2012 Annual Report
Demand-Side Management

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II. EXECUTIVE SUMMARY

The 2012 Demand-Side Management (DSM) Annual Report summarizes the Company's annual energy efficiency achievements for its Washington and Idaho 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 90 and 190, also known as the "Tariff Rider" which is a non-bypassable system benefit charge applied to all electric and natural gas retail sales.

In 2012, the electric DSM portfolio achieved 77,611 MWh and the natural gas portfolio delivered 839,953 therms in first year annual savings. Based on the 2012 target established by the 2011 Electric Integrated Resource Plan (IRP), the Company achieved 87 percent of the system (Idaho and Washington) target while only acquiring 34 percent of the 2012 target from the 2011 Natural Gas IRP. The Natural Gas IRP target was established prior to the precipitous 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, 2012 is the first 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 76,202 MWh for the energy efficiency portion. In 2012, Avista acquired 51,544 MWh[1] (unverified) in Washington, or 68 percent of its BCP two-year target.

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, since 2012 reported acquisition was not available at the time of this report, 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. Net-to-gross (NTG) adjustments to savings claims and cost-effectiveness are included within the NTG section of this report. Furthermore, while net-to-gross analysis is being studied on 2012 participation, NTG adjustments from 2011 participation were applied for purposes of this report.

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 2012, the TRC benefit-to-cost ratios were 1.58 for

[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 53,429 MWh with fuel conversions included.

electric and 0.48 for natural gas. The PAC test benefit-to-cost ratios were 2.64 for electric and 0.79 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.

The verification of the 2012 portfolio energy savings is in the process of being independently verified through external, third-party evaluators, Cadmus. Therefore, results reported in this report are based on Unit Energy Savings from the evaluation of 2011 programs where applicable.

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 2012 Demand-Side Management (DSM) Annual Report summarizes the Company's annual energy efficiency achievements of its DSM programs. Since DSM is typically the least-cost resource, it is imperative the Company acquire all cost-effective energy efficiency through effective program delivery.

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 system 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 2010-2011 programs while natural gas cost-effectiveness results are based on verification and impact evaluations conducted on 2011 programs. These savings estimates represent gross energy acquisition. Net-to-gross evaluation and impacts on cost-effectiveness will be addressed in the net-to-gross section of this report.

Avoided costs used for the cost-effectiveness valuation of the 2012 programs are the avoided costs from the most recently filed electric and natural gas IRPs. In 2012, 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 Idaho Public Utilities Commission authorized the suspension of the natural gas programs effective October 1, 2012 due to the cost-ineffectiveness of natural gas energy efficiency programs under the TRC benefit-cost test. The Washington Utilities and Transportation Commission approved continuation of Avista's natural gas energy efficiency programs under the PAC benefit-cost test.

While Schedule 190 was suspended in Idaho, a small number of customer projects were still in process and, by contract, have a year to complete. Therefore, there were still natural gas energy efficiency projects completing in both states in 2012 and 2013. The results of these projects that completed in 2012 are included in this report. Avista is not surprised that natural gas DSM did not pass most of the cost-effectiveness tests as will be described in this report.

In summary, system electric and natural gas TRC is 1.58 and 0.48, respectively. System electric and natural gas PAC test benefit-cost ratios are 2.64 and 0.79, respectively. Tables 1 through 12 illustrate system electric, natural gas and combined fuel cost-effectiveness, respectively. Details by fuel type and state are provided in Appendix 1.

System Electric Cost-Effectiveness

Table 1: Electric Total Resource Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$55,273,236	$1,239,844	$56,513,080
Natural Gas avoided cost	(823,705)	(234,046)	(1,057,752)
Non-energy Benefits	819,815	525,409	1,345,225
TRC benefits	$55,269,346	$1,531,207	$56,800,553
Non-incentive utility cost	$5,886,977	$87,724	$5,974,702
Customer cost	28,656,085	1,280,273	29,936,357
TRC costs	$34,543,062	$1,367,997	$35,911,059
TRC ratio	**1.60**	**1.12**	**1.58**
Net TRC benefits	**$20,726,284**	**$163,210**	**$20,889,494**

Table 2: Electric Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$55,273,236	$1,239,844	$56,513,080
Natural Gas avoided cost	(823,705)	(234,046)	(1,057,752)
PAC benefits	$54,449,531	$1,005,798	$55,455,328
Non-incentive utility cost	$5,886,977	$87,724	$5,974,702
Incentive cost	13,721,042	1,280,273	15,001,315
PAC costs	$19,608,020	$1,367,997	$20,976,017
PAC ratio	**2.78**	**0.74**	**2.64**
Net PAC benefits	**$34,841,511**	**($362,199)**	**$34,479,312**

Table 3: Electric Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric bill Reduction	$42,064,846	$1,123,550	$43,188,396
Gas bill Reduction	(3,315,612)	(336,233)	(3,651,844)
Non-energy benefits	819,815	525,409	1,345,225
Participant benefits	$39,569,050	$1,312,727	$40,881,776
Customer cost	$28,656,085	$1,280,273	$29,936,357
Incentive received	(13,721,042)	(1,280,273)	(15,001,315)
Participant costs	$14,935,042	$0	$14,935,042
Participant ratio	**2.65**	**NA**	**2.74**
Net Participant benefits	**$24,634,007**	**$1,312,727**	**$25,946,734**

Table 4: Electric Rate Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost savings	$55,273,236	$1,239,844	$56,513,080
Nonparticipant benefits	$55,273,236	$1,239,844	$56,513,080
Electric Revenue loss	$38,749,235	$787,317	$39,536,552
Non-incentive utility cost	5,886,977	87,724	5,974,702
Customer incentives	13,721,042	1,280,273	15,001,315
Nonparticipant costs	$58,357,254	$2,155,314	$60,512,569
RIM ratio	**0.95**	**0.58**	**0.93**
Net RIM benefits	**($3,084,018)**	**($915,470)**	**($3,999,489)**

System Natural Gas Cost-Effectiveness Tests

Table 5: Natural Gas Total Resource Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost	$4,800,873	$248,800	$5,049,673
Electric avoided cost	(268,751)	(2,602)	(271,353)
Non-energy Benefits	31,359	466,676	498,035
TRC benefits	$4,563,480	$712,874	$5,276,354
Non-incentive utility cost	$1,780,706	$114,685	$1,895,391
Customer cost	7,780,600	1,409,562	9,190,162
TRC costs	$9,561,306	$1,524,247	$11,085,553
TRC ratio	**0.48**	**0.47**	**0.48**
Net TRC benefits	**($4,997,826)**	**($811,373)**	**($5,809,199)**

Table 6: Natural Gas Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost	$4,800,873	$248,800	$5,049,673
Electric avoided cost	(268,751)	(2,602)	(271,353)
PAC benefits	$4,532,121	$246,198	$4,778,319
Non-incentive utility cost	$1,780,706	$114,685	$1,895,391
Incentive cost	2,710,177	1,409,562	4,119,739
PAC costs	$4,490,882	$1,524,247	$6,015,130
PAC ratio	**1.01**	**0.16**	**0.79**
Net PAC benefits	**$41,239**	**($1,278,049)**	**($1,236,810)**

Table 7: Natural Gas Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas bill reduction	$3,992,776	$331,951	$4,324,727
Electric bill reduction	(207,745)	(4,319)	(212,064)
Non-energy benefits	31,359	466,676	498,035
Participant benefits	$3,816,390	$794,308	$4,610,698
Customer cost	$7,780,600	$1,409,562	$9,190,162
Incentive received	(2,710,177)	(1,409,562)	(4,119,739)
Participant costs	$5,070,424	$0	$5,070,424
Participant ratio	**0.75**	**NA**	**0.91**
Net Participant benefits	**($1,254,034)**	**$794,308**	**($459,725)**

Table 8: Natural Gas Rate Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Natural gas avoided cost savings	$4,800,873	$248,800	$5,049,673
Nonparticipant benefits	$4,800,873	$248,800	$5,049,673
Natural gas revenue loss	$3,785,031	$327,632	$4,112,663
Non-incentive utility cost	1,780,706	114,685	1,895,391
Customer incentives	2,710,177	1,409,562	4,119,739
Nonparticipant costs	$8,275,913	$1,851,880	$10,127,793
RIM ratio	**0.58**	**0.13**	**0.50**
Net RIM benefits	**($3,475,040)**	**($1,603,079)**	**($5,078,120)**

System 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	$60,074,109	$1,488,644	$56,241,727
Natural Gas avoided cost	(1,092,457)	(236,648)	3,991,921
Non-energy benefits	851,174	992,086	1,843,259
TRC benefits	$59,832,826	$2,244,081	$62,076,907
Non-incentive utility cost	$7,667,683	$202,410	$7,870,093
Customer cost	36,436,685	2,689,835	39,126,520
TRC costs	$44,104,368	$2,892,244	$46,996,612
TRC ratio	**1.36**	**0.78**	**1.32**
Net TRC benefits	**$15,728,458**	**($648,163)**	**$15,080,295**

Table 10: Electric and Natural Gas Program Administrator Cost

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric avoided cost	$55,004,485	$1,237,242	$56,241,727
Natural Gas avoided cost	3,977,167	14,754	3,991,921
PAC benefits	$58,981,652	$1,251,996	$60,233,648
Non-incentive utility cost	$7,667,683	$202,410	$7,870,093
Incentive cost	16,431,219	2,689,835	19,121,054
PAC costs	$24,098,902	$2,892,244	$26,991,146
PAC ratio	**2.45**	**0.43**	**2.23**
Net PAC benefits	**$34,882,750**	**($1,640,249)**	**$33,242,501**

Table 11: Electric and Natural Gas Participant

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Electric bill reduction	$41,857,101	$1,119,231	$42,976,332
Gas bill reduction	677,164	(4,282)	672,883
Non-energy benefits	851,174	992,086	1,843,259
Participant benefits	$43,385,439	$2,107,035	$45,492,474
Customer cost	$36,436,685	$2,689,835	$39,126,520
Incentive received	(16,431,219)	(2,689,835)	(19,121,054)
Participant costs	$20,005,466	$0	$20,005,466
Participant ratio	**2.17**	**NA**	**2.27**
Net Participant benefits	**$23,379,973**	**$2,107,035**	**$25,487,009**

Table 12: Electric and Natural Gas Rate Impact Measure

	Regular Income portfolio	Low Income portfolio	Overall portfolio
Avoided Cost savings	$60,074,109	$1,488,644	$61,562,753
Nonparticipant benefits	$60,074,109	$1,488,644	$61,562,753
Revenue loss	$42,534,266	$1,114,950	$43,649,215
Non-incentive utility cost	7,667,683	202,410	7,870,093
Customer incentives	16,431,219	2,689,835	19,121,054
Nonparticipant costs	$66,633,168	$4,007,194	$70,640,362
RIM ratio	**0.90**	**0.37**	**0.87**
Net RIM benefits	**($6,559,059)**	**($2,518,550)**	**($9,077,609)**

IV. NET-TO-GROSS

During 2012, as part of Avista's portfolio process and impact review conducted by Cadmus, various net-to-gross analyses were performed on the residential and nonresidential energy efficiency programs. These findings are used by the Company to determine what, if any, portion of the gross energy savings have been influenced by and are attributable to the utility's energy efficiency programs rather than to other influences such as consumer self-motivation or other motivators such as tax credits.

While net-to-gross is comprised of freeridership, participant spillover and nonparticipant spillover, due to the time lag necessary to measure the effects of spillover, the net-to-gross study as performed by Cadmus most likely underestimates the spillover.

The following table summarizes the net-to-gross (NTG) findings on 2010 and 2011 programs for the residential program categories. When reviewing 2011 programs for NTG, some program categories that had been reviewed in 2010 were revisited in 2011. In addition, some new program categories were added to the 2011 program review. NTG for Low Income is assumed to be 100 percent.

Table 13: Residential Net-to-Gross Results

Program Category	NTG on 2011 Programs	NTG on 2010 Programs
Appliances	41.9%	52.0%
Heating, Cooling and Ventilation	45.5%	61.0%
Shell	68.3%	63.8%
ENERGY STAR Homes	N/A	73.6%
Appliance Recycling-Refrigerator	41.0%	N/A
Appliance Recycling-Freezer	42.0%	N/A
CFL Contingency	65.8%	N/A

The difference in NTG estimates between 2010 and 2011 are statistically significant for residential appliances and high-efficiency heating, cooling and ventilation equipment whereas it wasn't significantly different for shell. Consequently, these two program categories will be reviewed in 2013 to confirm whether this was an anomaly or whether programs need to be modified or terminated.

The following table summarizes the net-to-gross (NTG) findings on 2010 and 2011 programs for the nonresidential program categories.

Table 14: Nonresidential Net-to-Gross Results

Program Category	NTG on 2011 Programs	NTG on 2010 Programs
EnergySmart Grocer	96.0%	90.0%
Motors	53.0%	59.0%
Prescriptive	67.4%	87.8%
Site Specific	83.3%	74.2%

The difference in NTG estimates between 2010 and 2011 are statistically significant for the nonresidential prescriptive program category while the difference in the other program categories is not statistically significant. NTG on the prescriptive program category based on 2012 participation will be revisited in 2013 to determine if this difference was an anomaly or whether programs need to be modified or terminated.

Nonresidential programs, with the exception of motors, generally showed lower NTG than residential programs. The high freeridership scores on residential programs could indicate that the market has truly been transformed. In 2013, Cadmus is conducting a contractor panel study on Avista's behalf to determine saturation and penetration of the Company's existing residential and nonresidential energy efficiency programs.

Residential electric and natural gas net Total Resource Cost (TRC) and Program Administrator Cost (PAC) benefits and cost by program are summarized in the Tables 15 and 16, respectively. System residential electric gross TRC benefit-cost ratio of 0.69 becomes 0.45 when adjusted for NTG. System residential natural gas gross TRC benefit-cost ratio of 0.49 becomes 0.37 when adjusted for NTG. System residential electric gross PAC benefit-cost ratio of 1.11 decreases to 0.51 when adjusted for NTG. System residential natural gas gross PAC benefit-cost ratio of 0.77 declines to 0.37 when adjusted for NTG. The following tables provide more detail by program on residential electric and natural gas net benefits, costs and resulting ratios.

Table 15: Residential Electric Program Net Benefits and Costs

Program	State	Net TRC Benefits	Net TRC Costs	TRC	Net PAC Benefits	Net PAC Costs	PAC
Fuel Conversion	ID	$120,604	$250,250	0.48	$120,604	$212,537	0.57
	WA	$416,111	$998,469	0.42	$416,111	$877,619	0.47
ENERGY STAR Appliances	ID	$121,128	$254,600	0.48	$105,895	$186,480	0.57
	WA	$234,718	$547,762	0.43	$205,418	$415,886	0.49
ENERGY STAR Homes	ID	$23,818	$40,129	0.59	$23,818	$25,741	0.93
	WA	$42,085	$72,956	0.58	$42,085	$46,796	0.90
Heating and Cooling	ID	$260,192	$557,192	0.47	$260,192	$487,506	0.53
	WA	$342,263	$813,628	0.42	$342,263	$732,077	0.47
Water Heaters	ID	$3,068	$5,327	0.58	$3,068	$7,370	0.42
	WA	$8,467	$16,803	0.50	$8,467	$22,444	0.38
Home Weatherization	ID	$23,163	$40,836	0.57	$23,163	$33,974	0.68
	WA	$65,170	$117,281	0.56	$65,170	$102,779	0.63
	ID	$551,973	$1,148,333	0.48	$536,740	$953,609	0.56
	WA	$1,108,815	$2,566,899	0.43	$1,079,515	$2,197,601	0.49
	System	$1,660,788	$3,715,232	0.45	$1,616,255	$3,151,210	0.51

Table 16: Residential Natural Gas Program Net Benefits and Costs

Program	State	Net TRC Benefits	Net TRC Costs	TRC	Net PAC Benefits	Net PAC Costs	PAC
ENERGY STAR Appliances	ID	$35,981	$45,956	0.78	$35,829	$21,279	1.68
	WA	$102,949	$139,026	0.74	$102,512	$66,113	1.55
ENERGY STAR Homes	ID	$7,379	$11,060	0.67	$7,379	$7,882	0.94
	WA	$4,217	$7,612	0.55	$4,217	$5,796	0.73
Heating and Cooling	ID	$219,280	$549,270	0.40	$219,280	$633,065	0.35
	WA	$477,165	$1,516,124	0.31	$477,165	$1,697,916	0.28
Water Heaters	ID	$942	$1,871	0.50	$942	$3,288	0.29
	WA	$5,474	$13,581	0.40	$5,474	$21,811	0.25
Home Weatherization	ID	$41,931	$99,947	0.42	$41,931	$72,949	0.57
	WA	$144,164	$401,643	0.36	$144,164	$298,234	0.48
	ID	$305,513	$708,105	0.43	$305,361	$738,463	0.41
	WA	$733,969	$2,077,986	0.35	$733,532	$2,089,869	0.35
	System	$1,039,482	$2,786,090	0.37	$1,038,893	$2,828,332	0.37

Nonresidential electric and natural gas net Total Resource Cost (TRC) benefits and cost by program are summarized in the following tables. System nonresidential electric gross TRC of 1.57 becomes 1.53 when adjusted for NTG. System nonresidential natural gas gross TRC of 0.47 becomes 0.45 when adjusted for NTG. System nonresidential electric gross PAC of 2.80 decreases to 2.14 when adjusted for NTG. System nonresidential natural gas gross PAC of 1.41 declines to 1.12 when adjusted for NTG. Tables 17 and 18 provide more detail by program on nonresidential electric and natural gas net benefits, costs and resulting ratios.

Table 17: Nonresidential Electric Program Net Benefits and Costs

Program	State	Net TRC Benefits	Net TRC Costs	TRC	Net PAC Benefits	Net PAC Costs	PAC
EnergySmart Grocer	ID	$1,081,269	$527,976	2.05	$1,081,269	$299,969	3.60
	WA	$1,745,422	$805,573	2.17	$1,745,422	$534,535	3.27
Prescriptive	ID	$5,274,590	$3,844,444	1.37	$5,154,597	$3,599,831	1.43
	WA	$9,599,930	$6,847,744	1.40	$9,388,552	$6,340,105	1.48
Site Specific Heating and Cooling	ID	$1,121,014	$740,232	1.51	$1,121,014	$428,828	2.61
	WA	$2,269,577	$2,265,530	1.00	$2,269,577	$762,068	2.98
Site Specific Lighting	ID	$1,858,128	$787,101	2.36	$1,808,845	$489,838	3.69
	WA	$5,493,481	$3,577,668	1.54	$5,358,130	$1,678,523	3.19
Site Specific Other	ID	$883,811	$605,700	1.46	$883,811	$229,974	3.84
	WA	$3,780,391	$1,688,173	2.24	$3,780,391	$986,416	3.83
Site Specific Shell	ID	$226,700	$134,075	1.69	$226,700	$59,028	3.84
	WA	$326,633	$168,695	1.94	$326,438	$86,893	3.76
	ID	$10,445,514	$6,639,527	1.57	$10,276,237	$5,107,466	2.01
	WA	$23,215,435	$15,353,383	1.51	$22,868,511	$10,388,541	2.20
	System	$33,660,948	$21,992,910	1.53	$33,144,749	$15,496,007	2.14

Table 18: Nonresidential Natural Gas Program Net Benefits and Costs

Program	State	Net TRC Benefits	Net TRC Costs	TRC	Net PAC Benefits	Net PAC Costs	PAC
Prescriptive	ID	$113,647	$163,563	0.69	$112,157	$106,837	1.05
	WA	$340,206	$493,187	0.69	$325,717	$334,275	0.97
Site Specific Heating and Cooling	ID	$211,187	$381,758	0.55	$211,187	$192,252	1.10
	WA	$826,534	$2,125,784	0.39	$826,534	$681,670	1.21
Site Specific Other	ID	$12,172	$11,786	1.03	$12,172	$8,900	1.37
	WA	$41,097	$125,388	0.33	$41,097	$41,303	1.00
Site Specific Shell	ID	$71,523	$101,503	0.70	$71,523	$65,858	1.09
	WA	$258,871	$806,448	0.32	$253,668	$231,454	1.10
	ID	$408,529	$658,610	0.62	$407,039	$373,848	1.09
	WA	$1,466,708	$3,550,807	0.41	$1,447,016	$1,288,702	1.12
	System	$1,875,237	$4,209,417	0.45	$1,854,055	$1,662,550	1.12

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

Cadmus was retained to provide impact and process evaluations for the 2012-2013 electric and 2012 natural gas programs. As part of the 2009 Idaho Public Utilities Commission (IPUC) Memorandum of Understanding (MOU), the Company committed to a three-year cycle to evaluate all programs. By the time the Request for Proposal for Evaluation on Idaho and Washington DSM programs was issued, it was decided that Avista would take a portfolio approach for this first biennium in order to provide a comprehensive benchmark to compare against in future years. As Avista continues through the second Biennium, the Company continues this portfolio-wide approach for evaluation while leveraging the findings of past evaluations to inform future evaluation efforts that may require a "deeper dive."

Responsive to the 2009 IPUC MOU, evaluations published during the 2012 calendar year are included as part of this DSM Annual Report. The following evaluation reports are included within the Appendices as noted:

- **Avista 2011 Multi-Sector Gas Impact Evaluation Report** prepared by Cadmus is included in Appendix 2. This report summarizes findings and recommendations resulting from the impact evaluation on 2011 natural gas programs.
- **Avista 2010-2011 Multi-Sector Electric Impact Evaluation Report** prepared by Cadmus is included in Appendix 3. This report summarizes the findings and recommendations resulting from the impact evaluation on 2010-2011 electric programs.
- **Avista 2011 Multi-Sector Process Evaluation Report** prepared by Cadmus is included in Appendix 4. This report summarizes the findings and recommendations resulting from Cadmus' process evaluation on 2011 DSM programs.
- **Net-to-Gross Evaluation of Avista's 2011 Demand-Side Management Programs** is included in Appendix 5. This report summarizes the findings related to the net-to-gross study performed on 2011 programs.

VI. PROGRAMS

Residential

Home Improvement/Appliances

The Company's residential portfolio provides a variety of measures, through different delivery channels, offering energy efficiency improvement opportunities to Avista customers. The majority of the residential portfolio is implemented through prescriptive rebates and processed in-house by Avista. New construction and existing residential homes (up to a four-plex), that heat with Avista electric or natural gas, can select from a list of energy efficiency measures with rebates for consideration of installation in their homes. Customers must purchase and install the equipment or qualifying energy efficiency measure and submit a rebate application with the appropriate documentation within 90 days of installation in order to receive an incentive.

Idaho and Washington residential rebate programs offered in 2012 included high-efficiency equipment (furnaces, water heaters, central heat pumps, ductless heat pumps, variable speed motors), space and water fuel conversions (direct use of natural gas) and efficiency upgrades from electric resistance, insulation improvements, fireplace dampers and upgrades to ENERGY STAR® appliances.

Multi-family residences (larger than a five-plex) may be eligible for incentives but are treated under a 'site-specific' approach similar to that of nonresidential programs. Multi-family owners and developers that choose to treat entire complexes with energy efficiency improvements, including common areas or residential living spaces, would submit projects to be evaluated individually, following the procedures of the nonresidential site specific assessment.

Notable changes to the residential segment in 2012 included the launch of an online rebate application in February, as well as the discontinuation of the fireplace dampers, dishwashers and shade tree measures in March. In addition, Idaho Schedule 191 and natural gas program offerings were suspended for Idaho customers in November due to cost-effectiveness concerns in an environment of declining natural gas avoided costs.

Impact and process evaluations will continue on 2012 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.

Residential programs have benefited from the sustained customer outreach campaign, *EveryLittleBit*, that serves to educate the region on the availability of Avista's energy efficiency programs and encourages customers to participate in currently offered programs. Outreach efforts have included broad media, online, print and participation at several community events. Avista continued DSM-led outreach at select community events, energy fairs and vendor meetings. Avista launched a new DSM tool, "Outreach-in-a-Box", which can be leveraged by non-DSM personnel within Avista for use at various public engagements. Beginning in 2012, Avista began to transition away from the general messaging of *EveryLittleBit* to leverage targeted messaging promoting specific programs.

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.

During 2012, residential customers completed nearly 8,000 electric and over 6,400 natural gas prescriptive energy efficiency projects. Over $2.4 million in rebates were provided directly to residential customers to offset the cost of implementing these energy efficiency measures. Residential programs contributed over 4,466 MWh and over 407,000 therms in annual first-year energy savings. Tables 19 and 20 summarize the results from the electric and natural gas home improvement and appliance programs.

Table 19: Electric Residential Home Improvement and Appliances[2]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Fuel Conversion	ID	38	$20,709	344,734	(14,962)	$357,242	($92,177)	$0	$128,400	$191,828
	WA	149	$69,977	1,199,239	(53,275)	$1,242,748	($328,217)	$0	$419,400	$807,642
ENERGY STAR Appliances	ID	1,791	$50,770	380,897	0	$252,734	0	$36,356	$283,746	$135,710
	WA	3,464	$97,275	734,922	0	$490,258	0	$69,928	$546,900	$318,611
ENERGY STAR Homes	ID	11	$9,900	24,698	406	$29,501	$2,860	$0	$33,000	$15,841
	WA	20	$18,000	37,096	1,827	$44,310	$12,871	$0	$60,000	$28,796
Heating and Cooling Upgrades	ID	769	$180,440	676,843	0	$571,851	0	$0	$549,725	$307,067
	WA	1,208	$243,217	890,337	0	$752,227	0	$0	$713,775	$488,861
Water Heater Upgrades	ID	75	$3,750	8,933	0	$6,742	0	$0	$3,750	$3,620
	WA	207	$10,350	24,654	0	$18,609	0	$0	$10,350	$12,094
Home Weatherization	ID	49	$14,479	37,675	0	$36,306	0	$0	$33,449	$19,495
	WA	118	$36,395	105,998	0	$102,147	0	$0	$79,776	$66,384
	ID	2,733	$280,048	1,473,779	(14,556)	$1,254,375	($89,317)	$36,356	$1,032,070	$673,562
	WA	5,166	$475,214	2,992,246	(51,448)	$2,650,299	($315,346)	$69,928	$1,830,201	$1,722,388
	System	7,899	$755,261	4,466,025	(66,004)	$3,904,673	($404,663)	$106,284	$2,862,271	$2,395,949

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

Table 20: Natural Gas Residential Home Improvement and Appliances[3]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
ENERGY STAR	ID	532	$17,475	125,109	3,256	74,064	$11,447	$363	$100,602	$3,804
Appliances	WA	1,447	$47,950	358,112	9,253	212,098	$32,562	$1,043	$288,456	$18,163
ENERGY STAR	ID	7	$4,550	0	1,423	0	$10,026	$0	$10,500	$3,332
Homes	WA	4	$2,600	0	813	0	$5,729	$0	$6,000	$3,196
Heating and	ID	1,037	$414,625	(169,228)	106,691	(175,367)	$657,300	$0	$727,100	$218,439
Cooling Upgrades	WA	2,254	$901,375	(366,027)	231,792	(379,307)	$1,428,020	$0	$1,581,500	$796,541
Water Heater	ID	52	$2,600	0	468	0	$2,071	$0	$2,600	$688
Upgrades	WA	302	$15,100	0	2,721	0	$12,031	$0	$15,100	$6,711
Home	ID	172	$51,107	0	11,448	0	$65,723	$0	$122,423	$21,841
Weatherization	WA	594	$172,293	172	39,326	178	$225,784	$0	$432,135	$125,941
	ID	1,800	$490,358	(44,118)	123,287	(101,304)	$746,567	$363	$963,225	$248,105
	WA	4,601	$1,139,318	(7,743)	283,904	(167,031)	$1,704,126	$1,043	$2,323,191	$950,552
	System	6,401	$1,629,676	(51,861)	407,191	(268,334)	$2,450,693	$1,406	$3,286,416	$1,198,657

Simple Steps Smart Savings

Avista continues to participate in the regional manufacturer buy-down of CFL twists and specialty bulbs through Northwest Energy Efficiency Alliance (NEEA) and its contactor. During 2012, showerheads were briefly added to this buy-down effort, but were soon removed due to cost-effectiveness concerns. Over 456,000 bulbs and nearly 1,800 showerheads were purchased from participating retailers. The bulbs resulted in 9,991 MWh and the showerheads resulted in 430 MWh in annual first-year savings during 2012. The Company contributed nearly $390,000 in incentives toward this buy-down effort and nearly $157,000 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 2012, 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 nearly 1,172 MWh in annual first-year savings in 2012. The Company contributed over $146,000 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 2012, Avista pared down the community event list and DSM-led outreach to select engagements, 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

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

approach, also known as "Outreach-in-a-Box" has been successful in increasing the availability of DSM messaging and support.

The *Event-in-a-Box* includes energy efficiency tips, CFLs for distribution and other DSM program materials. During 2012, just over 5,400 bulbs were distributed at events throughout Avista's service territory which resulted in 81 MWh of annual first-year savings. The incentive cost of providing these bulbs to customers was over $10,700 and is offered at minimal utility cost.

In-Home Energy Audit

The In-Home Energy Audit program was introduced in 2010 in Spokane County only, specifically in the City of Spokane, City of Spokane Valley and unincorporated parts of Spokane County. This program was co-funded by American Recovery and Reinvestment Act through municipality partners who committed their Energy Efficiency and Conservation Block Grant funding in order to reduce the customer cost within their jurisdictions. The remaining cost of the audit was covered by the customer and through DSM funding. The audit included both internal and external inspections as well as diagnostic tests, including a blower door test, to detect outside air infiltration, pressure pan test for heating system duct leakage and a combustion zone test for natural gas fired furnaces, water heaters and ovens. Some minor efficiency measures were installed and an energy efficiency kit including CFLs and other energy savings items was left with each homeowner.

During 2012, 1,075 in-home audits were completed resulting in over 97 MWh of first-year energy savings based on the CFLs distributed to these homeowners during the in-home audits.

Manufactured Home Duct Repair

The Manufactured Home Duct Repair program began in Fall 2012 and will be ending 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, direct install measures such as showerheads and CFLs will be installed so that the customer and Avista realize some energy savings. Customers with disconnected or failed ducts may realize significant improvements in comfort and energy savings.

By the end of 2012, UCONS had treated 574 homes. Approximately 90 percent received both duct sealing and direct installed measures. This program acquired 1,191 MWh in first-year energy savings. The non-incentive utility cost for this effort, jointly funded by Washington State University's Extension Energy Program, was over $45,000.

Low Income and Outreach

The residential Low Income program is comprised primarily of holistic, site-specific offerings delivered by local Community Action Agencies (CAA) to benefit income-qualified, residential customers. Avista contracts with six agencies to utilize existing infrastructure currently in place as a result of delivering the Federal Weatherization Assistance and Low Income Heating Assistance Programs. The customer intake process includes potential consideration for participation for energy assistance and other income-qualified programs that can also serve as referrals for weatherization services.

Low income efficiency measures are similar to measures offered under the traditional residential prescriptive programs. A list of approved measures, based on high level of predictability of cost-effectiveness, is provided to the agencies in an attempt to manage the cost-effectiveness of the program. The program includes improvements to insulation, infiltration, ENERGY STAR® doors and windows, and fuel conversion from electric resistance heat. If agencies identify other opportunities that are not listed on the approved measure list, measures can be submitted to Avista for consideration. This review process considers the program's overall cost-effectiveness in a near real-time basis. Avista's funding covers the full cost of the energy efficiency installation for the qualified customer. Administrative fees of 15 percent are paid to the agencies for delivery of this service. In addition, Health and Human Safety (HH&S) measures are also funded by Avista. These improvements are limited to 15 percent of the agencies' total funding and are intended to ensure the habitability of the home where the energy efficiency improvements were made.

In 2012, much activity occurred around the Low Income program. There was significant effort by the Idaho Public Utilities Commission (IPUC), investor-owned utilities (IOUs) and other stakeholders to consider modifications to Low Income program implementation in order to improve cost-effectiveness. The end result was an IPUC order no. 32788 (case no. GNR-E-12-01) provided to IOUs in April 2013.

Results from the impact evaluation on 2011 program participants, determined that energy savings often being reported by agencies were actually exceeding the amount of energy being consumed by the individual homes. Consequently, adjustments were made in 2012 to ensure that savings claims did not exceed 20 percent of the home's total annual usage. It is hoped that this will help improve the realization rates on the 2012 Low Income program.

At Avista's request, the IPUC suspended Schedule 191 in November 2012. Consequently, Avista has suspended its Idaho natural gas programs until natural gas avoided costs increase sufficiently to provide cost-effective programs. While the filing was approved in November, agencies were allowed to continue to serve low income customers in Avista natural gas heated homes through the end of their contract year, which concluded in December 2012.

During 2012, the Low Income program acquired 1,111 MWh and over 33,000 therms in the treatment of 434 homes. For the 2012 program year, Avista paid $700,000 in Idaho and nearly $2.0 million in Washington incentives. Of these amounts, the Washington agencies spent $288,731 on H&HS while the Idaho agency spent $105,000. Refer to Tables 21 and 22 for detail on low income programs by state and fuel.

Table 21: Electric Low Income[4]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Fuel Conversion	ID	28	$89,766	171,428	(7,781)	$179,951	($46,908)	$28,000	$89,766	$16,233
	WA	113	$354,956	685,561	(31,217)	$716,079	($187,139)	$111,500	$354,956	$45,724
ENERGY STAR	ID	0	$0	0	0	$0	$0	$0	$0	$0
Appliances	WA	53	$36,837	42,983	0	$44,542	$0	$0	$36,837	$2,844
Heating and	ID	0	$0	0	0	$0	$0	$0	$0	$0
Cooling Upgrades	WA	2	$4,715	5,036	0	$5,218	$0	$0	$4,715	$333
Water Heater	ID	6	$8,710	630	0	$476	$0	$3,000	$8,710	$43
Upgrades	WA	13	$29,391	1,365	0	$1,030	$0	$6,500	$29,391	$66
Home	ID	180	$234,920	102,891	0	$144,217	$0	$84,277	$234,920	$13,010
Weatherization	WA	158	$310,591	101,087	0	$148,330	$0	$81,746	$310,591	$9,471
Health and	ID	0	$52,559	0	0	$0	$0	$52,559	$52,559	$0
Human Safety	WA	0	$157,827	0	0	$0	$0	$157,827	$157,827	$0
	ID	214	$385,955	274,949	(7,781)	$324,644	($46,908)	$167,836	$385,955	$29,286
	WA	339	$894,317	836,031	(31,217)	$915,200	($187,139)	$357,573	$894,317	$58,439
	System	553	$1,280,273	1,110,981	(38,998)	$1,239,844	($234,046)	$525,409	$1,280,273	$87,724

Table 22: Natural Gas Low Income[5]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Heating and	ID	25	$26,076	(2,807)	1,864	($2,909)	$11,194	$13,427	$26,076	$7,590
Cooling Upgrades	WA	67	$86,011	(10,071)	6,368	($10,436)	$39,013	$42,557	$86,011	$14,883
Water Heater	ID	0	$0	0	0	$0	$0	$0	$0	$0
Upgrades	WA	3	$5,435	0	27	$0	$120	$1,500	$5,435	$46
Home	ID	232	$235,510	2,322	7,499	$3,719	$55,468	$57,113	$235,510	$37,610
Weatherization	WA	543	$873,185	4,386	17,271	$7,024	$143,004	$168,734	$873,185	$54,556
Health and Human	ID	0	$52,441	0	0	0	$0	$52,441	$52,441	$0
Safety	WA	0	$130,904	0	0	0	$0	$130,904	$130,904	$0
	ID	257	$314,027	(485)	9,363	$810	$66,663	$122,981	$314,027	$45,200
	WA	613	$1,095,535	(5,685)	23,666	($3,412)	$182,138	$343,695	$1,095,535	$69,485
	SYS	870	$1,409,562	(6,170)	33,029	($2,602)	$248,800	$466,676	$1,409,562	$114,685

In addition to the Company's demand-side management efforts, Avista's Consumer Affairs department hosts conservation education and outreach for our low income, senior and vulnerable customers. These sessions include workshops, demonstrations and distribution of low-cost and no-cost materials with a focus on energy efficiency, conservation tips and measures, and information regarding 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:

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

- 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. Energy Fairs are conducted in partnership with DSM implementation staff. 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. Wattson, the energy watchdog conducts presentations to educate young fair attendees about energy savings and safety.
- 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 education and outreach activities that reached 862 senior and low income individuals through Avista workshops and 1,907 customers through energy fairs. General outreach activities have reached 688 individuals.

Idaho education and outreach activities reached 60 senior and low income customers through Avista workshops and 282 customers through energy fairs. We have engaged 218 customers through general outreach activities.

Additionally, in Idaho, a $50,000 conservation education (ConEd) grant funded through the DSM tariff rider, was provided to the Community Action Partnership (CAP) in Lewiston. The grant resulted from an Idaho General Rate Case settlement and covers the costs for brochures, flyers and video to reach individuals seeking energy assistance at the CAP offices and in the service area. The objectives of CAP's low income consumer energy conservation education program include:

- Increase ConEd knowledge and awareness of low income individuals
- Build capacity for ConEd in local communities, and
- Decrease energy consumption

These objectives are achieved through low, medium and high impact strategies. These strategies start with basic awareness building (low impact) activities through a rotating presentation that is visible to individuals as they wait for their energy assistance appointment in CAP offices as well as the distribution of print materials and Compact Fluorescent Lamps (CFLs) to those seeking assistance from the CAP. Medium impact includes workshops and participation in community events to increase individual knowledge of energy conservation. Finally, high impact activities include one-on-one education with those are receiving weatherization and other energy efficiency installations in their home. The CAP recognizes this strategy as providing the greatest opportunity for lasting behavioral change, although it is the highest cost and serves the fewest number of individuals.

