measures would have been determined using either a billing analysis or a metering study, which adjust for the disqualification. Since all other measures had qualification rates of 100%, the total qualification rate for all residential electric programs was therefore 100%.

1.3. Program Results and Findings

1.3.1. Overview

Cadmus analyzed data records, maintained by either Avista or an implementation contractor, to determine appropriate unit energy savings (UES) and measure counts for each supported measure within each program. The end result is the total adjusted gross savings for each measure and program, as well as the overall realized savings for each program.

We followed the same steps for calculating adjusted gross measure savings for all programs except Simple Steps, Smart Savings™, Second Refrigerator and Freezer Recycling, and Residential Weatherization:

- Review program database to determine if the adjusted measure counts correctly represent the number of installations.
- Conduct a phone survey or site visit to verify that the installation is within Avista's service territory.
- Calculate verification and qualification rates.
- Calculate deemed measure savings for products rebated during the program period.
- Apply verification and qualification rates and deemed savings to the measure counts to determine the adjusted gross savings for each measure.

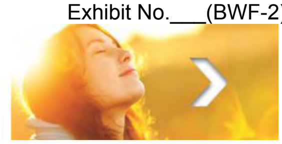
Details on the calculation methods used for Simple Steps, Smart Savings™, Second Refrigerator and Freezer Recycling, and Residential Weatherization are included in their specific sections below.

1.3.2. Simple Steps, Smart Savings™

Program Description

Avista's Simple Steps, Smart Savings ™ is an upstream incentive program that is an effective alternative to traditional mail-in incentives because of its ease of participation, widespread accessibility, and low administrative costs. This type of program allows utilities' incentives to pass directly from manufacturers to retailers, which then reduce bulb prices to their customers. The program motivates retailer participation by reducing bulb prices without a loss in profits. For the customer, participation may be so seamless they are unaware they have purchased an incentivized bulb or participated in a utility program.

Upstream programs, however, pose particular evaluation challenges because calculating metrics, such as in-service rates (ISR) and attributions, traditionally relies on surveying purchasers of incentivized products. As part of our determination of program savings, we referred to the Northwest Regional Technical Forum (RTF) UES assumptions, Avista's program records, and the compact fluorescent bulb (CFL) Contingency Program (discussed in Chapter 5).



This program incents various CFL products from standard twist to specialty bulbs that include 3-way, reflector, dimmable, globe, and other specialty bulbs. There are unique assumptions for standard twist bulbs and specialty bulbs; therefore, each was analyzed separately. Based on program funding, 70% of all bulb sales are assumed to be associated with residential sockets in Washington.

Analysis

This program has six different parameters to inform the calculation of gross savings for the lighting component: CFL wattage, delta watt multiplier (DWM), hours-of-use (HOU), days-per-year, waste heat factor (WHF), and ISR. The following algorithm shows the annual energy lighting savings:

$$\text{CFL Watts} \times \text{DWM} \times \text{HOU} \times \text{DAYS} \times \text{WHF} \times \text{ISR} = \text{Annual Energy Savings}$$

Where:

Measure Watts	=	Wattage of the purchased CFL or LED
DWM	=	The difference in wattage between the baseline bulb and the measure bulb divided by the wattage of the measure bulb
HOU	=	Daily lighting operating hours
DAYS	=	Days per year, 365.25
WHF	=	An adjustment representing the interactive effects of lighting measures on heating and cooling equipment operation
ISR	=	In-service rate, or percentage of units installed

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

CFL Wattage

Table 8 shows the reported and evaluated bulb and fixture sales for this program. Evaluated sales were determined from vendor provided data documenting sales allocated to Avista's territory. This discrepancy is likely due to monthly adjustments made in the database, which in turn may have led to either an over- or under-counting of the total sales volume.

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Table 8. Total Reported and Evaluated CFLs Sold by Year

PY	Type	Reported	Evaluated
2012	Twist	229,145	227,244
	Specialty	90,577	76,400
	Total	**319,722**	**303,644**
2013	Twist	300,908	302,651
	Specialty	83,188	92,359
	LED Bulb	22,042	22,042
	LED Fixture	20	20
	Total	**406,158**	**417,072**

Avista sales data included CFL wattage, units sold, and bulb type. Savings for each bulb type is analyzed separately. For 3-way bulbs, the middle wattage was used for the analysis. The average weighted CFL wattage sold in PY 2012 for standard twist and specialty was 16.23 and 15.53 watts, respectively. The average weighted CFL wattage sold in PY 2013, for standard twist, specialty, LED bulb, and LED fixture, was 16.15 watts, 14.23 watts, 10.19 watts, and 13.94 watts, respectively.

Delta Watt Multiplier

Cadmus followed the lumens equivalence method as laid out in the Uniform Methods Project (UMP) to evaluate the baseline wattage and the DWM for each wattage and type of bulb sold. The evaluation team matched the reported SKU numbers against the ENERGY STAR lighting database[1] to determine the lumens associated with each bulb. Once the lumens value was determined, the baseline wattage was evaluated in accordance with the guidelines outlined in the Energy Independence and Security Act (EISA) of 2007.

In PY2012 Cadmus was able to match 91% of the 433,777 bulbs sold using ENERGY STAR database. For the remaining 9% of bulbs, the first equation below was used to estimate the bulb's lumen output. This equation was developed by Cadmus using the ENERGY STAR lighting database, and is takes advantage of the relationship between CFL wattage and lumen output.

$$CFL\ Lumens\ in\ PY\ 2012 = 68.739 \times CFL\ Wattage - 56.25$$

In PY 2013, Cadmus was able to match 83.1% of the roughly 600,000 bulbs incented through the program. For the remaining 16.9% of bulbs, we determined the lumens value with an interpolation equation that is based on the relationship between CFL wattage and lumen output from the ENERGY STAR lighting database:

$$CFL\ Lumens\ in\ PY\ 2013 = 70.952 \times CFL\ Wattage - 86.11$$

Figure 3 and Figure 4 compare the lumens determined by lookup to the lumens determined using the regression model, along with the percent of PY 2012 sales for each wattage and type. The figures show

[1] http://www.energystar.gov/ia/products/prod_lists/compact_fluorescent_light_bulbs_prod_list.xls

that the regression method provides a better match standard twist CFLs than for specialty bulbs. Cadmus accepted the lumen output estimated by the regression for both types of bulbs due to the low percentage of sales volume used in the regression analysis.

Figure 5 and Figure 6 show a comparison of the lumens determined by lookup to the lumens determined by regression model, along with the PY 2013 sales data for the given wattage. The figures shows that the regression equation used in PY 2013 is a good estimate of the lumens output for a given measure wattage, especially considering the low percentage of total program sales.

Figure 3. Results of PY 2012 Lumens Determination, Standard Twist CFLs

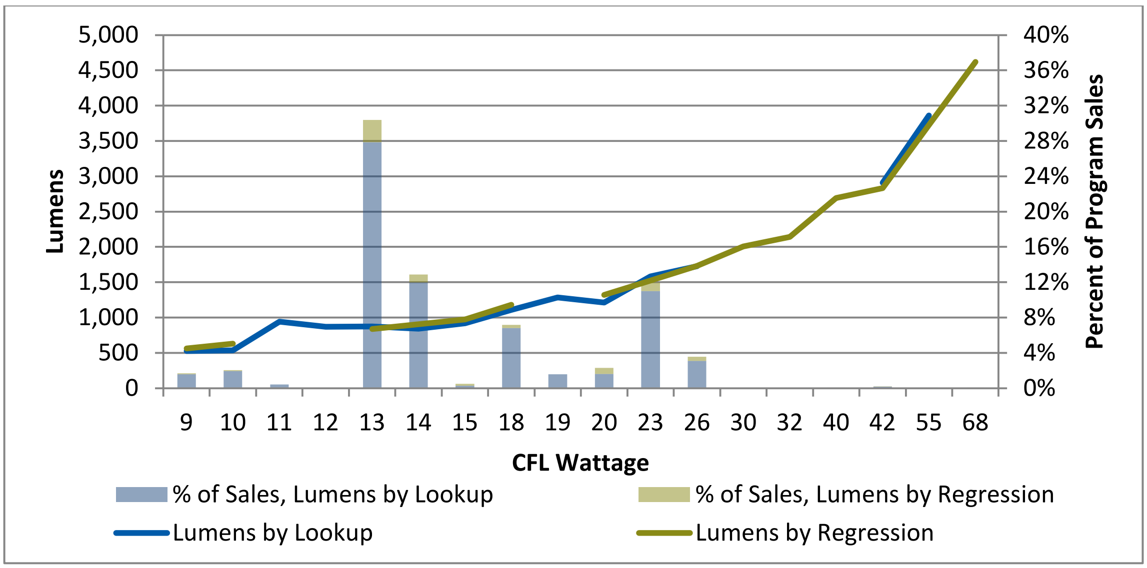


Figure 4. Results of PY 2012 Lumens Determination, Specialty CFLs

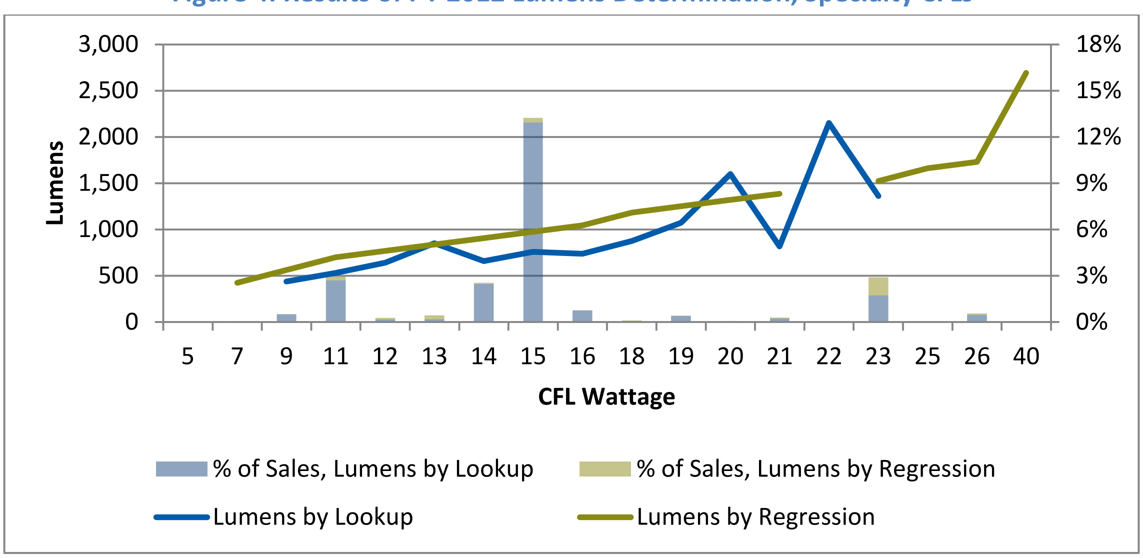


Figure 5. Results of PY 2013 Lumens Determination, Standard Twist CFLs

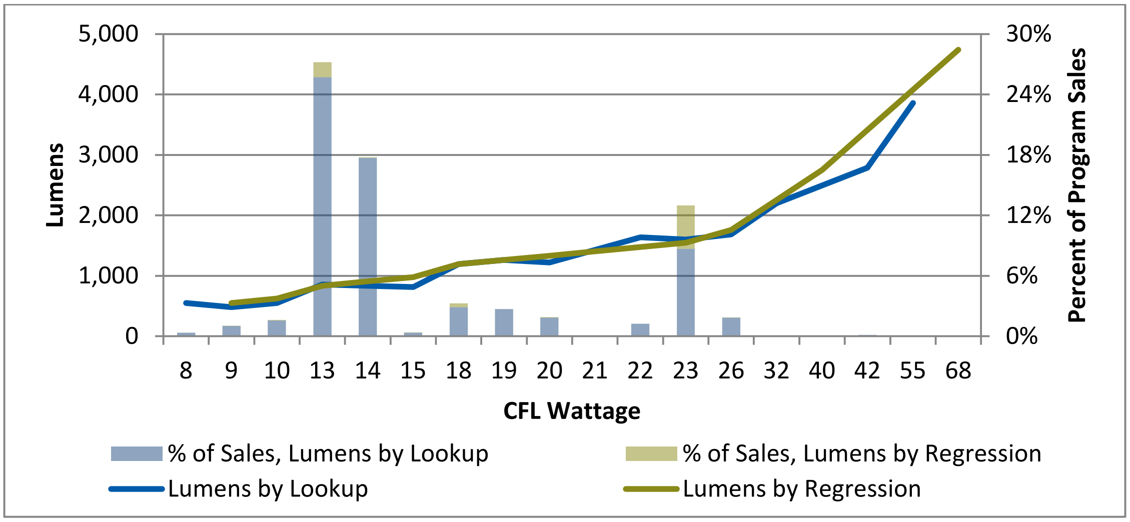
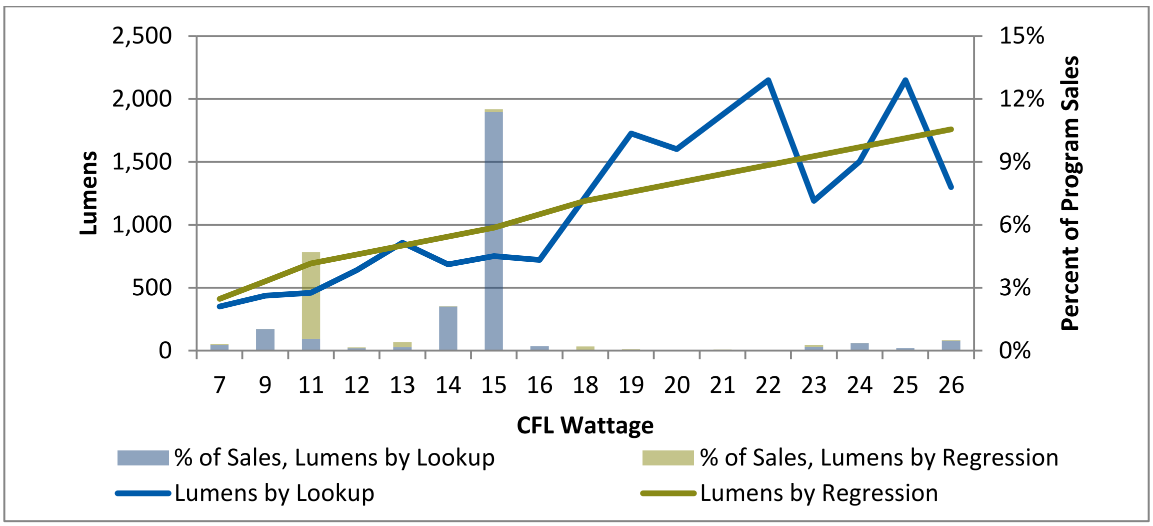


Figure 6. Results of PY 2013 Lumens Determination, Specialty CFLs



Cadmus then determined the baseline wattage for each bulb based on the lumen output and whether the bulb includes a reflector (which is not impacted by EISA).[2] Table 9 and Table 10 show the schedules Cadmus used to determine the baseline wattage for bulbs included in PY 2012 and PY 2013, for reflector and non-reflector bulbs, respectively. We then calculated the DWM for each bulb using the baseline wattage and purchased CFL wattage.

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2 Federal exemptions for some reflector style bulbs were set to expire in late 2012. In order to maintain consistency between this evaluation and the 2012 program year evaluation, Cadmus assumed that the exemptions expired on January 1, 2014. The impact of these exemptions on the 2013 program would have caused a 0.69% decrease in overall savings.

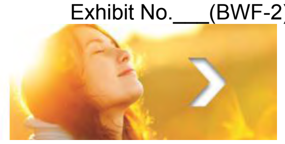

Table 9. Baseline Wattage Based on Measure Lumens, Non-Reflector Bulbs

Lumens Range	Incandescent Baseline [W]			Average CFL Wattage	Bulbs Rebated	% of Program Sales
	CFL or LED Sold Before 1/1/12	CFL or LED Sold on or After 1/1/12	CFL or LED Sold on or After 1/1/13			
0 - 309	25	25	25	0.00	0	0.0%
310 - 749	40	40	40	9.55	75,356	12.6%
750 - 1,049	60	60	60	13.43	283,365	47.6%
1,050 - 1,489	75	75	53	18.85	47,596	8.0%
1,490 - 2,600	100	72	72	23.27	96,976	16.3%
2,601 - 3,300	150	150	150	41.77	954	0.2%
3,301 - 4,815	200	200	200	62.34	593	0.1%

Table 10. Baseline Wattage based on Measure Lumens, Reflector Bulbs

Lumens Range	Incandescent Baseline [W]	Average CFL Wattage	Bulbs Rebated	% of Program Sales
0 - 419	30	11.00	509	0.1%
420 - 560	45	13.24	1,060	0.2%
561 - 837	65	14.82	77,336	13.0%
838 - 1,203	75	16.65	4,116	0.7%
1,204 - 1,681	90	23.92	6,943	1.2%
1,682 - 2,339	120	24.26	1,013	0.2%
2,340 - 3,075	175	0.00	0	0.0%

Hours-of-Use

For the 2012 RBSA, the Northwest Energy Efficiency Alliance (NEEA) completed field visits to residential homes in the Northwest in order to better understand how energy-consuming equipment is used in the region. Part of the study was to assess the location in homes where CFLs were installed. This study represents the best source for the likely installed locations of bulbs purchased through this program; therefore, Cadmus used this information along with the RTF room type HOU assumptions to estimate an average of 1.93 HOU per day for all bulbs (see Table 11).

Cadmus used the HOU for specialty CFLs from approved RTF assumptions.[3] We applied the same HOU in both PY 2012 and PY 2013.

Cadmus believes that the HOU assumptions used for this analysis are conservative and results in an underestimation of energy savings. Cadmus maintains an HOU model that aggregates all of the primary

[3] Version 2.2 of the RTF CFL workbook.

data we have collected on residential lighting use. The model calculates HOU using a regression statistical model that combines multistate, multiyear data. Cadmus used the multistate model's estimate of HOU by room type, weighting this based on Avista's survey results to determine an overall HOU average of 2.38, 23% longer than the value currently used by the RTF.

Table 11. Calculation of Hours-of-Use

Room Type	Percent of CFLs Installed in Room Type	Total Bulbs in Room Type	Total CFLs in Room Type	Likelihood CFL is Installed in Room	HOU
Bathroom	22.0%	12,977	2,855	13.34%	1.3
Bedroom	29.4%	9,847	2,895	13.53%	1.5
Closet	24.6%	1,747	430	2.01%	1.4
Dining Room	18.0%	4,314	777	3.63%	1.7
Exterior	24.3%	8,174	1,986	9.28%	3.8
Family Room	28.4%	4,724	1,342	6.27%	2.3
Garage	13.3%	5,474	728	3.40%	1.8
Hall	28.6%	6,270	1,793	8.38%	1.3
Kitchen	26.9%	9,665	2,600	12.15%	2.4
Laundry Room	27.9%	2,284	637	2.98%	1.5
Living Room	31.0%	7,662	2,375	11.10%	2.3
Master Bedroom	28.8%	4,015	1,156	5.40%	1.5
Office	28.1%	2,879	809	3.78%	1.3
Other	18.5%	5,477	1,013	4.74%	1.5
All Room Types	**25.0%**	**85,509**	**21,396**	**100%**	**1.93**

Waste Heat Factor

The WHF accounts for the change in annual HVAC energy, either lost or gained, due to the reduction in facility lighting energy. The most recent WHF approved by the RTF[4] is 84.6%.

The Council's method used to determine WHF is inherently conservative because it assumes a closed shell (i.e., that all interior lamps, including ceiling recessed cans, are contained in a closed system such that any heat output from bulbs goes into the building). In reality, wasted heat could transfer out of the conditioned space, thereby increasing the savings achieved through installation.

Cadmus based the WHF calculation on Avista's share of electric heating equipment,[5] along with its associated efficiencies and its surveys of interior and exterior distribution, to obtain a WHF of 89.8%.[6]

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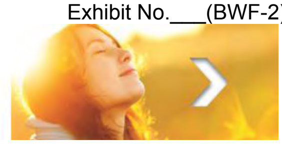
4 See: http://rtf.nwcouncil.org/measures/measure.asp?id=142.



In-Service Rate

Cadmus used the same CFL ISR accepted and approved by the RTF of 74.48%.[7] This a storage rate of 24% and a removal rate of 2%. The Council's method to determining ISR is inherently conservative, because it assumes that the remaining 24% of bulbs in storage never provide energy savings. However, research has revealed that almost all program bulbs are installed within three years of purchase. Cadmus used the same LED ISR accepted and approved by the RTF of 100%.[8]

Results and Findings

Overall Program Savings

Avista's total reported savings and evaluated savings for in PY 2012 are shown in Table 12.

Table 12. Simple Steps, Smart Savings PY 2012 Reported and Evaluated Total Savings

2012	Reported			Evaluated			Realization Rate
	Twist	Specialty	Total	Twist	Specialty	Total	
Bulbs Purchased	229,145	90,577	319,722	227,244	76,400	303,644	95%
Program Savings (kWh)	5,499,480	1,494,524	6,994,004	5,124,466	1,752,158	6,876,624	98%
Savings Per Bulb (kWh)	24.0	16.5	21.9	22.6	22.9	22.6	104%

In PY 2013, Avista added LED bulbs and fixtures to the program. Avista's total reported and evaluated savings for PY 2013 are shown in Table 13.

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5 Saturations of Avista equipment types are based on the 2011 participant survey for the CFL Contingency Program.

6 The RTF WHF is 86.4%; the adjusted Avista WHF is 89.8%.

7 See: http://rtf.nwcouncil.org/measures/measure.asp?id=142.

8 See: http://rtf.nwcouncil.org//measures/measure.asp?id=198

Table 13. Simple Steps, Smart Savings PY 2013 Reported and Evaluated Total Savings

2013	Reported Savings			Evaluated Savings		
	Bulbs Purchased	Program Savings (kWh)	Savings Per Bulb (kWh)	Bulbs Purchased	Program Savings (kWh)	Savings Per Bulb (kWh)
Twist	300,908	7,221,782	24.0	302,651	6,491,684	21.4
Specialty	83,188	1,372,602	16.5	92,359	1,965,742	21.3
LED Bulb	22,042	458,188	20.8	22,042	543,038	24.6
LED Fixture	20	487	24.0	20	454	22.4
Total	**406,158**	**9,053,059**	**22.3**	**417,072**	**9,000,917**	**21.6**
Realization Rate				**103%**	**99%**	**97%**

The total savings achieved by this program over the two years is shown in Table 14. Overall the program is delivering savings in line with the 6th Power plan values used to track and report savings.

Table 14. Simple Steps, Smart Savings, 2012 – 2013 Lighting Savings

2012 - 2013	Reported Total	Evaluated Total	Realization Rate
Bulbs Purchased	725,880	720,716	99%
Program Savings (kWh)	16,047,063	15,877,541	99%
Savings Per Bulb (kWh)	22.1	22.0	100%

Showerheads

Though primarily a lighting program, Simple Steps, Smart Savings also incentivized low-flow, energy-saving shower heads in PY 2013. The evaluation assumes that 51.6% of the units purchased were installed in homes with an electric water heater and 48.4% of the units were installed in homes with a gas water heater. This assumption is based on the responses of over 1,000 of Avista's residential customers in Washington to Cadmus' general population survey. The program sold showerheads with flow rates ranging from 1.5 gallons per minute (gpm) to 2.0 gpm. The unit energy savings for each flow rate sold are based on the net savings values currently approved by the RTF[9] for showerheads purchased through a "Retail" program and installed in "Any Shower" in the home. Evaluated savings follow the RTF methodology and include the electricity savings due to reduced water and sewer requirements for all units purchased through the program. The assumptions used and unit energy savings (UES) calculated for this evaluation are shown in Table 15.

[9] http://rtf.nwcouncil.org/measures/measure.asp?id=126

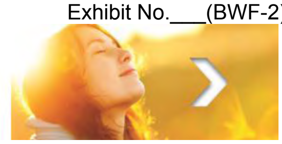


Table 15. Showerhead Assumptions

Evaluated Showerhead Savings – Washington	
Units Sold	
2012 Showerheads Sold	1,410
2013 Showerheads Sold	798
Total	2,208
Survey Results, Fuel Distribution	
Percent Gas DHW	48.4%
Percent Electric DHW	51.6%
Water Heater Savings – Fuel Specific	**UES**
2012 Electric Water Heater Savings (kWh)	150.7
2013 Electric Water Heater Savings (kWh)	139.2
2012 Gas Water Heater Savings (therms)	6.7
2013 Gas Water Heater Savings (therms)	6.2
Water & Sewer Savings - All Units Sold	**UES**
2012 Water & Sewer Savings (kWh)	6.7
2013 Water & Sewer Savings (kWh)	6.2

The total savings for these units are shown in Table 16. Avista did not provide Cadmus with reported electric savings for 2012 purchases. Cadmus has therefore chosen to not calculate a realization rate for these installations. The Electric Savings per Unit Purchased shown in the table apply to all units purchased through the program as it accounts for the saturation or electric and gas equipment as well as the water and sewer savings.

Table 16. Simple Steps, Smart Savings, 2012 – 2013 Showerhead Savings

2012 - 2013	Evaluated Total
Units Purchased	2,208
Program Savings (kWh)	181,540
Electric Savings Per Unit Purchased (kWh)	82.22

1.3.3. Second Refrigerator and Freezer Recycling

Summary of Program Participation

Cadmus reviewed the participant database, maintained by JACO, the program implementer, to test the reliability of program data. As shown in

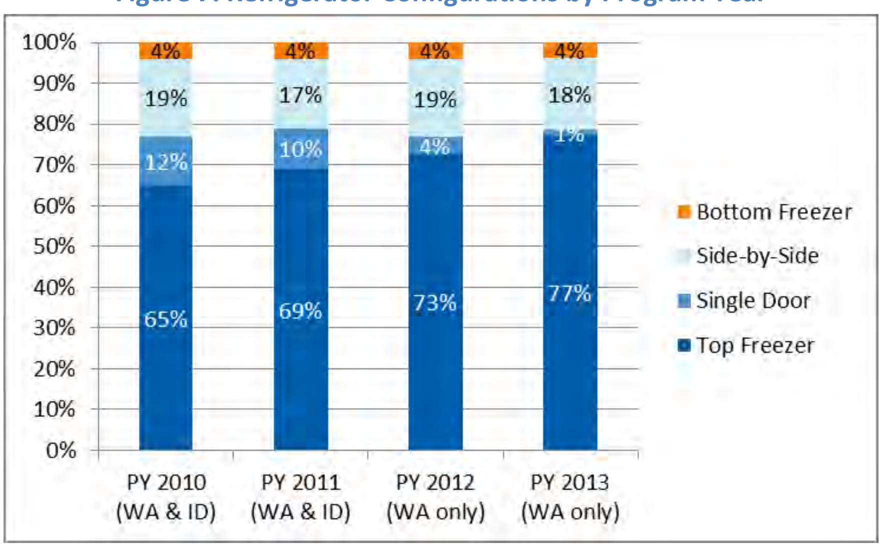
Table 17, 1,092 units were recycled through the program during PY 2012, and 1,067 units were recycled during PY 2013. Some participants recycled more than one appliance through the program.

Table 17. Washington Program Participation by Measure

Year	Measure	Participation
2010	Recycled Refrigerator	1,150
	Recycled Freezer	301
	Total	**1,451**
2011	Recycled Refrigerator	1,152
	Recycled Freezer	363
	Total	**1,515**
2012	Recycled Refrigerator	800
	Recycled Freezer	292
	Total	**1,092**
2013	Recycled Refrigerator	815
	Recycled Freezer	252
	Total	**1,067**
Total	Recycled Refrigerator	3,917
	Recycled Freezer	1,208
	Total	**5,125**

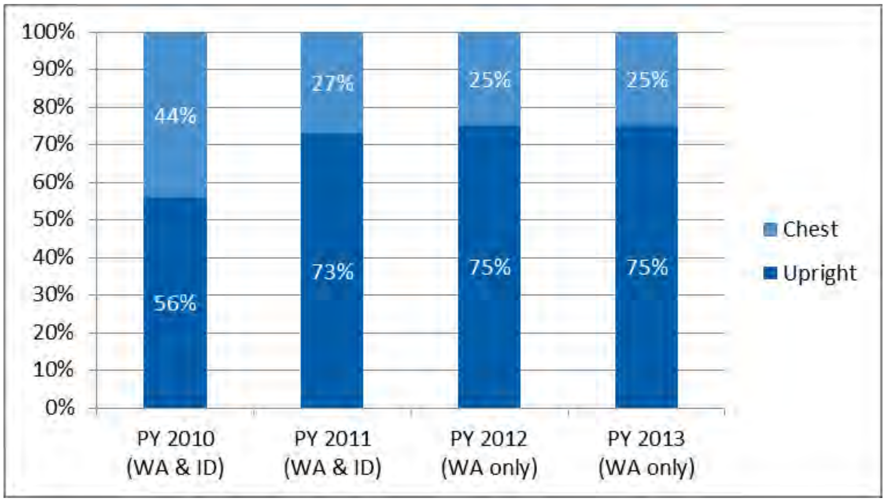
As shown in Figure 7, single-door refrigerators made up a smaller percentage of program participation in PY 2012 and PY 2013 than in PY 2010 and PY 2011. Decreasing quantities of single-door refrigerators, which are generally older units manufactured before the 1970s, is typical of maturing appliance recycling programs (ARPs). The PY 2010 and PY 2011 evaluations combined both Washington and Idaho data, so the decreasing quantities of single-door refrigerators observed in Washington in PY 2012 and PY 2013 may also be due to differences by state.

Figure 7. Refrigerator Configurations by Program Year



As shown in Figure 8, freezer configurations did not change substantially from PY 2010 and PY 2011 to PY 2012 and PY 2013.

Figure 8. Freezer Configurations by Program Year



In PY 2012 and PY 2013, recycled refrigerators averaged 28.2 years old, with 18.0 cubic feet of internal capacity. Recycled freezers averaged 33.5 years old, also with 18.0 cubic feet of internal capacity.

Determining Average Annual Gross Savings

Cadmus developed a multivariate regression model to estimate the gross savings of retired refrigerators and freezers. We estimated the model coefficients using an aggregated *in situ* metering dataset composed of over 600 appliances (which we metered as part of five California, Wisconsin, and Michigan evaluations conducted between 2009 and 2012). These evaluations reflected a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions.

UMP and RTF Protocols

Recent guidelines developed by the U.S. Department of Energy (DOE) informed Cadmus' impact evaluation methodology for PY 2012 and PY 2013. In 2011, DOE launched the UMP, intending to "strengthen the credibility of energy savings determinations by improving EM&V, increasing the consistency and transparency of how energy savings are determined."[10]

The UMP identifies seven common residential and commercial DSM measures, reporting results from an enlisted set of subject matter experts who drafted evaluation protocols for each measure category. Refrigerator recycling was one of the seven identified measures. The DOE recruited Cadmus to manage the UMP process and to serve as the lead author for the refrigerator recycling protocol.

Through a collaborative process that included reviews by a technical advisory group and a steering committee, as well as a public review and response period, the UMP resulted in a set of protocols

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[10] U.S. Department of Energy. *About the Uniform Methods Project*.. Accessed April 24, 2014. Available online: http://energy.gov/eere/about-us/uniform-methods-project-determining-energy-efficiency-program-savings/about-uniform-methods.

capturing the collective consensus of the evaluation community. Each protocol establishes broadly accepted best practices for evaluating key measures in that category, including methods for identifying and explaining key parameters, data sources, and gross- and net-related algorithms.

For the first Avista ARP evaluation in PY 2012, Cadmus followed the complete UMP methodology for Idaho. To evaluate the Washington PY 2012 and PY 2013 program, Cadmus followed the methodology outlined in the UMP refrigerator recycling protocol. This protocol largely mirrored the method Cadmus used for the PY 2010 and PY 2011 program evaluation, except for making changes recommended in the UMP.

The two most notable changes are discussed in greater detail below.

1. ***Prospective Part-Use***. The UMP recommends assessing part-use based on how the recycled appliance would likely have been used if not recycled (not based on how it was previously used). For example, if a primary refrigerator would have become a secondary refrigerator independent of the program, Cadmus based its PY 2012 and PY 2013 part-use factors on the average usage of secondary refrigerators, rather than the average usage of primary refrigerators (as we did for the PY 2010 and PY 2011 evaluation).
2. ***Secondary Market Impacts.*** The UMP recommends using a grid-level approach to estimating net program savings. Therefore, to evaluate PY 2012 and PY 2013, Cadmus considered the program's impact on the used appliance market. The secondary market impact adjustment accounted for changes in the availability of used appliances resulting from the program. The PY 2010 and PY 2011 evaluation did not account for secondary market impacts.

The DOE website[11] provides more information about the UMP Refrigerator Regression Model. Table 18 shows the variables we used to estimate refrigerators' annual energy consumption, along with the estimated parameters.

[11] U.S. Department of Energy. "Uniform Methods Project for Determining Energy Efficiency Program Savings.". Accessed April 24, 2014. http://energy.gov/eere/about-us/initiatives-and-projects/uniform-methods-project-determining-energy-efficiency-program-savings.

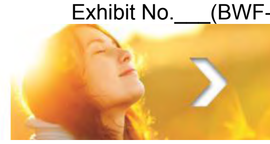


Table 18. Refrigerator UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, R-square = 0.30)

Independent Variables	Coefficient	p-Value
Intercept	0.805	0.166
Age (years)	0.021	0.152
Dummy: Manufactured Pre-1990	1.036	<.0001
Size (cubic feet)	0.059	0.044
Dummy: Single Door	-1.751	<.0001
Dummy: Side-by-Side	1.120	<.0001
Dummy: Primary	0.560	0.008
Interaction: Unconditioned Space x HDDs	-0.040	0.001
Interaction: Unconditioned Space x CDDs	0.026	0.188

The results of our analysis indicated the following:

- Older refrigerators experienced higher consumption due to year-on-year degradation.
- Refrigerators manufactured before the 1990 National Appliance Energy Conservation Act (NAECA) standard consumed more energy.
- Larger refrigerators consumed more energy.
- Single-door units consumed less energy, as these units typically did not have full freezers.
- Side-by-side refrigerators experienced higher consumption due to greater exposure to outside air when opened and due to the through-door features common in these units.
- Primary appliances experienced higher consumption due to increased usage.
- At higher temperatures, refrigerators in unconditioned spaces consumed more energy.
- At colder temperatures, refrigerators in unconditioned spaces consumed less energy.

Freezer Regression Model

Table 19 shows the freezer model details.

Table 19. Freezer UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, R-square = 0.38)

Independent Variables	Coefficient	p-Value
Intercept	-0.955	0.237
Age (years)	0.045	0.001
Dummy: Manufactured Pre-1990	0.543	0.108
Size (cubic feet)	0.120	0.002
Dummy: Chest Freezer	0.298	0.292
Dummy: Primary	-0.031	<.0001
Interaction: Unconditioned Space x HDDs	0.082	0.028
Interaction: Unconditioned Space x CDDs	-0.955	0.237

The results of our analysis indicated the following:

- Older freezers experienced higher consumption due to year-on-year degradation.
- Freezers manufactured before the 1990 NAECA standard consumed more energy.
- Larger freezers consumed more energy.
- Chest freezers experienced higher consumption.
- At higher temperatures, freezers in unconditioned spaces consumed more energy.
- At colder temperatures, freezers in unconditioned spaces consumed less energy.

Extrapolation

After estimating the final regression models, Cadmus analyzed the corresponding characteristics (the independent variables) for participating appliances (as captured in the JACO database). Table 20 summarizes program averages for each independent variable.

As an example, using values from Table 19 and Table 20, Cadmus calculated the estimated annual UEC for PY 2012 and PY 2013 freezers as:

$$\text{2012 \& 2013 Freezer UEC} = 365.25\, days * (-0.955 + 0.045 * [33.45\, years\ old] + 0.543 * [90\%\, units\ manufactured\ pre - 1990] + 0.120 * [17.97\, ft.^3\,] + 0.298 * [25\%\, units\ that\ are\ chest\ freezers] + 0.082 * [0.59\, Unconditioned\ CDDs] - 0.031 * [10.45\, Unconditioned\ HDDs]) = \ 1{,}098\, kWh/year^{12}$$

Figure 9 compares distributions of estimated UEC values for refrigerators and freezers.

[12] The UEC shown is higher than what would be calculated from the coefficients and means shown in the UEC equation, because those coefficients and means are rounded. Cadmus used unrounded coefficients and means for calculating the evaluated UEC.

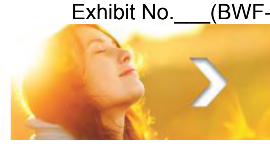


Table 20. 2012 Participant Mean Explanatory Variables

Appliance	Independent Variables	WA PY 2012 and PY 2013 Participant Population Mean Value
Refrigerator	Age (years)	28.24
	Dummy: Manufactured Pre-1990	0.73
	Size (cubic feet)	17.98
	Dummy: Single Door	0.03
	Dummy: Side-by-Side	0.19
	Dummy: Primary	0.41
	Interaction: Unconditioned Space x HDDs	6.71
	Interaction: Unconditioned Space x CDDs	0.38
Freezer	Age (years)	33.45
	Dummy: Manufactured Pre-1990	0.90
	Size (cubic feet)	17.97
	Dummy: Chest Freezer	0.25
	Interaction: Unconditioned Space x HDDs	10.45
	Interaction: Unconditioned Space x CDDs	0.59

Figure 9. PY 2012 and PY 2013 Distribution of Estimated Annual UECs by Appliance Type

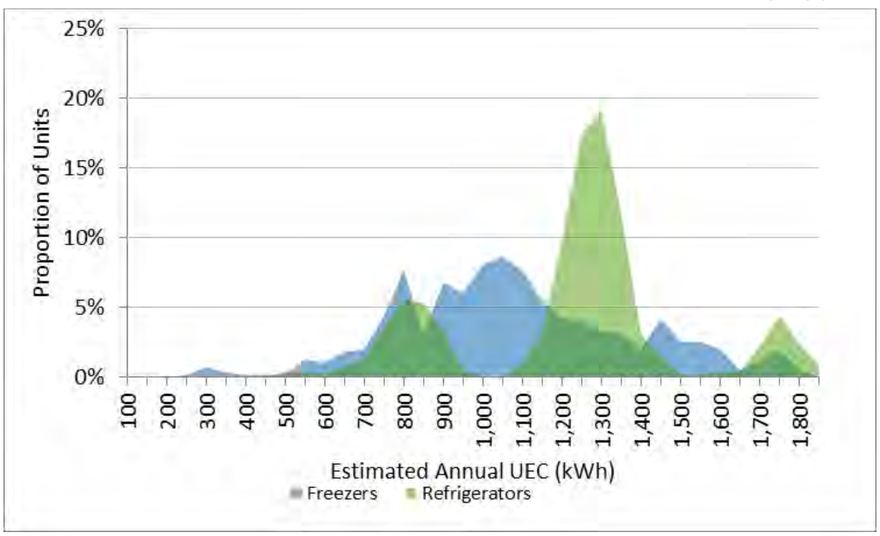


Table 21 presents the estimated, per-unit, average annual energy consumption for refrigerators and freezers recycled by Avista in PY 2012 and PY 2013. After the table, we describe how we adjusted these estimates to arrive at gross per-unit saving estimates for participant refrigerators and freezers.

Table 21. Estimate of Per-Unit Annual Energy Consumption

Appliance	*Ex Post* Annual UEC (kWh/year)	Relative Precision(90% confidence)
Refrigerators	1,225	8%
Freezers	1,098	18%

Table 22 presents the PY 2012 and PY 2013 UEC results for Avista, compared to other utilities located in Canada and the U.S. Avista's UECs are similar to the other utilities we benchmarked and to results from previous Avista evaluations.

Table 22. Benchmarking: Average UEC Values

Utility	Years Implemented	Average UEC (kWh/Year)	
		Refrigerator	Freezer
Avista (WA, PY 2012 and PY 2013)	**8**	**1,225**	**1,098**
Avista (ID, PY 2012)	7	1,199	1,117
Avista (WA & ID, PY 2011)	6	1,147	1,074
Avista (WA & ID, PY 2010)	5	1,158	1,073
Rocky Mountain Power (UT, 2011-2012)	10	1,323	1,082
Rocky Mountain Power (ID, 2011-2012)	8	1,217	1,111
Pacific Power (WA, 2011-2012)	8	1,239	1,087
Ontario Power Authority (2012)	6	1,153	1,270
Ontario Power Authority (2011)	5	1,240	1,172
Rocky Mountain Power (WY, 2011-2012)	4	1,256	1,098

Part-Use

Part-use is as an adjustment factor specific to appliance recycling, which is used to convert the UEC into average per-unit gross savings value. The UEC itself does not equal gross savings value, due to the following:

- The UEC model yields an estimate of annual consumption.
- Not all recycled refrigerators would have operated year-round if they had not been decommissioned through the program.

As Cadmus applied the UMP methodology, the determination of PY 2012 and PY 2013 part-use differs slightly from that used in the previous Washington evaluation of PY 2010 and PY 2011 (though it is the same as that used in the Idaho PY 2012 evaluation). Specifically, in the previous evaluation we assumed that the way customers operated participating appliances prior to the program served as a reasonable proxy for how the same appliances would likely be operated in the future, had they not been recycled through the program (either by the participant or, if the appliance was transferred, by the would-be recipient).

While the UMP part-use methodology uses information from surveyed customers regarding pre-program usage patterns, the final part-use estimate reflects the way appliances would likely be operated if they had not been recycled (not how they were previously operated). For example, a primary refrigerator operated year-round could become a secondary appliance and be operated part-time.

This updated methodology accounts for potential shifts in usage types. Specifically, it calculates part-use using a weighted average of the following, prospective part-use categories and factors:

- Appliances that would have run full-time (part-use = 1.0).
- Appliances that would not have run at all (part-use = 0.0).
- Appliances that would have operated for a portion of the year (part-use between 0.0 and 1.0).

Using information gathered through the participant surveys, Cadmus used the following multistep process to determine part-use, as outlined in the UMP:

We used the surveys to determine if recycled refrigerators were primary or secondary units (with all stand-alone freezers considered secondary units).

For participants indicating they recycled a secondary refrigerator, we asked if the refrigerator was unplugged, operated year-round, or operated for a portion of the preceding year (and assuming all primary units operated year-round). We asked all freezer participants the same question.

Cadmus asked participants who indicated that their secondary refrigerator or freezer operated for only a portion of the preceding year to estimate how many months during that time their appliance was plugged in. This subset of participants estimated 6.36 and 5.16 months for secondary refrigerators and freezers, respectively. Dividing both values by 12 provided the annual part-use factors of 0.53 for all secondary refrigerators and 0.43 for all freezers operated for only a portion of the year (Table 25).

Table 23. Historical Part-Use Factors by Category

Usage Type and Part-Use Category	Refrigerators			Freezers		
	Percent of Recycled Units	Part-Use Factor	Per-UES (kWh/Yr)	Percent of Recycled Units	Part-Use Factor	Per-UES (kWh/Yr)
Secondary Units Only			**n=42**			
Not in Use	8%	0.00	-			
Used Part Time	10%	0.53	649			
Used Full Time	82%	1.00	1,225			
Weighted Average	**100%**	**0.87**	**1,063**			
All Units (Primary and Secondary)			**n=87**			**n=24**
Not in Use	5%	0.00	-	9%	0.00	-
Used Part Time	6%	0.53	649	16%	0.43	467
Used Full Time	89%	1.00	1,225	75%	1.00	1,098
Weighted Average	**100%**	**0.92**	**1,131**	**100%**	**0.82**	**902**

Cadmus then asked participants how the appliances would likely have been operated if they had not been recycled through the program. For example, if surveyed participants indicated they would have kept a primary refrigerator independent of the program, we asked if they would have continued to use the appliance as their primary refrigerator or would have relocated it and used as a secondary refrigerator. We did not ask similar questions of participants who indicated they would have discarded their appliance independent of the program, as the future usage of their appliance would be determined by another customer.

Combining the historically based, part-use factors shown in Table 23 with participants' self-reported action had the program *not* been available resulted in the distribution of likely future usage scenarios and corresponding part-use estimates. Table 24shows the weighted average of these future scenarios, revealing the program part-use factor for refrigerators (0.89) and freezers (0.82).[13]

Table 24. Part-Use Factors by Appliance Type

Use Prior to Recycling	Likely Use Independent of Recycling	Refrigerator		Freezer	
		Part-Use Factor	Percent of Participants	Part-Use Factor	Percent of Participants
Primary	Kept (as primary unit)	1.00	3%		
	Kept (as secondary unit)	0.87	15%		
	Discarded	0.92	18%		
Secondary	Kept	0.87	45%	0.82	48%
	Discarded	0.92	19%	0.82	52%
Overall		**0.89**	**100%**	**0.82**	**100%**

Table 25 presents the part-use factors compared with other utilities located in Canada and the U.S. Cadmus found that Avista Washington has a similar part-use factor for refrigerators, and a slightly lower part-use factor for freezers than other utilities.

Table 25. Benchmarking: Part-Use Factors by Appliance Type

Utility	Years Implemented	Part-Use Factors	
		Refrigerator	Freezer
Avista (WA, PY 2012 and PY 2013)	**8**	**0.89**	**0.82**
Avista (ID, PY 2012)	7	0.95	0.74
Avista (WA & ID, PY 2010 and PY 2011)	6	0.94	0.82
Southern California Edison (2012)	12	0.94	
Rocky Mountain Power (UT, 2011-2012)	10	0.93	0.90
PG&E (2012)	10	0.94	
Rocky Mountain Power (ID, 2011-2012)	8	0.84	0.93
Pacific Power (WA, 2011-2012)	8	0.93	0.90
Ameren Illinois	5	0.88	0.88

13 As the future usage type of discarded refrigerators cannot be known, Cadmus applied the weighted part-use average of all units (0.89) to all refrigerators that would have been discarded independent of the program. This approach acknowledged that discarded appliances could be used as primary or secondary units in a would-be recipient's home.

Net-to-Gross

Cadmus used the following formula to estimate net savings for recycled refrigerators:

$$Net\ savings = Gross\ Savings - Freeridership\ and\ Secondary\ Market\ Impacts \\ - \ Induced\ Replacement$$

Where Gross Savings are the evaluated *in situ* UEC for the recycled unit, adjusted for part-use, Freeridership and Secondary Market Impacts are program savings that would have occurred in the program’s absence, And Induced Replacement is average, additional energy consumed by replacement units purchased due to the program

Applying the UMP protocol introduced an additional parameter related to net savings—secondary market impacts—and required the use of a decision-tree approach to calculate and present net program savings. Cadmus did not include this adjustment for the PY 2010 and PY 2011 impact evaluation; therefore, changes in net savings could be partially attributed to changes in the evaluation methodology.

The decision tree—populated by responses of surveyed participants—presented savings under all possible scenarios of the participants’ actions with the discarded equipment. Cadmus used a weighted average of these scenarios to calculate net savings attributable to the program. This section includes specific portions of the decision tree to highlight specific aspects of the net savings analysis.

Freeridership

For our freeridership analysis, Cadmus first asked participants if they considered discarding the participating appliance prior to learning about the program. If the participant did not indicate a previous consideration to dispose of the appliance, Cadmus categorized them as a non-freerider and excluded them from the subsequent freeridership analysis.

Next, Cadmus asked all remaining participants (i.e., those who had considered discarding their existing appliance before learning about the program) a series of questions to determine the distribution of participating units likely to have been kept versus those likely to have been discarded absent the program. Three scenarios independent of program intervention could have occurred:

- The unit would be discarded and transferred to someone else.
- The unit would be discarded and destroyed.
- The unit would be kept in the home.

To determine the percentage of participants in each of the three scenarios, Cadmus asked surveyed participants about the likely fate of their recycled appliance had it not been decommissioned through the program. Cadmus categorized their responses into the following options:

- Kept the appliance.
- Sold the appliance to a private party (either an acquaintance or through a posted advertisement).

- Sold or gave the appliance to a used appliance dealer.
- Gave the appliance to a private party, such as a friend or neighbor.
- Gave the appliance to a charity organization, such as Goodwill Industries or a church.
- Had the appliance removed by the dealer who provided the new or replacement unit.
- Hauled the appliance to a landfill or recycling center, or had someone else pick it up for junking or dumping.

Cadmus also asked surveyed participants if they had considered getting rid of their old appliance before they heard about the program. The distribution of their responses to this question are summarized in Table 26.

Table 26. Distribution of Participants' Pre-Program Disposal Intentions

Had Considered Disposing Recycled Appliance Prior to Hearing About the Program	Indicative of Freeridership	Refrigerators (n=87)	Freezers (n=26)
Yes	Varies by Discard Method	77%	77%
No	No	23%	23%
Total		**100%**	**100%**

Once Cadmus determined the final assessments of participants' actions independent of the ARP, we calculated the percentage of refrigerators and freezers that would have been kept or discarded (Table 27).

Table 27. Final Distribution of Kept and Discarded Appliance

Stated Action Absent Program	Indicative of Freeridership	Refrigerators (n=83)	Freezers (n=25)
Kept	No	31%	36%
Discarded	Varies by Discard Method	69%	64%
Total		**100%**	**100%**

Cadmus benchmarked these values against Avista Idaho's PY 2012 evaluation and those of other ARP programs in Idaho, Washington, Utah, and Wyoming, as shown in Table 28. Avista's PY 2012 and PY 2013 result for Washington is most similar to Rocky Mountain Power's Idaho result, and is generally higher than the other benchmarked programs.

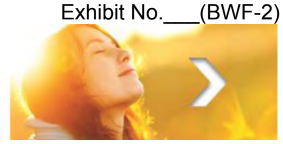


Table 28. Benchmarking Kept Appliances

Utility	Years Implemented	Percent Likely to Have Been Kept Independent of the Program	
		Refrigerator	Freezer
Avista (WA, PY 2012 and PY 2013)	**8**	**31%**	**36%**
Avista (ID, PY 2012)	7	25%	17%
Rocky Mountain Power (UT, 2011-2012)	10	20%	24%
Rocky Mountain Power (ID, 2011-2012)	8	32%	29%
Pacific Power (WA, 2011-2012)	8	22%	22%
Rocky Mountain Power (WY, 2011-2012)	4	16%	27%

Secondary Market Impacts

If, absent the program, a participant would have directly or indirectly (through a market actor) transferred the program-recycled unit to another Avista customer, Cadmus determined what actions the would-be acquirer might have taken with that unit.

Some would-be acquirers would find another unit; others would not. This reflects that some acquirers would be in the market for a refrigerator (and would acquire another unit), while others were not (and would have taken the unit opportunistically). Absent program-specific information, it is difficult to quantify changes in the total number of refrigerators and freezers in use (overall and specific to used appliances) before and after implementing the program. Without this information, the UMP recommends evaluators assume that one-half of the would-be acquirers would obtain an alternate unit. Without information to the contrary, Cadmus applied the UMP recommendation to this evaluation.

Next, Cadmus determined whether the alternate unit would likely be another used appliance (similar to those recycled through the program) versus a new, standard-efficiency unit (presuming fewer used appliances remained available due to program activity).[14]

As discussed, estimating this distribution definitively proves difficult. The UMP recommends taking a midpoint approach when primary research is unavailable: evaluators should assume that one-half of the would-be acquirers would obtain a similar used appliance, and one-half would acquire a new, standard-efficiency unit.

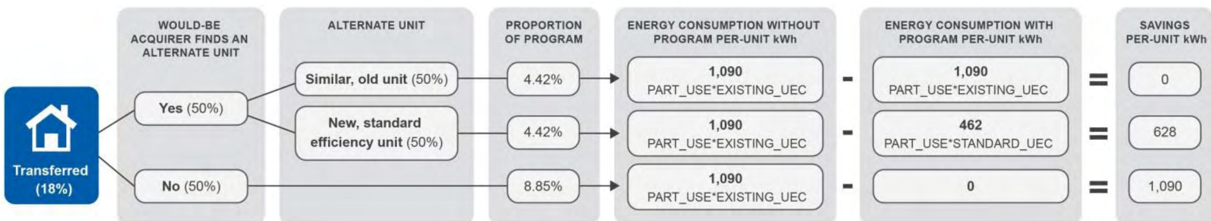
Cadmus used the ENERGY STAR website[15] to determine the energy consumption of new, standard-efficiency appliances. Specifically, Cadmus averaged the reported energy consumption of new, standard-efficiency appliances of comparable sizes and configurations as the program units.

[14] The would-be acquirer could also select a new ENERGY STAR unit. However, Cadmus assumed that most customers in the market for a used appliance would upgrade to the next lowest price point (a standard-efficiency unit).

Figure 10 details Cadmus' methodology for assessing the program impact on the secondary refrigerator market and for applying the recommended midpoint assumptions when primary data were unavailable. As shown, accounting for market effects resulted in three savings scenarios:

- Full per-unit gross savings;
- No savings; and
- Partial savings (i.e., the difference in energy consumption between the program unit and the new, standard-efficiency appliance that was acquired instead).

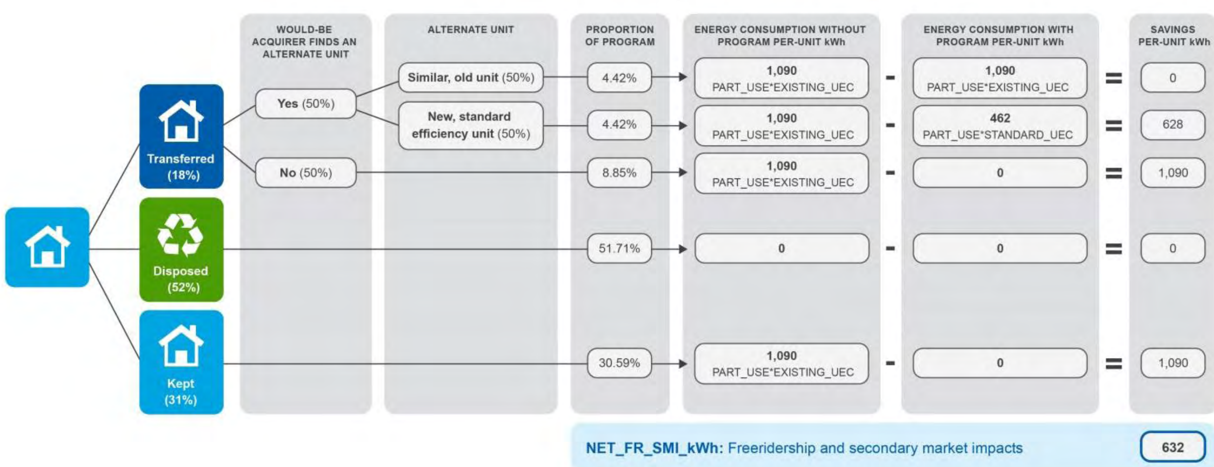
Figure 10. Secondary Market Impacts—Refrigerators



Integration of Freeridership and Secondary Market Impacts

After estimating the parameters of the freeridership and secondary market impacts, Cadmus used the UMP decision tree to calculate the average, per-unit program savings, net of their combined effect. Figure 11 shows how Cadmus integrated these values into an estimate of savings, net of freeridership and secondary market impacts. Again, Cadmus applied secondary market impacts to maintain consistency with the UMP: in previous Avista Washington appliance recycling evaluations, Cadmus did not account for this.

Figure 11. Savings Net of Freeridership and Secondary Market Impacts—Refrigerators



[15] http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator.

Induced Replacement

The UMP states that evaluators must account for the energy consumption of replacement units *only* when the program induced that replacement (i.e., when the participant would *not* have purchased the replacement refrigerator without the recycling program).

In the case of non-induced replacements, the energy consumption of the replacement appliance does not prove germane to the savings analysis, as the appliance would have been purchased or acquired regardless of the program. The acquisition of another appliance in conjunction with participation in the program does not necessarily indicate induced replacement. Again, this is consistent with the methods outlined in the UMP.

Cadmus used the results of the participant surveys to determine which replacement refrigerators and freezers program participants acquired due to the program. Survey results indicated that the program reduced the total number of used appliances operating within Avista's Washington service territory, and that the program raised the average efficiency of the active appliance stock.

Cadmus then used participant survey results to estimate the proportion of replacements induced by the customer's participation in the program. Specifically, Cadmus asked each participant that indicated they replaced the participating appliance: "*Would you have purchased the replacement appliance without the $30 incentive you received for recycling the old one*?"

As a $30 incentive will likely not provide sufficient motivation for most participants to purchase an otherwise unplanned for replacement unit (which can cost $500 to $2,000), Cadmus asked a follow-up question of participants who responded "*No*." Intended to confirm the participant's assertion that only the program caused them to replace their appliance, the question was: "*Just to confirm: you would not have replaced your old refrigerator/freezer without the Avista incentive for recycling, is that correct*?"

To further increase the reliability of these self-reported actions, we also considered whether the refrigerator was the primary unit in the induced replacement analysis and the participant's stated intentions in the program's absence.

For example, if a participant would have discarded their primary refrigerator independent of the program, the replacement could not be program induced (since it is extremely unlikely a participant would live without a primary refrigerator). However, for all other usage types and stated intention combinations, induced replacement was a viable response.

As expected, results indicated the program only induced a portion of the total replacements: the program induced 7% of all refrigerator participants and 11% of freezer participants to acquire a replacement unit, as shown in Table 29.

Table 29. 2011-2012 Induced Replacement Rates

Appliance	Induced Replacement Rates
Refrigerator	7%
Freezer	11%

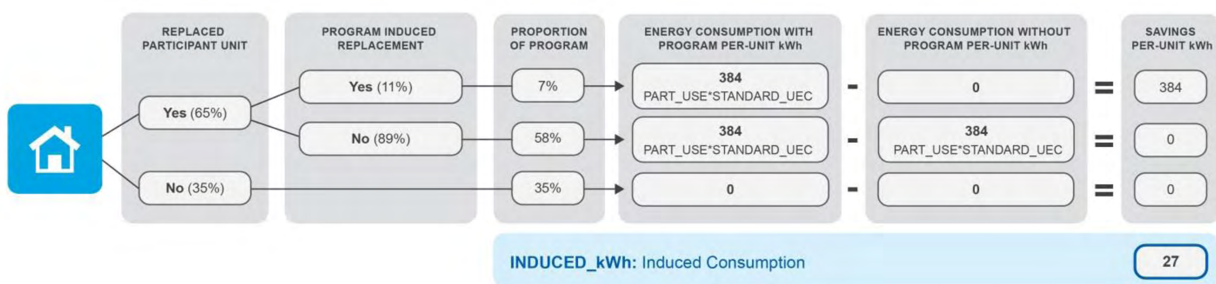
As shown in Table 30, Avista's induced replacement was higher than both the comparison utilities and higher than Avista's previous evaluations, and was most similar to Rocky Mountain Power's 2011-2012 results in Idaho.

Table 30. Benchmarking: Induced Replacement

Utility	Years Implemented	Induced Replacement Refrigerators	Induced Replacement Freezers
Avista (WA, PY 2012 and PY 2013)	**8**	**7%**	**11%**
Avista (ID, PY 2012)	7	0%	0%
Avista (WA & ID, PY 2010 and PY 2011)	6	4%	4%
Rocky Mountain Power (UT, 2011-2012)	10	3%	4%
Rocky Mountain Power (ID, 2011-2012)	8	7%	7%
Pacific Power (WA, 2011-2012)	8	4%	5%
Rocky Mountain Power (WY, 2011-2012)	4	2%	5%

Figure 12 shows Cadmus calculated induced replacement within the decision tree.

Figure 12. Induced Replacement Refrigerators



Final NTG

As summarized in Table 31, Cadmus determined final net savings as gross savings and spillover savings less freeridership, secondary market impacts, and induced replacement.

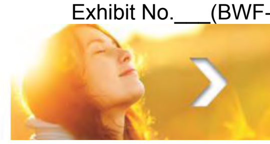


Table 31. PY 2012 and PY 2013 NTG Ratios

Appliance	Gross Per-Unit Savings (kWh)	Freeridership and Secondary Market Impacts (kWh)	Induced Replacement (kWh)	Induced Additional Savings (Spillover) (kWh)	Net Per-Unit Savings (kWh)	NTG
Refrigerator	1,090	632	27	12	443	41%
Freezer	902	366	55	12	493	55%

As noted, the application of the UMP protocol introduced two parameters related to net savings—secondary market impacts and induced replacements—that were not included in the previous evaluation. The application of these factors, through adherence with the UMP, contributed to a decreased program NTG for refrigerators compared to previous years. The NTG for freezers, however, increased relative to PY 2010 and PY 2011.

Summary of Impact Findings

Using the above per-unit values, Cadmus calculated the total program savings for the PY 2012 and PY 2013 Second Refrigerator and Freezer Recycling Program in Washington as 983,369 kWh, after adjustments (as shown in Table 32).

Table 32. Washington PY 2012 and PY 2013 Second Refrigerator and Freezer Recycling Program Savings

Measure	Evaluated Participation	Evaluated Gross Savings (kWh)	Evaluated Net Savings (kWh)	Precision at 90% Confidence
Refrigerator Recycling	1,615	1,760,081	715,176	23%
Freezer Recycling	544	490,689	268,193	38%
Total	**2,159**	**2,250,770**	**983,369**	**20%**

As shown in Table 33, Avista's NTG for refrigerators is less than most other benchmarked programs. This NTG result was driven downward from the previous evaluation, primarily due to the ratio of appliances that would have been discarded absent the program, as well as to the mature nature of the program relative to other programs. The NTG for freezers, however, is similar to the other programs benchmarked.

Table 33 Benchmarking NTG Ratio's

Utility	Years Implemented	NTG Ratio	
		Refrigerator	Freezer
Avista (WA, PY 2012 and PY 2013)	**8**	**41%**	**55%**
Avista (ID, PY 2012)	7	46%	33%
Avista(WA & ID, PY 2010 and PY 2011)	6	57%	56%
Rocky Mountain Power (UT, 2011-2012)	10	56%	56%
Rocky Mountain Power (ID, 2011-2012)	8	54%	48%
Pacific Power (WA, 2011-2012)	8	51%	51%
Ontario Power Authority (2012)	6	47%	48%
Ontario Power Authority (2011)	5	53%	53%
Rocky Mountain Power (WY, 2011-2012)	4	39%	51%
Pacific Power (CA, 2009-2010)	3	64%	67%

1.3.4. ENERGY STAR Products

Program Description

The ENERGY STAR Products Program includes the following measures:

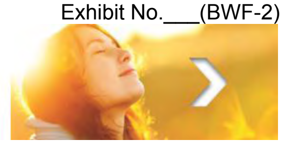
- Clothes Washer (Electric and Gas)
- Dishwasher (with Electric or Gas Water Heater)
- Freezer (Electric)
- Refrigerator (Electric)

Through the program, Avista offers direct financial incentives to motivate customers to use more energy-efficient appliances; this indirectly encourages market transformation by increasing the demand for ENERGY STAR products. The program includes electric and gas measures, but Cadmus only considers electric savings in this report.

Analysis

Energy savings credited to the ENERGY STAR Products Program had to meet the following criteria:

- Measures had to remain in place and be operating properly at the time of verification;
- Numbers of installed equipment pieces and their corresponding model numbers in the applications had to match the database; and
- Units must have been ENERGY STAR-qualified at the time of the program offering.



Clothes Washers, Dishwashers, Refrigerators, and Freezers

Cadmus evaluated the energy savings for clothes washers based on the RTF analysis that was applicable during the evaluation period.[16],[17],[18],[19]

Results and Findings

Table 34 shows total reported and qualified counts, savings, and realization rates for electric ENERGY STAR Products Program measures in Washington.

Table 34. ENERGY STAR Products Program Results

Program Name	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
Electric Clothes Washer With Electric Water Heater	1,359	662,101	56,630	100%	100%	56,630	9%
Electric Freezer	170	7,863	6,805	100%	100%	6,805	87%
Electric Refrigerator	2,065	129,338	89,910	100%	100%	89,910	70%
Electric Dishwasher With Electric Water Heater	311	19,280	2,743	100%	100%	2,743	14%
Program Total	**3,905**	**818,582**	**156,087**	**100%**	**100%**	**156,087**	**19%**

The program achieved a 19% realized adjusted gross savings rate; this low realization rate is due to savings being adjusted to match the RTF-approved savings.

1.3.5. Heating and Cooling Efficiency

Program Description

The electric Heating and Cooling Efficiency Program included the following equipment:

- Ductless Heat Pumps (DHP)
- Air-Source Heat Pumps (ASHP

[16] http://rtf.nwcouncil.org/measures/measure.asp?id=118#

[17] http://rtf.nwcouncil.org/measures/measure.asp?id=119

[18] http://rtf.nwcouncil.org/measures/measure.asp?id=122

[19] http://rtf.nwcouncil.org/measures/measure.asp?id=120

- Variable Speed Furnace Fans
- Air Conditioner Replacements

Analysis

The PY 2010 and PY 2011 electric impact evaluation report[20] documented analysis Cadmus performed to determine the change in energy consumption resulting from the installation of electric heating and cooling measures. As that analysis continues to provide the best information on these measures, Cadmus retained those results for PY 2012.

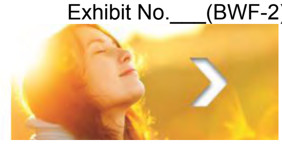
Results and Findings

Table 35 shows total tracked and qualified counts, savings, and realization rates for electric Heating and Cooling Efficiency Program measures in Washington. The program achieved a 98% realized adjusted gross savings rate.

Table 35. Heating and Cooling Efficiency Program Results*

Program Name	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
Electric ASHP	392	140,402	131,916	100%	100%	131,916	94%
Electric Ductless Heat Pump	33	11,048	6,093	100%	100%	6,093	55%
Electric Variable Speed Motor	1,554	681,820	681,507	100%	100%	681,507	100%
Program Total	**1,979**	**833,270**	**819,515**	**100%**	**100%**	**819,515**	**98%**
*Table values may not sum due to rounding							

[20] Cadmus. *Avista 2010–2011 Multi-Sector Electric Impact Evaluation Report.* May 2012.



1.3.6. Space and Water Heat Conversions

Program Description

Through the Space and Water Conversions Program, Avista incents three measures for residential electric customers who currently use electricity to heat their homes and water, but have the opportunity to use natural gas or switch to an alternative more efficient technology that uses the same fuel source. The equipment conversions during PY 2010 through PY 2013 included the following measures:

- Electric Forced Air Furnace to Air Source Heat Pumps (ASHP)
- Electric Forced Air Furnace to Natural Gas Forced Air Furnace (NGF)
- Electric Water Heater to Natural Gas Water Heater (NGWH)

By offering conversion rebates, Avista seeks to achieve energy efficiency by changing the fuel mix used by customers in order to achieve savings from lower-priced fuel (in case of a conversion from an electric to a NGF and electric to a NGWH) and to achieve higher efficiency in overall cooling and heating usage.

With the residential energy-efficiency programs, Avista targets single-family homes and units in multifamily buildings. Avista customers started participating in the conversion rebates in PY 2010. Table 36 shows participation by conversion measure and year, in both Idaho and Washington. Avista phased out conversion rebates in Idaho in PY 2013 for conversion from an electric to a NGWH.

Table 37 shows the number of participant that installed any of the conversion measures, grouped by year of installation.

Table 36. Participation in Fuel Conversion Program by Year and State

Conversion Measure	Application Year	Participants in Idaho	Participants in Washington	Total Participants by Year	Total Participants*
ASHP	2010	123	129	252	624
	2011	61	74	135	
	2012	60	64	124	
	2013	48	65	113	
NGF	2010	51	82	133	429
	2011	27	65	92	
	2012	24	74	98	
	2013	28	78	106	
NGWH	2010	22	95	117	362
	2011	16	79	95	
	2012	15	75	90	
	2013	5	55	60	

* This column includes participants who installed multiple measures.

Table 37. Number of Homes that Participated from PY 2010 through PY 2013

	Air-Source Heat Pump	Natural Gas Furnace	Natural Gas Water Heater	Multiple Conversion Measures*	All Homes
Total Participants	623	375	309	54	1,361

* This primarily consists of all customers who installed a NGF and NGWH.

Impact Evaluation Methodology

With the impact evaluation, Cadmus sought to estimate the change in energy use after installing these conversion measures. More specifically, Cadmus' evaluation of the Space and Water Conversions Program consisted of the following three tasks:

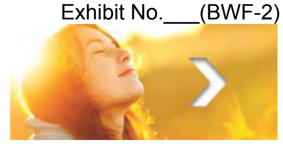
1. Data collection, review, and preparation.
2. Billing analysis.
3. Energy-savings estimations.

Data Collection, Review, and Preparation

To perform the billing and uplift analysis, Cadmus collected the following data.

Monthly Customer Bills

Cadmus collected data about monthly gas and electricity bills between January 2010 and December 2013. The data included approximately 10 to 12 months of bills prior to the measures installations and the same number of months after the installations. These billing data included: account numbers, energy use during the monthly billing cycle, and the last day of the billing cycle. Avista supplied these data to Cadmus.



Program Information

Cadmus obtained measures data from Avista. These data included the following fields: Program Tracking Data for the 2011-2013 participants, account numbers and site IDs for linking to billing data, all the measures installed, rebated amounts of therms and kWh saved, and application dates for the rebates.

Weather

Cadmus collected National Climatic Data Center daily average temperature data from 2010 through January 2014 for eight weather stations: two in Idaho (Lewiston and Coeur D'Alene) and six in Washington (Moses Lake Grant Co., Walla Walla, Spokane, Fairchild, Felts, and Pullman Moscow). These were the stations nearest to all the program homes in the Avista territory.

Data Preparation

Cadmus prepared billing data for analysis using the following steps:

- Reformatting and merging the raw billing data for all customers.
- Separating the gas and electricity datasets and identifying customers that had dual usage (electricity and gas) versus the customers that had only electricity.
- Renaming the market measure description, such as the following the same conversion measure naming convention for all program years.
- Identifying homes that had multiple conversions and assigning them to a separate group.
- Specifying the pre- and post-periods for each customer account:
    - ***The Customer Specific Measure Install Date:*** For each customer's unique installation date, this specification compares the year ending just before the install date with the year beginning on the installation month.
    - ***The Full Year:*** In this specification, the install year is taken as the current year and the energy consumption of the full year before the current year is compared to the full year after the current year.

Table 38 shows an example of the specification of the pre- and post-installation periods under the two specifications. In this analysis, Cadmus has used a combination of the two specifications. While the first specification allows the data from a more compressed timeframe to be used, it relies heavily on the exact installation date. The Full Year specification excludes this uncertainty by assuming that the conversion installations occurred any time during the rebate application year. The Full Year specification requires at least three years of data. In cases where this requirement was not met, Cadmus used the first specification.

Table 38. Example of Pre- and Post-Installation Period Under the Two Specifications

Specification of Pre and Post Period	Installation Date	Pre-Analysis Period	Post-Analysis Period
Customer Specific Measure Install Date	June 2010	June 2009 to May 2010	June 2010 to April 2011
Full Year		January 2009 to December 2009	January 2011 to December 2011

Cadmus used daily average temperature and billing cycle information to estimate cooling degree days (CDDs) and heating degree days (HDDs) for each home during the billing cycle. This required using a base temperature of 65 degrees and billing cycle end dates to calculate HDDs and CDDs that exactly matched days in the customer's bill.

Based on the conversion group (electric to NGF only, electric to NGWH only, both electric to NGF and electric to NGWH, and ASHP) and the fuel usage type (electric only and dual fuel: electric and gas), Cadmus estimated six separate models. We discuss the selected sample sizes of these six groups in the next section.

Data Attrition

Cadmus performed billing analysis on the population of program homes, except for homes from the estimation sample that satisfied one or more of the following criteria:

- The home had fewer than 11 pre- or post-program monthly energy bills.
- The home did not pass PRISM modeling screens, which are based on the weather normalized pre- and post-installation annual usage. These are discussed in more detail in the Billing Analysis section.

Table 39 shows the total customer accounts that had a conversion measure and the final sample Cadmus used in the PRISM and the regression analyses. Each row in the table indicates the accounts remaining after attrition.

Table 39. Sample Size Selection for PRISM Analysis

Accounts Remaining After Attrition	Air-Source Heat Pump			Natural Gas Furnace	Natural Gas Water Heater	Multiple Conversion Measures	All Conversion Homes
	Electric Only	Dual	All	Dual	Dual	Dual	
Total accounts with fuel conversion measures	561	62	623	375	309	54	1,361
Low usage (less than 1,000 kWh) in pre- or post-installation period	550	62	612	346	301	50	1,309
Total accounts with sufficient billing data for PRISM analysis	372	47	419	193	203	25	840
PRISM screens*	363	46	409	192	199	25	825
Accounts deleted due to vacancies, seasonal usage, outliers and inoperable heating systems	288*	33	321	164	159	23	667
Percentage of accounts retained for analysis**	**51%**	**53%**	**52%**	**44%**	**51%**	**43%**	**49%**

* These PRISM screens led to Cadmus dropping accounts with: 1) negative heating or cooling slopes in the pre- or the post-installation period and 2) usage that increased by more than 83% between the pre- and post-installation period.

** The numbers in bold are the final sample size used for the per home savings estimation.

Billing Analysis

To estimate program electricity savings, Cadmus used two approaches: PRISM and fixed-effects regression. Cadmus first estimated the PRISM model to obtain weather-normalized annual consumption (NAC) and identify outliers. Cadmus then estimated a regression model to control for the installation of other weatherization measures or efficient equipment. Details on the model specifications can be found in Appendix A.

Program Impact Evaluation Findings

Per Home Savings Impacts (PRISM)

Table 40 summarizes the PRISM results for conversion measures across the six groups. The results show the annual savings, relative precision on these savings, the pre-NAC for each group, and the savings as a percentage of the pre-NAC. Table 40 also reports savings as a percentage of the pre-conversion period heating load.

CADMUS

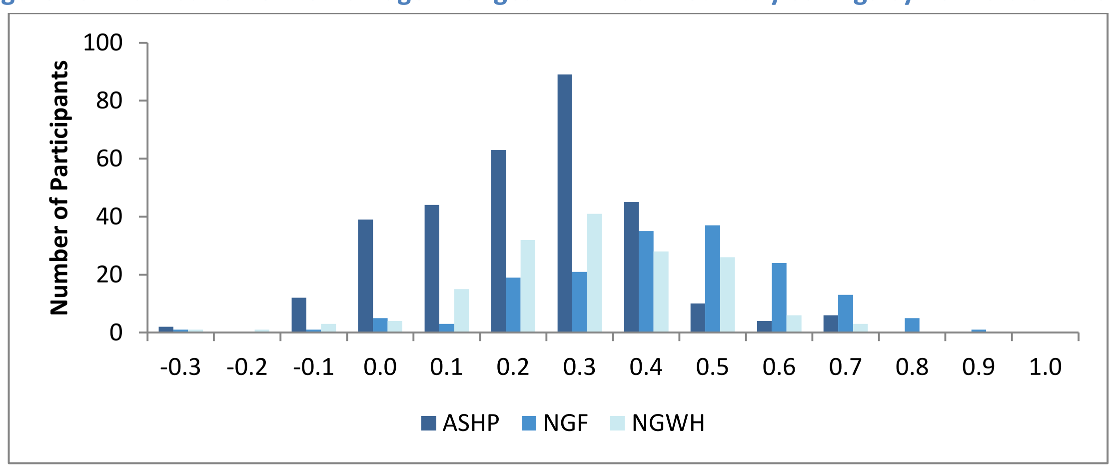
Table 40. Electric Savings per Home (PRISM Results)

Conversion Measure	Home Type	Number of Homes	Annual Savings (kWh)	Relative Precision on the Savings	Pre-Normalized Annual Consumption (kWh)	Savings as Percent of Pre-NAC	Pre-Heating Usage	Savings as Percent of Pre-Heating Usage
NGF	Dual	164	9,563	8%	24,349	39%	13,433	71%
NGWH	Dual	159	4,367	13%	16,305	27%	4,506	97%
Multiple	Dual	23	12,350	19%	25,646	48%	13,558	91%
ASHP	Electric Only	288	4,419	10%	24,955	18%	15,181	29%
	Dual	33	4,994	38%	24,566	20%	12,944	39%
	All Homes	321	4,478	10%	24,915	18%	14,951	30%

The evaluated savings for electric to NGF conversion resulted in annual savings of 9,500 kWh per home (39% of pre-conversion usage and 71% of pre-conversion heating usage) with a relative precision of ±8%. For electric to NGWH conversions, the annual savings are 4,300 kWh per home (27% of pre-conversion usage and 97% of pre-conversion heating usage) with a relative precision of ±13%. The homes with both furnace and water heater conversions had on average 12,300 kWh of savings (48% of pre-conversion usage and 91% of pre-conversion heating usage) with a relative precision of ±19%.

The following figures are based on PRISM model results. Figure 13 shows the distribution of percentage changes in the predicted electricity use between the pre- and post-conversion periods.

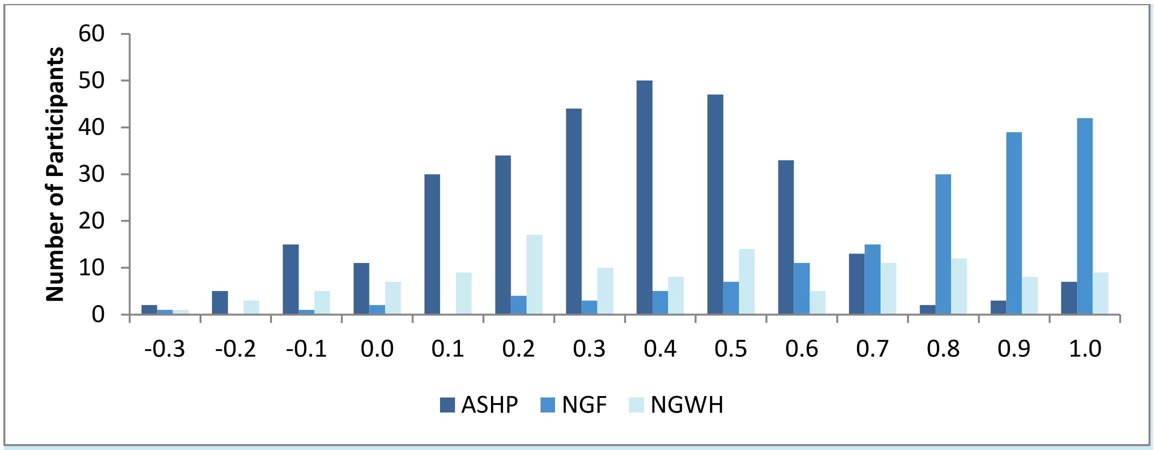
Figure 13. Distribution of Percentage Changes in Annual Electricity Savings by Conversion Group



These results show an approximate normal distribution centered around 30% reduction in electric use for ASHP conversions, 50% reduction for NGF conversions, and 35% for NGWH conversions.

Figure 14 shows the distribution of percentage changes in the predicted electricity use for heating between the pre- and post-conversion periods. The percentage changes are based on the pre-period heating load.

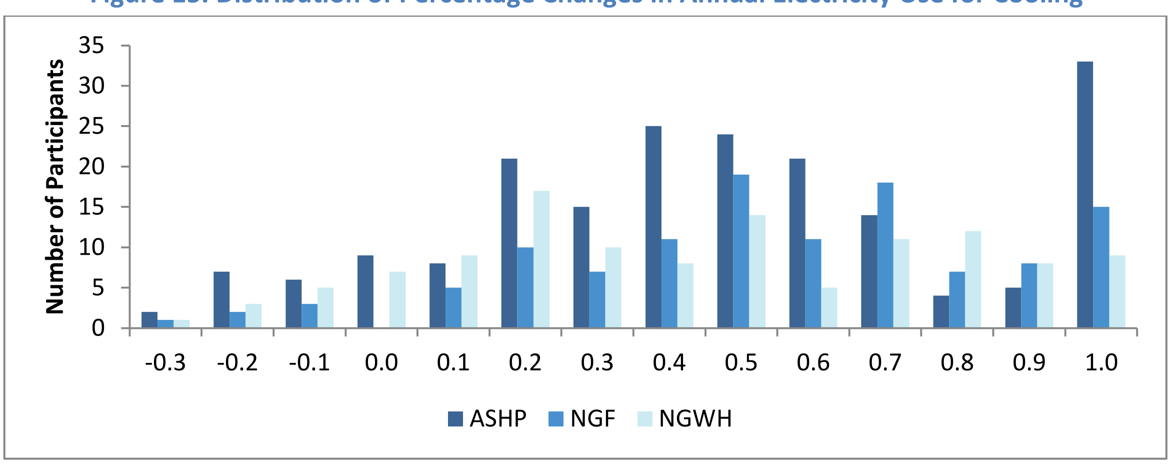
Figure 14. Distribution of Percentage Changes in Annual Electricity Use for Heating



The figure shows a more than 80% drop in the heating load for approximately 70% of electric to NGF conversion homes. For the electric to NGWH conversion homes, there is varying amounts of heat load savings across all homes. Almost 50% of savings were achieved for most ASHP conversion homes.

Figure 15 shows the distribution of percentage changes in the predicted electricity use for cooling between the pre- and post-conversion periods. The percentage changes are based on the pre-period cooling load.

Figure 15. Distribution of Percentage Changes in Annual Electricity Use for Cooling



The figure shows that customers achieved cooling efficiency, especially with ASHP conversions, followed by NGF conversions, then NGWH conversions.

Per Home Savings Impacts (Pooled Regression Model)

Cadmus ran several specification of the panel regression model. We found that the overall savings results were fairly consistent across the PRISM and pooled regression model. In the final model, Cadmus controlled for all other measures installed by the conversion participants (except for high-efficiency variable speed motors). The results for this model are shown in Table 41. Cadmus used the coefficient estimates and standard errors from this table to calculate the savings and its relative precision.

Table 41. Electric Savings per Home (Fixed-Effects Model)

Conversion Measure	Home Type	Number of Homes	Savings (kwh)	Relative Precision on the Savings	Pre-Normalized Annual Consumption (kWh)	Savings as Percent of Pre-Period Consumption
NGF	Dual	164	10,287	9%	24,349	42%
NGWH	Dual	159	4,370	16%	16,305	27%
Multiple	Dual	23	13,643	26%	25,646	53%
ASHP	Electric Only	288	4,775	11%	24,955	19%
	Dual	33	5,309	30%	24,566	22%
	All	321	4,826	10%	24,915	19%

The results reveal that there are higher savings for each conversion group after controlling for the installation of other measures.

Table 42 provides the percentage of conversion participants in each group who had other measures installed. The regression savings analysis controls for all other measure except high-efficiency motor rebates

Table 42. Percentage of Additional Measures Installed by the Conversion Participants

Conversion Measure	Percentage of Homes With Other Measures	Percentage of Homes With High Efficiency ASHP Rebates	Percentage of Homes with Variable Speed Motor Rebates
NGF	27%	9%	45%
NGWH	26%	6%	33%
ASHP	27%	20%	52%

Results and Findings

Table 43 shows the total tracked and qualified counts, savings, and realization rates for electric Space and Water Conversion Program measures in Washington.

Table 43. Space and Water Conversion Measures and Reported and Adjusted Savings

Program Name	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
E Electric to NGF	153	1,818,068	1,463,139	100%	100%	1,463,139	80%
E Electric to NGWH	130	512,143	567,710	100%	100%	567,710	111%
E Electric to ASHP	129	840,551	570,051	100%	100%	570,051	68%
Program Total	**412**	**3,170,761**	**2,600,900**	**100%**	**100%**	**2,600,900**	**82%**

The program achieved an 82% realized adjusted gross savings rate, which is reduced slightly from the previous evaluation due to qualifications and billing analysis findings.

1.3.7. Residential Weatherization

Program Description

Avista offered the Residential Weatherization Program, for which it incented four measures available to residential electric and gas customers who heat their homes with fuel provided by Avista:

- Fireplace Dampers
- Insulation—Ceiling/Attic
- Insulation—Floor
- Insulation—Wall

Avista customers primarily heating with electric or natural gas and having a wood burning fireplace could receive up to $100 for installing a rooftop damper. This measure was removed for the 2012 program year. The two participants are a legacy from the previous program year.

Qualifying ceiling and attic insulation (both fitted/batt and blown-in), which increased the R-value by 10 or more, were incented at $0.15 per square foot of new insulation. Homes qualified if they had attic insulation of R-19 or less.

Floor and wall insulation (both fitted/batt and blown-in), which increased the R-value by 10 or more, were incented at $0.20 per square foot of new insulation. Homes were eligible if they had existing floor and/or wall insulation of R-5 or less.

Analysis

Cadmus conducted a statistical billing analysis to determine adjusted gross savings and realization rates for installed electric weatherization in PY 2011, PY 2012, and PY 2013. The previous billing analysis primarily included PY 2010 customers, although we extrapolated the realization rates to PY 2011. We included PY 2011 customers in the billing analysis since they now have complete post-period billing data. This increased the sample sizes and improved the precision of the weatherization savings estimates. Results only including PY 2012 and PY 2013 are also presented. To increase the accuracy of our analysis, we only included participants with at least 10 months of pre- and post-installation billing data. Consequently, the billing analysis includes PY 2011, PY 2012, and early PY 2013 participants.

To estimate weatherization energy savings resulting from the Washington program, Cadmus used a pre- and post-installation combined CSA and PRISM approach. We calculated overall electric model savings estimates for each measure bundle. We also attempted to estimate the detailed measure-specific savings impacts.

Billing Analysis Methodology

Avista provided Cadmus with monthly electric billing data for all Washington participants, from January 2009 through January 2014. Avista also provided a measure detail file containing participation and measure data. Participant information included:

- Customer details;
- Account numbers;
- Types of measures installed;
- Rebate amounts;
- Measure installation costs;
- Measure installation dates; and
- Deemed savings per measure.

Cadmus first matched weatherization measure information with the electricity billing data. We obtained Washington daily average temperature weather data from January 2009 through January 2014 for nine National Oceanic and Atmospheric Administration (NOAA) weather stations, representing all ZIP codes in Avista's Washington service territory. From daily temperatures, we determined base 65 HDDs and CDDs for each station. Using ZIP code mapping for all U.S. weather stations, we determined the nearest station for each ZIP code. We then matched billing data periods with the HDDs and CDDs from the associated stations.

Cadmus specified the pre- and post-installation periods for each customer account using two specifications:

1. ***The Customer Specific Measure Install Date:*** For each customer's unique installation date, this specification compares the year ending just before the install date with the year beginning on the installation month.
2. ***The Fixed Dates:*** For this specification, the earliest and latest dates of available billing data are selected. In effect, we used the period of January 2010 through December 2010 as the pre-installation period, before any installations occurred. We defined the post-installation period as the latest period with complete billing data: February 2013 through January 2014.

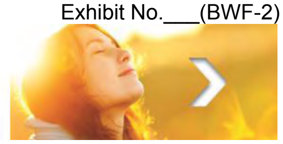


Table 44 shows an example of the specification of the pre- and post-installation periods under the two specifications. In this analysis, Cadmus used a combination of the two pre-post specifications. While the first specification allows for data from a more-compressed timeframe to be used, it relies heavily on the exact installation date. The Fixed Dates specification removes this uncertainty by keeping only the earliest and latest periods of data, which are well outside the installation period. The drawback with using Fixed Dates is that it requires a longer billing data history; however, Cadmus relied on this method by default. To minimize the attrition, we used the Customer Specific Measure Install Date specification when possible where there was insufficient billing data to use Fixed Dates.

Table 44. Example of Pre- and Post-Installation Period Under the Two Specifications

Specification of Pre- and Post-Installation Period	Installation Date	Pre-Analysis Period	Post-Analysis Period
Customer Specific Measure Install Date	November 2012	November 2011 - October 2012	November 2012 - October 2013
Fixed Dates		January 2010-December 2010	February 2013 - January 2014

Data Screening

General Screens

Cadmus removed accounts with fewer than 10 paired months (300 days) of billing data in the pre- or post-installation period, which could have skewed the weatherization savings estimates.

PRISM Modeling Screens

As a second step of the data screening process, Cadmus ran PRISM models for pre- and post-installation billing data. These models provided weather-normalized pre- and post-installation annual usage for each account, and provided an alternate check of the savings obtained from the CSA model. Details on the model specifications can be found in Appendix A.

After running the three models, we dropped any models with negative heating or cooling slopes. The best of the remaining models for each customer in either the pre- or post-installation period was the model with the highest R-square that still had positive heating and/or cooling slopes.

Next we applied the following screens to the PRISM model output, removing outlier participants from the billing analysis:

- ***Accounts where the post-installation weather-normalized (POSTNAC) usage was 70% higher or lower than the pre-installation weather-normalized (PRENAC) usage.*** Such large changes could indicate property vacancies or adding or removing other electric equipment that is unrelated to weatherization (such as pools or spas).
- ***Accounts with negative intercepts (base load).*** These negative intercepts indicate a negative base load, for example lighting, refrigerators, plug loads, etc. In electric homes, the base load is never expected to be negative.

- ***Accounts where the pre- and post-installation billing data had anomalies including: vacancies, seasonal usage, outliers, and equipment changes.***

The Washington weatherization population included 356 participants. Once we placed these screens on the data, 159 Washington weatherization participants (45%) remained for use in the CSA model, outlined below, for determining overall savings.

Table 45 summarizes the attrition from each step listed above. Each row in the table indicates the accounts remaining after attrition. We dropped approximately 36% of the participant accounts because they did not have sufficient pre- and post-installation billing data. We dropped another 20% based on PRISM screenings and the presence of vacancies, seasonal usage, outliers, or equipment changes in the billing data.

Table 45. Weatherization Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Total Washington weatherization accounts	356	100%	0	0%
Matched to billing data provided	353	99%	3	1%
Less than 10 months of pre- or post- billing data	230	65%	123	35%
PRISM screening*	212	60%	18	5%
vacancies, seasonal usage, equipment changes	159	45%	53	15%
Final analysis group	**159**	**45%**	**197**	**55%**

* Using PRISM screens, Cadmus dropped accounts with: 1) negative heating slopes in the pre- or the post-period or 2) post-period usage that changed by more than 70% from pre-period usage.

CSA Modeling Approach

To estimate weatherization energy savings from this program, we used a pre/post CSA, fixed-effects modeling method, using pooled monthly time-series (panel) billing data. This fixed-effects modeling approach corrected for differences between pre- and post-installation weather conditions, as well as for differences in usage consumption between participants through the inclusion of a separate intercept for each participant. This modeling approach ensured model savings estimates would not be skewed by unusually high-usage or low-usage participants. Details on the model specifications can be found in Appendix A.

Program Impact Evaluation Findings

Overall Savings Impacts (Fixed Effects)

Table 46 summarizes the usage and savings associated with the weatherization measures installed in electrically heated homes.[21] The results show the annual savings, relative precision on these savings, the pre-installation heating usage NAC for each level, and the savings as a percentage of the pre-heating usage NAC. The table also shows *ex ante* savings estimates and the achieved realization rates for the weatherization measures.

Table 46. Washington Weatherization Electric Savings per Home (Fixed-Effects Model)

Program Years	Number of Homes	Model Savings (kWh)	Relative Precision on the Savings	Pre-Normalized Annual Consumption (kWh)	Pre-Normalized Heating Annual Consumption (kWh)	Savings as Percent of Pre-Period Heating Consumption
2011-2013	159	2,444	19%	19,628	11,239	12.5%
2012-2013	39	3,170	24%	23,007	14,088	13.8%
2011	120	2,187	26%	18,529	10,314	11.8%

Table 47 shows the realization rates for the three analysis groups.

Table 47. Washington Weatherization Electric Savings Realization Rates (Fixed-Effects Model)

Program Years	Model Savings (kWh)	Relative Precision on the Savings	Annual *Ex Ante* Savings (kWh)	Realization Rate
2011-2013	2,444	19%	2,540	96%
2012-2013	3,170	24%	2,083	152%
2011	2,187	26%	2,689	81%

Overall, the PY 2011-PY 2013 weatherization measures achieved savings of 2,444 kWh, or 12.5% relative to the pre-installation period heating NAC. With an average weatherization measure *ex ante* savings estimate of 2,540 kWh, the weatherization measures realized 96% of the expected savings.

If the billing analysis is limited to only PY 2012 and PY 2013 participants, the sample sizes drop considerably; however, the *ex ante* estimates reflect a downward adjustment based on the previous billing analysis. Also, there was a program change in PY 2012 and PY 2013, in which only homes with

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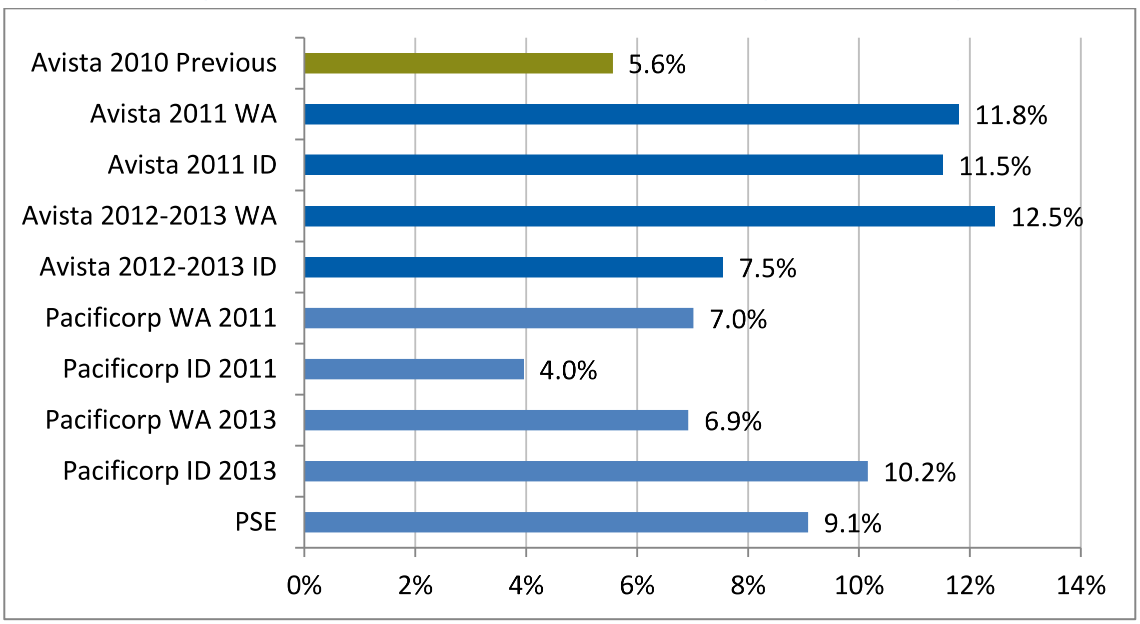
[21] Cadmus also estimated measure-level models for PY 2012 and PY 2013 that contain the most recent *ex ante* estimates. For Washington, these revealed that the attic insulation model savings were generally higher than the current *ex ante* values. The wall insulation model savings were similar to the *ex ante* savings, and the floor insulation model savings were lower than the *ex ante* savings.

very low initial R-value insulation levels qualified for the program. The PY 2012 and PY 2013 weatherization participants achieved savings of 3,170 kWh, or 13.8% savings relative to the pre-installation period heating NAC. With an average weatherization measure *ex ante* savings estimate of 2,083 kWh, the weatherization measures realized 152% of the expected savings.

Cadmus also estimated the savings for only PY 2011 participants. PY 2011 represents the predominant sample of the billing analysis; however, the *ex ante* estimates are considerably higher than in other years. The PY 2011 weatherization participants achieved savings of 2,187 kWh, or 11.8% relative to the pre-installation period heating NAC. With an average weatherization measure *ex ante* savings estimate of 2,689 kWh, the weatherization measures realized 81% of the expected savings.[22]

Figure 22 shows a comparison of the weatherization percentage savings to similar electric weatherization evaluations. Avista's PY 2011 PY 2012 and PY 2013 percent savings have improved significantly since the PY 2010 program year. The Washington weatherization percentage of savings also compare favorably with the Idaho savings.

Figure 16. Electric Weatherization Percent Savings Benchmarking



Cadmus did not include fireplace dampers in the billing analysis, but retaining the deemed savings value that Cadmus developed for the PY 2012 Avista Technical Reference Manual (TRM).

[22] The weatherization savings estimate from the previous PY 2010 and PY 2011 report was 953 kWh and the combined Washington and Idaho realization rate was 35%. For the evaluation outlined in the previous report, Cadmus relied primarily on PY 2010 participants. PY 2011 savings and realization rate are higher than the PY 2010 estimates.

Table 48 shows the total reported and qualified counts, savings, and realization rates of electric weatherization program measures.

Table 48. Weatherization Program Results

Program Name	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
E Attic Insulation with Electric Heat	102	60,310	91,671	100%	100%	91,671	152%
E Floor Insulation with Electric Heat	27	39,048	59,353	100%	100%	59,353	152%
E Wall Insulation with Electric Heat	52	83,131	126,360	100%	100%	126,360	152%
E Fireplace Damper With Electric Heat	2	326	326	100%	100%	326	100%
Program Total	**183**	**182,816**	**277,710**	**100%**	**100%**	**277,710**	**152%**

1.3.8. Water Heater Efficiency

Program Description

The Water Heater Efficiency Program represented one measure: electric high-efficiency water heaters.

Through this program, Avista offered a $50 incentive to residential electric customers who installed an eligible high-efficiency water heater. Electric water heaters with a tank had to have a 0.93 EF or greater to qualify for the program.

Analysis

The PY 2010-PY 2011 electric impact evaluation report[23] documented the analysis Cadmus performed to determine the change in energy consumption resulting from installation of this measure. As that analysis continued to provide the best information on this measure, we used those results for PY 2012.

Results and Findings

Table 49 shows the total tracked and qualified counts, savings, and realization rate.

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[23] Cadmus. *Avista 2010–2011 Multi-Sector Electric Impact Evaluation Report*. May 2012.

Table 49. Water Heater Efficiency Measure and Reported and Adjusted Savings

Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
314	37,311	37,397	100%	100%	37,397	100%

1.3.9. ENERGY STAR Homes

Program Description

Avista offered incentives through the ENERYG STAR Homes Program for builders constructing single-family or multifamily homes complying with ENERGY STAR criteria and certified as ENERGY STAR Homes. Avista provided a $900 incentive for homes using electric or electric and natural gas service from Avista for space and water heating.

Analysis

In the PY 2010-PY 2011 electric impact evaluation report, Cadmus documented the simulation modeling we performed to determine energy savings achieved by ENERGY STAR Homes. As the simulation results continued to provide accurate estimates of savings, we used those results for PY 2012-PY 2013.

Results and Findings

Table 50 shows total tracked and adjusted counts, savings, and realization rates for measures offered through the ENERGY STAR Homes Program. Avista funded both electric and gas measures for participating Avista homes.

Table 50. ENERGY STAR Home Program Results

Program Name	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
Home-Electric Only	19	62,603	47,690	100%	100%	47,690	76%
Home-Electric/Gas	11	11,608	11,594	100%	100%	11,594	100%
Program Total	**30**	**74,211**	**59,284**	**100%**	**100%**	**59,284**	**80%**

1.3.10. Manufactured Home Duct Sealing

Program Description

Through the Manufactured Home Duct Sealing Program, contractors performed one of three levels of duct inspection and sealing on manufactured homes in Washington. In addition to the duct sealing, the inspectors also installed CFLs and low-flow showerheads. Avista offered the program from October 2012 through June 2013.

Level 1 - Ducts are sealed from the interior (boots, registers, end caps). Cross-over duct is inspected and if no air leaks are found, no exterior treatment of the cross-over duct is conducted.

Level 2 - Ducts are sealed from the interior (boots, registers, end caps). Plenum is sealed. Cross-over duct is inspected and if determined to still be in good condition, but air leaks are identified at the cross-over duct connections to the collars, the collar connections to the main duct runs, or in the cross-over duct. The identified and repairable air leaks are sealed with mastic and/or repairs are made to the cross-over duct as required.

Level 3 - Ducts are sealed from the interior (boots, registers, end caps). Cross-over duct is inspected and if found to be disconnected and in good condition, the cross-over duct is reconnected and all connections are sealed with mastic. If the cross-over duct is damaged and in need of replacement, a new R-8 cross-over duct is installed, and cross-over duct connections are sealed with mastic.

Based on the measure data received, the population included 2,216 manufactured homes in Washington. Three out of every four customers, or 1,636, used electricity to heat their homes, while the remaining 580 used gas to heat their homes.

The duct sealing ex ante estimates by duct sealing levels for the electrically heated homes are as follows:

- Level 1 – 1,550 kWh
- Level 2 – 1,950 kWh
- Level 3 – 2,350 kWh

In gas-heated homes, the duct sealing measures were expected to save 50, 65, and 80 therms, respectively for the three levels. Secondarily, CFLs were installed in 83% of the homes. The *ex ante* estimate was 23 kWh per CFL, and most homes received five CFLs. Showerheads were also installed in two out of every three homes. The showerheads were expected to save 310 kWh in homes with electric water heating, and 11 therms in homes with gas water heating.

Analysis

For our impact evaluation, Cadmus sought to estimate the change in energy use after duct sealing measures were installed, for each duct sealing levels in electrically heated homes. Secondarily, we used billing analysis to obtain the electric savings of all the lighting and the water heating measures.

More specifically, Cadmus' evaluation of the Manufactured Home Duct Sealing Program consisted of the following three tasks:

- Data collection, review, and preparation.
- Billing analysis.
- Energy-savings estimation.

Data Collection, Review, and Preparation

To perform the billing and uplift analysis, Cadmus collected the following data.

Monthly Customer Bills

Avista supplied Cadmus with monthly gas and electricity bills between January 2010 and February 2014. These billing data included: account numbers, read dates, and energy use during the monthly billing cycle.

Program Information

Cadmus obtained program measure data from Avista. The measure data included account numbers, measures installed, measure level *ex ante* savings, heating type, and dates of participation in the program.

Weather

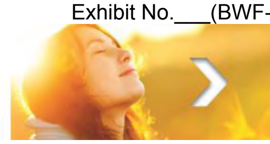
Cadmus collected daily temperature data from the National Climatic Data Center for January 2010 through February 2014 for nine weather stations associated with the ZIP codes for all the program homes in the Avista territory.

Data Preparation

To prepare the billing data for analysis, Cadmus conducted the following steps:

- Reformatting and merging the raw billing data in for all customers.
- Merging the information from the measure data with the billing data, and selecting the customers with electric heat that received duct sealing measures.
- Matching the account numbers in the measure database to the complete historical measure database to identify homes that received other measures outside the Manufactured Homes Duct Sealing Program.
- Specification of the pre- and post-installation periods for each customer account:
  - ***The Customer-Specific Measure Install Date:*** For each customer's unique installation date, this specification compares the year ending just before the install date with the year beginning on the installation month.
  - ***The Fixed Dates:*** For this method, we selected the earliest and latest dates of available billing data. In effect, we used January 2011 through December 2011 as the pre-period, before any installations occurred. We defined the post-installation period as the latest period of complete billing data: March 2013 through February 2014.

Table 51 shows an example of the pre- and post-installation periods under the two specifications. For this analysis, Cadmus used a combination of the two specifications. While the first specification allows data from a more compressed timeframe to be used, it relies heavily on the exact installation date. The Fixed Dates specification removes this uncertainty by keeping only the earliest and latest periods of data, which are well outside the installation period. The drawback with using Fixed Dates is that it requires a longer billing data history; however, Cadmus relied on this method by default. To minimize



the attrition, we used the Customer Specific Measure Install Date specification when possible where there was insufficient billing data to use Fixed Dates.

Table 51. Example of Pre- and Post- Period Under the Two Specifications

Specification of Pre- and Post-Period	Installation Date	Pre-Analysis Period	Post-Analysis Period
Customer Specific Measure Install Date	November 2012	November 2011 - October 2012	November 2012 - October 2013
Fixed Dates		January 2011 - December 2011	March 2013 - February 2014

Cadmus used daily average temperature and billing cycle information to estimate CDDs and HDDs for each home during each billing cycle. To calculate HDDs and CDDs exactly matching the energy use in the customer's bill, this required using a base temperature of 65 degrees and billing cycle start and end dates

Data Attrition

Cadmus performed the billing analysis on the population of program homes, with a few exceptions where we excluded homes from the estimation sample if they satisfied one or more of the following criteria:

- The home had fewer than 10 pre- or post-installation monthly energy bills
- The home did not pass one of the PRISM modelling screens, which are based on the weather normalized pre- and post- annual usage.

Table 52 outlines the total number of customer accounts that had a conversion measure, along with the final sample we used in the PRISM and regression analyses. Each row in the table indicates the accounts remaining after attrition. Roughly 27% of the accounts were dropped because they had gas heating or did not receive any duct sealing measures. Another 27% were dropped because they did not have sufficient pre- and post-installation billing data in the analysis. Another 9% were dropped based on PRISM screening, percent change screening, or the presence of vacancies, seasonal usage, outliers, and equipment changes in the billing data.

Table 52. Manufactured Homes Duct Sealing Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Total accounts with manufactured homes measures	2,216	100%	0	0%
Electrically heated customers who received duct sealing measures	1,621	73%	595	27%
Matched to billing data provided	1,582	71%	39	2%
Less than 10 months of pre- or post-installation billing data	1,033	47%	549	25%
PRISM screens*	1,020	46%	13	1%
Accounts deleted due to vacancies, seasonal usage, outliers, and equipment changes	832	38%	188	8%
Final Analysis Group	**832**	**38%**	**1,384**	**62%**

* Using PRISM screens, Cadmus dropped accounts with: 1) negative heating slopes in the pre- or the post-period or 2) post-period usage that changed by more than 70% from pre-period usage.

Billing Analysis

Based on the final group of 832 manufactured homes, Cadmus used two approaches to estimate the program electricity savings: PRISM and fixed-effects regression. Cadmus first estimated the PRISM model to obtain NAC and identify outliers. Then we estimated a regression model to control for the installation of other measures outside this program. Details on the model specifications can be found in Appendix A.

Energy-Savings Estimation

Overall Savings Impacts (Fixed Effects)

Table 53 summarizes the overall fixed-effects results for the three duct sealing levels across all measures installed in electrically heated homes. The results show the annual savings, relative precision of these savings, the pre-NAC for each group, and the savings as a percentage of the pre-NAC. The table also reports *ex ante* savings estimates and the achieved realization rates for the measures.

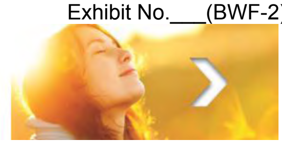


Table 53. Overall Electric Savings per Home (Fixed-Effects Model)

Duct Sealing Level	Number of Homes	Model Savings (kwh)	Relative Precision on the Savings	Pre-Normalized Annual Consumption (kWh)	Savings as Percent of Pre-Period Consumption	Annual *Ex Ante* Savings (kWh)	Realization Rate
Level 1	171	1,474	16%	19,532	7.5%	1,869	79%
Level 2	555	1,588	8%	19,928	8.0%	2,321	68%
Level 3	106	2,335	16%	21,045	11.1%	2,704	86%
Overall	**832**	**1,661**	**7%**	**19,989**	**8.3%**	**2,277**	**73%**

Duct Sealing Level 1 homes achieved savings of 1,474 kWh, or 7.5% relative to the pre-period NAC. With an average *ex ante* savings estimate of 1,869 kWh, these homes realized 79% of their expected savings.

Duct Sealing Level 2 homes achieved savings of 1,588 kWh, or 8.0% relative to the pre-period NAC. With an average *ex ante* savings estimate of 2,321 kWh, these homes realized 68% of their expected savings.

Duct Sealing Level 3 homes achieved savings of 2,335 kWh, or 11.1% relative to the pre-period NAC. With an average *ex ante* savings estimate of 2,704 kWh, these homes realized 86% of their expected savings.

Overall in the billing analysis sample, manufactured homes averaged achieved savings of 1,661 kWh, or 8.3% relative to the pre-period NAC. With an average *ex ante* savings estimate of 2,277 kWh, these homes realized 73% of their expected savings.

Duct Sealing Savings Impacts (Fixed Effects)

Table 54 summarizes savings specifically for the key duct sealing measures installed in electrically heated homes.[24] The results show the annual savings, relative precision of these savings, the pre-heating NAC for each level, and the savings as a percentage of the pre-heating NAC. The table also reports *ex ante* savings estimates and the achieved realization rates for the duct sealing measures.

[24] Cadmus determined the duct sealing savings by subtracting out the savings for CFLs and showerheads from the total *ex ante* and *ex post* savings. The resulting savings are for the duct sealing measures only.

Table 54. Duct Sealing Electric Savings per Home (Fixed-Effects Model)

Duct Sealing Level	Number of Homes	Model Savings (kwh)	Relative Precision on the Savings	Pre-Normalized Annual Heating Consumption (kWh)	Savings as Percent of Pre-Period Heating Consumption	Annual *Ex Ante* Savings (kWh)	Realization Rate
Level 1	171	1,155	16%	13,568	8.5%	1,550	75%
Level 2	555	1,218	8%	13,233	9.2%	1,950	62%
Level 3	106	1,980	16%	14,291	13.9%	2,350	84%
Overall	**832**	**1,303**	**7%**	**13,435**	**9.7%**	**1,919**	**68%**

The Duct Sealing Level 1 measure achieved savings of 1,155 kWh, or 8.5% relative to the pre-period heating NAC. With an average duct sealing measure ex ante savings estimate of 1,550 kWh, this measure realized 75% of the expected savings.

The Duct Sealing Level 2 measure achieved savings of 1,218 kWh, or 9.2% relative to the pre-period heating NAC. With an average duct sealing measure *ex ante* savings estimate of 1,950 kWh, this measure realized 62% of the expected savings.

The Duct Sealing Level 3 measure achieved savings of 1,980 kWh, or 13.9% relative to the pre-period heating NAC. With an average duct sealing measure *ex ante* savings estimate of 2,350 kWh, this measure realized 84% of the expected savings.

Overall, customers who received the duct sealing measures in the billing analysis sample achieved savings of 1,303 kWh, or 9.7% relative to the pre-period heating NAC. With an average duct sealing measure *ex ante* savings estimate of 1,919 kWh, this measure realized 68% of the expected savings.

Results and Findings

Table 55 shows total tracked and adjusted counts, savings, and realization rates for measures offered through the Manufactured Home Duct Sealing Program.

Table 55. Manufactured Home Duct Sealing Program Results

Measure	Reported Measure Count	Reported Savings (kWh)	Adjusted Savings (kWh)	Qualification Rate	Verification Rate	Adjusted Gross (kWh)	Realization Rate
Duct Sealing Level 1	401	621,550	463,155	100%	100%	463,155	75%
Duct Sealing Level 2	1,061	2,068,950	1,292,298	100%	100%	1,292,298	62%
Duct Sealing Level 3	194	455,900	384,120	100%	100%	384,120	84%
Direct Install CFL	9,184	211,232	211,232	100%	100%	211,232	100%
Direct Install Showerhead	1,500	465,000	465,000	100%	100%	465,000	100%
Program Total	**12,340**	**3,822,632**	**2,815,805**	**100%**	**100%**	**2,815,805**	**74%**

1.3.11. Geographic CFL Giveaway Events

Avista gives CFLs out to customers at events throughout the year. The number of bulbs distributed is tracked by Avista outside of their database and other CFL programs. Avista estimates the energy savings achieved by these bulbs at 15 kWh per bulb. This value is conservative compared to estimates currently in use by the RTF. Cadmus accepts the energy savings estimated by this effort at 15 kWh per bulb. No further evaluation activities were completed.

Table 56. Geographic CFL Giveaway Events, Evaluated Savings

Program	PY	Reported Measure Count	Evaluated Savings (kWh)
Residential Giveaways	2012	4,729	70,935
	2013	1,262	18,930
Home Energy Audits	2012	6,480	97,200
	2013	0	0
Low Income & Senior Citizen	2012	803	12,045
	2013	4,128	61,920
Program Total		**17,402**	**261,030**

1.4. Residential Conclusions

For PY 2012 and PY 2013, Avista's residential electric programs produced 23,167,742 kWh in savings, which yielded an overall realization rate of 91%. Table 57 shows reported and evaluated gross savings and realization rates per program.

Table 57. Total Program Reported and Evaluated Gross Savings and Realization Rates

Program	Reported Savings (kWh)	Adjusted Gross Savings (kWh)	Realization Rate
Simple Steps, Smart Savings™	16,095,035	16,059,081	100%
Second Refrigerator and Freezer Recycling	1,360,068	983,369	72%
ENERGY STAR® Products	818,582	156,087	19%
Heating and Cooling Efficiency	833,270	819,515	98%
Space and Water Conversions	3,170,761	2,600,900	82%
Weatherization/Shell	182,816	277,710	152%
Water Heater Efficiency	37,311	37,397	100%
ENERGY STAR® Homes	74,211	59,284	80%
Geographic CFL Giveaway	261,030	261,030	100%
Manufactured Home Duct Sealing	3,822,632	2,815,805	74%
Program Total	**26,607,743**	**23,888,639**	**90%**

1.5. Residential Recommendations

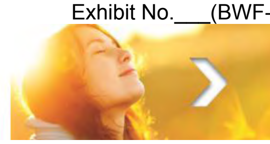
Cadmus recommends the following changes to Avista's residential electric programs:

- Avista should consider updating its per-unit assumptions of recycled equipment to reflect this evaluation in order to ensure that planning estimates of program savings are in line with evaluated savings.
- If clothes washer rebates are ever reinstated, Avista should track them all within the electric program unless there is a large penetration of gas dryers.
- Increase measure level detail capture on applications and include in the database. Specific additional information should include energy factors or model numbers for appliances, baseline information for insulation, and home square footage, particularly for the ENERGY STAR Homes program.
- Consider tiered incentives by SEER rating as higher SEER systems generally require ECM fan motors to achieve certain SEER ratings.

Future Research Areas

The following are recommended future research areas for this program. These research recommendations are based on the results of this impact evaluation and known future changes to program requirements.

- Avista should consider completing a lighting logger study within its territory if Avista believes the results of the forthcoming RBSA study do not accurately represent usage in their territory.
- Avista should consider researching the percentage of Simple Steps, Smart Savings bulb purchase that are installed in commercial settings. This could increase the average installed hours of use and increase program savings.



- Perform a billing analysis on ENERGY STAR homes using a non-participant comparison group once enough homes have participated under the new requirements to justify performing the work. This research could be used to demonstrate the achieved savings through energy efficiency construction practices.
- Consider researching the current variable speed motor market activity to determine if this measure should continue as a stand-alone rebate or be packaged with other equipment purchases.