To monitor program performance, CAP submits a quarterly report to Avista providing a summary of the ConEd activities. The report captures information regarding the number of Avista customers reached through the various strategies and results from the program evaluation.

In 2012, the conservation education specialist facilitated workshops and participated in community events reaching 1,961 people. Some workshop participants may be non-Avista customers. Twenty-five one-on-one education activities were conducted in conjunction with home weatherization in Avista-heated homes.

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 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 are capped at fifty percent of the customers' incremental cost of the energy efficiency investment. 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.

The notable change to the nonresidential segment was the suspension of Schedule 191 and the discontinuation of natural gas programs in Idaho. Due to declining natural gas avoided costs, Avista requested the suspension of Schedule 191 until changes in avoided cost make it possible to again offer cost-effective natural gas programs. The IPUC approved this filing in November 2012.

In 2012, over 4,400 prescriptive and site specific nonresidential projects were incented. Avista contributed over $13.5 million for energy efficiency upgrades in nonresidential applications. Nonresidential programs contributed over 58,756 MWh and 400,000 therms in annual first-year energy savings. Tables 23 and 24 provide detail on the electric and natural gas nonresidential programs.

Table 23: Electric Nonresidential[6]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
EnergySmart Grocer	ID	88	$228,179	1,586,096	(892)	$1,130,735	($4,413)	$0	$475,193	$71,790
	WA	249	$410,371	2,708,674	0	$1,818,148	$0	$0	$709,801	$124,164
Prescriptive	ID	1,260	$3,094,462	11,236,331	(75,213)	$7,959,838	($312,068)	$178,031	$4,954,117	$505,369
	WA	2,098	$5,337,817	20,659,768	(180,324)	$14,676,643	($747,040)	$313,617	$8,672,784	$1,002,288
Site Specific Heating and Cooling	ID	15	$327,732	1,679,069	(41,071)	$1,592,310	($246,555)	$0	$767,270	$101,096
	WA	19	$564,842	3,100,293	(30,716)	$2,888,015	($163,432)	$0	$2,482,958	$197,226
Site Specific Lighting	ID	69	$348,174	2,733,677	(12,063)	$2,231,281	($59,798)	$59,163	$774,835	$141,664
	WA	139	$1,224,770	8,470,303	(45,014)	$6,644,374	($212,045)	$162,485	$3,750,197	$453,753
Site Specific Other	ID	18	$162,611	1,190,962	0	$1,060,998	$0	$0	$646,263	$67,363
	WA	62	$662,291	4,767,341	(33,750)	$4,746,211	($207,926)	$0	$1,637,512	$324,125
Site Specific Shell	ID	10	$41,749	256,296	0	$272,149	$0	$0	$140,212	$17,279
	WA	2	$60,131	367,202	0	$391,883	$0	$234	$170,388	$26,762
	ID	1,460	$4,202,906	18,682,431	(129,239)	$14,247,311	($622,834)	$237,195	$7,757,889	$904,560
	WA	2,569	$8,260,222	40,073,581	(289,804)	$31,165,274	($1,330,444)	$476,336	$17,423,640	$2,128,319
	System	4,029	$12,463,128	58,756,013	(419,043)	$45,412,585	($1,953,278)	$713,531	$25,181,529	$3,032,879

Table 24: Natural Gas Nonresidential[7]

Program	State	Project Count	Incentives	kWh	Therms	kWh Avoided Costs	Therms Avoided Costs	Non-energy Benefits	Customer Incremental Costs	Non-incentive Utility Costs
Prescriptive	ID	36	$48,900	0	31,715	$0	166,405	$2,210	$156,714	$57,938
	WA	96	$228,404	0	85,880	$0	483,260	$21,496	$574,654	$105,870
Site Specific Heating and Cooling	ID	6	$103,981	0	48,036	$0	253,526	$0	$352,325	$88,271
	WA	15	$464,204	(471)	159,809	($417)	992,655	$0	$2,290,898	$217,466
Site Specific Other	ID	7	$3,813	0	2,499	$0	14,612	$0	$8,042	$5,087
	WA	18	$30,495	0	10,461	$0	49,336	$0	$137,551	$10,808
Site Specific Shell	ID	1	$35,963	0	13,387	$0	85,862	$0	$85,964	$29,895
	WA	9	$164,741	0	47,945	$0	304,523	$6,247	$888,036	$66,713
	ID	50	$192,657	0	95,638	0	520,405	$2,210	$603,045	$181,191
	WA	138	$887,844	(471)	304,096	($417)	1,829,774	$27,743	$3,891,139	$400,858
	System	188	$1,080,501	(471)	399,733	($417)	2,350,179	$29,953	$4,494,184	$582,049

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

VII. 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, or any individual utility, 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 2012, Avista contributed over $2.2 million to fund NEEA's electric market transformation activities. Typically, NEEA reports energy acquisition in June of the following year, so the corresponding acquisition funded by the $2.2 million was not available at the time of this report.

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.

VIII. ENERGY EFFICIENCY EXPENDITURES

During 2012, Avista incurred over $29.7 million in costs for the operation of electric and natural gas energy efficiency programs, with $23.9 million for electric energy efficiency and $5.7 million for natural gas energy efficiency. Of this amount, $2.2 million was contributed to the Northwest Energy Efficiency Alliance to fund regional market transformation ventures.

Sixty-eight percent of expenditures were returned to ratepayers in the form of incentives or products (e.g. CFLs). During the 2012 calendar year, over $1.3 million, or 4.5 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. 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 into early 2013. Prescriptive lighting incentives distributed increased more than seven-fold as compared with the previous year, while site specific lighting incentives increased 17 percent.

Evaluation, as well as other implementation expenditures, can be directly charged to the appropriate state and/or segment(s).[8] 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 2012 calendar year and often differ from the cost-effectiveness section where all benefits and costs associated with projects completing in 2012 are evaluated in order to provide matching of benefits and expenditures resulting in a more accurate look at cost-effectiveness.

Tables 25 and 26 provide a summary of energy efficiency expenditures by state and fuel type.

[8] After 2012 year end, EM&V expenditures were examined for cost-causation. As a result, EM&V costs previously allocated to Idaho were reassigned to Washington to appropriately reflect the necessary effort to comply with I-937 regulation and compliance. The expenditures shown in the tables in this section reflect this correcting entry completed in May 2013. The Tariff Rider section of this report is based on when expenditures and entries are actually booked and therefore, this correcting entry will be reflected in the 2013 annual DSM Report.

Table 25: Electric Energy Efficiency Expenditures

Segment	State	Incentives	Implementation	EM&V	NEEA	Total
Residential	ID	$550,487	$277,814	$131	$0	$828,432
	WA	$1,075,577	$735,287	$306	$0	$1,811,169
Low Income	ID	$454,688	$56,175	$0	$0	$510,863
	WA	$1,067,538	$24,958	$0	$0	$1,092,495
Nonresidential	ID	$3,993,211	$370,946	$2,321	$0	$4,366,478
	WA	$9,068,960	$903,624	$5,333	$0	$9,977,917
Regional	ID	$0	$1,683	$21,399	$651,195	$674,277
	WA	$0	$4,716	$49,930	$1,519,456	$1,574,102
General	ID	$0	$737,599	$183,430	$0	$921,029
	WA	$0	$1,411,438	$773,553	$0	$2,184,992
	ID	$4,998,386	$1,444,217	$207,281	$651,195	$7,301,079
	WA	$11,212,074	$3,080,023	$829,123	$1,519,456	$16,640,675
	System	$16,210,461	$4,524,239	$1,036,403	$2,170,651	$23,941,754

Table 26: Natural Gas Energy Efficiency Expenditures

Segment	State	Incentives	Implementation	EM&V	Total
Residential	ID	$501,265	$57,535	$0	$558,800
	WA	$1,058,167	$327,665	$0	$1,385,832
Low Income	ID	$244,765	$18,226	$0	$262,991
	WA	$922,458	$23,952	$0	$946,410
Nonresidential	ID	$224,950	$41,960	$58	$266,968
	WA	$908,901	$137,731	$449	$1,047,081
General	ID	$0	$304,995	$59,467	$364,462
	WA	$0	$693,448	$237,649	$931,097
	ID	$970,980	$422,716	$59,525	$1,453,221
	WA	$2,889,526	$1,182,796	$238,098	$4,310,420
	SYS	$3,860,506	$1,605,512	$297,623	$5,763,641

IX. TARIFF RIDER BALANCES

As of the start of 2012, the Washington and Idaho electric and natural gas (aggregate) tariff rider balances were overfunded by $994,000. During 2012, $27.0 million in tariff rider revenue was collected to fund energy efficiency while $29.7 million was expended to operate energy efficiency programs. The $2.8 million under-collection of tariff rider funding resulted in a year-end balance of $1.8 million underfunded balance.

During the first quarter of 2013, the underfunded balance has continued to grow reaching a total underfunded amount of $6.6 million. The bulk of this amount is attributable to Washington and Idaho electric which ended the year with underfunded balances of $4.8 million and $3.0 million respectively mostly due to the nonresidential T12 to T8 market transformation program that ended in December 2012.

Table 27 illustrates the 2012 tariff rider activity by state and fuel type.

Table 27: Tariff Rider Activity

	Electric		Natural Gas	
	Idaho	**Washington**	**Idaho**	**Washington**
Beginning Balance *(Underfunded)*	($26,723)	$804,042	$988,582	($771,695)
Energy Efficiency Funding	$6,804,865	$14,242,446	$1,284,191	$4,620,412
Net Funding for Operations	$6,778,142	$15,046,488	$2,272,773	$3,848,718
Energy Efficiency Expenditures	$7,300,840	$16,640,117	$1,453,449	$4,310,989
Ending Balances *(Underfunded)*	($522,697)	($1,593,629)	$819,324	($462,272)

X. ACTUAL TO BUSINESS PLAN COMPARISON

For 2012 operations, Avista exceeded budgeted energy efficiency expenditures by $6.5 million, or 28 percent. The bulk of this overage was due to Washington and Idaho electric programs with $4.4 million attributable to Washington and $2.6 million attributable to Idaho. The biggest driver of expenditures is incentives. Based on 2012 participation, Idaho and Washington prescriptive lighting incentives exceeded budgeted prescriptive lighting incentives by $5.6 million or 324 percent. This demand for incentives was higher than anticipated and its impact resulted in the underfunding in the Idaho and Washington electric programs. For both Idaho and Washington natural gas incentives, both states saw lower participation and therefore expended less in incentives than budgeted.

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 28 provides detail on the actual to budget comparison of energy efficiency expenditures by state and fuel type.

Table 28: Actual to Business Plan Comparison[9]

	Electric		**Natural Gas**		
	Idaho	**Washington**	**Idaho**	**Washington**	**Total**
Incentives Budget	$2,736,918	$6,644,389	$1,275,667	$3,093,975	$13,750,949
Non-incentives and Labor	$1,955,469	$5,628,182	$534,760	$1,324,206	$9,442,617
Total Budgeted Expenditures	$4,692,387	$12,272,571	$1,810,427	$4,418,181	$23,193,566
Actual 2012 Expenditures					
Incentives	$4,998,386	$11,212,074	$970,980	$2,889,526	$20,070,966
Non-incentive and Labor	$2,302,693	$5,428,601	$482,240	$1,420,895	$9,634,429
Total Actual Expenditures	$7,301,079	$16,640,675	$1,453,221	$4,310,420	$29,705,395
Variance *(Unfavorable)*	($2,608,692)	($4,368,104)	$357,206	$107,761	($6,511,829)

[9] Budget values from 2012 Business Plan.

APPENDICES

Appendix 1

Summary Cost-Effectiveness Tests

Summary of Electric Cost-Effectiveness Tests

Total Resource Cost	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Electric avoided cost	$17,030,144	$324,644	$17,354,787	$38,243,093	$915,200	$39,158,293	$55,273,236	$1,239,844	$56,513,080
Natural Gas avoided cost	($218,556)	($46,908)	($265,464)	($605,150)	($187,139)	($792,288)	($823,705)	($234,046)	($1,057,752)
Non-energy benefits	$273,550	$167,836	$441,387	$546,265	$357,573	$903,838	$819,815	$525,409	$1,345,225
TRC benefits	$17,085,138	$445,572	$17,530,710	$38,184,208	$1,085,635	$39,269,843	$55,269,346	$1,531,207	$56,800,553
Non-incentive utility cost	$1,682,843	$29,286	$1,712,128	$4,204,135	$58,439	$4,262,573	$5,886,977	$87,724	$5,974,702
Customer cost	$8,918,123	$385,955	$9,304,078	$19,737,962	$894,317	$20,632,279	$28,656,085	$1,280,273	$29,936,357
TRC costs	$10,600,966	$415,241	$11,016,207	$23,942,097	$952,756	$24,894,853	$34,543,062	$1,367,997	$35,911,059
TRC ratio	**1.61**	**1.07**	**1.59**	**1.59**	**1.14**	**1.58**	**1.60**	**1.12**	**1.58**
Net TRC benefits	**$6,484,172**	**$30,331**	**$6,514,504**	**$14,242,111**	**$132,879**	**$14,374,990**	**$20,726,284**	**$163,210**	**$20,889,494**

Program Administrator Cost	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Electric avoided cost	$17,030,144	$324,644	$17,354,787	$38,243,093	$915,200	$39,158,293	$55,273,236	$1,239,844	$56,513,080
Natural Gas avoided cost	($218,556)	($46,908)	($265,464)	($605,150)	($187,139)	($792,288)	($823,705)	($234,046)	($1,057,752)
PAC benefits	$16,811,588	$277,736	$17,089,324	$37,637,943	$728,061	$38,366,005	$54,449,531	$1,005,798	$55,455,328
Non-incentive utility cost	$1,682,843	$29,286	$1,712,128	$4,204,135	$58,439	$4,262,573	$5,886,977	$87,724	$5,974,702
Incentive cost	$4,623,898	$385,955	$5,009,853	$9,097,145	$894,317	$9,991,462	$13,721,042	$1,280,273	$15,001,315
PAC costs	$6,306,741	$415,241	$6,721,982	$13,301,279	$952,756	$14,254,035	$19,608,020	$1,367,997	$20,976,017
PAC ratio	**2.67**	**0.67**	**2.54**	**2.83**	**0.76**	**2.69**	**2.78**	**0.74**	**2.64**
Net PAC benefits	**$10,504,847**	**($137,505)**	**$10,367,342**	**$24,336,664**	**($224,694)**	**$24,111,970**	**$34,841,511**	**($362,199)**	**$34,479,312**

Participant	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Electric Bill Reduction	$11,640,790	$263,503	$11,904,293	$30,424,056	$860,047	$31,284,103	$42,064,846	$1,123,550	$43,188,396
Gas Bill Reduction	($1,018,581)	($68,731)	($1,087,312)	($2,297,031)	($267,502)	($2,564,533)	($3,315,612)	($336,233)	($3,651,844)
Non-energy benefits	$273,550	$167,836	$441,387	$546,265	$357,573	$903,838	$819,815	$525,409	$1,345,225
Participant benefits	$10,895,760	$362,608	$11,258,368	$28,673,290	$950,119	$29,623,408	$39,569,050	$1,312,727	$40,881,776
Customer cost	$8,918,123	$385,955	$9,304,078	$19,737,962	$894,317	$20,632,279	$28,656,085	$1,280,273	$29,936,357
Incentive received	($4,623,898)	($385,955)	($5,009,853)	($9,097,145)	($894,317)	($9,991,462)	($13,721,042)	($1,280,273)	($15,001,315)
Participant costs	$4,294,225	$0	$4,294,225	$10,640,817	$0	$10,640,817	$14,935,042	$0	$14,935,042
Participant ratio	**2.54**	**NA**	**2.62**	**2.69**	**NA**	**2.78**	**2.65**	**NA**	**2.74**
Net Participant benefits	**$6,601,535**	**$362,608**	**$6,964,143**	**$18,032,472**	**$950,119**	**$18,982,591**	**$24,634,007**	**$1,312,727**	**$25,946,734**

Rate Impact Measure	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Electric avoided cost savings	$17,030,144	$324,644	$17,354,787	$38,243,093	$915,200	$39,158,293	$55,273,236	$1,239,844	$56,513,080
RIM benefits	$17,030,144	$324,644	$17,354,787	$38,243,093	$915,200	$39,158,293	$55,273,236	$1,239,844	$56,513,080
Electric Revenue loss	$10,622,210	$194,772	$10,816,982	$28,127,025	$592,545	$28,719,570	$38,749,235	$787,317	$39,536,552
Non-incentive utility cost	$1,682,843	$29,286	$1,712,128	$4,204,135	$58,439	$4,262,573	$5,886,977	$87,724	$5,974,702
Customer incentives	$4,623,898	$385,955	$5,009,853	$9,097,145	$894,317	$9,991,462	$13,721,042	$1,280,273	$15,001,315
RIM costs	$16,928,950	$610,013	$17,538,963	$41,428,304	$1,545,301	$42,973,605	$58,357,254	$2,155,314	$60,512,569
RIM ratio	**1.01**	**0.53**	**0.99**	**0.92**	**0.59**	**0.91**	**0.95**	**0.58**	**0.93**
Net RIM benefits	**$101,193**	**($285,369)**	**($184,176)**	**($3,185,211)**	**($630,101)**	**($3,815,312)**	**($3,084,018)**	**($915,470)**	**($3,999,489)**

Summary of Natural Gas Cost-Effectiveness Tests

	Idaho			Washington			System		
Total Resource Cost	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**
Natural gas avoided cost	$1,266,972	$66,663	1,333,635	$3,533,900	$182,138	$3,716,038	$4,800,873	$248,800	$5,049,673
Electric avoided cost	($101,304)	$810	($100,493)	($167,448)	($3,412)	($170,860)	($268,751)	($2,602)	($271,353)
Non-energy Benefits	$2,573	$122,981	$125,554	$28,785	$343,695	$372,480	$31,359	$466,676	$498,035
TRC benefits	$1,168,242	$190,454	$1,358,696	$3,395,238	$522,420	$3,917,658	$4,563,480	$712,874	$5,276,354
Non-incentive utility cost	$429,296	$45,200	$474,496	$1,351,409	$69,485	$1,420,895	$1,780,706	$114,685	$1,895,391
Customer cost	$1,566,270	$314,027	$1,880,297	$6,214,330	$1,095,535	$7,309,865	$7,780,600	$1,409,562	$9,190,162
TRC costs	$1,995,566	$359,227	$2,354,794	$7,565,739	$1,165,020	$8,730,759	$9,561,306	$1,524,247	$11,085,553
TRC ratio	**0.59**	**0.53**	**0.58**	**0.45**	**0.45**	**0.45**	**0.48**	**0.47**	**0.48**
Net TRC benefits	**($827,324)**	**($168,773)**	**($996,098)**	**($4,170,501)**	**($642,600)**	**($4,813,101)**	**($4,997,826)**	**($811,373)**	**($5,809,199)**

	Idaho			Washington			System		
Program Administrator Cost	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**
Natural gas avoided cost	$1,266,972	$66,663	$1,333,635	$3,533,900	$182,138	$3,716,038	$4,800,873	$248,800	$5,049,673
Electric avoided cost	($101,304)	$810	($100,493)	($167,448)	($3,412)	($170,860)	($268,751)	($2,602)	($271,353)
PAC benefits	$1,165,669	$67,473	$1,233,142	$3,366,453	$178,725	$3,545,178	$4,532,121	$246,198	$4,778,319
Non-incentive utility cost	$429,296	$45,200	$474,496	$1,351,409	$69,485	$1,420,895	$1,780,706	$114,685	$1,895,391
Incentive cost	$683,014	$314,027	$997,042	$2,027,162	$1,095,535	$3,122,697	$2,710,177	$1,409,562	$4,119,739
PAC costs	$1,112,311	$359,227	$1,471,538	$3,378,572	$1,165,020	$4,543,592	$4,490,882	$1,524,247	$6,015,130
PAC ratio	**1.05**	**0.19**	**0.84**	**1.00**	**0.15**	**0.78**	**1.01**	**0.16**	**0.79**
Net PAC benefits	**$53,358**	**($291,755)**	**($238,396)**	**($12,119)**	**($986,295)**	**($998,414)**	**$41,239**	**($1,278,049)**	**($1,236,810)**

Participant	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Natural gas bill reduction	$1,720,052	$92,303	$1,812,355	$2,272,724	$239,648	$2,512,373	$3,992,776	$331,951	$4,324,727
Electric bill reduction	($77,647)	$156	($77,490)	($130,099)	($4,475)	($134,574)	($207,745)	($4,319)	($212,064)
Non-energy benefits	$2,573	$122,981	$125,554	$28,785	$343,695	$372,480	$31,359	$466,676	$498,035
Participant benefits	$1,644,979	$215,440	$1,860,419	$2,171,411	$578,868	$2,750,279	$3,816,390	$794,308	$4,610,698
Customer cost	$1,566,270	$314,027	$1,880,297	$6,214,330	$1,095,535	$7,309,865	$7,780,600	$1,409,562	$9,190,162
Incentive received	($683,014)	($314,027)	($997,042)	($2,027,162)	($1,095,535)	($3,122,697)	($2,710,177)	($1,409,562)	($4,119,739)
Participant costs	$883,256	$0	$883,256	$4,187,168	$0	$4,187,168	$5,070,424	$0	$5,070,424
Participant ratio	**1.86**	**NA**	**2.11**	**0.52**	**NA**	**0.66**	**0.75**	**NA**	**0.91**
Net Participant benefits	**$761,723**	**$215,440**	**$977,163**	**($2,015,757)**	**$578,868**	**($1,436,889)**	**($1,254,034)**	**$794,308**	**($459,725)**

Rate Impact Measure	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Natural gas avoided cost savings	$1,266,972	$66,663	$1,333,635	$3,533,900	$182,138	$3,716,038	$4,800,873	$248,800	$5,049,673
RIM benefits	$1,266,972	$66,663	$1,333,635	$3,533,900	$182,138	$3,716,038	$4,800,873	$248,800	$5,049,673
Natural gas revenue loss	$1,642,405	$92,459	$1,734,865	$2,142,626	$235,173	$2,377,799	$3,785,031	$327,632	$4,112,663
Non-incentive utility cost	$429,296	$45,200	$474,496	$1,351,409	$69,485	$1,420,895	$1,780,706	$114,685	$1,895,391
Customer incentives	$683,014	$314,027	$997,042	$2,027,162	$1,095,535	$3,122,697	$2,710,177	$1,409,562	$4,119,739
RIM costs	$2,754,716	$451,686	$3,206,402	$5,521,197	$1,400,193	$6,921,390	$8,275,913	$1,851,880	$10,127,793
RIM ratio	**0.46**	**0.15**	**0.42**	**0.64**	**0.13**	**0.54**	**0.58**	**0.13**	**0.50**
Net RIM benefits	**($1,487,744)**	**($385,024)**	**($1,872,767)**	**($1,987,297)**	**($1,218,056)**	**($3,205,353)**	**($3,475,040)**	**($1,603,079)**	**($5,078,120)**

Summary of Combined Electric and Natural Gas Cost-Effectiveness Tests

	Idaho			Washington			System		
Total Resource Cost	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**
Electric avoided cost	$18,297,116	$391,306	$17,254,294	$41,776,993	$1,097,338	$42,874,331	$60,074,109	$1,488,644	$56,241,727
Natural Gas avoided cost	($319,859)	($46,097)	($139,909)	($772,597)	($190,551)	($963,148)	($1,092,457)	($236,648)	$3,991,921
Non-energy Benefits	$276,124	$290,817	$1,800,083	$575,050	$701,268	$1,276,318	$851,174	$992,086	$1,843,259
TRC benefits	$18,253,380	$636,026	$18,914,468	$41,579,446	$1,608,055	$43,187,501	$59,832,826	$2,244,081	$62,076,907
Non-incentive utility cost	$2,112,139	$74,486	$2,186,625	$5,555,544	$127,924	$5,683,468	$7,667,683	$202,410	$7,870,093
Customer cost	$10,484,393	$699,983	$11,184,376	$25,952,292	$1,989,852	$27,942,144	$36,436,685	$2,689,835	$39,126,520
TRC costs	$12,596,532	$774,468	$13,371,000	$31,507,836	$2,117,776	$33,625,612	$44,104,368	$2,892,244	$46,996,612
TRC ratio	**1.45**	**0.82**	**1.41**	**1.32**	**0.76**	**1.28**	**1.36**	**0.78**	**1.32**
Net TRC benefits	**$5,656,848**	**($138,442)**	**$5,543,467**	**$10,071,610**	**($509,721)**	**$9,561,889**	**$15,728,458**	**($648,163)**	**$15,080,295**

	Idaho			Washington			System		
Program Administrator Cost	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**	**Regular Income portfolio**	**Low Income portfolio**	**Overall portfolio**
Electric avoided cost	$16,928,840	$325,454	$17,254,294	$38,075,645	$911,788	$38,987,433	$55,004,485	$1,237,242	$56,241,727
Natural Gas avoided cost	$1,048,416	$19,755	$1,068,172	$2,928,751	($5,001)	$2,923,750	$3,977,167	$14,754	$3,991,921
PAC benefits	$17,977,256	$345,209	$18,322,465	$41,004,396	$906,787	$41,911,182	$58,981,652	$1,251,996	$60,233,648
Non-incentive utility cost	$2,112,139	$74,486	$2,186,625	$5,555,544	$127,924	$5,683,468	$7,667,683	$202,410	$7,870,093
Incentive cost	$5,306,912	$699,983	$6,006,895	$11,124,307	$1,989,852	$13,114,159	$16,431,219	$2,689,835	$19,121,054
PAC costs	$7,419,051	$774,468	$8,193,520	$16,679,851	$2,117,776	$18,797,627	$24,098,902	$2,892,244	$26,991,146
PAC ratio	**2.42**	**0.45**	**2.24**	**2.46**	**0.43**	**2.23**	**2.45**	**0.43**	**2.23**
Net PAC benefits	**$10,558,205**	**($429,259)**	**$10,128,946**	**$24,324,545**	**($1,210,989)**	**$23,113,556**	**$34,882,750**	**($1,640,249)**	**$33,242,501**

Participant	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Electric Bill Reduction	$11,563,144	$263,659	$11,826,803	$30,293,957	$855,572	$31,149,529	$41,857,101	$1,119,231	$42,976,332
Gas Bill Reduction	$701,471	$23,572	$725,043	($24,307)	($27,853)	($52,160)	$677,164	($4,282)	$672,883
Non-energy benefits	$276,124	$290,817	$566,941	$575,050	$701,268	$1,276,318	$851,174	$992,086	$1,843,259
Participant benefits	$12,540,739	$578,048	$13,118,787	$30,844,701	$1,528,987	$32,373,687	$43,385,439	$2,107,035	$45,492,474
Customer cost	$10,484,393	$699,983	$11,184,376	$25,952,292	$1,989,852	$27,942,144	$36,436,685	$2,689,835	$39,126,520
Incentive received	($5,306,912)	($699,983)	($6,006,895)	($11,124,307)	($1,989,852)	($13,114,159)	($16,431,219)	($2,689,835)	($19,121,054)
Participant costs	$5,177,481	$0	$5,177,481	$14,827,985	$0	$14,827,985	$20,005,466	$0	$20,005,466
Participant ratio	**2.42**	**NA**	**2.53**	**2.08**	**NA**	**2.18**	**2.17**	**NA**	**2.27**
Net Participant benefits	**$7,363,258**	**$578,048**	**$7,941,306**	**$16,016,715**	**$1,528,987**	**$17,545,702**	**$23,379,973**	**$2,107,035**	**$25,487,009**

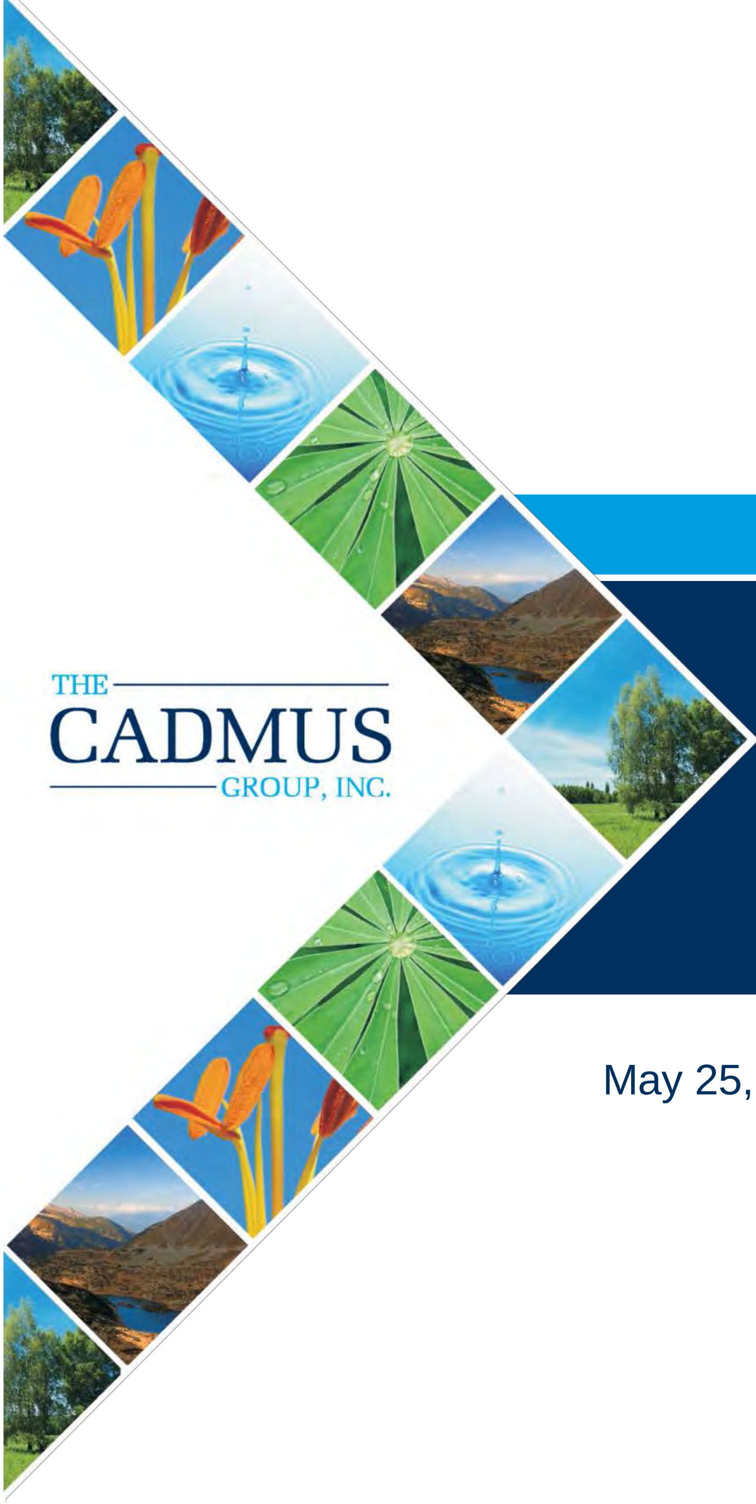
Rate Impact Measure	Idaho Regular Income portfolio	Idaho Low Income portfolio	Idaho Overall portfolio	Washington Regular Income portfolio	Washington Low Income portfolio	Washington Overall portfolio	System Regular Income portfolio	System Low Income portfolio	System Overall portfolio
Avoided Cost Savings	$18,297,116	$391,306	$18,688,422	$41,776,993	$1,097,338	$42,874,331	$60,074,109	$1,488,644	$61,562,753
RIM benefits	$18,297,116	$391,306	$18,688,422	$41,776,993	$1,097,338	$42,874,331	$60,074,109	$1,488,644	$61,562,753
Revenue Loss	$12,264,615	$287,231	$12,551,846	$30,269,650	$827,718	$31,097,369	$42,534,266	$1,114,950	$43,649,215
Non-incentive utility cost	$2,112,139	$74,486	$2,186,625	$5,555,544	$127,924	$5,683,468	$7,667,683	$202,410	$7,870,093
Customer incentives	$5,306,912	$699,983	$6,006,895	$11,124,307	$1,989,852	$13,114,159	$16,431,219	$2,689,835	$19,121,054
RIM costs	$19,683,666	$1,061,699	$20,745,366	$46,949,501	$2,945,494	$49,894,996	$66,633,168	$4,007,194	$70,640,362
RIM ratio	**0.93**	**0.37**	**0.90**	**0.89**	**0.37**	**0.86**	**0.90**	**0.37**	**0.87**
Net RIM benefits	**($1,386,550)**	**($670,393)**	**($2,056,943)**	**($5,172,508)**	**($1,848,157)**	**($7,020,665)**	**($6,559,059)**	**($2,518,550)**	**($9,077,609)**

Appendix 2

Avista 2011 Multi-Sector Gas Impact Evaluation Report

May 25, 2012

The Cadmus Group, Inc.



THE CADMUS GROUP, INC.

Avista 2011 Multi-Sector Gas Impact Evaluation Report

May 25, 2012

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Table of Contents

Portfolio Executive Summary

The Cadmus Group, Inc., was contracted by Avista Corporation to complete process and impact evaluations of the 2010 and 2011 gas and electric demand-side management (DSM) programs. This report only presents our impact findings for the PY 2011 gas portfolio.

Evaluation Activities

For each of the three sectors—residential, nonresidential, and low-income—we employed a variety of evaluation methods and activities. These are shown in Table ES-1.

Table ES-1. 2011 Gas Programs Evaluation Activities

Sector	Program	Document/ Database Review	Metering	Verification Site Visit	Survey	Billing Analysis	Modeling
Residential	ENERGY STAR Products	✓		✓	✓		
	Heating and Cooling Efficiency	✓		✓	✓		
	Weatherization/Shell	✓		✓	✓	✓	
	Water Heater Efficiency	✓		✓	✓		
	ENERGY STAR Homes	✓		✓			✓
Non-Residential	Prescriptive Programs	✓	✓	✓	✓		
	Site-Specific	✓	✓	✓	✓	✓	✓
Low-Income	Low-Income Programs	✓				✓	

Key Findings and Conclusions

Residential

For PY2011, Avista's residential gas programs produced 515,188 therms in savings, which yielded an overall realization rate of 66%. Residential gas savings achieved 37% of IRP goals.

The major residential program conclusions are:

- Overall, residential gas customers responded well to the programs, and often installed several measures within the same year.
- Avista's program and tracking databases were sufficient for evaluation purposes, providing adequate contact information, and measure and savings information, and the database review confirmed the information was reliable and accurate.
- All measures rebated through the program were installed and operating. With only a few exceptions, all measures were determined to meet program qualification standards.

Nonresidential

Cadmus evaluated 55 of 431 measures installed through the nonresidential energy-efficiency programs, representing 57% of reported savings. For PY2011, Avista's nonresidential gas programs produced 832,374 therms in savings, which yielded an overall realization rate of 87%. Nonresidential gas savings achieved 96% of IRP goals.

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

- Some participants did not operate the incented equipment correctly, or did not complete the improvements expected for the measure.
- Some participant heating or cooling loads did not achieve the level projected for post-installation usage.
- Some energy simulation models did not accurately represent the actual as-built building or system operation.

Cadmus also found the following implementation issues affected the impact evaluation:

- Several building simulation models were unavailable, due to reported server or laptop crashes.
- Individual new construction measure savings depended heavily on interactive effects. Avista calculated individual measure savings through a rolling baseline, in which each measure was simulated in a set order. Changing the simulation order substantially altered measure savings.
- Cadmus could have streamlined the sampling process if Avista's database had recorded site addresses and contact information. Having measure-level data, such as specific measure type and quantity, for each project would have improved the range and depth of our evaluation activities.
- Interactive effects between HVAC and lighting represent a significant impact on gas usage. We are unable to reliably estimate interactive savings impacts from the data available in Avista's current database.

Low-Income

For PY2011, Avista's low-income gas programs produced 35,877 therms in savings, which yielded an overall realization rate of 33%. Low-income gas savings achieved 55% of IRP goals.

State-level savings estimates from the 2010 gas billing analysis were applied to 242, gas-saving 2011 program participants. The average, non-conversion model savings per home was 112 therms. An additional 110 participants went through an electric to gas fuel-conversion (Washington only). Savings were assigned to three categories of participants:

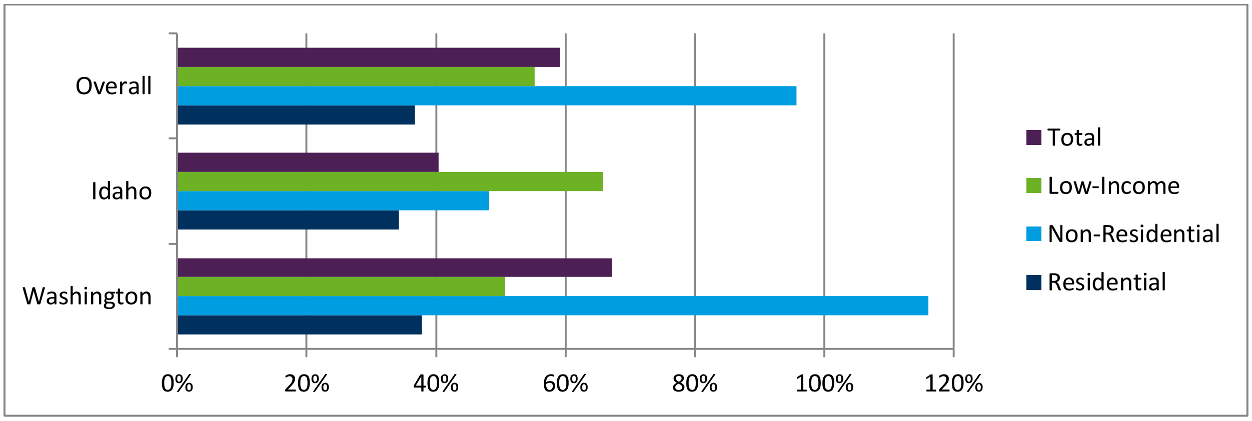
1. Full model savings to those receiving larger bundles of weatherization measures;
2. Savings specific to installation of a high-efficiency gas furnaces, in place of standard efficiency furnaces; and
3. No savings applied (a few cases).