CADMUS

2. Residential Behavior Program

2.1. Program Description

For the Residential Behavioral Program, Avista sends home energy reports to residential customers. The reports educate customers about their electricity use and suggest opportunities for saving electricity. Each report contains:

- An analysis of the home's current and past electricity use;
- A comparison of the home's electricity use to the electricity use of its similar neighbors (known as the neighbor comparison); and
- Electricity-savings tips, including promotions of other Avista energy-efficiency programs.

The program seeks to achieve electricity savings by increasing awareness of energy efficiency and by encouraging lasting changes in energy-use behaviors and in the adoption of energy-efficiency measures. Opower implements the program. It was expected that the program would save about 1% of energy use in PY 2013.

The program targeted single-family homes and units in multifamily buildings with above-average electricity use.[25] Although the program is focused on saving electricity, homes that receive electricity and natural gas service from Avista are eligible to participate. Each home will receive six reports during the first 12 months of the program.

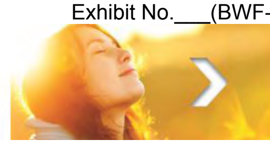
2.1.1. Program Details

The program began in June 2013, when Opower sent the first energy reports to homes in Avista's Washington service territory by U.S. mail. Approximately 48,000 Avista Washington residential electric customers received one or more reports in 2013. Most program homes received their first report in June or July 2013, although a small number received their first report in a later month.

To be eligible, homes had to meet the following criteria:

- Have above-average electricity use;
- Have an adequate electricity billing history (12 or more months of continuous bills at the same premise);
- Have a sufficient number of similar neighboring homes (for the neighbor comparison);
- Have home occupants who are responsible for paying electricity bills;
- Be a primary residence;
- Not be master-metered; and

[25] The average annual electricity use per program home was 17,509 kWh in 2012. Median annual energy use was 15,950 kWh and the 25th and 75th percentiles were, respectively, 13,340 kWh and 20,170 kWh.



- Have a valid mailing address.

By contacting Avista, a homeowner could stop delivery of the reports at any time; these homes are referred to as opt-outs. During PY 2013, there were 486 opt-out customers in Washington, for a rate of 1.05%, a very small share of customers that received reports.

Opower implemented the program as a randomized control trial (RCT), in which Opower identified homes in Avista's service territory eligible to receive the reports and Cadmus independently randomly assigned each home to the program treatment or control group.[26] Homes in the treatment group received the home energy reports while homes in the control group did not receive reports and were not informed of the program.[27] With random assignment, the treatment and control groups are expected to be equivalent except for the treatment group having received the energy reports, so it is therefore possible to attribute any difference in average energy use during the program between the groups to the receipt of the reports. RCT is the gold standard in program evaluation, because it yields unbiased and robust estimates of the program treatment effects. RCT is the recommended by both the DOE's forthcoming Uniform Methods Project for Evaluating Behavior-Based Programs (2014) and by SEE Action guidelines for evaluating residential behavior-based programs (2012).[28] This approach was also employed in evaluation of other large-scale, home energy reports programs of Washington investor-owned utilities.[29]

Table 58 shows the number of Avista residential customers in Washington assigned to the treatment group and the number receiving one or more energy reports in PY 2013. Not every treatment customer received energy reports because after Cadmus created the random assignments, Opower determined that some customers did not have a valid mailing address or information required to generate a report. The table also shows the number of customers in the control group and the number of customers in the

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26 Using standard statistical tests, Cadmus verified that the treatment and control groups were balanced in terms of their annual, summer, and winter ADCs.

27 Opower could not deliver reports to a small number of homes assigned to the treatment group, as discussed later in this report. Opower also identified control homes for which it would have been impossible to send a home energy report.

28 See the State and Local Energy Efficiency Action Nework (2012). Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations. Prepared by A. Todd, E. Stuart, S. Schiller, and C. Goldman, Lawrence Berkeley National Laboratory. http://behavioranalytics.lbl.gov. Also, the draft UMP protocols for behavior-based programs are available here: *http://energy.gov/eere/about-us/initiatives-and-projects/uniform-methods-project-determining-energy-efficiency-program*

29 See the 2012 impact evaluation of Puget Sound Energy's Home Energy Reports Program: *https://conduitnw.org/_layouts/Conduit/FileHandler.ashx?RID=849*

control group who would have received reports if they had instead been assigned to the treatment group.

Table 58. Number of Treatment and Control Homes in PY 2013

	Washington		
	Treatment	Control	Total
Randomly assigned	48,299	13,000	61,299
Randomly assigned and received a report (treatment) or could have received a report (control)*	46,474	12,583	59,057

* This row excludes treatment homes that did not receive a report and control homes that could not have received a report due to an invalid mailing address or unavailable information required to generate a report.

2.2. Residential Behavior Program Impact Evaluation Methodology

For the impact evaluation, Cadmus sought to estimate the program energy savings in PY 2013 and quantify the program impact on participation in Avista's other residential efficiency programs. Cadmus used a panel regression analysis of customer monthly bills to estimate the program's electricity savings between mailing of the first reports in June 2013 and December 2013. Cadmus analyzed Avista efficiency program participation and measure savings data to estimate the program's effects on participation in other Avista efficiency programs, as well as to estimate savings that were counted towards other efficiency programs.

More specifically, Cadmus' evaluation of the Residential Behavior Program savings and efficiency program uplift consisted of the following four tasks:

1. Data collection, review, and preparation.
2. Equivalency analysis (checks on treatment and control groups).
3. Billing analysis.
4. Energy-efficiency program uplift and savings analysis.

2.2.1. Data Collection, Review, and Preparation

To perform the billing and uplift analyses, Cadmus collected the data outlined below.

Monthly Customer Bills

Avista supplied Cadmus with monthly electricity and gas bills (for dual-fuel customers) between June 2012 and January 2014. The data included approximately 12 months of bills prior to and six months of bills after the program began for homes in the treatment and control groups. These billing data included: account numbers, energy use during the monthly billing cycle, number of days in the billing cycle, and the first and last days of the billing cycle.

Program Information

Cadmus obtained program enrollment information from Opower. These data included the following fields for each home in the treatment and control groups:

- Address of residence;
- Assignment to treatment or control group;
- First report date;[30]
- Opt-out date for homes in the treatment group choosing not to participate in the program;
- Inactive date for homes that closed their gas or electric account; and
- Account numbers for linking to billing data.

Weather

Cadmus collected daily average temperature data for weather stations in the program region from the National Climate Data Center (NCDC). For a small number of stations where the NCDC data were incomplete, Cadmus was able to interpolate daily average temperature as an average of the preceding and following day. In cases where a string of days were missing data, Cadmus used temperature data from the next-nearest weather station. Then we used temperatures to calculate the number of HDDs and CDDS for each customer billing cycle.

Residential Energy-Efficiency Program Tracking Data

Avista provided Cadmus with participant and measure savings data for PY 2013 residential energy-efficiency programs in which the behavior program could have influenced participation. These programs included appliance recycling and residential rebates for HVAC equipment, conversions to natural gas, and insulation. For each program and measure, the data included: the account number; the number and description of measures installed; measure installation dates; and verified gross savings. Cadmus used this information to estimate the behavior-based program's participation and savings effects on other efficiency programs.

[30] Opower assigned a pseudo first report date to control homes, representing the date the first energy report would have been mailed.

Data Cleaning

Cadmus conducted a number of steps to inspect and clean the data provided by Opower. The steps are described in Appendix B: Residential Behavior Program Data Cleaning Procedures. Cadmus did not identify any significant issues with the Opower data.

Cadmus requested monthly billing data from Avista for Washington customers from June 2012 through February 2014. Avista provided bills for all but a few customers in the program treatment and control groups.[31] Cadmus then followed a number of steps to clean the billing data. These steps are also described in Appendix B: Residential Behavior Program Data Cleaning Procedures.

Data Preparation

Using the number of days in the billing cycle, Cadmus expressed each month's energy use and weather in average daily terms, then merged the billing, weather, and program information data, including information about the approximate delivery date of the first home energy report.

Cadmus performed billing analysis on the population of program homes, except for homes from the estimation sample that satisfied one or more of the following criteria:

- The home was in the treatment group but did not receive a home energy report or was in the control group but would not have received a home energy report (indicated by missing the first report date in the customer information data).[32]
- Opower flagged the home as receiving a home energy report, but the home had not been randomly assigned to the treatment group.[33]
- The home did not have a complete or near-complete billing history for the 12 months before the start of the program. Cadmus dropped homes from the analysis that had fewer than 11 bills between June 2012 and May 2013.

Applying these filters resulted in a group containing 54,324 customers: 11,579 in the control group and 42,745 in the treatment group. Although the billing analysis excluded homes with fewer than 11 bills in the year before the program, the savings estimate includes savings from these homes.[34]

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31 Avista provided billing data for all but 868 customers. While we did not use these customers' bills in the savings analysis, we did count the savings from these customers in our estimated PY 2013 total program savings.

32 A home in the treatment group may have been missing a first report date because either the account became inactive before the first report was generated, or Opower did not have a valid mailing address. An approximately equal number of control homes were not assigned a first report date and were left out of the analysis for the same reasons.

33 For example, this group included utility employees who requested to participate in the program.

2.2.2. Equivalency Analysis

Per an agreement between Avista, Cadmus, and Opower, Cadmus performed the random assignments of eligible residential customers to the program treatment or control groups. At the time, Cadmus verified that the random assignment resulted in treatment and control groups that were balanced in terms of their annual, winter, and summer electricity use. Cadmus provided these random assignments to Opower, who additionally analyzed the random assignments using proprietary home and demographic characteristic data and verified that the groups were balanced.

Cadmus also performed an equivalency check of homes in the analysis sample treatment and control groups after applying the filters described in the preceding section. As Table 59 shows, the difference between the two groups' annual consumption is not statistically significant.

Table 59. Equivalency of Analysis Sample Treatment and Control Group Homes

	Average Annual Consumption
Treatment	17,786
Control	17,807
t value	0.32
P value	0.75

As described below, any time-invariant differences in energy use between the treatment and control groups after filtering are absorbed with customer fixed effects.[35]

2.2.3. Billing Analysis

To estimate Residential Behavioral Program electricity savings, Cadmus used difference-in-differences (D-in-D) regression. D-in-D regression uses the energy use of treatment and control group homes before and after the first energy reports to account for any naturally occurring efficiency that might have been correlated with Residential Behavior Program activity.

The D-in-D approach requires monthly energy use from before and during the program in the treatment and control group homes. Using Avista billing data, Cadmus conducted panel regression analysis of the electricity consumption in Washington to estimate the average program savings per home per day in PY 2013.

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[34] Cadmus followed the guidelines in the SEE Action's report *EM&V of Residential Behavior-Based Energy Efficiency Programs* (2012) to drop homes with less than 10 months of billing data from the analysis.

[35] A home fixed effect represents the portion of a home's energy use that does not vary over time. This energy use is captured in the regression analysis by the inclusion of a separate intercept for each customer or by equivalently transforming all the variables by subtracting home-specific means.

Model Specification

Assume ADC of electricity of home 'i' in month 't' is given by:

$$ADC_{it} = \beta_1 POST_{it} + \beta_2 PART_i \times POST_{it} + W'\gamma + \alpha_i + \tau_t + \varepsilon_{it}$$

Where:

β_1	=	Coefficient representing the impact of non-program factors on consumption between pre- program and program months.[36]
POST	=	An indicator variable for whether the month is pre- or post-treatment. This variable equals 1 in months following the first report date and 0 otherwise. The variable is defined with a short lag to allow for time between the report's generation and delivery of the report to the home.[37]
β_2	=	Coefficient representing the conditional average treatment effect (ATE) of the program on electricity use (kWh per home per day).
PART	=	An indicator variable for program participation (which equals 1 if the home was in the treatment group, and 0 otherwise).
W	=	A vector using both HDD and CDD variables to control for the impacts of weather on energy use.
γ	=	Vector of coefficients representing the average impact of weather variables on energy use.
α_i	=	Average energy use in home 'i' that is not sensitive to weather or time. Analysis controlled for non-weather-sensitive and time-invariant energy use with home fixed effects.
τ_t	=	Average energy use in month 't' reflecting unobservable factors specific to the month. The analysis controls for these effects with month-by-year fixed effects.[38]
ε_{it}	=	Error term for home 'i' in month 't.'

[36] In addition to naturally occurring efficiency, this term captures differences in average consumption between pre-program and program months due to having 12 months of pre-program bills and only 7 months of program bills.

[37] Specifically, we defined the first report date as 14 days after the report was generated. This allowed for time between generating and delivering the report.

[38] It was possible to include month-by-year fixed effects and POST in the same model because there was variation between customers in the month of the first report date.

Program Energy Savings

Cadmus estimated the total Residential Behavioral Program energy savings in PY 2013 by multiplying the total number of program days across treated homes by the average savings per home per day, β_2. To illustrate, let i=1, 2, …, N index the number of homes receiving a home energy report; and D(x) return the number of the days in 2013 from January 1 for a given date x (e.g., D(February 1)=32).

The net program savings then equaled:

$$\text{Net Savings} = -\beta_2 * \left(\sum_{i=1}^{N} \text{ProgDays}_i\right)$$

Where:

i	=	1, 2, …, N; indexes the number of homes in the treatment group.
ProgDays_i	=	365 – D(first report date_i), if the billing account for home ‘i' was still active on December 31, 2013; and,
	=	D(inactive date_i) - D(first report date_i), if the billing account for home ‘i' became inactive before December 31, 2013.

As the definition of $\textit{ProgDays}_i$ shows, Cadmus counted savings in treated homes whose accounts became inactive up until the accounts closed.

2.2.4. Energy-Efficiency Program Uplift Analysis

The Residential Behavioral Program could have increased participation in Avista’s other efficiency programs in two ways:

- First, energy reports directly educated customers about some of Avista’s efficiency programs and encouraged them to take advantage of program offerings and incentives.
- Second, the reports could have raised customer awareness and knowledge of energy efficiency, which may cause some to participate in Avista’s efficiency programs.

Analysis of efficiency program uplift is important for two reasons:

- First, Avista sought to learn whether and to what extent the Residential Behavior Program caused participation in its other efficiency programs.
- Second, to the extent the Residential Behavioral Program caused participation in other efficiency programs, energy savings resulting from this participation will have be counted twice: in the regression estimate of Residential Behavior Program savings; and in the other programs’ savings. (Thus, Avista will want to subtract the double-counted savings from its portfolio savings.)

The uplift analysis described here yields estimates of the effect of the Residential Behavioral Program on other efficiency program participation and the double-counted savings. The analysis was limited, however, to program measures that Avista tracked at the customer level, and thus did not include residential upstream programs promoting CFLs through store discounts. However, analysis of Opower home energy report programs in other service territories suggests that CFLs only account for a small percentage of total program savings.[39]

Methodology

As with the energy-savings analysis, the uplift analysis follows the logic of the program's experimental design. Cadmus collected Avista electric efficiency program participation and savings data for PY 2013, matched the data to the program treatment and control homes, and estimated uplift as a simple difference in participation rates and savings between treatment and control groups. As customers in the treatment and control groups are expected to be similar, except for having participated in the behavior program, the difference between treatment and control groups in other efficiency program participation is expected to equal the true Residential Behavior Program uplift. In matching treatment and control homes to the PY 2013 efficiency program data, Cadmus excluded measures installed after an account became inactive or before the first energy report date.

Let ρ_m be the participation rate (defined as the number of efficiency program participants to the number of potential participants) in a PY 2013 program for group m (as before, m=1 for treated homes, and m=0 for control homes). Then:

$$\text{Participation uplift} = \rho_1 - \rho_0$$

Expressing participation uplift relative to the participation rate of control homes in PY 2013 yields an estimate of the percentage of uplift:

$$\%\text{Participation Uplift} = \text{Program Uplift}/\rho_0$$

Residential Behavior Program savings from participation in other efficiency programs can be estimated the same way, by replacing the program participation rate with the program net savings per home:

$$\text{Net savings per home from participation uplift} = \sigma_1 - \sigma_0.$$ [40]

Multiplying net savings per home by the number of program homes yielded an estimate for a customer segment and wave of total Residential Behavioral Program net savings counted in Avista's other efficiency programs.

39 See impact evaluation of PG&E Home Energy Reports Program, 2010-2012. Available at *http://www.calmac.org/publications/2012_PGE_OPOWER_Home_Energy_Reports__4-25-2013_CALMAC_ID_PGE0329.01.pdf*

40 Cadmus obtained net savings by multiplying measure-verified gross savings by the estimated measure net-to-gross ratio.

Cadmus performed participation and savings uplift analyses for the following Avista residential efficiency programs:

- Appliance Recycling
- Residential rebate programs, including:
    - Residential conversions (conversion from electric to NGF or NGWH)
    - Residential HVAC (ASHP (including conversions), variable frequency drives (VFDs), and electric water heaters)
    - Residential shell (floor and attic insulation)

Cadmus did not perform uplift analyses for the following residential electricity efficiency programs:

- Upstream Lighting. Though the Residential Behavior Program may have influenced CFL and other high-efficiency lighting purchases, such purchases were tracked at the store level.
- ENERGY STAR Homes. This program targeted builders of new homes, which the Residential Behavior Program did not target.
- Low-Income Weatherization. The typical time lag between the application for a retrofit and installation of measures exceeded the number of program months (which was six or seven) in PY 2013, making it unlikely that the energy reports would have resulted in any savings for this program.

2.3. Program Results and Findings

2.3.1. Electricity Savings per Home Estimates

Table 60 shows the average daily energy savings per home or, equivalently, the conditional average program treatment effect (ATE) per home of Avista's Residential Behavioral Program. The savings are represented by the coefficient on the interaction variable between $PART_{it}$ x $POST_{it}$. On average, homes saved 0.764 kWh (1.61%) per day.[41] This savings estimate was statistically significant at the 1% level.

For perspective, these savings could be achieved by turning off a 75-watt incandescent lamp for 10 hours per day or by replacing ten 100-watt incandescent lamps used for one hour each day with ten 25-watt CFLs.

[41] Average savings of 1.61% during the first seven months is slightly greater than the average savings over the same period estimated for other utility home energy reports programs. See Allcott, H. (2011). Social Norms and Energy Conservation. Journal of Public Economics, 95(2), 1082-1095. Also, Rosenberg, Mitchell, G. Kennedy Agnew, and Kathleen Gaffney. Causality, Sustainability, and Scalability – What We Still Do and Do Not Know about the Impacts of Comparative Feedback Programs. Paper prepared for 2013 International Energy Program Evaluation Conference, Chicago.

Table 60. Conditional Average Treatment Effects*

	kWh/day
PARTit x POSTit – Year 1 (Year 1 savings per day per home)	0.764 (0.100)
Customer fixed effects	Yes
Month-by-year fixed effects	Yes
Weather polynomials	Yes
N (homes)	58,535

* The dependent variable is average daily electricity use in the month for a treatment or control group home. The model estimated this by ordinary least squares using monthly bills between June 2012 and January 2014. Huber-White estimated standard errors (shown in parentheses) are clustered on homes.

Cadmus ran several other model specifications to check the robustness of the savings estimates with the inclusion or omission of different variables. For example, we estimated models with and without different combinations of home-fixed effects, time-fixed effects, and the weather variables. Appendix C: Residential Behavior Program Regression Model Estimates includes complete results from these other regression specifications. Little or no difference occurred in the estimated savings between specifications—an expected result, as estimates of treatment effects in large RCTs typically prove robust to changes in model specifications.

Table 61 shows the average savings per Residential Behavior Program home in PY 2013. Cadmus obtained this estimate by multiplying the estimated savings per home per day in Table 60 by the average number of program days for treated homes in PY 2013. We defined the program days for a home as the number of days between the first report date and December 31, 2013.

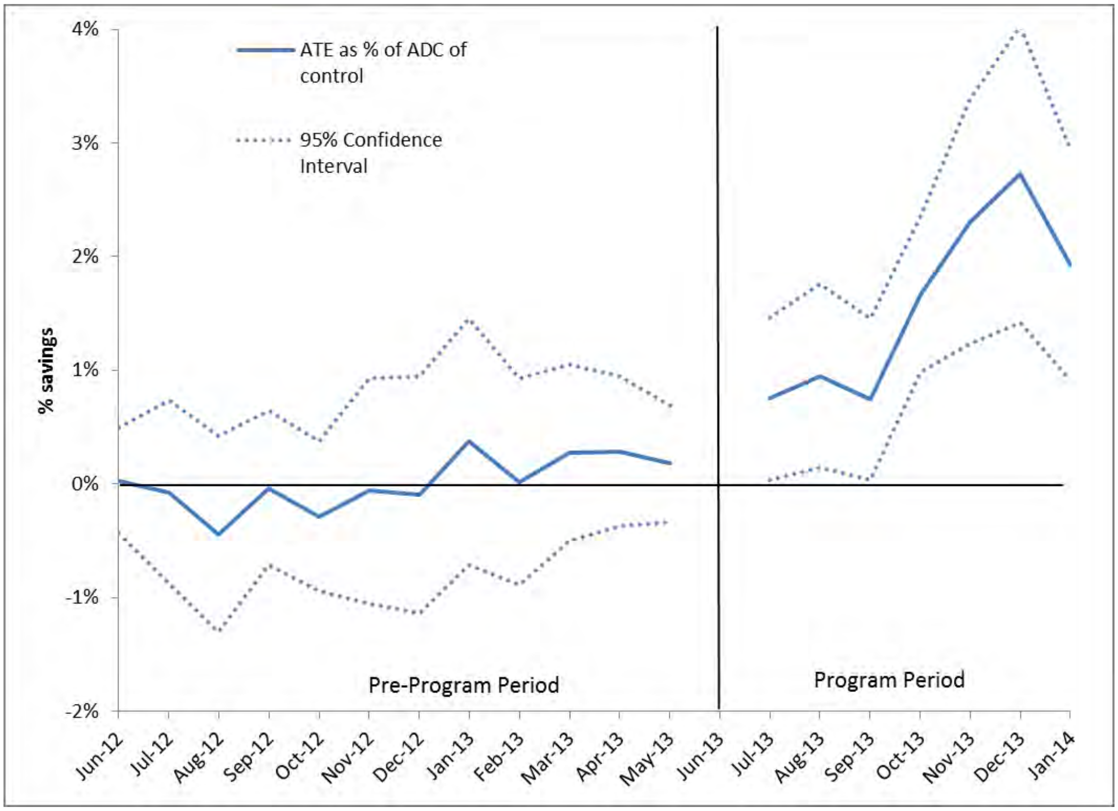
Table 61. Average Savings (kWh) Per Home for PY 2013*

Savings (kWh)	90% CI Lower Bound	90% CI Upper Bound
135	106	164

* Cadmus estimated these savings per home based on Table 61and the average number of program days per home in PY 2013.

Figure 17 shows estimates of average savings per month from June 2012 to January 2014. Cadmus obtained savings via a regression that estimated the difference in energy use between treatment and control group homes, conditional on home fixed effects. The ATE is shown as a percentage of the ADC of control group homes.

Figure 17. Average Savings Per Month*



* Cadmus obtained the savings estimates in this figure Figure 17 from a regression of ADC on home fixed effects, month-by-year fixed effects, and month-by-year fixed effects interacted with an indicator of whether that home was in the treatment group. As the model also includes home fixed effects, it was necessary to omit one month-by-year fixed effect.

As expected, there were not significant differences in average energy use between treatment and control group homes before Opower sent the first energy reports in June 2013. The 90% confidence interval includes zero in each month. The approximate equality of energy use before treatment means that we cannot reject the identifying assumption of the savings analysis: that receiving a home energy report was random and uncorrelated with expected energy use.

Treated homes started saving energy after receiving the first reports. In July and August, percentage savings were below 1% but still substantial. Percent savings increased in subsequent months. The ramping of savings in the first six months of the program is evident in Figure 17, which is typical of home energy report programs.

2.3.2. Program Savings Estimates

Table 62 reports the total program savings for Avista's Washington service territory. Cadmus estimated savings by multiplying the estimate of average daily savings per home by the total number of program days for treated homes.

Table 62. Residential Behavioral Program Energy Savings in PY 2013

Service Area	*Ex Ante* Percent Net Electricity Savings*	Evaluated Percent Net Electricity Savings	Evaluated Annual Net Electricity Savings (kWh)	90% CI Lower Bound	90% CI Upper Bound	Realization Rate
Washington	1.2%	1.61%	6,283,477	4,927,294	7,639,600	134%

* Cadmus obtained *ex ante* percent electricity savings from the 2013 *Avista Energy Efficiency Business Plan*. Avista expected electric savings from the program to be 1.4% in the first year, and Avista assumed that 40% of the first-year energy savings would occur in the first six months of the program in 2013. Given the 2013 consumption data for the control group, it follows that the savings expected for the first six months of the program are 1.2%
Evaluated annual net electricity savings are based on the savings estimate shown in Table 60.

Avista expected net savings of 1.2% from the Residential Behavioral Program in PY 2013. Based on the regression analysis of monthly energy use, Cadmus determined that the program achieved net savings of 1.61%. Cadmus estimated net savings of 6,283,477 kWh in PY 2013, with a 90% confidence interval of [4,927,294 kWh, 7,639,600 kWh] or relative precision of ±21%. The program realized 134% of the expected savings.

2.3.3. Uplift Analysis

This section reports estimates of the Residential Behavioral Program's effect on participation in Avista's other efficiency programs (the uplift), as well as savings resulting from additional participation. To avoid double-counting savings, behavior program savings from participation in other efficiency programs must be subtracted from the residential portfolio savings. In estimating participation uplift and savings from uplift, Cadmus considered only those measures installed after the first reports were received.

Participant Uplift

Table 63 shows the percentage uplift estimates for each program. As noted in the methodology, uplift equals the absolute effect on the participation rate, and the percentage uplift equals the participation rate effect divided by the participation rate of control homes in PY 2013.

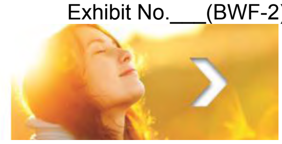


Table 63. Residential Behavioral Program Participation Uplift*

Program	Participation Uplift	% Participation Uplift
Appliance Recycling	0.02%	4%
Residential Rebate Programs		
Residential Conversions	0.03%	96%
Residential HVAC	-0.02%	-7%
Residential Shell	0.001%	8%

* Participation uplift derives from the estimate of change in the rate of program participation attributable to the Residential Behavior Program. The percent of participation uplift is the change in the participation rate relative to the program participation rate of control homes in PY 2013. The text below provides estimation details and data sources.

The Residential Behavioral Program increased the rate of participation of homes in the Appliance recycling, residential conversions, and residential shell programs. The behavior program increased the participation rate in these other programs by less than 1%, but because the baseline rate of participation was relatively low, the percentage uplift effect was higher, especially for residential conversion programs. Appliance recycling presented 4% uplift, residential conversion programs presented 96% uplift, and residential shell programs presented 8% uplift. This means, for example, that treatment homes were 4% more likely to participate in the ARP than control homes.[42] The behavior program did not increase participation in the Residential HVAC Rebate Program: the negative uplift occurred because control group homes participated in the program at a higher rate than treatment group homes. The difference in participation rates was not statistically significant, however.

Savings Analysis

Table 64 shows electricity savings from lift in participation in the ARP and residential rebate programs in PY 2013. The savings reflect the behavior program's effects both on participation rates and on the numbers and/or kinds of measures installed.[43] The savings from program uplift reported in Table 64 should be subtracted from the PY 2013 residential portfolio savings.

[42] Percent uplift for the residential conversion program was large because the increase in the conversion rate was large relative to the baseline rate.

[43] The methodology called for using net savings of efficiency measures in calculating Residential Behavioral Program savings from efficiency program uplift; however, except for the ARP, Cadmus did not derive net-to-gross values for program measures. Instead, we used adjusted gross savings estimates based on field estimates of utilization and installation rates to calculate uplift savings. For consistency across programs, we used the adjusted gross savings for the APR.

Table 64. Residential Behavior Program Electricity Savings from Program Uplift

Program	Washington PY 2013	
	Home (kWh)	Total Savings (kWh)
Appliance Recycling	0.16	7,416
Residential Rebate Programs		
Residential Conversions	1.48	56,702
Residential HVAC	-0.06	-2,799
Residential Shell	0.03	1,635
Total	**1.61**	**62,954**

Participation in the Appliance Recycling and Residential Rebate programs resulted in savings of 62,954 kWh. The majority of uplift savings derived from residential conversions of electricity to gas. To avoid double counting, the savings from uplift must be subtracted from evaluated savings for the electricity efficiency portfolio, the behavior program, or other efficiency programs from PY 2013.

2.3.4. Evaluated Net Savings Adjustment

shows the Residential Behavioral Program adjusted net savings for PY 2013. The adjusted savings are the difference between the program evaluated net savings and estimated savings from program uplift. The adjusted net program savings in PY 2013 were 6,220,493 kWh.

Table 65 shows the Residential Behavioral Program adjusted net savings for PY 2013. The adjusted savings are the difference between the program evaluated net savings and estimated savings from program uplift. The adjusted net program savings in PY 2013 were 6,220,493 kWh.

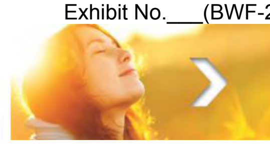
Table 65. Residential Behavioral Program Adjusted Net Savings in PY 2013

Service Area	Evaluated Net Electricity Savings (kWh/yr)	Adjusted Net Electricity Savings (kWh/yr)
Washington	6,283,447	6,220,493

2.4. Behavior Program Conclusions

Analysis of the monthly electric bills of treatment and control homes during the first seven months of the program led to the following findings about Residential Behavior Program savings in PY 2013:

- Homes in Washington saved on average 0.764 kWh (1.61%) per day. The percentage savings were significantly higher than expected (1.2%).
- The program achieved total electricity savings of 6,283,447 kWh. The relative precision of the electricity savings estimate was ±21% with 90% confidence.
- The program generated percentage savings at a slightly higher rate than the normal range for energy reports programs.



Analysis of Avista's energy-efficiency program data resulted in the following findings about the Residential Behavior Program effects on other efficiency program participation and savings:

- The Residential Behavior Program lifted the rate of participation in the ARP, residential conversions, and residential shell programs. Percent uplift for conversion was large because of the low baseline rate of conversions.
- The total Residential Behavior Program electricity savings from efficiency program uplift was 62,954 kWh, or 1.0%.
- Savings from efficiency program uplift are counted in the Residential Behavior Program regression-based estimate of savings and the savings of the other programs. To avoid double counting, the uplift savings must be subtracted from the evaluated savings for the electric portfolio or for the Residential Behavior Program.
- After adjusting net electricity savings for program uplift, the program saved 6,220,493 kWh.

2.5. Behavior Program Recommendations

Based on the analysis, Cadmus makes the following recommendations:

- Avista should continue to promote its efficiency programs in the energy reports, as the reports increase both the rate of efficiency program participation and savings.
- Avista should consider performing additional research about the peak-coincident demand savings from the behavior program to determine whether it is cost-effective relative to existing residential load control programs.[44]

[44] Research would require analysis of high frequency (15 minute or one hour interval) energy use data for a large number of treatment group and control group homes. For an example of such an analysis, see Stewart, James, 2013. Peak-Coincident Demand Savings from Residential Behavior-Based Programs: Evidence from PPL Electric's Behavior and Education Program. Available at *http://escholarship.org/uc/item/3cc9b30t*.

CADMUS

3. Nonresidential Impact Evaluation

3.1. Introduction

Through its nonresidential portfolio of programs, Avista promotes the purchase of high-efficiency equipment for commercial utility customers. Avista provides rebates to partially offset the difference in cost between high-efficiency equipment and standard equipment.

The nonresidential electric portfolio has 11 programs in three major categories: prescriptive, Energy Smart Grocer, and Site-Specific (custom). The programs are described below.

Prescriptive Commercial Clothes Washer

To encourage customers to select high-efficiency clothes washers, this program is targeted to nonresidential electric and natural gas customers in multifamily or commercial laundromat facilities. Avista streamlined the prescriptive program approach to reach customers quickly and effectively and to promote ENERGY STAR or Consortium for Energy Efficiency (CEE)-listed units.

Prescriptive Commercial Windows and Insulation

Beginning in January 2011, Avista has processed the installation of commercial insulation through a prescriptive program in addition to the site-specific program. Projects are eligible for the Prescriptive Commercial Windows and Insulation Program when they have:

- Wall insulation of less than R-4 that is improved to R-11 or better
- Attic insulation of less than R-11 that is improved to R-30 or better
- Roof insulation of less than R-11 that is improved to R-30 or better

Prescriptive Food Service

Applicable to nonresidential electric and gas customers with commercial kitchens, Avista provides direct incentives to customers who choose high-efficiency kitchen equipment though this program. The equipment must meet either ENERGY STAR or CEE tier levels (depending on the unit) to qualify for an incentive.

Prescriptive Green Motors Initiative

Operated in partnership with The Green Motors Practices Group[45], Avista provides education through this program to foster the organization and promotion of member motor service centers' commitment to energy-saving shop rewind practices for motors ranging from 15 HP to 500 HP.

Prescriptive Lighting

Since there is a significant opportunity for lighting improvements in commercial facilities, Avista offers direct financial incentives to customers who increase the efficiency of their lighting equipment through this program. The rebate is available to existing commercial and industrial electric customers whose

[45] http://www.greenmotors.org/

facilities on rate schedules 11 or above. Avista provides pre-determined incentive amounts for 38 measures, including:

- T12 fluorescent to T8 fluorescent lighting
- High bay, high-intensity discharge lighting to T5 fluorescent or T8 fluorescent
- High bay, high-intensity discharge lighting to induction fluorescent
- Incandescent to CFL or cold cathode fluorescent
- Incandescent to LED
- Incandescent exit signs to LED exit signs

Prescriptive Motor Controls HVAC

The use of single-speed motors to drive fans or pumps often provides the opportunity to save energy through the use of a VFD. A VFD can convert a single-speed motor to variable speed motor with no modification to the motor itself. This can be an efficient way to convert constant volume air systems into variable volume systems, for example. VFDs are readily available for motors from 1 HP to 300 HP and are easily installed directly into the power line leading to the motor, replacing the existing motor starter. Avista provides incentives for the installation of VFDs.

Many fan and pump systems have a cost-effective application for VFDs. Quite often these systems have a variable flow rate through the use of throttling devices, such as valves and dampers that vary the flow. Throttling devices essentially waste excess energy to maintain a given pressure or flow, and the use of a VFD can be very cost-effective in these situations. Typical examples of systems using throttling devices are: booster pumps for domestic water, process chilled or condenser water systems, and fan discharge dampers.

Other variable flow systems use mechanical or electrical methods such as inlet vanes, outlet dampers, eddy current clutches, hydraulic couplings, or variable pitch pulleys to vary the speed of the fan or pump. These are more efficient than throttling devices, but not as efficient as VFDs. Some fan and pump systems that currently have a constant flow may be converted to variable flow systems through modifications to the system.

Prescriptive PC Network Controls

Computers that remain in a full-power state when idle can waste significant energy, especially for customers with numerous PCs. Through this program, available to nonresidential electric customers, Avista provides an incentive for the installation of a network-based power management software solution that manages the power of networked PCs.

Prescriptive Standby Generator Block Heater

Most block heating technology employs natural convection within the engine block system to drive circulation—more commonly known as thermosiphon. Avista promotes the replacement of thermosiphon-style engine block heaters with pump driven circulation units, which reduces the overall block temperature. Because this replacement also decreases the heat transfer rate from the block to the environment, it can reduce overall block heater energy consumption, which is tied to the circulation method.

Because thermosiphon heaters require temperature variation to drive circulation, warmer coolant rises to the top of the block and colder coolant descends to the lower sections of the block. The coolant in the lower portions of the block must meet the minimum block temperature requirements, which means the coolant in the upper parts of the block will exceed the minimum temperature requirements. A pump driven heater does not require a temperature difference to drive flow, leading to a more uniform coolant temperature throughout the block. This reduces the overall average block temperature and minimizes the driving force affecting heat transfer.

Renewables

Avista provides prescriptive incentives for residential and nonresidential projects where photovoltaic (solar electric) systems and/or wind turbines are installed.

Energy Smart Grocer

Refrigeration has high potential for energy savings, but is often overlooked because of the technical aspects of the equipment. Through the Energy Smart Grocer Program, Avista assists grocery store customers with technical aspects of their refrigeration systems, while also providing guidance as to the amount of savings they can achieve. A field energy analyst offers technical assistance to customers, produces a detailed report of the potential energy savings at their facility, and guides them through the program process from inception through the payment of incentives for qualifying equipment.

Site Specific

The Site-Specific Program is for nonresidential measures that are not addressed by any of the prescriptive applications, but must be considered based on their project-specific information. For a measure to be considered, it must have demonstrable kWh and/or therm savings. These measures are available to all commercial, industrial, or pumping customers that receive electric or natural gas service from Avista.

Electric and saving measures included in the program are:

- Site-Specific HVAC
  - HVAC Combined
  - HVAC Cooling
  - HVAC Heating
  - Multifamily Measures
- Site-Specific Lighting
  - Lighting Exterior
  - Lighting Interior
- Site-Specific Other

    - Appliances
    - Compressed Air
    - Green Motors Rewind
    - Industrial Process
    - Motor Controls Industrial
    - Standby Generator Block Heater
- Site-Specific Shell

Avista implements the Site-Specific Program and prescriptive programs, while PECI implements the Energy Smart Grocer Program. As implementers, both Avista and PECI are responsible for designing and managing program details. Both implementers developed algorithms for use in calculating measure savings and determining measure and customer eligibility.

Avista staff fields inquiries from potential participants and contractors and maintains a tracking database for projects. Throughout the program, Avista manages projects by reviewing and approving applications at all stages of the process, calculating project savings, and populating the database with relevant information.

3.2. Methodology

Cadmus designed the impact evaluation to verify reported program participation and estimate energy savings. In the impact evaluation, we determined gross savings through engineering calculations, verification site visits, metering, and some project-level billing analysis.

We reviewed Avista's reported gross energy savings and available documentation, such as audit reports and savings calculation work papers, for a sample of sites, giving particular attention to the calculation procedures and documentation for savings estimates. We also verified the appropriateness of Avista's analyses to calculate savings, as well as the operating and structural parameters of the analyses. We then determined gross evaluated energy savings through site visits and engineering calculations for a sample of projects.

Cadmus collected baseline, tracking, and program implementation data through on-site interviews with facility staff. During on-site visits, we verified measure installations and determined any changes to the operating parameters since the measures were first installed. We also interviewed facility staff about their experiences and any additional benefits or shortcomings of the installed system. We used the savings realization rates from site visits to estimate savings and develop recommendations for future studies.

3.2.1. Sampling

Cadmus developed a sampling calculation tool to estimate the number of on-site visits required to achieve the rigor levels of the precision target shown in Table 66. We used preliminary program population data provided by Avista, and determined we needed to conduct measurement and verification on 107 sites. We anticipated achieving 90/10 precision at the overall nonresidential portfolio level through the targets for each stratum.

Cadmus selected both a census and random sample for each stratum. The census projects represented a small number of participants with large savings impacts in the stratum. The cutoff for the census savings for each stratum is shown in Table 67. We visited all sites with reported savings above this census level. In each stratum, we also randomly selected additional participants from the remaining population of projects.

Table 66. Proposed PY 2012-PY 2013 Nonresidential Evaluation Activities

Stratum	Precision Target	Proposed Site Visits
Prescriptive	90/20	26
Energy Smart Grocer	90/20	13
Site-Specific HVAC	90/20	25
Site-Specific Lighting	90/20	21
Site-Specific Other	90/20	15
Site-Specific Shell	90/20	7
Total	**90/10**	**107**

Table 67. Census-Level Cutoff by Stratum

Stratum	Reported Savings (kWh)
Prescriptive	300,000
Energy Smart Grocer	300,000
Site-Specific HVAC	500,000
Site-Specific Lighting	500,000
Site-Specific Other	500,000
Site-Specific Shell	N/A

In Table 68, we show the precision achieved for the actual number of evaluation activities for electric measures. Subsequent sections of this report will explain the differences between our initial proposed and actual sampling plan for evaluation activities. For example, in our initial sampling plan we categorized ENERGY STAR appliances in the site-specific other category. As the impact evaluation progressed, we determined these measures were more appropriate for the prescriptive category.

Table 68. Final PY 2012-PY 2013 Electric Evaluation Activity Sample

Stratum	Achieved Precision	Completed Metering Projects	Completed Site Visits
Prescriptive	90/17	7	25
Energy Smart Grocer	90/5	2	23
Site-Specific HVAC	90/6	1	29
Site-Specific Lighting	90/11	5	20
Site-Specific Other	90/3	7	13

Site-Specific Shell	90/11	0	10
Total	**90/9**	**22**	**120**

As explained above, we selected projects with large reported savings (census-level) to use in our analysis. In selecting the rest of our sample, we found that the extract from Avista's database did not include addresses that would enable us to identify if projects performed for the same company were at different sites, nor did it include information on the specific measures installed. Therefore, the sampling process was iterative. From the extract, we completed the final primary and backup samples by selecting projects of interest and asking Avista for additional data that we received and used to determine how many and what types of projects were at various locations.

We also found that the database extract provided program-level data, but not measure-level information. Therefore, we attempted to verify savings for every incented measure at each site, regardless of whether it achieved gas or electric savings. We were unable to determine whether we evaluated an accurate distribution of measure types within each program. That type of distribution would have required an exhaustive review of project files, which was not within the scope of the evaluation.

3.2.2. Data Collection

Cadmus collected data from 22 metering sites and 120 on-site verifications. For each, we first conducted a document review to determine measure type, quantity, operational parameters, and calculation methodology.

Document Review

Avista provided Cadmus with documentation of the energy-efficiency projects undertaken at the sample sites. We reviewed program forms, the tracking database, audit reports, and savings calculation work papers for each rebated measure. In our review of calculation spreadsheets and energy simulation models relevant to the evaluation effort, we paid particular attention to calculation procedures and documentation for savings estimates.

Cadmus reviewed each application for the following information:

- ***Equipment being replaced:*** descriptions, schematics, performance data, and other supporting information.
- ***New equipment installed:*** descriptions, schematics, performance data, and other supporting information.
- ***Savings calculation methodology:*** methodology used, specifications of assumptions and sources for these specifications, and correctness of calculations.

Short-Term and Long-Term Metering

Cadmus performed short-term (two weeks) metering for projects within the nonresidential electric portfolio. We installed power meters and light loggers to obtain operational data to inform energy-savings estimates. The metering and analysis requirements were specific to the measure category.

Site Visits

Cadmus performed on-site visits to verify measure installations, collect primary data to calculate savings impacts, and interview facility staff.

We accomplished three primary tasks during the on-site visits:

1. We verified the implementation status of all measures for which customers received incentives. We verified that the energy-efficiency measures were installed correctly and still functioned properly, and also verified the operational characteristics of the installed equipment, such as temperature setpoints and operating hours.
2. We collected the physical data, such as cooling capacity or horsepower, and analyzed the energy savings realized from the installed improvements and measures.
3. We conducted interviews with facility personnel to obtain additional information on the installed system to supplement data from other sources.

3.2.3. Engineering Analysis

The prescriptive programs and the Site-Specific Program required significantly different methods of analysis.

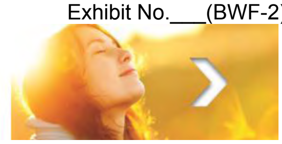
Overview

Our procedures for verifying savings through an engineering analysis depended on the type of measure being analyzed. The analytical methods included in this evaluation are listed below and described in the following sections:

- Prescriptive deemed savings
- Short-term metering
- Billing analysis
- Calculation spreadsheets
- Energy simulation modeling

Prescriptive Deemed Savings

For most prescriptive measures, Cadmus verified the deemed savings estimates that Avista used. We focused our verification activities on the installed quantity and equipment nameplate data and on the proper installation of equipment and operating hours. Where appropriate, we used data from site verification visits to re-analyze prescriptive measure savings using Avista's Microsoft Excel® calculation tools, ENERGY STAR calculation tools, RTF deemed savings, and other secondary sources.



Short-Term Metering

Depending on the site and measure, Cadmus determined whether short-term metering (over a period of two weeks) or long-term metering (over a period of several months) would be most effective for achieving precision in that particular project's energy-saving calculations. Specific metering details for each measure category are discussed in the Results and Findings section. The installed metering equipment encompassed:

- HOBO light loggers for 12 lighting projects.
- Energy Logger Pros for metering two Energy Smart Grocer projects: anti-sweat heater controls and refrigeration compressors.
- Energy Logger Pros for metering fan usage for one site-specific HVAC cooling project.
- Energy Logger Pros for metering energy use for seven compressed air and industrial process motor projects.

The analysis for each project varied by the measure and metering data obtained.

Billing Analysis

Cadmus analyzed Avista's metered billing data for several site-specific HVAC projects. Using a pre- and post-modeling approach, we developed retrofit savings estimates for each site. This modeling approach accounted for differences in HDDs between years. It also determined savings based on normalized weather conditions, since the actual weather conditions may have been milder or more extreme than the TMY3 15-year normal weather averages from 1991-2005 obtained from the NOAA.

We also obtained daily weather data from NOAA for each weather station associated with the participant projects, then calculated the base 65 reference temperature HDDs. We matched the participant billing data to the nearest weather station by ZIP code, then matched each monthly billing period to the associated base 65 HDDs.

We followed a modified PRISM approach when developing the analysis models, which normalized all dependent and independent variables for the days in each billing period and allowed for model coefficients to be interpreted as average daily values. We used this methodology to account for differences in the length of billing periods. For each project, we modeled the ADC in kWh as a function of some combination of average standing base load, HDDs, and (where appropriate) daily consumption.

For each site, Cadmus estimated two demand models: one for the pre-period and one for the post-period. We chose this methodology over a single standard treatment effects model to account for structural changes in demand that might have occurred due to retrofits.

Cadmus calculated three scenarios after estimating model coefficients for each site. First, we estimated a reference load for the previous 12 billing cycles using the pre-installation period model. This scenario extrapolated the counterfactual consumption, which is what the consumption would have been in absent the program. We calculated the energy savings as the difference between the counterfactual scenario and the actual consumption.

Cadmus then estimated two normalized scenarios: one using the pre-model, and one using the post-model. We used 15-year TMY3 data in both scenarios as the annual HDD and mean annual values for the usage data. The difference between these two scenarios represents the long-term expected annual savings.

Calculation Spreadsheets

Avista developed calculation spreadsheets to analyze energy savings for a variety of measures, including building envelope measures such as ceiling and wall insulation. Calculation spreadsheets require input of relevant parameters such as square footage, efficiency value, HVAC system details, and location details. Avista programmed algorithms that estimate energy savings from these data. For each spreadsheet, we reviewed the input requirements and output estimates and determined if the approach was reasonable.

Energy Simulation Modeling

Avista determined savings for many site-specific HVAC and shell projects with energy simulation modeling, choosing eQuest software because of the complex interactions between heating and cooling loads and the building envelope. Avista provided the original energy simulation models, which we reviewed to determine the relevant parameters and operating details (such as temperature setpoints) for the applicable measure. We updated the models as necessary based on our site verification data.

3.3. Results and Findings

3.3.1. Overview

Cadmus adjusted gross savings estimates based on our evaluated findings. Further details by program are discussed in the following sections.

For most projects, the documentation was readily available and the measures performed close to expectations. However, some project files contained excessive documentation. In certain cases, projects evolved over time based on participant capital availability and interest level. These project files often included the different iterations of project development, but did not clearly identify the final reported project energy savings and analysis documentation. Cadmus contacted the participants regarding these measures, but the lack of clarity sometimes caused them to be confused and dismayed.

3.3.2. Prescriptive

Cadmus evaluated savings for a sample of sites across eight prescriptive programs and the Renewables program. Table 69 and Table 70 show our evaluated results by program. Specific evaluation details are described in each program subsection below.

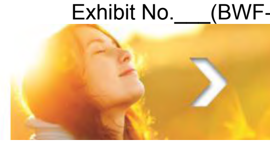


Table 69. Evaluated Results for Nonresidential Prescriptive Sample - Combined States

Program	Number of Measure Installations	Evaluated Sample	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Prescriptive Commercial Clothes Washer	2	0	N/A	N/A	N/A
Prescriptive Commercial Windows and Insulation	97	3	1,866	1,168	63%
Prescriptive Food Service	154	3	11,136	16,470	148%
Prescriptive Green Motors Rewind	35	1	2,254	1,376	61%
Prescriptive Lighting	4,784	19	3,150,101	2,582,336	82%
Prescriptive Motor Controls HVAC	24	3	1,069,027	1,035,447	97%
Prescriptive PC Network Controls	3	1	21,000	0	0%
Prescriptive Standby Generator Block Heater	42	1	1,849	1,849	100%
Renewables	11	0	N/A	N/A	N/A
Total	**5,827**	**31**	**4,257,233**	**3,638,646**	**85%**

Table 70. Evaluated Results for Nonresidential Prescriptive Sample – Washington Only

Program	Number of Measure Installations	Evaluated Sample	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Prescriptive Commercial Clothes Washer	2	0	N/A	N/A	N/A
Prescriptive Commercial Windows and Insulation	74	1	207	207	100%
Prescriptive Food Service	114	3	11,136	16,470	148%
Prescriptive Green Motors Initiative	6	0	N/A	N/A	N/A
Prescriptive Lighting	2,978	12	375,747	363,106	97%
Prescriptive Motor Controls HVAC	18	3	1,069,027	1,035,447	97%
Prescriptive PC Network Controls	2	0	N/A	N/A	N/A
Prescriptive Standby Generator Block Heater	36	1	1,849	1,849	100%
Renewables	8	0	N/A	N/A	N/A
Total	**3,238**	**20**	**1,457,966**	**1,417,079**	**97%**

Overall, the prescriptive programs' analysis achieved a level of 90/17 confidence and precision. Cadmus identified several necessary adjustments to the reported savings for the prescriptive programs. We note that these calculations often rely on reported equipment and operations data, which may vary from the parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 10%. Typical adjustments were to correct equipment efficiency, fuel type, operating schedules, and/or operating parameters as described below:

- Cadmus used lighting logging and verification data to confirm or adjust operating hours for lighting projects. These adjustments, in addition to those made from verified fixture counts, reduced or increased energy savings by varying amounts.
- Avista implementation staff made a data entry error on one census-level lighting project. The calculation workbook listed 646 baseline fixtures listed instead of 64. This data entry error significantly overestimated baseline consumption, and the resulting realization rate was 3%. However, Avista paid the correct incentive for the project.
- One motor controls HVAC project was provided with incentives for two pump VFDs. One of the pumps was redundant, as only one is operating at any given time. The realization rate for this project was 50%.
- One food service equipment refrigerator had a larger volume than reported, which increased savings. The resulting realization rate was 157%.
- Cadmus evaluated one PC network controls project. The participant installed the system in 2009 and applied for an incentive in December 2009. The project files show that Avista was still attempting to obtain output reports from the control system to verify savings during 2011 and 2012. The incentive was approved in early 2012. Cadmus contacted the facility in October 2012, but learned the participant had deactivated the PC network control system. As a result, we did not assign any savings for this project.

3.3.3. Energy Smart Grocer

Cadmus performed on-site or metering visits at 26 Energy Smart Grocer Program projects, which represented a mixture of refrigeration case lighting and refrigeration equipment measures. We calculated an overall realization rate for all projects in Idaho and Washington, then we applied the resulting realization rate to the savings for each state. Table 71 lists the two measure types we evaluated and the number of projects and reported savings. Table 72 shows our evaluated results for the program.

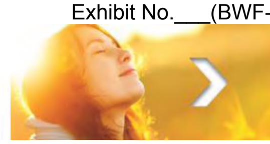


Table 71. Energy Smart Grocer Program Measure Types and Projects Evaluated

Measure Type	Idaho		Washington		Total	
	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)
Case Lighting	2	88,535	9	24,012	11	112,547
Industrial Process	6	477,441	8	972,020	14	1,449,461
Total	**8**	**565,976**	**17**	**996,032**	**25**	**1,562,008**

Table 72. Evaluated Results for Nonresidential Energy Smart Grocer Program Sample

State	Total FY12-13 Measure Installations	Evaluated Sample	Gross Reported Sample Savings (kWh)	Gross Evaluated Sample Savings (kWh)	Sample Realization Rate
Idaho	191	8	565,976	503,604	89%
Washington	485	17	996,032	1,012,166	102%
Total	**676**	**25**	**1,562,008**	**1,515,770**	**97%**

Overall, the Energy Smart Grocer analysis achieved a level of 90/5 confidence and precision. Cadmus identified several necessary adjustments to the reported savings for the Energy Smart Grocer Program. We note that these calculations often rely on reported equipment and operations data, which may vary from the parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 5%. Typical adjustments were to correct equipment efficiency, operating schedules, and/or operating parameters as described below:

- At one large site, we found that floating head pressure controls were not enabled on the medium temperature rack. Energy management system (EMS) data showed the controls had not been in operation for at least three weeks, the limit of the EMS trending history. The reduction in energy savings resulted in a 51% realization rate.
- Cadmus applied a PECI benchmarking work paper[46] to evaluate savings for several doors added to medium temperature walk-in cases. The adjustment resulted in a decrease in electricity savings, for a realization rate of 50%.
- Cadmus found variation in actual installed LED case lighting quantities during site visits at two retail chain stores. The stores installed fewer low output LED case lights and more high output LED case lights than reported. This increased savings, and the resulting realization rate was 112%.

[46] http://rtf.nwcouncil.org/meetings/2011/0830/WP_PECIREF_CA%20DRAFT.pdf.

3.3.4. Site Specific

Cadmus performed site visits for 84 projects, which represent a variety of measure types. Cadmus calculated an overall realization rate for all projects in Idaho and Washington, then we applied the resulting realization rate to the savings for each state. Table 73 lists the different measure types we evaluated, as well as the number of projects and reported savings. Table 74 shows our evaluated results for the program.

Table 73. Site-Specific Measure Types and Projects Evaluated

Measure Type	Idaho		Washington		Total	
	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)
Site-Specific HVAC	10	1,345,068	20	4,708,338	30	6,053,406
Site-Specific Lighting	8	1,990,605	17	6,766,338	25	8,756,943
Site-Specific Other	4	3,460,866	16	2,864,862	20	6,325,728
Site-Specific Shell	5	149,317	5	359,772	10	509,089
Total	**27**	**6,945,856**	**58**	**14,699,310**	**85**	**21,645,166**

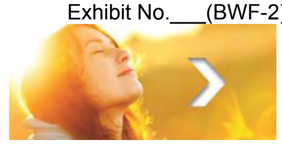
Table 74. Evaluated Results for Nonresidential Site-Specific Sample

State	Total FY12-13 Measure Installations	Evaluated Sample	Gross Reported Sample Savings (kWh)	Gross Evaluated Sample Savings (kWh)	Sample Realization Rate
Idaho	214	27	6,945,856	7,401,914	107%
Washington	434	58	14,699,310	14,024,358	95%
Total	**648**	**85**	**21,645,166**	**21,426,272**	**99%**

Overall, the Site-Specific Program achieved a level of 90/10 confidence and precision. Cadmus identified many adjustments to Site-Specific Program project reported savings. Site-specific projects tend to be more complex, with energy savings parameters and impacts that are more difficult to estimate. In addition, the calculations often rely on participant-supplied building, equipment, and operations data, which may vary from parameters identified during an on-site verification visit.

In aggregate, the adjustments noted by Cadmus increased savings by 1.5%, driven primarily by the high realization rate for lighting projects.

Typical adjustments made to the savings values included corrections to equipment efficiency, operating schedules, temperature setpoints, and building parameters. Cadmus also identified errors in simulation models and calculation estimates, which resulted in adjustments. Specific adjustments are identified by major measure category below.



Site-Specific HVAC Adjustments

- Cadmus determined that Avista overestimated cooling savings for one project. We applied an equivalent full load hours algorithm supported by RTF analysis. This resulted in lower savings, for a realization rate of 41%.
- Avista adjusted the furnace calculator on a project to calculate heat pump savings, but resulting values were too high. The result appears to account for the per-unit consumption instead of energy savings. Cadmus benchmarked results against ENERGY STAR, and used the more conservative value. This led to a 14% realization rate.
- Cadmus conducted a utility billing analysis on one small heat pump project, which revealed no electricity savings resulting from the project and resulted in a realization rate of 0%.
- The heating load appeared to have been overestimated on two large, partially-occupied, multifamily new construction projects. The utility billing data showed an average 65% of expected consumption when normalized to full occupancy.
- Cadmus engineers found issues with simulation modeling by one contractor on four projects. The models had an excessive portion of simulation hours outside of the throttling range. The unmet load hours outside the throttling range indicate zones in the model, which do not receive sufficient heating or cooling. This value should be less than 5% (as recommended by the U.S. Green Building Council's Leadership in Energy and Environmental Design). Larger values call the integrity of the model into question. These four evaluated projects had unmet load hour issues ranging from 10.36% to 99.9% for any system zone outside throttling range. However, the contractor had calibrated the models to the utility billing data. Overall, the energy savings and model energy consumption appeared to be within a reasonable range. An example of the issue from an eQuest simulation output file is shown in Figure 18.

Figure 18. eQuest Output File Showing Throttling Range Issue

```
Sloan Part 2                                                    DOE-2.2-47d   12/08/2010    9:10:30  BDL RUN  1

REPORT- BEPS Building Energy Performance                                      WEATHER FILE- Spokane      WA TMY2
---------------------------------------------------------------------------------------------------------------

                        TASK     MISC    SPACE    SPACE    HEAT    PUMPS    VENT   REFRIG  HT PUMP  DOMEST    EXT
              LIGHTS   LIGHTS    EQUIP  HEATING  COOLING  REJECT   & AUX    FANS  DISPLAY  SUPPLEM  HOT WTR  USAGE    TOTAL
              ------   ------   ------  -------  -------  ------  ------  ------  -------  -------  -------  -----   ------

EM1  ELECTRICITY
   MBTU       1152.2      0.0   1353.1     17.2    321.6     0.0    58.6  1426.4      0.0      0.0      0.0    0.0   4329.2

FM1  NATURAL-GAS
   MBTU          0.0      0.0      0.0   5509.6      0.0     0.0     0.0     0.0      0.0      0.0    156.4    0.0   5666.1
              ======   ======   ======  =======  =======  ======  ======  ======  =======  =======  =======  =====   ======

   MBTU       1152.2      0.0   1353.1   5526.9    321.6     0.0    58.6  1426.4      0.0      0.0    156.4    0.0   9995.3


      TOTAL SITE ENERGY       9995.27 MBTU     92.0 KBTU/SQFT-YR GROSS-AREA     92.0 KBTU/SQFT-YR NET-AREA
      TOTAL SOURCE ENERGY    18653.63 MBTU    171.7 KBTU/SQFT-YR GROSS-AREA    171.7 KBTU/SQFT-YR NET-AREA

      PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 54.1
      PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0

      NOTE:  ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.
```

Site-Specific Lighting Adjustments

Cadmus evaluated a non-census sample of site-specific lighting projects using a combination of light logging and verification data. On average, the results indicated reasonable reported values, and the measure category had a realization rate of 98%.

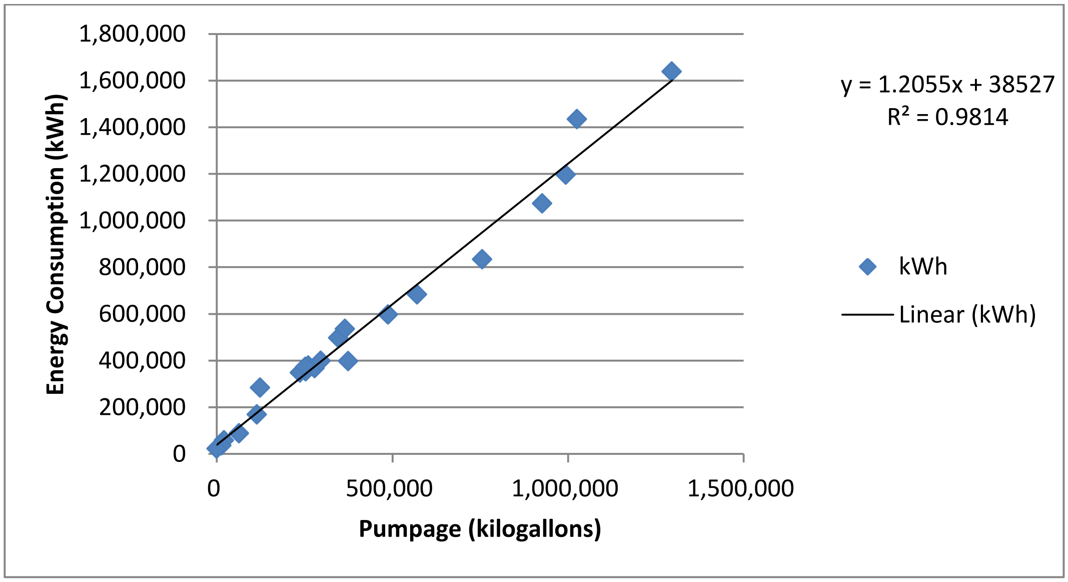
- Cadmus evaluated the largest project (with 2,857,210 kWh of reported savings) through extensive verification and light logging. The evaluated results were nearly identical to Avista's reported values, resulting in a 100.5% realization rate.
- On one hotel project, Avista assumed 25 operating hours per week for wall sconces. Light logging revealed that the fixtures were never turned off. This increased the baseline and retrofit energy consumption. Therefore, it also increased energy savings, resulting in a 306% realization rate.
- On one small new construction project, the installed lighting power density exceeded code requirements, therefore no savings could be achieved and the realization rate was 0%.

Site-Specific Other Adjustments

- Cadmus found that Avista applied an incorrect baseline for a refrigerated dryer on a compressed air application. The baseline listed a desiccant dryer, which would actually consume far more energy than Avista estimated. The refrigerated dryer is the industry standard, and typically represents the baseline. Thus, no savings were achieved for this project.

We identified issues with the calculations for a census-level project for a water pump replacement at one station. The participant reported savings using the change in efficacy (kilogallons pumped per kWh) across four stations. The baseline was difficult to define because the retrofit station shares its Avista utility meter with another station. However, that station's impact was not included in efficacy calculation. Each station's pumpage varied considerably between baseline and retrofit conditions. The retrofit station pumped much more during the post-installation period than the baseline period. A linear regression (Figure 19) showed a strong correlation between retrofit pumpage and energy consumption. Based on our analysis, we determined the project should achieve at least the reported level of savings, and evaluated the savings at the reported level for a 100% realization rate.

Figure 19. PY 2011-PY 2012 Retrofit Monthly Pumpage vs. Electric Consumption



- Cadmus metered two industrial process motor projects and one compressed air project, and accepted Avista's metering data for baseline energy consumption. Our metering data indicated lower retrofit energy consumption than Avista's retrofit data. This would increase energy savings. We compared the production data for both periods, and could not reconcile the difference in energy consumption based on that data. We therefore combined the Avista and Cadmus retrofit metering data to establish the normalized retrofit energy consumption. The realization rate for these three projects was 86%.
- Cadmus adjusted savings for a small refrigeration circulation pump project to match actual operating hours. This resulted in a reduction in energy savings, with a realization rate of 33%.
- Cadmus evaluated the remaining site-specific other projects using a combination of utility billing and verification data. On average, the results indicated the achieved energy savings were slightly less than the reported values.

Site-Specific Shell Adjustments

- One shell project had low evaluated savings based on the initial calculation methods. Avista funded the switch from electric resistance to natural gas heating, but did not update the shell calculator with new fuel, and calculated shell savings in terms of electricity. The resulting realization rate was 35%.
- Cadmus performed a site visit at one school with two site-specific shell projects. We found that the site turned off their HVAC system completely during the summer months when school was not in session. The Avista energy-savings estimate relied on the assumption that air conditioning would operate during the summer months. The required an adjustment to reduced energy savings, with a resulting realization rate of 34% for both projects combined.

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Cadmus evaluated the remaining site-specific shell projects using verification data with the applicable Avista savings calculators. In general, Cadmus found the reported shell quantities and properties did not vary much from verified values, and the savings calculators produced reasonable results. The remaining results indicated that the achieved energy savings were equal to the reported values.

3.3.5. Extrapolation to Program Population

For our evaluation of the nonresidential electric programs, we selected sites that could provide the most impactful information. We designed the site visits to achieve a statistically valid sample for the major strata, as discussed previously. For measures in the random (non-census) sample, we calculated realization rates (the ratio of claimed-to-verified savings) and applied these to the remaining non-sampled sites. We did not apply measure-level realization rates to the census population. These realization rates are weighted averages, based on the random verification sample and using the following four equations.

We calculated realization rates for each individual site in the sample based on measure type:

$$RR_{ij} = \frac{Verified_{ij}}{Claimed_{ij}};\ for\ measure\ j\ at\ site\ i$$

Where:

RR	=	realization rate
i	=	sample site
j	=	measure type

Then we calculated the realization rates for the measure types using the ratio of the sum of verified savings to the sum of claimed savings from the randomly selected sample for each measure type:

$$RR_j = \frac{\sum_i Verified_i}{\sum_i Claimed_i};\ for\ measure\ j\ across\ all\ sample\ sites$$

We calculated the population verified savings for non-census projects by multiplying the measure type realization rate from the random sample by the claimed savings for the non-census population of each measure type:

$$\sum_k Verified_k = RR_j x \sum_k Claimed_k;\ for\ measure\ j\ across\ all\ sites\ in\ measure\ population$$

Where:

k	=	total population for measure type ‘j’

Finally we added the claimed and verified savings from census stratum measures to calculate the total reported and verified savings for each program. The program realization rate is the ratio of all verified to all claimed savings:

$$RR_l = \frac{\sum_k Verified_k}{\sum_k Claimed_k}; \text{ for the population (all sites and measures)}$$

Where:

l = total program population

Cadmus summed these values to determine the total adjusted evaluated savings and program-level realization rates for the programs as a whole and for Idaho and Washington, as shown in Table 75 and Table 76. The overall portfolio gross realization rate was 97%.

Table 75. PY 2012-PY 2013 Electric Gross Program Realization Rates – Combined States

Program	Gross Sample Reported Savings (kWh)	Gross Sample Evaluated Savings (kWh)	Realization Rate*	Gross Program Reported Savings (kWh)	Gross Program Evaluated Savings (kWh)
Prescriptive	4,257,233	3,638,646	95%	6,791,118	6,448,089
Energy Smart Grocer	1,562,008	1,515,770	92%	22,560,559	20,652,917
Site-Specific HVAC	6,053,406	5,229,048	91%	3,367,537	3,053,079
Site-Specific Lighting	8,756,943	9,141,338	110%	9,596,933	10,589,164
Site-Specific Other	6,325,728	6,659,011	100%	4,693,462	4,696,253
Site-Specific Shell	509,089	396,875	78%	82,037	63,954
Total	**27,464,407**	**26,580,688**	**97%**	**47,091,646**	**45,503,456**

* Realization rates vary from the ratio of evaluated to reported savings due to the impact of census-level projects.

Table 76. PY 2012-PY 2013 Electric Gross Program Realization Rates – Washington

Program	Gross Sample Reported Savings (kWh)	Gross Sample Evaluated Savings (kWh)	Realization Rate*	Gross Program Reported Savings (kWh)	Gross Program Evaluated Savings (kWh)
Prescriptive	1,457,966	1,417,079	91%	36,327,974	32,985,879
Energy Smart Grocer	996,032	1,012,166	95%	7,745,984	7,339,802
Site-Specific HVAC	4,708,338	3,976,437	86%	6,749,168	5,786,311
Site-Specific Lighting	6,766,338	6,709,814	110%	14,646,188	16,067,671
Site-Specific Other	2,864,862	3,044,525	104%	4,961,496	5,174,412
Site-Specific Shell	359,772	293,582	78%	379,131	295,562
Total	**17,153,308**	**16,453,603**	**96%**	**70,809,941**	**67,649,637**

* Realization rates vary from the ratio of evaluated to reported savings due to the impact of census-level projects.

3.4. Nonresidential Conclusions

Cadmus evaluated 142 of 6,476 measures installed through the programs, representing 16% of reported savings.

In general, Cadmus determined that Avista implemented the programs well. The overall portfolio achieved a 96% realization rate when comparing gross evaluated savings to gross reported savings.

Cadmus identified the following key issues that led to adjusted energy savings:

- Metering on several industrial process measures indicated that post-installation power consumption was lower or higher than expected, which increased or decreased energy savings respectively.
- Some participants did not operate the incented equipment correctly or did not complete the improvements expected for the measure.
- Some participant post-installation heating or cooling loads did not achieve the level of projected consumption.
- Simulation models sometimes did not accurately represent the actual as-built building or system operation.
- Avista implementation staff sometimes may not have conducted a thorough analysis of energy-savings calculations provided by participants or third-party contractors for all projects.
- Avista implementation staff sometimes made errors on some projects in entering data to characterize building or measure performance.

Cadmus also found one implementation issue that affected the impact evaluation. One PC network controls project was installed in 2009, but did not provide the final data demonstrating a reduction in consumption until 2012. Avista paid the incentive in 2012, but the participant reported deactivating the system soon after.

3.5. Nonresidential Recommendations

Cadmus recommends that Avista continue to offer incentives for measure installation through the evaluated programs. We have the following recommendations for improving program energy-savings impacts and evaluation effectiveness:

- Create a quality control system to double-check all projects with savings over 300,000 kWh.
- Consider working with participants to accelerate the process of claiming energy savings and paying the project incentive. Preferably this should happen within one year of measure installation, depending on Avista's requirements for post-installation data on the particular project.
- Continue working with participants to conduct metering on baseline conditions in cases of high uncertainty.
- Avista may want to consider tracking and reporting demand reduction to better understand measure load profiles and peak demand reduction opportunities.
- Update prescriptive measure assumptions and sources on a regular basis.
- Streamline its file structure to enable reviewers more easily identify the latest documentation.
- Continue to perform follow-up measure confirmation and/or site visits on a random sample of projects (at least 10%).
- Consider flagging sites for additional scrutiny when the paid invoice does not include installation labor.
- Avista may consider adding a flag to their tracking database to automatically calculate the unit of energy savings per dollar (kWh/$ or therm/$) to provide a quick check to identify extreme outliers.
- In the case of redundancy, Avista may want to consider incenting pump projects through the Site-Specific Program to more accurately characterize the equipment operating hours.
- Avista may want to adopt modeling design guidelines to set minimum standards. The Energy Trust of Oregon provides an example on their website: http://energytrust.org/commercial/incentives/construction-renovation-improvements/custom/modeled-savings.

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4. Low Income Impact Evaluation

4.1. Introduction

Cadmus conducted a statistical billing analysis to determine evaluated savings and realization rates for energy-efficient measures installed through the low-income weatherization program in 2012. We examined energy savings at the household or participant level, rather than at the measure level. Cadmus performed billing analysis on 2012 participants who had full years of energy consumption data, before (2011) and after (2013) the weatherization period. Then we applied 2012 billing analysis results to 2013 participants to report evaluated savings across both program years.

To estimate energy savings resulting from the program, Cadmus used a pre- and post-installation, combined CSA and a PRISM approach, using monthly billing data. We analyzed energy-savings estimates for program participants and ran a series of diagnostic tests on the data. These tests included reviewing savings by pre-consumption usage quartile, ensuring households have a sufficient amount of billing data, and conducting a graphical outlier analysis. A detailed discussion of the regression model used for this billing analysis is outlined below, accompanied by resulting savings.

4.1.1. Program Description

Five components, listed in Table 77, are included in the low-income weatherization Program. Local Community Action Partners (CAPs) within Avista's Washington service territory implement the projects. CAPs holistically evaluate homes for energy-efficiency measure applicability, combining funding from different utility and state/federal programs to apply appropriate measures to a home, based on the results of a home energy audit.

Table 77. Low-Income Weatherization: 2012-2013 Electric-Efficiency Installations by Component*

Low-Income Program Component	Measure Description	Measure Installations
Shell/Weatherization	Insulation, window/door, air infiltration, programmable thermostat	309
Fuel Conversion*	Electric furnace, heat pump or water heater replacement	289
Hot Water Efficiency	High-efficiency water heater replacement	20
ENERGY STAR Appliance	High-efficiency refrigerator replacement	90
HVAC Efficiency	High-efficiency heat pump replacement, variable speed motor	7

*The Avista portfolio considers (and reports) fuel conversion measures as electric-saving measures.

4.2. Data Collection and Methodology

Cadmus obtained impact evaluation data from multiple sources, including:

- ***Program participant database***: Avista provided information regarding program participants and installed measures. Specifically, these data included a list of measures installed per home and the reported savings from each completed installation. The data did not, however, include the quantity of measures installed (such as the total square feet of installed insulation) or per-unit savings estimates.
- ***Billing records***: Avista provided participant meter records from January 2011 through December 2013.
- ***Weather data***: Cadmus collected Washington weather data from NOAA for six representative stations, drawn for the corresponding time period.

4.2.1. Sampling

Cadmus began the analysis with a census of 2012 program participants. We then screened the 2012 program participant data by specific criteria (e.g., had sufficient monthly billing data, was not classified as an outlier) for use in the final analysis. In all, 82 Washington participants were included in the billing analysis: 43 non-conversion and 39 conversion participants. Cadmus defined a conversion customer as any participant who received a new gas furnace or water heater.

4.2.2. Billing Analysis

Avista provided monthly billing data for all participants, from January 2011 through December 2013. Avista also provided the participant database, which contained participation and measure data for the 2012 and 2013 program years, detailing all gas and electric measures installed per home by CAPs.

Cadmus obtained daily average temperature weather data from 2011 to 2013 for the six NOAA weather stations, representing all 2012 electric participant ZIP codes in Avista's Washington territory. From daily temperatures, we determined base 65-degree HDDs and CDDs for each station, then matched billing data periods with the HDDs and CDDs from the station closest to each participant.

As we received billing data through December 2013, we could only perform the billing analysis for the 2012 program year. We defined the analysis pre-period as 2011, before all participation installations occurred, and defined the analysis post-period as 2013, following all installations occurring in 2012. We then applied the analysis results for 2012 participants to the 2013 participant population, thus reporting overall impacts across the 2012 and 2013 program years.

To estimate energy savings from this program, Cadmus used a pre/post CSA fixed-effects modeling method using pooled monthly time-series (panel) billing data. This modeling approach corrected for differences between pre- and post-installation weather conditions, as well as for differences in usage consumption between participants (as the model included a separate intercept for each participant). The modeling approach ensured that model savings estimates would not be skewed by unusually high-usage or low-usage participants.

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4.3. Data Screening and Modeling Approach

Cadmus conducted a series of steps to screen participant usage data, ensuring a clean, reliable dataset for analysis.

4.3.1. General Screens

Cadmus used the following screens to remove accounts that could have skewed the savings estimation:

- Accounts with fewer than three months (90 days) of billing data, in either the pre- or post-period.
- Accounts with annual usage outside of reasonable bounds in either the pre- or post-period (less than 1,000 kWh or more than 50,000 kWh).
- Accounts that change electric usage from the pre- or post- period by more than 90% (unless for a conversion project).[47]

4.3.2. Weather Normalization Screens

To screen the data, Cadmus used PRISM-like models for weather-normalizing pre- and post-billing data for each account, and to provide an alternate check on measure savings obtained from the CSA model. For more detail on the model specification, see Appendix E: Low-Income Weatherization – Billing Analysis Model Specification.

Table 78 and Table 79 summarize non-conversion and conversion account attrition, respectively, from the screens listed above.

[47] Changes in usage of this magnitude are probably due to vacancies, home remodeling or addition, seasonal occupation, or fuel switching. Changes of usage over a certain threshold are not expected to be attributed to program effects and can confound the analysis of consumption.

Table 78. Low-Income Weatherization: Non-Conversion Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original Electric Accounts	89	100%	0	0%
Overlap Participation within Pre- or Post- Periods	69	78%	20	22%
Matched to Billing Data Provided	69	78%	0	0%
Insufficient Pre- and/or Post-Period Months	54	61%	15	17%
Insufficient Pre- and/or Post-Period Days	53	60%	1	1%
Low or High Usage in Pre- or Post-Period	53	60%	0	0%
Changed Usage Between Pre- to Post-Periods (> 90%)	52	58%	1	1%
PRISM Screen: Low R-Squared, Low Heating Usage	52	58%	0	0%
Account-level inspection of pre/post 12-month usage (e.g., vacancies, anomalies)	43	48%	9	10%
Final Analysis Group	**43**	**48%**	**46**	**52%**

Table 79. Low-Income Weatherization: Conversion Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original Electric Accounts	72	100%	0	0%
Overlap Participation within Pre- or Post- Periods	49	68%	23	32%
Matched to Billing Data Provided	49	68%	0	0%
Insufficient Pre- and/or Post-Period Months	44	61%	5	7%
Insufficient Pre- and/or Post-Period Days	44	61%	0	0%
Low or High Usage in Pre- or Post-Period	44	61%	0	0%
Changed Usage Between Pre- to Post-Periods (> 90%)	43	60%	1	1%
PRISM Screen: Low R-Squared, Low Heating Usage	43	60%	0	0%
Account-level inspection of pre/post 12-month usage (e.g., vacancies, anomalies)	39	54%	4	6%
Final Analysis Group	**39**	**54%**	**33**	**46%**

4.3.3. Conditional Savings Analysis Modeling Approach

To estimate energy savings from this program, Cadmus used a pre/post CSA fixed-effects modeling method, which uses pooled monthly time-series (panel) billing data. The fixed-effects modeling approach corrects for differences between pre- and post-installation weather conditions, as well as for differences in usage consumption between participants with a separate intercept for each participant. This modeling approach ensured that model savings estimates are not skewed by unusually high usage or low usage participants. We used the following model specification to determine program-level savings. For more detail on the model specification, see Appendix E: Low-Income Weatherization – Billing Analysis Model Specification.

4.4. Results and Findings

This section presents the evaluated savings for the program derived from the billing analysis. Several detailed tables are presented to contextualize the impacts evaluated using billing analysis, including measure distributions and some benchmarking comparisons.

4.4.1. Billing Analysis Results

Table 80 summarizes model savings results for electric non-conversion and conversion participants of the low-income weatherization program.

Table 80. Electric Model Savings Summary

Participant Type	n	PRENAC	Change in Consumption (kWh)	Savings as Percent of Pre-Usage	Relative Precision at 90%	Savings Lower 90% (kWh)	Savings Upper 90% (kWh)
Non-Conversion	43	15,865	3,504	22%	±37%	2,223	4,785
Conversion	39	18,951	10,397	55%	±13%	9,034	11,760

The model savings averaged 3,504 kWh for each non-conversion participant and 10,397 kWh for each conversion participants. In this analysis, Cadmus determined an overall conversion estimate instead of equipment-specific estimates due to the small sample size of furnace-only and water heater-only participants at the state level. The precision estimates are 37% and 13% for non-conversion and conversion models, respectively.

Table 81 provides a distribution of the electric measures in the final model that Avista funded for participants. This distribution reveals a slightly different mix of measures for the two participant groups. Specifically, non-conversion participants had slightly higher percentages of refrigerator replacement and shell measures (e.g., doors, windows, wall insulation). Conversion participants had slightly higher percentages of air infiltration.

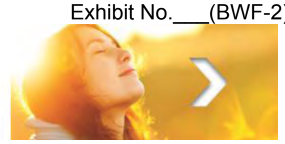


Table 81. Measure Distribution of Final Model Sample by Participant Type

Measures	Non-Conversion		Conversion	
	Count	Percent	Count	Percent
Air infiltration controls	30	70%	32	82%
Windows	14	33%	7	18%
Doors	17	40%	7	18%
Floor Insulation	23	53%	23	59%
Attic Insulation	19	44%	16	41%
Duct Insulation	1	2%	2	5%
Water heater replacement	4	9%	1	3%
Wall Insulation	8	19%	4	10%
T-stat (No AC)	0	0%	4	10%
Refrigerator replacement	16	37%	8	21%
Furnace conversion	0	0%	35	90%
Water heater conversion	0	0%	35	90%
Sample (n)	**43**	**100%**	**39**	**100%**

Statistical billing analysis results encompass all measure installations made at participant households, including those not paid for through Avista's program. Since local CAP agencies use a variety of funding sources to implement the low-income program, it is possible that participant homes received measures paid for by federal, state, and/or other utility dollars. Specifically, Avista does not fund CFLs offered through the program, which likely had a significant impact on the electric savings in participant homes.

4.4.2. Overall Program Results

Table 82 shows the realization rates for Washington low-income weatherization program participants.

Table 82. Low-income Weatherization: Electric Model Realization Rate Summary

Participant Type	n	PRENAC	Model Savings (kWh)	Per Participant Reported Savings (kWh)	Realization Rate	Model Savings as Percent of Pre-Usage	Expected Savings as Percent of Pre-Usage
Non-Conversion	43	15,865	3,504	2,860	123%	22%	18%
Conversion	39	18,951	10,397	7,181	145%	55%	38%

Both participant groups exceeded their expected savings and had realization rates above 100%. There were nine participants during 2013 who received electric resistance to electric heat pump conversions, which were not represented in the billing analysis sample. Cadmus used Avista's listed database savings for the heat pump conversion measures and additional non-conversion measures for these customers. Table 83 presents the overall program population savings separated by participant type and program year.

Table 83. Low-Income Weatherization: Total 2012-2013 Evaluated Program Savings

Participant Type	Year	Total Participants	Model Savings per Participant	Total Evaluated Savings (kWh)	Total Reported Savings (kWh)	Realization Rate
Non-Conversion	2012	89	3,504	250,797	204,701	123%
	2013	83	3,504	155,726	127,104	123%
Conversion	2012	72	10,397	575,332	397,361	145%
	2013	97	10,397	490,673	338,890	145%
Heat Pump Replacement*	2012	1	N/A	5,360	5,360	N/A
	2013	8	N/A	38,350	38,350	N/A
Overall		**350**	**N/A**	**1,516,238**	**1,111,766**	**136%**

* Avista funded high-efficiency electric heat pump replacements that were not included in the billing analysis participant sample (i.e., the one participant from 2012 was removed through screening process). For these measures, Cadmus used the claimed savings values listed in the Avista database.

Cadmus calculated the total program savings by multiplying the modeled realization rates by the claimed *ex ante* savings.

4.5. Comparison to Previous Billing Analysis

The results from the 2012 billing analysis indicate greater energy savings than results from the 2010 billing analysis. Table 84 compares the model results from Cadmus' 2010 and 2012 billing analyses. Both participant groups show increased energy savings and have realization rates greater than 100%.

Table 84. Low-Income Weatherization: Comparison of Model Results by Participant Group and Year

Participant Type	Program Year	n	PRENAC	Model Savings (kWh)*	Average Reported Savings Per Participant (kWh)	Realization Rate	Model Savings as Percent of Pre-Usage	Reported Savings as Percent of Pre-Usage
Non-Conversion	2010	128	14,608	2,099	2,256	93%	14%	15%
	2012	43	15,865	3,504	2,860	123%	22%	18%
Conversion	2010	137	16,449	8,394	10,511	80%	51%	64%
	2012	39	18,951	10,397	7,181	145%	55%	38%

* The models results are not statistically different.

One factor contributing to increased energy savings between the 2010 and 2012 program years is a change in the distribution of electric-saving measures that Avista funded. With the exception of refrigerator replacements, Avista funded a greater number of high energy-saving measures in 2012 than in 2010 for non-conversion participants. Figure 20 shows the percentage of Avista-funded measures for non-conversion participants for both program years.

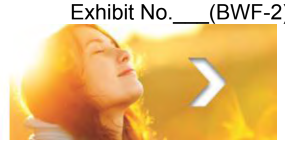
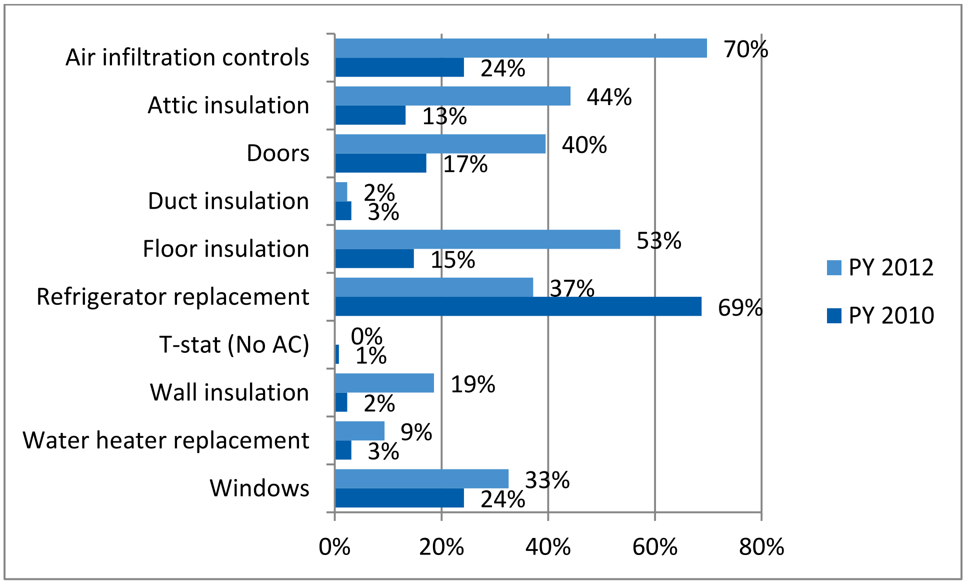


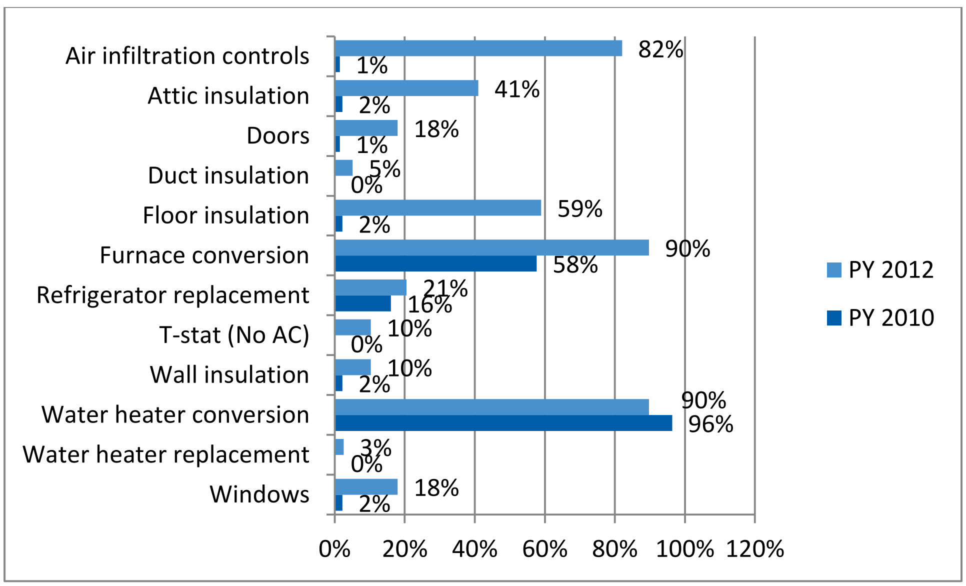
Figure 20. Percent of Installed Measures for Non-Conversion Model Participants by Program Year



The PY 2012 program reveals higher frequencies of shell measures (i.e., insulation, air sealing, doors, and windows) being installed in participant homes than during PY 2010.

A similar trend is observed for conversion participants, as shown in Figure 21.

Figure 21. Percent of Installed Measures for Conversion Model Participants by Program Year



A larger percentage of conversion participants received a furnace conversion in 2012 than in 2010. Additionally, a greater percentage of 2012 conversion participants received a non-conversion shell measures than 2010 conversion participants. For example, 82% of 2012 conversion customers received air infiltration controls, compared to only 1% in 2010.

The realization rates are also substantially higher in 2012 than in previous years. As explained above, there was an increase in the installation of building shell measures during 2012. The difference in realization rates is also partially due to the reported measure-level savings. Table 85 presents a comparison of the average kWh savings between PY 2011 and PY 2012-2013.

Table 85. Comparison of Average Reported Measure-Level Savings Between Program Years*

Measures	PY 2011 (kWh)	PY 2012-2013 (kWh)
Attic insulation	3,329	562
Door	287	333
Duct insulation	760	1,511
Floor insulation	4,137	2,132
Air infiltration controls	1,456	431
Refrigerator replacement	691	533
Wall insulation	3,447	1,694
Water heater replacement	299	115
Window	1,205	1,275
Furnace replacement (conversion)	8,655	3,496
ASHP replacement	N/A	3,645
Water heater replacement (conversion)	5,567	1,586

* These savings values reflect full program years, not the analysis sample

All but three measures experienced a decrease in average reported savings between PY 2011 and PY 2012-2013. The measures with the largest change in reported savings were attic insulation, wall insulation, and both of the conversion measures (furnace replacement and water heater replacement).

An additional factor may account for changes in modeled savings: (1) non-Avista funded measures installed by agencies through the program.

4.6. Benchmarking

To place Avista program savings estimates in context, we compared billing analysis results from other low-income program efforts across the country.[48] This section provides two metrics for comparing Avista's program savings to other similar programs. First, Figure 22 compares the percentage of energy savings, relative to PRENAC, of Avista's program and a number of other low-income weatherization programs, based on electric billing analyses. This metric allows for comparing programs given variation in weather, costs, program delivery, and measure offerings.

48 The comparable studies include Oak Ridge National Laboratory Meta-evaluation of Low-Income Weatherization Programs, Ohio Home Weatherization Assistance Program, People Working Cooperatively Low-Income Weatherization Program in Ohio, Pacific Power Low-Income Weatherization Program in Washington, Rocky Mountain Power Low-Income Weatherization Program in Idaho, Energy Smart low-income program in Oregon, and the Ohio Home Weatherization Assistance Program.

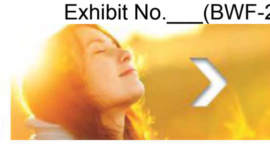
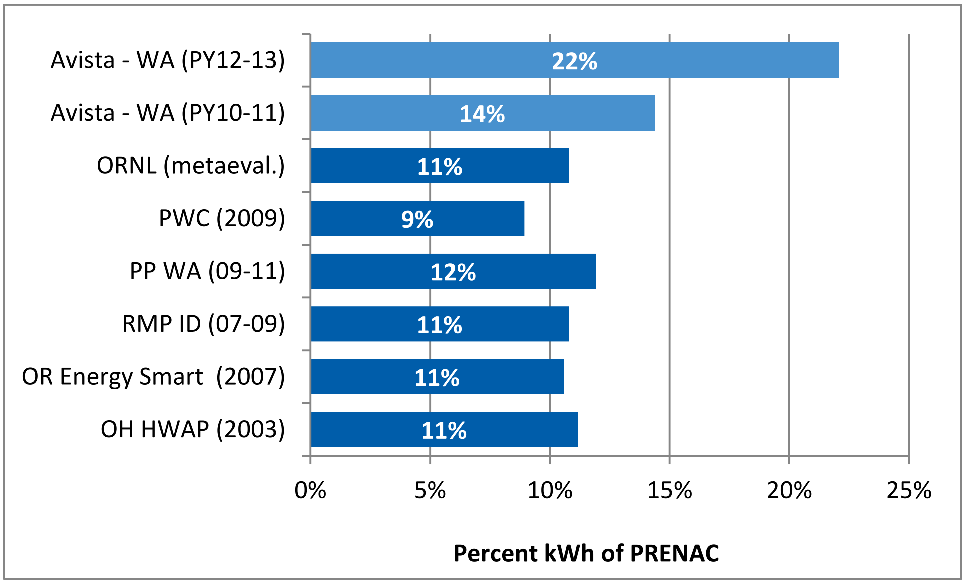


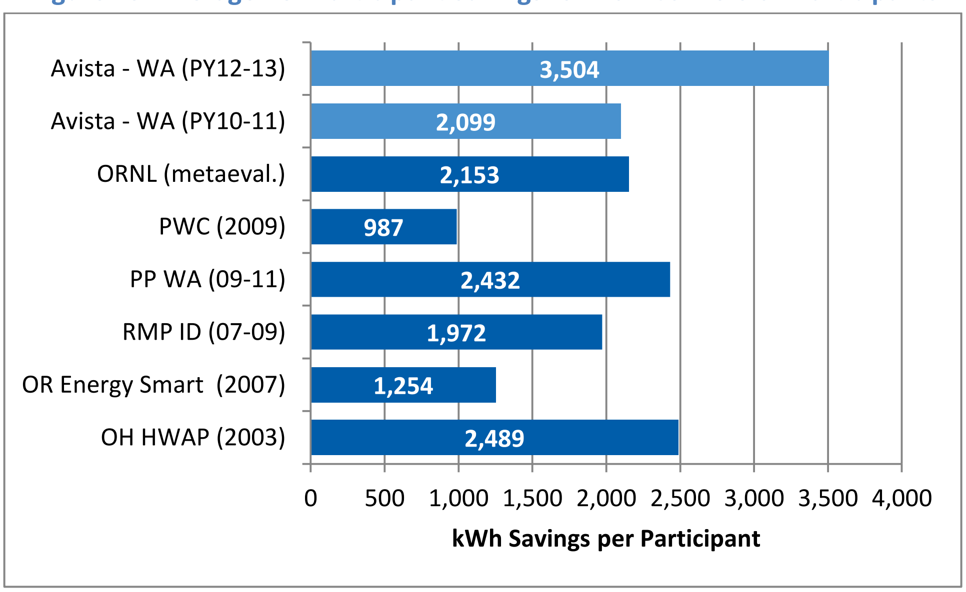
Figure 22. Savings Percentage of Pre-Period Consumption*



*This chart reflects savings for non-conversion participants

Figure 23 presents the absolute energy savings from low-income programs; this is a second metric for comparing Avista's non-conversion results to other programs. Absolute estimates do not use PRENAC, but rather show savings that are directly attributable to the program.

Figure 23. Average Per-Participant Savings for Non-Conversion Participants



4.7. Low Income Conclusions

Compared to PY2010, Avista's low-income program demonstrated an increase in average electric savings per participant, in addition to an increase in overall program realization rate (from 78% to

136%). Several factors may have contributed to the increase in participant savings, including: (1) an increased frequency of installation of high-saving measures (e.g., shell) in the evaluation period, (2) changes in agency delivery protocols or energy-saving installation made with non-utility funding, and (3) exogenous effect (e.g., economic, rate changes) that may have occurred simultaneous to program activity. One factor contributing to higher realization rates are lower average reported savings occurring in the evaluation period compared to previous years.

4.8. Low Income Recommendations

Cadmus recommends the following enhancements in order to improve program impact results:

- ***Use a control or comparison group in future billing analyses***. Cadmus recommends using a comparison group in subsequent impact evaluations to analyze the treatment group of program participants. Use of a control or comparison group of nonparticipants would allow controlling for exogenous factors (e.g., macroeconomic, rate changes, technological trends) that could result in trends that affect consumption. Controlling for these trends using a control/comparison group is a robust and defensible method for estimating accurate energy-savings impacts.
- ***Consider options for increasing analysis sample sizes (such as using combined models with participation of both state programs).*** Smaller sample sizes in state-specific models attributed to decreased precision in the 2012 model estimates. Increasing the sample sizes by using a combined state model in future evaluations will mitigate this cause of decreased precision.
- ***Obtain a full list of weatherization measures from agencies.*** The billing analysis results do not allow Cadmus to disaggregate energy savings specific to Avista-funded measures. In addition, a complete list of participants' installed measures would allow Cadmus to conduct a measure-level billing analysis specific to measure types. This granularity could help Avista improve future program offerings and help fully characterize the energy savings modeled through billing analysis.
- ***Include high-use customers in program targeting.*** While prioritization guidelines for targeting low-income weatherization participants are set at the federal level, some utilities, for targeting purposes, actively track customer usage and provide agencies with lists of customers that have particularly high energy consumption.

  Notably, DOE protocols list high-energy consumption as a factor allowed in participant prioritization. In such cases, along with other targeting criteria (e.g., families with children, senior citizens), agencies may incorporate energy-consumption characteristics into their program participant prioritization. Not only would weatherizing high-use customers likely result in higher energy savings, but could provide these customers with some financial relief for higher energy bills due to their housing characteristics.

  Avista should identify high-usage customers while controlling for factors that contribute to consumption (e.g., square footage, income, numbers of people per household).

  Given reductions in federal funding for weatherization and associated reduced agency capacities resulting in more limited leveraging opportunities, Avista has an opportunity to lead new efforts for the continued delivery of energy-savings resources to low-income residential customers. Potential exists to secure cost-effective energy savings through high-usage targeting, while continuing to support weatherization for income-qualified customers. Efficient targeting balances efforts to provide whole-house weatherization, and allows for leveraging the agency network as a resource for outreach and delivery.

- ***Track and compile additional data from agency audits.*** These data include information on primary and secondary heating and cooling, and on the size of a home. As an inexpensive alternative to gas heat, gas customers may turn to electric room heaters and wood stoves, reducing the impacts of installed weather-sensitive measures (e.g., insulation). Collecting information on customers' primary heating usage during weatherization would lead to more reasonable savings estimates.

  Cadmus recommends that Avista work with CAP agencies to develop explicit, on-site tracking protocols for collecting information on participant heating sources. The CAPs should collect the following information to better inform heating and cooling sources:

  - Visual inspections of all heating equipment found on site;
  - Participant-reported primary and supplemental heating sources used;
  - Quantities of secondary heating, if applicable (e.g., numbers of electric room heaters); and
  - Any indicators suggesting discrepancies between actual and reported primary heating.

- ***Consider performing quantitative, non-energy benefit analyses.*** Cadmus recommends that Avista consider pursuing additional analyses aimed at quantifying non-energy benefits associated with low-income weatherization, applicable to the Total Resource Cost (TRC) test. Specifically, analyses of economic impacts and payment pattern improvements (including reduced arrearages and collections costs) can provide program stakeholders with the monetized value of energy-efficiency measures. Other Northwest utilities have used such analyses to report low-income weatherization cost-effectiveness (in Idaho and Washington). Standard cost-effectiveness TRC testing accounts for all program costs and only includes energy savings as a program benefit. The TRC test omits some non-energy benefits genuinely experienced by participants, such as decreased mortality and morbidity, as well as environmental benefits such as reduced emissions of carbon dioxide and other pollutants listed in the Clean Air Act.

5. CFL Contingency Program

5.1. Introduction

In our previous evaluation,[49] Cadmus estimated the percentage of bulbs installed by the end of calendar year 2011 and provided the savings associated with only these bulbs. This report provides total energy savings achieved by the program in the first year and calculates energy savings for measures installed in 2012 as the difference between the total program savings and evaluated PY 2011 savings.

5.1.1. Program Description

The CFL Contingency Program design was intended to deliver cost-effective, energy-efficiency resources to Avista's residential and small commercial customers, while simultaneously maintaining the flexibility to meet anticipated energy acquisition targets at a lower ratepayer cost.

Starting in July 2011 and continuing through November 2011, Avista sent residences and small businesses within the territory a box of eight ENERGY STAR CFLs of varying sizes, accompanied by literature on the benefits of their use and instructions on proper disposal and bulb placement. Avista also sent customers information about returning the CFLs, at no cost, should they decide not to keep them, and about requesting additional bulbs.

5.2. Methodology

For evaluating the savings achieved by the CFL Contingency Program, Cadmus completed an engineering review, which was based on the previous evaluation analysis, but updated to include recent evaluation results and expected regional decisions.

Six parameters informed the calculation of gross savings for the lighting component:

$$\text{CFL Watts} \times \text{DWM} \times \text{HOU} \times \text{DAYS} \times \text{WHF} \times \text{ISR} = \text{Annual Energy Savings}$$

Where:

CFL Watts	=	Wattage of the mailed ENERGY STAR CFL
DWM	=	The difference in wattage between baseline bulb and the CFL, divided by the wattage of the CFL
HOU	=	Daily lighting operating hours
DAYS	=	Days per year (365)

49 Cadmus. *Avista 2010–2011 Multi-Sector Electric Impact Evaluation Report*. May 2012.

WHF = An adjustment representing the interactive effects of lighting measures on heating and cooling equipment operations

ISR = The percentage of units installed

The annual savings algorithm derived from industry-standard engineering practices, consistent with the methodology used by the Northwest RTF. Discussions of each input follow.

5.2.1. CFL Wattage

This assumption did not change from the previous analysis. The program delivered over 2.3 million CFLs to residential and commercial customers in Avista's territory, with the distribution shown in Table 86. The CFL wattage derived from the weighted average of units delivered to each sector. The residential sector had an average delivered CFL wattage of 18.30, and the commercial sector had an average delivered CFL wattage of 18.25.

Table 86. Total Units of Delivered CFLs by Sector Type

CFL Wattage	Residential	Commercial
13	389,006	18,960
19	55,116	-
20	1,056,786	56,880
23	55,116	-
Total	**1,556,024**	**75,840**

5.2.2. DWM

The DWM assumption did not change from the previous evaluation. Cadmus relied on the RTF (for residential) and the 6th Power Plan (for commercial) to determine the DWM. Adjusting the RTF's residential DWM allowed incorporation of Avista's survey results for the room distribution of installed bulbs. Thus, the DWM for residential installation was updated from the RTF's 2.60 to 2.63.[50] The commercial DWM was 2.70, based on the 6th Power Plan lighting workbook.

This analysis did not account for EISA's potential impact. EISA could only impact the baseline for the 55,116 23-watt CFLs mailed to residential customers in the first round of packages. Survey results suggest that these bulbs achieved the maximum ISR by the end of 2011.

5.2.3. HOU

Cadmus updated the residential HOU assumption to 1.93 for bulbs installed in 2012. This aligns with the current RTF assumptions and with the Simple Steps Smart Savings analysis completed for this evaluation.

50 The RTF DWM represents the 2011 baseline, and does not include federal EISA impacts that started in 2012.

To determine commercial HOU, Cadmus used the 6th Power Plan's documented lighting hours of operating for each building. After gathering building type information from Avista's survey of commercial participants, Cadmus weighted the 10.16 lighting hours from the 6th Power Plan to calculate 10.02 for Avista's commercial HOU. The assumed commercial HOU did not change from the previous analysis.

5.2.4. WHF

The WHF assumption did not change from the previous evaluation. The WHF accounts for changes in annual HVAC energy (lost or gained) due to reductions in facility lighting energy. Cadmus based the WHF on SEEM building models, developed by the Northwest Power and Conservation Council. We used these SEEM building models to estimate the change in HVAC equipment energy use due to a change in lighting technology (e.g., incandescent lamps to CFLs). In general, the models accounted for interactions using load-shape profiles of the HVAC and lighting equipment, based on dwelling occupancy.

The Northwest Power and Conservation Council uses an inherently conservative method that assumes a closed shell (i.e., all interior lamps, including ceiling recessed cans, would be contained in a closed system, hence any heat generated by the bulbs would go into the building). In reality, waste heat could transfer out of the conditioned space.

Cadmus based the residential WHF calculation on Avista's share of electric heating equipment,[51] along with its associated efficiencies and its surveys of interior and exterior distribution. We determined a residential WHF of 89.8%.[52]

Cadmus used the commercial WHF of 85.5% provided in the 6th Power Plan.

5.2.5. ISR

Cadmus updated the ISR assumption. The ISR used in this analysis represents the percentage of bulbs believed to be installed and operating within one calendar year of receiving the CFL package.

In October 2013, the RTF approved an updated *Residential: Lighting — CFLs* workbook.[53] Based on the NEEA RBSA results, the approved workbook assumes a 24% storage rate and 2% removal rate for residential, unsolicited mailed CFLs. The overall first-year ISR is therefore now assumed to be 74.48%.

5.3. *Overall Program Savings*

Cadmus calculated PY 2012 savings by subtracting the PY 2011 evaluated savings, calculated in the previous evaluation, from the total program savings calculated in this evaluation. Table 87 shows achieved annual savings by year and sector.

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51 Saturations of Avista equipment types are based on the 2011 CFL Contingency Program participant surveys.

52 The RTF WHF is 86.4%; the adjusted Avista WHF is 89.8%.

53 http://rtf.nwcouncil.org//measures/measure.asp?id=141.

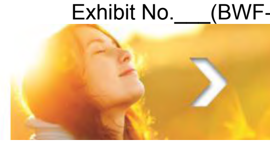

Table 87. CFL Contingency Program Evaluated and Expected Savings by Year

Sector	Total Program Savings (kWh)	PY 2011 Evaluated (kWh)	PY 2012 Evaluated (kWh)
Residential	39,637,362	23,347,564	16,289,799
Commercial	8,715,798	3,826,229	4,889,569
Total	**48,353,160**	**27,173,793**	**21,179,368**

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6. Portfolio Savings and Goals

6.1. Gross Portfolio Savings

The PY 2012-PY 2013 Washington electric portfolio consisted of several sectors and many program delivery streams. In total, the programs achieved a 97.0% gross realization rate and total evaluated savings of 120,635,914 kWh (Table 88).

Table 88. PY 2012-PY 2013 Washington Gross Savings

Segment*	Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Residential	26,655,717	24,070,178	90.3%
Nonresidential	70,809,941	67,649,637	95.5%
Low Income	1,111,766	1,516,238	136.4%
CFL Contingency**	21,179,368	21,179,368	100.0%
Residential Behavior	4,636,392	6,220,493	134.2%
Total	**124,393,184**	**120,635,914**	**97.0%**

* Note that residential Behavior Program and Second Refrigerator and Freezer Recycling Program savings are inherently calculated as net, not gross.
** Program did not have reported savings, so the verified savings are duplicated as reported savings, thus giving the 100% realization rate.

6.2. Gross and Net Savings Designation

The 2012-2013 biennium yielded many uncertainties on savings definitions, and what would be allowable for different goal requirements. The following are terms and definitions as Cadmus understands them to apply to various programs and individual measures when assessing gross and net savings.

Gross Savings – Gross savings have not been subjected to an evaluated net-to-gross (NTG) value, and that use the traditional method of code baseline for savings calculation.

RTF Based Savings – We are terming savings to be an RTF based value if the measure uses the market adjusted baseline determined by the RTF, or similarly uses the RTF savings calculation methodology.

Net Savings – Net savings are have either been decremented by an evaluated customer self-reported NTG, or that produces a true net savings value in the way a measure is analyzed.

Another important element to distinguish between gross, RTF based, and net savings is the application of freeridership and spillover. True gross savings do not have freeridership (the actions customers would have taken in the absence of the program) or spillover (additional actions customers have taken because of the self-stated influence of Avista's programs) applied, while net savings include both. The RTF's modified gross definition accounts for freeridership but not spillover. Therefore, when appropriate, we have included evaluated spillover savings to RTF-based measures.

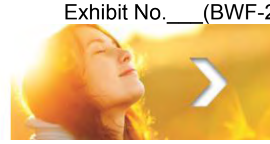


Table 89 outlines Avista's programs and type of savings methodology applied.

Table 89. Avista's DSM Programs' NTG Methodology

Program	Designation	Reasoning
Low Income	Gross	Traditionally free from NTG modifications (i.e., NTG assumed 1)
Nonresidential programs	Gross	The CPA included nonresidential savings free from NTG modification
CFL Contingency	RTF Based	Using the methodology and inputs from the RTF
Residential Behavior Program	Net	The results from the billing analysis are net because of the control group, but do not include any spillover
Manufactured Homes Duct Sealing	Gross	Direct install measure, free to customers (i.e., NTG assumed 1)
ENERGY STAR Products	RTF Based	RTF deemed savings values with the addition of spillover
ENERGY STAR Homes	RTF Based	RTF deemed savings values with the addition of spillover
Appliance Recycling	Net	The analysis methodology produces a net value
Geographic CFL Giveaway	RTF Based	Using the methodology and inputs from the RTF
Simple Steps, Smart Savings	RTF Based	Using the methodology and inputs from the RTF
Weatherization/Shell	Gross	Measure not available in RTF; savings calculated by billing analysis, yielding gross savings
Heating and Cooling Efficiency	Gross	Measure not available in RTF; some measure savings calculated by billing analysis, yielding gross savings
Water Heater Efficiency	RTF Based	RTF deemed savings values with the addition of spillover
Space and Water Conversions	Gross	Measure not available in RTF; savings calculated by billing analysis, yielding gross savings

6.3. Goals Achievement

Evaluation of the 2012-2013 portfolio was challenging due to:

- Multiple statements and sources of goals (I-937, Avista's Integrated Resource Plan, and Avista Business Plan).
- Varying definitions of savings (e.g., gross versus net, Regional Technical Forum versus evaluation based estimates).
- Different means of achieving the goals (e.g., fuel conversion counts toward the IRP electric savings but not toward I-937).
- Different programs are not included under certain goals (e.g., Avista Business Plan does not include Contingency CFL savings).

Table 90 through Table 92 show achieved savings toward each of the three goals: the DSM portion of I-937, IRP, and Avista Business Plan. All goals were exceeded. The goals are portfolio-level targets, so in order to conduct sector-level comparisons, Cadmus adopted the Avista Business Plan goals by sector, and applied those proportions to the I-937 and IRP targets. The tables also show saving achievements for the portfolio excluding the CFL Contingency and residential Behavior programs. I-937 and IRP goals are still met, but the more aggressive Business Plan goal falls slightly short.

Table 90. PY 2012-PY 2013 I-937 DSM End-Use Goals and Achieved Savings

Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	22,596,781	44,586,457	197.3%
Nonresidential	51,209,063	70,993,666	138.6%
Low Income	2,396,157	450,233	18.8%
Total	**76,202,000**	**116,030,356**	**152.3%**
Excluding CFL Contingency and Behavior Programs	**76,202,000**	**88,630,495**	**116.3%**

* Achieved savings do not include fuel switching measures.

Table 91. PY 2012-PY 2013 IRP Goals and Achieved Savings

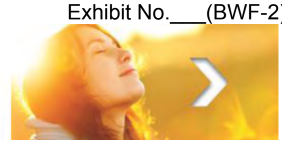
Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	22,483,207	46,617,306	207.3%
Nonresidential	50,951,680	72,539,206	142.4%
Low Income	2,384,113	1,516,238	63.6%
Total	**75,819,000**	**120,672,750**	**159.2%**
Excluding CFL Contingency and Behavior Programs	**75,819,000**	**93,272,889**	**123.0%**

* Achieved savings includes all savings.

Table 92. PY 2012-PY 2013 Avista Business Plan Goals and Achieved Savings

Sector	Savings Goal (kWh)	Achieved (kWh)*	Achievement Rate
Residential	28,391,942	30,327,507	106.8%
Nonresidential	64,342,119	67,649,637	105.1%
Low Income	3,010,674	1,516,238	50.4%
Total	**95,744,735**	**99,493,382**	**103.9%**
Excluding Behavior Program	**95,744,735**	**93,272,889**	**97.4%**

* Achieved savings do not include CFL Contingency.



Appendix A: Residential Billing Analysis Model Specifications

Overview of the PRISM Approach

A site-level modeling approach was originally developed for the PRISM software (Fels et al. 1995). In this model, the NAC is estimated separately for each customer account, for both the pre- and post-installation periods. The weather normalization for each account and period relies on a longitudinal regression analysis. The difference between the pre- and post-program NAC represents the program-related change in the consumption plus exogenous changes in consumption. Without a non-participants group this exogenous change is not eliminated, but it is expected to be small for consumption over the three year evaluation period, especially with respect to the larger change in consumption from conversion.

Model Specification

Cadmus fitted each account with specific degree-day regression models, separately for the pre- and post-installation periods. We first normalized the monthly bills by the number of days in each billing period to obtain the average daily consumption (ADC). Then we calculated the average temperature during each utility billing period.

This degree-day regression for each account is modeled as:

$$\mathrm{ADC_{it}} = \alpha_\mathrm{i} + \beta_i \mathrm{AVGHDD_{it}} + \gamma_i \mathrm{AVGCDD_{it}} + \epsilon_\mathrm{it}$$

Where:

ADC_{it}	=	Average daily kWh or therm consumption for each customer ‘i' during billing month ‘t’
α_ι	=	participant intercept; represents the average daily kwh or therm base load or the energy use for non-space heating or cooling purposes
β_ι	=	participant slope; represents the change in the energy use for a unit change in the HDDs
$AVGHDD_{it}$	=	base 65 average daily HDDs for customer ‘i' in period ‘t’
γ_ι	=	participant slope; represents the change in energy use for a unit change in the CDDs
$AVGCDD_{it}$	=	base 65 average daily CDDs for customer ‘i' in period ‘t’

Cadmus used the results from the above estimation to compute the NAC for electricity:

$$\mathrm{NAC_i} = \hat{\alpha}_\mathrm{i} * 365 + \hat{\beta}_i \mathrm{NORMHDD_i} + \hat{\gamma}_i \mathrm{NORMCDD_t}$$

Where:

NAC_i	=	Normalized annual kWh or therm consumption for each customer ‘i'
$\hat{\alpha}_\mathrm{i}$	=	The participant intercept; estimated from the above model

$\hat{\beta}_i$ = The participant heating slope; estimated from the above model

$NORMHDD_i$ = Annual normal-year HDDs (base 65) for customer 'i' in period 't'

$\hat{\gamma}_i$ = The participant cooling slope; estimated from the above model

$NORMCDD_i$ = Annual normal-year CDDs (base 65) for customer 'i' in period 't'

Overview of the Regression Approach

Cadmus specified a conditional savings regression model with paired pre- and post-participation months. This is a pooled regression approach that combines all participants and time intervals for a single measure group into a single regression analysis. The observations vary across both time and individual accounts. This pooled approach is recommended for cases like this, where there is no separate comparison group and where other energy-efficiency measures are installed in homes.

Model Specification

Cadmus estimated a separate regression model for each of the groups. The model determined ADC of electricity of home 'i' in month 't' as:

$$\mathrm{ADC_{it}} = \alpha_i + \tau_t + \beta_1\mathrm{HDD_{it}} + \beta_2\mathrm{CDD_{it}} + \beta_3\mathrm{HDD_{it}} * Other_{it} + \beta_4\mathrm{CDD_{it}} * Other_{it} + \beta_5\mathrm{POST_{it}} + \beta_6\mathrm{POST_{it}} * \mathrm{HDD_{it}} + \beta_7\mathrm{POST_{it}} * \mathrm{CDD_{it}} + \beta_8\mathrm{POST_{it}} * Other_{it} + \varepsilon_{it}$$

Where:

α_i = Average daily base load energy use in home 'i' that is not sensitive to weather or time. This analysis controlled for non-weather-sensitive and time-invariant energy use with home fixed effects.

τ_t = Average energy use in month 't' reflecting unobservable factors specific to the month. This analysis controlled for these effects with month-by-year fixed effects.

β_1, β_2 = Average daily usage per HDD and CDD (kWh or therm/degree day) in the pre-conversion period.

HDD = Average daily HDDs (heating load) during the billing cycle.