In total, we estimated an additional 8,683 therms in savings for conversion participants.

Savings Results

Figure ES-1 displays the portfolio achieved gross savings, relative to reported goals by sector, state, and overall. The nonresidential sector exceeded goals in Washington. The portfolio overall achieved 59% of the stated goals.

Figure ES-1. Gross Achieved Savings Percentages of IRP Goals



The following two tables show sector-level gross savings values and realization rates compared to reported savings and IRP goals.

Table ES-2. 2011 Reported and Gross Verified Savings by State and Sector

Sector	Washington			Idaho			Total		
	Expected Savings	Gross Verified Savings	Real-ization Rate	Expected Savings	Gross Verified Savings	Real-ization Rate	Expected Savings	Gross Verified Savings	Real-ization Rate
Residential	560,430	372,330	66%	220,081	142,858	65%	780,511	515,188	66%
Nonresidential	812,857	706,657	87%	149,393	125,717	84%	962,251	832,374	87%
Low-Income	77,381	23,042	30%	31,675	12,835	41%	109,056	35,877	33%
Total	1,450,668	1,102,029	76%	401,149	281,410	70%	1,851,818	1,383,439	75%

Table ES-3. 2011 IRP Goals and Gross Verified Savings by State and Sector

Sector	Washington			Idaho			Total		
	Savings Goal	Gross Achieved	% Achieved	Savings Goal	Gross Achieved	% Achieved	Savings Goal	Gross Achieved	% Achieved
Residential	985,175	372,330	38%	416,750	142,858	34%	1,401,925	515,188	37%
Nonresidential	608,731	706,657	116%	260,885	125,717	48%	869,616	832,374	96%
Low-Income	45,500	23,042	51%	19,500	12,835	66%	65,000	35,877	55%
Total	1,639,406	1,102,029	67%	697,135	281,410	40%	2,336,541	1,383,439	59%

In summary, the 2011 gas portfolio achieved a realization rate of 75% of reported savings, and 59% of the IRP goals. Our evaluation verified nearly 100% of the claimed measures. The achieved realization rates are driven entirely by the lower than expected per unit energy savings. The nonresidential sector had the highest realization rate of 87% from reported savings, and also had the highest goal achievement rate of 96% of Avista-stated IRP goals. Washington had higher goal achievement, overall.

Recommendations and Further Analysis

Residential

Cadmus offers the following recommendations, based on evaluation results:

- List energy factors, or at least model numbers for appliances. The inclusion of more information regarding the actual efficiency of equipment installed allows for greater accuracy in estimates of gross energy savings achieved.
- If possible, include existing equipment information.
- Avista should consider moving all ENERGY STAR Clothes Washer rebates to the electric program.

The following research recommendations are based on the results of this impact evaluation and known future changes to program requirements:

- Perform a review of all available secondary research and/or collect primary data on the penetration of gas heated clothes dryers.
- Perform a targeted billing analysis on weatherization participants that use both electricity and gas to heat their homes.
- Perform a billing analysis on ENERGY STAR homes using a nonparticipant comparison group once enough homes have participated under the new requirements to justify performing the work.

Nonresidential

We recommend the following for improving program energy-savings impacts and effectiveness of the evaluation:

- Avista should create a quality control system to double-check all projects with savings over 10,000 therms. An Avista EM&V engineer reported he has begun to review these types of projects.
- Avista should consider performing three- to six-month post-installation random inspections to confirm measure persistence, and to identify opportunities to improve performance.
- Avista should consider adding a program for recommissioning measures identified as non-functional during the previous year’s evaluation process, and report the energy savings these measures achieve in the subsequent year.
- Avista should consider applying more conservative assumptions on Site-Specific heating loads.
- Avista should save all internally and externally developed simulation models to Avista’s servers.

- Avista should consider developing a New Construction measure that would combine the interactive effects associated with all individual measures at new construction projects.
- Avista should consider revising its methodology for calculating and tracking HVAC/lighting interactive effects.

Low-Income

The impact evaluation revealed several areas where program performance and savings accuracy could be improved. Consequently, we recommend Avista consider the following:

- Standardize expected savings calculations between states.
- Account for additional factors in savings calculations, such as historical consumption, interaction effects, square footage, and primary heating sources.
- Track alternative heating sources in homes.
- Include high-use customers in program participant targeting.
- Conduct further impact analysis, focused on use of a comparison group and estimating savings at the measure-level.
- Perform quality checks on expected savings estimates.
- Consider analyzing easy-to-quantify, non-energy benefits, which can be added to program cost-effectiveness reporting.

Recommendations for possible future analysis include:

- Conduct further gas impact analysis with greater populations to determine measure-level savings.
- Consider conducting a non-energy benefits analysis in the future.

1 ~~2010~~ Residential Gas Impact Report

Executive Summary

During the 2011 program year, Avista's residential gas DSM programs claimed savings of 780,517 therms. This report explains the methods used to qualify and verify these savings. Avista's 2011 DSM residential gas programs included:

- ENERGY STAR Products
- ENERGY STAR Homes
- Heating and Cooling Efficiency
- Water Heating
- Weatherization Measures

Evaluation Methodology

We employed a variety of evaluation methods and activities for each program, as shown in Table 1-1.

Table 1-1. 2011 Gas Programs Evaluation Activities

Sector	Program	Document/ Database Review	Verification Site Visit	Survey	Billing Analysis	Modeling
	ENERGY STAR Products	✓	✓	✓		
	Heating and Cooling Efficiency	✓	✓	✓		
Residential	Weatherization/Shell	✓	✓	✓	✓	
	Water Heater Efficiency	✓	✓	✓		
	ENERGY STAR Homes	✓	✓	✓		✓

Energy Savings

Cadmus adjusted claimed savings associated with each measure to reflect our deemed savings updates. Most changes resulted from the updated baseline and measure efficiency levels, due to adjustments in federal and ENERGY STAR standards.

Aggregated adjusted gross savings and resulting realization rates are shown in by program (Table 1-2) and by state (Table 1-3). Table 1-4 shows adjusted measure counts. We verified savings of 515,188 therms through the installation of 11,225 measures during the PY 2011. Overall, residential gas programs achieved an adjusted gross realization rate of 64%.

Table 1-2. Reported and Adjusted Gross Savings

Program Name	Reported Savings (Therms)	Adjusted Gross (Therms)	Realization Rate
ENERGY STAR Products	30,992	22,185	72%
Heating and Cooling Efficiency	365,679	305,789	84%
Weatherization/Shell	375,882	157,874	42%
Water Heater Efficiency	5,009	4,334	87%
ENERGY STAR Homes	24,096	25,006	104%
Total	801,658	515,188	64%

Table 1-3. Reported and Adjusted Gross Savings by State

Program Name	Washington			Idaho		
	Reported Savings (Therms)	Adjusted Gross (Therms)	Realization Rate	Reported Savings (Therms)	Adjusted Gross (Therms)	Realization Rate
ENERGY STAR Products	22,068	15,732	71%	8,924	6,453	72%
Heating and Cooling Efficiency	250,797	209,697	84%	114,882	96,092	84%
Weatherization/Shell	283,033	121,357	43%	92,849	36,517	39%
Water Heater Efficiency	4,144	3,587	87%	865	746	86%
ENERGY STAR Homes	21,143	21,956	104%	2,952	3,050	103%
Total	581,185	372,330	64%	220,472	142,858	65%

Table 1-4. Avista 2011 DSM Programs Adjusted Measure Counts

Program	Washington Measure Count	Idaho Measure Count	Total Measure Count
ENERGY STAR Products	2,999	1,200	4,199
Heating and Cooling Efficiency	2,039	934	2,973
Weatherization/Shell	2,672	787	3,459
Water Heater Efficiency	388	83	471
ENERGY STAR Homes	108	15	123
Total	8,206	3,019	11,225

1.1 Introduction

PY 2011 DSM residential gas programs included:

- ENERGY STAR Products
- ENERGY STAR Homes
- Heating and Cooling Efficiency
- Water Heating
- Weatherization

We designed our impact evaluation to verify reported program participation and energy savings, utilizing: data collected and reported in the tracking database; online application forms; on-site visits; phone surveys; and applicable deemed values we developed for Avista's TRM.[1]

1.2 Methodology

1.2.1 Sampling

Cadmus created separate random samples for surveys and site visits. The following subsections describe methods used to select sufficient samples.

Site Visit Sampling

Cadmus randomly selected participants for verification site visits from the 2010 and 2011 electric program population, and from the 2011 gas program population, scheduling site visits via telephone. If a sampled participant could not be reached or refused to participate in a site visit, a replacement was drawn from a backup sample within the same geographic region.

Initially, participants were sampled using a single measure record. However, if a customer received multiple rebates during the program year, all measures were verified during site visits, whether for electric or gas.

Table 1-5 shows Cadmus completed site visits and unique measures.

Table 1-5. Electric Measure Level Site Visit Completes

Total Homes Visited	174
Total Measures Verified	258

Survey Sampling

For program-level survey results, Cadmus designed participant survey sample sizes to yield significance at the 90% confidence and ±10% precision levels. The participant survey sampling plan drew upon on multiple factors, including: the feasibility of reaching customers, program participant population, and research topics of interest. Customer fuel types were not a factor in survey sampling.

For ENERGY STAR New Homes, Cadmus did not survey buyers as rebates were paid to builders. Customers included in the site visit sample or back-up sample were excluded from the survey population to limit the evaluation's burden on each participant.

Table 1-6 shows numbers of surveys achieved, and the resulting absolute precision for each program.

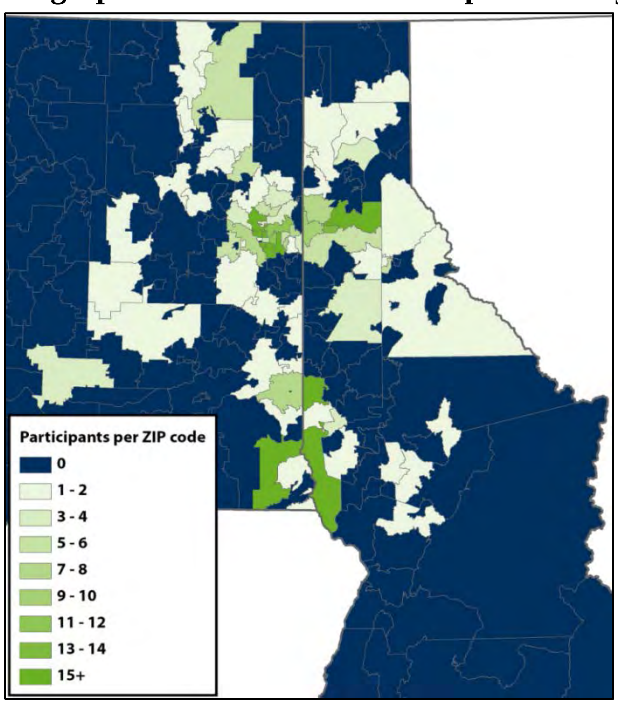
[1] In 2011's first quarter, Cadmus created a TRM for use in deemed measure savings, and updated where necessary for the evaluation's second half (2011 program year).

Table 1-6. Participant Survey Sample Sizes and Savings-Weighted Precision Estimates by Program (Gas and Electric Participants)

Program	Total Program Participants	Survey Completes	Absolute Precision at 90% Confidence
ENERGY STAR Appliance Rebate	10,983	79	±9.3%
High Efficiency Equipment	4,156	126	±7.2%
Weatherization and Shell Measures	3,981	72	±9.6%
Home Energy Audit Pilot	664	56	±10.3%
Second Refrigerator and Freezer Recycling	1,903	74	±9.3%
Space and Water Conversions	314	57	±9.1%
Overall	22,001	464	±5.2%

Program participants included in survey sample frames were called at random. Geographic distributions of survey respondents clustered around urban centers, specifically the cities of Spokane, Pullman, Moscow, and Lewiston, as shown in Figure 1-1, below.

Figure 1-1. Geographic Distribution of Participant Survey Completes



1.2.2 Data Collection and Analysis

Site Visits

On-site measure verification included:

- Visual inspections of measures;
- Verifying documentation;
- Ensuring units were still operable;

- Recording make and model information;
- Recording home characteristics; and
- Determining program qualification.

Surveys

Cadmus contracted with market-research firm Discovery Research Group (DRG) to conduct surveys with sampled participants. To minimize response bias, DRG called customers during various hours of the days and evenings (including on 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 measure level. Survey results at the portfolio level were 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 was necessary as Avista uses its database to track achieved savings and rebates paid. The review revealed multiple measures that were incorrectly classified, and measures with duplicate records, as rebates were paid in two parts. Cadmus reported all such cases to Avista. In most cases, measure count adjustments were made to correct for the inconsistencies found.

Unit Energy Savings

Cadmus reviewed every prescriptive measure in Avista's residential gas programs, except Weatherization (savings estimated using a billing analysis). Unit energy savings were updated to reflect gross energy savings achieved by a measure's installation during the program years.

Billing Analysis

Cadmus conducted a statistical billing analysis to determine adjusted gross savings and realization rates for installed gas weatherization and window measures in PY2011. To estimate energy savings resulting from the program, Cadmus used a pre and post-installation combined Conditional Savings Analysis (CSA) and Princeton Score Keeping Method (PRISM).

1.2.3 Verification Rates

Cadmus determined verification rates for each program, but not for each measure. 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 a 100% verification rate.

1.2.4 Measure Qualification Rates

Cadmus considered a measure as qualified if it met the various requirements particular to its category, such as ENERGY STAR certification or meeting program minimum efficiency standards. When applicable, we conducted online database searches of model numbers, and noted necessary characteristics to ensure achievement of all qualifications.

Two non-qualified measures were identified (out of the entire site visit verification sample):

- A floor insulation project had a base case condition, which should have prevented the project from qualifying.
- A high-efficiency heat pump installation used equipment not meeting required efficiency thresholds.

Neither project impacted the overall residential qualification rate. Average savings for the insulation measure was determined using a billing analysis. Average savings for heat pumps was determined using a metering study.

1.3 Program Results and Findings

1.3.1 Overview

Cadmus analyzed implementer data records to determine appropriate unit energy savings and measure counts for each supported measure within each program. The end result is: total adjusted gross savings for each measure and program as well as overall realized savings for each program. In the following sections, we describe each program, explain our analysis steps, and discuss the results and findings.

Excluding Weatherization, methods used for calculating adjusted gross measure savings for measures included the following steps:

1. Review of the database to determine whether adjusted measure counts correctly represented the number installed.
2. Conducting a phone survey or site visit to verify installation of measures.
3. Calculating verification and qualification rates.
4. Calculate deemed measure savings for rebated products.
5. Apply rates calculated above and deemed savings to measure counts to determine adjusted gross savings for each measure.

1.3.2 ENERGY STAR Products

Program Description

The ENERGY STAR Products program included the following gas measures:

- Clothes washer (electric and gas); and
- Dishwasher (with electric or gas water heater).

The program 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. The program includes electric and gas measures, though 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;
- Numbers of installed pieces of equipment and their corresponding model numbers (if available) had to match database; and
- Units must have been ENERGY STAR-qualified at the time of the program offering.

Clothes Washers

Cadmus calculated savings based on a 2009 metering study,[3] which metered more than 100 clothes washers in California homes for three weeks. The largest *in situ* metering study on residential clothes washers and dryers conducted in the last decade, the study indicated higher consumption and savings values than those often estimated.

Dryers experienced the majority of energy consumption and savings, as high-efficiency washing machines removed more moisture from clothes, allowing shorter drying times. As most energy savings resulted from decreased dryer use, it was necessary to estimate the percentage of homes, having gas domestic hot water heaters, which used electric dryers. An 82% assumption, set by the RTF, was used for this analysis. As a result, 82% of the installations of an ENERGY STAR clothes washer in a home with a gas domestic hot water heater achieved significant amount of electricity savings.

The following additional input assumptions were used to determine adjusted gross savings:

- Recent evaluation surveys conducted in the region estimated 377 washing cycles per year. [4,5]
- Cadmus adjusted the average base case and efficient case Modified Energy Factor (MEF), both of which were based on the same data used by the RTF. The baseline MEF equaled the average market efficiency of units not qualifying for the program. The efficient MEF equaled the average market efficiency of units qualifying for the program.

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2 See Appendix 1C for the electricity savings achieved through the gas program.

3 The Cadmus Group, Inc. 2010. "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems." http://www.cadmusgroup.com/pdfs/Do_the_Savings_Come_Out_in_the_Wash.pdf

4 Pacific Power Washington 2009-2010 Residential Home Energy Savings Evaluation, January 2012.

5 Rocky Mountain Power 2009-2010 Idaho Residential Home Energy Savings Evaluation, February 2012.

Dishwashers

Cadmus calculated dishwasher savings employing methods currently used in the ENERGY STAR Calculator,[6] the only calculator available providing consistent energy savings estimates in the presence of a gas or electric domestic hot water heater. The following input assumptions applied:

- Cadmus calculated the average base case and efficient case Energy Factor (EF), both of which were based on data utilized by the RTF. The baseline EF equaled the average market efficiency of units not qualifying for the program. The efficient EF equaled the average market efficiency of units qualifying for the program at the time of their rebate.
- Recent evaluation surveys conducted in the region estimated 245 washing cycles per year.[4,5]
- Fifty-six percent of electricity required to run a dishwasher connected to an electric domestic hot water heater was used for water heating.[7]

Results and Findings

Table 1-7 shows total reported and adjusted gross savings for gas ENERGY STAR Products program, by measure.

Table 1-7. ENERGY STAR Products Measured, Program Reported, and Adjusted Savings

Measure Name	Measure Count		Savings per Unit		Program Savings		Realization Rate
	Avista	Evaluation	Avista	Evaluation	Avista	Evaluation	
G CLOTHES WASHER-NAT GAS H2O	2,498	2,499	9	8.00	22,482	19,992	89%
G DISHWASHER-NAT GAS H2O	1,702	1,700	5	1.29	8,510	2,193	26%
PROGRAM TOTAL	4,200	4,199	N/A	N/A	30,992	22,185	72%

Recent increases to the average efficiency of non-ENERGY STAR baseline units have reduced energy savings achieved by these measures. Appendix 1C addresses electricity savings achieved by the installation of ENERGY STAR products in homes with a gas domestic hot water heater.

1.3.3 Heating and Cooling Efficiency

Program Description

The Heating and Cooling Efficiency program includes the following gas measures:

- Gas Boiler
- Gas Furnace

[6] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDishwasher.xls?7182-1c92

[7] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDishwasher.xls?7182-1c92

This program offers five categories of incentives for residential electric and gas customers seeking to purchase high-efficiency heating and cooling equipment. This report only discusses installations resulting from the $400 incentive, available 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

The PY2010 gas impact evaluation report documented a census billing analysis Cadmus performed to determine the change in energy consumption due to installation of a high-efficiency gas furnace. As the billing analysis continued to provide the best information on this measure, results were maintained for the 2011 program year.[8]

Energy savings achieved through installation of high-efficiency gas boilers were calculated by adjusting the results of the billing analysis to the typical participant home installing a high-efficiency boiler.

Results and Findings

Table 1-8 shows the energy savings achieved by this program in 2011.

Table 1-8. Heating and Cooling Efficiency Measures and Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit		Program Savings		Realization Rate
	Avista	Evaluation	Avista	Evaluation	Avista	Evaluation	
G NAT GAS BOILER	43	43	123	93	5,289	3,999	76%
G NAT GAS FURNACE	2,930	2,930	123	103	360,390	301,790	84%
PROGRAM TOTAL	2,973	2,973	N/A	N/A	365,679	305,789	84%

The program achieved an 84% realized adjusted gross savings rate.

1.3.4 Weatherization/Shell

Program Description

This program incented five categories of measures, available to residential electric and gas customers with homes heated with fuel provided by Avista:

- Fireplace Dampers
- Insulation—Ceiling/Attic
- Insulation—Floor
- Insulation—Wall
- Window Replacement

Avista customers primarily heating with electric or natural gas, and having a wood-burning fireplace, may receive up to $100 for installing a rooftop fireplace damper.

[8] Avista 2010 Multi-Sector Gas Impact Evaluation Report, August 2011.

Qualifying ceiling and attic insulation (both fitted/batt and blown-in), which increased the R-value by 10 or more, were incented at $0.25 per square foot of new insulation, up to 50% of installation costs. Homes qualified if they had attic insulation less than R-19.

Floor and wall insulation (both fitted/batt and blown-in), which increased the R-value by 10 or more, were incented at $0.50 per square foot of new insulation, up to 50% of the installation cost. Homes were eligible if they had existing floor and/or wall insulation less than R-5.

For upgrading windows with a U-factor of 0.30 or less, the program offered a $3.00 per square foot incentive for qualifying windows installed, up to 50% of the installation cost. This measure ended April 1, 2011, and customers had until June 30, 2011, to install windows and submit rebate forms to Avista.

Analysis

Cadmus conducted a statistical billing analysis to determine adjusted gross savings and realization rates for installed gas weatherization and window measures in PY 2010 and PY 2011. To increase accuracy of the analysis, we only included participants with at least 11 months of pre and post billing data. Consequently, the billing analysis includes PY 2010 participants and January PY 2011 participants.

To estimate weatherization and windows energy savings resulting from the program, Cadmus used a pre- and post-installation combined CSA and PRISM approach. We calculated gas model savings estimates for each measure.

Billing Analysis Methodology

Avista provided Cadmus with monthly billing data for all participants, from January 2008 through January 2012. 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/windows measure information with gas billing data. We obtained daily average temperature weather data from 2008 through January 2012 for 14 National Oceanic and Atmospheric Administration (NOAA) weather stations, representing all ZIP codes in Avista's Washington and Idaho service territories. From daily temperatures, we determined base 65 heating degree days (HDDs) 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 from the associated stations.

To prevent bias resulting from differing reading cycles in assigning the pre and post periods, and to simplify the analysis, we allocated therm billing usage and associated matched HDDs to calendar months. As the latest available billing data were from January 2012, and weatherization and windows measures were installed primarily in 2010, we defined the analysis pre period as 2009, before any participation installations occurred. We defined the post period as 2011, where post period data were available for all 2010 participants.

In a few cases, fewer than the standard 12 months of pre- and post-installation billing data months were available. For these cases we paired pre and post months used in the billing analysis. For example, if a customer installed measures in January 2011, we defined the post period as February 2011 through December 2011, and the pre period as the corresponding months from February 2009 through December 2009. This ensured using the same months in pre and post periods, preventing bias from using mismatched months.

Data Screening

General Screens

The following screens removed accounts that could skew weatherization and windows savings estimations:

- **Customers indicating unit numbers in the address.** These could potentially indicate weatherization or windows installations occurring in apartments.
- **Accounts with fewer than 11 paired months (330 days) of billing data in the pre or post period**. T

PRISM Modeling Screens

Running PRISM models for pre and post billing data provided a second step in the screening process. These models provided weather-normalized pre and post annual usage for each account, and provided an alternate check savings obtained from the CSA model.

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 calendar month 't':

ADC_{it}	=	the average daily therm consumption in the 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

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	=	the normalized annual therm consumption
α_i	=	the intercept is the average daily or base load for each participant; it represents the average daily base load from the model
$\alpha_i * 365$	=	the annual base load therm usage (non-weather sensitive)
β_1	=	the heating slope; in effect, this is usage per heating degree from the model above
$LRHDD_i$	=	annual, long-term HDDs of a typical month 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
ε_i	=	the error term

After running the models, we applied the following, first set of screens to the PRISM model output, removing outlier participants from the billing analysis:

- **Accounts where the post weather-normalized (POSTNAC) usage was 80% higher or lower than the pre weather-normalized (PRENAC) usage**. Such large changes could indicate property vacancies, when adding or removing "other" gas equipment (such as pools or spas), unrelated to weatherization/windows installations.
- **Accounts where the pre period base load was 0, and the post period base load was greater than 0.** As the base load indicates usage occurring in non-winter and shoulder months, this outcome suggested a gas water heater, gas dryer, or gas range was added to the participant's home. In this situation, the additional base load usage in the post period was not related to weatherization/windows installations.
- **Accounts with negative intercepts and, hence, negative base load,** were included in the analysis, but were truncated 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.

Once we placed these screens on the data, 809 weatherization-only participants and 1,721 windows-only participants remained for use in the CSA model, outlined below, to determine overall savings.

Table 1-9 summarizes weatherization account attrition from the screens listed above. Most attrition occurred in limiting analysis to participants only installing weatherization measures (not additional gas measures).

Table 1-9. Weatherization Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original	1,703	100%	0	0%
Accounts that Installed Other Measures	1,067	63%	636	37%
Insufficient Pre/Post Months or Moved During Pre or Post	908	53%	159	9%
PRISM Screens: Low Heating Usage	870	51%	38	2%
Changed Usage Between Pre and Post Period (> 70%)	860	50%	10	1%
Added Base Load	817	48%	43	3%
Multifamily (Unit Number Present)	809	48%	8	0%
Final Analysis Group	809	48%	894	52%

Table 1-10 summarizes account attrition for windows resulting from the various screens listed above. Most attrition occurred in limiting analysis to participants only installing windows measures (not additional gas measures). Attrition also occurred due to insufficient pre or post data, or participants moving from the pre to post period.

Table 1-10. Windows Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original	3,654	100%	0	0%
Accounts that Installed Other Measures	2,708	74%	946	26%
Insufficient Pre/Post Months or Moved During Pre or Post	1,925	53%	783	21%
PRISM Screens: Low Heating Usage	1,874	51%	51	1%
Changed Usage Between Pre and Post Period (> 70%)	1,853	51%	21	1%
Added Base Load	1,763	48%	90	2%
Multifamily (Unit Number Present)	1,721	47%	42	1%
Final Analysis Group	1,721	47%	1,933	53%

CSA Modeling Approach

To estimate weatherization and windows energy savings from this program, we used a pre-post, CSA, fixed-effects modeling method, utilizing pooled monthly time-series (panel) billing data. The 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. The following model specification determined overall weatherization and windows savings:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 POST_i * AVGHDD_{it} + \beta_{3..13} M_t + \varepsilon_{it}$$

Where for participant ‘i’ and monthly billing period ‘t’:

ADC_{it} = the average daily therm consumption during the pre- or post-program period

α_i = the average daily therm base load intercept for each participant (this is part of the fixed effects specification)

β_1 = the baseline usage per HDD

$AVGHDD_{it}$ = the average daily base 65 HDDs based on home location

β_2 = the therm savings per HDD for the weatherization or windows measures

$POST_i$ = an indicator variable that is 1 in the post-period (after the weatherization or windows installation), and 0 in the pre-weatherization period

$POST_i * AVGHDD_{it}$ = an interaction between the post indicator ($POST_i$) and the HDDs ($AVGHDD_{it}$)

M_t = an array of bill month dummy variables (Feb, Mar, …, Dec); 0 otherwise[9]

ε_{it} = the modeling estimation error

The model estimates savings per heating degree for weatherization or windows measures with β_2. To obtain actual annual savings under normal weather conditions, we applied the 1991–2005 TMY3 normal HDDs, from NOAA.

The per-HDD modeling approach resolved much potential bias from customers with predominantly winter month data. As weatherization and windows measures affect heating usage, a per heating degree savings allowed savings to be allocated across all calendar months as well as being based on HDDs. Furthermore, the per heating degree savings estimation allowed savings to be obtained under normal weather conditions. Using just a post period indicator would have been influenced by any predominance of winter or summer months, resulting in savings biased upwards or downwards.

Results and Findings

Table 1-11 summarizes model savings results for the 809 weatherization participants and the 1,721 windows measure participants. Model savings for weatherization measures were 72 therms, and 24 therms for windows measures. The precision level indicated the percent error of the savings estimate was less than 10% for weatherization participants, and 18% for windows participants.

Table 1-11. Weatherization and Windows Savings Summary

Group	N	PRENAC	Normal HDDs	Model Savings (Therms)	Precision at 90% Confidence
Weatherization	809	865	6,325	72	9%
Windows	1,721	800	6,269	24	18%

Table 1-12 compares modeled with deemed savings to obtain realization rates (49% and 29% for weatherization and windows measures, respectively).

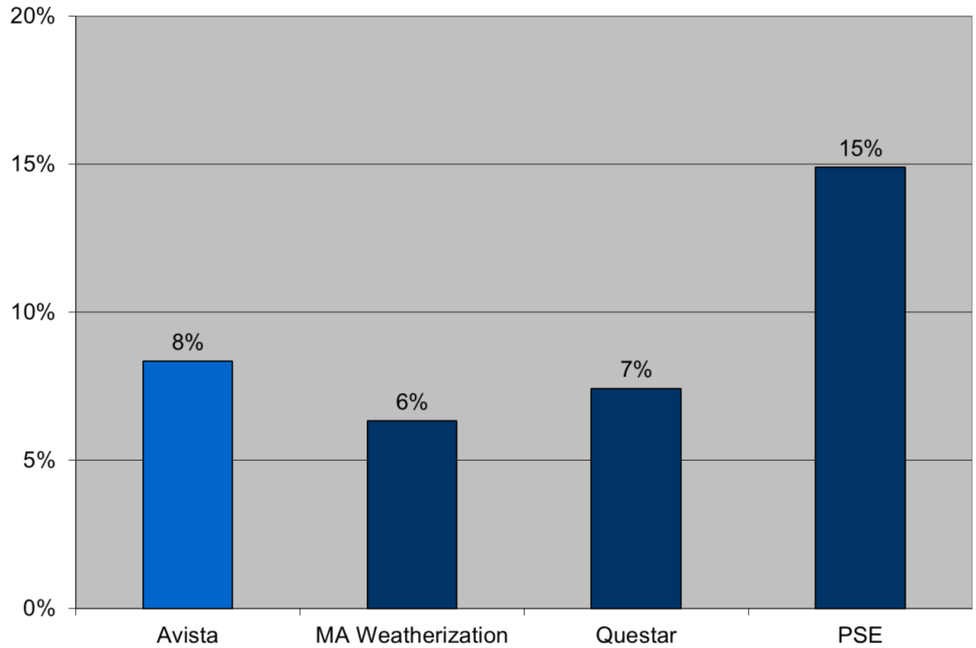
9 We excluded one dummy variable from the independent variables; otherwise, the 12 monthly indicators would form perfect co-linearity with the intercepts (we excluded January, thus the intercepts included seasonality from January).

Table 1-12. Realization Rate Summary

Group	N	PRENAC	Model Savings (Therms)	Expected Savings	Realization Rate	Savings as Percent of Pre
Weatherization	809	865	72	147	49%	8%
Windows	1,721	800	24	83	29%	3%

Figure 1-2 compares weatherization percent savings to similar gas weatherization evaluations. To improve comparisons, the respective chart includes only attic insulation savings, which are the predominant component of the program.

Figure 1-2. Gas Weatherization Percent Savings Benchmarking



To extrapolate billing analysis results to the entire program population, realization rates shown in Table 1-12 were applied to total savings for measures reported in the Avista database. The one measure not included in the billing analysis was Fireplace Dampers. For this measure, Cadmus maintained the deemed savings value developed for the 2011 Avista TRM. Table 1-13 shows total reported and adjusted savings for gas Weatherization program measures.

Table 1-13. Weatherization Measure and Program Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit		Program Savings		Realization Rate
	Avista	Evaluation	Avista	Evaluation	Avista	Evaluation	
G Fireplace Damper-Nat Gas Ht	15	15	76	6	1,140	83	7%
G Windows	1,620	1,620	79	22	128,429	36,385	28%
G Insulation	1,824	1,824	135	67	246,313	121,405	49%
Program Total	3,459	3,459	N/A	N/A	375,882	157,874	42%

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
- High-Efficiency Tankless Water Heater

Through this program, Avista offers a $50 incentive to residential customers installing an eligible high-efficiency water heater. To qualify for the program, natural gas water heaters with tanks must have 0.60 EF or greater for a 50-gallon tank, and 0.62 EF or greater for a 40-gallon tank. Avista no longer offers an incentive on tankless water heaters. The two units rebated in 2011 were completed prior to termination of the incentive.

Analysis

Cadmus updated deemed savings assumptions and algorithms for each measure to the most recent research available for the region and technology.

Results and Findings

Table 1-14 shows total reported and adjusted savings for the various measures.

Table 1-14. Water Heater Efficiency Measure and Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit		Program Savings		Realization Rate
	Avista	Evaluation	Avista	Evaluation	Avista	Evaluation	
G 40 Gallon Nat Gas Hot Water	90	90	8	9	720	792	110%
G 50 Gallon Nat Gas Hot Water	379	379	11	9	4,169	3,426	82%
G HE WH Tankless	2	2	60	58	120	116	96%
Program Total	471	471	N/A	N/A	5,009	4,334	87%

1.3.6 ENERGY STAR Homes

Program Description

The ENERGY STAR Homes program offers incentives to builders constructing single-family or multifamily homes complying with ENERGY STAR criteria (and verified as ENERGY STAR Homes). Avista provides a $900 incentive for homes using their electric or their electric and natural gas service for space and water heating. Avista provides a $650 incentive for homes only using their natural gas service (both hot water and space heating must be natural gas).

Analysis

Using the ENERGY-10 modeling software, Cadmus simulated models of an ENERGY STAR home and a standard built-to-code home. We completed one model for each state (Washington and Idaho) to account for all differences in state building codes (see Appendix 1B). We averaged savings results of each simulation, according to the proportion of ENERGY STAR home rebates awarded in each state. Finally, we applied weighted averaged savings to the entire population of ENERGY STAR homes that Avista provided with rebates for during PY 2011.

Results and Findings

Table 1-15 shows total reported and adjusted savings for the gas measures within ENERGY STAR Homes. Participating homes using both Avista electric and gas were funded through both the electric and gas programs. Electric savings associated with these homes are addressed in the 2010 and 2011 electric impact evaluation report.

Table 1-15. ENERGY STAR Home Measure and Program Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (therms)		Program Savings (therms)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
HOME-GAS ONLY	15	15	197	203	2,955	3,050	103%
ELEC/GAS (GAS)	108	108	196	203	21,141	21,956	104%
PROGRAM TOTAL	123	123			24,096	25,006	104%

1.3.7 Residential Programs Confidence and Precision

Cadmus determined the overall precision of the adjusted gross savings by estimating the standard error associated with each measure. For measures based on deemed savings estimates only, the error in the deemed savings is due to error in each of the input assumptions. Typically, this is due to the sampling error associated with research into each input. To simplify this analysis, Cadmus has conservatively estimated that the standard error associated with each deemed measure is 20% of the unit energy savings unless recent evaluation research has developed a more accurate estimate. This estimate is greater than values Cadmus typically determines, but provides for a conservative estimate of program precision. Two programs use more accurate estimates of error based on recent research. The standard error for the Heating and Cooling efficiency program is based on the billing analysis performed last year.[10] The standard error for the Weatherization/Shell program is based on the billing analysis performed this year. Following the determination of program measure savings based error, Cadmus applies the verification error determined through this year's surveys to each program except the two using billing analysis results. Verification rates are not applied to savings determined through a billing analysis as their results include any homes where the installation was stated to have occurred, but did not occur. Table 1-16 shows the program level error and precision for the residential portion of the portfolio. Overall the residential programs achieved 4% relative precision at the 90% confidence interval.

[10] Avista 2010 Multi-Sector Gas Impact Evaluation Report, August 2011.

Table 1-16. Program Savings Precision at the 90% Confidence Interval

Program	Adjusted Gross Savings (therms)	Standard Error (therms)	Relative Precision at 90% Confidence
ENERGY STAR Products	22,185	4,044	30%
Heating and Cooling Efficiency	305,789	7,304	4%
Weatherization/Shell	157,874	7,752	8%
Water Heater Efficiency	4,334	708	27%
ENERGY STAR Homes	25,006	4,459	29%
Total	515,188	12,255	4%

1.4 Conclusions

Overall, the 2011 residential gas programs produced 515,188 therms in savings. The evaluation yielded an overall realization rate of 64%. (See Table 1-17, Table 1-18, and Table 1-19)

Table 1-17. Total Program Reported and Verified Gross Savings and Realization Rates

Program	Reported Savings (Therms)	Verified Gross (Therms)	Realization Rate
ENERGY STAR Products	30,992	22,185	72%
Heating and Cooling Efficiency	365,679	305,789	84%
Weatherization/Shell	375,882	157,874	42%
Water Heater Efficiency	5,009	4,334	87%
ENERGY STAR Homes	24,096	25,006	104%
Total	801,658	515,188	64%

Table 1-18. Program Reported and Verified Gross Verified Savings and Realization Rates—Washington

Program	Reported Savings (Therms)	Adjusted Gross (Therms)	Realization Rate
ENERGY STAR Products	22,068	15,732	71%
Heating and Cooling Efficiency	250,797	209,697	84%
Weatherization/Shell	283,033	121,357	43%
Water Heater Efficiency	4,144	3,587	87%
ENERGY STAR Homes	21,143	21,956	104%
Total	581,185	372,330	64%

Table 1-19. Program Reported and Verified Gross Verified Savings and Realization Rates—Idaho

Program	Reported Savings (Therms)	Adjusted Gross (Therms)	Realization Rate
ENERGY STAR Products	8,924	6,453	72%
Heating and Cooling Efficiency	114,882	96,092	84%
Weatherization/Shell	92,849	36,517	39%
Water Heater Efficiency	865	746	86%
ENERGY STAR Homes	2,952	3,050	103%
Total	220,472	142,858	65%

Table 1-20 shows achievement rates of gross savings, compared to IRP goals for the residential sector.