CDD = Average daily CDDs (cooling load) during the billing cycle.

β_3, β_4 = Coefficients for HDD and CDD (kWh or therm/degree day) interacted with the installation of other measures.

Other = An indicator variable for whether the month is pre- or post-installation of other measure. This variable equals 1 in the months following the maximum install date for all other measures, and equals 0 for months prior to the minimum install date.

$\beta_5 - \beta_8$ = Coefficients used to estimate the conversion program effect on electricity usage (as shown in next equation).

POST	=	An indicator variable for whether the month is pre- or post-conversion. This variable equals 1 in the months and years following the conversion date, and 0 otherwise. The variable is defined using a combination of Customer Specific Measure Install Date and Full Year specifications.
ε_{it}	=	Error term for home ‘i’ in month ‘t.’

Cadmus used the mean differences approach to estimate the above model. This approach removes the customer-specific constant term, α_i, and controls for the variation in electricity use between customers and between months.

Cadmus estimated the fuel conversion program savings for each conversion group using estimated coefficients on all the post-installation period dummy variable components in the above fixed-effects regression model. For a home in conversion group ‘j,’ the gross savings are given by:

$$\text{Savings}_j = \hat{\beta}_5 * 365 + \hat{\beta}_6 \text{AnnualHDD}_j + \hat{\beta}_7 \text{AnnualHDD}_j + \hat{\beta}_8 * 365$$

Where:

AnnualHDD_j	=	Average annual HDDs for all customers in conversion group ‘j’
AnnualCDD_j	=	Average annual CDDs for all customers in conversion group ‘j’

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Appendix B: Residential Behavior Program Data Cleaning Procedures

Cadmus conducted the following steps to inspect and clean the data provided by Opower:

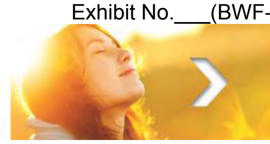
1. Removal of one customer from the Opower data that appeared in both the control and treatment groups
2. Verification that customer assignments to treatment and control groups in the Opower data corresponded to the assignments that Cadmus made. No discrepancies were found.
3. Removal of customers flagged by Opower for exclusion from analysis. Customers were flagged because it was not possible to generate an energy report or they received a report but were not randomly assigned.[54]
4. Checks for duplicate records. None were found.

One participant originally selected by Cadmus for the control group was missing from Opower's list of participants. The Opower data also included 12 extra participants in the treatment group that were not present in Cadmus' original sample, but these were all flagged to be excluded from the analysis. After cleaning the data, there were 99,495 customers on Opower's list.

Cadmus conducted the following steps to clean the billing data provided by Avista:

1. Verification that customer account numbers were unique to addresses.
2. Removal of billing data for customers not in the Opower control or treatment groups and for billing records ending before June 1st, 2012 or beginning after December 31st, 2013.
3. Removal of gas bills
4. Removal of customers whose maximum daily average consumption in any billing period was greater than 1,000 kWh per day. There were less than ten such customers, and Cadmus assumed their large bills were likely due to meter misreads, billing errors, or significant commercial, industrial, or agricultural activity which would make them ineligible for analysis. Cadmus also noted that there were 185 customers who regularly consumed more than 240 kWh-per-day on average, but Cadmus did not remove these customers from the analysis.
5. Removal of duplicate bills. One of the additional billing data files that Avista provided included many duplicate records; Cadmus did not include these in the analysis.
6. Removal of $0.00 bills. Cadmus noticed that there were many duplicate bills of this type. Cadmus only removed these bills when either:
   a. The service amount was $0.00 and the usage quantity (kWh) was non-zero, or
   b. Both the service amount and the usage quantity were zero, but there was another non-zero bill in the same period
7. Removal of bills from August 2012 that ended on the 27th of August, when there were multiple bills for that month. Cadmus noticed that many customers had two partially-overlapping records

[54] For example, some Avista staff requested to receive energy reports from Opower. There were 12 customers who received reports but were not assigned to the treatment group.



in August 2012. These two bills had the same start dates. The first always ended on August 15^{th} or 16^{th}, and the second on August 27^{th}. Cadmus noted that the next bill started on the 15^{th} or 16^{th} of August, not the 27^{th}, so to ensure that there would be no double-counting of kWh Cadmus removed the longer, partially-overlapping bill.

8. Manual data cleaning of partially-overlapping bills. In less than 20 instances, Cadmus manually removed problematic partially-overlapping bills, so that there would be no double-counting of kWh when the bills were summarized for analysis.

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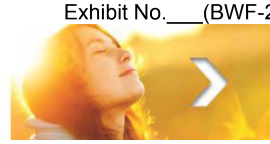
Appendix C: Residential Behavior Program Regression Model Estimates

Table 93 shows results from different panel regressions of home average daily electricity use. Model 4 was used to estimate savings as shown in the report. There were only small differences between models 1-4 in the estimated savings.

Table 93. Regression Estimates of Home Energy Report Effects on Energy Use

Conditional Average Treatment Effects				
	Model 1	Model 2	Model 3	Model 4
Post	3.0979	1.7691	-0.9085	0.741
	(0.09)	(0.18)	(0.09)	(0.18)
Participant x Post	-0.6586	-0.7612	-0.7642	-0.7637
	(0.10)	(0.10)	(0.10)	(0.10)
Customer fixed effects	Yes	Yes	Yes	Yes
Month by year fixed effects	No	Yes	No	Yes
Weather	No	No	Yes	Yes
N homes	54,324	54,324	54,324	54,324
Number of Observations	1,022,886	1,022,886	1,022,886	1,022,886

Notes: Dependent variable is the home's average daily electricity use for a month. Estimates based on difference-in differences OLS regression of average daily consumption between June 2012 and December 2013. Huber-White estimated standard errors in parentheses are clustered on homes.



Appendix D: Low Income Weatherization Participant Survey

In May 2013, Cadmus coordinated a phone survey of 150 residential low-income weatherization program participants. We developed the participant survey instrument and defined the sample, then subcontracted survey administration to an implementation firm.

Table 94 provides details regarding the telephone survey planned and achieved completes.

Table 94. Participant Telephone Survey Sampling Plan

	Quantity
Total Participants	434
Screened out due to a change in occupancy or incorrect phone number	78
Eligible participants on call list	356
Completed surveys	150
Sample size goal	150

Cadmus selected a random sample of participants from the 2012 Q3 to 2013 Q1 participant population as available in April 2013 (434 participants). Cadmus aimed for and achieved 150 completed survey responses, which provided results with 90% confidence and ±5.1% precision at the program level. The survey achieved a high fielding response rate, as we used only 75% the sample frame to accomplish the targeted completes.

We asked participants about their experiences with the program, addressing the following topics:

- Changes in energy usage associated due to the following:
  - Behavior impacts attributed to energy-education
  - Heating usage, including equipment and fuel
  - Changes in occupancy
- Use of supplemental heating or cooling systems
- Functionality of equipment prior to repair or replacement
- Demographics and home characteristics

Program Awareness and Wait Time

Most survey respondents said they heard about the program through family or friends. Figure 24 presents all ways survey respondents heard about the program.

Figure 24. How Respondents Heard About the Program (n=125)

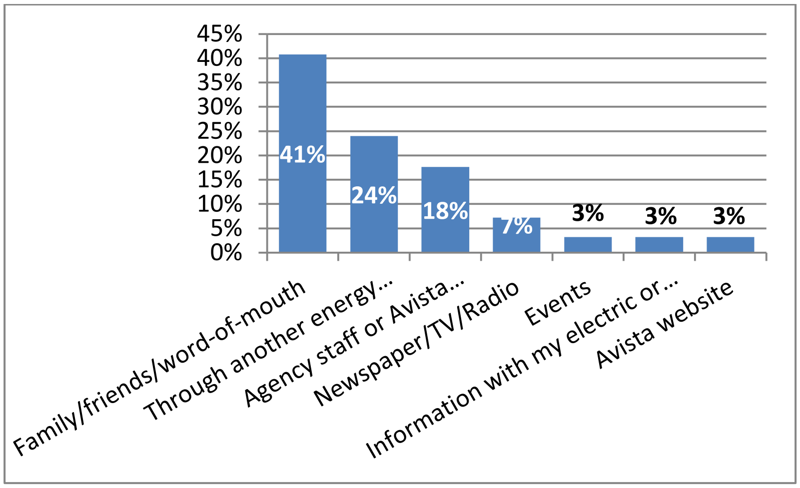
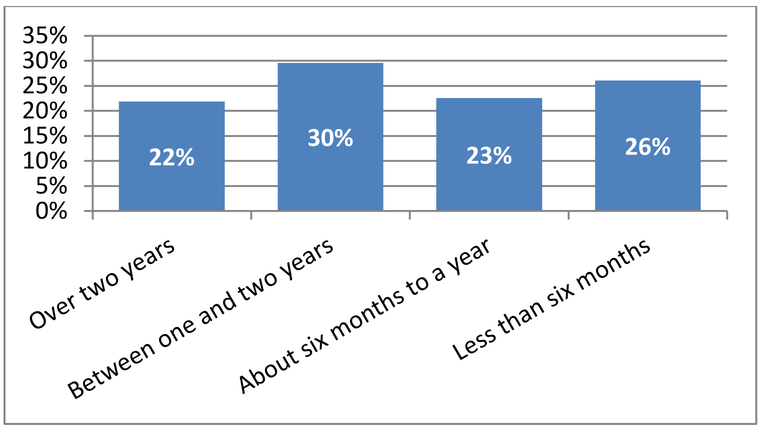


Figure 25 shows how long respondents were on the waiting list for the program.

Figure 25. How Long Respondents Were on the Program Waiting List (n=142)



As shown above, about half of the respondents said they were on the waiting list for the program one year or less, with 26% indicating they were on the wait list for less than six months. Thirty percent of the respondents waited between one and two years, and 22% waited over two years for program services.

Previous and New Equipment

Table 95 shows the distribution of installed equipment and the condition of the replaced equipment. For respondents who received programmable thermostats, the table also indicates whether the installer programmed the thermostat, the participants just received education on how to install it, or received neither programming nor education.

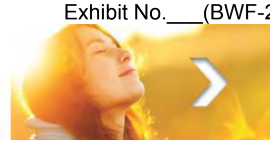


Table 95. Equipment Installed and Equipment Condition

Equipment Installed	% Installed	Worked Fine	Had Problems	Did Not Work
Refrigerator (n=150)	16%	54%	38%	8%
Furnace (n=146)	60%	24%	61%	15%
Water Heater (n=148)	51%	50%	43%	7%
Windows (n=148)	45%	29%	71%	n/a
Doors (n=149)	62%	8%	92%	n/a
Equipment Installed	**% Installed**	**Programmed**	**Just Education**	**Neither**
Thermostat (n=143)	50%	87%	7%	6%

For those respondents who said their previous equipment had problems or did not work, Table 96 shows how long the equipment was experiencing those issues.

Table 96. Equipment Problem Duration

Problem Equipment	Months	Year	> 1 Year
Refrigerator (n=10)	30%	10%	60%
Furnace (n=59)	15%	24%	61%
Water Heater (n=34)	26%	32%	41%

Table 97 details the fuel type of old and replaced furnaces and water heaters for respondents who received this new equipment.

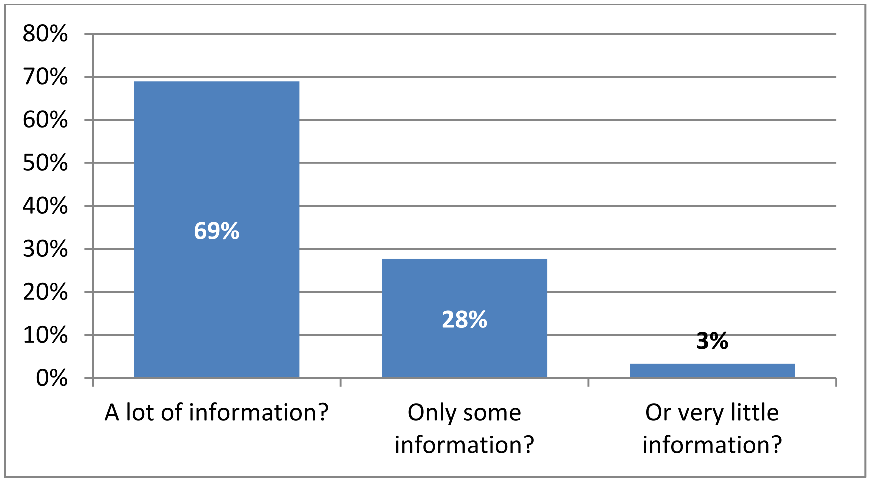
Table 97. Furnace and Water Heater Fuel

Equipment Type	Fuel	Previous	New
Furnace (n=61)	Electric	42%	10%
	Gas	53%	90%
	Oil	5%	0%
Water Heater (n=67	Electric	76%	25%
	Gas	24%	75%

Program Education

Only 3% of respondents said they received little information, while over two-thirds said they received a lot of information, as shown in Figure 26.

Figure 26. Amount of Much Information Respondents Received (n=119)



As shown in Table 98, 89% of respondents said they received educational pamphlets, and 97% of those respondents said they read them.

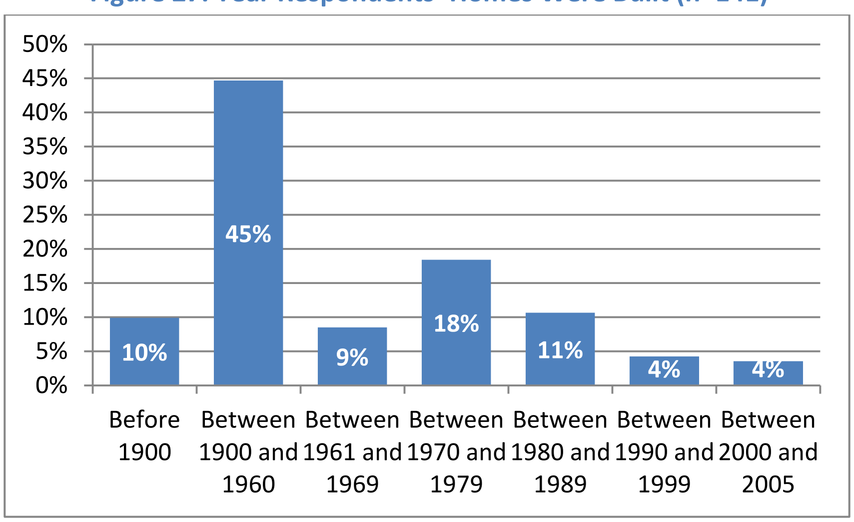
Table 98. How Many Respondents Received and Read Pamphlets

	Received Pamphlet (n=132)	Read Pamphlet (n=116)
Yes	89%	97%
No	11%	3%

Home Characteristics

Figure 27 shows the distribution of years that the respondents' homes were built.

Figure 27. Year Respondents' Homes Were Built (n=141)



Most respondents live in a single-family home or a mobile home or trailer, as shown in Figure 28.

Figure 28. Home Types (n=147)

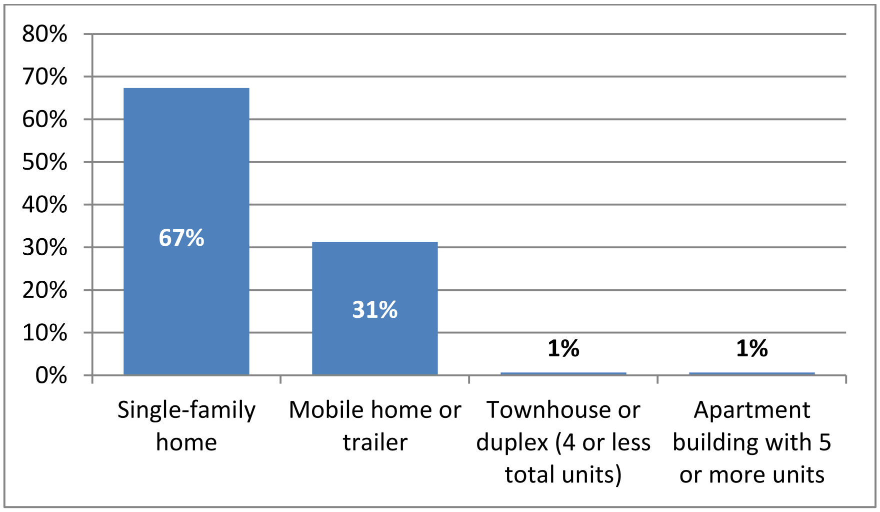


Figure 29 shows that most respondents heat their home by natural gas, followed by electricity.

Figure 29. Heating Fuel (n=147)

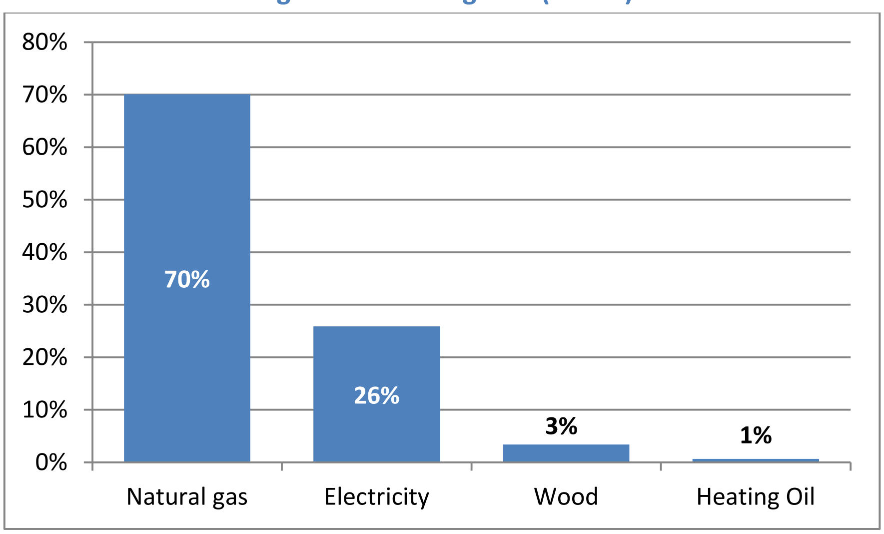
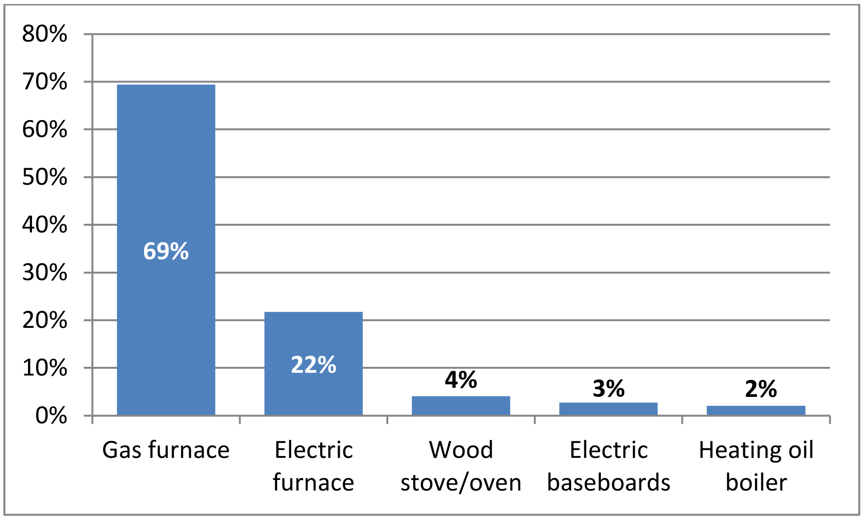


Figure 30 presents the distribution of respondents' primary heating equipment. Most respondents (69%) said their primary heater is a natural gas furnace, followed by an electric furnace (22%).

Figure 30. Primary Heater Type (n=147)



Most respondents said that after the program equipment was installed, they either did not change or turned down the temperature setting on their thermostat, as shown in Figure 31.

Figure 31. Post-Installation Thermostat Changes (n=135)

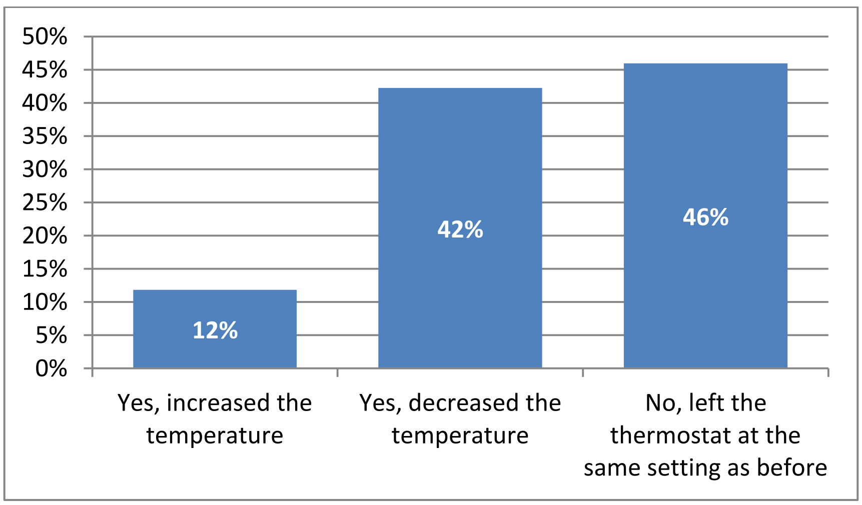
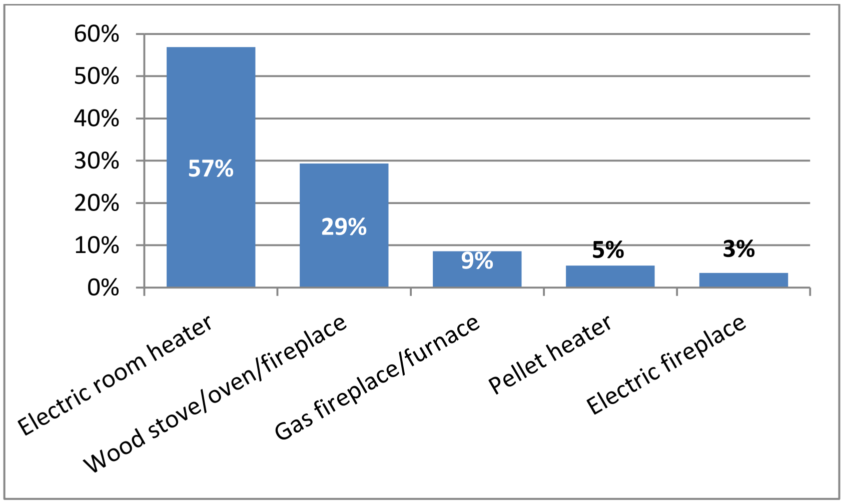


Figure 32 shows what respondents use as a supplemental heating source. Most indicated using an electric room heater or a wood burning device.

Figure 32. Supplemental Heater Types (n=58)



Respondents who use a supplemental heating source said they used it less or about the same after the program equipment was installed, as shown in Figure 33.

Figure 33. Post-Installation Supplemental Heater Use (n=56)

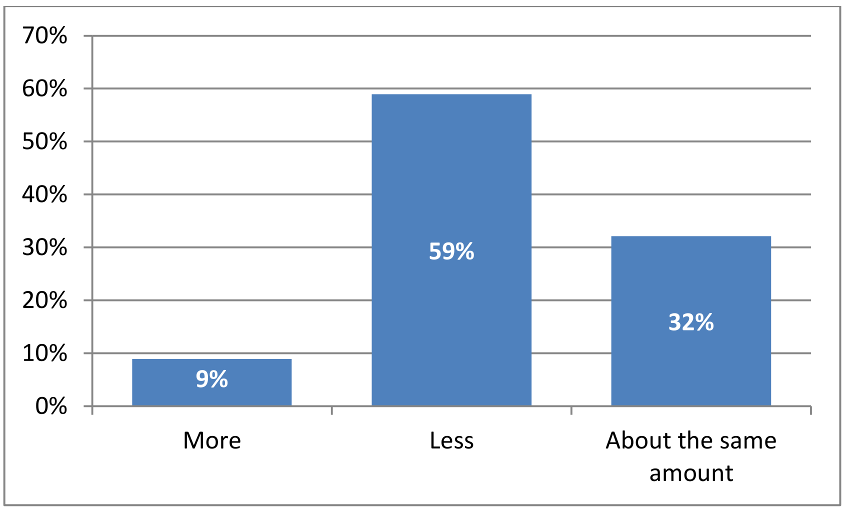


Figure 34 presents the distribution of equipment used to cool respondent's homes. When asked if they would change the way they cool their home after participating in the program, only 8% responded affirmatively.

Figure 34. Summer Cooling Equipment Types (n=140)

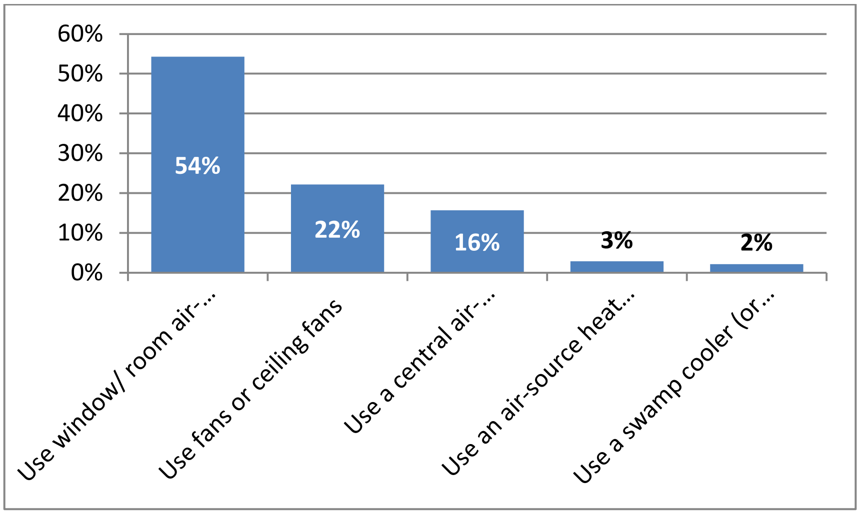
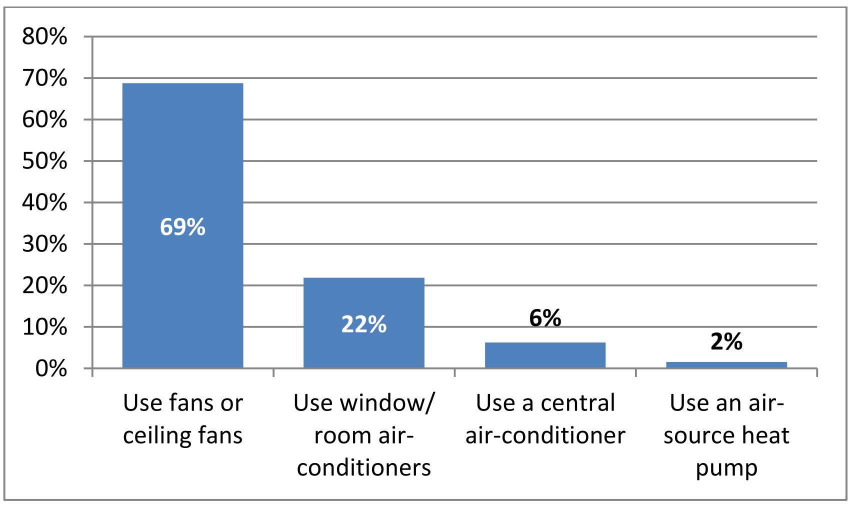
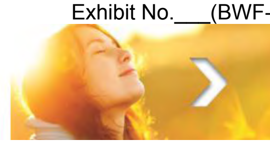


Figure 35 shows what type of supplemental equipment respondents use to cool their home.

Figure 35. Supplemental Cooling Equipment Types (n=64)





Appendix E: Low-Income Weatherization – Billing Analysis Model Specification

For each participant home, Cadmus estimated three models in both the pre- and post-periods in order to weather-normalize raw billing data:

- Heating and cooling,
- Heating only, and
- Cooling only.

The heating and cooling PRISM model specification was:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \varepsilon_{it}$$

Where for each customer 'i' and calendar month 't':

ADC_{it}	=	The average daily kWh consumption in the pre- or post-program period
α_i	=	The participant intercept; represents the average daily kWh base load
β_1	=	The model space heating slope (used in the heating only and heating + cooling models)
$AVGHDD_{it}$	=	The base 65 average daily HDDs for the specific location (used in the heating only and heating + cooling models)
β_2	=	The model space cooling slope (used in the cooling only and heating + cooling models)
$AVGCDD_{it}$	=	The base 65 average daily CDDs for the specific location (used in the cooling only and heating + cooling models)
ε_{it}	=	The error term

From the model above, we computed the NAC as follows:

$$NAC_i = \alpha_i * 365 + \beta_1 LRHDD_i + \beta_2 LRCDD_i + \varepsilon_i$$

Where, for each customer 'i':

NAC_i	=	Normalized annual kWh consumption
α_i	=	The intercept that is the average daily or base load for each participant, representing the average daily base load from the model
$\alpha_i * 365$	=	Annual base load kWh usage (non-weather sensitive)
β_1	=	The heating slope; in effect, usage per heating degree from the model
$LRHDD_i$	=	The annual, long-term HDDs of a TMY3 in the 1991–2005 series from NOAA, based on home location

$\beta_1 * LRHDD_i$	=	Weather-normalized annual weather sensitive (heating) usage, also known as HEATNAC
β_2	=	The cooling slope; in effect, the usage per cooling degree from the model
$LRCDD_i$	=	The annual, long-term CDDs of a TMY3 in the 1991–2005 series from NOAA, based on home location
$\beta_2 * LRCDD_i$	=	The weather-normalized annual weather sensitive (cooling) usage, also known as COOLNAC
ε_i	=	The error term

Although we used the same specification for both electric (non-conversion) and conversion participants, Cadmus estimated separate fixed-effects CSA models for each group to determine program-level savings:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \beta_3 POST_{it} + \beta_{4\ldots14} M_t + \varepsilon_{it}$$

Where, for customer 'i' and monthly billing period 't':

ADC_{it}	=	Average daily kWh consumption during the pre- and post-program periods
α_i	=	The average daily kWh base load intercept for each participant (part of the fixed-effects specification)
β_1	=	The model space heating slope
$AVGHDD_{it}$	=	The average daily base-65 HDDs, based on home location
β_2	=	The model space cooling slope
$AVGCDD_{it}$	=	The average daily base-65 CDDs, based on home location
β_3	=	The kWh change in usage per day
$POST_{it}$	=	An indicator variable that is 1 in the post-period (after measure installations) and 0 in the pre-period
M_t	=	An array of bill month dummy variables (Feb, Mar, …, Dec), 0 otherwise[55]
ε_{it}	=	The modeling estimation error

Cadmus estimated the above model for Washington non-conversion and conversion participants separately. The model coefficient, β_3, is an estimate of the kWh savings per day in each model.

[55] We excluded the January dummy variable from the independent variables, otherwise the 12 monthly indicators would form perfect co-linearity with the intercepts; thus, the intercepts include the seasonality from January.

Appendix 4

Avista 2013 Washington Gas Portfolio Impact Evaluation

May 15, 2014

The Cadmus Group, Inc.

FINAL REPORT

Avista 2013 Washington Gas Portfolio Impact Evaluation

May 15, 2014

Avista Corporation
1411 E Mission Ave
Spokane, WA 99220

The Cadmus Group, Inc.

An Employee-Owned Company • www.cadmusgroup.com

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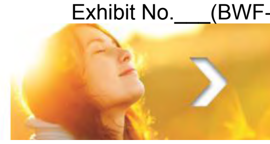

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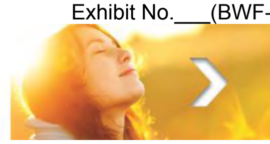
Table of Contents



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Portfolio Executive Summary

Avista Corporation contracted with Cadmus to complete process and impact evaluations of the company's program year (PY) 2013 natural gas and electric demand-side management (DSM) programs. Avista has been administering DSM programs for several decades to reduce its customers' energy use for electricity and natural gas. Most programs are implemented in-house, but for a few, Avista utilizes external implementers. This report presents our impact findings for the PY 2013 gas portfolio in the State of Washington.

Evaluation Activities

For each of the three sectors—residential, nonresidential, and low income—we employed a variety of evaluation methods and activities, as shown in Table 1.

Table 1. PY 2013 Gas Programs Evaluation Activities

Sector	Program	Document /Database Review	Verification /Metering Site Visit	Survey	Billing Analysis	Simulation
Residential	ENERGY STAR Products	✓		✓		
	Heating and Cooling Efficiency	✓		✓		
	Weatherization/Shell	✓		✓	✓	
	Water Heater Efficiency	✓		✓		
	ENERGY STAR Homes	✓				
	Manufactured Homes Duct Sealing	✓			✓	
	Simple Steps, Smart Savings	✓				
Nonresidential	Prescriptive programs	✓	✓			
	Site-Specific	✓	✓		✓	✓
Low Income	Low Income programs	✓		✓	✓	

Savings Results

Table 2 presents sector-level reported and gross verified savings values and realization rates. Overall, the portfolio achieved a 96% realization rate, and acquired 613,788 in annual therm savings.

Table 2. PY 2013 Reported and Gross Evaluated Savings for Washington

Sector	Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
Residential	296,130	285,497	96%
Nonresidential	319,804	304,081	95%
Low Income	23,676	24,210	102%
Total	**639,610**	**613,788**	**96%**

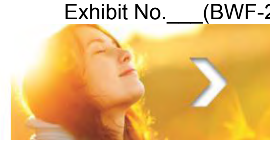

Table 3 shows gross verified savings compared to the Integrated Resource Plan (IRP) goal of 892,000 therms. The IRP goal is at the portfolio level, so in order to show a sector-level comparison, Cadmus adopted the Avista 2013 Business Plan goals by sector, and applied those proportions to the IRP target. In PY 2013, the programs achieved 69% of the IRP target in Washington, which is notable because of the uncertainty of the existence of the gas program in 2013 for Washington.

Table 3. PY 2013 IRP Goals and Gross Evaluated Savings for Washington

Sector	Savings Goal (therms)	Gross Evaluated (therms)	Achievement Rate
Residential	264,512	285,497	108%
Nonresidential	599,439	304,081	51%
Low Income	28,049	24,210	86%
Total	**892,000**	**613,788**	**69%**

Key Findings and Conclusions

Residential

For PY 2013, Avista's residential gas programs produced 285,497 therms in savings, yielding an overall realization rate of 96% of reported savings and 108% of equivalent residential IRP goals.

The evaluation produced the following residential program conclusions:

- Avista's program and tracking databases were adequate for evaluation purposes, providing sufficient contact information and measure and savings information in most cases (the one major exception was omitted Avista account numbers in the Manufactured Homes Duct Sealing Program files). The database review confirmed the information was reliable and accurate.
- High-efficiency furnaces continue to dominate the residential gas portfolio savings.
- Weatherization billing analyses revealed larger per home savings than expected.

Nonresidential

For PY 2013, Avista's nonresidential gas programs produced 304,081 therms in savings, yielding an overall realization rate of 95% of reported savings, and 51% of equivalent nonresidential IRP goals.

Cadmus evaluated 30 of 160 measures installed through the programs in PY 2013 in Washington, representing 44% of tracked savings. Through evaluation, we determined that Avista generally implemented the programs well. Cadmus identified the following key issues that reduced evaluated energy savings below the reported values:

- Some calculations provided by participants/contractors contained information that varied from what Cadmus engineers found on site.
- One prescriptive project had not actually been installed as reported.
- Retrofit natural gas consumption varied from predicted values for some site-specific projects.

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Low Income

In PY 2013, Avista's low-income gas programs produced 24,210 therms in savings, yielding a 102% overall realization rate of reported savings and 86% of the equivalent low income IRP goals.

Compared to the PY 2010 billing analysis, Avista's PY 2013 low-income program demonstrated an average increase in gas savings per participant, in addition to an increase in the overall program realization rate (from 31% to 102%). Several factors may have contributed to the increase in participant savings, including:

- An increased frequency of installing high-saving measures (e.g., shell) in the evaluation period,
- Changes in agency delivery protocols or energy-saving installations made with non-utility funding, and
- Exogenous effect (e.g., economic, rate changes) that may have occurred simultaneously with program activity.

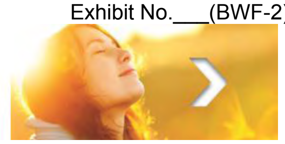
One factor contributing to higher realization rates is lower average reported savings occurring in the PY 2013 evaluation period compared to previous years.

Recommendations and Further Analysis

Residential

Based on our evaluation results, Cadmus offers the following recommendations:

- If the clothes washer measure is reinstated, Avista should consider moving all rebates to the electric program, as the majority of savings will likely result from a reduction in consumed electricity from the dryer. Qualifying for the program should be based on the presence of an electric dryer in the home. Given the large percentage of savings achieved through reduced dryer energy, and because of the high likelihood that most participants have an electric dryer, this measure predominantly produces electric energy savings.
- Avista should consider increasing the amount of data tracked as part of the Manufactured Homes Duct Sealing Program, including such fields as the Avista customer account number.
- Avista may consider performing a targeted billing analysis for weatherization participants who use *both* electricity and gas to heat their homes. Our current study analyzes homes based on the program they are tracked in. Customers who use multiple fuels to heat their home may be saving more energy than currently estimated.
- High-efficiency gas furnaces continue to provide the largest portion of savings for the residential portfolio. The last billing analysis we performed was in 2011 on PY 2010 participants, so those results could be re-estimated in the next evaluation.
- Once the gas heated homes participation in the Manufactured Homes Duct Sealing Program has reached sufficient size, consider conducting a billing analysis to estimate savings.



Nonresidential

Cadmus offers the following recommendations based on the evaluation results:

- Streamline the file structure to enable internal and external reviewers to more easily identify the latest documentation.
- Avista should continue to perform follow-up measure confirmation and/or site visits on a random sample of projects (at least 10%).
- Consider flagging sites for additional scrutiny where the paid invoice does not list installation labor.

Low Income

The impact evaluation revealed several areas where program performance and savings calculation accuracy could be improved. Consequently, we have the following recommendations:

- Consider including a control/comparison group in future billing analyses.
- Consider options to increase the analysis sample size due to small program populations (such as combining Washington and Idaho program participants).
- Obtain a full list of weatherization measures from agencies.
- Consider targeting high-use customers.
- Track and compile additional data from agency audits.
- Consider performing a quantitative, non-energy benefit analyses.

1. 2013 Residential Gas Impact Report

1.1. Introduction

During PY 2013, Avista's residential gas DSM programs in Washington reported savings of 296,130 therms for 3,958 measures installed through the following programs:

- ENERGY STAR Products
- ENERGY STAR Homes
- Heating and Cooling Efficiency
- Water Heater Efficiency
- Weatherization/Shell
- Manufactured Homes Duct Sealing
- Simple Steps, Smart Savings

This report explains the methods we used to qualify and verify these savings.

1.1.1. Evaluation Methodology

We designed our impact evaluation to verify reported program participation and energy savings using:

- Data collected in the tracking database;
- Online application forms;
- Phone surveys;
- Applicable deemed values developed for Avista's technical reference manual (TRM);[1] and
- Billing analyses.

As shown in Table 4, Cadmus employed up to three basic evaluation methods and activities for each program.

[1] In the first quarter of 2011, Cadmus created a TRM for use in deemed measure savings. We updated the TRM when necessary or when new results are available.

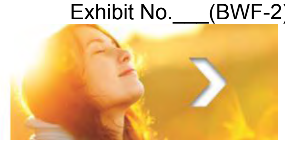


Table 4. Evaluation Methodology

	Program	Document/Database Review	Surveys	Billing Analysis
Residential	ENERGY STAR Products	✓	✓	
	Heating and Cooling Efficiency	✓	✓	
	Weatherization/Shell	✓	✓	✓
	Water Heater Efficiency	✓	✓	
	ENERGY STAR Homes	✓		
	Manufactured Homes Duct Sealing	✓		✓
	Simple Steps, Smart Savings	✓		

1.1.2. Energy Savings

Table 5 shows aggregated, adjusted gross savings and resulting realization rates by program.

Table 5. PY 2013 Reported and Adjusted Gross Savings

Program Name	Reported Savings (therms)	Adjusted Gross Savings (therms)	Realization Rate
ENERGY STAR Products	695	590	85%
Heating and Cooling Efficiency	212,308	209,714	99%
Weatherization/Shell	38,326	40,242	105%
Water Heater Efficiency	1,096	1,566	143%
ENERGY STAR Homes	1,009	1,017	101%
Manufactured Homes Duct Sealing	41,978	29,973	71%
Simple Steps, Smart Savings	718	2,395	334%
Total	**296,130**	**285,497**	**96%**

Table 6 shows the reported measure counts. We verified savings of 285,497 therms through the installation of 3,958 measures during PY 2013. Overall, residential gas programs achieved an adjusted gross realization rate of 96%.

Table 6. Avista PY 2013 DSM Programs' Reported Measure Counts

Program	Washington Measure Count
ENERGY STAR Products	139
Heating and Cooling Efficiency	2,038
Weatherization/Shell	313
Water Heater Efficiency	174
ENERGY STAR Homes	5
Manufactured Homes Duct Sealing	1,042
Simple Steps, Smart Savings	247
Total	**3,958**

1.2. Methodology

1.2.1. Sampling

Cadmus randomly sampled program participants to complete surveys. Cadmus also randomly sampled participant applications to review for this evaluation. The following subsections describe the methods we used to select the required samples.

Record Review Sampling

To determine the percentage of measures incented that qualified for the program, Cadmus designed sample sizes to yield result at the 90% level of confidence and ±10% precision level for each application type, across both states and both fuel types. Cadmus randomly selected participant measures for a record qualification review from the 2012 and 2013 gas and electric program populations. We sampled participants using a single measure record. However, if a customer applied for multiple rebates on the same application form during the program year, we checked all measures included in the application for qualification, whether the fuel was electric or gas.

Table 7 shows the number of record reviews we completed of unique accounts and unique measures.

Table 7. Measure-Level Record Reviews Completed

Record Review	Count
Total Participants Reviewed	445
Total Measures Qualified	554

Survey Sampling

Cadmus conducted the participating customer surveys in two rounds, one in March and April 2013 and a second in February 2014. This approach ensured that respondents had a clear recollection of their participation experience. Table 8 summarizes unique customers (identified using Avista account number) and surveys completed in each effort.

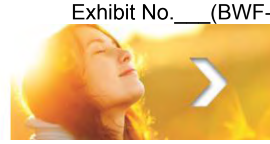


Table 8. Residential Participant Details and Survey Sample—Washington and Idaho

Measure Type	2012			2013		
	Participants	Surveys	%	Participants	Surveys	%
Natural Gas and Electric Programs						
ENERGY STAR Products	6,429	149	2%	782	65	8%
Heating and Cooling Efficiency	3,747	142	4%	2,490	70	3%
Water Heater Efficiency	629	88	14%	316	60	19%
Weatherization/Shell	692	102	15%	313	60	19%
Electric-Only Programs						
2nd Refrigerator & Freezer Recycling	1,351	133	10%	1,319	65	5%
Space and Water Conversions	171	34	20%	156	37	24%
Total	**13,019**	**648**	**5%**	**5,376**	**357**	**7%**

Cadmus designed participant survey completion targets to yield results with 90% confidence and ±10% precision, for measure-category-level survey results. In PY 2012, we expanded this approach to yield results at the measure category and state level. Cadmus deemed this necessary as data collected through these surveys—specifically installation rates—were used to inform an impact assessment of Avista’s residential programs. Cadmus drew upon multiple additional factors in selecting the participant survey sampling plan, including the feasibility of reaching customers, program participant populations, and research topics of interest.

Cadmus did not conduct participant surveys with Simple Steps, Smart Savings customers, as that program has an upstream focus and therefore there is no tracking of participant contact information. Similarly, for ENERGY STAR Homes, Cadmus did not survey residential customers who purchased a rebated home because Avista pays program rebates to builders, not to end-use customers. Cadmus also did not focus evaluation resources on new programs that were reviewed by the implementation organizations (i.e., Residential Behavior) or temporary programs (e.g., Home Audit & Manufactured Homes Duct Sealing).

Within each program stratum, Cadmus randomly selected participant contacts included in survey sample frames. A review of collected data shows geographic distribution of survey respondents clustered around urban centers, specifically the cities of Spokane, Coer d’Alene, Pullman, Moscow, and Lewiston. This aligns with the population distributions in Avista’s service territory. Figure 1 provides the distribution of participating customer survey respondents.

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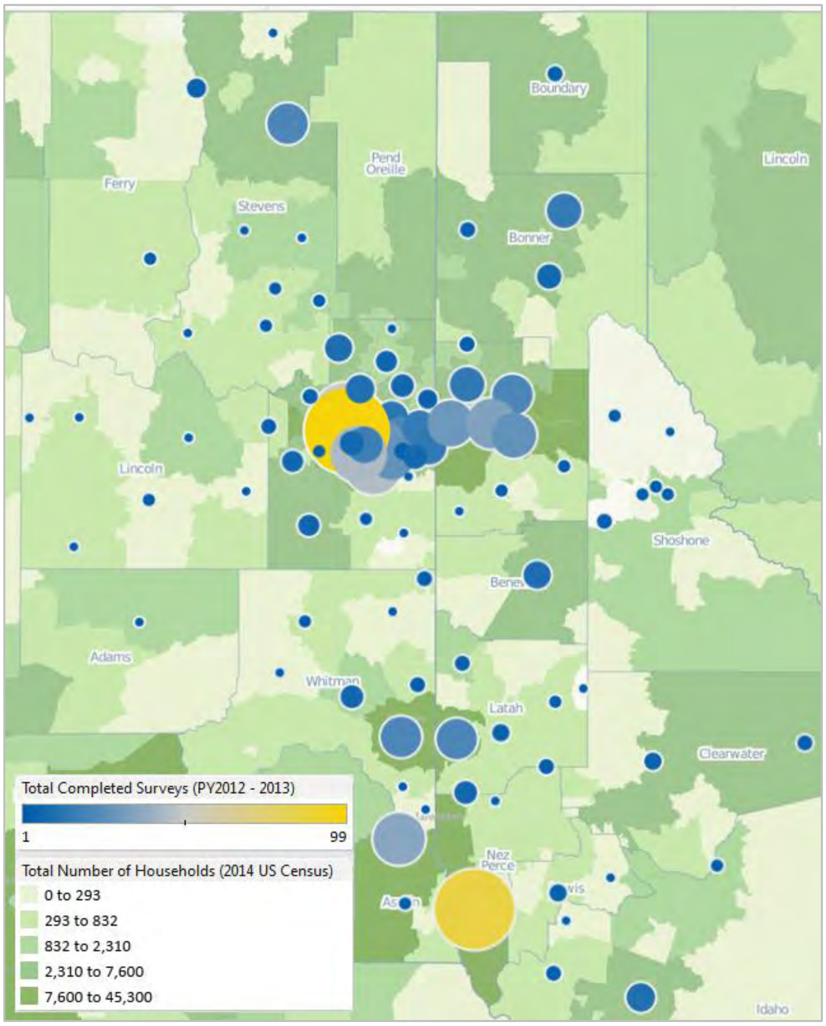
Figure 1. Geographic Distribution of PY 2012-PY 2013 Participating Customer Survey Respondents

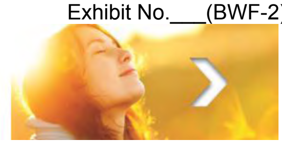


1.2.2. Data Collection and Analysis

Record Review

Cadmus reviewed all records for the selected sample of accounts, checking them for completeness and program compliance using the data they contained. Measures qualified if all data found in the application complied with the program specifications. As Cadmus randomly sampled customers by application type (and several measures can be found on different application forms), we tracked qualification rates by the type of application.

The review revealed one improperly issued insulation rebate on a home improvement application, as it had an existing R-value above the participation requirements (the applied qualification rates included this result).



Surveys
Cadmus contracted with Discovery Research Group (DRG), a market research firm, to survey sampled participants. To minimize response bias, DRG called customers during various hours of days and evenings (including weekends), and made multiple attempts to contact individual participants. Cadmus monitored survey phone calls to ensure accuracy, professionalism, and objectivity. We analyzed the survey data at the program level rather than the measure level, and weighted survey results at the portfolio level by program participation to ensure proper representation.

Database Analysis
Cadmus reviewed the participant database Avista provided to check for inconsistencies in reported savings and measure duplications. We did not identify inconsistencies in data tracking. All reported savings were based on the 2012 Avista TRM.

Unit Energy Savings
Cadmus updated the unit energy savings achieved by ENERGY STAR clothes washers based on new survey data of Avista participants. We did not update unit energy savings for other measures.

1.2.3. Verification Rates
Cadmus determined verification rates for each program, but not for each measure. Where applicable, our review covered the following topics:

- Checking that the database tracked the correct measures;
- Accounting for correct quantities; and
- Determining whether units remained in place and were operable.

All the measures we researched remained in place and were operable, resulting in a 100% verification rate.

1.2.4. Measure Qualification Rates
Cadmus considered a measure qualified if it met the various requirements particular to its category, such as receiving an ENERGY STAR certification or achieving program minimum efficiency standards. When necessary, we conducted online database searches for model numbers, and noted necessary characteristics to verify achievement of all qualifications.

Out of the entire verification sample, we identified one nonqualified measure:

- An attic insulation project had a base case condition that prevented it from qualifying.

1.3. Program Results and Findings

1.3.1. Overview

Cadmus determined the total adjusted gross savings for each measure and each program, as well as the overall realized savings for each program. In the following sections we describe each program, explain our analysis steps, and discuss the results and findings.

Calculating the adjusted gross measure savings required the following steps:

- Reviewing the database to determine whether adjusted measure counts correctly represent the number of measures installed.
- Conducting a phone survey with a sample of customers to verify measure installations.
- Reviewing records to determine measure qualification.
- Calculating verification and qualification rates.
- Calculating deemed measure savings for rebated products.
- Determining adjusted gross savings for each measure by applying the above-calculated rates and deemed savings to measure counts.

1.3.2. ENERGY STAR Products

Program Description

The ENERGY STAR Products Program included the following gas measures:

- Clothes washer (gas)
- Dishwasher (with gas water heater)

Through the program, Avista offered direct financial incentives to motivate customers to use more energy-efficient appliances. The program indirectly encouraged market transformation by increasing demand for ENERGY STAR products. While electric and gas measures were included in the program, this report focuses on gas savings.[2]

Analysis

Energy savings credited to the ENERGY STAR Products Program had to meet multiple criteria:

- Measures had to remain in place and be operating properly at the time of verification;
- The numbers of installed equipment pieces and their corresponding model numbers listed in the applications had to match the database; and
- Units must have been ENERGY STAR-qualified at the time of the program offering.

[2] See Appendix B for the electricity savings achieved through this gas program.

Clothes Washers

To calculate energy savings, Cadmus drew upon a metering study we conducted in 2009,[3] for which we metered more than 100 clothes washers in California homes for three weeks; this was the largest *in situ* metering study of residential clothes washers and dryers conducted in the last decade. The study revealed higher consumption and savings values than are often estimated.

Dryers produced the majority of energy consumption and savings, as high-efficiency washing machines remove more moisture from clothes, allowing shorter drying times. As most energy savings resulted from decreased dryer use, Cadmus estimated the percentage of homes using gas domestic hot water heaters and electric dryers. The Regional Technical Forum (RTF) advocates an 82% assumption, which we used for this evaluation. Consequently, 82% of installations of ENERGY STAR clothes washers in homes with a gas domestic hot water heater achieved significant electricity savings.

To determine adjusted gross savings, Cadmus used the following additional input assumptions:

- Recent independent evaluation surveys from the Residential Building Stock Assessment resulted in 256 washing cycles per year. This value nearly matches 2012 Avista participant surveys, which led to an estimated 262 washing cycles per year.[4] Cadmus adjusted the unit energy-savings values according to the Avista participant survey results, as reflected in the realization rate for this measure.
- Cadmus used the California metering study to estimate consumption per wash and dry cycle for the base and efficient equipment.

Dishwashers

There were no applications processed for this measure in PY 2013.

Results and Findings

Table 9 shows the total reported and qualified counts, savings, and realization rates of gas ENERGY STAR Products Program measures in Washington.

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[3] The Cadmus Group, Inc. *Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems*. 2010. Available online: http://www.cadmusgroup.com/wp-content/uploads/2013/02/Home-Energy-Magazine-January-2012-Mattison-Korn-article.pdf.

[4] Ecotope Inc. *2011 Residential Building Stock Assessment: Single-Family Characteristics and Energy Use*. Seattle, Washington. Prepared for Northwest Energy Efficiency Alliance. 2012.

Table 9. ENERGY STAR Products Program Results in Washington

Program Name	Reported Measure Count	Reported Savings (therms)	Adjusted Savings (therms)	Qualification Rate	Verification Rate	Adjusted Gross (therms)	Realization Rate
Gas Clothes Washer With Natural Gas Water Heater	139	695	590	100%	100%	590	85%

Appendix B addresses electricity savings achieved by the installation of ENERGY STAR products in homes with a gas domestic hot water heater.

The program achieved an 85% realized adjusted gross savings rate, a result driven by an adjustment in the baseline to account for market effects.

1.3.3. Heating and Cooling Efficiency

Program Description

The Heating and Cooling Efficiency Program included the following gas measures:

- Gas boiler
- Gas furnace

Through the program, Avista offered a $400 direct financial incentive to motivate customers to install more energy-efficient heating and cooling equipment. Participants could receive the incentive for installing a high-efficiency natural gas furnace of 90% AFUE (heating efficiency) or greater, or a natural gas boiler of 90% AFUE or greater.

Analysis

In the PY 2010 gas impact evaluation report,[5] Cadmus documented a census billing analysis we performed to determine the change in energy consumption due to the installation of a high-efficiency gas furnace. As the billing analysis provided the best information on this measure, Cadmus continued tracking results for PY 2013.

We calculated the amount of energy savings achieved through installations of high-efficiency gas boilers by adjusting the billing analysis results to the typical participant home installing a high-efficiency boiler.

Results and Findings

Table 10 shows the total reported and qualified counts, savings, and realization rates for gas Heating and Cooling Efficiency Program measures in Washington.

[5] Cadmus. *Avista 2010 Multi-Sector Gas Impact Evaluation Report*. August 2011.

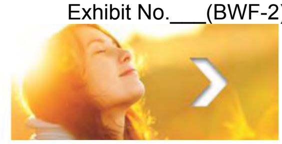

Table 10. Heating and Cooling Efficiency Program Results in Washington

Measure	Reported Measure Count	Reported Savings (therms)	Adjusted Savings (therms)	Qualifi-cation Rate	Verifi-cation Rate	Adjusted Gross (therms)	Reali-zation Rate
Natural Gas Boiler	20	2,820	1,860	100%	100%	1,860	66%
Natural Gas Furnace	2,018	209,488	207,854	100%	100%	207,854	99%
Program Total	**2,038**	**212,308**	**209,714**	**100%**	**100%**	**209,714**	**99%**

The program achieved a 99% realized adjusted gross savings rate.

1.3.4. Weatherization/Shell

Program Description

The following three categories of measures were incented through this program, available to residential customers with gas heated homes served by Avista:

- Insulation—ceiling/attic
- Insulation—floor
- Insulation—wall

Qualifying ceiling and attic insulation (both fitted/batt and blown-in) must have increased the R-value by 10 or more, and were incented at $0.15 per square foot of new insulation. Homes qualified if they had attic insulation of R-19 or less.

Floor and wall insulation (both fitted/batt and blown-in) must have increased the R-value by 10 or more, and were incented at $0.20 per square foot of new insulation. Homes were eligible if they had existing floor and/or wall insulation of R-5 or less.

Analysis

Cadmus conducted a statistical billing analysis to determine adjusted gross savings and realization rates for installed gas weatherization measures in PY 2011, PY 2012, and PY 2013. Our previous billing analysis primarily included PY 2010 customers, although we extrapolated realization rates to PY 2011. We included PY 2011 customers in this billing analysis since they now have complete post-period billing data. This increased the sample size and improved the precision of weatherization savings estimates. We also present results that only include PY 2012 and PY 2013. To increase accuracy of the analysis, we only included participants with at least 10 months of pre- and post-installation billing data. Consequently, the billing analysis includes PY 2011, PY 2012, and early PY 2013 participants.

To estimate weatherization energy savings resulting from the Washington program, Cadmus used a pre- and post-installation combined Conditional Savings Analysis (CSA) and Princeton Score-Keeping Method (PRISM) approach. We calculated overall gas model savings estimates for each measure bundle. We also attempted to estimate the detailed measure-specific savings impacts.

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Billing Analysis Methodology

Avista provided Cadmus with monthly gas billing data for all Washington participants from January 2009 through January 2014. Avista also provided a measure detail file containing participation and measure data. Participant information included:

- Customer details,
- Account numbers,
- Types of measures installed,
- Rebate amounts,
- Measure installation costs,
- Measure installation dates, and
- Deemed savings per measure.

Cadmus first matched weatherization measure information with the gas billing data. We obtained Washington daily average temperature weather data from January 2009 through January 2014 for eight National Oceanic and Atmospheric Administration (NOAA) weather stations, representing all the ZIP codes in Avista's Washington service territory. From daily temperatures, we determined base 65 heating degree days (HDDs) for each station. Using a ZIP code mapping for all U.S. weather stations, we determined the nearest station for each ZIP code. We then matched billing data periods with the HDDs from the associated stations.

Cadmus specified the pre- and post-periods for each customer account using two specifications:

- ***The Customer-Specific Measure Install Date:*** For each customer's unique installation date, this specification compares the year ending just before the install date with the year beginning on the installation month.
- ***The Fixed Dates:*** For this method, we selected the earliest and latest dates of available billing data. In effect, we used January 2010 through December 2010 as the pre-period, before any installations occurred. We defined the post-installation period as the latest period of complete billing data: February 2013 through January 2014.

Table 11 shows an example of the pre- and post-periods under the two specifications. For this analysis, Cadmus used a combination of the two specifications. While the first specification allows data from a more compressed timeframe to be used, it relies heavily on the exact installation date. The Fixed Dates specification removes this uncertainty by keeping only the earliest and latest periods of data, which are well outside the installation period. The drawback with using Fixed Dates is that it requires a longer billing data history; however, Cadmus relied on this method by default. To minimize attrition, we used the Customer Specific Measure Install Date specification when possible where there was insufficient billing data to use Fixed Dates.

Table 11. Example of Pre- and Post-Period Under the Two Specifications

Specification of Pre- and Post-Period	Installation Date	Pre-Analysis Period	Post-Analysis Period
Customer Specific Measure Install Date	November 2012	November 2011 - October 2012	November 2012 - October 2013
Fixed Dates		January 2010 - December 2010	February 2013 - January 2014

Data Screening

General Screens

Cadmus removed accounts with fewer than 10 paired months (300 days) of billing data in the pre- or post-period, as these data that could skew weatherization savings estimates.

PRISM Modeling Screens

As the second step in the screening process, Cadmus ran PRISM models on pre- and post-period billing data. These models provided weather-normalized pre- and post-period annual usage for each account, and we used them as an alternate check of the savings determined from the CSA model. The model specifications can be found in Appendix A.

For each participant home, we estimated a heating model in both pre- and post-periods to weather-normalize raw billing data.

After running the models, we applied the following screens to the PRISM model output, removing outlier participants from the billing analysis:

- ***Accounts where the post-weather-normalized (POSTNAC) usage was 70% higher or lower than the pre-weather-normalized (PRENAC) usage.*** Such large changes could indicate property vacancies when adding or removing gas equipment such as pools or spas, which are unrelated to weatherization installations.
- ***Accounts with negative intercepts and, hence, negative base load.*** We included these accounts in the analysis, but truncated them to 0. These negative intercepts typically occurred in homes with gas space heating and without gas water heating. The base load for these homes was expected to be 0; thus, we set the base load to 0.

The Washington weatherization population included 1,878 participants. Once we had screened the data, 1,211 participants (64%) remained for use in the CSA model, outlined below, to determine overall savings.

Table 12 summarizes the attrition from each data screening step listed above. Each row in the table indicates the accounts remaining after attrition. Roughly 26% of the participant accounts were dropped from the analysis because they did not have sufficient pre- and post-period billing data. Another 9%

were dropped based on PRISM screening and the presence of vacancies, seasonal usage, outliers, or equipment changes in the billing data.

Table 12. Weatherization Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Total Washington weatherization accounts	1,878	100%	0	0%
Matched to billing data provided	1,871	100%	7	0%
Less than 10 months of pre- or post-period billing data	1,385	74%	486	26%
PRISM screening*	1,351	72%	34	2%
Accounts deleted due to vacancies, seasonal usage, outliers and equipment changes	1,211	64%	140	7%
Final Analysis Group	**1,211**	**64%**	**667**	**36%**

* Using PRISM screens, Cadmus dropped accounts with: 1) negative heating slopes in the pre- or the post-period or 2) post-period usage that changed by more than 70% from pre-period usage.

CSA Modeling Approach

To estimate weatherization energy savings from this program, we used a pre/post CSA, fixed-effects model with pooled monthly time-series (panel) billing data. This modeling approach corrected for differences between pre- and post-period weather conditions, as well as for differences in usage consumption between participants through the inclusion of a separate intercept for each participant. This approach ensured that model savings estimates would not be skewed by unusually high-usage or low-usage participants. The model specifications can be found in Appendix A.

Program Impact Evaluation Findings

Overall Savings Impacts (Fixed Effects)

Table 13 summarizes the usage and savings associated with the weatherization measures installed in gas heated homes.[6] The results show the annual savings, relative precision on these savings, the PRENAC for each level, and the savings as a percentage of PRENAC. Table 13 also reports *ex ante* savings estimates and the realization rates achieved for the weatherization measures.

Overall, the PY 2011-PY 2013 weatherization measures achieved savings of 81 therms, or 9.3% savings relative to PRENAC. With an average weatherization measure *ex ante* savings estimate of 125 therms, the weatherization measures realized 65% of the expected savings.

[6] Cadmus also estimated measure-level models for PY 2012 and PY 2013 that contain the most recent *ex ante* estimates. For Washington, these revealed that the attic and wall insulation gas model savings were generally close to the current *ex ante* values; however, the floor insulation savings were considerably lower than the *ex ante* savings.

If the billing analysis is limited only to the PY 2012 and PY 2013 participants, the sample sizes drop considerably; however, the *ex ante* estimates reflect a downward adjustment based on the previous billing analysis. Also, there was a program change in the PY 2012 and PY 2013, in which only homes with very low initial R-value insulation levels qualified for the program. The PY 2012 and PY 2013 weatherization participants achieved savings of 100 therms, or 11.5% savings relative to PRENAC. With an average weatherization measure *ex ante* savings estimate of 95 therms, the weatherization measures realized 105% of the expected savings.

Finally, Cadmus estimated savings for only PY 2011 participants. This year forms the predominant sample of the billing analysis; however, the *ex ante* estimates are considerably higher. The PY 2011 weatherization participants achieved savings of 74 therms, or 8.5% savings relative to PRENAC. With an average weatherization measure *ex ante* savings estimate of 135 therms, the weatherization measures realized 55% of the expected savings.[7] Cadmus used the 2012 – 2013 results to determine program savings as the analysis was completed on homes only within this biennium.

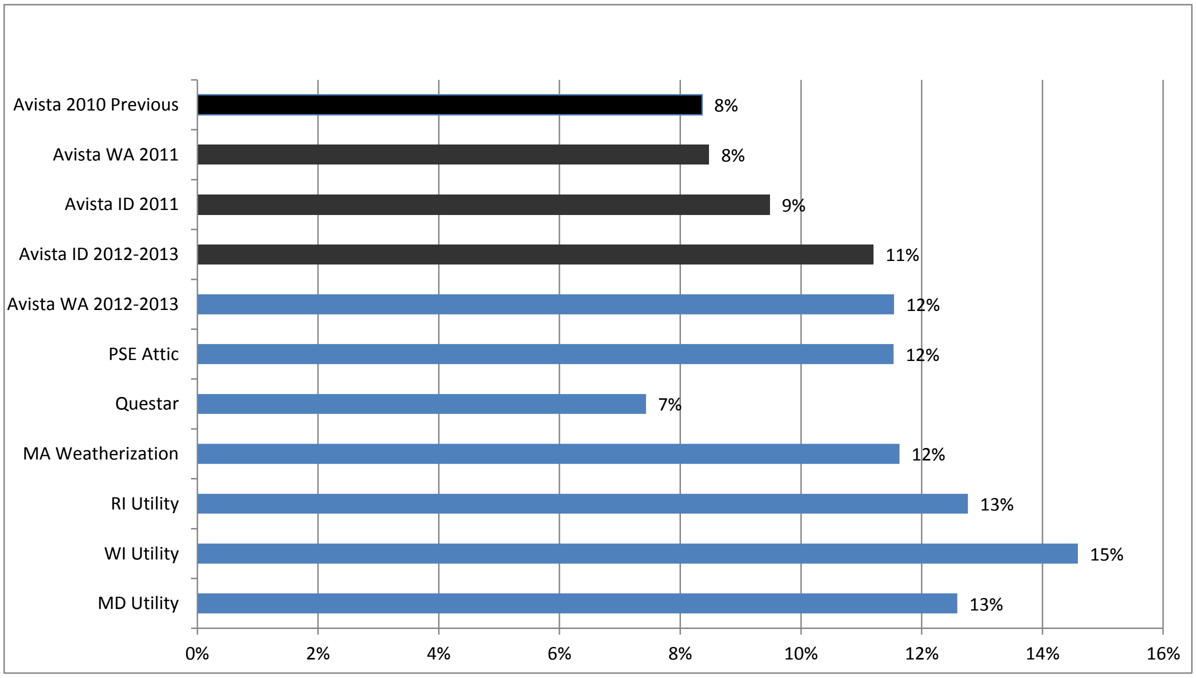
Table 13. Washington Weatherization Gas Savings per Home (Fixed-Effects Model)

Program Years	Number of Homes	Model Savings (therms)	Relative Precision on the Savings	Pre-Normalized Annual Consumption (therms)	Pre-Normalized Heating Annual Consumption (therms)	Savings as Percent of Pre-Period Annual Consumption	Annual *Ex Ante* Savings (therms)	Realization Rate
2011-2013	1,211	81	6%	874	681	9.3%	125	65%
2012-2013	303	100	6%	868	689	11.5%	95	105%
2011	908	74	8%	876	679	8.5%	135	55%

Figure 2 compares the percentage of program savings to similar gas weatherization evaluations. Avista's PY 2012 - PY 2013 percentage savings have improved significantly from PY 2010 and PY 2011. The Washington percentage savings are comparable with the Idaho percentage savings.

7 The weatherization savings for the PY 2010 and PY 2011 participants, outlined in our previous report, was 72 therms. The combined Idaho and Washington realization rate was 49%. In the previous report, we relied primarily on PY 2010 participants. PY 2011 savings and realization rate are very similar to the PY 2010 estimates.

Figure 2. Gas Weatherization Percentage Savings Benchmarking



Results and Findings

Table 14 shows total reported and qualified counts, savings, and realization rates of gas weatherization efficiency measures in Washington.

Table 14. Weatherization Program Results in Washington

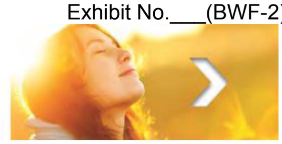
Measure	Reported Measure Count	Reported Savings (Therms)	Adjusted Savings (Therms)	Qualifi-cation Rate	Verifi-cation Rate	Adjusted Gross (Therms)	Reali-zation Rate
Attic/Ceiling Insulation	190	11,941	12,538	100%	100%	12,538	105%
Floor Insulation	43	8,438	8,860	100%	100%	8,860	105%
Wall Insulation	80	17,947	18,844	100%	100%	18,844	105%
Program Total	**313**	**38,326**	**40,242**	**100%**	**100%**	**40,242**	**105%**

1.3.5. Water Heater Efficiency

Program Description

The Water Heater Efficiency Program includes the following gas measures:

- High-efficiency 40-gallon water heater
- High-efficiency 50-gallon water heater



Through this program, Avista offered a $50 incentive to residential customers who installed eligible high-efficiency water heaters. To qualify for the program, natural gas water heaters with tanks had to have a 0.60 EF or greater for a 50-gallon tank, and a 0.62 EF or greater for a 40-gallon tank.

Analysis

Deemed unit energy savings remained consistent with those used in PY 2011, thus no changes were necessary.

Results and Findings

Table 15 shows total reported and qualified counts, savings, and realization rates of gas Water Heater Efficiency Program measures in Washington.

Table 15. Water Heater Efficiency Program Results in Washington

Measure	Reported Measure Count	Reported Savings (Therms)	Adjusted Savings (Therms)	Qualifi-cation Rate	Verifi-cation Rate	Adjusted Gross (Therms)	Reali-zation Rate
40-Gallon Natural Gas Hot Water	26	208	229	100%	100%	229	110%
50-Gallon Natural Gas Hot Water	148	888	1,337	100%	100%	1,337	151%
Program Total	**174**	**1,096**	**1,566**	**100%**	**100%**	**1,566**	**143%**

1.3.6. ENERGY STAR Homes

Program Description

Through the ENERGY STAR Homes Program, Avista offered incentives to builders constructing single-family or multifamily homes complying with ENERGY STAR criteria (and verified as an ENERGY STAR Home). Avista provided a $900 incentive for customer homes that use electric or electric and natural gas service for space and water heating. Avista provided a $650 incentive for homes that only have natural gas service (both hot water and space heating had to be natural gas).

Analysis

In the PY 2011 gas impact evaluation report, Cadmus documented the simulation modeling we had performed to determine the energy savings achieved by these measures. As the simulation results continue to provide accurate savings estimates, the results were maintained for PY 2012.

Results and Findings

Table 16 shows total reported and adjusted counts, savings, and realization rates for gas measures within ENERGY STAR Homes. The electric and gas program measures were installed in participating homes that use both electric and gas from Avista. The associated electric impact evaluation report will address electric savings associated with these homes.

Table 16. ENERGY STAR Home Program Results

Type of Fuel Used	Reported Measure Count	Reported Savings (Therms)	Adjusted Savings (Therms)	Qualifi-cation Rate	Verifi-cation Rate	Adjusted Gross (Therms)	Reali-zation Rate
Gas Only	3	609	610	100%	100%	610	100%
Electric/Gas	2	400	407	100%	100%	407	102%
Program Total	**5**	**1,009**	**1,017**	**100%**	**100%**	**1,017**	**101%**

1.3.7. Manufactured Homes Duct Sealing

Program Description

For this program, inspectors performed one of three levels of duct inspection and sealing on manufactured homes. In addition to duct sealing, they installed carbon dioxide monitors, CFLs, and showerheads. The program was offered from October 2012 through June 2013. Below are the description of each level of duct sealing and repair offered through the program.

Level 1 - Ducts are sealed from the interior (boots, registers, end caps). Cross-over duct is inspected and if no air leaks are found, no exterior treatment of the cross-over duct is conducted.

Level 2 - Ducts are sealed from the interior (boots, registers, end caps). Plenum is sealed. Cross-over duct is inspected and if determined to still be in good condition, but air leaks are identified at the cross-over duct connections to the collars, the collar connections to the main duct runs, or in the cross-over duct. The identified and repairable air leaks are sealed with mastic and/or repairs are made to the cross-over duct as required.

Level 3 - Ducts are sealed from the interior (boots, registers, end caps). Cross-over duct is inspected and if found to be disconnected and in good condition, the cross-over duct is reconnected and all connections are sealed with mastic. If the cross-over duct is damaged and in need of replacement, a new R-8 cross-over duct is installed, and cross-over duct connections are sealed with mastic.

Based on the measure data received, the population included 2,216 manufactured homes. Three out of every four customers, or 1,636, used electricity to heat their homes, while the remaining 580 (26%) used gas.

The duct sealing *ex ante* estimates by duct sealing level for the electrically heated homes are as follows:

- Level 1 – 50 therms
- Level 2 – 65 therms
- Level 3 – 80 therms

Showerheads were installed in two out of every three homes, and were expected to save 11 therms in homes with gas water heating.

Analysis

For our impact evaluation, Cadmus sought to estimate the change in energy use after duct sealing measures were installed, for each duct sealing level in electrically heated homes. Secondarily, we used billing analysis to obtain the electric savings of all the lighting and the water heating measures.

We determined the gas savings from the program by applying the evaluated realization rate for duct sealing measures in electrically heated homes to the gas *ex ante* therm savings for the gas heated homes. The methods used to develop the *ex ante* savings for this program were the same for electric and gas heated homes. The performance of the electric homes compared to the original estimation method is assumed to be sufficient for evaluation of gas savings at this time.

Data Collection, Review, and Preparation

To perform the billing and channeling analysis, Cadmus collected the data outlined below.

Monthly Customer Bills

Avista supplied Cadmus with monthly gas and electricity bills between January 2010 and February 2014.

Program Information

Cadmus obtained program measure data from Avista. The original measure data included measures installed, measure-level *ex ante* savings, heating type, and dates of participation in the program, but did not include account numbers. Avista staff completed a matching analysis to determine the account numbers associated with each home.

Weather

Cadmus collected daily temperature data from the National Climatic Data Center for January 2010 through February 2014 for nine weather stations associated with the ZIP codes for all the participating homes.

Data Preparation

To prepare the billing data for analysis, Cadmus conducted the following steps:

- Reformatting and merging the raw billing data for all customers.
- Merging the information from the measure data with the billing data, and selecting the customers with electric heat that received duct sealing measures.
- Matching the account numbers in the measure database to the complete historical measure database to identify homes that received other measures outside the Manufactured Homes Duct Sealing Program.
- Specification of the pre- and post-periods for each customer account. We followed a similar approach to the one described in the 2013 Low Income Gas Impact Report section below.

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Data Attrition

Cadmus performed a billing analysis on the population of program homes, excluding a few homes from the estimation sample that satisfied one or more of the following criteria:

- The home had fewer than 10 pre- or post-installation monthly energy bills
- The home did not pass one of the PRISM modelling screens, which are based on the weather normalized pre- and post-period annual usage.

Table 17 outlines the total number of customer accounts that had a conversion measure, along with the final sample we used in the PRISM and regression analyses. Each row in the table indicates the accounts remaining after attrition. Roughly 27% of the accounts were dropped because they had gas heating or did not receive any duct sealing measures. Another 27% were dropped because they did not have sufficient pre- and post-period billing data in the analysis. Another 9% were dropped based on PRISM screening, percentage change screening, or the presence of vacancies, seasonal usage, outliers, and equipment changes in the billing data.

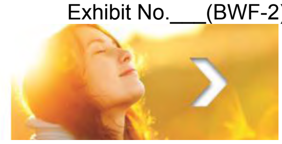
Table 17. Manufactured Homes Duct Sealing Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Total accounts with manufactured homes measures	2,216	100%	0	0%
Electrically heated homes that received duct sealing measures	1,621	73%	595	27%
Matched to billing data provided	1,582	71%	39	2%
Less than 10 months of pre- or post-period billing data	1,033	47%	549	25%
PRISM screens*	1,020	46%	13	1%
Accounts deleted due to vacancies, seasonal usage, outliers, and equipment changes	832	38%	188	8%
Final Analysis Group	**832**	**38%**	**1,384**	**62%**

* Using PRISM screens, Cadmus dropped accounts with: 1) negative heating slopes in the pre- or the post-period or 2) post-period usage that changed by more than 70% from pre-period usage.

Billing Analysis

Based on the final group of 832 manufactured homes, Cadmus used two approaches to estimate the program electricity savings: PRISM and fixed-effects regression. Cadmus first estimated the PRISM model to obtain NAC and identify outliers. Then we estimated a regression model to control for the installation of other measures outside this program. The model specifications can be found in Appendix A.



Program Impact Evaluation Findings

Overall Savings Impacts (Fixed Effects)

Table 18 summarizes the overall fixed-effects results for the three duct sealing levels across all measures installed in electrically heated homes. The results show the annual savings, relative precision of these savings, the pre-period NAC for each group, and the savings as a percentage of the pre-period NAC. The table also reports *ex ante* savings estimates and the achieved realization rates for the measures.

Table 18. Duct Sealing Electric Savings per Home (Fixed-Effects Model)

Duct Sealing Level	Number of Homes	Model Savings (kwh)	Relative Precision on the Savings	Pre-Normalized Heating Annual Consumption (kWh)	Savings as Percent of Pre-Period Heating Consumption	Annual *Ex Ante* Savings (kWh)	Realization Rate
Level 1	171	1,155	16%	13,568	8.5%	1,550	75%
Level 2	555	1,218	8%	13,233	9.2%	1,950	62%
Level 3	106	1,980	16%	14,291	13.9%	2,350	84%
Overall	**832**	**1,303**	**7%**	**13,435**	**9.7%**	**1,919**	**68%**

Results and Findings

Cadmus applied the realization rates calculated from the electrically heated homes billing analysis to the reported gas savings. Table 19 shows total tracked and adjusted counts, savings, and realization rates for measures offered through the Manufactured Homes Duct Sealing Program.

Table 19. Manufactured Homes Duct Sealing Program Results

Measure	Reported Measure Count	Reported Savings (Therms)	Adjusted Savings (Therms)	Qualifi-cation Rate	Verifi-cation Rate	Adjusted Gross (Therms)	Reali-zation Rate
Duct Sealing Level 1	134	6,700	5,025	100%	100%	5,025	75%
Duct Sealing Level 2	384	24,960	15,475	100%	100%	15,475	62%
Duct Sealing Level 3	66	5,280	4,435	100%	100%	4,435	84%
Direct Install Showerhead	458	5,038	5,038	100%	100%	5,038	100%
Program Total	**1,042**	**41,978**	**29,973**	**100%**	**100%**	**29,973**	**71%**

1.3.8. Simple Steps, Smart Savings

Though primarily a lighting program, Simple Steps, Smart Savings also incentivized low-flow, energy-saving shower heads in PY 2013. The evaluation assumes that 48.4% of the units purchased were installed in homes with a gas fueled water heaters. This assumption is based on the responses of over 1,000 of Avista's residential customers in Washington to Cadmus' general population survey. The program sold showerheads with flow rates ranging from 1.5 gallons per minute (gpm) to 2.0 gpm. The unit energy savings for each flow rate sold are based on the values currently approved by the RTF[8] for "Any Shower" in a home with a gas fueled water heater. The savings for the program are shown in Table 20. The increase in savings is a result of a 56% increase in the saturation of gas water heaters compared to program tracking and a 114% increase in the UES for each assumed gas installation.

Table 20. Simple Steps, Smart Savings Program Results in Washington

Measure	Reported Measure Count	Reported Savings (Therms)	Evaluated Measure Count	Evaluated Savings (Therms)	Realization Rate
Showerheads	247	718	386	2,395	334%

1.4. Residential Conclusions

Overall, the PY 2013 Washington residential gas programs produced 285,497 therms in savings. As shown in Table 21, the evaluation yielded a 96% realization rate.

Table 21. Program Reported and Evaluated Gross Savings and Realization Rates

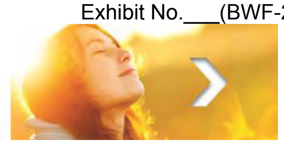
Program Name	Reported Savings (Therms)	Evaluated Gross Savings (Therms)	Realization Rate
ENERGY STAR Products	695	590	85%
Heating and Cooling Efficiency	212,308	209,714	99%
Weatherization/Shell	38,326	40,242	105%
Water Heater Efficiency	1,096	1,566	143%
ENERGY STAR Homes	1,009	1,017	101%
Manufactured Homes Duct Sealing	41,978	29,973	71%
Simple Steps, Smart Savings	718	2,395	334%
Total	**296,130**	**285,497**	**96%**

1.5. Residential Recommendations

Based on our evaluation results, Cadmus offers the following recommendations:

- If the clothes washer measure is reinstated, Avista should consider moving all rebates to the electric program, as the majority of savings will likely result from a reduction in consumed electricity from the dryer. Qualifying for the program should be based on the presence of an electric dryer in the home. Given the large percentage of savings achieved through reduced dryer energy, and because of the high likelihood that most participants have an electric dryer, this measure predominantly produces electric energy savings.
- Avista should consider increasing the amount of data tracked as part of the Manufactured Homes Duct Sealing Program, including such fields as the Avista customer account number.

[8] http://rtf.nwcouncil.org/measures/measure.asp?id=126



- Avista may consider performing a targeted billing analysis for weatherization participants who use *both* electricity and gas to heat their homes. Our current study analyzes homes based on the program they are tracked in. Customers who use multiple fuels to heat their home may be saving more energy than currently estimated.
- High-efficiency gas furnaces continue to provide the largest portion of savings for the residential portfolio. The last billing analysis we performed was in 2011 on PY 2010 participants, so those results could be re-estimated in the next evaluation.
- Once the gas heated homes participation in the Manufactured Homes Duct Sealing Program has reached sufficient size, consider conducting a billing analysis to estimate savings.

CADMUS

2. 2013 Nonresidential Gas Impact Report

2.1. Introduction

With its nonresidential portfolio of programs, Avista promotes the purchase of industry-proven, high-efficiency equipment for its commercial customers. The company provides rebates to partially offset the cost differences between high-efficiency equipment and standard equipment, reducing first-cost barriers and making the high-efficiency equipment a more viable option for commercial customers.

Five programs make up the nonresidential gas portfolio, divided into two major categories:

- Prescriptive (four programs)
- Site-Specific (one program)

2.1.1. Prescriptive

Prescriptive Commercial HVAC

Beginning in January 2011, Avista has been processing installations of efficient HVAC systems through a prescriptive program, rather than through the Site-Specific Program. The prescriptive program limits eligible measures to the following:

- Furnaces under 225 kBtu with an efficiency level greater than 90% AFUE.
- Furnaces between 225 kBtu and 300 kBtu with an efficiency level greater than 85% AFUE.

Prescriptive Commercial Windows and Insulation

Beginning in January 2011, Avista has been processing installation of commercial insulation through a prescriptive program, in addition to the Site-Specific Program. Projects qualify for the prescriptive program if they have the following, pre-existing conditions:

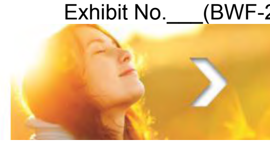
- Wall insulation levels of less than R-4, improved to R-11 or better.
- Attic insulation levels of less than R-11, improved to R-30 or better.
- Roof insulation levels of less than R-11, improved to R-30 or better.

Prescriptive Energy Smart Grocer

Grocery measures have high potential for energy savings but are often overlooked because of the technical aspects of the equipment. Through the Energy Smart Grocer Program, Avista assists grocery store customers with technical aspects of their refrigeration systems, while providing information about the savings they can achieve. A field energy analyst offers customers' technical assistance, produces a detailed report of the potential energy savings at their facility, and guides them through the Energy Smart Grocer process from inception through the payment of incentives for qualifying equipment.

Prescriptive Food Service Equipment

This program is applicable to nonresidential electric and gas customers with commercial kitchens. Avista provides direct incentives to customers who choose to install high-efficiency kitchen equipment. To



qualify for an incentive, the equipment must meet ENERGY STAR or Consortium for Energy Efficiency tier levels (depending on the unit).

2.1.2. Site-Specific

The Site-Specific Program addresses nonresidential measures that do not fit the prescriptive applications; thus, they are considered based on project-specific information. Measures eligible for consideration must produce demonstrable kWh or therm savings, and are available to commercial, industrial, or pumping customers who receive electric or natural gas service from Avista.

The program includes the following measures:

- Site-Specific HVAC
  - HVAC combined
  - HVAC heating
- Site-Specific Other
  - Appliances
  - Motors (demand controlled ventilation)
- Site-Specific Shell

Avista implements the Site-Specific Program and three of the prescriptive programs, while PECI implements the forth prescriptive program, Energy Smart Grocer. As implementers, both Avista and PECI are responsible for designing and managing program details. Both implementers developed algorithms for use in calculating measure savings and determining measure and customer eligibility.

Avista staff fields inquiries from potential participants and contractors, and maintains a tracking database for projects. Avista manages projects by reviewing and approving applications at all stages of the process, calculating project savings, and populating the database with relevant information.

2.2. Methodology

Cadmus designed the impact evaluation to verify tracked program participation and to estimate energy savings. We determined gross savings using engineering calculations, desk reviews, verification site visits, and some project-level billing analysis.

Cadmus reviewed Avista's tracked gross energy savings and available documentation for a sample of sites, such as audit reports and savings calculation work papers, particularly focusing on calculation procedures and documentation for savings estimates. We also verified the appropriateness of Avista's analyses for calculating savings, and the operating and structural parameters of the analyses. Through site visits or desk reviews of a sample of projects, we collected data on equipment installation and operation and evaluated gross energy savings through engineering calculations.

Cadmus collected baseline, tracking, and program implementation data through on-site interviews with facility staff. During on-site visits, we verified measure installations and determined changes to the operating parameters occurring since measure installation. We asked facility staff questions regarding the installed systems' operating conditions, additional benefits, and shortcomings. We used the savings realization rates from sample sites to estimate savings for the overall program and to develop recommendations for future studies.

2.2.1. Sampling

Avista reported planning to phase out its gas programs due to cost-effectiveness concerns associated with the declining price of natural gas in 2012. However, Avista later determined it would be preferable to continue delivering gas programs, and therefore we reinstituted gas project sampling.

Cadmus developed a sampling calculation tool to estimate the number of on-site visits required to achieve the rigor levels of the precision target for both Idaho and Washington combined. We used preliminary program population data provided by Avista and determined that we needed to verify 70 projects across the combined PY 2012 and PY 2013 program populations. We anticipated achieving 90/10 precision at the overall nonresidential program level through the targets for each stratum. We calculated the final precision based on the combined program populations for both years following the PY 2013 evaluation.

Table 22 shows the proposed precision targets for the site verification and desk review evaluation activities.

Table 22. Proposed PY 2012-PY 2013 Nonresidential Idaho and Washington Gas Evaluation Sample

Measure Category	Proposed Precision Target	Proposed Evaluated Projects
Prescriptive (all four programs)	90/20	40
Site-Specific HVAC	90/20	12
Site-Specific Other	90/20	6
Site-Specific Shell	90/20	12
Total	**90/10**	**70**

We assigned both a census and a random sample for each stratum. The census stratum represented the four 2013 projects with the highest overall gas savings, with all four sites located in Washington. Each census site reported over 9,000 therms in savings and combined to represent 19% of total 2013 program reported savings. For the non-census stratum, we randomly selected additional participants from the remaining project population.

In Table 23, we show the precision achieved for the actual number of evaluation activities for gas measures, which exceeds our targeted precision estimate. Subsequent sections of this report will explain the differences between our initial proposed and actual sampling plan for evaluation activities. For example, in our initial sampling plan we categorized ENERGY STAR appliances in the site-specific other category. As the impact evaluation progressed, we determined these measures were more appropriate for the prescriptive category.

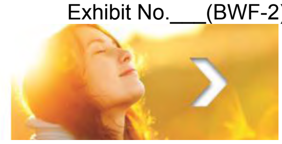


Table 23. Actual PY 2012-PY 2013 Nonresidential Idaho and Washington Gas Evaluation Sample

Measure Category	Achieved Precision	Evaluated Projects
Prescriptive (all four programs)	90/12	34
Site-Specific HVAC	90/3	23
Site-Specific Other	90/1	11
Site-Specific Shell	90/1	10
Total	**90/4**	**78**

Cadmus found that the database extract from Avista provided program-level details, but not measure-level information. Therefore, we sought to verify savings for every incented measure at each site, regardless of whether it achieved gas or electric savings. To establish whether we evaluated an accurate distribution of specific measure types within each program would have required an exhaustive review of project files, which fell outside of the evaluation scope.

2.2.2. Data Collection

Cadmus collected data from 30 sites during project verifications in Washington. For each selected project, we first conducted a document review to determine measure types, quantities, operational parameters, and calculation methodologies.

Document Review

Avista provided Cadmus with documentation on the selected sites' energy-efficiency projects, including program forms, the tracking database, audit reports, and savings calculation work papers for each rebated measure. When reviewing calculation spreadsheets and energy simulation models, Cadmus paid particular attention to calculation procedures and documentation for savings estimates.

Cadmus reviewed each application for the following information:

- ***Equipment replaced:*** descriptions, schematics, performance data, and other supporting information.
- ***New equipment installed:*** descriptions, schematics, performance data, and other supporting information.
- ***Savings calculation methodology:*** the methodology type used, specifications of assumptions, sources for these specifications, and the correctness of calculations.

Site Visits

During on-site visits, Cadmus sought to accomplish three primary tasks:

- Verify the implementation status of all measures for which customers received incentives. This required verifying that the energy-efficiency measures had been installed correctly and functioned properly. We also verified the operational characteristics of the installed equipment, such as temperature setpoints and operating hours.
- Collect physical data, such as boiler capacities or operational temperatures, and analyzing the energy savings realized from the installed improvements and measures.
- Interview facility personnel to obtain additional information regarding the installed systems, thus supplementing data from other sources.

Desk Reviews

For some prescriptive and site-specific projects in PY 2013, we analyzed and evaluated energy savings by reviewing calculation spreadsheets and documentation submitted with the rebate applications. We verified equipment efficiency based on equipment model numbers provided in rebate applications and on savings calculation methodologies. We chose projects for desk review that realized smaller therm savings than the census-level projects we selected for site visits. Cadmus applied the on-site verification details to all 2013 sample projects rather than conducting a desk review after Avista confirmed they would continue offering nonresidential gas programs in PY 2013.

2.2.3. Engineering Analysis

The nonresidential prescriptive programs required a significantly different method of analysis than the Site-Specific Program.

Overview

Cadmus chose what procedures to use for verifying savings through an engineering analysis based on the type of measure analyzed. For this evaluation, we used the following analytical methods, with descriptions included in their respective program detail sections below:

- Prescriptive deemed savings
- Billing analysis
- Calculation spreadsheets
- Energy simulation modeling

Prescriptive Deemed Savings

For most prescriptive measures, we verified the deemed savings estimates that Avista used for savings calculations, then compared these with the values we developed for the TRM. We focused our verification activities on:

- The installed quantity;
- Equipment nameplate data;

- Proper installation of equipment; and
- Operating hours.

Where appropriate, we used data from site verification visits to reanalyze prescriptive measure savings using Avista's Microsoft Excel® calculation tools, ENERGY STAR calculation tools, RTF deemed savings, and other secondary sources.

Billing Analysis

Cadmus analyzed Avista's metered billing data for one site-specific HVAC project. Using a pre- and post-modeling approach, we developed retrofit savings estimates for the site. This modeling approach accounted for differences in HDDs, and determined savings based on normalized weather conditions, as actual weather conditions may have been milder or more extreme than the TMY3 15-year normal weather averages from 1991–2005, obtained from NOAA.

NOAA also provided daily weather data for each weather station associated with the participant projects, and we calculated the base 65 reference temperature HDDs. We matched participant billing data to the nearest weather station by ZIP code, and matched each monthly billing period to the associated base 65 HDDs.

In developing the analysis model, we followed a modified PRISM approach, which normalized all dependent and independent variables to the days in each billing period, and allowed model coefficients to be interpreted as average daily values. This methodology accounted for differences in the length of billing periods. For each project, we modeled average daily consumption in therms as a function of some combination of the average standing base load and HDDs.

For each site, Cadmus estimated two demand models: one for the pre-installation period; and one for the post-installation period. We chose this methodology over a single standard treatment effects model to account for structural changes in demand that might have occurred due to retrofits.

After estimating model coefficients for each site, Cadmus calculated two scenarios:

- We estimated a reference load for the previous 12 billing cycles using the pre-installation period model. This scenario extrapolated the counterfactual consumption (i.e., what consumption would have been absent the program).
- We estimated a normalized scenario using the post-installation period model. We used 15-year TMY3 data as the annual HDD and mean annual values for the usage data. The difference between this scenario and the counterfactual assumption represented the expected long-term annual savings.

Calculation Spreadsheets

Avista developed calculation spreadsheets to analyze energy savings for a variety of measures, including envelope measures (such as ceiling and wall insulation). These calculation spreadsheets required entering relevant parameters, such as square footage, efficiency values, HVAC system details, and location details. From these data, energy savings could be estimated using algorithms programmed by Avista. For each spreadsheet, we reviewed input requirements and output estimates, and determined if the approach proved reasonable.

Energy Simulation Modeling

Avista determined savings for many site-specific HVAC and shell projects using energy simulation modeling (which they chose due to the complex interactions between heating and cooling loads and the building envelope). Avista provided the original energy simulation models, which we reviewed to determine the relevant parameters and operating details (such as temperature setpoints) for the applicable measures. We updated the models as necessary based on site verification data.

2.3. Results and Findings

Cadmus adjusted gross savings estimates based on our evaluated findings. The following sections discuss further details by program.

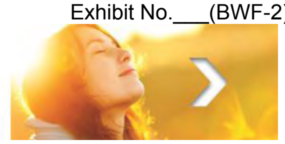
For most projects, the documentation was readily available and the measures performed close to expectations. However, some project files contained an excessive amount of documentation. In certain cases, projects evolved over time based on participant capital availability and interest level. These project files often included the different iterations of project development, but did not clearly identify the final reported project energy savings and analysis documentation. When Cadmus contacted the participants regarding these measures, the lack of clarity sometimes caused them to be confused and dismayed.

2.3.1. Prescriptive Programs

We evaluated savings for a sample of sites across the four prescriptive programs. Table 24 shows the savings and realization rates by program for Washington projects in PY 2013. Cadmus used total program results (both states, two years) for final extrapolation because the sample was built using a combined sampling methodology. Further evaluation details for each program follow.

Table 24. Evaluated Results for PY 2013 Nonresidential Gas Prescriptive Sample—Washington

Prescriptive Program	Total PY 2013 Measure Installations	Evaluated Sample	Gross Reported Savings (Therms)	Gross Evaluated Savings (Therms)	Realization Rate
Commercial HVAC	36	5	2,497	2,620	105%
Commercial Windows and Insulation	54	7	17,047	14,823	87%
Energy Smart Grocer	7	3	6,387	6,693	105%
Food Services Equipment	5	1	3,600	3,600	100%
Total	**102**	**16**	**29,531**	**27,736**	**94%**



Cadmus identified several adjustments necessary to the tracked savings for the prescriptive programs. The calculations often require reported equipment and operations data, which could vary from parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 6% for Washington projects, the same reduction as for the combined adjustments for both states. This similarity was due to the limited number of Idaho prescriptive gas projects (only one commercial HVAC project). Typical adjustments corrected equipment efficiencies, fuel types, operating schedules, and operating parameters, as described below:

- On one large commercial insulation project, Cadmus found that a portion of the area was not heated. We adjusted the savings calculator appropriately. This adjustment resulted in lower savings and an 81% realization rate.
- One medium commercial insulation project reported savings in PY 2013, but the work was not complete. Cadmus confirmed that the project was still incomplete when we called to schedule the on-site verification. The project documentation showed that the business was newly established. The invoice only covered materials, with installation labor being conducted by the participant. The project did not achieve savings in PY 2013.
- Cadmus applied a PECI benchmarking work paper[9] to evaluate savings for two Energy Smart Grocer projects in which doors were added on medium temperature walk-in cases. The adjustment resulted in an increase in gas savings, for a realization rate of 117%.
- We adjusted calculation parameters on several small projects to account for variance in furnace efficiency, furnace capacity, window square footage, and heating load hours. The adjustments increased savings, on average.

2.3.2. Site-Specific

Cadmus evaluated the savings for 14 Site-Specific Program projects in Washington in PY 2013, representing a variety of measure types. We calculated an overall realization rate for all randomly selected (non-census) projects in Washington, then applied the resulting realization rate to the non-census population for each state and major measure type. Table 25 shows our evaluated results for the program. Cadmus used total program results (both states, two years) for final extrapolation because the sample was built using a combined sampling methodology.

9 http://rtf.nwcouncil.org/meetings/2011/0830/WP_PECIREF_CA%20DRAFT.pdf.

Table 25. Evaluated Results for PY 2013 Nonresidential Gas Site Specific Sample—Washington

Site-Specific Program	Total PY 2013 Measure Installations	Evaluated Sample	Gross Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
HVAC	26	8	80,499	71,349	89%
Other	5	3	10,808	11,378	105%
Shell	27	3	20,503	20,503	100%
Total	**58**	**14**	**111,810**	**103,230**	**92%**

Cadmus identified several adjustments to the tracked savings from Site-Specific Program projects. Site-specific projects tend to be more complex, making energy-savings parameters and impacts more difficult to estimate. In addition, the calculations often rely on participant-supplied building, equipment, and operations data, which may vary from the parameters identified during an on-site verification visit.

In aggregate, the Site-Specific Program performed well, achieving an overall combined realization rate of 93%. We made the following specific adjustments to Washington projects, based on our review of rebate applications and billing data:

- A census-level HVAC project disconnected a building heating system from a campus-wide central plant. We accepted the reported baseline consumption, then used actual billing data to determine the retrofit consumption. The actual retrofit consumption was higher than the expected value used in savings calculations. The reduced the difference between baseline and retrofit consumption, resulting in lower gas savings and an 86% realization rate.
- One large multifamily project included estimated savings for apartment furnace units. Avista based the reported savings on a furnace capacity of 60,000 Btu/hour/unit. Cadmus found that the actual capacity was 44,000 Btu/hour/unit. This reduced gas savings, with a resulting realization rate of 77%.
- We analyzed the energy savings for one large HVAC project through a billing analysis, as shown by the pre- and post-installation linear regressions in Figure 3 and Figure 4, respectively. The resulting regression analysis revealed that the project achieved less gas savings than reported, for a realization rate of 72%.
- Cadmus analyzed one census-level site-specific project through a calibrated simulation analysis with the utility billing data. This analysis revealed that the project achieved more energy savings than reported. The resulting realization rate was 108%.

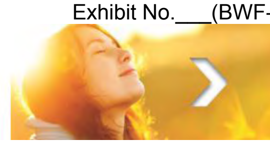


Figure 3. Large Site-Specific HVAC Project Pre-Installation Linear Regression

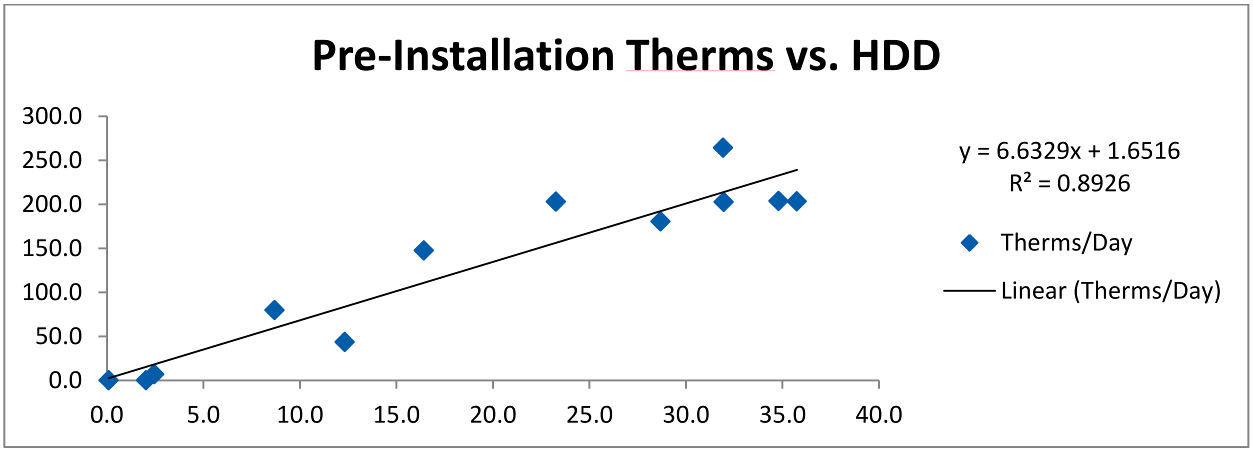
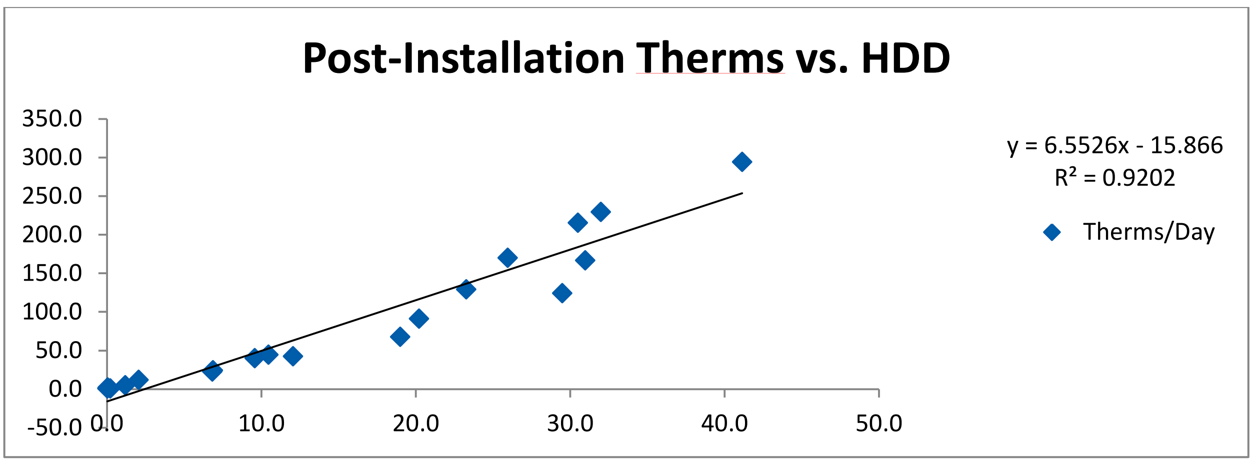


Figure 4. Large Site-Specific HVAC Project Post-Installation Linear Regression



2.3.3. Extrapolation to Program Population

For our evaluation of the nonresidential gas programs, we selected sites that could provide the most significant impacts. We designed the site visits to achieve a statistically valid sample for the major strata, as discussed previously. For measures in the random (non-census) sample, we calculated realization rates (the ratio of tracked-to-evaluated savings) and applied these to the remaining non-sampled sites. We did not apply measure-level realization rates to the census population. These realization rates are weighted averages, based on the random verification sample and using the following four equations.

We calculated realization rates for each individual site in the sample based on measure type:

$$RR_{ij} = \frac{Evaluated_{ij}}{Tracked_{ij}}; \text{ for measure } j \text{ at site } i$$

Where:

RR = Realization rate

i = Sample site

j = Measure type

Then we calculated the realization rates for the measure types using the ratio of the sum of evaluated savings to the sum of reported savings from the randomly selected sample for each measure type:

$$RR_j = \frac{\sum_i Evaluated_i}{\sum_i Tracked_i};\ for\ measure\ j\ across\ all\ sample\ sites$$

We calculated non-census population evaluated savings by multiplying the measure-type realization rate (RR_j) from the random sample by the reported savings for the non-census population of each measure type:

$$\sum_k Evaluated_k = RR_j x \sum_k Tracked_k;\ for\ measure\ j\ across\ all\ sites\ in\ measure\ population$$

Where:

k = The total population for measure type 'j'

Finally we added the reported and evaluated savings from census stratum measures to calculate the total reported and evaluated savings for each program. The program realization rate derived from the ratio of all evaluated to all reported savings:

$$RR_l = \frac{\sum_k Evaluated_k}{\sum_k Tracked_k};\ for\ the\ population\ (all\ sites\ and\ measures)$$

Table 26 summarizes of the results of all prescriptive programs and the Site-Specific Program in Washington; the overall nonresidential portfolio achieved a gross realization rate of 95%.

Table 26. PY 2013 Gas Programs' Gross Realization Rates—Washington

Measure Category	Gross Program Reported Savings (Therms)	Gross Program Evaluated Savings (Therms)	Realization Rate
Prescriptive Programs	91,559	86,792	95%
Site-Specific HVAC	158,023	146,635	93%
Site-Specific Other	14,266	14,858	104%
Site-Specific Shell	55,956	55,796	100%
Total	**319,804**	**304,081**	**95%**

2.3.4. Fuel Conversion and HVAC/Lighting Interactive Impacts

The Avista natural gas portfolio reported savings do not include increases in gas consumption due to fuel conversions from electric heating to gas heating, or from increased lighting efficiency. Lighting systems convert a large portion of their input energy to useful light output, but a substantial portion also converts to heat. Any reduction in lighting input energy also reduces waste heat. Reducing waste heat lowers the site's required cooling load, but increases the site's heating load.

Cadmus noted that Avista tracked and recorded these gas consumption effects for many projects to determine electric program cost-effectiveness. Most of the tracked interactive effects involved prescriptive or site-specific lighting projects, although some therm penalties resulted from the Energy Smart Grocer (in Avista's electric portfolio) and site-specific HVAC projects.

In addition, Avista did not include interactive effects into its portfolio energy-savings goals (which would have reduced goals).

2.4. Nonresidential Conclusions

Cadmus evaluated 30 of 160 measures installed through the program in Washington for PY 2013, representing 44% of tracked savings.

Through evaluation, we determined that Avista generally implemented the programs well. Cadmus identified the following key issues that reduced evaluated energy savings below the reported values:

- Some calculations provided by participants/contractors contained information that varied from what Cadmus engineers found on-site.
- One prescriptive project had not actually been installed as reported.
- Retrofit natural gas consumption varied from predicted values for some site-specific projects.

2.5. Nonresidential Recommendations

Cadmus offers the following recommendations, based on the evaluation results:

- Avista should streamline the file structure to enable internal and external reviewers to more easily identify the latest documentation.
- Avista should continue to perform follow-up measure confirmation and/or site visits on a random sample of projects (at least 10%).
- Avista should consider flagging sites for additional scrutiny for which the paid invoice does not list installation labor.

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3. 2013 Low Income Gas Impact Report

3.1. Introduction

Cadmus conducted a statistical billing analysis to determine adjusted gross savings and realization rates for energy-efficient measures installed through the low-income weatherization program for 2013 customers. Cadmus examined energy savings at the household or participant level, rather than at the measure level. We performed billing analysis on 2012 participants who had a full year of energy consumption data both before (2011) and after (2013) the weatherization period. Then Cadmus applied 2012 billing analysis results to 2013 program participants. We deemed gas savings using a tiered approach for conversion participants using model results from the billing analysis.

To estimate energy savings resulting from the program, Cadmus used a pre- and post-installation, combined Conditional Savings Analysis (CSA), and a Princeton Score-Keeping Method (PRISM) approach, using monthly billing data. We analyzed energy-savings estimates for program participants and ran a series of diagnostic tests on the data. These tests included reviewing savings by pre-consumption usage quartile, checking to ensure households have a sufficient amount of billing data, and creating a graphical outlier analysis. Below is a detailed discussion of the regression model used for this billing analysis along with resulting savings.

3.1.1. Program Description

Five components, listed in Table 27, are included in the low-income weatherization program. Local Community Action Partners (CAPs) within Avista's Washington service territory implemented these low-income projects. CAPs holistically evaluate homes for energy-efficiency measure applicability, combining funding from different utility and state/federal programs to apply appropriate measures to a home, based on the results of a home energy audit.

Table 27. Low-Income Weatherization: 2013 Gas-Efficiency Installations by Program Component*

Low-Income Program Component	Measure Description	Measure Installations
Shell/Weatherization	Insulation, window/door, air infiltration, programmable thermostat	463
Fuel Conversion*	Electric furnace, heat pump, water heater replacement with gas units	N/A
Hot Water Efficiency	High-efficiency water heater/high-efficiency boiler replacement	35
ENERGY STAR Appliance	High-efficiency refrigerator replacement	N/A
HVAC Efficiency	High-efficiency furnace/ high-efficiency boiler replacement	84

* The Avista portfolio considers (and reports) fuel conversion measures as electric-saving measures.

3.2. Data Collection and Methodology

Cadmus obtained impact evaluation data from multiple sources, including:

- ***Program participant database:*** Avista provided information regarding program participants and installed measures. Specifically, these data included a list of measures installed per home and reported savings from each completed installation. The data did not, however, include the quantity of measures installed (such as the number of square feet of installed insulation) or per-unit savings estimates.
- ***Billing records:*** Avista provided participant meter records from January 2011 through December 2013.
- ***Weather data***: Cadmus collected Washington weather data from seven representative NOAA stations, drawn for the corresponding time period.

3.2.1. Sampling

The analysis started with a census of 2012 program participants. Cadmus screened the 2012 program participants data by specific criteria for use in the final analysis (ensuring sufficient monthly billing data, not classified as an outlier). In all, 48 non-conversion Washington gas participants were included in the billing analysis; while we evaluated an additional 105 electric-to-gas conversion participants outside of the billing analysis model. Cadmus defined conversion customers as any participant who received a new gas furnace, water heater, or heat pump that replaced an electric unit.

3.2.2. Billing Analysis

Avista provided monthly billing data for all participants from January 2011 through December 2013. Avista also provided the participant database, which contained participation and measure data for the 2012 and 2013 program years, including all gas and electric measures installed per home by CAPs.

Cadmus obtained daily average temperature weather data from 2011 to 2013 for the seven NOAA weather stations representing all 2012 electric participant ZIP codes in Avista's Washington service territory. From daily temperatures, we determined base 65-degree HDDs for each station, then matched billing data periods with the HDDs from stations closest to each participant.

As we received billing data through December 2013, we could only perform the billing analysis for the 2012 program year. We defined the analysis pre-period as 2011, before all participation installations occurred, and defined the analysis post-period as 2013, following all installations occurring in 2012. We then applied the analysis results for 2012 participants to the 2013 participant population, thus reporting overall impacts for the 2013 program year. Given consistency in delivery infrastructure, measure offerings, and program design, using billing analysis and extrapolating evaluated impacts from the previous year to 2013 seems appropriate. Furthermore, performing billing analysis for whole-house programs is considered an industry best-practice, cited in several evaluation protocols (IPMVP, UMP), allowing to account for measure interaction, participant take-back, and effects of energy-education on participant usage behavior.

3.3. Data Screening

Cadmus conducted a series of steps to screen participant usage data, ensuring that we used a clean, reliable dataset for analysis.

3.3.1. General Screens

The following screens removed non-conversion gas accounts that could have skewed the savings estimation:

- Accounts with fewer than three months (90 days) of billing data, in either the pre- or post-period;
- Accounts with annual usage outside of reasonable bounds (i.e., less than 150 therms or more than 2,000 therms) in either the pre- or post-period and;
- Accounts with abnormal changes in usage from the pre- to post-period (an absolute change of 70% or more).[10]

3.3.2. Weather Normalization Screens

To screen data, Cadmus used PRISM-like models for weather-normalizing pre- and post-billing data for each account, and to provide an alternate verification of measure savings obtained from the CSA model. For more detail on the model specification, see Appendix D.

Cadmus applied the following screens to the PRISM model output and removed participants from the billing analysis:

- ***Accounts with a PRISM model r-squared of less than 0.50.*** These accounts indicate a bad fit of the monthly gas usage with actual HDDs, which is unexpected when gas appliances are used in both the pre- and post-periods.
- ***Accounts with a HEATNAC of less than 100 therms in either the pre- or post-period.*** If the annual heating usage accounts for less than 100 therms, the gas heating system was likely not used at all or was only used for backup secondary heating. This screen also removed accounts with negative heating slopes, since it is unlikely the usage would have decreased during the heating months.
- ***Accounts where the pre-period base load was 0 and the post-period base load was greater than 0.*** Since the base load indicates the usage that occurs during non-winter shoulder months, or those months outside of the heating season, this outcome suggests that a gas water heater, gas dryer, or gas range was added to the participant home. In this situation, the additional base

[10] Changes in usage of this magnitude are probably due to vacancies, home remodeling or addition, seasonal occupation, or fuel switching. Changes of usage over a certain threshold are likely not program effects and can confound the analysis of consumption.

load usage in the post-period should not correspond to the weatherization measures installed through the program.

Table 28 summarizes gas account attrition from the screens listed above.

Table 28. Low-Income Weatherization: Non-Conversion Gas Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original Gas Accounts	130	100%	0	0%
Overlap Participation within Pre- or Post-Period	99	76%	31	24%
Matched to Billing Data Provided	99	76%	0	0%
Insufficient Pre- and Post-Period Months	83	64%	16	12%
Insufficient Pre- and Post-Period Days	83	64%	0	0%
Low or High Usage in Pre- or Post-Period	78	60%	5	4%
Changed Usage from the Pre- to Post-Period (> 70%)	60	46%	18	14%
PRISM Screen: Low R-Squared, Low Heating Usage	56	43%	4	3%
Account-level inspection of pre/post 12-month usage (e.g., vacancies, anomalies)	48	37%	8	6%
Final Analysis Group	**48**	**37%**	**82**	**63%**

After applying these screens, Cadmus included 48 Washington gas participants in the statistical billing analysis.

3.4. Conditional Savings Analysis Modeling Approach

To estimate energy savings from this program, Cadmus used a pre/post CSA fixed-effects model, which uses pooled monthly time-series (panel) billing data. The fixed-effects modeling approach corrects for differences between pre- and post-installation weather conditions, as well as for differences in usage consumption between participants (with the inclusion of a separate intercept for each participant). This modeling approach ensures that model savings estimates are not skewed by unusually high usage or low usage participants. For more detail on the model specification, see Appendix D.

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3.5. Estimating Conversion Participant Savings

Cadmus used a similar approach for calculating gas savings for conversion participants as we did in 2012 (reflected in the *Avista 2012 Washington Gas Portfolio Impact Evaluation Report)*. An alternative impact approach to billing analysis was necessary for gas-saving conversion participants, since this the net increase in gas consumption (due to the fuel conversion) made any potential gas savings occurring via non-conversion measures imperceptible. We assigned savings to conversion participants (n=105) based on three distinct customer categories:

- ***Full model savings*** (150 therms), assigned to participants (n=27) who received three or more distinct gas-saving measures (including a high-efficiency furnace).
- ***Partial model savings*** specific to participants (n=64) who installed a high-efficiency gas furnace or high-efficiency gas water heater in place of a standard-efficiency unit. These participants fell into three subgroups:
  - Customers who received a high-efficiency furnace replacement and a high-efficiency water heater and no other gas saving measures (70 therms; n=21),
  - Customers who received either a high-efficiency furnace and one non-conversion gas measure (61 therms; n=41)
  - Customers who received a high-efficiency water heater and no more than one additional non-conversion gas-saving measure (9 therms; n=2). For participants in this group with one additional, non-conversion gas-savings measure, we passed through Avista's claimed savings associated with the non-furnace measures.
- ***No model savings*** for customers (n=14) who received at most one gas-saving measure and no high-efficiency furnace. For these customers, we passed through Avista reported savings if they received a gas-savings measure.