Table 1-20 IRP Goals and Gross Verified Savings by State

	Washington			Idaho			Total		
Sector	Savings Goal	Gross Achieved	Achiev-ement Rate	Savings Goal	Gross Achieved	Achiev-ement Rate	Savings Goal	Gross Achieved	Achiev-ement Rate
Residential	985,175	372,330	38%	416,750	142,858	34%	1,401,925	515,188	37%

1.5 Recommendations

Cadmus offers the following recommendations, based on evaluation results:

- Avista should collect and record equipment efficiency information, or at least model numbers for appliances. Including equipment-specific information regarding the actual efficiency of equipment installed would allow greater accuracy in estimating gross energy savings achieved. Future evaluations could use collected information to determine savings, rather than relying on regional market average estimates, which do not account for the self-selection inherent in rebate programs.
- Avista should consider moving all ENERGY STAR Clothes Washer rebates to the electric program. Given the large percentage of savings achieved through reduced dryer energy, and most participants likely having an electric dryer, this measure predominantly produces electric energy savings.

1.5.1 Future Research Areas

These research recommendations are based on the results of this impact evaluation and known future changes to program requirements.

- Perform a review of all available secondary research (including the Residential Building Stock Assessment (RBSA)) and/or collect primary data on the penetration of gas heated clothes dryers. This information can be used to refine the estimated gas and electric savings associated with the purchase of an ENERGY STAR clothes washer in a home with a gas domestic hot water tank.

- Perform a targeted billing analysis on weatherization participants that use both electricity and gas to heat their home.
- Perform a billing analysis on ENERGY STAR homes using a nonparticipant comparison group once enough homes have participated under the new requirements to justify performing the work.

2 ~~2010~~ Nonresidential Gas Impact Report

Executive Summary

Program Overview

Avista's nonresidential programs promote the purchase of industry-proven, high-efficiency equipment for commercial utility customers. They provide rebates to partially offset the difference in cost between high-efficiency and standard equipment, reducing the first-cost barrier and making high-efficiency equipment a more viable option for commercial customers.

Avista's nonresidential gas portfolio has nine programs in two major categories: eight Prescriptive and one Site-Specific (custom). The programs are:

- Prescriptive:
  - ENERGY STAR Residential Products (APP)
  - Commercial Clothes Washer (PCW)
  - Commercial HVAC (PCH)
  - Commercial Shell (PCS)
  - Demand Controlled Ventilation (PDCV)
  - Food Service (PFS)
  - Refrigerated Warehouse (PRW)
  - Steam Trap Replacement (PSTR)
- Site-Specific (SS)

Avista administers both the Prescriptive and Site-Specific programs. Cadmus conducted both qualitative (process) and quantitative (impact) evaluations of these programs. We also documented the evolution of these programs and provided timely feedback to enable recommended program improvements.

The Site-Specific program reported the largest quantity of savings. For the purposes of this evaluation, Cadmus subdivided the Site-Specific program into the following major measure categories:

- Site-Specific HVAC (SSHVAC)
- Site-Specific Other (SSO)
- Site-Specific Shell (SSS)

Key Findings

Cadmus evaluated 55 of 431 measures installed through the nonresidential energy efficiency programs, representing 57% of reported savings. Throughout the impact evaluation, we documented program achievements and identified issues such as lower-than-expected achieved savings.

Avista's reported and evaluated savings are shown in Table 2-1 through Table 2-3. The gross evaluated program savings were 832,374 therms.

Table 2-1. Program Summary

Measure Category	Number of Measure Installations	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)	Realization Rate
Prescriptive	173	104,286	95,963	92%
SSHVAC	115	628,625	489,993	78%
SSO	24	15,867	15,998	101%
SSS	119	213,473	230,420	108%
Total	431	962,251	832,374	87%

Table 2-2. Program Summary - Idaho

Measure Category	Number of Measure Installations	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)	Realization Rate
Prescriptive	41	16,184	14,893	92%
SSHVAC	43	96,426	70,476	73%
SSO	8	4,569	4,607	101%
SSS	38	32,214	35,741	111%
Total	130	149,393	125,717	84%

Table 2-3. Program Summary - Washington

Measure Category	Number of Measure Installations	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)	Realization Rate
Prescriptive	132	88,102	81,070	92%
SSHVAC	72	532,199	419,517	79%
SSO	16	11,298	11,392	101%
SSS	81	181,259	194,679	107%
Total	301	812,857	706,657	87%

Avista did not report participation goals by number of projects but did report energy savings goals as shown in Table 2-4. The overall PY 2011 nonresidential gas portfolio achieved 96% of the natural gas integrated resource plan (IRP) savings goal.

Table 2-4. IRP Energy Savings Achievements Compared to Goals

Program	Program Gross Goals (therms)	Evaluated Gross Program (therms)	Goal Achievement
Idaho	260,885	125,717	48%
Washington	608,731	706,657	116%
Total	869,616	832,374	96%

The energy savings results shown in Table 2-4 do not account for therm penalties due to increased lighting efficiency. Lighting systems convert a large portion of their input energy to useful light output, but a substantial portion is converted to waste heat. Any reduction in lighting input energy also reduces waste heat, which, if reduced, lowers the site's required cooling load while increasing the heating load. Cadmus noted that Avista tracked these HVAC interactive effects for calculating cost-effectiveness but did not include them in energy savings goals or reported savings values. Avista noted its methodology for calculating interactive impacts was not as robust as that for energy savings. The Avista database extract did not provide sufficient detail for Cadmus to calculate those impacts.

2.1 Introduction

Avista's nonresidential portfolio of programs promotes the purchase of industry-proven, high-efficiency equipment for its commercial customers. Avista provides rebates to partially offset the difference in cost between high-efficiency equipment and standard equipment, reducing the first-cost barrier and making the high-efficiency equipment a more viable option for commercial customers.

The nonresidential gas portfolio has nine programs in two major categories: eight prescriptive and one Site-Specific (custom).

2.1.1 ENERGY STAR Residential Products (APP)

This program is available to nonresidential customers who use residential-grade appliances in a small business application. Savings are determined through deemed estimates.

2.1.2 Prescriptive Commercial Clothes Washer (PCW)

To encourage customers to select high-efficiency clothes washers, this program targets nonresidential electric and natural gas customers in multifamily or commercial Laundromat facilities. The program's streamlined prescriptive approach is designed to reach customers quickly and effectively to promote ENERGY STAR or Consortium for Energy Efficiency (CEE) listed units.

2.1.3 Prescriptive Commercial HVAC (PCH)

Beginning in January 2011, the installation of efficient HVAC systems has been processed through a prescriptive program rather than through the Site-Specific program. Measures eligible for the prescriptive program are limited to the following installations:

- Furnaces under 225 kBtu with an efficiency greater than 90% AFUE
- Furnaces between 225 kBtu and 300 kBtu with an efficiency greater than 85% AFUE

2.1.4 Prescriptive Commercial Shell (PCS)

Beginning in January 2011, the installation of commercial insulation has been processed through a prescriptive program in addition to the Site-Specific program. Projects eligible for the prescriptive program are those with pre-existing:

- Wall insulation levels of less than R4 that are improved to R11 or better
- Attic insulation of less than R11 that are improved to R30 or better
- Roof insulation of less than R11 that are improved to R30 or better

2.1.5 Prescriptive Demand Controlled Ventilation (PDCV)

Under this program, nonresidential electric and natural gas customers receive direct incentives to install DCV in existing buildings. This type of ventilation measures the approximate number of people occupying a space—based on carbon dioxide levels—and resets the outdoor air intake rate for occupant ventilation. To be eligible for the program, the existing equipment must maintain the temperature of the conditioned spaces between 65 and 75 degrees during operating hours. Also, the controlled conditioned space must be a minimum of 2,000 square feet.

2.1.6 Prescriptive Food Service (PFS)

Applicable to nonresidential electric and gas customers with commercial kitchens, this program provides direct incentives to customers who choose high-efficiency kitchen equipment. The equipment must meet either ENERGY STAR or CEE tier levels (depending on the unit) to qualify for an incentive.

Prescriptive Refrigerated Warehouse (PRW)

This program offers nonresidential electric customers a direct incentive for efficiency improvements in refrigerated warehouses. Although the customer base for this program is limited, the opportunities for energy savings from the program's measures are significant.

Prescriptive Steam Trap Replacement (PSTR)

This program offers rebates to nonresidential gas customers who repair or replace failed steam traps on the steam distribution lines of a boiler heating system. The key criteria for this rebate are:

- The replacement must be a new steam trap of the same duty as the trap it replaces.
- Each steam trap repair or replacement is only eligible for a rebate once every five years.
- The repaired or replaced trap must include a strainer.

Site-Specific (SS)

The Site-Specific program is for nonresidential measures that do not fit any of the prescriptive applications and thus 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 who receive electric or natural gas service from Avista and want to make cost-effective, energy-efficiency improvements to their business. Electric and gas saving measures included in the program are:

- Site-Specific HVAC
  - HVAC combined
  - HVAC heating

- Site-Specific other
  - Appliances
  - Industrial process
- Site-Specific shell

Avista designs, manages, and implements the prescriptive and Site-Specific programs. It also developed the algorithms it uses to calculate measure savings and determine 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.

2.2 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.

Cadmus worked with a subcontractor for this evaluation, SBW. 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 to ask their experience of the operating conditions of the installed system and any additional benefits or shortcomings of the installed system. Cadmus used the savings realization rates from site visits to estimate savings and develop recommendations for future studies.

2.2.1 Sampling

We developed a sampling calculation tool to estimate the number of metered projects and site verifications required to achieve the rigor levels of the precision target. We used preliminary program population data provided by Avista and determined we needed to meter 18 projects and visit 33 sites. The proposed precision targets for these two evaluation activities are shown in Table 2-5.

Table 2-5. Proposed PY 2011 Nonresidential Evaluation Activities

Stratum	Precision Target	Proposed Metering Projects	Proposed Site Visits
Prescriptive	90/20	3	10
SSHVAC	90/20	10	1
SSO	90/15	5	19
SSS	90/15	0	3
Total	90/10	18	33

We selected both a census and random sample for each stratum. The census projects represented a small number of those participants with large savings impacts for the stratum. The census savings cutoff for each stratum is shown in Table 2-6 below. 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 2-6. Census Level Cutoff by Stratum

Stratum	Reported Savings (therms)
Prescriptive	10,000
SSHVAC	35,000
SSO	10,000
SSS	20,000

In Table 2-7, we show the precision achieved for the actual number of evaluation activities for gas measures. Subsequent sections of this report will explain the differences between our initial proposed and actual sampling plan for evaluation activities. For example, our initial sampling plan 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 2-7. Final FY 2011 Gas Evaluation Activity Sample

Stratum	Precision Achieved	Completed Metering Projects	Completed Site Visits
Prescriptive	90/37	3	17
SSHVAC	90/11	8	11
SSO	90/6	3	4
SSS	90/14	0	9
Total	90/9	14	41

As explained above and presented in Table 2-6, we selected projects with large reported savings. In selecting the rest of our sample, we found that the extract from Avista's database did not include addresses so that we could identify if projects performed for the same company were at different sites nor did it list what specific measures were installed. Therefore, the sampling process was iterative. From the extract, we selected projects of interest, asked Avista for additional data to determine how many and what types of projects were at various locations, and obtained their project files, until we had compiled the final primary and backup samples.

Cadmus also found that the database extract provided program-level 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. To establish this distribution, we would have required an exhaustive review of project files, which was not within the scope of the evaluation.

2.2.2 Data Collection

Cadmus collected data from 14 metering projects and 41 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. This documentation included 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, 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 Metering

Avista provided hourly usage for 14 sites through each site's gas meter. The metered data for six sites came from digital meters that Avista had previously installed. The metered time period varied from several weeks to several months for each meter. For the other eight sites, Avista installed a connection to the analog gas flow meter so we could install data loggers to record pulse counts for two weeks.

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 we also verified the operational characteristics of the installed equipment, such as temperature set points and operating hours.

2. We collected the physical data, such as boiler capacity or operational temperature, 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.

2.2.3 Engineering Analysis

Nonresidential Prescriptive and Site-Specific programs 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 used 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, we verified the deemed savings estimates that Avista used for savings calculations then compared these with the values we had developed for the new technical reference manual (TRM).[11] 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 with Avista's Microsoft Excel calculation tools, ENERGY STAR calculation tools, Regional Technical Forum deemed savings, and other secondary sources.

Short-Term Metering

Cadmus used the hourly gas flow data from analog and digital meters to characterize site gas usage quantities and patterns. Where possible, we attempted to isolate the impact of the particular measure for which the participant received incentives.

Billing Analysis

Cadmus analyzed Avista's metered billing data for six 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 heating degree days (HDDs). It also determined savings based on normalized weather conditions, since the actual weather conditions may have been milder or more extreme than the TMY3 (typical meteorological year) 15-year normal weather averages from 1991-2005 obtained from the National Oceanic and Atmospheric Administration (NOAA).

[11] Avista's new iteration of the TRM is expected around July 2012.

From NOAA, we also obtained daily weather data for each weather station associated with the participant projects and calculated the base 65 reference temperature HDDs. We matched the participant billing data to the nearest weather station by zip code, and 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 average daily consumption in kWh as a function of some combination of average standing base load, HDD, 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 occur 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-period model. This scenario extrapolated the counterfactual consumption, i.e., what the consumption would have been in the absence of 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. Both scenarios used 15-year TMY3 data 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 the building of envelope measures such as ceiling and wall insulation. The calculation spreadsheets require input of relevant parameters such as square footage, efficiency value, HVAC system details, and location details. From these data, energy savings are estimated through algorithms programmed by Avista. For each spreadsheet, we reviewed 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, which it chose because of the complex interactions between heating and cooling loads and the building envelope. Avista provided the original energy simulation models, and we reviewed the models to determine the relevant parameters and operating details (such as temperature set points) for the applicable measure. We updated the models as necessary based on our on-site verification data.

2.3 Results and Findings

2.3.1 Overview

Cadmus adjusted gross savings estimates based on our evaluated findings. Further details by program are discussed in the following sections.

2.3.2 Prescriptive Programs

We evaluated savings for a sample of sites across eight prescriptive programs. Table 2-8 through Table 2-10 show the savings and realization rates by program. Further evaluation details in each program are described below. The realization rate for all but the residential appliances (APP) and steam trap measures (PSTR) are high, and the APP measures only delivered a small portion of savings.

Table 2-8. Evaluated Results for PY11 Nonresidential Gas Prescriptive Sample

Program	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
APP	16	8	51	21	41%
PCW	6	0	N/A	N/A	N/A
PCH	51	4	2,131	2,852	134%
PCS	65	2	1,237	1,385	112%
PDCV	3	2	651	651	100%
PFS	28	2	2,678	2,630	98%
PRW	1	0	N/A	N/A	N/A
PSTR	3	2	3,248	1,654	51%
Total	173	20	9,996	9,193	92%

Table 2-9. Evaluated Results for PY11 Nonresidential Gas Prescriptive Sample - Idaho

Program	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
APP	3	2	10	3	49%
PCH	12	2	652	673	103%
PCS	14	0	N/A	N/A	N/A
PDCV	2	1	550	550	100%
PFS	10	2	2,678	2,630	98%
Total	41	7	3,890	3,856	99%

Table 2-10. Evaluated Results for PY11 Nonresidential Gas Prescriptive Sample - Washington

Program	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
APP	13	6	41	18	44%
PCW	6	0	N/A	N/A	N/A
PCH	39	2	1,479	2,179	147%
PCS	51	2	1,237	1,385	112%
PDCV	1	1	101	101	100%
PFS	18	0	N/A	N/A	N/A
PRW	1	0	N/A	N/A	N/A
PSTR	3	2	3,248	1,654	51%
Total	132	13	6,106	5,337	87%

Overall, the Prescriptive program analysis achieved a level of 90/37 confidence and precision. Cadmus identified several necessary adjustments to the reported savings for the Prescriptive programs. We note that the calculations often rely on reported equipment and operations data, which may vary from parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 8%. Typical adjustments were to correct equipment efficiency, fuel type, operating schedules, and operating parameters as described below:

- One dishwasher and one clothes washer measure used electric water heating instead of gas, so this reduced electric energy savings. Cadmus attributed the electric savings to the nonresidential electric program. In addition, one dishwasher measure used gas water heating instead of electric, as reported. This increased the evaluated gas savings.
- For ENERGY STAR clothes washers we applied the results from a previous Cadmus clothes washer study[12]. The Cadmus study estimated larger energy savings for this measure than the reported values.
- For two commercial HVAC measures, we adjusted savings based on short-term metered usage data and utility billing data. One measure used less gas than reported, which reduced savings. The other measure used much more gas than reported, which increased energy savings. The overall impact resulted in additional savings.
- For two commercial shell measures we updated the savings estimate to account for additional insulation square footage and heating setpoints using Avista's calculator for this measure. The adjustments increased energy savings.
- One Prescriptive Food Service project installed a commercial dishwasher that relied on gas heating instead of electric, as reported. The gas savings were attributed to the nonresidential gas program.

[12] The Cadmus Group, Inc. "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems." 2010. http://www.cadmusgroup.com/pdfs/Do_the_Savings_Come_Out_in_the_Wash.pdf

- One steam trap replacement project replaced and repaired steam traps on a low pressure steam system (3 to 5 psi). The measure did not qualify for the program since it fell below the threshold requirement of 15 psi; therefore, we did not attribute savings to this project.

2.3.3 Site-Specific

Cadmus performed site visits on 35 Site-Specific program projects, which represented a variety of measure types. We calculated an overall realization rate for all randomly selected (non-census) projects in both Idaho and Washington and then applied the resulting realization rate to the non-census savings for each state and major measure type. Table 2-11 lists the different measure types we evaluated, as well as the number of projects and reported savings. Table 2-12 and Table 2-13 show our evaluated results for the program.

Table 2-11. Site-Specific Measure Types and Projects Evaluated

	Idaho		Washington		Total	
Measure Type	Evaluated Projects	Reported Savings (therms)	Evaluated Projects	Reported Savings (therms)	Evaluated Projects	Reported Savings (therms)
SSHVAC	5	52,534	14	397,423	19	449,957
SSO	3	4,499	4	11,103	7	15,602
SSS	3	12,303	6	50,062	9	62,365
Total	11	69,336	24	458,588	35	527,924

Table 2-12. Evaluated Results for PY 2011 Nonresidential Site-Specific Sample

State	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Sample Savings (therms)	Gross Evaluated Sample Savings (therms)	Sample Realization Rate
Total	258	35	527,924	437,905	83%
Idaho	89	11	69,336	53,348	77%
Washington	169	24	458,588	384,558	84%

Table 2-13. Evaluated Results for PY 2011 Nonresidential Site-Specific Measure Categories

Measure Category	Gross Reported Sample Savings (therms)	Gross Evaluated Sample Savings (therms)	Realization Rate
SSHVAC	628,625	489,993	78%
SSO	15,867	15,998	101%
SSS	213,473	230,420	108%
Total	857,965	736,412	86%

Overall, the Site Specific program analysis achieved a level of 90/9 confidence and precision. Cadmus identified many adjustments to Site-Specific program project reported savings. Site-Specific projects tend to be more complex, and energy savings parameters and impacts can be 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, our adjustments decreased savings by 14% due to reductions in Site-Specific HVAC savings (realization rate of 78%). We evaluated higher than reported savings for both the Site-Specific other (101%) and Site-Specific shell (108%) sample.

We typically adjusted savings values to correct equipment efficiency, operating schedules, temperature set points, and building parameters. We also identified errors in simulation models and Microsoft Excel calculation tools, which when corrected resulted in adjustments. We made the following specific adjustments:

- One manufacturing facility installed an overhead radiant system to replace unit heaters that received heat from fan coils on a boiler loop. The participant did not decommission the boiler and left two unit heaters operational over the loading dock. The new system radiantly heated the production area as intended, but the unit heaters attempted to bring the entire space temperature up to the set point. As a result, the system used more gas than in the baseline condition, resulting in a savings reduction of 14,641 therms.
- Cadmus found Avista's assumptions for post-installation heating loads on several large projects resulted in savings reductions. Based on our analysis of billing data and heating degree days, we calculated lower than reported savings on the following projects:
  - Athletic club boiler retrofit (92% realization rate, savings reduction of 3,293 therms)
  - Jail boiler to central steam plant retrofit (84% realization rate, savings reduction of 3,276 therms)
  - Medical center HVAC controls retrofit (91% realization rate, savings reduction of 1,983 therms)
  - University code baseline to efficient boiler (72% realization rate, savings reduction of 1,792 therms)
- Avista reported savings based on LEED simulation models for three HVAC projects at a prison in southeast Washington. The third-party engineer who developed the LEED models lost them in a server crash, and Avista did not obtain a copy of the models prior to project approval. For one building that installed all three measures (high-efficiency equipment and heat recovery), we created a new Trane TRACE simulation model using architectural drawings, mechanical specifications, site verification data, and utility billing data. We also located high-efficiency gas equipment measures in 15 other buildings on the prison campus. We combined modified simulation models and spreadsheet calculations to evaluate savings on these measures. The combined realization rate for all three HVAC measures was 75%, a reduction of 64,787 therms. The specific issues for each measure are noted below.
  - The measure with the largest reported savings involved high-efficiency boilers and domestic water heating systems in most buildings on the prison campus. The prison utility billing data did not support the heating loads projected in the original simulation models. We evaluated the measure's realization rate at 85%, a reduction of 29,814 therms.

  - The second largest measure was a heat recovery system for one building's laundry facilities. We calculated savings using participant records on laundry loads, as well as equipment specifications, operating details, and temperature data we verified during the visit. The measure's realization rate was 62%, a reduction of 12,178 therms. Cadmus could not obtain the LEED model to identify the exact source of discrepancy.
  - The third measure used heat recovery from refrigeration compressors to heat incoming air and water. Our simulation model indicated the system's water storage capacity acted as a limiting factor for heat transfer and that the tanks could not recharge fast enough during the day to keep up with demand. The original LEED simulation model may not have accounted for this effect. The realization rate was 14%, a reduction of 22,795 therms.

- Cadmus identified multiple discrepancies and simulation model errors on an office project with HVAC direct digital control upgrades. The realization rate was 43%, a reduction of 5,568 therms. The discrepancies between the model and our site visit were:
  - The proposed window U-values did not match installed values.
  - The modeled computer room area was smaller than the actual area.
  - The model listed one system zone per floor whereas the as-built zoning used one system for the building perimeter and one system for the building interior.
  - The model used 8,760 hours per year for the occupancy schedule in the model baseline and followed a normal office schedule in retrofit case. The schedule should have used the same conventional office operating schedule for both baseline and retrofit conditions. The higher baseline operating hours inflated savings.

- Cadmus identified issues with simulation model calibration to utility billing data on one HVAC heating project. The simulation model had been stored on an Avista engineer's laptop and was lost due to a hardware issue, so we could not perform an updated calibration. We analyzed the project by comparing pre- and post-installation utility billing data and heating degree days and calculated the realization rate at 67%, a reduction of 569 therms.

- Individual new construction measure savings were heavily dependent on interactive effects. Avista applies a rolling baseline in which each energy-efficiency measure's savings reduce the energy-usage baseline for all of the successive measures. The order in which the analysis is performed will change energy savings results by measure type. As an example, a newly constructed school installed various shell and gas efficiency measures, as well as daylighting controls. The daylighting controls reduce waste heat from lighting and increase gas heating requirements. If the daylighting controls measure is modeled first, it increases the baseline energy usage for the shell and gas measures. If the daylighting controls measures is modeled last, its savings does not impact the baseline, which reduces potential gas measure savings.

2.3.4 Extrapolation to Program Population

For our evaluation of the nonresidential gas 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) to apply to the programs at the remaining non-sampled sites. These realization rates are weighted averages, based on the random verification sample and using the following four equations:

$$RR_{ij} = \frac{Verified_{ij}}{Claimed_{ij}};\ for\ measure\ j\ at\ site\ i \tag{1}$$

$$RR_{j} = \frac{\sum_{i} Verified_{i}}{\sum_{i} Claimed_{i}};\ for\ measure\ j\ across\ all\ sample\ sites \tag{2}$$

$$\sum_{k} Verified_{k} = RR_{j}\, x \sum_{k} Claimed_{k};\ for\ measure\ j\ across\ all\ sites\ in\ measure\ population \tag{3}$$

$$RR_{l} = \frac{\sum_{k} Verified_{k}}{\sum_{k} Claimed_{k}};\ for\ the\ population\ (all\ sites\ and\ measures) \tag{4}$$

Where:

RR	=	the realization rate
i	=	the sample site
j	=	the measure type
k	=	the total population for measure type ‘j’
l	=	the total program population

We calculated realization rates for each individual site in the sample based on measure type (Equation 1). We then 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 (Equation 2). We calculated the non-census population verified savings by multiplying the measure type realization rate from the random sample by the claimed savings for the non-census population of each measure type (Equation 3). We then 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 (Equation 4).

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 2-14 through Table 2-16. The overall portfolio gross realization rate is 87%.

Table 2-14. PY 2011 Gas Gross Program Realization Rates

Measure Category	Gross Sample Reported Savings (therms)	Gross Sample Evaluated Savings (therms)	Realization Rate	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)
Prescriptive	9,996	9,193	92%	104,286	95,963
SSHVAC	449,957	359,408	78%	628,625	489,993
SSO	15,602	15,732	101%	15,867	15,998
SSS	62,365	62,332	108%	213,473	230,420
Total	537,920	446,665	87%	962,251	832,374

Table 2-15. PY 2011 Gas Gross Program Realization Rates - Idaho

Measure Category	Gross Sample Reported Savings (therms)	Gross Sample Evaluated Savings (therms)	Realization Rate	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)
Prescriptive	3,890	3,856	92%	16,184	14,893
SSHVAC	52,534	33,549	73%	96,426	70,476
SSO	4,499	4,064	101%	4,569	4,607
SSS	12,303	15,735	110%	32,214	35,741
Total	73,226	57,203	84%	149,393	125,717

Table 2-16. PY 2011 Gas Gross Program Realization Rates - Washington

Measure Category	Gross Sample Reported Savings (therms)	Gross Sample Evaluated Savings (therms)	Realization Rate	Gross Program Reported Savings (therms)	Gross Program Evaluated Savings (therms)
Prescriptive	6,106	5,337	92%	88,102	81,070
SSHVAC	397,423	325,859	79%	532,199	419,517
SSO	11,103	11,668	101%	11,298	11,392
SSS	50,062	47,031	107%	181,259	194,679
Total	464,694	389,895	87%	812,857	706,658

2.3.5 Achievements Compared to Goals

Avista outlined goals for various programs to save a total of 869,616 therms as its integrated resource planning (IRP) goal, as shown in Table 2-17. The overall Avista portfolio's evaluated gross savings achieved 96% of its goals.

Table 2-17. PY 2011 Gas Program Achievements Compared to IRP Goals

Program	Program Gross Goals (therms)	Evaluated Gross Program (therms)	Goal Achievement
Idaho	260,885	125,717	48%
Washington	608,731	706,658	116%
Total	869,616	832,374	96%

2.3.6 HVAC / Lighting Interactive Impacts

The Avista portfolio results did not account for gas heating penalties due to increased lighting efficiency. Lighting systems convert a large portion of their input energy to useful light output, but a substantial portion is converted 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 tracks and records these HVAC interactive effects for many projects to determine program cost-effectiveness. Most interactive effects involved prescriptive or Site-Specific lighting projects, although some therm penalties were reported for the Energy Smart Grocer (in Avista's electric portfolio) and Site-Specific HVAC program projects.

Cadmus typically applies interactive factors based on values supplied by the RTF of the Northwest Power and Conservation Council. Those values rely on the fixture savings, building type, and HVAC system; however, that information was not available for most of the affected projects we evaluated. Avista noted its methodology for calculating interactive effects was not as robust as that for its energy savings methodology.

In addition, Avista did not factor interactive effects into their portfolio energy savings goals, which would have reduced goals.

2.4 Conclusions

Cadmus evaluated 55 of 431 measures installed through the program, representing 57% of reported savings.

In general, Cadmus determined that Avista implemented the programs well. Gross evaluated savings achieved 96% of reported program savings goals. The overall portfolio achieved an 87% realization rate when we compare gross evaluated savings to gross reported savings.

Cadmus identified the following key issues that reduced energy savings:

- Some participants did not operate the incented equipment correctly or did not complete the improvements expected for the measure.
- Some participant heating or cooling loads did not achieve the level projected for post-installation usage.
- Some energy simulation models did not accurately represent the actual as-built building or system operation.

Cadmus also found the following implementation issues that affected the impact evaluation:

- Several building simulation models were unavailable due to reported server or laptop crashes on the part of either Avista implementation staff or third-party consultants. At one site, a LEED consultant lost the building simulation model that had been used to estimate 25% of the total nonresidential gas savings.

- Individual new construction measure savings were heavily dependent on interactive effects. Avista calculated individual measure savings through a rolling baseline in which each measure was simulated in a set order. Changing the simulation order substantially altered measure savings.
- Cadmus could have streamlined the sampling process if Avista's database had recorded site addresses and contact information. Having measure-level data, such as specific measure type and quantity, for each project would have improved the range and depth of our evaluation activities.
- Interactive effects between HVAC and lighting represent a significant impact on gas demand. We are unable to reliably estimate interactive savings impacts from the data available in Avista's current database.

2.5 Recommendations

Cadmus recommends that Avista continue to offer incentives for measure installation through the evaluated programs. We recommend the following for improving program energy savings impacts and effectiveness of the evaluation:

- Avista should create a quality control system to double-check all projects with savings over 10,000 therms. An Avista EM&V engineer reported he has begun to review these types of projects.
- Avista should consider performing three- to six-month post-installation random inspections to confirm measure persistence and to identify opportunities to improve performance.
- Avista should consider adding a program for recommissioning measures that were identified as non-functional during the previous year's evaluation process and report the energy savings these measures achieve in the subsequent year. Recommissioning measure costs would primarily be for utility and implementer staff to resolve issues and to re-inspect the measure. We recommend that recommissioning measures be evaluated through a census sample, and the verified energy savings should not be extrapolated to the overall program population.
- Avista should consider applying more conservative assumptions on Site-Specific heating loads.
- Avista should save all internally and externally developed simulation models to Avista's servers.
- Avista should consider developing a New Construction measure that would combine the interactive effects associated with all individual measures at new construction projects.
- Avista should consider revising its methodology for calculating and tracking HVAC/lighting interactive effects.

3 2011 Low-Income Gas Impact Report

Executive Summary

Program Overview

Avista's Low-Income Weatherization Program in Washington and Idaho seeks to lower customers' energy consumption and reduce their utility bills. At no cost to income-qualified customers, the program provides: a complete home energy audit, and installation of energy-efficient measures.

Evaluation Approach

For the 2011 impact evaluation, we used gas savings estimates, calculated through billing analysis of 2010 gas participants. The final model's savings estimates from the 2010 impact evaluation have been applied to 2011 gas participants. Savings are reported for all 2011 gas participants in Avista's Washington and Idaho service territories. Major tasks performed for the evaluation are described in detail below.

Data Collection

Table 3-1 lists data required for this evaluation and their sources.

Table 3-1. Data Sources

Data	Source
Program participant and measure data	Avista
Expected savings by measure installation	Avista / CAP agencies

Evaluation of Program Energy Savings

Cadmus reviewed Avista's estimated savings, and calculated the average achieved household and total savings, as described below:

- **Expected Savings:** Based on expected measure-level gas savings estimates, provided by Avista, and drawn from their program participant database.
- **Actual Savings:** Calculated using a pre-post CSA, fixed-effects regression model, estimating weather-normalized, program-induced energy savings, based on participant billing data. Model savings estimates from the 2010 Impact Report's billing analysis were applied to current 2011 participants. In addition, we utilized data from Avista's 2010 Residential evaluation to determine savings achieved for participants receiving electric to high-efficiency gas furnace conversions.

Gas Impact Findings and Conclusions

State-level savings estimates from the 2010 gas billing analysis were applied to 242, gas-saving 2011 program participants, summarized in Table 3-2. An additional 110 participants received electric to gas fuel-conversion measures. Savings for these installations are discussed below.

Table 3-2. Non-Conversion Whole House Gas Savings by State

State	Total Participants	Average Expected Savings Per Participant (Therms)	Model Savings Per Participant (Therms)	Realization Rate
Idaho	104	305	123	41%
Washington	138	361	104	29%
Overall	242	337	112	33%

Fuel-Conversion Savings

Of the 110 participants receiving fuel conversions for electric heating and/or water heating equipment, along with bundles of other gas-savings weatherization measures (e.g., insulation), conversion installations occurred only in Washington. Savings were assigned to three categories of participants:

1. Full model savings to those receiving larger bundles of weatherization measures;
2. Savings specific to installation of a high-efficiency gas furnaces, in place of standard efficiency furnaces; [13] and
3. No savings applied (a few cases).

In total, we estimated an additional 8,683 therms savings for gas-saving conversion participants.

Overall Gas Savings

Table 3-3 compares reported gas savings for 2011 IRP goals against evaluated savings, drawn from our analysis. The 2011 Low-Income portfolio achieved savings of nearly 36,000 therms, resulting in approximately 55% of IRP's savings goals.

Table 3-3. Overall Evaluated Gas Savings and IRP Goals

State	Total Customers	IRP Goal (Therms)	Evaluated Gas Savings (Therms)	Goal Achievement
Idaho	104	19,500	12,835	66%
Washington*	248	45,500	23,042	51%
Overall	352	65,000	35,877	55%

* Includes 138 participants receiving model savings, and 110 conversion customers.

Recommendations

The impact evaluation revealed several areas where program performance and savings accuracy could be improved. Consequently, we recommend Avista consider the following:

[13] The program participant database did not indicate water heater conversions were replaced with efficient units; therefore, no additional gas savings were applied.

- Standardize expected savings calculations between states;
- Account for additional factors in savings calculations, such as historical consumption, interaction effects, square footage, and primary heating sources;
- Track alternative heating sources in homes;
- Include high-use customers in program participant targeting;
- Conduct further impact analysis, focused on use of a comparison group and estimating savings at the measure-level;
- Perform quality checks on expected savings estimates; and
- Consider analyzing easy-to-quantify, non-energy benefits, which can be added to program cost-effectiveness reporting.

3.1 Introduction

In 2010, Cadmus conducted a statistical billing analysis, determining adjusted gross savings and realization rates for energy-efficient measures installed through the Low-Income Weatherization Program. Analysis and results were performed at the household or participant level, rather than the measure level. In this report, we apply these savings estimates to the 2011 participant population and report total gas impacts associated with the 2011 program year.[14]

To estimate 2010 energy savings resulting from the program, Cadmus used a pre- and post-installation, combined CSA and PRISM approach, using monthly billing data. We analyzed savings estimates for Idaho and Washington, and ran a series of diagnostics, such as a review of savings by pre-consumption usage quartile, and outlier analysis. A detailed discussion of the regression model and methodology used for this analysis can be found in Avista's 2010 Gas Impact Report.

3.1.1 Program Description

Five programs comprise the Low-Income Weatherization Program, listed in Table 3-4. Local Community Action Partners (CAPs), within Avista's Idaho and Washington service territories, implement all these low-income programs. CAPs holistically evaluate homes for energy-efficiency measure applicability, combining funding from different programs to apply appropriate measures to a home, based on results of a home energy audit.

While both states operate very similar weatherization programs, each state has individual programs, with different, sovereign statewide administrators, implementation agencies, and weatherization protocols. Table 3-4 describes the measures installed under each program component, along counts of gas measures installed in PY 2011, and included in our gas impact analysis (findings on evaluated electric measures are contained in a separate report).

[14] Due to time constraints imposed by the filing schedule (not allowing a full year of usage data to be accrued for a billing analysis of 2011 participants), we felt it appropriate to extrapolate results from the recent 2010 gas impact analysis to the 2011 participants for this report.

Table 3-4. 2011 Gas Efficiency Installations by Program Component

Low-Income Program Component	Measure Description	Measure Installations
Shell/Weatherization	Insulation, window/door installation, air infiltration, programmable thermostat	924
Hot Water Efficiency	High-efficiency water heater replacement	1
HVAC Efficiency	High-efficiency gas furnace replacement	90

3.1.2 Data Collection

Cadmus primarily drew impact evaluation data from the program participant database. Avista provided information regarding program participants and installed measures for each state. Specifically, these data included lists of measures installed per home, and expected savings from each completed installation. The data, however, did not include the quantity of measures installed (such as the square footage of installed insulation) or per-unit savings estimates.

3.2 Methodology

3.2.1 Sampling

In applying the 2010 gas billing analysis results, we used a census of program participants, comprised of 242 gas accounts, and not including any of the 110 gas customers receiving conversion measures.

3.2.2 Data Collection Activities

Documentation Review/Database Review

Cadmus used the 2011 Idaho and Washington program participant database, provided by Avista, to develop a complete population for applying the 2010 billing analysis results. The participant data included: customer information; account numbers; types of measure installed; rebate amounts; measure installation costs; measure installation dates; and expected savings per measure.

Billing Analysis—CSA Modeling Approach

To estimate energy savings from this program, we used a pre-post CSA fixed-effects modeling method, which utilizes pooled monthly time-series (panel) billing data.