To account for gas savings from high-efficiency furnace replacements, we used savings calculated for the 2010 evaluation of Avista's Residential Furnace Replacement Program (84 therms), scaled to reflect low-income participant home square footage, which resulted in 61 therms.[11] Savings from high-efficiency hot water heater replacements came from the *Avista 2011 Multi-Sector Gas Impact Evaluation Report.*

3.6. Non-Conversion Results and Findings

This section presents the evaluated savings the program derived from the billing analysis. Several detailed tables are presented to contextualize the evaluated impacts, including measure distributions and benchmarking comparisons.

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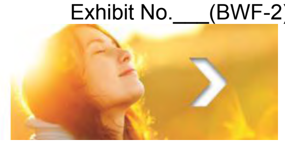
[11] Low-income participants averaged 1,250 square feet per home, while single-family participants averaged 1,728 square feet per home.



Cadmus included PRENAC in these results to characterize the average energy consumption prior to any participation. PRENAC is a helpful metric for comparison and for assessing the magnitude of program impacts, since this ratio normalizes savings relative to consumption levels.

3.6.1. Billing Analysis Results

Table 29 summarizes model savings results of the Washington low-income weatherization program for gas non-conversion participants.

Table 29. Gas Non-Conversion Model Savings Summary

n	PRENAC	Model Savings Per HDD	Normal HDDs	Model Savings (therms)	Precision 90%
48	780	(0.02)	6,178	150	25%

The per-participant model savings averaged 150 therms for non-conversion participants, with a precision estimate of 25%.

Table 30 compares the evaluated average participant savings to reported savings, along with realization rates.

Table 30. Gas Non-Conversion Model Realization Rate Summary

n	PRENAC	Model Savings (therms)	Average Reported Savings Per Participant (therms)	Realization Rate	Model Savings as Percent of Pre-Usage	Expected Savings as Percent of Pre-Usage
48	780	150	112	133%	19%	14%

The analysis of non-conversion participants has a realization rate 133% with 19%savings over pre-usage, which is 5% higher than the reported savings (as a percentage of pre-usage).

Table 31 provides a distribution of the gas measures Avista paid for participants in the final model group.

Table 31. Measure Distribution of Final Model Sample

Measure	Count	Percent
Attic insulation	40	83%
Wall insulation	20	42%
Floor insulation	37	77%
Duct insulation	2	4%
Air infiltration controls	39	81%
Doors	21	44%
Windows	14	29%
High-efficiency furnace replacement	4	8%
High-efficiency water heater replacement	2	4%
Sample (n)	**48**	**100%**

As shown in the table, there was a high concentration of shell measures, with 83% and 81% of program participants, respectively, receiving attic insulation and air infiltration controls. Conversely, few gas participants received a high-efficiency furnace replacement (8%) or high-efficiency water heater replacement (4%).

3.6.2. Overall Gas Non-Conversion Program Savings

Table 32 presents evaluated gas savings for PY 2013 non-conversion gas participants. Cadmus extrapolated savings from the billing analysis results by multiplying the modeled realization rate by the reported savings.

Table 32. Low-Income Weatherization: Total 2013 Gas Non-Conversion Evaluated Program Savings

Total Non-Conversion Participants	Average Model Savings per Participant (therms)	Total Evaluated Non-Conversion Savings (therms)	Total Reported Savings (therms)	Realization Rate
132	150	15,738	11,840	133%

3.7. Comparison to Previous Billing Analysis

The results from our billing analysis of 2012 program participants revealed greater energy savings than the billing analysis completed for 2010 participants. Table 33 compares these model results.

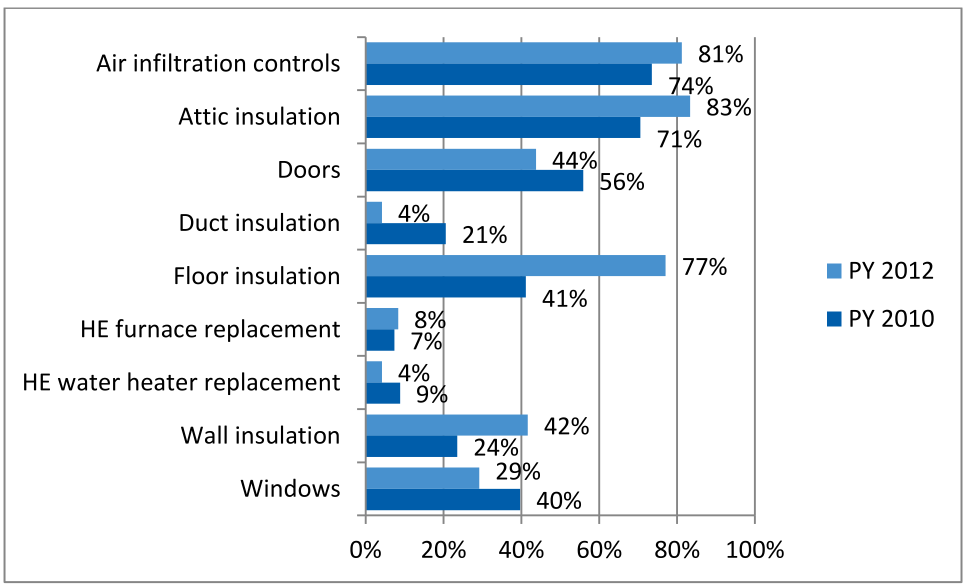
Table 33. Low-Income Weatherization: Comparison of Gas Model Results*

Billing Analysis Year	n	PRENAC	Model Savings (therms)	Average Reported Savings Per Participant (therms)	Realization Rate	Model Savings as Percent of Pre-Usage	Reported Savings as Percent of Pre-Usage
2010	68	753	104	347	30%	14%	46%
2012	48	780	150	112	133%	19%	14%

* These model results are not statistically different.

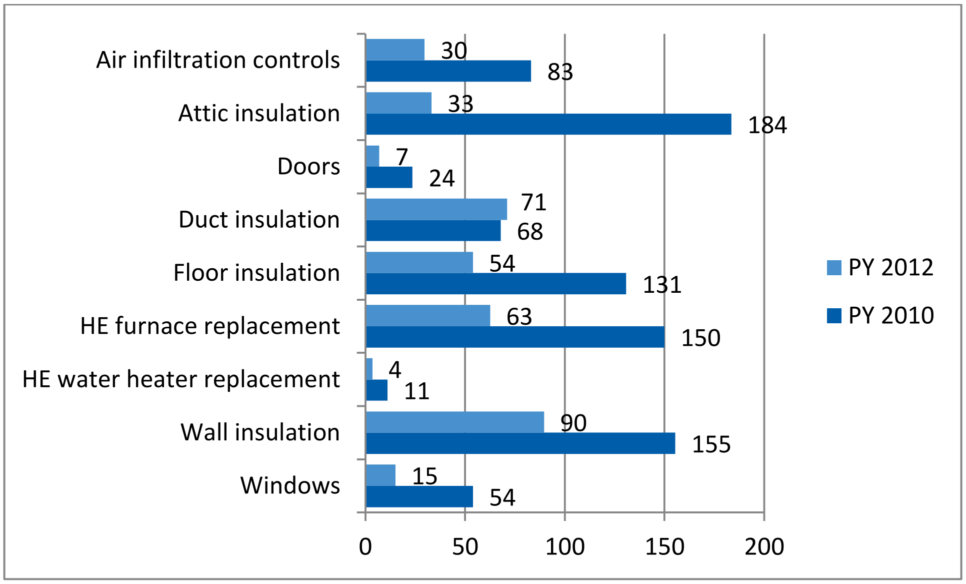
One factor contributing to increased average savings is an increase in the percentage of program participants who received high-saving measures, such as air infiltration and shell insulation. Figure 5 shows the percentage of Avista-funded measures for gas model participants in both program years.

Figure 5. Percent of Installed Measures for Gas Model Participants by Program Year



The gas non-conversion realization rate is also substantially higher in 2012 than in 2010. One factor contributing to this increase is the difference in reported savings reported by Avista for gas saving measures between years. Figure 6 presents average reported therm savings by measure for both program years.

Figure 6. Average Reported Therm Savings of Gas Saving Measures by Program Year



Aside from duct insulation, reported savings for every measure is lower in PY 2012. Several high-savings measures showed substantial changes in average reported savings between years, in particular insulation, air infiltration, and furnace replacements.

Two additional factors that may account for changes in modeled savings include: (1) non-Avista funded measures installed by agencies through the program, and (2) lack of control or comparison group.

3.8. Benchmarking

To place Avista program savings estimates in context, we compared them to billing analysis results from other low-income program efforts from across the country.[12] Figure 7 shows a comparison of the percentage energy savings, relative to PRENAC, of Avista's program, along with numerous other gas billing analyses of low-income weatherization programs. This metric allows for a fair comparison of programs given variation in weather, costs, program delivery, and measure offerings.

[12] The comparable studies include Oak Ridge National Laboratory Metaevaluation of Low-Income Weatherization Programs, Ohio Home Weatherization Assistance Program, People Working Cooperatively Low-Income Weatherization Program in Ohio, Massachusetts Low-Income Program, and Rhode Island Income-Eligible Services program.

Figure 7. Savings Percentage of Pre-Period Consumption

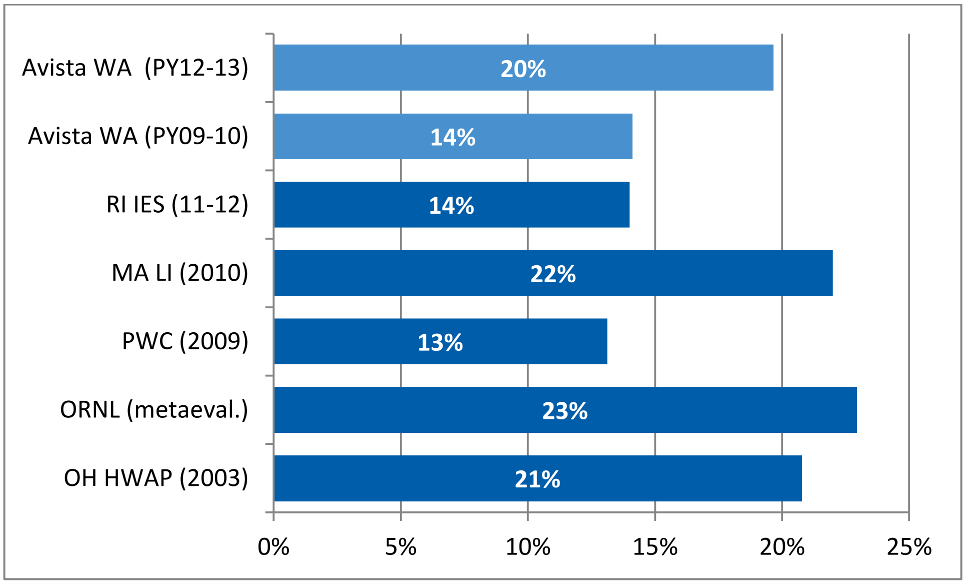
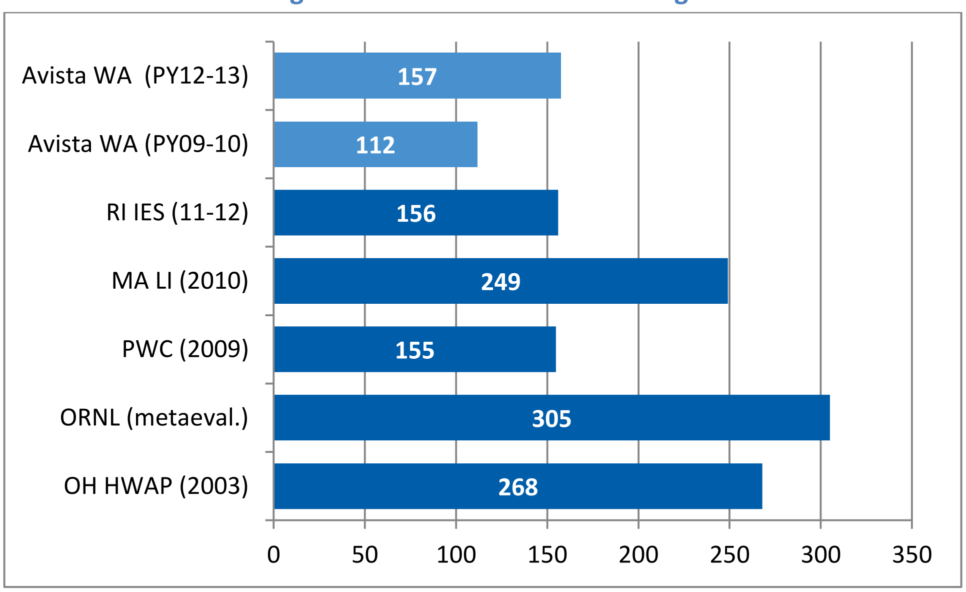


Figure 8 presents average household therm savings from comparable low-income programs.

Figure 8. Household Therm Savings



3.9. Conversion Participant Results and Total Program Savings

There were 105 Washington program participants who received electric-to-gas conversion measures, including electric-to-gas furnaces and water heaters. Cadmus considered these participants separately, as the methodology for estimating evaluated savings differed slightly from the non-conversion participant group.

In total, Cadmus estimated an additional 8,472 therms of savings from gas conversion participants, presented in Table 34.

Table 34. Conversion Participant Gas Savings

Conversion Customer Tier	N	Average Applied Per-Participant Savings (therms)	Total Evaluated Savings (therms)
Full Model Savings	27	150	4,050
Partial Savings*	64	70/61/9	4,357
No Model Savings*	14	N/A	65
Total	**105**		**8,472**

*Total evaluated savings may include instances of pass-through measure-level savings.

All conversion customers experienced a net increase in therm usage. However, based on Avista's approach to correcting for these impacts through its cost-effectiveness analysis, Cadmus calculated therm savings associated with the following:

- Installation of gas-savings weatherization measure bundles.
- Furnace and water heater conversion replacements, using high-efficiency gas equipment compared to standard gas equipment.[13]

Table 35 provides a distribution of all Avista-funded measure installations for conversion participants in PY 2013, including Avista-designated electric-saving measures.

Table 35. Measure Installations for Conversion Participants

Measure Description	Count
Electric air infiltration controls	6
Electric doors	2
Electric refrigerator replacement	7
Electric windows	2
Electric attic insulation	2
Electric duct insulation	1
Electric floor insulation	4
Electric furnace conversion	81
Electric water heater conversion	86
Electric heat pump conversion	8
Electric variable speed motor	1
Gas air infiltration controls	25
Gas doors	18

[13] Electric savings associated with conversion measure installations are outlined in the *2014 Avista Washington Portfolio Electric Impact Report*.

Measure Description	Count
Gas windows	1
Gas water heater replacement	35
Gas boiler replacement	2
Gas furnace replacement	79
Gas attic insulation	17
Gas duct insulation	5
Gas floor insulation	22
Gas wall insulation	7

Of the 81 conversion participants receiving a gas furnace replacement, 79 had a high-efficiency gas furnace installed. Fewer high-efficiency gas water heaters replaced electric water heaters: of the 86 participants receiving a gas water heater replacement, only 35 installed a high-efficiency unit. Avista also funded a large number of non-conversion measures for conversion participants: energy savings from electric measures are accounted for in the *2014 Avista Washington Portfolio Electric Impact Report*.

3.9.1. Overall Program Savings

Table 36 presents overall gas savings for both non-conversion and conversion participants.

Table 36. Overall Gas Savings for PY 2013

Participant Type	n	Total Reported Savings	Total Evaluated Savings	Realization Rate
Non-Conversion	132	11,840	15,738	133%
Conversion	105	11,836	8,472	72%
Total	**237**	**23,676**	**24,210**	**102%**

3.10. Low Income Conclusions

Compared to the PY 2010 billing analysis, Avista's PY 2013 low-income program demonstrated an average increase in gas savings per participant, in addition to an increase in the overall program realization rate (from 31% to 102%). Several factors may have contributed to the increase in participant savings, including:

- An increased frequency of installing high-saving measures (e.g., shell) in the evaluation period,
- Changes in agency delivery protocols or energy-saving installations made with non-utility funding, and
- Exogenous effect (e.g., economic, rate changes) that may have occurred simultaneously with program activity.

One factor contributing to higher realization rates is lower average reported savings occurring in the PY 2013 evaluation period compared to previous years.

CADMUS

3.11. Low Income Recommendations

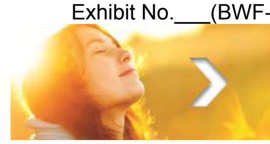
Cadmus recommends the following enhancements to improve program impact results:

- ***Use a control or comparison group in future billing analyses.*** Cadmus recommends using a comparison group in subsequent impact evaluations to analyze the treatment group of program participants. Use of a control or comparison group of nonparticipants would allow controlling for exogenous factors (e.g., macroeconomic, rate changes, technological trends) that could result in trends that affect consumption. Controlling for these trends using a control/comparison group is a robust and defensible method for estimating accurate energy-savings impacts.
- ***Consider using the combined state programs to increase model sample sizes.*** Smaller sample sizes in state-specific models attributed to decreased precision in the 2012 model estimates. Increasing the sample sizes by using a combined state model in future evaluations will mitigate this cause of decreased precision.
- ***Obtain a full list of weatherization measures from agencies.*** The billing analysis results do not allow Cadmus to disaggregate energy savings specific to Avista-funded measures. In addition, a complete list of participants' installed measures would allow Cadmus to conduct a measure-level billing analysis specific to measure types. This granularity could help Avista improve future program offerings and help fully characterize the energy savings modeled through billing analysis.
- ***Include high-use customers in program targeting.*** While prioritization guidelines for targeting low-income weatherization participants are set at the federal level, some utilities, for targeting purposes, actively track customer usage and provide agencies with lists of customers that have particularly high energy consumption.

  Notably, DOE protocols list high-energy consumption as a factor allowed in participant prioritization. In such cases, along with other targeting criteria (e.g., families with children, senior citizens), agencies may incorporate energy-consumption characteristics into their program participant prioritization. Not only would weatherizing high-use customers likely result in higher energy savings, but could provide these customers with some financial relief for higher energy bills due to their housing characteristics.

  Avista should identify high-usage customers while controlling for factors that contribute to consumption (e.g., square footage, income, numbers of people per household).

  Given reductions in federal funding for weatherization and associated reduced agency capacities resulting in more limited leveraging opportunities, Avista has an opportunity to lead new efforts for the continued delivery of energy-savings resources to low-income residential customers. Potential exists to secure cost-effective energy savings through high-usage targeting, while continuing to support weatherization for income-qualified customers. Efficient targeting balances efforts to provide whole-house weatherization, and allows for leveraging the agency network as a resource for outreach and delivery.



- ***Track and compile additional data from agency audits.*** These data include information on primary and secondary heating and cooling, and on the size of a home. As an inexpensive alternative to gas heat, gas customers may turn to electric room heaters and wood stoves, reducing the impacts of installed weather-sensitive measures (e.g., insulation). Collecting information on customers' primary heating usage during weatherization would lead to more reasonable savings estimates.

  Cadmus recommends that Avista work with CAP agencies to develop explicit, on-site tracking protocols for collecting information on participant heating sources. The CAPs should collect the following information to better inform heating and cooling sources:

  - Visual inspections of all heating equipment found on site;
  - Participant-reported primary and supplemental heating sources used;
  - Quantities of secondary heating, if applicable (e.g., numbers of electric room heaters); and
  - Any indicators suggesting discrepancies between actual and reported primary heating.

- ***Consider performing quantitative, non-energy benefit analyses.*** Cadmus recommends that Avista consider pursuing additional analyses aimed at quantifying non-energy benefits associated with low-income weatherization, applicable to the Total Resource Cost (TRC) test. Specifically, analyses of economic impacts and payment pattern improvements (including reduced arrearages and collections costs) can provide program stakeholders with the monetized value of energy-efficiency measures. Other Northwest utilities have used such analyses to report low-income weatherization cost-effectiveness (in Idaho and Washington). Standard cost-effectiveness TRC testing accounts for all program costs and only includes energy savings as a program benefit. The TRC test omits some non-energy benefits genuinely experienced by participants, such as decreased mortality and morbidity, as well as environmental benefits such as reduced emissions of carbon dioxide and other pollutants listed in the Clean Air Act.

Appendix A: Residential Weatherization and Manufactured Homes Duct Sealing – Billing Analysis Model Specification

For each participant home, we estimated a heating model in both pre- and post-periods to weather-normalize raw billing data.

The PRISM model specification used was:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \varepsilon_{it}$$

Where for each customer ‘i’ and month ‘t’:

ADC_{it}	=	Average daily therm consumption in the pre- and post-periods
α_i	=	Participant intercept; represents the average daily therm base load
β_1	=	Model space heating slope (therms per HDD)
$AVGHDD_{it}$	=	Base 65 average daily HDDs for the specific location
ε_{it}	=	Error term

From the above model, we computed weather-normalized annual consumption (NAC) as follows:

$$NAC_i = \alpha_i * 365 + \beta_1 LRHDD_i + \varepsilon_i$$

Where for each customer ‘i’:

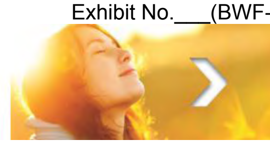
NAC_i	=	Normalized annual therm consumption
$\alpha_i * 365$	=	Annual base load therm usage (non-weather sensitive)
$LRHDD_i$	=	Annual, long-term HDDs of a typical meteorological year (TMY3) in the 1991–2005 series from NOAA, based on home location
$\beta_1 * LRHDD_i$	=	The weather-normalized annual weather sensitive (heating) usage, also known as HEATNAC

The fixed-effects model specification using the average daily consumption (ADC) of gas in home ‘i’ during month ‘t’ is defined as:

$$\mathrm{ADC_{it}} = \alpha_i + \gamma_i \mathrm{HDD_{it}} + \beta_1 \mathrm{POST_{it}} + \beta_2 \mathrm{POST_{it}} * \mathrm{HDD_{it}} + \beta_3 * Other_{it} + \varepsilon_{it}$$

Where:

α_i	=	Average daily base load energy use in home ‘i' that is not sensitive to weather. Cadmus’ analysis controlled for non-weather-sensitive and time-invariant energy use with home fixed effects.
γ_i	=	Average daily heating usage per HDD in home ‘i.’ This controls for weather-sensitive energy use with home fixed-effects interacted with HDDs.



HDD = Average daily HDDs (heating load) during the billing cycle.

β_1, β_2 = Coefficients that estimate the weatherization measure program effect on gas usage.

POST = An indicator variable for whether the month is before or after the measure installation. This variable equals 1 in the months and years following the measure installation, and 0 otherwise. The variable is defined using the combination of Customer Specific Measure Install Date and Fixed Date specifications.

β_3 = Coefficient that estimates the savings attributable to the other measures.

Other = An indicator variable for whether the month is before or after other measures were installed. This variable equals 1 in the months following the maximum install date for all other measures, and equals 0 for months prior to the minimum install date.

ε_{it} = Error term for home 'i' in month 't.'

Cadmus estimated the savings for the weatherization measures using estimated coefficients on all the post-period indicator variable components listed in the above fixed-effects regression model. The overall gross weatherization model savings are given by:

$$\text{Savings} = \hat{\beta}_1 * 365 + \hat{\beta}_2 \text{AnnualHDD}$$

Where:

Annual HDD = Average annual normal TMY3 HDDs for the participants.

CADMUS

Appendix B: Electricity Savings Achieved by Residential Gas Programs

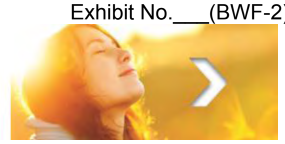
Table 37 shows electricity saved in kWh by the PY 2013 gas energy-efficiency programs. High penetration of electric dryers in homes with gas domestic hot water heating likely resulted in electric savings accompanying ENERGY STAR clothes washer installation.

The 2010 gas furnace billing analysis showed a portion of participants choose to install an air source heat pump at the same time they install a new high-efficiency furnace. This switch from all-gas heating to dual-fuel heating results in an electric penalty.

Table 37 shows values for all measure installations in Washington, both inside and outside Avista's electric service territory.

Table 37. Electricity Savings for Gas Program in Washington

Measure Name	Measure Count	UES (kWh)	Total Savings (kWh)
Gas Clothes Washer With Natural Gas Water Heater	139	99.1	13,774
Natural Gas Furnace	2,018	-165	-332,970
TOTAL	**2,157**	**NA**	**-319,196**



Appendix C: Low-Income Weatherization Participant Survey

In May 2013, Cadmus coordinated a phone survey of 150 residential low-income weatherization program participants. Cadmus developed the participant survey instrument and defined the sample. Cadmus subcontracted the administration of the surveys to an implementation firm.

Table 38 provides details regarding the telephone survey planned and achieved completes.

Table 38. Participant Telephone Survey Sampling Plan

	Quantity
Total Participants	434
Screened out due to change in occupancy or bad phone number	78
Eligible Participants in Call List	356
Completed Surveys	150
Sample Size Goal	150

Cadmus selected a random sample of participants from the 2012 Q3 to 2013 Q1 participant population available in April 2013 (434 participants). Cadmus aimed and achieving 150 completed survey responses, which achieved at the 90% confidence with ±5.1% precision at the program level. The survey achieved a high response rate in fielding, using only 75% the sample frame to accomplish its targeted completes.

We asked participants about their experiences with the program, addressing the following topics:

- Changes in energy usage associated due to the following:
  - Behavior impacts attributed to energy-education
  - Heating usage, including equipment and fuel
  - Changes in occupancy
- Use of supplemental heating or cooling systems
- Functionality of equipment prior to repair or replacement
- Demographics and Home Characteristics

PROGRAM AWARENESS AND WAIT TIME

Most survey respondents said they heard about the program through family or friends. Figure 9 presents all ways survey respondents heard about the program.

Figure 9. How Respondents Heard About the Program (n=125)

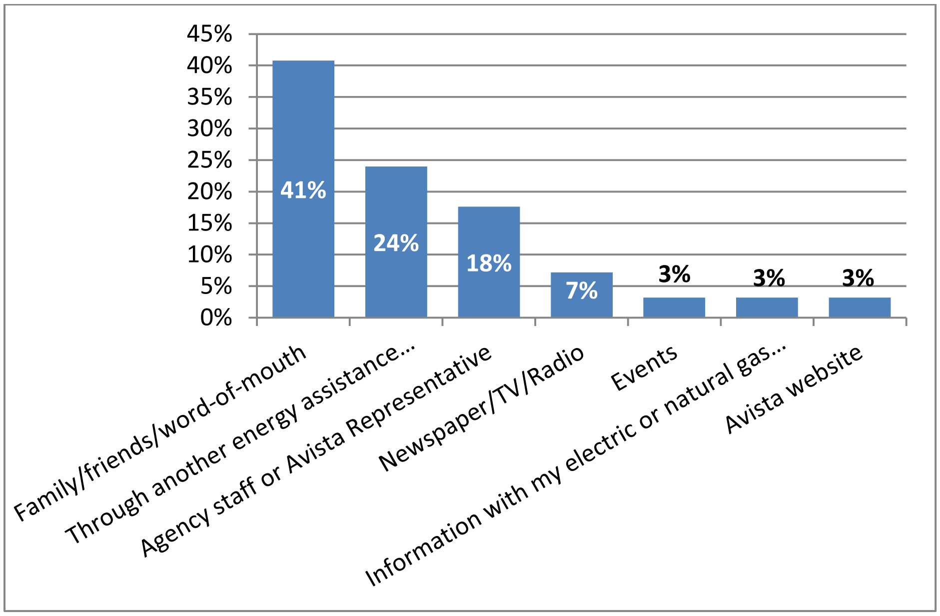
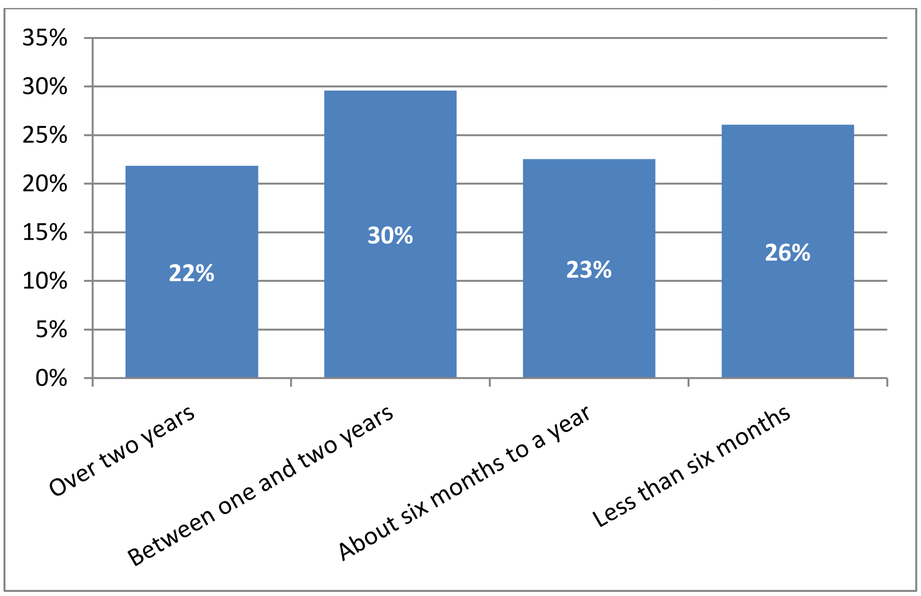
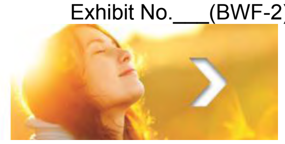


Figure 10 shows how long respondents were on the waiting list for the program.

Figure 10. How Long Respondents Were On the Waiting List (n=142)



As shown above, about half the respondents said they were on the waiting list for the program one year or less, with 26% indicating they were on the waitlist for less than six months. Thirty percent of the respondents indicated that they waited between one and two years, and 22% waited for over two years for the program's services



PREVIOUS AND NEW EQUIPMENT

Table 39 shows the distribution of installed equipment and the condition of the replaced equipment. Table 39 also indicates for respondents who received programmable thermostats if the installer programmed the thermostat, the participants just received education on how to install it, or received neither programming or education.

Table 39. Equipment Installed and Equipment Condition

Equipment installed	% Installed	Worked Fine	Had Problems	Did not Work
Refrigerator (n=150)	16%	54%	38%	8%
Furnace (n=146)	60%	24%	61%	15%
Water Heater (n=148)	51%	50%	43%	7%
Windows (n=148)	45%	29%	71%	n/a
Doors (n=149)	62%	8%	92%	n/a
Equipment installed	**% Installed**	**Programmed**	**Just education**	**Neither**
Thermostat (n=143)	50%	87%	7%	6%

For those respondents who said their previous equipment had problems or did not work, Table 40 shows how long the equipment was experiencing those issues.

Table 40. Equipment Problem Duration

Problem Equipment	Months	Year	> 1 Year
Refrigerator (n=10)	30%	10%	60%
Furnace (n=59)	15%	24%	61%
Water Heater (n=34)	26%	32%	41%

Table 41 details the fuel type of old and replaced furnaces and water heaters for respondents who received this new equipment.

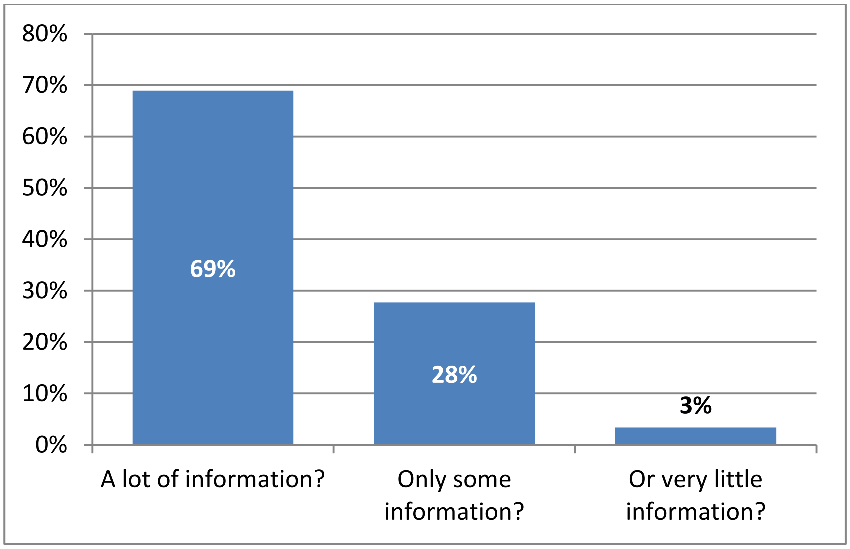
Table 41. Furnace and Water Heater Fuel

Equipment Type	Fuel	Previous	New
Furnace (n=61)	Electric	42%	10%
	Gas	53%	90%
	Oil	5%	0%
Water Heater (n=67	Electric	76%	25%
	Gas	24%	75%

PROGRAM EDUCATION

Only a small number (3%) of respondents said they received little information, and over two thirds said they received a lot of information, as shown in Figure 11.

Figure 11. How Much Information Respondents Said They Were Provided (n=119)



As shown in Table 42, almost 90% of respondents said they received educational pamphlets, and 97% of those respondents said they read them.

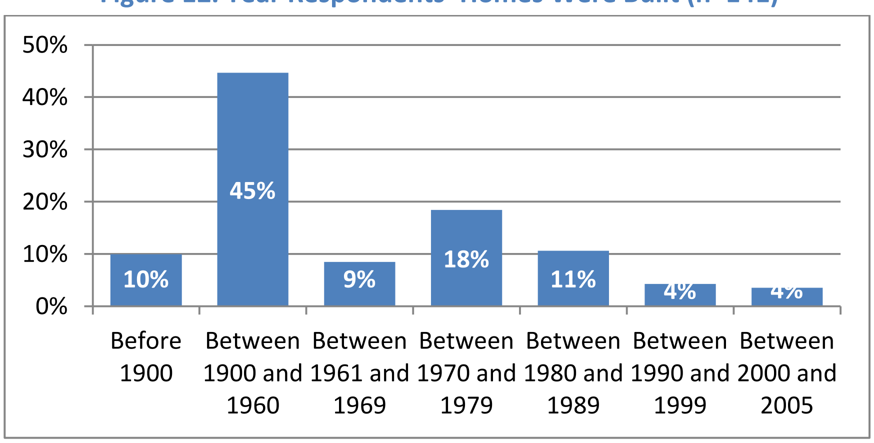
Table 42. How Many Respondents Received and Read Pamphlets

	Received Pamphlet (n=132)	Read Pamphlet (n=116)
Yes	89%	97%
No	11%	3%

HOME CHARACTERISTICS

Figure 12 shows the years that the respondent's homes were built.

Figure 12. Year Respondents' Homes Were Built (n=141)



Most respondents lived in a single family home or a mobile home or trailer, as shown in Figure 13.

Figure 13. Home Types (n=147)

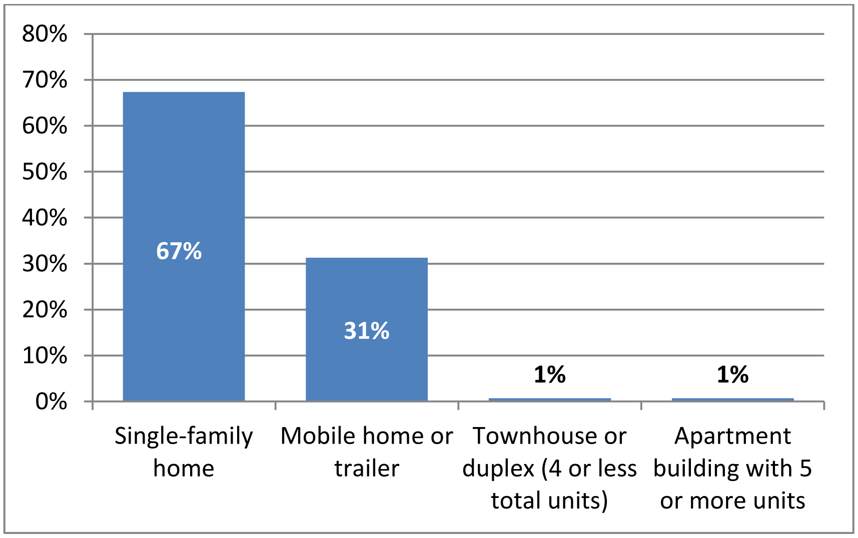


Figure 14 shows that most respondents heat their home by natural gas, followed by electricity.

Figure 14. Heating Fuel (n=147)

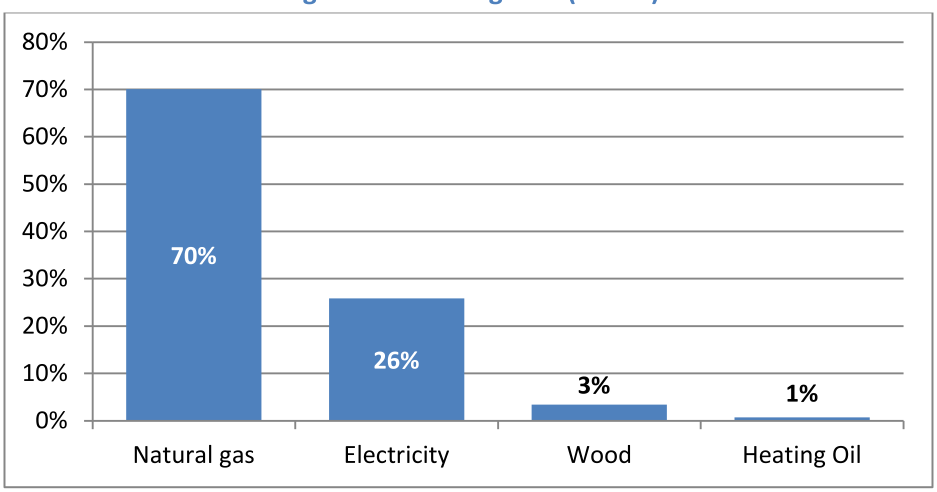
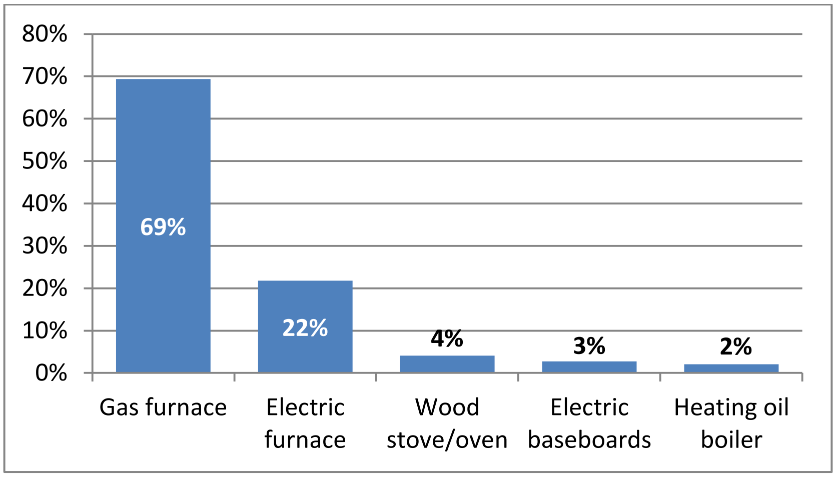


Figure 15 presents the distribution of respondent's primary heating equipment. Most respondents (69%) said their primary heater was a natural gas furnace, followed by an electric furnace (22%).

Figure 15. Primary Heater Type (n=147)



Most respondents said that after the program equipment was installed, they either did not change or turned down the temperature setting on their thermostat, as shown in Figure 16.

Figure 16. Post-installation Thermostat Changes (n=135)

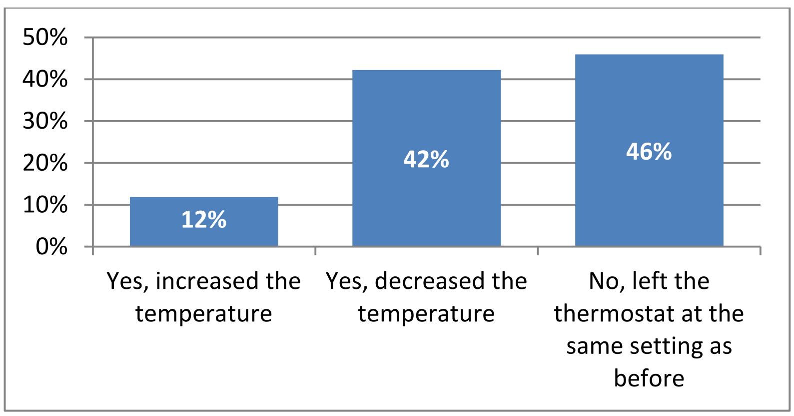
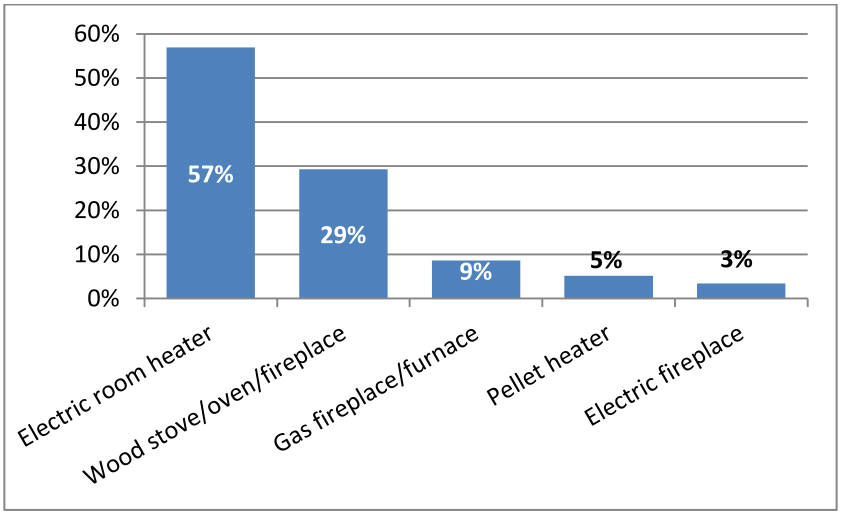


Figure 17 shows what respondents use as a supplemental heating source. Most indicated they use an electric room heater or a wood burning device.

Figure 17. Supplemental Heater Types (n=58)



Respondents who use a supplemental heating source said they used it less or about the same after the program equipment was installed, as shown in Figure 18.

Figure 18. Post-installation Supplemental Heater Use (n=56)

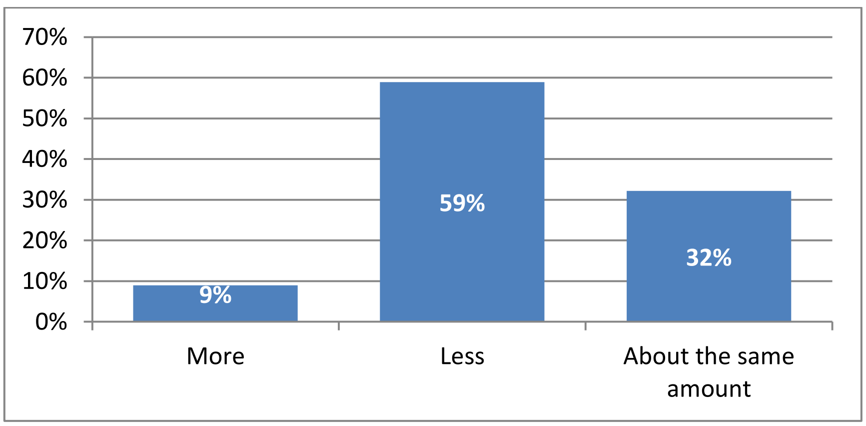


Figure 19 presents the distribution of equipment used to cool respondent's homes. When asked if they would change the way they cool their home after participating in the program, only 8% said they changed.

Figure 19. Summer Cooling Equipment Types (n=140)

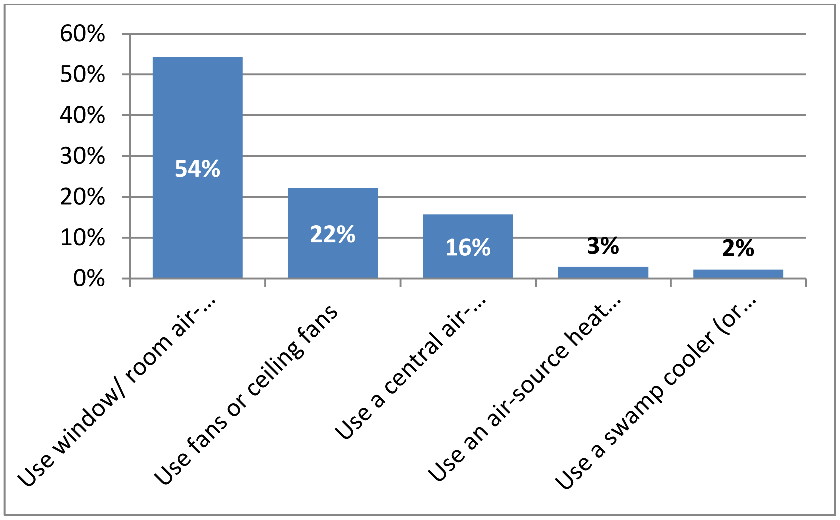
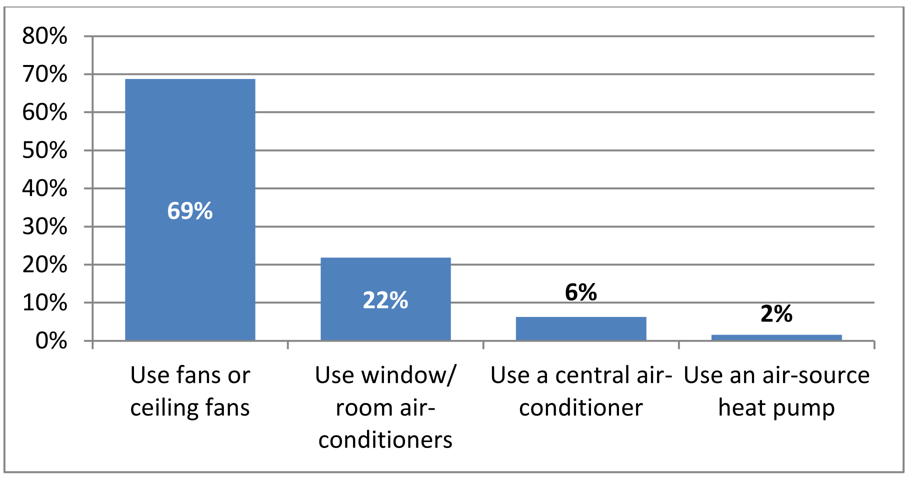


Figure 20 shows what supplemental equipment respondents use to cool their home.

Figure 20. Supplemental Cooling Equipment Types (n=64)



Appendix D: Low-Income Weatherization – Billing Analysis Model Specification

For each participant home, Cadmus estimated a heating model in both the pre- and post-periods to weather-normalize raw billing data. Cadmus used the following PRISM model specification:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \varepsilon_{it}$$

Where for each customer 'i' and calendar month 't':

ADC_{it}	=	The average daily therm consumption in the pre- or post-program period
α_i	=	The participant intercept; represents the average daily therm base load
β_1	=	The model space heating slope
$AVGHDD_{it}$	=	The base 65 average daily HDDs for the specific location
ε_{it}	=	The error term of the regression

From the model above, we computed the weather-normalized annual consumption (NAC) as follows:

$$NAC_i = \alpha_i * 365 + \beta_1 LRHDD_i + \varepsilon_i$$

Where, for each customer 'i':

NAC_i	=	Normalized annual therm consumption
α_i	=	The intercept that is the average daily or base load for each participant, representing the average daily base load from the model
$\alpha_i * 365$	=	Annual base load therm usage (non-weather sensitive)
β_1	=	The heating slope; in effect, usage per heating degree from the PRISM model
$LRHDD_i$	=	The annual, long-term HDDs of a TMY3 in the 1991–2005 series from NOAA, based on home location
$\beta_1 * LRHDD_i$	=	The weather-normalized annual weather sensitive (heating) usage, also known as HEATNAC
ε_i	=	The error term of the regression

Cadmus used the following fixed-effects CSA model specification to determine program-level savings:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 POST_{it} * AVGHDD_{it} + \beta_{3\ldots13} M_t + \varepsilon_{it}$$

Where, for customer ‘i’ and monthly billing period ‘t’:

ADC_{it}	=	Average daily therm consumption during the pre- and post- periods
α_i	=	The average daily therm base load intercept for each participant (part of the fixed-effects specification)
β_1	=	The model space heating slope
$AVGHDD_{it}$	=	The average daily base 65 HDD, based on home location
β_2	=	The model space cooling slope
$POST_{it}$	=	An indicator variable that is 1 in the post-period (after measure installations) and 0 in the pre-measure period
M_t	=	An array of billing month dummy variables (Feb, Mar, …, Dec), 0 otherwise
ε_{it}	=	Error term of the regression

The model estimated the therm savings per HDD in Washington as coefficient β_2. In order to calculate actual savings under normal weather conditions, Cadmus applied the 1991-2005 TMY3 normal HDDs from NOAA.

Appendix 5

Avista Utilities' Conservation Voltage Reduction Program Impact Evaluation

May 1, 2014

Navigant Consulting, Inc.

NAVIGANT

Avista Utilities' Conservation Voltage Reduction Program

Impact Evaluation

Prepared for:
Northwest Energy Efficiency Alliance

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Reference No.: 164638
May 1, 2014

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The Navigant Consulting, Inc. team included Kevin Cooney (managing director), Dan Greenberg (project manager for the distribution efficiency project), Frank Stern (task manager), Paul Higgins (statistical analysis), and Eugene Shlatz (distribution engineer lead).

Table of Contents

List of Figures and Tables

Figures:

Tables:

Executive Summary

Avista Utilities (Avista) implemented a conservation voltage reduction (CVR) program in 2013 as part of larger Smart Grid projects. This report presents Navigant Consulting, Inc.'s (Navigant's) evaluation of the energy efficiency acquisition impact of that program.

Overview of Program

CVR is a type of distribution efficiency, also known as conservation voltage regulation or voltage optimization. CVR is the long-term practice of controlling distribution voltage levels in the lower range of acceptable levels, as defined by the American National Standards Institute, to reduce demand and energy consumption.

Avista's CVR program is a part of its two Smart Grid 2.0 projects. Both projects incorporate Integrated Volt Var Control (IVVC). The IVVC module issues commands to the station or midline regulators to maintain the minimum voltage set-point within a specified voltage dead-band. Avista based the business case for IVVC on the avoided cost of energy resulting from the reduction of load by lowering the distribution line voltage.

Commissioning of IVVC in the Washington service territory, including the cities of Spokane and Pullman, began in September 2013 and concluded on December 31, 2013.

Regulatory Requirement

Washington's public utilities (public utility districts, municipals) are required to report to the state Department of Commerce on their progress in the preceding biennium in meeting regulatory targets. Investor-owned utilities are required to supply the same information to the Utilities and Transportation Commission (UTC). Utilities are also required to make these reports available to their customers and the general public.

The UTC issued an order requiring Avista to provide third-party verification of distribution efficiency savings:

> *For savings claimed from distribution efficiency, Avista Corporation must provide third-party verified values calculated using applicable parts of the RTF's Automated CVR Protocol No. 1, Voltage Optimization Protocol, or any other protocol recognized by the RTF following the date of this order. This requirement does not prevent Avista Corporation from developing an additional EM&V methodology for distribution efficiency and advocating at a future Commission proceeding for the recognition of third-party verified savings calculated using that methodology.* (UTC 2012)

Description of the Evaluation

As noted above, the UTC required that Avista have distribution efficiency savings evaluated using the Regional Technical Forum's (RTF's) Automated CVR Protocol No. 1, but allowed Avista to develop additional methodology.

The protocol specifies an approach for verifying energy savings on electric power distribution circuits and substations on which a utility has implemented CVR. It is flexible with respect to type of load and the utility can apply the approach to circuits serving any combination of residential, commercial, and industrial customers. The main requirements include the ability to measure and record voltage levels and energy usage at uniform intervals, and the ability to vary circuit target voltage levels on each controlled circuit at the same time every day for periods of up to a year. The protocol consists of an experimental design prescribing the procedures to follow for generating experimental data, and a recommended method for statistically estimating the conserved energy from the experimental data.

Navigant also considered two alternative methodologies.

Washington State University (WSU) Voltage Optimization Validation Methodology

WSU has developed a methodology to derive CVR savings as part of a research effort it is conducting on behalf of Avista. WSU developed its approach to address limitations associated with RTF Automated CVR Protocol No. 1, including the need to conduct day-on, day-off measurements over an extended period. Navigant assessed the applicability of the WSU model to derive accurate energy savings for CVR.

Navigant Regression Methodology

Navigant developed parallel savings estimation methodologies to evaluate alternative calculations in comparison to RTF Automated CVR Protocol No. 1. Navigant used the same data set as that specified in RTF Automated CVR Protocol No. 1, but relied instead on direct regression modeling to estimate energy savings. Navigant formulated several alternative model specifications and relied on empirical testing methods to select the ones with the most desirable properties.

Summary of Results

Navigant completed an impact evaluation of Avista's CVR program. Navigant explored three methods:

1. RTF Automated CVR Protocol No. 1
2. WSU Voltage Optimization Validation Methodology
3. Navigant Regression Methodology

When fully implemented and tested, the WSU approach may present an acceptable alternative to savings estimated using industry protocols (or other methods). However, only two feeders have been modeled thus far (out of the more than seventy feeders with CVR), and Avista has not fully integrated the enhanced SynerGEE model with its Distribution Management System (DMS). Thus, at this time, Navigant is unable to conduct a rigorous comparison of savings calculated by the WSU model versus those estimated using RTF Automated CVR Protocol No. 1.

The RTF and Navigant approaches yielded savings estimates as shown in Table 1.

Table 1. Summary of Savings Estimates

Approach	Savings Estimates (MWh)
RTF Automated CVR Protocol No. 1	42,292
Navigant Regression Methodology	42,374

The two estimates are statistically indistinguishable, giving confidence that the RTF method's value is reasonable. Navigant expects that inclusion of summer data would not substantially change the savings estimate and might well increase it.[1]

Recommendations

Navigant recommends that Avista continue to cycle the CVR voltage levels per the RTF Automated CVR Protocol No. 1 for the remainder of 2014. This will enable a more robust estimate of annual savings.

Navigant also recommends that the RTF consider adopting Navigant's alternative regression approach for the evaluation, measurement and verification (EM&V) of savings for automated CVR programs. It produces similar results to the RTF Automated CVR Protocol No. 1, and is somewhat less burdensome to implement.

[1] In previous evaluations, Navigant has found significantly higher savings during summer periods relative to the rest of the year.

1 Introduction

Avista Utilities (Avista) implemented a conservation voltage reduction (CVR) program in 2013 as part of larger Smart Grid projects. This report presents Navigant Consulting, Inc.'s (Navigant's) evaluation of the energy efficiency acquisition impact of that program.

1.1 Description of the Program

CVR is a type of distribution efficiency, also known as conservation voltage regulation or voltage optimization. CVR is the long-term practice of controlling distribution voltage levels in the lower range of acceptable levels, as defined by the American National Standards Institute (ANSI; ANSI 1995), to reduce demand and energy consumption.

The Northwest Energy Efficiency Alliance (NEEA) conducted a major study on the effects of CVR, known as the NEEA Distribution Efficiency Initiative (Leidos 2007). The objective of this initiative was to establish the viability of CVR as a conservation measure through pilot projects and demonstrations starting in 2003 through 2007. The results of the study conclusively showed that operating a utility distribution system in the lower half of the acceptable voltage range (120–114 volts) saves energy, reduces demand, and reduces reactive power requirements without negatively affecting the customer.

Avista's CVR program is a part of its two Smart Grid 2.0 projects, implemented in 2013. In Spokane, the utility smart circuits project involves upgrading fourteen substations and fifty-eight distribution feeders (Avista 2009).[2] In Pullman, Avista's Smart Grid Demonstration project encompasses updating and automating the distribution system, installing an advanced metering infrastructure, implementing a Web portal where customers can monitor their energy use, and a demand response pilot project, with upgrades to three substations and thirteen feeders (Avista 2010).

Both projects incorporate Integrated Volt Var Control (IVVC). The IVVC predictive application leverages existing power flow models, loading information, and network topology to calculate the minimum voltage on the feeder. The IVVC module issues commands to the station or midline regulators to maintain the minimum voltage set-point within a specified voltage dead-band. Avista based its business case for IVVC is on the avoided cost of energy resulting from the reduction of load by lowering the distribution line voltage (Avista 2010).

Commissioning of IVVC in Spokane and Pullman began in September 2013 and concluded on December 31, 2013.

[2] This does not include one feeder originating at the Post Street substation in Spokane, PST12F1, which was part of the Smart Grid 2.0 project but does not currently have a smart voltage regulator and thus is not CVR-enabled.

1.2 Regulatory Requirements

The Energy Independence Act, enacted by voters in 2006 as Initiative 937, imposes targets for energy conservation and the use of eligible renewable resources on all electric utilities that serve more than 25,000 customers in Washington. By January 1, 2010, utilities were required to identify their "achievable cost-effective conservation potential" through 2019. Each utility must set a biennial target consisting of a certain share of this achievable cost-effective conservation potential, and will have to meet that share of conservation.

Utilities that fail to comply with either the energy conservation or the renewable energy targets will pay a penalty of fifty dollars for each megawatt-hour of shortfall, adjusted annually for inflation. Penalty payments will go into a special account that utilities can only use for the purchase of renewable energy credits or for energy conservation projects at state and local government facilities or publicly owned educational institutions.

Each year beginning in June 2012, Washington's public utilities are required to report to the state Department of Commerce on the utilities' progress in the preceding biennium in meeting the targets. Investor-owned utilities are required to supply the same information to the Utilities and Transportation Commission (UTC). Utilities are also required to make these reports available to their customers and the general public.

The UTC issued an order (UTC Docket UE-111882) requiring that Avista provide third-party verification of distribution efficiency savings:

> *For savings claimed from distribution efficiency, Avista Corporation must provide third-party verified values calculated using applicable parts of the RTF's Automated CVR Protocol No. 1, Voltage Optimization Protocol, or any other protocol recognized by the RTF following the date of this order. This requirement does not prevent Avista Corporation from developing an additional EM&V methodology for distribution efficiency and advocating at a future Commission proceeding for the recognition of third-party verified savings calculated using that methodology.* (UTC 2012)

1.3 Overview of the Impact Evaluation

As noted above, the UTC required that Avista have distribution efficiency savings evaluated using the Regional Technical Forum's (RTF's) Automated CVR Protocol No. 1, but allowed Avista to develop additional methodologies. The following sections discuss the RTF Automated CVR Protocol No. 1 and two other methodologies.

1.3.1 RTF Automated CVR Protocol No. 1

The protocol specifies an approach for measuring and verifying energy savings on electric power distribution circuits and substations on which a utility has implemented CVR. It is flexible with respect to type of load and the utility can apply the approach to circuits serving any combination of residential, commercial, and industrial customers. The main requirements include the ability to measure and record voltage levels and energy usage at uniform time intervals[3], and the ability to vary circuit target voltage levels on each controlled circuit at the same time every day for periods of up to a year.[4] The protocol consists of an experimental design prescribing the procedures to follow for generating experimental data, and a recommended method for statistically estimating the conserved energy from the experimental data (RTF 2004).

Experimental Design

The protocol calls for an initial verification period lasting for one year, beginning with three months of alternating, on successive days, among full voltage reduction (CVR on), voltage set at the legacy level (CVR off), and voltage set at the nominal midpoint between CVR on and CVR off. During the next nine months, the protocol specifies that all test circuits are to be on full CVR reduction continuously except for three months, selected based on season and other factors, when the utility alternates the voltage between full voltage reduction and the controlled nominal midpoint on successive days.

During the verification period, the utility measures and records end-of-line voltages and low-side circuit loads at each time interval. The only additional information required to measure energy savings is local ambient temperatures, at uniform intervals of no more than one hour. The protocol recommends collecting the temperatures at each substation to which experimental circuits connect, as well as at the feeder end-of-line locations, in order to reduce the possibility of confounding due to localized microclimates.[5]

Recently Utilidata, the principal author of the RTF Automated CVR Protocol No. 1, proposed altering the experimental design of the protocol to eliminate the third set-point at the nominal voltage midpoint, so that all cycling of voltage settings occurs between full voltage reduction (CVR on) and CVR off on alternate days. Utilidata proposed this change because they now consider the third set-point unnecessary.[6]

Data Preparation

The protocol recommends grouping the experimental voltage and load observations into twenty-four-hour periods, aggregating them up to hourly intervals, matching them to their corresponding hourly weather series, and separating the resulting twenty-four-hour ensembles into CVR and non-CVR categories.

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[3] Preferred interval length is anywhere between 5 seconds and 15 minutes (Donohue July 25, 2013).

[4] The need for systematic changes in voltage settings to take place at the same time every day over long periods makes this approach most suitable for automated CVR systems; hence, the title of the protocol document.

[5] However, hourly National Weather Service data from the closest available weather station is also acceptable (Donohue, July 25, 2013).

[6] The third set-point called for in the 2004 protocol at the nominal midpoint between the on and off CVR settings was originally included out of concern for the possibility that there may be significant nonlinearities in the relationship between voltage and load that would not be captured if the only experimental data corresponded to the extremes of full voltage reduction and removing CVR control altogether. However, with the benefit of experience it has become clear that this is unnecessary because CVR programs generally reduce nominal voltage settings by relatively small amounts, typically one to three percent. Over such short intervals, the third set-point is extraneous (Donohue, July 25, 2013; Utilidata 2011).

Statistical Estimation Procedure

The protocol recommends using robust time-series econometric techniques to identify "integrated demand profiles" for CVR-on and CVR-off periods, separately for each combination of season (summer, winter, shoulder) and day-type (weekday, weekend/holiday). The twenty-four-hour sums of the differences between the CVR-on and CVR-off demand profiles constitute the daily energy savings due to CVR for each season and day-type. To estimate the CVR factor (CVRf), or percent difference in energy usage per unit reduction in voltage, this difference is expressed as a percentage reduction relative to the non-CVR usage, and divided by the average percentage reduction in measured end-of-line voltage for the circuit over the same time interval.

No control group is required because with on-off and variable voltage set-point capability, the application group can act as its own control group during testing periods. Essentially, the protocol requires conducting an experiment with voltage control.

1.3.2 The Experimental Design

Avista began daily cycling between CVR and non-CVR set-points on a representative sample of test circuits on January 1, 2014, and concluded on April 8, 2014. Given the constraints of implementation and report timing, it was not possible to conduct a full year of cycling. Navigant worked with Avista personnel to conduct as thorough and defensible an evaluation as possible using the RTF Automated CVR Protocol No. 1, given the existing time constraints.

1.3.3 Alternative Methodologies

Navigant also considered two alternative methodologies.

Washington State University (WSU) Voltage Optimization Validation Methodology

WSU has developed an enhanced methodology to derive CVR savings as part of a research effort it is conducting on behalf of Avista. As part of the research effort, Avista and WSU have prepared two reports (Avista 2013 and Chanda 2014) that highlight progress it has made with respect to applying advanced algorithms and feeder simulation models to calculate CVR savings to a high degree of accuracy. WSU developed its approach to address limitations associated with RTF Automated CVR Protocol No. 1, including the need to conduct day-on, day-off measurements over an extended period. Navigant assessed the applicability of the WSU model to derive accurate energy savings for CVR.

Navigant Regression Methodology

Navigant developed parallel savings estimation methodologies to evaluate alternative calculations in comparison to RTF Automated CVR Protocol No. 1. Navigant used the same data set as that specified in RTF Automated CVR Protocol No. 1, but relied instead on direct regression modeling to estimate energy savings. Navigant formulated several alternative model specifications and relied on empirical testing methods to select the one(s) with the most desirable properties.

1.4 Overview of Report

The next section describes the available data. Section 3 discusses the RTF Automated CVR Protocol No. 1 analysis. Section 4 presents Navigant's review of the WSU model. Section 5 presents the Navigant methodology. Section 6 summarizes findings and recommendations.

2 Description of Data

The primary data Navigant used to evaluate Avista's CVR program savings consists of automated distribution line measurements recorded at fifteen-minute intervals on the quarter-hours by Avista's IVVC system on a representative sample of twenty-five distribution feeder circuits. The measurements include phase-specific kilovolts (kV), amperes (Amps), kilowatts (kW), and kilovolt-amperes-reactive (kvar). Because Navigant's primary purpose was estimating the total energy savings from the CVR program, Navigant focused mainly on aggregate kW and kV. Navigant evaluated measurements at several distinct points along each feeder: at the circuit breaker immediately downstream of the substation transformer, at up to three "smart" reclosers, and at a voltage regulator. Navigant also evaluated limited information at up to three capacitor banks. Besides these quantitative measurements, qualitative information pertaining to status of the IVVC system and its components was also provided at fifteen-minute intervals, including the date-time stamp, the feeder identifier, the measurement location on the feeder, whether CVR voltage reduction was on or off, whether capacitor banks were on or off, and whether the IVVC reporting and communication system was functioning. The system automatically delivered files containing each day's data to Navigant via the internet.

In addition to the interval data covering all of the sample feeders continuously from the point at which daily voltage cycling began on January 1, 2014, Avista provided Navigant with limited additional data from the commissioning phase of the IVVC program (i.e., September through December 2013). Avista recorded these observations while installing the system and testing it on each feeder participating in the program and, as such, the observations are intermittent and sparse, covering only some of the sample on any given day, and for only limited periods. Nevertheless, Navigant welcomed the opportunity to include these data, as they allowed Navigant to extend its analysis period back into the fall 2013 season.[7]

Navigant designed the sample of feeders studied for this evaluation in conjunction with Avista staff. Navigant used information provided by Avista on the distribution of loads by customer class on each of the seventy-one feeder circuits in Spokane and Pullman on which Avista commissioned IVVC to draw a representative sample of 25 feeders. The sample drawn targeted a maximum program-level relative precision of 10 percent with a one-tailed 90 percent confidence interval, stratified over five customer strata.[8] Navigant included in the sample all available

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[7] Navigant statistically tested whether inclusion of these data altered the results before including these data and found no evidence that they did so. Navigant's main purpose in including commissioning period data was to increase the reliability of the statistical results by increasing the sample size, and to strengthen the ability to identify "shoulder season" (i.e., spring and fall) CVR effects.

[8] Avista provided Navigant with a table of kilovolt-ampere (kVa) loadings attributable to each of several customer classes by feeder. Navigant used this information to sort the seventy-one IVVC feeder circuits into five broad strata:

circuits in the industrial and rural/agricultural categories, and randomly sampled from the residential and commercial-mixed strata in proportion to their relative shares in the number of IVVC feeders. Navigant also selected two Pullman feeders dedicated to delivering power to the WSU grid. Table 2 shows the list of sample feeders, along with their locations and characteristics.

Table 2. Feeder Circuit Sample

No.	City	Substation	Feeder	Category
1	Spokane	GLN	GLN12F1	Predominantly residential (7 of 26)
2		L&S	L&S12F2	
3		SE	SE12F5	
4		9CE	9CE12F4	
5	Pullman	SPU	SPU123	
6		TUR	TUR113	
7			TUR117	
8	Spokane	3HT	3HT12F1	Commercial/mixed (9 of 32)
9			3HT12F7	
10		F&C	F&C12F4	
11			F&C12F5	
12			F&C12F6	
13		L&S	L&S12F1	
14		ROS	ROS12F6	
15		SE	SE12F4	
16		SUN	SUN12F1	
17	Spokane	GLN	GLN12F2	Significant rural/ agricultural (census)
18		NE	NE12F3	
19	Spokane	3HT	3HT12F5	Predominantly industrial (census)
20		BEA	BEA12F3	
21			BEA12F4	
22			BEA12F5	
23		NE	NE12F5	
24	Pullman	TVW	TVW131	Express feeder (13.2 kV)
25		SPU	SPU125	Express feeder (13.2 kV to 4 kV)

Notes: Data from LoadingByFeederAndZone.xlsx (Avista) and Navigant analysis.

residential (at least 85 percent residential load); rural/agricultural (20-30 percent agricultural loads or with significant rural stretches); industrial (at least 50 percent industrial load); commercial/mixed (either predominantly commercial or mixed commercial-residential); and dedicated lines providing power to WSU.

Table 3 provides selected descriptive statistics on the wattage and voltage measurements observed in the interval data for each sample circuit.

Table 3. Descriptive Statistics for Sample Feeder Circuits

#	Feeder	kW at Circuit Breaker				kV at Regulator			
		Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
1	3HT12F1	4,834	871	2,899	7,382	7.75	0.09	7.59	7.92
2	3HT12F5	5,010	1,074	2,694	8,515	7.79	0.08	7.60	7.94
3	3HT12F7	2,191	463	1,305	3,524	7.74	0.09	7.57	7.91
4	9CE12F4	3,734	1,025	1,921	8,149	7.78	0.07	7.57	7.91
5	BEA12F3	3,288	1,012	1,462	9,002	7.75	0.11	7.58	7.99
6	BEA12F4	3,846	1,180	1,441	7,150	7.75	0.09	7.56	7.95
7	BEA12F5	3,919	1,634	798	8,168	7.80	0.08	7.61	7.93
8	F&C12F4	4,281	869	2,325	7,299	7.78	0.08	7.60	7.91
9	F&C12F5	3,402	959	1,598	7,917	7.78	0.07	7.54	7.91
10	F&C12F6	4,367	929	2,144	7,309	7.78	0.08	7.61	7.91
11	GLN12F1	4,426	961	2,317	7,770	7.79	0.08	7.60	7.92
12	GLN12F2	4,193	1,016	2,122	8,212	7.78	0.07	7.60	7.91
13	L&S12F1	3,697	541	1,702	5,231	7.74	0.10	7.58	7.91
14	L&S12F2	5,938	1,108	3,087	9,509	7.77	0.08	7.61	7.92
15	NE12F3	2,526	542	1,198	4,741	7.82	0.09	7.60	7.97
16	NE12F5	3,008	1,537	991	6,801	7.78	0.08	7.57	7.92
17	ROS12F6	4,707	890	2,472	7,409	7.78	0.07	7.61	7.93
18	SE12F4	4,593	1,010	2,469	8,531	7.80	0.07	7.62	7.95
19	SE12F5	3,521	825	1,702	6,134	7.80	0.08	7.62	7.95
20	SPU123	4,350	728	2,648	6,664	7.81	0.11	7.62	8.01
21	SPU125	3,079	597	1,977	6,581	7.86	0.06	7.73	8.05
22	SUN12F1	4,654	1,134	1,970	12,944	7.78	0.10	7.59	7.99
23	TUR113	3,482	907	1,688	6,555	7.79	0.11	7.59	8.03
24	TUR117	5,125	1,033	2,883	8,921	7.85	0.10	7.66	8.08
25	TVW131	1,492	282	917	5,065	7.81	0.06	7.63	7.96

Notes: The interval dataset contains separate kW and kV measurements for the A, B, and C phases on each feeder taken at the circuit breaker, at up to three reclosers, and at the voltage regulator. For purposes of this analysis, Navigant aggregated the phase-specific readings for each feeder and time interval. Navigant chose to use the kV measurements taken at the regulator and the kW measurements taken at the circuit breaker because they are the most complete, appear to be the most reliable, and conform most closely to the evaluation methodology described in RTF Automated CVR Protocol No. 1.

Table 4 shows the mean voltage reductions between IVVC-off and IVVC-on states at each of the sample feeders.

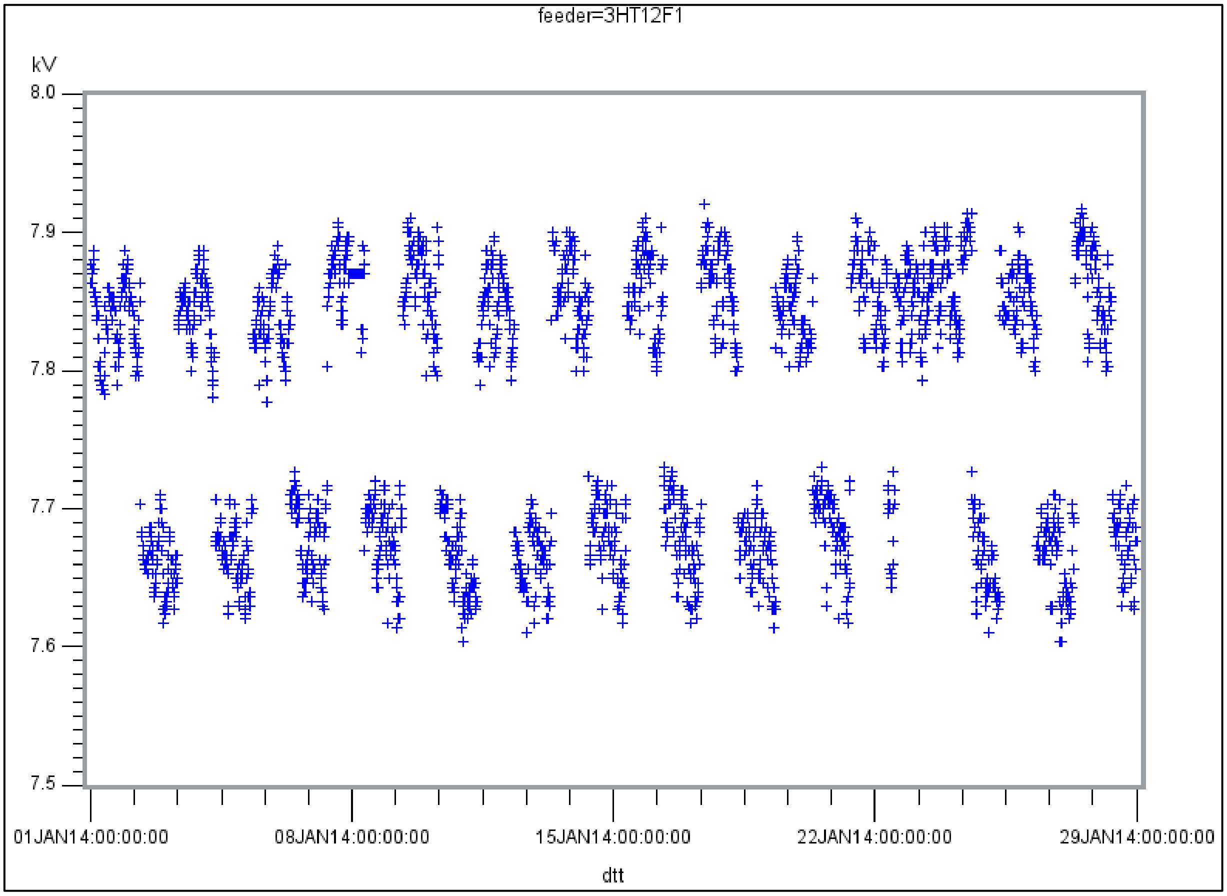
Table 4. Voltage Reductions Observed in Sample

#	Feeder	Mean kV Measured at Regulator		
		IVVC Off	**IVVC On**	**% Difference**
1	3HT12F1	7.853	7.676	2.304%
2	3HT12F5	7.843	7.698	1.875%
3	3HT12F7	7.837	7.669	2.190%
4	9CE12F4	7.837	7.716	1.562%
5	BEA12F3	7.870	7.670	2.606%
6	BEA12F4	7.843	7.676	2.177%
7	BEA12F5	7.848	7.703	1.890%
8	F&C12F4	7.837	7.687	1.955%
9	F&C12F5	7.833	7.700	1.729%
10	F&C12F6	7.835	7.693	1.847%
11	GLN12F1	7.844	7.684	2.090%
12	GLN12F2	7.836	7.707	1.675%
13	L&S12F1	7.846	7.662	2.400%
14	L&S12F2	7.849	7.708	1.833%
15	NE12F3	7.875	7.711	2.135%
16	NE12F5	7.833	7.692	1.824%
17	ROS12F6	7.853	7.725	1.661%
18	SE12F4	7.847	7.726	1.565%
19	SE12F5	7.863	7.719	1.861%
20	SPU123	7.928	7.716	2.746%
21	SPU125	7.911	7.816	1.215%
22	SUN12F1	7.884	7.701	2.369%
23	TUR113	7.911	7.691	2.858%
24	TUR117	7.959	7.761	2.545%
25	TVW131	7.827	7.762	0.828%
Weighted Average		7.861	7.705	2.020%

Notes: To obtain weighted averages, Navigant weighted the individual feeder values by their estimated 2014 annual MWh (see Table 12). All values are rounded to three decimal places.

A representative example of the daily voltage cycling that was performed on the twenty-five sample feeders is shown in Figure 1, which is a time plot of the fifteen-minute interval kV measurements on one sample feeder (3HT12F1) for the month of January 2014.

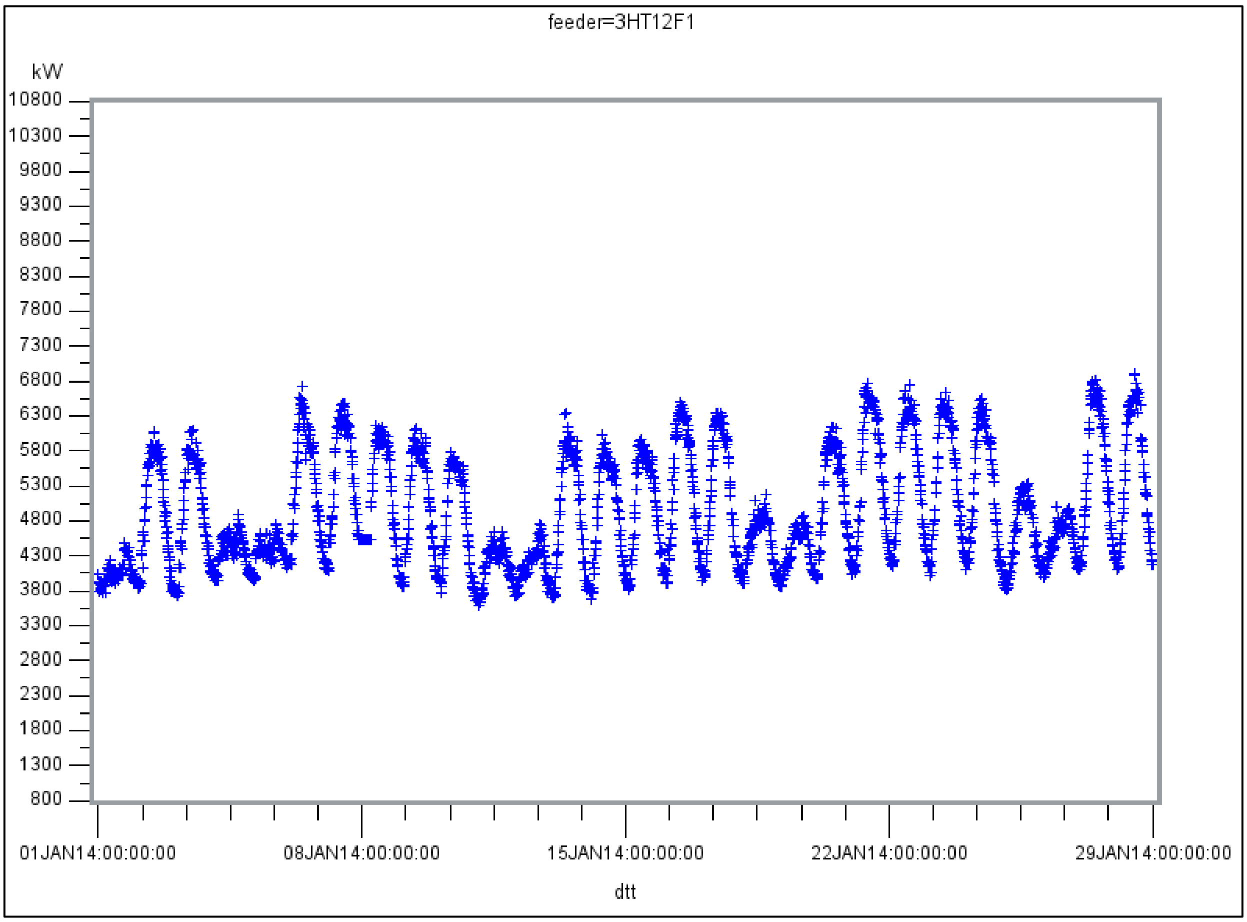
Figure 1. Plot of Voltage Cycling on Feeder 3HT12F1, January 2014



The figure illustrates how CVR works: a target reduction of approximately two percent is set. During each IVVC state (on and off) voltage continues to fluctuate about the set-point, but the separation between the set-points during the on and off states is clear.

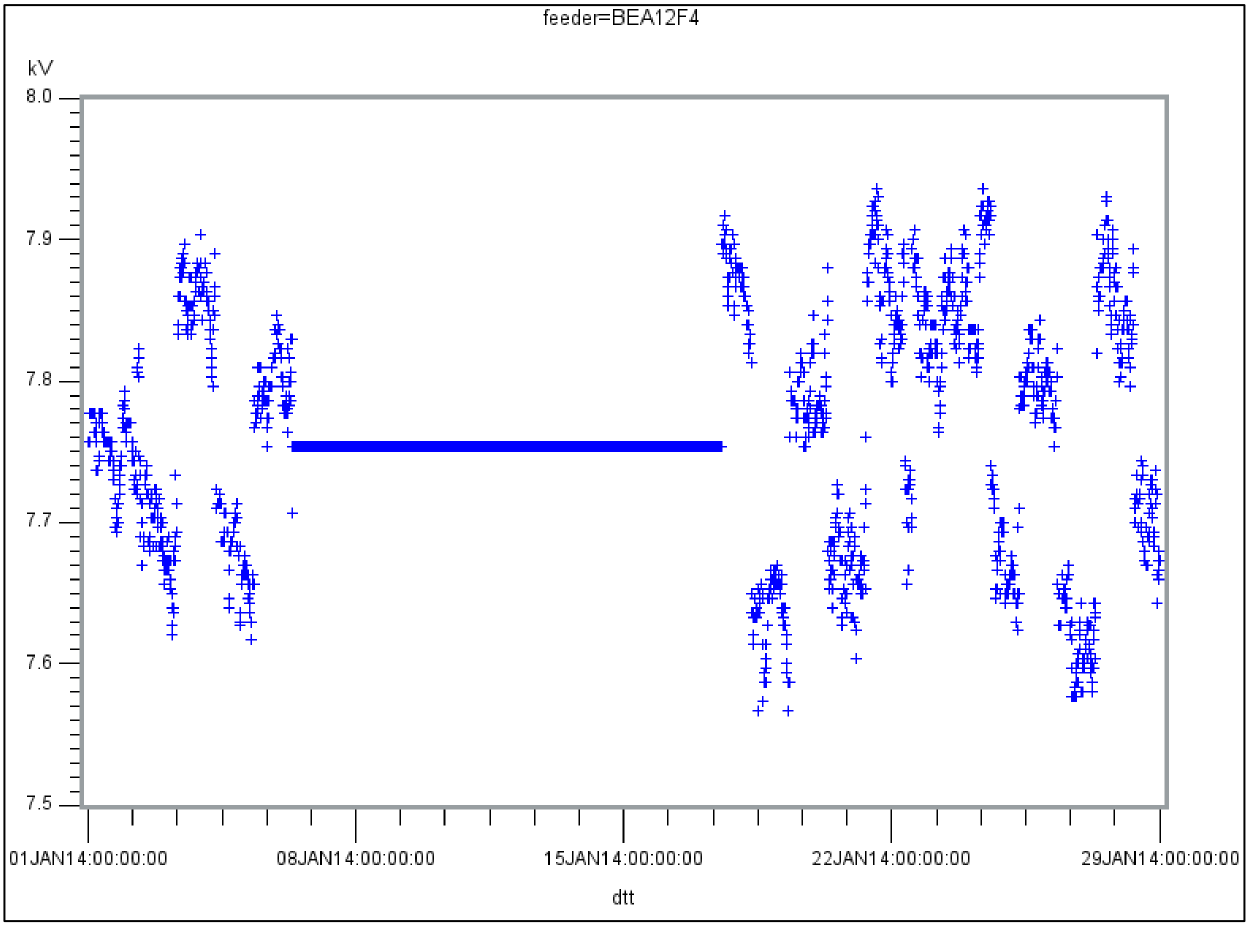
Figure 2 shows the time plot of the corresponding kW series for the same feeder and period (3HT12F1, January 2014). What is notable here is the strong daily cyclical pattern of aggregate load, with a characteristic humped or saw tooth shape with load rising to a peak during the day and falling back at night, superimposed on a clear weekly pattern with five similar weekday load shapes followed by notches on the weekends when the daily peaks are much less pronounced. The pattern observed in the kW series in Figure 2 underscores the need to develop a statistical model for explaining load fluctuations that accommodates these intra-day, daily, and weekly patterns. Failure to do so runs the risk of attributing load fluctuations to CVR that are actually due to these secular patterns.

Figure 2. Plot of kW on Feeder 3HT12F1, January 2014



For the most part, the IVVC interval data were clean and free from obvious problems. However, Navigant did discover a string of problematic data from two of the sample feeders in January 2014. The kV readings measured at the voltage regulator for BEA12F4 (shown in Figure 3 below) and BEA12F5 remained constant for a period of more than eleven continuous days; over the same period, the kW measured at the circuit breaker was flat at zero. Navigant dropped these values, as well as observations when the IVVC system reported being down, before performing any statistical analyses.

Figure 3. Example of "Stuck" Voltage



The other data Navigant used to evaluate Avista's CVR program savings consists of weather data obtained from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA). Navigant downloaded hourly temperature and humidity series from the NCDC's Quality Controlled Local Climatological Data site (NOAA 2014) for Spokane International Airport and Pullman/Moscow Regional Airport. After aligning the series to the nearest whole hour, Navigant used cubic spline interpolation to generate fifteen-minute series for each weather station that were then merged with the IVVC interval data (i.e., fifteen-minute observations on the quarter-hour).

3 RTF Automated CVR Protocol No. 1

RTF Automated CVR Protocol No. 1 establishes a method for measuring and verifying energy savings from CVR voltage reductions using experimental data produced by alternating the voltage set-points on a set of distribution circuits on successive days. The protocol uses data collected during an extended period of voltage cycling to estimate energy savings using time-series analysis and robust statistical methods.

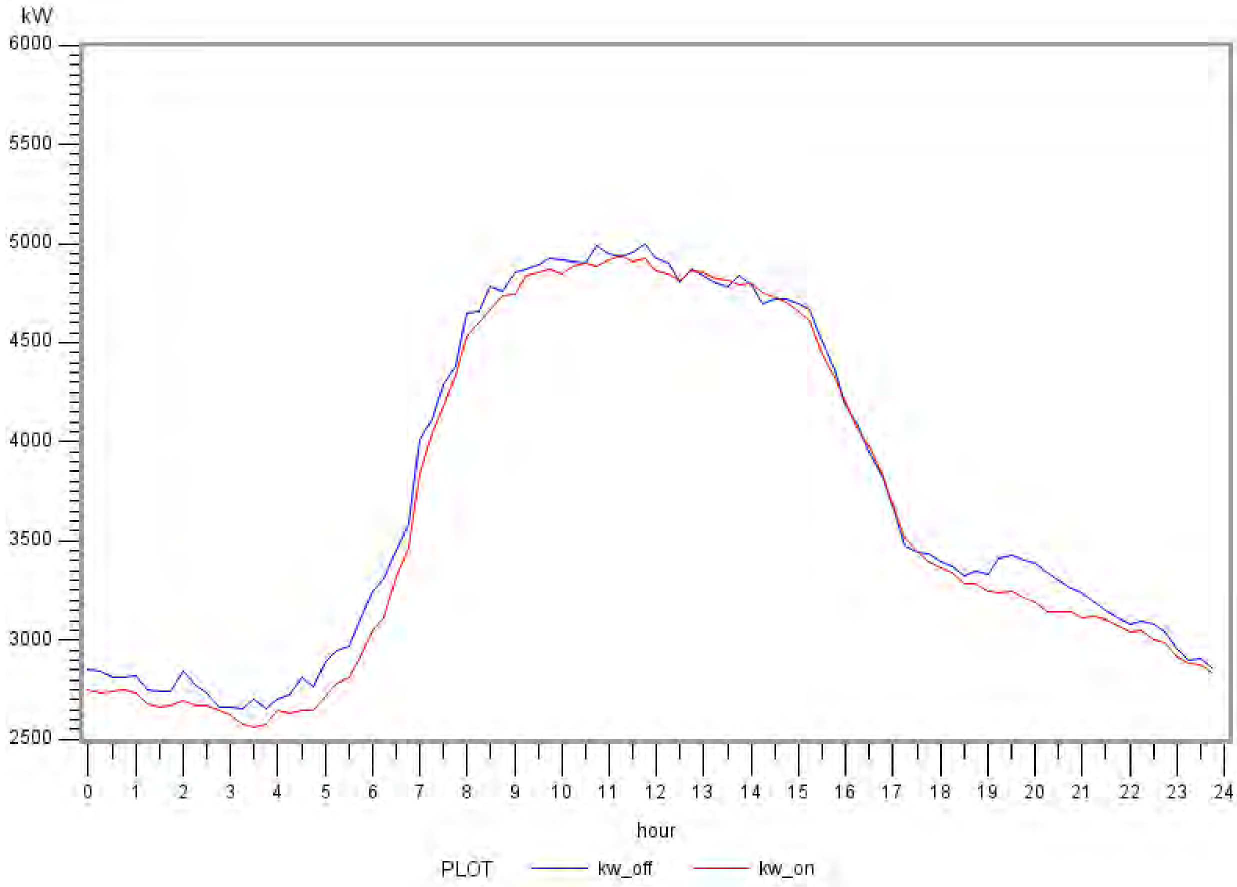
To implement the protocol, Navigant worked with Avista staff to develop a sampling methodology that resulted in a representative sample selection of twenty-five distribution feeder circuits, as described in section 2. Avista began daily cycling of the voltage set-points on these circuits between full CVR voltage control (IVVC on) and no CVR control (IVVC off) on January 1, 2014, a process that continued through April 8, 2014.

Avista provided Navigant with fifteen-minute interval data from the twenty-five sample feeders collected over the ninety-eight-day period, as described in section 2. Navigant grouped the data for each feeder into twenty-four-hour ensembles identified by day-type (weekday or weekend/holiday), season (winter or shoulder), and IVVC system state (IVVC on, IVVC off, or IVVC system not operational). Navigant aggregated phase-specific data to feeder level by summing the phase-specific loads (kW) and taking the arithmetic means of the phase-specific voltages (kV). Navigant eliminated observations where IVVC reported being non-operational, or where kW was zero or kV was stuck (as described in section 2).

Navigant produced integrated demand profiles for each feeder by day-type, season, and IVVC state using robust time-series methods to isolate the effects of voltage reduction from the effects of other factors, such as weather, load characteristics, and customer behavior.[9] This resulted in two demand profiles per sample feeder for each combination of day-type and season: one when IVVC is off, the other when it is on. Figure 4 shows plots of the demand profiles for one of the feeder circuits in the sample, BEA12F3, for winter weekdays.

[9] Weather effects were explicitly modeled using data on ambient temperature and season. Load characteristics and customer behavior with respect to loads generally occur behind the customer meter and are thus not directly observed. However, the effects of time-invariant load characteristic differences across feeders are reflected in the load profiles estimated separately for each feeder. Time-varying effects due to shifting customer loads (intra-day, inter-day, inter-week) are accommodated through the use of high-frequency (15-minute) interval data; time-varying effects over longer intervals are accommodated by estimating separate load profiles by season.

Figure 4. Integrated Demand Profiles, Feeder BEA12F3, Winter Weekdays



Summing the vertical differences between the two demand profiles for each feeder over the twenty-four-hour period estimates the CVR energy savings for each day-type/season combination. To estimate the CVRf[10] for a given feeder, season and day-type, this sum is expressed as a percentage reduction relative to the corresponding baseline energy usage for the same feeder, day-type, and season, and divided by the corresponding mean percentage reduction in voltage on the circuit.

The resulting CVR factors range from 0.705 on weekends/holidays in the winter and 0.942 in the shoulder period on weekdays. Corresponding energy savings range from 1.440 to 1.919 percent. Table 5 summarizes these results.[11]

[10] The CVR factor (CVRf) is defined as the ratio of the mean percentage energy saved to the mean percentage voltage reduction: $CVRf = \%\Delta E/\%\Delta V$.

[11] Detailed results by feeder, season and day-type are presented in Appendix A.

Table 5. Summary of Findings from RTF Automated CVR Protocol No. 1

Day-Type	Measurement	Season: Winter	Season: Shoulder
Weekday	%ΔVolts	2.020%	2.016%
	%ΔkWh	1.694%	1.919%
	CVRf*	0.833	0.942
Weekend/Holiday	%ΔVolts	1.984%	1.810%
	%ΔkWh	1.440%	1.520%
	CVRf*	0.705	0.834

* Weighted average of individual CVRfs shown in Table 12, these do not equal average %ΔkWh/ΔVolts.

To estimate the annual energy savings attributable to Avista's CVR program, Navigant calculated an average annual CVRf value of 0.881 as the weighted average of the four season/day-type specific factors by their relative shares of the year, and applied them to the post-implementation estimated annual energy usage for the seventy-one IVVC-controlled distribution circuits. Total estimated usage is 2,442,217 MWh (see Appendix A). Multiplying the estimated annual energy usage by the weighted-average 2 percent voltage reduction and 0.881 CVRf yields an estimated energy savings of 42,292 MWh.

The basis for these savings does not include summer data values; Navigant has extrapolated the results of winter and spring periods for the year. A recent study of CVR savings in Pennsylvania (Navigant 2011) found CVR factors and savings were significantly higher in summer periods than in the rest of the year. Therefore, the savings resulting from a year-round experimental design may well be higher than what is shown here.

4 WSU Voltage Optimization Validation Methodology

WSU developed its approach to address limitations associated with RTF Automated CVR Protocol No. 1, including the need to conduct day-on, day-off measurements over an extended period. Navigant assessed the applicability of the WSU model to derive accurate energy savings for CVR. Navigant's findings are informed by several discussions held with WSU and Avista in 2013 and early 2014.

The two WSU reports previously referenced in section 1 highlight several key advancements in the modeling of distribution feeder loads and integration of real-time data via supplemental logic used in the SynerGEE model. Each of these advancements should improve the accuracy of real-time estimation of energy savings achieved with CVR. The WSU approach calculates CVR savings using feeder simulation models (i.e., SynerGEE), with predicted savings tallied on a daily basis. All analyses and tests presented in the WSU reports are for distribution feeders located in Pullman, Washington.[12] Initial results for two representative feeders appear to confirm the accuracy of the algorithm and model results. As the reports state, additional studies need to be performed for a broader range of feeders and operating conditions.

When fully implemented and tested, the WSU approach may present an acceptable alternative to savings estimated using industry protocols (or other methods). However, only a few feeders have been modeled (out of the more than seventy feeders with CVR) and Avista has not fully integrated the enhanced SynerGEE model with its Distribution Management System (DMS). Thus, at this time, Navigant is unable to conduct a rigorous comparison of savings calculated by the WSU model versus those estimated using RTF Automated CVR Protocol No. 1. Discussions with WSU and Avista confirm that it is necessary to have additional testing and integration of the WSU model with Avista's DMS in order to measure savings for the full set of feeders with CVR control. Accordingly, Navigant is not yet able to develop an opinion on the effectiveness of the integration of model logic to Avista's DMS or the systems that Avista will use to collect RTES data, nor can Navigant speak to whether they will be a suitable alternative to current measurement protocols.

5 Navigant Regression Methodology

In addition to the measurement and verification (M&V) methodology specified in RTF Automated CVR Protocol No. 1, Navigant pursued a parallel statistical analysis to produce an alternative estimate of CVR savings using the same dataset described in section 2. The approach, which applies regression analysis to the data using a flexible, semi-parametric functional form, employs robust time-series econometric techniques similar to those used in the RTF approach. It has the advantage of producing CVRf estimates directly, rather than having to calculate them in a separate post-hoc analysis, which can save time and resources. It also permits direct estimation of standard program evaluation metrics, including statistical confidence and precision.

[12] To test the accuracy of its approach, WSU conducted series of tests for representative feeders using both the SynerGEE model and the U.S. Department of Energy/Pacific Northwest National Laboratory's GridLAB-D model to predict real-time energy savings (RTES) using the advanced load models and an interactive IVVC algorithm.

To estimate the net effect of CVR voltage reductions on energy usage, Navigant performed regression analyses, modeling the average load in each fifteen-minute interval as a function of interval average voltage, interval heating degree-hours (HDH), and a set of time-of-day and day-type indicators. To allow the model to reflect differences in the characteristics of the loads served by each test feeder, which are largely unobserved, Navigant ran separate regressions for each feeder, as well as for each season.[13] The model is as follows:

$$f(kW_{it}) = \beta_{i1} g(kV_{it}) + \beta_{i2} HDH_t + \beta_{i3} HDH_t \cdot g(kV_{it}) + \sum_{t=1}^{96} \sum_{j=Weekday}^{Weekend} \beta_{itj}^{DTYPE} TOD_t \cdot DayType_j + \varepsilon_{it}$$

where:

- $i, t, and\ j$ are index feeder circuits, time intervals, and day-types, respectively;
- kW_{it} and kV_{it} are the instantaneous power demand and voltage, measured at the circuit breaker and voltage regulator, respectively, on feeder i at time interval t;
- TOD_t and $DayType_j$ are sets of ninety-six time-of-day and two day-type indicators, respectively; and
- $f(\cdot)$ and $g(\cdot)$ are functions of the variable contained in the parentheses.[14]

Navigant used robust regression methods to estimate the parameters of the above model for each combination of feeder and season, and calculated the system average CVRf as the weighted average of the individual feeder estimates, using the annual feeder MWh as weights. Table 6 summarizes these results.

[13] This is a common method used in applied statistics when confronting panel data (i.e., multiple observations over time on a set of individual sample units) reflecting the influence of multiple unobserved factors that vary systematically across individual units – in this case, customer load characteristics. This technique allows the model results to reflect not only different mean load levels, but also differential effects of voltage, weather, time of day, day-type and season on the loads served by different circuits (Wooldridge 2010).

[14] Navigant tested several functional forms and selected the double-logarithmic form based on statistical testing.

Table 6. Alternative Regression CVRf Values

#	Feeder	CVRf Estimates		
		Winter	**Shoulder**	**Combined**
1	3HT12F1	0.711	0.847	0.813
2	3HT12F5	0.564	0.642	0.623
3	3HT12F7	0.447	0.592	0.556
4	9CE12F4	0.604	0.823	0.769
5	BEA12F3	1.167	1.276	1.249
6	BEA12F4	1.063	1.059	1.060
7	BEA12F5	0.692	0.744	0.731
8	F&C12F4	0.727	0.929	0.879
9	F&C12F5	1.466	1.692	1.636
10	F&C12F6	1.743	1.951	1.900
11	GLN12F1	0.729	0.733	0.732
12	GLN12F2	0.412	0.487	0.469
13	L&S12F1	0.498	0.671	0.628
14	L&S12F2	0.683	0.726	0.715
15	NE12F3	0.294	0.299	0.298
16	NE12F5	1.687	1.996	1.920
17	ROS12F6	0.074	0.117	0.106
18	SE12F4	0.348	0.518	0.476
19	SE12F5	0.193	0.236	0.225
20	SPU123	0.476	0.545	0.528
21	SPU125	1.093	1.207	1.179
22	SUN12F1	0.223	0.211	0.214
23	TUR113	1.428	1.438	1.436
24	TUR117	1.577	1.764	1.718
25	TVW131	0.967	1.124	1.085
Weighted Average		0.797	0.911	0.883

Notes: Navigant weighted the individual feeder values by their cumulative kWh over the sample period to obtain the weighted averages. All values shown are rounded.

To obtain estimates of the annual energy savings attributable to Avista's CVR program, Navigant applied the weighted average CVRf value above to the estimated annual energy usage for the seventy-one IVVC-controlled distribution circuits in calendar 2014, as was done for the RTF Automated CVR Protocol No. 1 calculation. Multiplying the estimated annual energy usage by the weighted-average 2 percent voltage reduction and 0.883 CVRf yields an estimated energy savings of 42,374 MWh, very similar to that produced by the RTF Protocol No. 1.

As with the RTF Automated CVR Protocol No. 1 results, the basis for these savings does not include summer data values. As noted previously, an analysis that includes summer data could well result in higher savings.

6 Summary

6.1 Findings

Navigant completed an impact evaluation of Avista's CVR program. Navigant explored three methods:

1. RTF Automated CVR Protocol No. 1
2. WSU Voltage Optimization Validation Methodology
3. Navigant Regression Methodology

When fully implemented and tested, the WSU approach may present an acceptable alternative to savings estimated using industry protocols (or other methods). However, only two feeders have been modeled (out of the over seventy feeders with CVR) and Avista has not fully integrated the enhanced SynerGEE model with its DMS. Thus, at this time, Navigant is unable to conduct a rigorous comparison of savings calculated by the WSU model versus those estimated using RTF Automated CVR Protocol No. 1.

The RTF and Navigant approaches yielded savings estimates as shown in Table 7.

Table 7. Summary of Savings Estimates

Approach	CVRf	Savings Estimates (MWh)
RTF Automated CVR Protocol No. 1	0.881	42,292
Navigant	0.883	42,374

The two estimates are statistically identical, giving confidence that the RTF estimate is reasonable. Navigant expects that inclusion of summer data would not substantially change the savings estimate and might well increase it.

6.2 Recommendations

Navigant recommends that Avista continue to cycle the CVR voltage levels per the RTF Automated CVR Protocol No. 1 for the remainder of 2014. This will enable a more robust estimate of annual savings.

Navigant also recommends that the RTF consider adopting Navigant's alternative econometric approach to EM&V of savings for automated CVR programs. It produces similar results to the RTF Automated CVR Protocol No. 1, and is somewhat less burdensome to implement.

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8 Appendix A. Feeder-Level Estimates using RTF Automated CVR Protocol No. 1 Methodology

Table 8 shows the mean voltage reductions, energy savings, and CVR factors for winter weekdays.

Table 8. RTF Protocol Results, Winter Weekdays

#	Feeder	Mean Voltage Reduction	Mean Energy Saved	CVRf
1	3HT12F1	2.354%	1.747%	0.742
2	3HT12F5	1.893%	1.111%	0.587
3	3HT12F7	1.538%	0.743%	0.483
4	9CE12F4	1.633%	1.138%	0.697
5	BEA12F3	2.681%	3.348%	1.249
6	BEA12F4	2.223%	2.386%	1.073
7	BEA12F5	1.998%	1.373%	0.687
8	F&C12F4	1.968%	1.519%	0.772
9	F&C12F5	1.765%	2.623%	1.486
10	F&C12F6	1.887%	3.620%	1.918
11	GLN12F1	2.097%	1.497%	0.714
12	GLN12F2	1.683%	0.667%	0.396
13	L&S12F1	2.424%	1.232%	0.508
14	L&S12F2	1.832%	1.184%	0.646
15	NE12F3	2.209%	0.625%	0.283
16	NE12F5	1.647%	3.247%	1.971
17	ROS12F6	1.657%	0.139%	0.084
18	SE12F4	1.571%	0.600%	0.382
19	SE12F5	1.947%	0.358%	0.184
20	SPU123	2.714%	1.273%	0.469
21	SPU125	1.227%	1.389%	1.132
22	SUN12F1	2.448%	0.570%	0.233
23	TUR113	2.834%	3.984%	1.406
24	TUR117	2.555%	4.029%	1.577
25	TVW131	0.788%	0.773%	0.981
Weighted Average		2.020%	1.694%	0.833

Notes: To obtain weighted averages, Navigant used the 2014 feeder-level estimated annual MWh as weights (see Table 12). All values are rounded to three decimal places.

Error! Not a valid bookmark self-reference. shows the mean voltage reductions, energy savings, and CVR factors for winter weekends and holidays.

Table 9. RTF Protocol Results, Winter Weekends/Holidays

#	Feeder	Mean Voltage Reduction	Mean Energy Saved	CVRf
1	3HT12F1	2.268%	1.399%	0.617
2	3HT12F5	1.900%	0.905%	0.476
3	3HT12F7	2.083%	0.819%	0.393
4	9CE12F4	1.602%	0.553%	0.345
5	BEA12F3	2.491%	2.431%	0.976
6	BEA12F4	1.990%	2.024%	1.017
7	BEA12F5	1.781%	1.167%	0.655
8	F&C12F4	2.012%	1.270%	0.631
9	F&C12F5	1.815%	2.580%	1.422
10	F&C12F6	1.855%	2.367%	1.276
11	GLN12F1	2.023%	1.560%	0.771
12	GLN12F2	1.621%	0.677%	0.418
13	L&S12F1	2.414%	1.180%	0.489
14	L&S12F2	1.814%	1.381%	0.761
15	NE12F3	2.210%	0.670%	0.303
16	NE12F5	1.948%	1.923%	0.987
17	ROS12F6	1.536%	0.083%	0.054
18	SE12F4	1.523%	0.437%	0.287
19	SE12F5	1.818%	0.404%	0.222
20	SPU123	2.630%	1.365%	0.519
21	SPU125	1.080%	1.083%	1.003
22	SUN12F1	2.376%	0.461%	0.194
23	TUR113	2.709%	4.004%	1.478
24	TUR117	2.442%	3.893%	1.594
25	TVW131	0.818%	0.784%	0.959
Weighted Average		1.984%	1.440%	0.705

Notes: To obtain weighted averages, Navigant used the 2014 feeder-level estimated annual MWh as weights (see Table 12). All values are rounded to three decimal places.

Error! Not a valid bookmark self-reference. shows the mean voltage reductions, energy savings, and CVR factors for shoulder-season weekdays.

Table 10. RTF Protocol Results, Shoulder-Season Weekdays

#	Feeder	Mean Voltage Reduction	Mean Energy Saved	CVRf
1	3HT12F1	2.233%	1.966%	0.881
2	3HT12F5	1.869%	1.213%	0.649
3	3HT12F7	2.176%	1.306%	0.600
4	9CE12F4	1.538%	1.238%	0.805
5	BEA12F3	2.591%	3.530%	1.363
6	BEA12F4	2.266%	2.473%	1.091
7	BEA12F5	1.875%	1.407%	0.751
8	F&C12F4	1.942%	1.839%	0.947
9	F&C12F5	1.680%	2.878%	1.714
10	F&C12F6	1.846%	3.775%	2.045
11	GLN12F1	2.076%	1.489%	0.717
12	GLN12F2	1.703%	0.811%	0.476
13	L&S12F1	2.309%	1.578%	0.683
14	L&S12F2	1.839%	1.327%	0.722
15	NE12F3	2.194%	0.676%	0.308
16	NE12F5	1.940%	4.051%	2.088
17	ROS12F6	1.780%	0.195%	0.110
18	SE12F4	1.736%	0.923%	0.532
19	SE12F5	1.859%	0.445%	0.239
20	SPU123	2.644%	1.578%	0.597
21	SPU125	1.246%	1.549%	1.243
22	SUN12F1	2.252%	0.616%	0.274
23	TUR113	2.732%	4.661%	1.706
24	TUR117	2.402%	4.250%	1.770
25	TVW131	0.743%	0.859%	1.156
Weighted Average		2.016%	1.919%	0.942

Notes: To obtain weighted averages, Navigant used the 2014 feeder-level estimated annual MWh as weights (see Table 12). All values are rounded to three decimal places.

Error! Not a valid bookmark self-reference. shows the mean voltage reductions, energy savings, and CVR factors for shoulder-season weekends and holidays.

Table 11. RTF Protocol Results, Shoulder-Season Weekends/Holidays

#	Feeder	Mean Voltage Reduction	Mean Energy Saved	CVRf
1	3HT12F1	1.993%	1.575%	0.790
2	3HT12F5	1.691%	1.013%	0.599
3	3HT12F7	1.921%	1.120%	0.583
4	9CE12F4	1.310%	1.129%	0.862
5	BEA12F3	2.122%	2.288%	1.078
6	BEA12F4	1.977%	1.935%	0.979
7	BEA12F5	1.579%	1.147%	0.726
8	F&C12F4	1.688%	1.468%	0.870
9	F&C12F5	1.530%	2.510%	1.641
10	F&C12F6	1.600%	2.755%	1.722
11	GLN12F1	2.047%	1.550%	0.757
12	GLN12F2	1.529%	0.786%	0.514
13	L&S12F1	2.112%	1.356%	0.642
14	L&S12F2	1.607%	1.202%	0.748
15	NE12F3	1.715%	0.496%	0.289
16	NE12F5	1.738%	3.072%	1.767
17	ROS12F6	1.455%	0.194%	0.133
18	SE12F4	1.312%	0.644%	0.491
19	SE12F5	1.640%	0.413%	0.252
20	SPU123	2.648%	1.107%	0.418
21	SPU125	1.187%	1.321%	1.113
22	SUN12F1	2.046%	0.125%	0.061
23	TUR113	2.723%	2.094%	0.769
24	TUR117	2.468%	4.316%	1.749
25	TVW131	0.699%	0.715%	1.022
Wt'd Average		1.810%	1.520%	0.834

Notes: To obtain weighted averages, Navigant used the 2014 feeder-level estimated annual MWh as weights (see Table 12). All values are rounded to three decimal places.

9 Appendix B. Estimated 2014 Annual MWh Sales for IVVC Feeders

Table 12. Avista Estimated 2014 Energy Sales

#	Feeder	Annual MWh (mid-2012 to mid-2013)	Assumed Annual Growth Rate	Annual MWh (Calendar 2014)*
1	3HT12F1	36,278.27	1.9%	37,317.10
2	3HT12F2	35,670.13	1.9%	36,691.54
3	3HT12F3	27,477.03	1.9%	28,263.83
4	3HT12F4	35,185.73	1.9%	36,193.27
5	3HT12F5	39,725.97	1.9%	40,863.52
6	3HT12F6	28,745.10	1.9%	29,568.21
7	3HT12F7	18,989.12	1.9%	19,532.87
8	3HT12F8	46,023.45	1.9%	47,341.33
9	9CE12F1	45,768.91	2.1%	47,218.17
10	9CE12F4	33,008.18	2.1%	34,053.38
11	BEA12F2	40,060.15	2.0%	41,267.94
12	BEA12F3	26,862.57	2.0%	27,672.46
13	BEA12F4	33,961.58	2.0%	34,985.50
14	BEA12F5	5,618.23	2.0%	5,787.62
15	C&W12F1	33,191.42	2.0%	34,192.12
16	C&W12F2	25,350.52	2.0%	26,114.83
17	C&W12F3	40,244.70	2.0%	41,458.06
18	C&W12F4	50,006.74	2.0%	51,514.42
19	C&W12F5	23,604.21	2.0%	24,315.87
20	C&W12F6	35,052.69	2.0%	36,109.51
21	F&C12F1	40,414.59	2.2%	41,755.58
22	F&C12F2	28,812.37	2.2%	29,768.39
23	F&C12F3	32,184.98	2.2%	33,252.90
24	F&C12F4	36,652.51	2.2%	37,868.67
25	F&C12F5	30,786.56	2.2%	31,808.08
26	F&C12F6	37,615.24	2.2%	38,863.35
27	FWT12F1	29,581.19	2.1%	30,517.87
28	FWT12F2	31,378.49	2.1%	32,372.08
29	FWT12F3	33,066.91	2.1%	34,113.97
30	FWT12F4	28,245.42	2.1%	29,139.81
31	GLN12F1	36,992.32	2.3%	38,275.87

#	Feeder	Annual MWh (mid-2012 to mid-2013)	Assumed Annual Growth Rate	Annual MWh (Calendar 2014)*
32	GLN12F2	34,428.48	2.3%	35,623.07
33	L&S12F1	35,582.96	2.1%	36,709.69
34	L&S12F2	46,081.43	2.1%	47,540.59
35	L&S12F3	28,880.17	2.1%	29,794.65
36	L&S12F4	38,074.55	2.1%	39,280.17
37	L&S12F5	23,287.06	2.1%	24,024.44
38	NE12F1	30,860.67	2.1%	31,837.87
39	NE12F2	36,954.35	2.1%	38,124.50
40	NE12F3	19,459.38	2.1%	20,075.56
41	NE12F4	25,749.62	2.1%	26,564.98
42	NE12F5	40,324.68	2.1%	41,601.55
43	NW12F2	26,375.69	2.1%	27,210.87
44	NW12F4	33,351.94	2.1%	34,408.02
45	ROS12F1	50,209.41	1.4%	51,267.49
46	ROS12F2	44,648.77	1.4%	45,589.67
47	ROS12F3	29,395.92	1.4%	30,015.39
48	ROS12F4	43,290.52	1.4%	44,202.80
49	ROS12F5	57,493.33	1.4%	58,704.91
50	ROS12F6	43,336.62	1.4%	44,249.87
51	SE12F1	31,086.65	2.4%	32,212.46
52	SE12F2	49,494.83	2.4%	51,287.29
53	SE12F3	39,678.51	2.4%	41,115.47
54	SE12F4	38,713.39	2.4%	40,115.40
55	SE12F5	28,096.71	2.4%	29,114.24
56	SPU121	36,601.55	1.9%	37,649.63
57	SPU122	31,068.99	1.9%	31,958.65
58	SPU123	33,228.29	1.9%	34,179.78
59	SPU124	47,467.80	1.9%	48,827.04
60	SPU125	29,975.82	1.9%	30,834.18
61	SUN12F1	33,631.60	2.3%	34,798.54
62	SUN12F3	34,042.05	2.3%	35,223.23
63	SUN12F6	26,865.83	2.3%	27,798.01
64	TUR111	28,154.34	1.9%	28,960.54
65	TUR112	30,857.00	1.9%	31,740.59

#	Feeder	Annual MWh (mid-2012 to mid-2013)	Assumed Annual Growth Rate	Annual MWh (Calendar 2014)*
66	TUR113	24,569.53	1.9%	25,273.08
67	TUR115	30,818.36	1.9%	31,700.84
68	TUR116	28,836.07	1.9%	29,661.79
69	TUR117	38,576.25	1.9%	39,680.88
70	TVW131	34.49	1.9%	35.48
71	TVW132	14,607.37	1.9%	15,025.65
	Total	2,370,746.26		2,442,216.96

Notes: Annual MWh sales (7/2012 to 7/2013) and assumed annual growth rate obtained from Avista Utilities, April 18, 2014.
** Annual mid-2012 to mid-2013 figures are Avista audited sales data. Calendar 2014 annual figures were obtained by applying the assumed annual growth rates to the mid-2012 to mid-2013 values for a period of 18 months.*