The fixed-effects modeling approach corrects for differences between the pre- and post-installation weather conditions as well as for differences in usage consumption between participants, including a separate intercept for each participant. Our modeling approach ensures model savings estimates will not be skewed by unusually high-usage or low-usage participants. Monthly consumption also is paired between pre- and post-months to maintain the same time frame for evaluating unique participants.

Additional details regarding the 2010 billing analysis can be found in the Avista 2010 Gas Impact Report.

3.3 Results and Findings

3.3.1 Overall Program Results

Applying state-level savings estimates from the billing analysis to the gas-saving participant program population achieved total therms savings of 27,194. Savings estimates were only applied to gas-savings participants not receiving conversion measures. Table 3-5 provides greater detail on overall savings calculations by state.

Table 3-5. Non-Conversion Gas Savings by State

State	Total Participants	Average Expected Savings Per Participant (Therms)	Model Savings Per Participant (Therms)	Realization Rate
Idaho	104	305	123	41%
Washington	138	361	104	29%
Overall	242	337	112	33%

We compared average expected measure savings, and noticed some discrepancies between the two states. Table 3-6 provides average expected savings for each installed gas measure, by state.

Table 3-6. 2011 Average Expected Savings by Measure and by State

Measures	Expected Therms Savings		Number of Installations	
	ID	WA	ID	WA
Wall Insulation	239	250	12	43
Duct Insulation	222	89	18	13
Floor Insulation	207	117	44	78
Doors	89	52	38	58
Air infiltration controls	89	142	95	103
Attic Insulation	82	82	37	106
Windows	22	22	37	60
High-efficiency furnace replacement	N/A	123	N/A	8
High-efficiency water heater replacement	N/A	11	N/A	1
T-stat (No AC)	N/A	31	N/A	2
T-stat (AC)	N/A	31	N/A	1

Note: Frequencies reflect all gas savings measures from gas-saving participants not receiving conversion measures.

As shown, expected savings associated with duct and floor insulation were substantially higher in Idaho than Washington. Many expected savings estimates in 2011 appeared higher than those averaged from 2010 (which is discussed in more detail below). Generally, the measure mix was relatively similar for the two years. In both cases, agencies appeared to implement whole-house weatherization measures throughout participant homes.

The remaining 110 participants in Washington received electric to gas conversion measures, including high-efficiency gas furnaces and water heaters. Table 3-7 provides a distribution of all Avista-funded measure installations for the conversion participants.

Table 3-7. Measure Installations for Conversion Participants

Measure Description	2011 Frequency
Electric air infiltration controls	4
Electric doors	1
Electric refrigerator replacement	5
Electric windows	1
Electric water heater replacement	1
Electric attic insulation	2
Electric duct insulation	1
Electric floor insulation	2
Electric wall insulation	2
Electric furnace conversion	81
Electric water heater conversion	91
Gas air infiltration controls	36
Gas doors	19
Gas windows	23
Gas furnace replacement	82
Gas attic insulation	42
Gas duct insulation	3
Gas floor insulation	40
Gas wall insulation	15
Gas t-stat (no ac)	1

Over half of these 110 participants received water heater and high-efficiency furnace conversions (n = 65), while 16 only received high-efficiency furnace conversions, and 26 only received water heater conversions. These customers experienced a net increase in therm usage; however, based on Avista's approach to correcting for these impacts through its cost-effectiveness analysis, this report calculated therm savings associated with:

1. Installation of gas-savings weatherization measure bundles; and
2. Furnace conversion replacement, using high-efficiency gas equipment, compared to standard gas equipment.[15]

In the 2010 report, very few additional gas-saving weatherization measures were installed in conversion participant households; so therm savings were only applied to conversion participants installing high-efficiency gas furnaces. To account for gas savings experienced through high-efficiency furnace replacement, we used savings calculated through the 2010 evaluation of Avista's residential furnace replacement program (84 therms for Washington participants), and

[15] Electric savings associated with conversion measure installations will be addressed in the 2010–2011 Avista Electric Impact Report.

scaled this value to reflect low-income participant home square footage, thus resulting in 61 therms.[16]

Due to the mix of additional gas-savings weatherization measures that conversion participants received, we adjusted the 2010 impact analysis approach. Of 110 conversion participants, three categories were identified for attributing savings:

- Full model savings (104 therms per Washington participant) were assigned to:
  - Participants with four or more distinct gas-saving measures (including high-efficiency gas furnaces) (n = 46); and
  - Participants with two distinct gas-savings measures (not including high-efficiency gas furnaces) (n = 3).
- Furnace-specific savings (61 therms per participant) were assigned to participants with two or less measures (including high-efficiency gas furnaces) (n = 59).
- No savings were applied to participants only receiving one (non-furnace) gas-saving measure (n = 2).

Table 3-8 provides overall gas savings by state, including savings attributed to fuel conversion participants receiving gas-saving measures.

Table 3-8. Overall Gas Savings by State

State	Total Model Savings (Therms)	Conversion Participant Savings (Therms)	Total Savings (Therms)	Total Expected Savings (Therms)	Realization Rate
Idaho	12,835	N/A	12,835	31,675	41%
Washington	14,359	8,683	23,042	77,381	30%
Overall	27,194	8,683	35,877	109,056	33%

3.3.2 Goals Comparison

We compared evaluated savings for the 352 gas participants against Avista's IRP goals. Table 3-9 summarizes overall evaluated savings, IRP savings goals, and achievement rates, overall and by state. In all, the low-income weatherization program achieved approximately 55% of its gas savings goals.

[16] For Washington, low-income participants averaged 1,250 square feet per home, while single-family participants averaged 1,728 square feet per home.

Table 3-9. IRP Program Goals Comparison

State	Total Customers	Reported Savings (Therms)	Evaluated Gas Savings (Therms)	Goal Achievement
Idaho	104	19,500	12,835	66%
Washington*	248	45,500	23,042	51%
Overall	352	65,000	35,877	55%

* Includes 138 participants receiving model savings, and 110 conversion customers.

3.4 Conclusions

Changes in Avista's expected savings calculations have affected differences in realization rates, when comparing 2010 and 2011 results. Table 3-10 compares average per-participant expected savings.

Table 3-10. Expected Savings Comparison of 2010 and 2011 Participants*

State	Expected Savings (Therms)		Percent Change
	2010	2011	
Idaho	207	305	47
Washington	347	361	4
Overall	293	337	15

* Average expected savings are only provided for gas-savings, non-conversion participants from the 2010 final model and 2011 gas-saving, non-conversion participants.

As shown, a significant increase in expected savings occurred in Idaho between 2010 and 2011, while Washington's average per participant expected savings remained fairly constant.

Table 3-11 compares average, measure-specific, expected savings estimates by state for 2010 and 2011.

Table 3-11. Average Measure-Level Expected Savings by State and Year (in therms)

Measures	Idaho		Washington	
	2010	2011	2010	2011
Wall Insulation	75	239	155	245
Duct Insulation	42	222	68	105
Floor Insulation	88	207	131	119
Doors	23	22	24	22
Air infiltration controls	46	89	83	133
Attic Insulation	59	82	184	79
Windows	132	89	54	53
High-efficiency furnace replacement	N/A	N/A	150	123
High-efficiency water heater replacement	N/A	N/A	11	11
T-stat (No AC)	N/A	N/A	N/A	31
T-stat (AC)	N/A	N/A	N/A	31

As shown, few measure-level savings estimates appeared constant across program years or states.

The 2010 Gas Impact Report presented recommendations for standardizing expected savings calculations, and for accounting for factors to achieve more robust savings estimates. These factors included:

- Historical consumption;
- Square footage;
- Primary and alternative heating sources; and
- Interaction effects.

We were not provided with detail regarding how expected savings estimates were modified, or whether they accounted for the factors listed above. It appears, however, that changes to these calculations had different effects on the previous savings estimates by state (i.e., resulting in increased per participant savings in Idaho, and decreased per participant savings in Washington).

Aside from the expected savings calculations, differences in distributions of measures installed in each program year likely contributed to changes in expected savings estimates between years.

Additional details regarding conclusions from the 2010 billing analysis can be found in the Avista 2010 Gas Impact Report.

3.5 Recommendations

The following subsections outline our suggestions for enhancements to help improve program impact results.

- **Standardize Expected Savings Calculations**. Standardizing expected savings calculations across both states will help avoid wide discrepancies in realization rates.
- **Account for Additional Factors in Savings Calculations.** Accounting for pre-period annual consumption, square footage, and interaction effects will help create a more robust savings estimate, and avoid overestimates that could occur through a prescriptive application of deemed estimates.
- **Track Alternative Heating Sources.** As inexpensive alternatives to gas heat, gas customers may turn to electric room heaters and wood stoves, thereby reducing impacts of weather-sensitive measures installed through weatherization (e.g., insulation). Collecting information on customers' primary heating usage at the time of weatherization will allow more reasonable estimates where gas is used as a secondary heating source.

  We recommend working with agencies to develop explicit, on-site tracking protocols for collecting information on participant heating sources. Agencies 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.

- **Perform Quality Checks on Expected Savings Estimates.** Avista claims changes were made to expected savings calculations starting in 2011, which is evident when comparing these estimates between program years; however, it appears additional quality checks on values will strengthen the robustness and reliability of these estimates. Specifically, Avista should screen savings relative to historical consumption, making certain the percent of savings is no more than 100% of typical annual usage, and most non-conversion projects experience no more than 50%. Typically, savings over 30% as a percent of pre-period usage is considered high, and may indicate other changes occurring within a household, aside from weatherization provided through the program (e.g., changes in occupancy, take-back, change in heating/cooling usage).

- **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 with particularly high energy consumption. In fact, DOE and Washington state 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 are equipped to incorporate energy-consumption characteristics into their program participant prioritization. Not only would weatherizing high-use customers likely result in higher energy savings, it is possible some customers are overly burdened with energy bills, due to their housing characteristics, and the program could provide some relief.

  Methods exist for identifying high-usage customers, while controlling for factors contributing to consumption (e.g., square footage, income, number of people per household). Using such an approach would allow Avista to identify high-use customers.

- **Consider Performing Quantitative Non-Energy Benefit Analyses.** With respect to ongoing Advisory Group discussions surrounding quantifying non-energy benefits, we recommend Avista consider pursuing additional analyses, aimed at quantifying some non-energy benefits associated with low-income weatherization that are applicable to the TRC test. In particular, analyses of economic impacts and payment pattern improvements (including reduced arrearages and collections costs) can produce monetized values of benefits to program stakeholders; these have been used other utilities reporting low-income weatherization cost-effectiveness in both Idaho and Washington. While standard cost-effectiveness testing using the TRC test accounts for all program costs, only including energy savings as program benefits clearly omits some genuine non-energy benefits experienced by participants (as discussed in greater detail in the 2010 Process Evaluation).

3.5.1 Recommended Possible Future Analysis

- **Conduct Further Gas Impact Analysis: Measure-Level Impacts.** As Avista attempts to refine its expected savings estimates, performing a billing analysis aimed at specific measure-level impacts will help develop reasonable ranges for benchmarking these estimates. Through increasing the participant sample available for billing analysis, modeling measure-specific savings estimates becomes more reliable. Measures such as heating system replacements and major weatherization (insulation and air sealing) will likely generate large energy savings, relative to total household energy consumption, and can be more easily estimated through billing analysis.

- **Analyze Easily Quantified Non-Energy Benefits for Cost-Effectiveness Reporting.** Recommended non-energy benefit analyses were included in the 2010 Gas Impact report, and have been briefly discussed with Avista over the past year. In light of the increased emphasis on program cost-effectiveness as well as the inclusion of non-energy benefits (e.g., economic impacts, payment impacts) by other Idaho and Washington utilities, we recommend revisiting the discussion to address some of these analyses in more detail, and to determine any of these analyses to be pursued with further research.

Appendix 1A: Residential Weatherization Measures Billing Model Outputs

The following tables summarize model result outputs[17] from our billing analysis of PY 2010 and January 2011 participants.

Table A1. Weatherization Measure Savings Regression Model (Overall Savings)

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	13	45208	3477.5101	4265.41	<.0001
Error	19234	15681	0.81528		
Corrected Total	19247	60889			
Root MSE	0.90293		R-Square	0.7425	
Dependent Mean	2.42E-17		Adj R-Square	0.7423	
Coeff Variable	3.73E+18				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AVGHDD	1	0.10507	0.00428	24.54	<.0001
POST * AVGHDD	1	-0.01142	0.00059987	-19.01	<.0001
Feb	1	-0.08351	0.03434	-2.43	0.015
Mar	1	-0.325	0.04688	-7.02	<.0001
Apr	1	-0.65081	0.0735	-8.94	<.0001
May	1	-0.79757	0.1091	-7.4	<.0001
Jun	1	-0.72477	0.13843	-5.34	<.0001
Jul	1	-0.58576	0.15259	-3.94	0.0001
Aug	1	-0.57488	0.15425	-3.83	0.0002
Sep	1	-0.73161	0.1368	-5.44	<.0001
Oct	1	-0.7923	0.08346	-9.58	<.0001
Nov	1	-0.40127	0.04453	-9.06	<.0001
Dec	1	-0.1275	0.03283	-3.85	0.0001

[17] We ran all models with a fixed-effects specification, which has a separate intercept for each participant. Due to the large amount of output resulting from showing model coefficients for each intercept, we only present the average of all separate intercepts in the output.

Appendix 1B: Residential ENERGY STAR Home Model Inputs

The following table summarizes the inputs used to simulate homes in Washington and Idaho.

Table B1. ENERGY STAR, Washington, and Idaho Construction Standards for New Homes

Measure	Type	ENERGY STAR® Home	WA Code - Climate Zone II, R-3	ID Code - IECC 2006 Zone 5
Insulation	Ceiling	R-38	R-38	R-38
	Wall	R-19	R-19 + R-5	R-19
	Floors Over Unconditioned Space	R-30	R-30	R-30
	Slab Floors	R-10	R-10	R-10
Windows & Doors	Windows	0.35	0.35	0.35
	Max Glazing Area	0.21	Unlimited	Set to ENERGY STAR standards
	Doors	R-5	0.2 U-factor	Set to ENERGY STAR standards
Ducts	Insulation	R-8	R-10	R-8
	Sealing	Mastic only	Tapes allowed	Tapes allowed
	Max Leakage	<0.06 CFM/sqft or 75 CFM total @50Pa	Set to ENERGY STAR standards	Set to ENERGY STAR standards
Ventilation & Air Sealing	Ventilation System	Exhaust ventilation	Exhaust ventilation	Exhaust ventilation
	Envelope Tightness	0.35 normal ACH	0.35 normal ACH	0.35 normal ACH
Heating & Cooling Equipment	Gas Furnace	90 AFUE	78 AFUE	80 AFUE
	Air Conditioner	SEER 13	SEER 13	SEER 13

Appendix 1C: Electricity Savings Achieved by the Gas Program

The following table shows the electricity saved in kWh by the 2011 gas energy efficiency programs. The believed high penetration of electric dryers in homes with gas domestic hot water heating is the reason for the significant savings achieved. The electricity saved through the installation of an efficient dishwasher is associated with the machine operation, not water savings. The 2010 gas furnace billing analysis showed that a portion of participants are choosing 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. The electricity saved through the installation of efficient windows was determined through a billing analysis and is associated with a reduction in the summer cooling load.

The values shown in the table are for all measure installations, both inside and outside Avista's electric service territory.

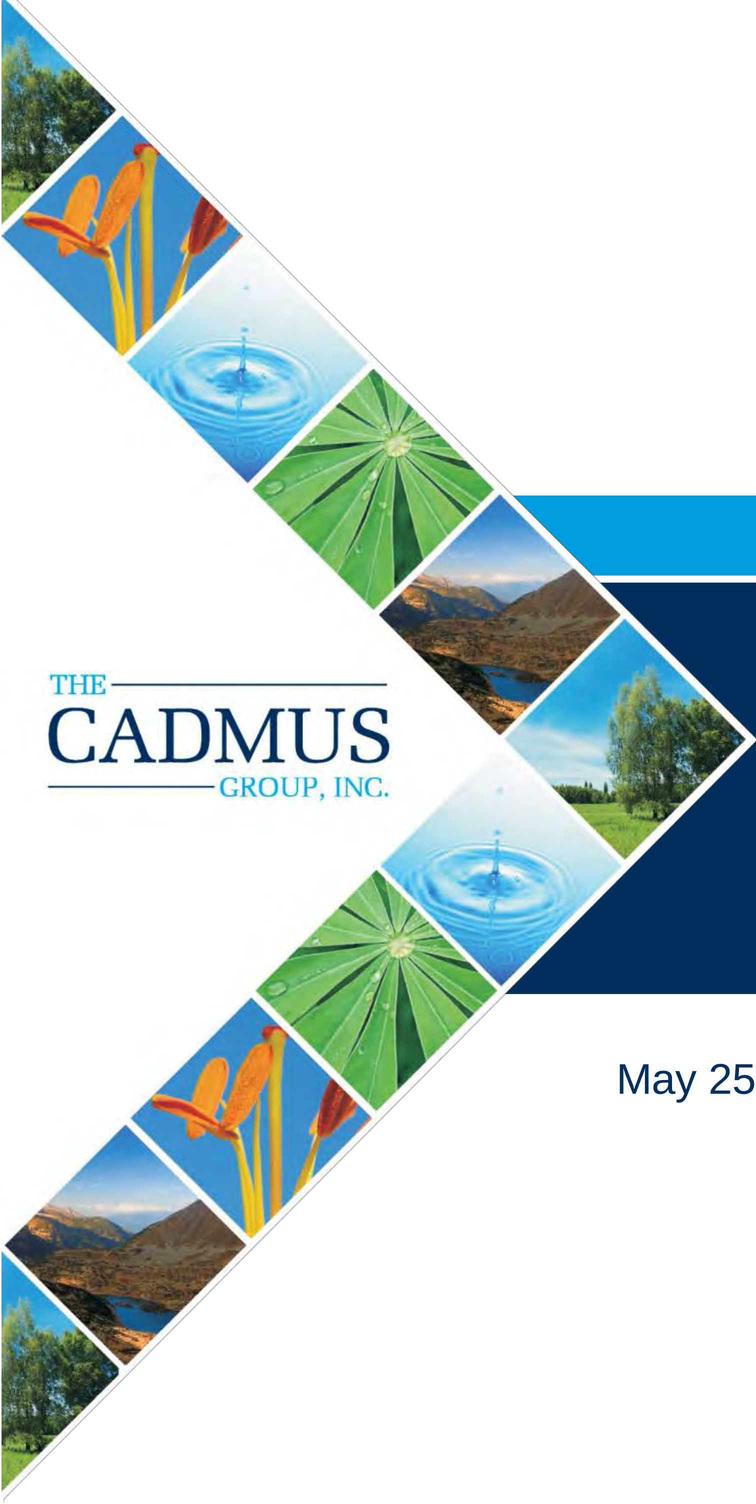
Measure Name	Measure Count	UES (kWh)	Total Savings (kWh)
G CLOTHES WASHER-NAT GAS H20	2,499	318	794,682
G DISHWASHER-NAT GAS H20	1,700	22	37,825
G NAT GAS FURNACE	2,930	-165	-483,743
G WINDOWS (kWh)	1,620	86	139,320
TOTAL	8,749		488,084

Appendix 3

Avista 2010-2011 Multi-Sector Electric Impact Evaluation Report

May 25, 2012

The Cadmus Group, Inc.



Avista 2010–2011 Multi-Sector Electric Impact Evaluation Report

May 25, 2012

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PORTFOLIO EXECUTIVE SUMMARY

The Cadmus Group, Inc. was contracted by Avista Corporation to complete process and impact evaluations of the 2010 and 2011 gas and electric demand-side management (DSM) programs. This report only presents our impact findings for the PY 2010-2011 electric portfolio.

Evaluation Activities

For each of the three sectors—residential, nonresidential, and low-income— plus the Contingency Program, we employed a variety of evaluation methods and activities. These are shown in Table ES-1.

Table ES-1. 2010-2011 Electric Programs Evaluation Activities

Sector	Program	Document/ Database Review	Metering	Verification 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	✓		✓	✓		
	Renewables						
Nonresidential	Prescriptive Programs	✓	✓	✓	✓	✓	
	Site-Specific	✓	✓	✓	✓	✓	✓
	EnergySmart Grocer	✓	✓	✓	✓		
Low-Income	Low-Income Programs	✓				✓	
Residential/ Nonresidential	CFL Contingency	✓			✓		

Key Findings and Conclusions

Residential

For PY2010 and PY2011, Avista's residential electric programs produced 76,928,027 kWh in savings (33,491,536 kWh from the CFL Contingency Program and 43,436,491 kWh from all other programs), which yielded an overall realization rate of 83%. All residential electric savings achieved 184% of IRP goals.

The major residential program conclusions are:

- Overall, residential electric program customers responded well to the programs and often installed several measures within the same program year.
- Avista's program and tracking databases were sufficient for evaluation purposes, providing adequate contact, measure and savings information. The database review confirmed that the information was reliable and accurate.
- All measures rebated through the program were installed and were operating. With only a few minor exceptions, all measures were determined to meet program qualification standards.

Nonresidential

The Cadmus team evaluated 223 of 4,215 measures installed through the program, representing 29% of reported savings.

For PY2010 and PY2011, Avista's nonresidential electric programs produced 104,060,197 kWh in savings (6,972,374 kWh from the CFL Contingency Program and 97,087,824 kWh from all other programs), which yielded an overall realization rate of 96%. All nonresidential electric savings achieved 118% of IRP goals.

Cadmus identified the following key findings that adjusted energy savings:

- Some participants did not operate the incented equipment correctly or did not complete the improvements expected for the measure.
- Some participant heating or cooling loads did not achieve the level projected for post-installation usage.
- Some simulation models did not accurately represent the actual as-built building or system operation.
- HVAC fan VFD deemed savings estimates may have been too conservative and were based on an older study from 1995.
- Avista implementation staff may not have conducted thorough analysis of energy savings calculations provided by participants or third-party contractors for all projects.
- Avista implementation staff made errors on some projects in entering data to characterize building or measure performance.
- Cadmus could have streamlined the sampling process if Avista's database had recorded site addresses and contact information. Having measure-level data, such as specific measure type and quantity, for each project would have improved the range and depth of our evaluation activities.

Low-Income

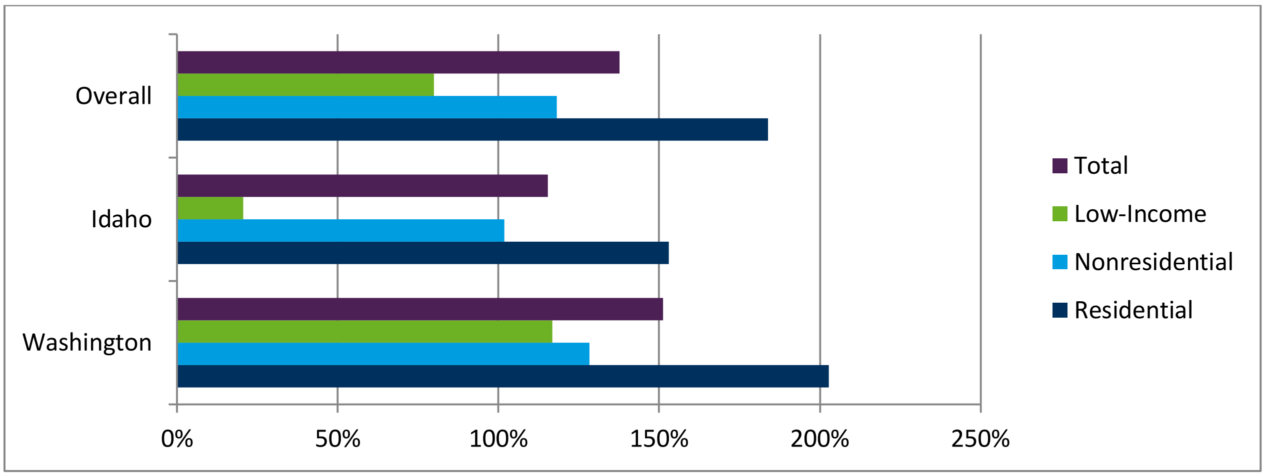
For PY2010 and PY2011, Avista's low-income electric programs produced 3,225,929 kWh in savings, which yielded an overall realization rate of 66%. Low-income electric savings achieved 80% of IRP goals.

Billing analysis results for electric (non-conversion) and conversion participant impacts yielded high levels of precision. To place Avista program savings estimates in context, we compared billing analysis results from other low-income weatherization efforts from across the country. Avista's results were on the higher end of the range of values.

Savings Results

Figure ES-1 displays the portfolio achieved gross savings relative to reported goals by sector, state, and overall. All sectors in both states achieved the stated goals except for Idaho's Low-Income Program. The portfolio overall achieved 138% of the stated goals.

Figure ES-1-1. Gross Achieved Savings Percentages of IRP Goals



The following two tables show sector-level gross savings values and realization rates compared to reported savings and IRP goals (CFL Contingency savings are included in the residential and nonresidential sector totals).

Table ES-1-2. 2010-2011 Reported and Gross Verified Savings by State and Sector (kWh)

Sector	Washington			Idaho			Total		
	Expected Savings	Gross Verified Savings	Real-ization Rate	Expected Savings	Gross Verified Savings	Real-ization Rate	Expected Savings	Gross Verified Savings	Real-ization Rate
Residential	63,340,690	52,463,788	83%	29,838,695	24,464,240	82%	93,179,385	76,928,027	83%
Nonresidential	73,583,693	69,837,841	95%	34,549,236	34,222,356	99%	108,132,929	104,060,197	96%
Low-Income	3,749,264	2,910,327	78%	1,156,559	315,602	27%	4,905,823	3,225,929	66%
Total	140,673,647	125,211,956	89%	65,544,490	59,002,198	90%	206,218,137	184,214,154	89%

Table ES-1-3. 2010-2011 IRP Goals and Gross Verified Savings by State and Sector (kWh)

Sector	Washington			Idaho			Total		
	Savings Goal	Gross Achieved	% Achieved	Savings Goal	Gross Achieved	% Achieved	Savings Goal	Gross Achieved	% Achieved
Residential	25,871,685	52,463,788	203%	15,986,226	24,464,240	153%	41,857,911	76,928,027	184%
Nonresidential	54,405,239	69,837,841	128%	33,617,010	34,222,356	102%	88,022,249	104,060,197	118%
Low-Income	2,492,905	2,910,327	117%	1,540,377	315,602	20%	4,033,282	3,225,929	80%
Total	82,769,829	125,211,956	151%	51,143,613	59,002,198	115%	133,913,442	184,214,154	138%

In summary, the 2010-2011 electric portfolio achieved a realization rate of 89% of reported savings, and a 138% of the IRP goals. The great majority of claimed installations were verified. The major driver in the derived values of the realization rates was the change in per unit savings as a result of the evaluation. The nonresidential sector had the highest realization rate of 96% from reported savings, but the residential sector had the highest goal achievement rate of 184% of Avista IRP goals. Washington had higher goal achievement overall at 151%.

Recommendations and Further Analysis

Residential

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.
- Move all clothes washer rebates to the electric program unless there is a large penetration of gas dryers. Forthcoming Residential Building Stock Assessment data can support future analysis.
- Include a SEER requirement to increase savings for high-efficiency heat pump participation. Consider continuing the Variable Speed Motor measure in conjunction with any change to equipment efficiency requirements. Often, an electrically commutated motor (ECM) is standard on the highest efficiency heat pump systems.
- Consider restricting dual fuel customers who acquire multiple rebates that have interactive effects. If program changes are made to reduce the participation of dual fuel customers in certain measure categories, future evaluation activities should reassess the participant penetration of the dual fuel home.
- 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 estimating savings and incenting systems separately for all-electric heating systems.

- Consider tiered incentives by SEER rating as higher SEER systems generally require ECM fan motors to achieve certain SEER ratings.

The following are recommended future research areas for this program:

- Perform a review of all available secondary research and/or collect primary data on the penetration of gas heated clothes dryers within Avista's gas territory.
- Perform a targeted billing analysis on weatherization participants that use both electricity and gas to heat their home.
- 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.
- Identify new, cost-effective measures that can be added to portfolio.

Nonresidential

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 effectiveness of the evaluations:

- Avista should create a quality control system to double-check all projects with savings over 300,000 kWh. An Avista EM&V engineer reported he has begun to review these types of projects.
- Avista should consider performing three- to six-month post-installation random inspections to confirm measure persistence and to identify opportunities to improve performance.
- Avista should consider conducting future studies to quantify less conservative assumptions for HVAC fan VFD deemed savings estimates.
- Avista should consider revising its methodology for calculating and tracking HVAC/lighting interactive effects.
- Avista should consider adding a program for recommissioning measures that were identified as non-functional during the previous year's evaluation process and report the energy savings these measures achieve in the subsequent year.

Low-Income

The impact evaluation revealed several areas where program performance and savings accuracy could be improved:

- Standardize calculation of expected savings between states and agencies.
- Work with Idaho agencies to provide refrigerator replacements.
- Perform quality checks on expected savings estimates.
- Track alternative heating sources.
- Consider performing quantitative, non-energy benefit analyses.

- Include high-use customers in program targeting.

Recommendations for possible future analysis include:

- Consider additional analyses of measure-level impacts. Billing analysis is used for estimating whole-house energy savings and measure-level savings, given a sufficient sample and large energy savings relative to household consumption.
- Consider undertaking a non-energy benefits estimation task.

1 2011 Residential Electric Impact Report

Executive Summary

Avista's residential electric demand-side management (DSM) programs reported savings of 48,361,828 kWh during the 2010 and 2011 program years. This report explains the methods undertaken to qualify and verify these savings. The PY 2010 and 2011 DSM residential electric programs are Simple Steps, Smart Savings™; Second Refrigerator and Freezer Recycling; ENERGY STAR® Products; ENERGY STAR Homes; Heating and Cooling Efficiency; Space and Water Conversions; Water Heating; and Weatherization and Shell Measures. Cadmus reviewed every prescriptive measure with the one exception of photovoltaic installations.

Evaluation Methodology

Evaluation methods and activities employed are displayed in Table 1-1.

Table 1-1. 2011 Residential Electric Programs Evaluation Activities

Sector	Residential Program	Document/ Database Review	Verification Site Visit	Survey	Metering	Billing Analysis	Modeling
Residential	Simple Steps, Smart Savings™	✓					
	Second Refrigerator and Freezer Recycling	✓		✓			
	ENERGY STAR Products	✓	✓	✓			
	Heating and Cooling Efficiency	✓	✓	✓	✓		
	Space and Water Conversions	✓	✓	✓			
	Weatherization and Shell Measures	✓	✓	✓		✓	
	Water Heating	✓	✓	✓			
	ENERGY STAR® Homes	✓	✓	✓			✓
	Residential Renewables						

Energy Savings

Cadmus adjusted the claimed savings to reflect updated values following our engineering analysis and reference to recent studies. We found significant changes in savings for all programs. Some changes were due to updating baseline and measure levels of efficiency to meet changes in federal and ENERGY STAR standards. Other changes were the result of specific activities completed as part of this evaluation, such as site visits to confirm measure installation and qualification, a billing analysis to investigate the impact of the installation of insulation or windows on energy consumption, and metering of residential heat pumps to understand annual consumption patterns and savings achieved through high-efficiency installations.

The aggregated adjusted gross savings and resulting realization rates for each program are shown in Table 1-2. Overall, the residential electric programs achieved an adjusted gross realization rate of 90%.

Table 1-2. Reported and Adjusted Gross Savings

Program Name	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rates
Simple Steps, Smart Savings™	18,097,253	24,601,728	136%
Second Refrigerator and Freezer Recycling	4,529,827	4,054,783	90%
ENERGY STAR Products	3,000,261	3,623,509	121%
Heating and Cooling Efficiency	9,432,431	4,743,627	50%
Space and Water Conversions	3,169,151	3,577,879	113%
Weatherization/Shell	8,993,856	2,164,907	24%
Water Heating	312,156	124,460	40%
ENERGY STAR Homes	688,267	406,972	59%
Residential Renewables	138,626	138,626	100%
PROGRAM TOTAL	48,361,828	43,436,491	90%

Table 1-3. Reported and Adjusted Gross Savings by State

	Washington			Idaho		
Program Name	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rates	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rates
Simple Steps, Smart Savings™	12,064,835	16,401,152	136%	6,032,418	8,200,576	136%
Second Refrigerator and Freezer Recycling	3,421,329	3,062,439	90%	1,108,498	992,344	90%
ENERGY STAR Products	2,016,007	2,444,129	121%	984,254	1,179,380	120%
Heating and Cooling Efficiency	5,616,729	2,751,306	49%	3,815,702	1,992,321	52%
Space and Water Conversions	2,245,319	2,463,378	110%	923,832	1,114,501	121%
Weatherization and Shell Measures	6,064,022	1,447,434	24%	2,929,834	717,472	24%
Water Heating	253,253	100,997	40%	58,903	23,463	40%
ENERGY STAR Homes	539,437	336,246	62%	148,830	70,726	48%
Residential Renewables	109,143	109,143	100%	29,483	29,483	100%
PROGRAM TOTAL	32,330,075	29,116,224	90%	16,031,753	14,320,267	89%

Table 1-4. Avista 2010 and 2011 DSM Programs Participation Counts

Program	Washington Measure Count	Idaho Measure Count	Total Measure Count
Simple Steps, Smart Savings™ (Units Sold)	523,677	261,839	785,516
Second Refrigerator and Freezer Recycling	2,939	952	3,891
ENERGY STAR Products	14,907	7,229	22,136
Heating and Cooling Efficiency	3,730	2,120	5,850
Space and Water Conversions	321	120	441
Weatherization and Shell Measures	4,717	1,891	6,608

Program	Washington Measure Count	Idaho Measure Count	Total Measure Count
Water Heating	848	197	1,045
ENERGY STAR® Homes	261	45	306
Residential Renewables	26	7	33
Total Measures	551,426	274,400	825,826

Cadmus verified that a total of 43,436,491 kWh have been saved through the installation of 825,826 measures during PY 2010 and 2011 of the electric DSM programs.

1.1 Introduction

We designed our impact evaluation to verify reported program participation and energy savings. For the evaluation, we used data collected and reported in the tracking database, online application forms, phone surveys, on-site visits, on-site metering, billing analyses, and applicable updated deemed savings values.

1.2 Methodology

1.2.1 Sampling

Site Visit Sampling

Cadmus randomly selected participants for verification site visits from the 2010 and 2011 electric program population and the 2011 gas program population. Participants were scheduled by Cadmus staff via telephone. If a selected participant could not be reached or refused to participate in the site visit, then we selected a replacement within the same geographic region from the backup sample. Each recruited site visit participant received a $25 gift card in appreciation for making time for this evaluation.

A participant was initially sampled using one measure record. However, if a customer received multiple rebates during the program year, then all measures for both fuels were verified during the site visit.

Table 1-5 shows that Cadmus completed site visits at 174 homes, which covered 258 unique measures across both program fuels.

Table 1-5. Electric Measure Site Visits Completed

Total Homes Visited	174
Total Measures Verified	258

Survey Sampling

The participant sampling plan was based on multiple factors, including feasibility of reaching customers, program participant population, and research topics of interest. Customer fuel type was not a factor in survey sampling.

Cadmus did not conduct participant surveys with Simple Steps, Smart Savings customers, as this is an upstream program and therefore does not track participant contact information. Similarly, for ENERGY STAR Homes, we surveyed the builders, not the buyers.

Table 1-6- shows the number of surveys achieved, and the resulting absolute precision for each program.

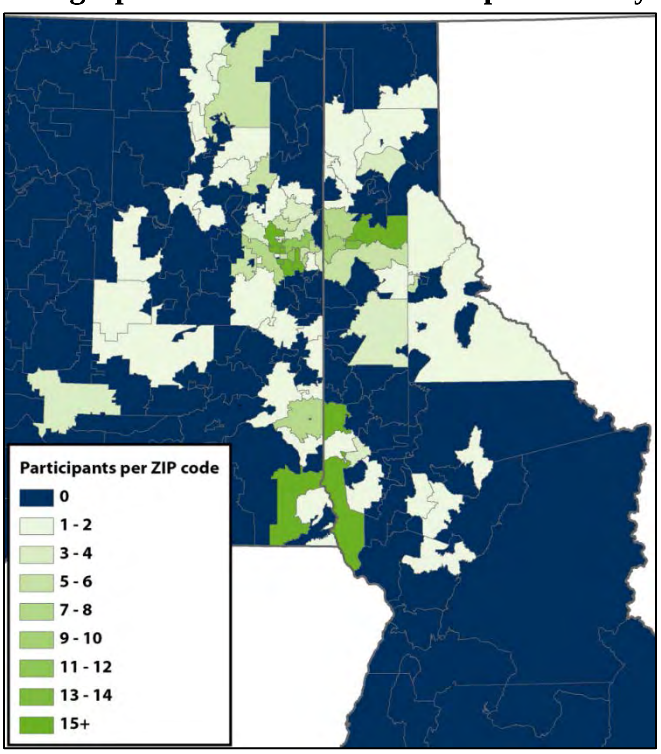
Table 1-6. Participant Survey Sample Sizes and Savings-Weighted Precision Estimates by Program (Both Gas and Electric Participants)

Program	Total Program Participants	Survey Completes	Absolute Precision at 90% Confidence
ENERGY STAR® Products	10,983	79	±9.3%
Heating and Cooling Efficiency	4,156	126	±7.2%
Weatherization and Shell Measures	3,981	72	±9.6%
Home Energy Audit Pilot	664	56	±10.3%
Second Refrigerator and Freezer Recycling	1,903	74	±9.3%
Space and Water Conversions	314	57	±9.1%
Overall	22,001	464	±5.2%

Not surprisingly, the geographic distribution of survey respondents was clustered around urban centers, especially the cities of Spokane, Pullman, Moscow and Lewiston, shown in Figure 1-1.

Additional specific surveys were completed as part of the CFL Contingency Plan impact analysis and are discussed in more detail in Chapter 4.

Figure 1-1. Geographic Distribution of Participant Survey Completes



1.2.2 Data Collection and Analysis

Site Visits
The on-site verification of measures included visually inspecting the measure(s), verifying documentation, ensuring that the unit is still operable, recording make and model information, recording home characteristics, and determining program qualification. Specific details on our verification and analysis activities for each measure are included in the Program Results and Findings section below.

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 measures that were incorrectly classified and measures with duplicate records because rebates were paid in two parts. Cadmus reported all cases to Avista. Specific adjustments are described in detail later in the report. In most cases, we made measure count adjustments to correct inconsistencies.

Metering
Cadmus metered 79 high-efficiency air source heat pump installations. We used the metered data to estimate the unit's annual heating and cooling consumption and its annual energy savings.

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 billing data to determine the adjusted gross savings and realization rates for electric weatherization/windows in PY 2010 and PY 2011. We used a pre- and post-installation combined Conditional Savings Analysis (CSA) and Princeton Score Keeping Method (PRISM) approach.

1.2.3 Verification Rates
Cadmus determined verification rates for each program, but not for each measure. 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 a 100% verification rate for the programs.

1.2.4 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 site visit verification sample. One was a floor insulation project in which the base case condition 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:

1. Review program database to determine if the adjusted measure counts correctly represent the number of installations.
2. Conduct a phone survey or site visit to verify that the installation is within Avista’s service territory.
3. Calculate verification and qualification rates.
4. Calculate deemed measure savings for products rebated during the program period.
5. 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 the utility's 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 finding 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 CFL Contingency Program (discussed in Chapter 4).

This program incents various CFL products from standard twist bulbs 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.

Analysis

Similar to CFL Contingency Program, 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:

CFL Watts = Wattage of the CFL

DWM = Delta watt multiplier, or the difference in wattage between baseline bulb and the CFL divided by the wattage of the CFL

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

DAYS = Days per year, 365

WHF = Waste heat factor is the 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 (CFL Watts) and Multiplier (DWM)

According to Avista's reported sales, the program incented over 832,000 CFLs, as shown in Table 1-7. We reviewed Avista's sales database and were able to verify roughly 785,000 CFLs. 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 claimed number CFLs.[1]

Table 1-7. Total Reported and Evaluated CFLs Sold by Year

Program Year	Reported			Evaluated		
	Twist	Specialty	Total	Twist	Specialty	Total
2010	177,007	90,320	267,327	175,514	87,291	262,805
2011	394,858	169,841	564,699	367,134	155,577	522,711
Total	571,865	260,161	832,026	542,648	242,868	785,516

Avista sales data included CFL wattage, units sold, estimated kWh, and bulb type. CFL wattage came directly from the database for each bulb; however, 46,484 bulbs (less than 6% of the total) did not include wattage in the database. We used an average of each bulb type, standard, and specialty to estimate the missing wattage information. The average CFL wattage, weighted across PY 2010 and PY 2011, for standard twist and specialty, was 16.18 watts and 14.28 watts, respectively.

Cadmus relied on the RTF for both standard twist and specialty bulbs to determine the DWM. The DWM from the RTF workbooks was 2.60 for twist and 3.13 for specialty.[2] The product of the DWM and the average CFL wattage is the reduction in wattage achieved through the installation of the average CFL.

Hours of Use

Cadmus had estimated hours of use (HOU) for the CFL Contingency Program and applied the same HOU for this program to maintain consistency with both programs. Cadmus used a multistate modeling approach, which built on light logger data collected from studies in four states: Missouri, Michigan, Ohio, and Maryland.[3] Base on this multistate modeling approach, Cadmus calculated an average HOU of 2.45. This approach is calculated using ANCOVA model coefficients, drew from combined, multistate, multiyear data from recent CFL HOU metering studies. These data were combined into a regression model with HOU as the dependent variable.

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1 The database included two worksheets of sales and adjusted sale for each month.

2 The RTF DWM represents the 2011 baseline and does not include federal EISA impacts starting in 2012.

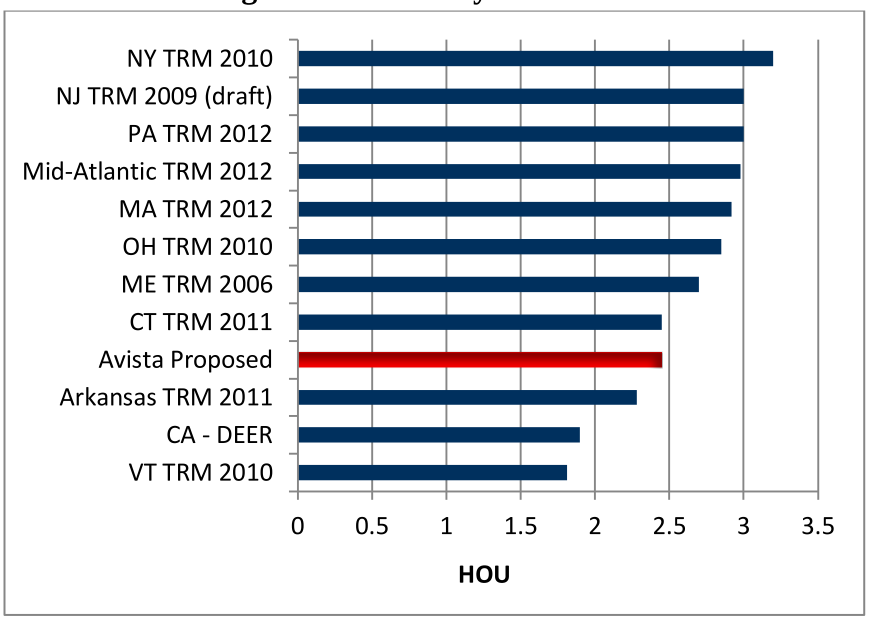
3 The Cadmus Group, Inc. *2010 Evaluation, Measurement, and Verification Report.* Dayton Power and Light. March 15, 2011

Explanatory variables included presence of children, existing CFL saturation, day type (weekend/weekday), and room type. The multistate model was used to estimate HOU by room type. The room type HOUs were then weighted using CFL Contingency surveys to calculate the program average HOU of 2.45.

We believe the HOU we estimated for the CFL Contingency Program is more appropriate for Avista's territory than other estimates available. It is important to compare Cadmus' estimate of HOU to other estimates used in the region. The RTF currently utilizes an HOU estimate of 1.9, which represents the average across ***all*** residential bulbs in California. Cadmus believes CFLs are placed in a higher use area than the average residential bulb and therefore do not support the use of 1.9 as the average CFL HOU. Cadmus advocates for the use of the multi-state study over the California study for the following reasons. The multi-state study controls not only for room type, but also for existing CFL saturation, the presence of children in the home, and day type (weekday/weekend). Not only does this result in more precise estimates than one would achieve by simply taking a weighted average, but it allows us to estimate a value more appropriate to Avista's customer base. The 2.45 hours per day results in an annual 895 hours per year.[4]

When compared to various technical reference manuals (TRMs) across the country, our value of 2.45 is in line and appears to be conservative compared with the TRMs as shown in Figure 1-2.

Figure 1-2. HOU By Jurisdiction



* VT TRM 2010: Projected estimate for 2011. Daily usage is DPS-VEIC agreement March 2009 (see ref doc). Based on November 2008 CFL Reduction Model. Annual operating hours are calculated as (Daily usage * 365). CA (DEER): 2008 metered evaluation of an average across all bulbs in CA. Arkansas TRM 2011: CFL METERING STUDY FINAL REPORT 2005, Pacific Gas & Electric Company, San Diego Gas & Electric Company, and Southern California

[4] Cadmus found a discrepancy between the RTF standard CFL workbook and the RTF specialty CFL workbook in terms of the number of days per year, 365 and 365.25 respectively. For consistency within Avista's CFL programs, we used 365 days for all bulb types.

Edison Company, 2005. CT TRM 2011: Residential Lighting Markdown Impact Evaluation, Nexus Market Research, January 20, 2009. Maine TRM 2006: Impact evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs. Nexus Market Research & RLW Analytics. October 1, 2004. OH TRM 2010 (draft): Based on weighted average daylength adjusted hours from Duke Energy, June 2010; "Ohio Residential Smart Saver CFL Program" MA TRM 2012: Nexus Market Research and RLW Analytics (2008). Residential Lighting Measure Life Study. Prepared for New England Residential Lighting Program Sponsors. Mid-Atlantic TRM 2012: Based on EmPOWER Maryland DRAFT 2010 Interim Evaluation Report; Chapter 5: Lighting and Appliances. PA TRM 2012: US Department of Energy, ENERGY STAR Calculator. Accessed 3-16-2009. NJ TRM 2009: US Department of Energy, ENERGY STAR Calculator. NY TRM 2010: "Extended residential logging results" by Tom Ledyard, RLW Analytics Inc. and Lynn Heofgen, Nexus Market Research Inc., May 2, 2005, p.1.

Waste Heat Factor

The WHF is used to account for the change in annual HVAC energy, either lost or gained, due to the reduction in facility lighting energy. Similar to the CFL Contingency Program, Cadmus based the WHF on SEEM building models developed by the Northwest Power and Conservation Council. The SEEM building models estimate the change in HVAC equipment energy use due to the change in lighting technology; incandescent lamps to CFLs. In general, the models account for the interaction using load shape profiles of the HVAC and lighting equipment based on dwelling occupancy.

Cadmus aggregated the available models based 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]

Cadmus believes the utilized Council method is inherently conservative because it assumes a closed shell, i.e., all interior lamps including ceiling recessed cans are contained in a closed system so any heat put out by the bulbs goes into the building. In reality, the waste heat could transfer out of the conditioned space, therefore increasing the savings achieved through installation. Even though the methodology is conservative, Cadmus believes it is the best available method at this time.

In-Service Rate

The ISR for the Simple Steps, Smart Savings ™ program is based on the CFL Contingency Program, which determined a three year cumulative ISR of 91% from the logistic model with an upper limit of 98% to account for breakage/removal. This is likely to be a conservative value as participants are paying for bulbs in a different delivery mechanism than an unsolicited giveaway. In addition, one-third of all bulbs are expensive specialty bulbs and likely to have an ISR close to

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5 Avista equipment type saturations are based on the 2011 participant survey for the CFL Contingency Program.

6 The RTF WHF is 86.4% for standard and 86.7% for specialty, which were adjusted to Avista's territory to be 89.8%.

or at 100%.[7,8] We believe that the Simple Steps program is sufficiently different from the one-time CFL Contingency Plan program and does not need a segmented three-year ISR. This is because Simple Steps is a continuous program so, for any given year, bulbs will be installed from the current year, one year prior, and two years prior.

Results and Findings

The calculated Unit Energy Savings (UES) is shown in Table 1-8. Unit Energy Savings by Year and Bulb Type. Avista's reported per unit savings was derived from RTF workbooks and assumed the average per unit of 24 kWh for twist bulbs and 17 kWh for specialty bulbs.

Table 1-8. Unit Energy Savings by Year and Bulb Type

Program Year	Reported		Evaluated	
	Twist	Specialty	Twist	Specialty
2010	24.00	17.00	31.03	31.47
2011	24.00	17.00	30.69	33.35
Average kWh	24.00	17.00	30.80	32.68

The reported per unit savings weighted across both bulb types is 21.81 kWh and the evaluated unit savings across both bulb types is 31.38 kWh.

Overall Program Savings

For PY 2010 and PY 2011, Avista's total reported savings is 18,097,253 kWh and evaluated savings is 24,601,728 kWh, as found in Table 9. Regional distribution of purchased CFLs is based on Avista's service territory of residential customers, two-thirds live in Washington and one-third lives in Idaho.

Table 1-9. Simple Steps, Smart Savings ™ PY 2010 and PY 2011 Reported and Verified Total Savings

Program Year	Region	Measure Count	Reported Savings	Verified Savings	Realization Rate
2010	WA	178,218	3,855,739	5,462,335	142%
	ID	89,109	1,927,869	2,731,167	142%
	Total	267,327	5,783,608	8,193,502	142%
2011	WA	376,466	8,209,097	10,941,773	133%
	ID	188,233	4,104,548	5,470,886	133%
	Total	564,699	12,313,645	16,412,659	133%
Total		832,026	18,097,253	24,601,728	136%

The realization rates for PY 2010 and PY 2011 are 142% and 133% for all bulbs, respectively, with an overall two-year realization rate of 136%. The ISR and HOU values are the main drivers for the difference between the reported and evaluated savings.

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7 Expensive interior fixtures, like expensive specialty bulbs, were found have high installation rates (94.8%) according to Nexus Market Research, "Impact Evaluation of the Massachusetts, Rhode Island and Vermont 2003 Residential Lighting Programs", Final Report, October 1, 2004, p. 43 (Table 4-9).

8 The Massachusetts 2012 TRM assume 100% for specialty bulbs.

1.3.3 Second Refrigerator and Freezer Recycling

Summary of Program Participation

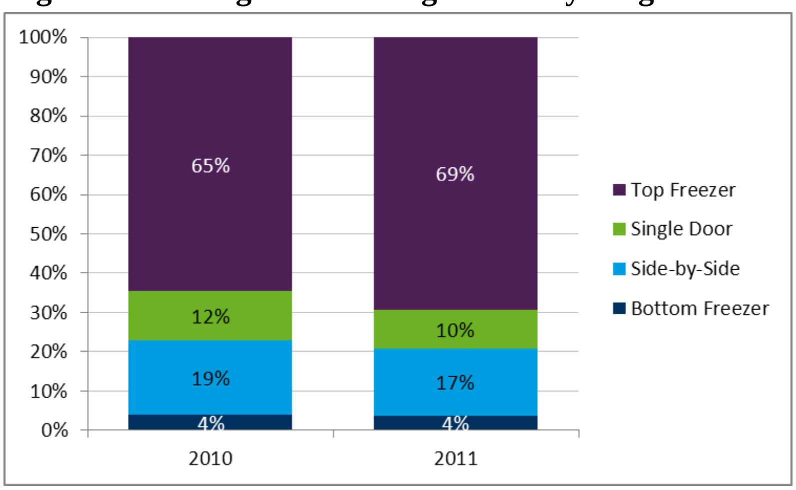
Cadmus reviewed the participant database, maintained by JACO, the program implementer, to test the reliability of program data. There were 3,891 total participant units during PY 2010 and PY 2011. Some participants recycled more than one appliance through the program. (See Table 1-10).

Table 1-10. Program Participation by Measure

Year	Measure	Idaho	Washington	Total
2010	Recycled Refrigerator	317	1,150	1,467
	Recycled Freezer	75	301	376
	Total	392	1,451	1,843
2011	Recycled Refrigerator	412	1,152	1,564
	Recycled Freezer	121	363	484
	Total	533	1,515	2,048
Total	Recycled Refrigerator	729	2,302	3,031
	Recycled Freezer	196	664	860
	Total	925	2,966	3,891

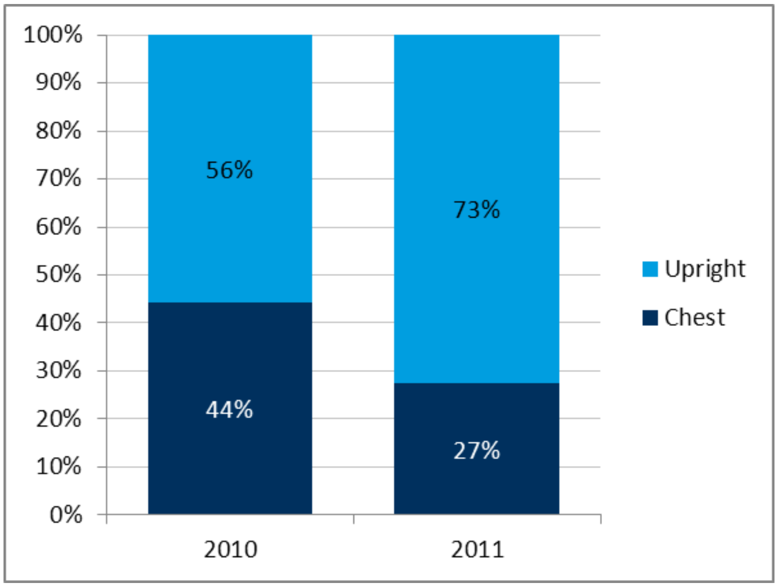
As shown in Figure 1-3, refrigerator configurations have not changed substantially during the last two program years.

Figure 1-3. Refrigerator Configuration by Program Year



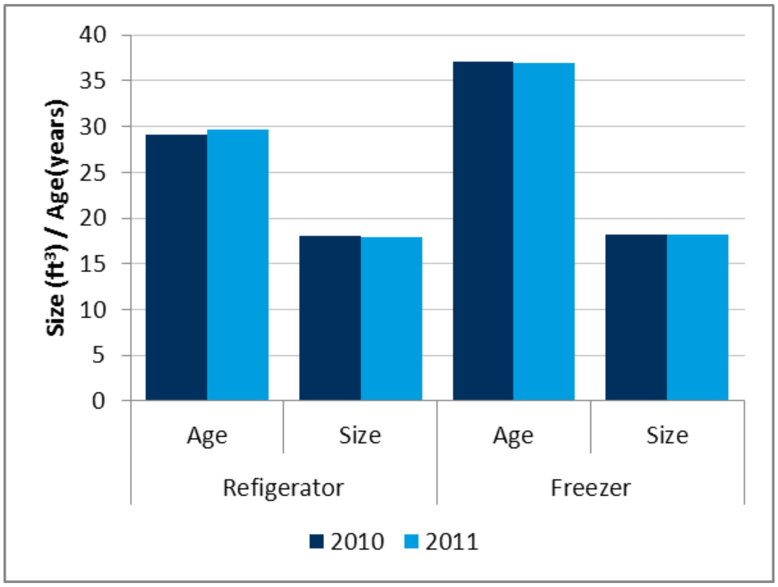
Substantially more upright freezer units were recycled in 2011, as shown in Figure 1-4.

Figure 1-4. Freezer Configuration by Program Year*



In 2011, recycled refrigerators averaged 29 years old, with 18 cubic feet of internal capacity. Recycled freezers averaged 37 years old, with 18 cubic feet of internal capacity. As seen in Figure 1-5, average appliance age and size did not change considerably from 2010.

Figure 1-5. Appliance Age and Size by Program Year



Determination of Average Annual Gross Savings

Cadmus developed a multivariate regression model to estimate gross UEC for retired refrigerators and freezers; model coefficients were estimated using an aggregated *in situ* metering dataset,[9] which is composed of over 400 appliances (metered as part of four California and Michigan evaluations conducted between May 2009 and April 2011).[10] These evaluations offered a wide distribution of appliance ages, sizes, configurations, usage scenarios (primary or secondary), and climate conditions. The diversity of the Avista participant dataset provided an effective secondary data source for estimating energy savings when Avista-specific metering could not be conducted.

For two reasons, Cadmus prefers using in-home metering data for estimating energy consumption, rather than the U.S. Department of Energy's (DOE) testing protocols:

- Metering an appliance in its original location captures impacts of critical external factors on appliance energy use (such as door openings, unit locations, and weather).
- Second, most existing DOE databases estimate energy consumption at the time of appliance manufacture, not by unit retirement.[11]

Each observation in the aggregated dataset represented an appliance metered for a minimum of 10 days, in a manner consistent with its preprogram use (e.g., in the same location, cooling food, used by the home's occupants). Cadmus mapped weather data to participating homes' ZIP code-specific National Oceanic and Atmospheric Administration (NOAA) weather stations, and collected additional on-site data on relevant appliance characteristics to ensure data consistency with administrator tracking databases.

Cadmus' approach to model specification weighed the impacts of including alternative independent variables, using a variety of criteria. The model specification process sought to include variables adequately reflecting program design, while maintaining model simplicity. For each set of estimated parameters, the analysis assessed variance inflation factors (VIFs), adjusted R^2s, and measures of statistical significance.[12]

Cadmus used the following modeling considerations in the specification process:

- **Considering all relevant appliance characteristics for inclusion in the model.** These included configuration, defrost type, age, size, and (in the case of refrigerators) primary or secondary designations. Age was considered as a continuous variable (capturing degradation); dummy variables for decades of manufacture (to approximate vintages); and a dummy variable for units manufactured before enactment of 1990's National Appliance Energy Conservation Act (NAECA), which required new refrigerators and freezers to be more energy-efficient.

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

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

11 The California Energy Commission maintains one such database, which can be accessed online at: http://www.energy.ca.gov/appliances/database/historical_excel_files/Refrigeration/

12 VIFs, R^2s, and statistical significance are tests of the validity of a regression model.

- **Considering two environmental factors in the *in situ* model.** In addition to terms pertaining to appliance characteristics, the analysis considered two environmental factors in the *in situ* model: cooling/heating degree-days (CDD/HDD) and primary or secondary appliances. Appliances in warmer climate zones were assumed to consume greater energy—as were primary appliances—due to more frequent door openings.
- **Including interaction terms only due to theoretical importance to the model.** The model included only one interaction term, between units located in garages and CDDs, to account for additional impacts of warmer temperatures on refrigerators in unconditioned spaces.
- **Considering transformations of explanatory variables**. These included logged and squared values, based on theoretical and empirical grounds.

Cadmus used regression models to estimate consumption for refrigerators and freezers (Table 1-11, Table 1-12). Each independent variable's coefficient indicated the influence of that variable on daily consumption, holding all other variables constant. A positive coefficient indicated an upward influence on consumption; a negative coefficient indicated a downward effect.

The coefficient's value indicated the marginal impact of a one-point increase in the independent variable on the UEC. For instance, a 1 cubic foot increase in refrigerator size resulted in a 0.083 kWh increase in daily consumption. In the case of dummy variables, the value of the coefficient represented the difference in consumption, if the given condition was true. For example, in the refrigerator model, the coefficient for the variable indicating a refrigerator as a primary unit was 0.642, which means, all else being equal, a primary refrigerator consumed 0.642 kWh per day more than a secondary unit.

Refrigerator Regression Model

Table 1-11 shows the model used to estimate refrigerators' annual energy consumption, and its estimated parameters.

Table 1-11. Refrigerator UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, Adj. R^2 = 0.33)

Independent Variables	Coefficient	p-Value	VIF
Intercept	0.769	<.0001	0.0
Age (years)	0.008	0.016	2.0
Dummy: Manufactured Pre-1990	0.827	<.0001	1.7
Size (ft.^{3})	0.083	<.0001	1.9
Dummy: Single Door	-1.316	<.0001	1.3
Dummy: Side-by-Side	0.862	<.0001	1.6
Interaction: Unconditioned Space x CDDs	0.031	<.0001	1.3
Interaction: Unconditioned Space x HDDs	-0.049	<.0001	1.2
Dummy: Primary	0.642	<.0001	1.5

Results indicate:

- Older refrigerators experienced higher consumption due to year-on-year degradation.
- Refrigerators manufactured before the 1990 NAECA standard consumed more energy.

- Larger refrigerators consumed more energy.
- Single-door units consumed less energy, as these units typically do not have full freezers.
- Side-by-side refrigerators experienced higher consumption due to greater exposure to outside air when opened and through-door features, which are 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 1-12 details final freezer model.

Table 1-12. Freezer UEC Regression Model Estimates (Dependent Variable = Average Daily kWh, Adj. R^2 = 0.47)

Independent Variables	Coefficient	p-Value	VIF
Intercept	-0.372	0.043	0.0
Age (years)	0.036	<.0001	2.0
Dummy: Unit Manufactured Pre-1990	0.632	<.0001	2.1
Size ($ft.^3$)	0.107	<.0001	1.2
Dummy: Chest Freezer	-0.293	<.0001	1.2
Interaction: Unconditioned Space x CDDs	0.047	<.0001	1.1
Interaction: Unconditioned Space x HDDs	-0.052	<.0001	1.0

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 1-13 summarizes program averages or proportions for each independent variable.

Table 1-13. 2010-2011 Participant Mean Explanatory Variables*

Appliance	Independent Variables	2010 Participant Population Mean Value	2011 Participant Population Mean Value
Refrigerator	Age (years)	29.43	29.59
	Dummy: Manufactured Pre-1990	0.81	0.76
	Size (ft^3)	18.06	17.63
	Dummy: Single Door	0.13	0.10
	Dummy: Side-by-Side	0.19	0.16
	Interaction: Unconditioned Space x CDDs	0.33	0.34
	Interaction: Unconditioned Space x HDDs	6.91	6.86
	Dummy: Primary	0.51	0.51
Freezer	Age (years)	36.79	36.62
	Dummy: Unit Manufactured Pre-1990	0.94	0.93
	Size (ft^3)	17.92	18.08
	Dummy: Chest Freezer	0.26	0.26
	Interaction: Unconditioned Space x CDDs	0.43	0.44
	Interaction: Unconditioned Space x HDDs	9.04	9.01

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

For example, using values from Table 1-12 and Table 1-13, the estimated annual UEC for 2011 freezers was calculated as:[13]

Figure 1-6. 2010–2011 Distribution of Estimated Annual UECs by Appliance Type

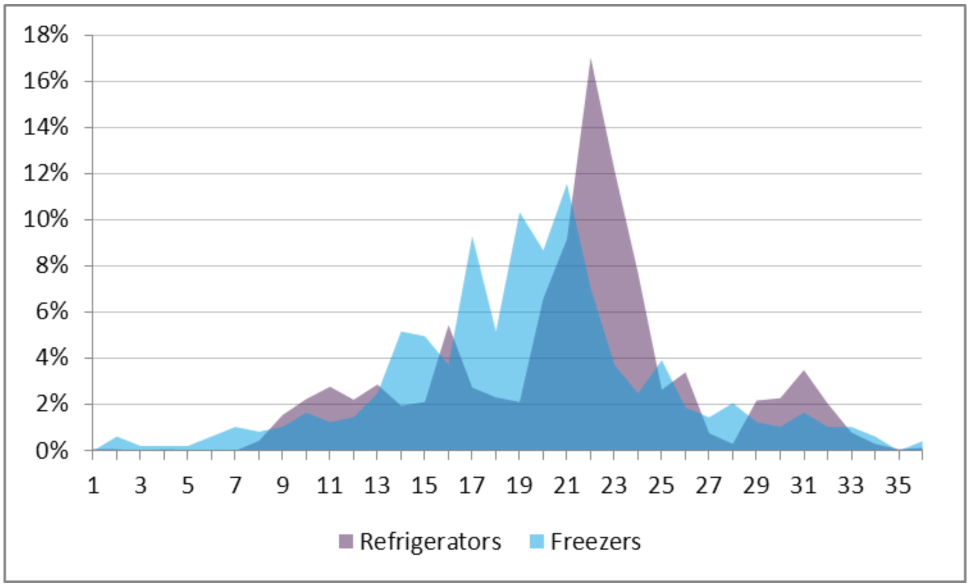

Table 1-14 presents estimated per-unit average annual energy consumption for refrigerators and freezers recycled by Avista in 2011. The next section describes how we adjusted these estimates to arrive at gross per-unit saving estimates for participant refrigerators and freezers.

Table 1-14. Estimate of Per-Unit Annual Energy Consumption

Appliance	2010 Evaluated Annual UEC (kWh/year)	Relative Precision (90% confidence)	2011 Evaluated Annual UEC (kWh/year)	Relative Precision (90% confidence)
Refrigerators	1,158	±3.4%	1,147	±3.4%
Freezers	1,073	±4.6%	1,074	±4.7%

Applying the Part Use Factor

To determine average per-unit gross energy savings for refrigerators and freezers, Cadmus calculated and applied the program's part-use factor, which accounted for participating appliances not plugged in year-round prior to participation. Retirement of appliances not previously in operation or operated for only part of the year would not yield the full year of energy savings presented in Table 1-15. We analyzed data from the 2010 participant survey to calculate part-use factors, which we then used in the following three participant categories:

- Participating units **not used for at least one full year** prior to being recycled were assigned a part-use factor of **0**. As the unit did not consume electricity, no savings were generated by its retirement.
- Recycled units **operating the full year** prior to participation were assigned a part-use factor of **1**.

- To determine part-use factors for units **used only a portion of the previous year**, we divided the average number of months such units were used by 12. The part-use factor for these appliances ranged between **0** and **1**.

Based on the per-unit gross annual energy savings presented in Table 1-15, and after adjusting for part-use, we determined gross energy savings generated by Avista's participation in 2010 and 2011, as presented in Table 1-16.

Table 1-15. 2010-2011 Per-Unit Gross Annual Energy Savings

Year	Measure	In Situ UEC (kwh/yr)	Part-Use Factor	Per-Unit Gross Energy Savings (kWh/yr)	Relative Precision (90% Confidence)
2010	Recycled Refrigerator	1,158	0.94	1,093	±4%
	Recycled Freezer	1,073	0.82	880	±14%
2011	Recycled Refrigerator	1,147	0.94	1,083	±4%
	Recycled Freezer	1,074	0.82	881	±14%

Using the above per-unit values, we calculated total program savings for the Second Refrigerator and Freezer Recycling program in Idaho to be 547 MWh per year (Table 1-16).

Table 1-16. Idaho 2010-2011 Annual Second Refrigerator and Freezer Recycling Program Savings

		Idaho		
Year	Measure	Units	Gross Savings (kWh/yr)	Net Savings (kWh/yr)
2010	Refrigerator	317	363,504	195,027
	Freezer	75	80,551	37,303
	Total	392	444,055	232,330
2011	Refrigerator	412	474,618	254,678
	Freezer	121	129,908	60,160
	Total	533	604,526	314,839
Total	Refrigerator	729	838,122	449,705
	Freezer	196	210,459	97,463
	Total	925	1,048,581	547,169

As shown in Table 1-17, we calculated total program savings for the Second Refrigerator and Freezer Recycling program in Washington to be 1,747 MWh per year.

Table 1-17. Washington 2010-2011 Annual Second Refrigerator and Freezer Recycling Program Savings

Year	Measure	Washington		
		Units	Gross Savings (kWh/yr)	Net Savings (kWh/yr)
2010	Refrigerator	1,150	1,318,704	707,510
	Freezer	301	323,277	149,711
	Total	**1,451**	**1,641,982**	**857,221**
2011	Refrigerator	1,152	1,320,998	708,741
	Freezer	363	389,866	180,548
	Total	**1,515**	**1,710,864**	**889,289**
Total	Refrigerator	2,302	2,639,702	1,416,251
	Freezer	664	713,143	330,259
	Total	**2,966**	**3,352,846**	**1,746,510**

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)

The program offers direct financial incentives to motivate customers to use appliances that are more energy-efficient. The program indirectly encourages market transformation by increasing demand for ENERGY STAR products. Both electric and gas measures are included in the program, but this report considers only electric savings.

Analysis

The energy savings credited to the ENERGY STAR Products program must meet several criteria. First, the measure must still be installed and operating properly at the time of verification. Second, the number of installed pieces of equipment and their corresponding model numbers (if available) need to match Avista's database. Lastly, the unit must have been ENERGY STAR-qualified at the time of the program offering.

Clothes Washers

Cadmus calculated savings based on a 2009 study,[14] which metered more than 100 clothes washers in California homes for three weeks. The largest *in situ* metering study on residential clothes washers and dryers conducted in the last decade, this study indicated higher consumption and savings values than are often estimated. The dryers experienced the majority of energy

[14] The Cadmus Group, Inc. "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems." 2010. http://www.cadmusgroup.com/pdfs/Do_the_Savings_Come_Out_in_the_Wash.pdf

consumption and savings, as high-efficiency washing machines removed more moisture from clothes, allowing shorter drying times.

Four of the twelve clothes washers we verified had listed electricity as their domestic hot water fuel on the application, but during site visits to these homes we found that water was heated with gas. Cadmus therefore assumed that one-third of all clothes washer applications did not achieve electric domestic hot water savings. Finally, most of the energy savings resulting from these installations are from decreased dryer usage as the clothes exiting the washer are dryer when an ENERGY STAR model is used compared to a standard model. As a result, it is important to estimate the percent of homes that have gas domestic water heaters but use an electric dryer. We used the RTF assumption of 82% for this analysis as it represents the best available regional estimate.[15]

We made the following additional input assumptions:

- Washing cycles are estimated at 377 per year based on recent evaluation surveys conducted in the region.[16,17]
- We adjusted the average base case and efficient case Modified Energy Factor (MEF), which are both based on the same data utilized by the RTF. The baseline MEF equals the average market efficiency of units that did not qualify for the program. The efficient MEF equals the average market efficiency of units that did qualify for the program.

Dishwashers

Cadmus calculated dishwasher savings using the current method in the ENERGY STAR Calculator.[18] This is the only calculator available that provides consistent calculation of energy savings for either a gas or electric domestic hot water heater.

Three of the ten dishwashers we verified had listed electricity as their domestic hot water fuel on the application, but during site visits to these homes we found that water was heated by gas. Cadmus therefore assumed that 30% of all dishwasher applications did not achieve electric domestic hot water savings. All gas savings achieved by the electric programs are shown in Appendix D.

We made the following input assumptions:

- Cadmus calculated the average base case and efficient case EF. Both are based on the same data utilized by the RTF. The baseline EF equals the average market efficiency of units that did not qualify for the program. The efficient EF equals the average market efficiency of units that did qualify for the program at the time they were rebated.

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15 http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=118

16 Pacific Power Washington 2009-2010 Residential Home Energy Savings Evaluation, January 2012.

17 Rocky Mountain Power 2009-2010 Idaho Residential Home Energy Savings Evaluation, February 2012.

18 http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDishwasher.xls?7182-1c92

- We used recent evaluation surveys conducted in the region to estimate washing cycles at 245 per year.[16,17]
- Fifty-six percent of the electricity required to run a dishwasher when connected to an electric domestic hot water heater is for water heating.[19]

Refrigerators

Cadmus used the methodology shown in the RTF's FY11v2_1 refrigerator analysis to estimate gross per-UES.[20] The RTF's analysis assumes 32% of baseline units were ENERGY STAR-qualified. This assumption embeds NTG in the calculated savings. We modified the analysis to assume that 0% of baseline units would be ENERGY STAR-qualified. The resulting savings is the gross savings achieved by the installation of an ENERGY STAR refrigerator.

Freezers

Cadmus used the methodology shown in the RTF's FY10v2_0 freezer analysis to estimate gross per-UES.[21] The RTF's analysis assumes 10% of baseline units were ENERGY STAR-qualified. This assumption embeds NTG in the savings calculated. We modified the analysis to assume that 0% of baseline units would be ENERGY STAR-qualified. The resulting savings is the gross savings achieved by the installation of an ENERGY STAR freezer.

Results and Findings

Table 1-18 shows the total reported and adjusted gross savings for the ENERGY STAR Products program by measure.

Table 1-18. ENERGY STAR Products Measure and Program Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E Clothes Washer	6,624	6,624	240	433	1,589,760	2,868,192	180%
E Dishwasher	4,124	4,124	132	26	544,368	108,049	20%
G ES Dishwasher (kWh Savings)	1,914	1,914	36	22	68,904	42,587	62%
E Freezer	835	835	65	47	54,275	38,828	72%
E Refrigerator	8,639	8,639	86	66	742,954	565,855	76%
PROGRAM TOTAL	22,136	22,136			3,000,261	3,623,509	121%

The low dishwasher savings achieved is due to the small difference in efficiency between the base case and efficient case products. Avista is aware that the dishwasher market appears to have fully accepted the ENERGY STAR efficiency threshold and has eliminated this measure from their 2013 program offering.

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19 http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDishwasher.xls?7182-1c92

20 http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=122

21 http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=120

1.3.5 Heating and Cooling Efficiency

Program Description

The electric Heating and Cooling Efficiency program included the following equipment during all or part of PY 2010 and PY 2011:

- Ductless Heat Pump (Electric)
- Air Source Heat Pump (Electric)
- Ground Source Heat Pump (Electric)
- Variable Speed Furnace Fan (Electric)
- Air Conditioner Replacement (Electric)
- Shade Tree (Electric)

Analysis

To evaluate electric heating and cooling efficiency, Cadmus first calculated energy savings based on consistent assumptions about the energy required to heat and cool a home in Avista's territory. It is possible that self-selection and circumstance can lead to unique characteristics within a measure's population. Cadmus used consistent assumptions until evidence suggested otherwise.

We used two sources to calculate energy savings. Cadmus performed a billing analysis for Avista of homes receiving a high-efficiency gas furnace in 2010. This analysis provided a confident estimate of the savings associated with this measure. Using the resulting savings and assumptions of equipment efficiency, we estimated that 41,553 kBtu of heating output are required annually to heat the average participant home in Avista's territory. This assumption was compared to RTF SEEM energy simulations for Spokane, Washington, which estimate energy requirements for three different sizes and configurations of homes. Table 1-19 compares these estimates for the three models to the Cadmus estimate for Avista. We deemed our estimate to be reasonable and used it as the basis from which consistent savings estimates were determined for this electric Heating and Cooling Efficiency program.

Table 1-19 Annual Home Heating Output Estimates

Model	Annual Heating Output (kBtu)
SEEM 1,344 Square Foot Home	33,674
SEEM 2,200 Square Foot Home	63,700
SEEM 2,688 Square Foot Home, Conditioned basement	51,988
Avista 2,000 Square Foot Home	41,553

Ductless Heat Pumps

Four of the units installed as part of the Northwest Energy Efficiency Alliance's (NEEA) 2010 ductless heat pump metering study are included in Avista's program. For these four units, we assumed the base case heating system was electric resistance baseboard heating. The installed efficient ductless heat pump is assumed to provide 50% of the required home heating load and operate at an average system coefficient of performance (COP) of 2.15 over the entire heating season.[22] No cooling penalty is assessed for this measure. We assumed that the home owner would only use the heat pump system for cooling if they had previously had a cooling system for the spaces.

We assume the remaining rebated ductless heat pumps in Avista's program to have achieved the installation of a higher efficiency unit than would have been installed in the absence of the program. Again, the ductless heat pump is assumed to provide 50% of a home's heating load. The base case system is assumed to operate with an average system COP of 2.15. The installed efficient case is assumed to operate with an average system COP of 2.30. This is equivalent to a 7% improvement in the ductless system's heating efficiency. Improvements in cooling efficiency are not considered for this measure. The cooling load in Avista's territory is estimated to be 5% of the heating load. Any increase in cooling efficiency will have a negligible impact on annual savings.

Air Source Heat Pumps

Avista supported 388 conversions from an electric forced air furnace to a heat pump system. For this measure, Cadmus assumed that the heating system provides 100% of the heating load for the home. The base case system is assumed to be an electric resistance forced air furnace. The installed efficient system is a heat pump supported by a furnace. Two percent of the customers who participated in this measure also received a rebate for a high-efficiency gas furnace. The installed efficient system for these customers is assumed to be a heat pump supported by a gas furnace. We assumed the remaining 98% of participants to have an installed efficient system of a heat pump supported by an electric resistance furnace.

In a separate measure, Avista supported the installation 1,494 high efficiency heat pumps with a heating season performance factor (HSPF) of 8.5 or greater. To evaluate this measure, Cadmus conducted a metering study of a random selection of 89 heat pump participants; metering was successful completed at 79 homes. Meters were installed in May or July of 2011 and removed in February of 2012. We used these metering results to estimate the average annual energy savings achieved by this measure. A detailed discussion of this metering study and the measure's participants is documented in Appendix C.

Ground Source Heat Pumps

Avista supported two conversions from an electric forced air furnace to a ground source heat pump system in 2010. This measure was not supported 2011. For this measure, Cadmus assumed that the heating system provides 100% of the heating load for the home. The base case system is assumed to be an electric resistance forced air furnace. The installed efficient system is a ground source heat pump with an HSPF of 10.6.

In a separate measure, Avista supported the installation of 17 high-efficiency ground source heat pumps in 2010. This measure was not supported 2011. For this measure, Cadmus assumed that

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[22] Cadmus' assumption of 50% matches the assumption used by Avista. Cadmus does not have evidence to confidently argue for an alternative assumption and has therefore maintained Avista's original assumption. The average annual heating COP was estimated using models developed for this evaluation.

the heating system provides 100% of the heating load for the home. The base case system is a ground source heat pump with an HSPF of 10.6. The installed efficient system is a ground source heat pump with an HSPF of 12.

Variable Speed Furnace Fans

Avista supported the installation of 3,687 variable speed furnace fans within its electric territory. The number of measures was originally 3,762, but Cadmus reduced the measure count to 3,687 because the 95 units were found to have been installed in gas furnaces outside of Avista's electric service territory. Avista stopped supporting these installations during the program year once it was discovered. The records remained in the data in order to keep track of the rebates paid. Avista had already removed the claimed savings from these measures when we received the participant dataset.

Adjusted gross savings are based on a field study of furnaces in Wisconsin.[23] Cadmus believes this study provides the best available estimate of savings for this technology. We calculated gross savings for Avista's territory by performing a linear ratio adjustment using typical heating and cooling degree days.

Air Conditioner Replacements

Avista supported the replacement of 44 air conditioners in 2010 with high efficiency units within its electric territory. This measure was not supported in 2011. Using the same SEEM model outputs discussed above, Cadmus estimated the required annual cooling output to be 5,762 kBtu per home. The base case system efficiency is assumed to have a seasonal energy efficiency rating of 10. The installed efficient equipment is assumed to have an efficiency SEER of 15.

Shade Trees

Avista supported the installation of 129 trees within its territory. Given the limited impact of this measure on the total program savings, no evaluation activities were performed.

Results and Findings

Table 1-20 shows the overall program savings for heating and cooling efficiency measures.

[23] Electricity Use by New Furnaces: A Wisconsin Field Study, Technical Report 230-1, October 2003, p34 and table 3. http://www.ecw.org/ecwresults/230-1.pdf

Table 1-20. Heating and Cooling Efficiency Measures and Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E SHADE TREE	129	129	21	21	2,709	2,709	100%
E FAF TO AIR HPUMP CONVERSION	388	388	5,646	6,589	2,190,648	2,556,648	117%
E FAF TO GROUND HPUMP CONVERSION	2	2	5,646	8,255	11,292	16,510	146%
E HE A/C REPLACEMNT	44	44	1,889	243	83,116	10,674	13%
E DHP	85	85	804	185	68,340	15,691	23%
E DHP (NEEA)	4	4	8,519	3,256	34,076	13,024	38%
E HE AIR SOURCE HP	1,497	1,494	3,237	337	4,845,789	503,478	10%
E HE GROUND SOURCE HP	17	17	4,615	457	78,455	7,774	10%
E VARIABLE SPEED MOTOR	3,762	3,687	563	439	2,118,006	1,617,118	76%
PROGRAM TOTAL	5,928	5,850	N/A	N/A	9,432,431	4,743,627	50%

1.3.6 Space and Water Conversions

Program Description

The Space and Water Conversions program incents three measures which are available to residential electric customers who currently use electricity to heat their homes and water, but have the opportunity to use natural gas instead:

- Electric Forced Air Furnace to Natural Gas Forced Air Furnace.
- Electric Zonal Heat to a Gas Wall Unit Heater
- Electric Water Heater to Gas Water Heater

Avista customers receive a rebate to reduce the cost of purchasing new equipment when the conversion is made. These measures may be claimed in addition to the heating and cooling efficiency measures described above. The installed efficient equipment case is therefore assumed to be the standard efficiency equipment assumed for the base case equipment in the measures above.

Analysis

Electric Forced Air Furnace to Natural Gas Forced Air Furnace

Matching the analysis for the heating and cooling efficiency program, Cadmus utilized the same assumption that each home requires 41,553 kBtu per year of heating output. Ninety-one percent of participants achieved savings through the conversion of a whole house forced air furnace from electricity to gas. The annual energy savings are equal to the entire electrical input required to produce the energy output. No fan savings are achieved by this measure as the fan is assumed to operate the same in both cases. The remaining 9% of measure participants received this rebate and a rebate for a high efficiency air source heat pump. These customers converted from an electric forced air furnace to a dual fuel air source heat pump and gas furnace heating system. The reduction in electricity consumption achieved for these participants is less than those that did not also install a heat pump, therefore requiring a reduction in the average electricity savings achieved per participant. Savings for each scenario are calculated separately. The adjusted gross savings is the weighted average of the two participant scenarios.

Electric Zonal Heat to a Gas Wall Unit Heater

Cadmus assumed that the installed gas wall unit provided 50% of the annual heating output required for the home since these units are typically placed in the main living areas of a house. The savings achieved by this measure are equivalent to a 50% reduction in the required input of an electrically heated home.

Electric Water Heater to Gas Water Heater

The savings achieved by this measure is equal to the total input energy required to heat a home's water using electricity for an entire year. Cadmus used the most recent data available for the region and end use to estimate the total water consumption of a typical home and the total required energy to overcome standby loses. The annual energy savings is equal to the energy required to heat the total water consumption plus the energy required to overcome the standby losses. Cadmus assumed an average electric unit energy factor of 0.91 for this measure.

Results and Findings

Table 1-21 shows the overall program savings for space and water conversion measures. Overall the program achieved a realization rate of 113%.

Table 1-21. Space and Water Conversion Measures and Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E TO G FURNACE CONVERSION	224	224	8,655	12,012	1,938,720	2,690,778	139%
E TO G WALL UNIT CONVERSION	6	6	9,299	6,087	55,794	36,524	65%
E TO G H2O CONVERSION	211	211	5,567	4,031	1,174,637	850,577	72%
PROGRAM TOTAL	441	441			3,169,151	3,577,879	113%

1.3.7 Residential Weatherization

Program Description

The Residential Weatherization program incents six categories of measures, which are available to residential electric and gas customers whose homes are heated with fuel provided by Avista:

- Fireplace Dampers (Electric and/or Gas Savings)
- Insulation - Ceiling/Attic (Electric and/or Gas Savings)
- Insulation - Floor (Electric and/or Gas Savings)
- Insulation - Wall (Electric and/or Gas Savings)
- Window Replacement (Electric and/or Gas Savings)

Avista customers who heat primarily with electric or natural gas and that have a wood burning fireplace may receive up to $100 for installing a rooftop damper.

To qualify for the program, ceiling and attic insulation (both fitted/batt type and blown-in) must have increased the R-value by 10 or more; this insulation was incented at $0.25 per square foot of new insulation up to 50% of the installation cost. Homes were eligible if their existing attic insulation was less than R-19.

Floor and wall insulation (both fitted/batt type and blown-in) that increases the R-value by 10 or more was incented at $0.50 per square foot of new insulation up to 50% of the installation cost. Homes were eligible if their existing floor and/or wall insulation was less than R-5.

For upgrading windows with a U-factor of 0.30 or lower, the program provides an incentive of $3.00 per square foot of qualifying windows installed up to 50% of the installation cost. This measure in the program ended on April 1, 2011. Customers had until June 30, 2011, to install windows and submit a rebate form to Avista.

Billing Analysis

Cadmus conducted a statistical billing analysis to determine the adjusted gross savings and realization rates for the electric weatherization and windows measures installed through the electric Residential Weatherization rebate program in PY 2010 and PY 2011. In order to increase the accuracy of the analysis, we included only participants with at least 11 months of pre- and post-billing data in the analysis. Therefore, the billing analysis includes PY 2010 participants and January PY 2011 participants.

To estimate the weatherization and windows measure energy savings from the program, Cadmus used a pre- and post-installation combined CSA and PRISM approach using monthly billing data. We calculated electric model savings estimates for the electric weatherization and windows measures and for the gas windows measures.

Billing Analysis Methodology

Avista provided Cadmus with monthly billing data for all the 2010 and 2011 electric weatherization and windows participants from January 2008 through January 2012. Avista also provided participation and measure data that included all additional gas and electric measures installed in conjunction with the electric weatherization and windows measures, with participant information such as customer details, account numbers, type of measure installed, rebate amounts, measure installation costs, measure installation dates, and deemed savings per measure.

We matched weatherization/windows measure information with the electric billing data. We obtained daily average temperature weather data from 2008 through January 2012 for the 14 NOAA weather stations that represent all the ZIP codes in Avista's Washington and Idaho service territories. From the daily temperatures, we determined base 65 heating degree days (HDDs) and base 65 cooling degree days (CDDs) for each station. Using ZIP code mapping for all of the U.S. weather stations, we determined the nearest station for each ZIP code. We then matched the billing data periods with the HDDs and CDDs from the associated station.

In order to prevent bias from differing reading cycles in assigning pre- and post-periods, and to simplify the analysis, we allocated the kWh billing usage and the associated matched HDDs and

CDDs to calendar months. Since the latest available billing data were from January 2012, and the weatherization and windows measures were installed primarily in 2010, we defined the analysis *pre* period as 2009, before any participation installations occurred. We defined the *post* period as the months following the installation date. Where *post* period data was available for all 2010 participants, we defined the *post* period as 2011.

Due to billing data limitations, there were fewer than the standard 12 months of pre- and post-installation billing data months for all customers. For this reason, we paired the pre- and post-months used in the billing analysis. For example, if a customer installed measures in January 2011, we defined the post-period as February 2011 through December 2011, while the pre-period was the corresponding months from February 2009 through December 2009. This ensured that we used the same months in both the pre- and post-periods, in order to prevent bias from mismatched months.

Data Screening

General Screens

We performed the following screens to remove accounts that could possibly skew our weatherization and windows savings estimation.

- **For Weatherization measures:** To accurately isolate the weatherization savings, weatherization participants installing other electric measures were excluded from the analysis.
- **For Electric Windows measures:** To accurately isolate the electric windows savings, participants installing other electric measures were excluded from the analysis.
- **For Gas Windows measures with electric savings:** To accurately isolate the electric savings from the gas windows participants, gas windows participants installing other electric measures were excluded from the analysis.
- **Customers who indicated unit numbers in the address.** Unit numbers for addresses could potentially indicate weatherization or windows installations occurred in apartments.
- **Accounts with fewer than 11 paired months (330 days) of billing data in either the pre- or post-period**. This screen also excluded customers who changed addresses between the pre- and post-periods, since there would not be sufficient pre-month data for analysis. It is unlikely that the household characteristics and weatherization and windows usage behavior of the previous residents would match that of the current residents who installed the weatherization or windows measures.

PRISM Modeling Screens

We ran PRISM models for the pre- and post-billing data to obtain weather-normalized pre- and post-annual usage for each account and to provide an alternate check of the weatherization and windows savings obtained from the CSA model.

For each participant home, we estimated three models: heating and cooling, heating only, and cooling only in both the pre- and post-periods to weather-normalize raw billing data.

The heating and cooling PRISM model specification we used 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 post-program period
α_i	=	the participant intercept; represents the average daily kWh base load
β_1	=	the model space heating slope (used only in the heating only, heating + cooling model)
$AVGHDD_{it}$	=	the base 65 average daily HDDs for the specific location (used only in the heating only, heating + cooling model)
β_2	=	the model space cooling slope (used only in the cooling only, heating + cooling model)
$AVGCDD_{it}$	=	the base 65 average daily CDDs for the specific location (used only in the cooling only, heating + cooling model)
ε_{it}	=	the error term

From the model above, we computed the weather-normalized annual consumption (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	=	the normalized annual kWh consumption
α_i	=	the intercept that is the average daily or base load for each participant; represents the average daily base load from the model
$\alpha_i * 365$	=	the annual base load kWh usage (non-weather sensitive)
β_1	=	the heating slope; in effect, this is the usage per heating degree from the model above
$LRHDD_i$	=	the annual, long-term HDDs of a typical month 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
β_2	=	the cooling slope; in effect, this is the usage per cooling degree from the model above
$LRCDD_i$	=	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

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-period was the model with the highest R-square that still had positive heating and/or cooling slopes. After obtaining the final pre- and post-period NAC we applied the additional set of screens on the PRISM model output to remove outlier participants from the weatherization and windows billing analysis:

- **Accounts where the post weather-normalized (POSTNAC) usage was 80% higher or lower than the pre weather-normalized (PRENAC) usage**. Such large changes could indicate property vacancies, when adding or removing "other" gas equipment (such as pools or spas), unrelated to weatherization/windows installations.
- **Accounts with negative intercepts (base load) were removed.** 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; therefore, these accounts were removed from the analysis.

Once we placed these screens on the data, there remained 195 weatherization-only participants, 673 windows-only participants, and 1,714 gas windows participants with electric savings. We used these in the CSA model outlined below to determine the overall savings.

Table 1-22 summarizes the weatherization account attrition from the various screens listed above. The primary screen was for accounts that installed non-weatherization electric measures.

Table 1-22. Weatherization Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original	477	100%	0	0%
Accounts that Installed Other Measures	278	58%	199	42%
Insufficient Pre/Post Months or Moved During Pre or Post	212	44%	66	14%
PRISM Screens: Low Heating Usage	200	42%	12	3%
Changed Usage Between Pre and Post Period (> 70%)	198	42%	2	0%
Multifamily (Unit Number Present)	195	41%	3	1%
Final Analysis Group	195	41%	282	59%

Table 1-23 summarizes the windows measures account attrition from the various screens listed above. The primary screen was for accounts that installed non-windows electric measures.

Table 1-23. Windows Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original	1,523	100%	0	0%
Accounts that Installed Other Measures	1,090	72%	433	28%
Insufficient Pre/Post Months or Moved During Pre or Post	817	54%	273	18%
PRISM Screens: Low Heating Usage	807	53%	10	1%
Changed Usage Between Pre and Post Period (> 70%)	792	52%	15	1%
Multifamily (Unit Number Present)	673	44%	119	8%
Final Analysis Group	673	44%	850	56%

Table 1-24 summarizes the gas windows measures with electric savings attrition from the various screens listed above. The primary screen was for accounts that installed non-windows gas measures with electric savings.

Table 1-24. Gas Windows Account Attrition

Screen	Number Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original	3,388	100%	0	0%
Accounts that Installed Other Measures	2,359	70%	1,029	30%
Insufficient Pre/Post Months or Moved During Pre or Post	1,804	53%	555	16%
PRISM Screens: Low Heating Usage	1,788	53%	16	0%
Changed Usage Between Pre and Post Period (> 70%)	1,751	52%	37	1%
Multifamily (Unit Number Present)	1,714	51%	37	1%
Final Analysis Group	1,714	51%	1,674	49%

CSA Modeling Approach

To estimate weatherization and windows energy savings from this program, we used a pre-post CSA fixed-effects modeling method that uses pooled monthly time-series (panel) billing data. The fixed-effects modeling approach corrects for differences between the pre- and post-installation weather conditions, as well as for differences in usage consumption between participants, by including a separate intercept for each participant. Our modeling approach ensures that model savings estimates will not be skewed by any unusually high usage or low usage participants. We used the following model specification to determine the overall weatherization and windows savings

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \beta_3 POST_i * AVGHDD_{it} + \beta_{4..14} M_t + \varepsilon_{it}$$

Where for participant ‘i’ and monthly billing period ‘t’:

ADC_{it} = the average daily kWh consumption during the pre- or post-program period

α_i = the average daily kWh base load intercept for each participant (this is part of the fixed effects specification)

β_1 = the baseline usage per HDD

$AVGHDD_{it}$ = the average daily base 65 HDDs based on home location

β_2 = the baseline usage per CDD

$AVGCDD_{it}$ = the average daily base 65 CDDs based on home location

β_3 = the kWh savings per HDD for the weatherization or windows measures

$POST_i$ = an indicator variable that is 1 in the post-period (after the weatherization or windows installation), and 0 in the pre-weatherization period

$POST_i * AVGHDD_{it}$ = an interaction between the post indicator ($POST_i$) and the HDDs ($AVGHDD_{it}$)

M_t = an array of bill month dummy variables (Feb, Mar, …, Dec), 0 otherwise[24]

ε_{it} = the modeling estimation error

The model above estimates the savings per heating degree for the weatherization or windows measures with β_3. In order to obtain the actual annual savings under normal weather conditions, we applied the 1991-2005 TMY3 normal HDDs from NOAA.

The per-HDD modeling approach resolves much of the potential bias from customers where predominantly winter month data were available. Since weatherization and windows measures affect the heating usage, a per heating degree savings allows for allocating savings across all the calendar months, as well as being based on the HDDs. Furthermore, the per heating degree savings estimation allows for obtaining savings under normal weather conditions. Using just a post-period indicator would have been influenced by any predominance of winter or summer months, resulting in savings being biased upwards or downwards.

Results and Findings

Weatherization and Windows Billing Analysis Model Results

Table 1-25 summarizes the electric model savings results for the 195 weatherization participants, the 673 windows measure participants, and the 1,714 windows gas participants. The model savings for weatherization measures are 953 kWh, for electric windows measures the savings are 485 kWh, and for gas windows measures the electric savings are 91 kWh. The precision level indicates that the percent error of the savings estimate is 26% for the electric weatherization and windows participants and 60% for the gas windows participants.

[24] We excluded one of the dummy variables from the independent variables, otherwise the 12 monthly indicators would form perfect co-linearity with the intercepts. We excluded January, thus the intercepts include the seasonality from January.

Table 1-25. Weatherization and Windows Savings Summary

Group	N	PRENAC	Model Savings Per HDD	Normal HDDs	Model Savings (kWh)	Precision at 90% Confidence	Savings Lower 90% (kWh)	Savings Upper 90% (kWh)
Weatherization	195	17,156	0.15029	6,338	953	26%	708	1197
Windows Electric	673	17,803	0.07667	6,327	485	26%	358	612
Windows Gas Heat, Electric Cooling Savings	1,714	10,894	NA	NA	91	60%	36	146

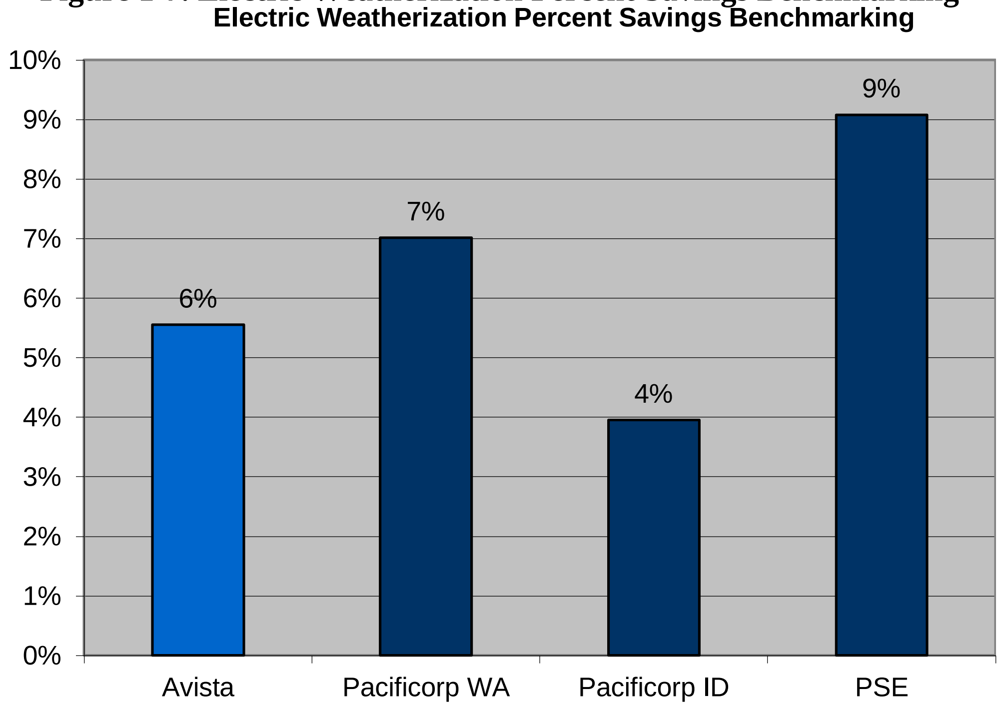
Table 1-26 compares the modeled savings with the expected deemed savings to obtain realization rates (35% and 23% for weatherization and windows measures, respectively). The realization rate for the electric savings from the gas windows measure installation is 14%.

Table 1-26. Realization Rate Summary

Group	N	PRENAC	Model Savings (kWh)	Expected Savings	Realization Rate	Savings as Percent of Pre
Weatherization	195	17,156	953	2,720	35%	6%
Windows	673	17,803	485	2,148	23%	3%
Windows Gas Heat, Electric Cooling Savings	1,714	10,894	91	657	14%	1%

Figure 1-7 compares the weatherization percent savings to similar electric weatherization evaluations. To improve the comparisons, the respective chart includes only the attic insulation savings that are the predominant component of Avista's Weatherization Program. Generally the percent savings is similar to other programs, except the attic percent savings of the Puget Sound Energy (PSE) program were higher.

Figure 1-7. Electric Weatherization Percent Savings Benchmarking



To extrapolate the billing analysis results of the entire program population, the realization rates shown in Table 1-26 were applied to the total savings for the measure reported in the Avista database. The one measure not included in the billing analysis was Fireplace Dampers, for which we maintained the deemed savings value developed for the 2011 Avista TRM. Table 1-27 shows the total reported and adjusted savings for the gas Weatherization program measures.

Table 1-27. Weatherization Measure and Program Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E FIREPLACE DAMPER	27	27	2,304	163	62,208	4,401	7%
E WINDOWS	2,162	2,162	2,057	464	4,446,636	1,004,033	23%
G WINDOWS (kWh Savings)	3,422	3,422	569	78	1,946,893	267,737	14%
E INSULATION	997	997	2,546	891	2,538,119	888,736	35%
PROGRAM TOTAL	6,608	6,608			8,993,856	2,164,907	24%

We found that the energy savings achieved by the weatherization measures were in line with similar programs we have evaluated. The one exception is PSE's weatherization program. Changes in program design may have contributed to the difference in percent savings achieved because the mix of measures for the PSE program was different than for Avista's program. The evaluation process also has shown the increasing penetration of dual fuel heated homes in Avista's territory. Some of the participant homes may use both electricity and gas to heat their home. We recommend Avista create a mechanism through which participants can explain that they use both fuels to heat their home. A future billing analysis should then evaluate the impact of weatherization on both fuels serving the home.

1.3.8 Water Heater Efficiency

Program Description

The Water Heater Efficiency program has one measure:

- High-Efficiency Water Heater (Electric)

Through this program, Avista offers a $50 incentive to residential electric customers who install an eligible high-efficiency water heater. Electric water heaters with a tank must have 0.93 EF or greater to qualify for the program.

Analysis

Avista supported 1,045 installations of a high-efficiency electric water heater. To calculate savings for this measure, Cadmus used the WHAM method.[25] The average base case energy factor is assumed to be 0.909. The average installed efficient energy factor is assumed to be 0.934. We believe it likely that the average efficiency of the equipment installed under Avista's program is higher than 0.934, but no information is available to support this. The base and installed average efficiencies were taken from the RTF's file ResDHWFY10v2_1.xls.[26]

Results and Findings

Table 1-28 shows the total reported and adjusted savings for the electric Water Heater Efficiency program measure.

Table 1-28. Water Heater Efficiency Measure and Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E HE WH	1,044	1,045	299	119	312,156	124,460	40%
PROGRAM TOTAL	1,044	1,045	N/A	N/A	312,156	124,460	40%

1.3.9 ENERGY STAR Homes

Program Description

This program offers incentives to builders for constructing single-family or multifamily homes that comply with ENERGY STAR criteria and are certified as ENERGY STAR Homes. Avista provides a $900 incentive for homes that use its electric or electric and natural gas service for space and water heating.

25 http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/d-2.pdf

26 http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=125

Analysis

Dual Fuel Homes

For Avista's 2010 Gas Impact Report, Cadmus used ENERGY-10® modeling software to simulate models of an ENERGY STAR home and a standard built-to-code home with gas heating equipment. The results of this modeling effort were reviewed and retained for this program year. The gas savings achieved by this measure are reported in Appendix D

All Electric Homes

Cadmus updated its 2010 gas models to adjust for the use electricity as the heating fuel. We completed one model for each state (Washington and Idaho) to account for all differences in state building codes. The savings resulting from each simulation were nearly equal; the difference was 10 kWh. Overall, the modeled savings ranged between 2,138 kWh and 2,894 kWh depending on the penetration of CFL lighting assumed. The RTF used a more sophisticated modeling method that produced savings of 2,510 kWh for the Washington envelope option with heat pump in heating zone 2 and cooling zone 2. Since this estimate is consistent with Cadmus' modeling results and the sophistication of the RTF's modeling method is greater than Cadmus', the value of 2,510 kWh is chosen as the deemed savings for an all-electric ENERGY STAR home.

Results and Findings

Table 1-29 shows the total reported and adjusted savings for the gas and electric/gas ENERGY STAR Homes program measures.

Table 1-29. ENERGY STAR Homes Measure and Program Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E ESTAR HOME ALL ELEC	58	58	7,415	2,510	430,052	145,580	34%
E ESTAR HOME ELEC/GAS (kWh)	248	248	1,041	1,054	258,215	261,392	101%
PROGRAM TOTAL	306	306	N/A	N/A	688,267	406,972	59%

1.3.10 Residential Renewables

Avista supported the installation of 33 residential renewable projects. Cadmus performed no evaluation activities on ENERGY STAR Homes program. For this report, all installations are assumed to achieve a 100% adjusted gross realization rate.

Table 1-30. Residential Renewables Reported and Adjusted Savings

Measure Name	Measure Count		Savings per Unit (kWh)		Program Savings (kWh)		Realization Rate
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted	
E RENEWABLE	33	33	VARIES	N/A	138,626	138,626	100%
PROGRAM TOTAL	33	33	N/A	N/A	138,626	138,626	100%

1.3.11 Residential Programs Confidence and Precision

Cadmus determined the overall precision of the adjusted gross savings by estimating the standard error associated with each measure. For measures based on deemed savings estimates only, the error in the deemed savings is due to error in each of the input assumptions. Typically, this is due to the sampling error associated with research into each input. To simplify this analysis, Cadmus has conservatively estimated that the standard error associated with each deemed measure is 20% of the unit energy savings unless recent evaluation research has developed a more accurate estimate. This estimate is greater than values Cadmus typically determines, but provides for a conservative estimate of program precision.

The following programs use more accurate estimates of error based on recent research:

- The standard error estimated for Simple Steps, Smart Savings™ is based on the errors associated with the estimates of daily hours of use and in-service rate for each purchased bulb.
- The standard error estimated for Second Refrigerator and Freezer Recycling is based on the regression model errors existing within the analysis.
- The standard error for air source heat pumps within the Heating and Cooling efficiency program is based on the sampling error within the metering project. The standard error for all other equipment measures within the program is based on the billing analysis performed last year since the estimate of annual heating load is based on this previous analysis' result.[27]
- The standard error for all HVAC equipment measures within the Space and Water Conversions program is also based on the billing analysis performed last year.
- The standard error for the Weatherization/Shell program is based on the billing analysis performed this year.

Following the determination of program measure savings based error, Cadmus applies the verification error determined through this year's surveys to each program except the two using billing analysis results and the Simple Steps, Smart Savings™ program. Verification rates are not applied to savings determined through a billing analysis as their results include any homes where the installation was stated to have occurred, but did not occur. The Simple Steps, Smart Savings™ program is an upstream lighting program for which verification rates do not apply.

Table 1‑16 shows the program level error and precision for the residential portion of the portfolio. Overall the residential programs achieved 16% relative precision at the 90% confidence interval.

Table 1-31. Program Savings Precision at the 90% Confidence Interval

[27] Avista 2010 Multi-Sector Gas Impact Evaluation Report, August 2011.

Program	Adjusted Gross Savings (kWh)	Standard Error (kWh)	Relative Precision at 90% Confidence
Simple Steps, Smart Savings™	24,601,728	4,124,873	28%
Second Refrigerator and Freezer Recycling	4,054,783	83,527	3%
ENERGY STAR® Products	3,623,509	589,297	27%
Heating and Cooling Efficiency	4,743,627	342,824	12%
Space and Water Conversions	3,577,879	210,856	10%
Weatherization/Shell	2,164,907	286,216	22%
Water Heater Efficiency	124,460	25,007	33%
ENERGY STAR® Homes	406,972	60,341	24%
PROGRAM TOTAL	43,297,865	4,197,261	16%

1.4 Conclusions

For PY2010 and PY2011, Avista's residential electric programs produced 43,436,491 kWh in savings, which yielded an overall realization rate of 90%. Table 1-32 through Table 1-34 show reported and verified gross savings and realization rates per program and by state.

Table 1-32. Total Program Reported and Verified Gross Savings and Realization Rates

Program	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rate
Simple Steps, Smart Savings™	18,097,253	24,601,728	136%
Second Refrigerator and Freezer Recycling	4,529,827	4,054,783	90%
ENERGY STAR Products	3,000,261	3,623,509	121%
Heating and Cooling Efficiency	9,432,431	4,743,627	50%
Space and Water Conversions	3,169,151	3,577,879	113%
Weatherization/Shell	8,993,856	2,164,907	24%
Water Heating	312,156	124,460	40%
ENERGY STAR Homes	688,267	406,972	59%
Residential Renewables	138,626	138,626	100%
PROGRAM TOTAL	48,361,828	43,436,491	90%

Table 1-33. Program Gross and Net Verified Savings and Realization Rates - Washington

Program	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rate
Simple Steps, Smart Savings™	12,064,835	16,401,152	136%
Second Refrigerator and Freezer Recycling	3,421,329	3,062,439	90%
ENERGY STAR Products	2,016,007	2,444,129	121%
Heating and Cooling Efficiency	5,616,729	2,751,306	49%
Space and Water Conversions	2,245,319	2,463,378	110%
Weatherization/Shell	6,064,022	1,447,434	24%
Water Heating	253,253	100,997	40%
ENERGY STAR Homes	539,437	336,246	62%
Residential Renewables	109,143	109,143	100%
PROGRAM TOTAL	32,330,075	29,116,224	90%

Table 1-34. Program Gross and Net Verified Savings and Realization Rates - Idaho

Program	Reported Savings (kWh)	Adjusted Gross (kWh)	Realization Rate
Simple Steps, Smart Savings™	6,032,418	8,200,576	136%
Second Refrigerator and Freezer Recycling	1,108,498	992,344	90%
ENERGY STAR Products	984,254	1,179,380	120%
Heating and Cooling Efficiency	3,815,702	1,992,321	52%
Space and Water Conversions	923,832	1,114,501	121%
Weatherization/Shell	2,929,834	717,472	24%
Water Heating	58,903	23,463	40%
ENERGY STAR Homes	148,830	70,726	48%
Residential Renewables	29,483	29,483	100%
PROGRAM TOTAL	16,031,753	14,320,267	89%

Table 1-35 shows the rate of achievement of gross savings compared to the IRP goal for the residential sector.

Table 1-35 IRP Goals and Gross Verified Savings by State

	Washington			Idaho			Total		
Sector	Savings Goal	Gross Achieved	Goal Achiev-ement	Savings Goal	Gross Achieved	Goal Achiev-ement	Savings Goal	Gross Achieved	Goal Achiev-ement
Residential	25,871,685	29,116,224	113%	15,986,226	14,320,267	90%	41,857,911	43,436,491	104%

1.5 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.
- Move all clothes washer rebates to the electric program unless there is a large penetration of gas dryers. Forthcoming RBSA data can support future analysis.
- Include a SEER requirement to increase savings for high-efficiency heat pump participation. Consider continuing the Variable Speed Motor measure in conjunction with any change to equipment efficiency requirements. Often, an electrically commutated motor (ECM) is standard on the highest efficiency heat pump systems.
- Consider restricting dual fuel customers who acquire multiple rebates that have interactive effects. If program changes are made to reduce the participation of dual fuel customers in certain measure categories, future evaluation activities should reassess the participant penetration of the dual fuel home.
- 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 estimating savings and incenting systems separately for all-electric heating systems.
- Consider tiered incentives by SEER rating as higher SEER systems generally require ECM fan motors to achieve certain SEER ratings.

1.5.1 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.

- Perform a review of all available secondary research and/or collect primary data on the penetration of gas heated clothes dryers within Avista's gas territory. This information can be used to refine the estimated gas and electric savings associated with the purchase of an ENERGY STAR clothes washer in a home with a gas domestic hot water tank.
- Perform a targeted billing analysis on weatherization participants that use both electricity and gas to heat their home.
- 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.
- Identify new, cost-effective measures that can be added to its portfolio.

2 2010–2011 Nonresidential Electric Impact Report

Executive Summary

Program Overview

Avista's nonresidential programs promote the purchase of industry-proven, high-efficiency equipment for commercial utility customers. They provide rebates to partially offset the difference in cost between high-efficiency and standard equipment.

Avista's nonresidential electric portfolio has sixteen programs in three major categories: Prescriptive, Energy Smart Grocer, and site-specific (custom):

- Prescriptive:
  - ENERGY STAR Residential Products (APP)
  - Commercial Clothes Washer (PCW)
  - Commercial Shell (PCS)
  - Demand Controlled Ventilation (PDCV)
  - Food Service (PFS)
  - LED Traffic Signals (PTS)
  - Lighting Exterior (PL)
  - Lighting Interior (PL)
  - Motors (PM)
  - PC Network Controls (PNC)
  - Refrigerated Warehouse (PRW)
  - Side-Stream Filtration (PSSF)
  - Vending Machine Controls (PVC)
  - Renewables (REN)
- Energy Smart Grocer (ESG)
- Site Specific (SS)
  - HVAC (SSHVAC)
  - Lighting (SSL)
  - Other (SSO)
  - Shell (SSS)

Avista implements the Prescriptive and site specific programs and Portland Energy Conservation, Inc. (PECI) implements the Energy Smart Grocer program. Cadmus assessed and documented savings of all programs for this evaluation. We also documented the evolution of these programs and provided timely feedback to enable recommended improvements.

Key Findings

Cadmus evaluated 223 of 4,215 projects, representing 29% of reported savings for nonresidential electric measures installed during PY 2010 and 2011. Throughout the impact evaluation, we documented programs' achievements and, where savings were lower than expected, we identified issues that need to be resolved.

Reported and evaluated savings are shown in Table 2-1 through Table 2-3. The gross evaluated savings for all nonresidential electric programs were 97,087,824 kWh.

Table 2-1. Program Summary

Measure Category	Number of Measure	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Prescriptive	2,310	30,744,663	24,469,769	80%
ESG	757	18,314,967	14,665,926	80%
SSHVAC	328	17,719,269	21,966,665	124%
SSL	377	21,489,162	20,768,632	97%
SSO	194	14,013,381	12,911,517	92%
SSS	249	2,667,193	2,305,315	86%
Total	4,215	104,948,636	97,087,824	93%

Table 2-2. Program Summary - Idaho

Measure Category	Number of Measure	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Prescriptive	878	9,764,945	8,137,296	83%
ESG	289	7,376,731	5,907,004	80%
SSHVAC	117	5,183,634	6,279,138	121%
SSL	133	7,033,160	7,289,607	104%
SSO	85	2,810,585	2,539,103	90%
SSS	113	1,078,833	924,062	86%
Total	1,615	33,247,888	31,076,211	93%

Table 2-3. Program Summary - Washington

Measure Category	Number of Measure	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
Prescriptive	1,432	20,979,718	16,332,473	78%
ESG	468	10,938,236	8,758,922	80%
SSHVAC	211	12,535,635	15,687,527	125%
SSL	244	14,456,002	13,479,024	93%
SSO	109	11,202,796	10,372,414	93%
SSS	136	1,588,360	1,381,252	87%
Total	2,600	71,700,748	66,011,612	92%

Avista did not report goals for number of project participants but did report energy savings goals, as shown in Table 2-4. The overall PY 2010 and 2011 nonresidential electric portfolio achieved 110% of the original IRP energy savings goals.

Table 2-4. IRP Energy Savings Achievements Compared to Goals

Program	Program Gross Goals (kWh)	Evaluated Gross Program (kWh)	Goal Achievement
Idaho	33,617,010	31,076,211	92%
Washington	54,405,239	66,011,612	121%
Total	88,022,249	97,087,824	110%

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 effectiveness of the evaluations:

- Avista should create a quality control system to double-check all projects with savings over 300,000 kWh. An Avista EM&V engineer reported he has begun to review these types of projects.
- Avista should consider performing three- to six-month post-installation random inspections to confirm measure persistence to identify opportunities to improve performance.
- Avista should consider conducting future studies to quantify less conservative assumptions for HVAC fan VFD deemed savings estimates.
- Avista should consider revising its methodology for calculating and tracking HVAC/lighting interactive effects.
- Avista should consider adding a program for recommissioning measures that were identified as non-functional during the previous year's evaluation process and report the energy savings these measures achieve in the subsequent year.

2.1 Introduction

Avista's nonresidential portfolio of programs 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 sixteen programs in three major categories: Prescriptive, Energy Smart Grocer, and site-specific (custom). The programs are described below.

2.1.1 ENERGY STAR Residential Products (APP)

This program is available to nonresidential customers who use residential-grade appliances in a small business application. Savings are determined through deemed estimates.

2.1.2 Prescriptive Commercial Clothes Washer (PCW)

To encourage customers to select high-efficiency clothes washers, this program targets nonresidential electric and natural gas customers in multifamily or commercial Laundromat facilities. The program's streamlined prescriptive approach is designed to reach customers quickly and effectively to promote ENERGY STAR or Consortium for Energy Efficiency (CEE) listed units.

2.1.3 Prescriptive Commercial Shell (PCS)

Beginning in January 2011 the installation of commercial insulation has been processed through a prescriptive program in addition to the site-specific program. Projects eligible for the prescriptive commercial shell program are those with pre-existing:

- Wall insulation levels of less than R4 that are improved to R11 or better
- Attic insulation of less than R11 that are improved to R30 or better
- Roof insulation of less than R11 that are improved to R30 or better

2.1.4 Prescriptive Demand Controlled Ventilation (PDCV)

Under this program, nonresidential electric and natural gas customers receive direct incentives to install DCV in existing buildings. This type of ventilation measures carbon dioxide levels as an indicator of fresh ventilation in relation to approximate number of people occupying a space—based on —and adjusts the outdoor air intake rate to match occupant need for ventilation. To be eligible for the program, the existing equipment must maintain the temperature of the conditioned spaces between 65 and 75 degrees during operating hours. Also, the controlled conditioned space must be a minimum of 2,000 square feet.

2.1.5 Prescriptive Food Service (PFS)

Applicable to nonresidential electric and gas customers with commercial kitchens, this program provides direct incentives to customers who choose high-efficiency kitchen equipment. The equipment must meet either ENERGY STAR or CEE tier levels (depending on the unit) to qualify for an incentive.

2.1.6 Prescriptive LED Traffic Signals (PTS)

This program targets nonresidential electric customers (primarily municipalities) that own traffic signals and offers incentives to replace incandescent with high-efficiency LED signals. These LED signals are designed for use in pedestrian signals, red-yellow-and-green traffic signals, and traffic arrows. Since market saturation has nearly been reached, this program was scheduled to run only until the end of 2011.

2.1.7 Prescriptive Lighting (PL)

Since there is a significant opportunity for lighting improvements in commercial facilities, this program offers direct financial incentives to customers who increase the efficiency of their lighting equipment. The rebate is available to existing commercial and industrial electric customers whose facilities have rate schedules 11 or above. This program provides pre-determined incentive amounts for 38 measures, including:

- T12 fluorescent to T8 fluorescent
- High bay, high intensity discharge lighting to T5 fluorescent or T8 fluorescent
- High bay, high intensity discharge lighting to induction fluorescent

- Incandescent to compact fluorescent or cold cathode fluorescent
- Incandescent to LED
- Incandescent exit signs to LED exit signs

2.1.8 Prescriptive Motors (PM)

Avista offers rebates and incentives to help pay for qualifying premium motors. Participants can choose one of two options. They can develop a comprehensive motor inventory using the Department of Energy's (DOE) Motormaster program and submit that with the rebate application paperwork. Or they can purchase a new premium efficiency motor, select the motor from the CEE Premium Efficient Motor List, fill out the rebate form, and then attach the appropriate invoices and manufacturer's specification sheet.

2.1.9 Prescriptive PC Network Controls (PNC)

Computers that remain in a full-power state when idle can waste significant energy for customers with numerous PCs. This program, available to nonresidential electric customers, provides an incentive to install a network-based power management software solution to manage the power of networked PCs.

2.1.10 Prescriptive Refrigerated Warehouse (PRW)

This program offers nonresidential electric customers a direct incentive for efficiency improvements in refrigerated warehouses. Although the customer base for this program is limited, the opportunities for energy savings from the program's measures are significant.

2.1.11 Prescriptive Side Stream Filtration (PSSF)

This program provides incentives to nonresidential electric customers who install permanent side-stream filtration systems on their new or existing open-loop evaporative cooling tower/chiller systems. With incentives for this program paid at $18 per ton—or 50% of the installed cost, whichever is less—these systems help the equipment operate more efficiently between normal cleanings and inspections.

2.1.12 Renewables (REN)

This program provides prescriptive incentives for residential and nonresidential projects that install photovoltaic (solar electric) systems and/or wind turbines.

2.1.13 Energy Smart Grocer (ESG)

Refrigeration has high potential for energy savings but is often overlooked because of the technical aspects of the equipment. The Energy Smart Grocer program assists grocery store customers with technical aspects of their refrigeration systems while providing a clear view of what 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 customers through the ESG process from inception through the payment of incentives for qualifying equipment.

2.1.14 Site Specific (SS)

The site-specific program is for nonresidential measures that do not fit under any of the prescriptive applications and thus 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 gas saving measures included in the program are:

- Site Specific HVAC (SSHVAC)
  - HVAC Combined
  - HVAC Cooling
  - HVAC Heating
    - Motor Controls HVAC
  - Site-specific Lighting (SSL)
  - Lighting Exterior
  - Lighting Interior
- Site-specific Other (SSO)
  - Appliances
  - Compressed Air
  - Green Motors Rewind
  - Industrial Process
  - Motor Controls Industrial
  - Multifamily
  - Standby Generator Block Heater
- Site-specific Shell (SSS)

Avista implements the site-specific and prescriptive programs and 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 managed 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 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 worked with a subcontractor, SBW, to review Avista's reported gross energy savings and available documentation, such as audit reports, 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 to ask their experience 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.

2.2.1 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 2-5. We used preliminary program population data provided by Avista and determined we needed to meter 75 projects and visit 125 sites. We anticipated achieving 90/10 precision at the overall nonresidential program 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 for the stratum. The cutoff for the census savings for each stratum is shown in Table 2-6 below. 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 2-5. Proposed PY 2010-2011 Nonresidential Evaluation Activities

Stratum	Precision Target	Proposed Metering Projects	Proposed Site Visits
Prescriptive	90/15	14	10
ESG	90/15	19	22
SSHVAC	90/20	17	33
SSL	90/15	12	4
SSO	90/20	13	34
SSS	90/20	0	22
Total	90/10	75	125

Table 2-6. Census Level Cutoff by Stratum

Stratum	Reported Savings (kWh)
Prescriptive	500,000
ESG	500,000
SSHVAC	500,000
SSL	500,000
SSO	750,000
SSS	200,000

In Table 2-7, 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, our initial sampling plan 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 2-7. Final FY 2011 Gas Evaluation Activity Sample

Stratum	Achieved Precision	Completed Metering Projects	Completed Site Visits
Prescriptive	90/22	10	38
ESG	90/15	17	19
SSHVAC	90/16	17	32
SSL	90/14	8	22
SSO	90/33	11	13
SSS	90/11	0	17
Total	90/9	63	141

As explained above, we selected projects with large reported savings. In selecting the rest of our sample, we found that the extract from Avista's database did not include addresses so that we could 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 selected projects of interest, asked Avista for additional data to determine how many and what types of projects were at various locations, and obtained their project files, until we completed the final primary and backup samples.

We also found that the database extract provided program-level, 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. To establish this distribution, we would have required an exhaustive review of project files, which was not within the scope of the evaluation.

2.2.2 Data Collection

Cadmus collected data from 63 metering sites and 141 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. Our review included 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 and Long-Term Metering

Cadmus performed short-term (two weeks) and long-term (multiple months) metering for projects across the nonresidential electric portfolio. We installed power meters, temperature 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 we also verified the operational characteristics of the installed equipment, such as temperature set points 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.

2.2.3 Engineering Analysis

Prescriptive and site-specific programs 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 and compared these with the values we developed for the new technical reference manual (TRM).[28] 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 with 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 that either short-term metering over a period of two weeks or long-term metering over a period of several months presented the most effective method for achieving precision in a particular project's energy saving calculations. Specific metering details for each measure category are discussed in the Findings section. Installed metering equipment is listed:

- HOBO light loggers for 24 lighting projects, including six for LED refrigeration case lighting and one for a refrigerated warehouse.
- Energy Logger Pros for metering 11 Energy Smart Grocer projects such as anti-sweat heater controls and refrigeration compressors.
- Energy Logger Pros for metering variable frequency drive energy on seven site-specific HVAC fan projects.
- Energy Logger Pros for metering energy use for eight heat pump and air conditioning projects.
- Energy Logger Pros for metering energy use for eight compressed air, wastewater blower, and industrial process motor projects.
- Energy Logger Pros for metering energy use and temperature for two standby generator block heater projects.
- An Energy Logger Pro for metering energy use on one efficient elevator motor replacement project.

The analysis for each project varied by the measure and metering data obtained.

Billing Analysis

Cadmus analyzed Avista's metered billing data for two 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 heating degree days (HDDs). It also determined savings based on normalized weather conditions, since the actual weather conditions may have been milder or more extreme than the TMY3 (typical meteorological year) 15-year normal weather averages from 1991-2005 obtained from the NOAA.

[28] Avista's new iteration of the TRM is expected in July 2012.

From NOAA, we also obtained daily weather data for each weather station associated with the participant projects and calculated the base 65 reference temperature HDDs. We matched the participant billing data to the nearest weather station by zip code, and 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 average daily consumption in kWh as a function of some combination of average standing base load, HDD, 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 occur 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-period model. This scenario extrapolated the counterfactual consumption, i.e., what the consumption would have been in the absence of 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. Both scenarios used 15-year TMY3 data 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 the building of 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. From these data, energy savings are estimated through algorithms programmed by Avista. For each spreadsheet, we reviewed 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 (eQuest or Trane TRACE), which it chose because of the complex interactions between heating and cooling loads and the building envelope. Avista provided the original energy simulation models, and we reviewed the models to determine the relevant parameters and operating details (such as temperature set points) for the applicable measure. We updated the models as necessary based on our on-site verification data.

2.3 Results and Findings

2.3.1 Overview

Cadmus adjusted gross savings estimates based on our evaluated findings. Further details by program are discussed in the following sections.

2.3.2 Prescriptive

The Cadmus team evaluated savings for a sample of sites across fourteen prescriptive programs. Table 2-8 through Table 2-10 show our evaluated results by program. Specific evaluation details are described in each program subsection below.

Table 2-8. Evaluated Results for Nonresidential Prescriptive Sample

Program	Number of Measure Installations	Evaluated Sample	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
APP	125	10	1,368	1,703	124%
PCW	15	1	869	1,111	128%
PCS	57	1	6,093	6,093	100%
PDCV	10	0	N/A	N/A	N/A
PFS	181	3	27,762	14,597	53%
PTS	17	2	130,947	106,067	81%
PL	1,807	24	3,405,128	1,560,358	46%
PM	74	3	62,046	53,547	86%
PNC	4	2	360,302	358,760	100%
PRW	3	1	121,135	146,759	121%
PSSF	6	1	84,214	84,214	100%
PVC	2	0	N/A	N/A	N/A
REN	10	0	N/A	N/A	N/A
Total	2,311	48	4,199,864	2,333,209	56%

Table 2-9. Evaluated Results for Nonresidential Prescriptive Sample - Idaho

Program	Number of Measure Installations	Evaluated Sample	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
APP	36	2	172	131	76%
PCW	2	0	N/A	N/A	N/A
PCS	18	1	6,093	6,093	100%
PDCV	7	0	N/A	N/A	N/A
PFS	59	2	14,597	14,597	100%
PTS	12	2	130,947	106,067	81%
PL	716	9	161,598	155,211	96%
PM	25	1	2,080	2,080	100%
PSSF	2	0	N/A	N/A	N/A
REN	2	0	N/A	N/A	N/A
Total	879	17	315,487	284,179	90%

Table 2-10. Evaluated Results for Nonresidential Prescriptive Sample - Washington

Program	Number of Measure Installations	Evaluated Sample	Gross Reported Savings (kWh)	Gross Evaluated Savings (kWh)	Realization Rate
APP	89	8	1,196	1,572	131%
PCW	13	1	869	1,111	128%
PCS	39	0	N/A	N/A	N/A
PDCV	3	0	N/A	N/A	N/A
PFS	122	1	13,165	0	0%
PTS	5	0	N/A	N/A	N/A
PL	1091	15	3,243,530	1,405,147	43%
PM	49	2	59,966	51,467	86%
PNC	4	2	360,302	358,760	100%
PRW	3	1	121,135	146,759	121%
PSSF	4	1	84,214	84,214	100%
PVC	2	0	N/A	N/A	N/A
REN	8	0	N/A	N/A	N/A
Total	1,432	31	3,884,377	2,049,030	53%

Overall, the Prescriptive program analysis achieved a level of 90/22 confidence and precision. Cadmus identified several necessary adjustments to the reported savings for the Prescriptive programs. We note that the calculations often rely on reported equipment and operations data, which may vary from parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 46%, primarily as the result of a low realization rate on one large Prescriptive Lighting project. Typical adjustments were to correct equipment efficiency, fuel type, operating schedules, and operating parameters as described below:

- A dishwasher measure used gas water heating instead of electric, so this reduced electric energy savings. Cadmus attributed the gas savings to the nonresidential gas program. In addition, one dishwasher and one clothes washer measure used electric water heating instead of gas, as reported. This increased the evaluated electric savings.
- For ENERGY STAR clothes washers we applied the results from a previous Cadmus clothes washer study.[29] The Cadmus study estimated larger energy savings for this measure than the reported values.
- One Prescriptive Food Service project installed a commercial dishwasher that relied on gas heating instead of electric, which reduced electric energy savings. The gas savings were attributed to the nonresidential gas program.
- One Prescriptive LED Traffic Signal project double-counted savings for pedestrian signals. Deemed savings of 498 kWh for a pedestrian signal assume 22 hours of operation per day, and therefore include both the "Don't Walk" and "Walk" portion of the

[29] The Cadmus Group, Inc. "Do the Savings Come Out in the Wash? A Large Scale Study of In-Situ Residential Laundry Systems." 2010. http://www.cadmusgroup.com/pdfs/Do_the_Savings_Come_Out_in_the_Wash.pdf

savings. Avista reported 498 kWh for both "Walk" and "Don't Walk" cycles. The realization rate for this project was 52%.

- Avista implementation staff made a data entry error on the largest prescriptive lighting project. The participant replaced 94 metal halide fixtures with 94 T5 high output fixtures. An implementation staff member recorded the baseline as 994 fixtures. This error greatly increased baseline energy usage. Cadmus calculated the realization rate at 16%, a reduction of 1,419,473 kWh. This one site represented 77% of the overall savings reduction of 1,835,347 kWh.
- Avista reported another census-level prescriptive lighting project at a grocery store that operated 8,760 hours per year. During the site visit verification, Cadmus determined the store operated only 6,570 hours per year. The project realization rate was 80%, a reduction of 111,603 kWh.
- Cadmus used lighting logging and verification data to confirm or adjust operating hours for all other projects. These adjustments, in addition to those made from verified fixture counts, reduced energy savings by 27%.
- One Prescriptive Refrigerated Warehouse measure involved high efficiency lighting and occupancy sensors. We adjusted estimates of the occupancy sensor savings and operating hours and evaluated savings at a realization rate of 121%.

2.3.3 Energy Smart Grocer

Cadmus performed on-site or metering visits to 36 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 2-11 lists the two measure types we evaluated and the number of projects and reported savings. Table 2-12 shows our evaluated results for the program.

Table 2-11. Energy Smart Grocer Measure Types and Projects Evaluated

	Idaho		Washington		Total	
Measure Type	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)	Evaluated Projects	Reported Savings (kWh)
Case Lighting	3	51,360	6	161,655	9	213,015
Refrigeration Equipment	13	1,717,158	14	1,104,120	27	2,821,278
Total	16	1,768,518	20	1,265,775	36	3,034,293

Table 2-12. Evaluated Results for Nonresidential Energy Smart Grocer Sample

State	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Sample Savings (kWh)	Gross Evaluated Sample Savings (kWh)	Sample Realization Rate
Idaho	289	16	1,768,518	1,352,713	76%
Washington	468	20	1,265,775	1,077,032	85%
Total	757	36	3,034,293	2,429,746	80%

Overall, the Energy Smart Grocer analysis achieved a level of 90/15 confidence and precision. Cadmus identified several necessary adjustments to the reported savings for the Energy Smart Grocer program. We note that the calculations often rely on reported equipment and operations data, which may vary from parameters identified during on-site verification visits and metering.

Our adjustments decreased savings by 20%. Typical adjustments were to correct equipment efficiency, operating schedules, and operating parameters as described below:

- Cadmus metered operating hours for six case lighting projects. We found an average realization rate of 118% on these projects, based on the logged data, verified equipment data, and assumptions for the refrigeration equipment efficiency (COP).
- One participant reported energy savings for installing efficient refrigerated cases, but included savings for LED case lights both in the equipment measure and as a separate lighting measure, thereby double-counting energy savings. Cadmus corrected this resulting in a realization rate of 18%.
- Several new construction projects for one grocery chain reported savings for efficient refrigerated cases. Cadmus verified equipment specifications and operating hours, but on average evaluated lower savings than the reported values.
- Cadmus metered compressor operation on several projects and found the actual operating hours were lower than the reported hours.
- Cadmus metered anti-sweat heater power at one grocery store and found the operating hours were lower than the value used in the savings calculation. The project realization rate was 65%.
- Cadmus applied more conservative energy savings for several measures based on secondary sources. The affected measures and secondary sources are:
    - Night covers, using values estimated by the American Society of Heating Refrigeration, and Air-Conditioning Engineers (ASHRAE).[30]
    - Special doors with low/no anti-sweat heaters, using data from a Southern California Edison (SCE) study.[31]
    - ECMs, using data from the Regional Technical Forum developed by PECI.[32]

2.3.4 Site Specific

Cadmus performed site visits on 120 site-specific program projects, which represent a variety of measure types. Cadmus calculated an overall realization rate for all projects in Idaho and Washington, and then we applied the resulting realization rate to the savings for each state.

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[30] ASHRAE 2010 Refrigeration Handbook, Chapter 15.10. “Six hours of night cover use can reduce the cooling load by 8% and the compressor power requirements by 9%.”

[31] http://asset.sce.com/Documents/Business%20-%20Services%20for%20Your%20Business/Anti_Sweat_Heater_Report.pdf

[32] http://www.nwcouncil.org/energy/rtf/meetings/2010/01/SP%20to%20ECM%20in%20Display%20Case%20for%20RTF%20updated%20efficiencies.xls

Table 2-13 lists the different measure types we evaluated, as well as the number of projects and reported savings. Table 2-14 shows our evaluated results for the program.

Table 2-13. 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)
SSHVAC	22	2,715,552	27	4,317,457	49	7,033,009
SSL	8	2,828,836	22	4,699,164	30	7,528,000
SSO	4	1,397,649	20	6,548,497	24	7,946,146
SSS	10	255,664	7	664,358	17	920,022
Total	44	7,197,701	76	16,229,476	120	23,427,177

Table 2-14. Evaluated Results for Nonresidential Site-Specific Sample

State	Total FY11 Measure Installations	Evaluated Sample	Gross Reported Sample Savings (kWh)(	Gross Evaluated Sample Savings (kWh)	Sample Realization Rate
Idaho	448	44	7,197,701	8,317,696	116%
Washington	700	76	16,229,476	15,637,482	96%
Total	1,148	120	23,427,177	23,955,178	102%

Overall, the site-specific program analysis achieved a level of 90/11 confidence and precision. Cadmus identified many adjustments to site-specific program project reported savings. Site-specific projects tend to be more complex, and energy savings parameters and impacts can be 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 2%, driven primarily by the high realization rate for the HVAC stratum.

Typical adjustments made to the savings values included corrections to equipment efficiency, operating schedules, temperature set points, and building parameters. Cadmus also identified errors in simulation models and Microsoft Excel calculation tools, which resulted in adjustments when corrected. Specific adjustments are identified by major measure category below.

Site-specific HVAC Adjustments

- Cadmus found Avista's assumptions for the post-installation heating load on a large HVAC heating project resulted in a savings reduction. Based on analysis of billing data and heating degree days, we calculated lower than reported savings with a realization rate of 88%.
- During a site visit at a university, Cadmus found two HVAC fan VFDs had been manually overridden to operate at 100-percent speed. This required more energy than in the baseline condition.

- Cadmus installed power meters on twelve HVAC fan VFDs for periods ranging from two weeks to six months. The metered energy savings estimates were substantially higher than the reported values, with a realization rate of 247%. Avista reported the deemed savings estimates had been derived from a study performed by a third-party engineering firm in 1995. We applied our metered results to all HVAC fan VFDs in the sample, which increased savings for the site-specific HVAC measure category.

- Cadmus identified multiple discrepancies and simulation model errors on an office project with HVAC DDC control upgrades. The electric realization rate was 49%. The discrepancies between model and site visit were:

  - The proposed window U-values did not match installed values.
  - The modeled computer room area was smaller than the actual area.
  - Avista included VFDs in the retrofit model, but also reported VFD savings using the site-specific HVAC deemed savings calculator. Therefore, the VFD savings appear to have been double-counted.
  - The model listed one system zone per floor whereas the as-built zoning used one system for the building perimeter and one system for the building interior.
  - The model used 8,760 hours per year for the occupancy, lighting, and plug load schedules in the model baseline and followed normal office schedules in the case of retrofit. The schedule should have used the same conventional office operating schedule for both baseline and retrofit conditions. The higher baseline operating hours inflated savings.

- One church reported electric savings for HVAC combined and shell measures. Cadmus conducted a site visit and found the original HVAC equipment only used gas heat without cooling. We determined there were no electric energy savings at this site.

- Cadmus evaluated site-specific HVAC projects using a combination of metering, simulation, utility billing, and verification data. In general, the results indicated the reported values were somewhat conservative, and the measure category had a realization rate of 124%.

Site-Specific Lighting Adjustments

- Two sampled 2010 electric projects had duplicate savings in the Avista database extract. As an example, one census-level retail store lighting project reported savings of 455,484 kWh in the project file. Cadmus evaluated slightly higher savings than this value, but the database extract reported savings of 910,968 kWh. The realization rate for this project was 53 %. This issue involved a reporting error in Avista software and was resolved for the 2011 database extract.

- The Cadmus team inspected another census-level lighting project for a postal distribution center and found eight of the reported spaces on site did not have efficient lighting installed. This reduced the project realization rate to 70%.

- Cadmus inspected three census-level lighting projects on a university campus and conducted light logging. The logged data and verified information indicated savings were higher than reported. The three projects combined had a realization rate of 116%.

- Cadmus evaluated non-census site-specific lighting projects using a combination light logging and verification data. On average, the results indicated the reported values were reasonable, and the measure category had a realization rate of 98%.

Site-Specific Other Adjustments

- Cadmus performed a site visit on a compressed air project where the trim compressor was outfitted with a VFD. During the site visit, we found the participant had adjusted the control system so the smaller VFD compressor provided the base load (with continuous operation) while a larger and less efficient compressor performed trim operations. This configuration uses more energy than the baseline condition due to losses in the VFD drive at 100-percent speed.
- We performed metering on a compressor at an industrial facility. To determine energy savings, Avista had applied baseline energy use from 2008, which was during the beginning of the nationwide economic slowdown and when the plant's compressed air usage was significantly lower than in current conditions. Therefore we considered the 2008 baseline too conservative. We adjusted the baseline upward based on current operating conditions and our detailed understanding of compressed air energy use. The project's evaluated realization rate was 594%.
- Cadmus metered seven other compressed air and industrial process motor projects. The average project achieved slightly lower energy savings than reported, and the realization rate for these projects was 94%.
- We metered one elevator motor replacement project for three months. The metered savings indicated operating time and energy usage were much less than reported. The project achieved a realization rate of 8%.
- Cadmus also metered two standby generator block heaters. The reported savings were based on interpolating energy savings from a study performed on two block heater sizes. The metered data indicated the energy savings were lower than the interpolated value. Each block heater project achieved an 84% realization rate.
- We verified two pump replacement projects for water pumping stations and recalculated savings based on participant reported flow volume data and utility billing data. We adjusted the analysis to compare only pre- and post-installation periods when these pumps operated. Both projects achieved energy savings, but the data showed savings were lower than the values reported by the participant. The combined realization rate for both projects was 47%.
- 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, and the measure category had a realization rate of 92%.

Site-specific Shell Adjustments

Cadmus performed a site visit at one census-level site-specific shell project which installed new, efficient windows in an apartment complex. Our verification visit showed one building was oriented incorrectly in the original analysis. The original analysis indicated the building had 759 square feet of windows facing west, therefore absorbing significant heat from the late afternoon sun. Cadmus verified the west face of the building had only 30 square feet of window area. This reduced energy savings to 90%.

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 too much from verified values, and the savings calculators produced reasonable results. On average, the results indicated the achieved energy savings were less than the reported values, and the measure category had a realization rate of 86%.

2.3.5 Extrapolation to Program Population

For our evaluation of the nonresidential gas 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) to apply to the programs at 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:

$$RR_{ij} = \frac{Verified_{ij}}{Claimed_{ij}}; \textit{ for measure } j \textit{ at site } i \tag{1}$$

$$RR_{j} = \frac{\sum_{i} Verified_{i}}{\sum_{i} Claimed_{i}}; \textit{ for measure } j \textit{ across all sample sites} \tag{2}$$

$$\sum_{k} Verified_{k} = RR_{j} x \sum_{k} Claimed_{k}; \textit{ for measure } j \textit{ across all sites in measure population} \tag{3}$$

$$RR_{l} = \frac{\sum_{k} Verified_{k}}{\sum_{k} Claimed_{k}}; \textit{ for the population (all sites and measures)} \tag{4}$$

Where:

RR	=	the realization rate
i	=	the sample site
j	=	the measure type
k	=	the total population for measure type ‘j’
l	=	the total program population

We calculated realization rates for each individual site in the sample based on measure type (Equation 1). We then 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 (Equation 2). We calculated the population verified savings for projects not in the census category by multiplying the measure type realization rate from the random sample by the claimed savings for the non-census population of each measure type (Equation 3). We then 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 (Equation 4).

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 2-15 through Table 2-17. The overall portfolio gross realization rate was 93%.

Table 2-15. PY 2010 and 2011 Gross Program Realization Rates

Program	Gross Sample Reported Savings (kWh)	Gross Sample Evaluated Savings (kWh)	Realization Rate*	Gross Program Reported Savings (kWh)	Gross Program Evaluated Savings (kWh)
Prescriptive	4,204,571	2,346,164	80%	30,744,663	24,469,769
ESG	3,034,293	2,429,746	80%	18,314,967	14,665,926
SSHVAC	7,263,552	8,587,587	124%	17,719,269	21,966,665
SSL	7,528,000	7,186,741	97%	21,489,162	20,768,632
SSO	7,946,146	7,430,332	92%	14,013,381	12,911,517
SSS	920,022	808,795	86%	2,667,193	2,305,315
Total	30,896,583	28,789,365	93%	104,948,636	97,087,824

*Realization rates vary from the ratio of evaluated to reported savings due to the impact of census-level projects.

Table 2-16. PY 2010 and 2011 Gas Gross Program Realization Rates - Idaho

Program	Gross Sample Reported Savings (kWh)	Gross Sample Evaluated Savings (kWh)	Realization Rate	Gross Program Reported Savings (kWh)	Gross Program Evaluated Savings (kWh)
Prescriptive	315,559	284,224	83%	9,764,945	8,137,296
ESG	1,768,518	1,352,713	80%	7,376,731	5,907,004
SSHVAC	2,443,517	4,095,261	121%	5,183,634	6,279,138
SSL	2,828,836	3,242,789	104%	7,033,160	7,289,607
SSO	1,397,649	594,230	90%	2,810,585	2,539,103
SSS	255,664	197,058	86%	1,078,833	924,062
Total	9,009,743	9,766,275	93%	33,247,888	31,076,211

Table 2-17. PY 2010 and 2011 Gas 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	3,889,012	2,061,940	78%	20,979,718	16,332,473
ESG	1,265,775	1,077,032	80%	10,938,236	8,758,922
SSHVAC	4,820,035	4,492,326	125%	12,535,635	15,687,527
SSL	4,699,164	3,943,952	93%	14,456,002	13,479,024
SSO	6,548,497	6,836,101	93%	11,202,796	10,372,414
SSS	664,358	611,737	87%	1,588,360	1,381,252
Total	21,886,840	19,023,090	92%	71,700,748	66,011,612

2.3.6 Achievements Compared to Goals

Avista outlined goals for various programs to save a total of 88,022,249 kWh as its integrated resource planning (IRP) goal, as shown in Table 2-18. The overall Avista nonresidential portfolio's evaluated gross savings achieved 110% of its goals.

Table 2-18. PY 2010 and 2011 Electric Program Achievements Compared to IRP Goals*

Program	Program Gross Goals (kWh)	Evaluated Gross Program (kWh)	Goal Achievement
Idaho	33,617,010	31,076,211	92%
Washington	54,405,239	66,011,612	121%
Total	88,022,249	97,087,824	110%

*These savings are exclusive of the CFL Contingency Plan savings which are discussed in another chapter.

2.4 Conclusions

The Cadmus team evaluated 223 of 4,215 measures installed through the program, representing 29% of reported savings.

In general, Cadmus determined that Avista implemented the programs well. Gross evaluated savings achieved 110% of reported program savings goals. The overall portfolio achieved a 93% realization rate when we compare gross evaluated savings to gross reported savings.

Cadmus identified the following key issues that adjusted energy savings:

- Some participants did not operate the incented equipment correctly or did not complete the improvements expected for the measure.
- Some participant heating or cooling loads did not achieve the level projected for post-installation usage.
- Simulation models did not accurately represent the actual as-built building or system operation.
- HVAC fan VFD deemed savings estimates may have been too conservative and were based on an older study from 1995.

- Avista implementation staff may not have conducted thorough an analysis of energy savings calculations provided by participants or third-party contractors for all projects.
- Avista implementation staff 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:

- Cadmus could have streamlined the sampling process if Avista's database had recorded site addresses and contact information. Having measure-level data, such as specific measure type and quantity, for each project would have improved the range and depth of our evaluation activities.

2.5 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 effectiveness of the evaluations:

- Avista should create a quality control system to double-check all projects with savings over 300,000 kWh. An Avista EM&V engineer reported he has begun to review these types of projects.
- Avista should consider performing three- to six-month post-installation random inspections to confirm measure persistence and to identify opportunities to improve performance.
- Avista should consider conducting future studies to quantify less conservative assumptions for HVAC fan VFD deemed savings estimates.
- Avista should consider revising its methodology for calculating and tracking HVAC/lighting interactive effects.
- Avista should consider adding a program for recommissioning measures that were identified as non-functional during the previous year's evaluation process and report the energy savings these measures achieve in the subsequent year. Recommissioning measure costs would primarily be for utility and implementer staff to resolve issues and to re-inspect the measure. We recommend that recommissioning measures be evaluated through a census sample, and the verified energy savings should not be extrapolated to the overall program population.

3 2011 Low-Income Electric Impact Report

Executive Summary

Program Overview

Avista's Low-Income Weatherization Program in Washington and Idaho seeks to lower customers' energy consumption and utility bills. At no cost to income-qualified customers, the program provides: a complete home energy audit, and installation of energy-efficient measures.

Evaluation Approach

This impact evaluation assessed electric energy impacts resulting from measure installations in homes within Avista's Washington and Idaho service territories. Electric impacts have been presented separately for homes receiving electric-to-gas conversion measures (i.e., water heater and furnace replacements) from homes receiving electric-saving measures without conversions. Major tasks performed for the evaluation are described in greater detail below.

Data Collection

Table 3-1 lists data required for this evaluation and their sources.

Table 3-1. Data Sources

Data	Source
Program participant and measure data	Avista
Expected savings by measure installation	Avista/CAP agencies
Participant billing histories	Avista
Weather data	NOAA

Evaluation of Program Energy Savings

Cadmus reviewed Avista's estimated savings, and calculated average achieved household and total savings, as described below:

- **Expected Savings:** Based on expected measure-level electric savings estimates, provided by Avista from their program participant database.
- **Actual Savings:** Calculated using a pre/post-conditional savings analysis (CSA), fixed-effects regression model, estimating weather-normalized, program-induced energy savings, based on participant billing data. This analysis was performed on the 2010 participant population in the previous gas impact report; in this report, state-specific savings per participant calculated in that billing analysis have been applied to the 2011 participant population.

Electric Impact Findings and Conclusions

Billing Analysis Electric Savings

Table 3-2 and Table 3-3 and summarize model savings results of weatherization measure installations for electric non-conversion and conversion participants, respectively.

Electric savings for non-conversion participants were estimated at approximately 10% and 14% of pre-participation annual consumption in Idaho and Washington, respectively. For conversion participants, those receiving both conversions achieved savings at 64% of the pre-period annual consumption, while furnace-only and water heater-only conversion participant percentages both achieved approximately 31%.

Based on the billing analysis sample (e.g., 2010 participants), we calculated the following realization rates:

- 44% in Idaho;
- 93% in Washington; and
- 68% overall for electric non-conversion participants, relative to reported expected savings.

For conversion participants, realization rates were:

- 85% for combo;
- 53% for furnace-only; and
- 70% for hot water-only conversion customers.

Table 3-2. Low-Income Weatherization Non-Conversion Participant Savings Summary

Group	n	Average Expected Savings (kWh)	Model Savings (kWh)	Realization Rate
Idaho	73	3,626	1,602	44%
Washington	128	2,256	2,099	93%
Overall Electric	201	2,753	1,864	68%

Table 3-3. Low-Income Weatherization Conversion Participant Savings Summary

Group	n	Average Expected Savings (kWh)	Model Savings (kWh)	Realization Rate
Furnace Only	5	8,902	4,683	53%
DWH Only	58	5,738	4,019	70%
Combo	74	14,361	12,233	85%
Overall Conversion	137	10,511	8,394	80%

Overall Electric Savings

In applying savings estimates from the billing analysis to the electric-saving, 2010–2011, participant program population, 3,225,930 total kWh savings were achieved. Table 3-4 provides more detail on overall savings calculations by state and by participant type.

Table 3-4. Overall 2010-2011 Electric Savings by State and Participant Type

Participant Type	State / Type	Total Participants	Total Expected Savings (kWh)	Model Savings Per Participant (kWh)	Total Savings (kWh)	Realization Rate
Electric (Non-Conversion)	Idaho	197	1,156,559	1,602	315,602	27%
	Washington	232	650,482	2,099	487,046	75%
Conversion (WA only)	Furnace Only	22	238,280	4,683	103,020	43%
	DWH Only	139	792,851	4,019	558,688	70%
	Combo	144	2,067,651	12,233	1,761,573	85%
Overall		734	4,905,823	N/A	3,225,930	66%

Table 3-5 summarizes electric savings by state, rolling up conversion participant savings to reflect both the conversion and non-conversion savings in Washington.

Table 3-5. Overall 2010-2011 Electric Savings by State

State	Total Expected Savings (kWh)	Total Savings (kWh)	Realization Rate
Idaho	1,156,559	315,602	27%
Washington	3,749,264	2,910,327	78%
Overall	4,905,823	3,225,930	66%

We compared evaluated savings for the 734 electric participants (conversion and non-conversion) against Avista's IRP goals. Table 3-6 summarizes overall evaluated savings, IRP savings goals, and the goal achievement rates, overall and by state.

Table 3-6. IRP Program Goals Comparison

State	Reported Savings (kWh)	Evaluated Electric Savings (kWh)	Goal Achievement
Idaho	2,492,905	315,602	13%
Washington	1,540,377	2,910,327	189%
Overall	4,033,282	3,225,930	80%

Recommendations

The impact evaluation revealed several areas where program performance and savings accuracy could be improved:

- Work with Idaho agencies to provide refrigerator replacements.
- Perform quality checks on expected savings estimates.
- Track alternative heating sources.
- Consider performing quantitative, non-energy benefit analyses.
- Include high-use customers in program targeting.

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 2010 customers. Analysis and results examined the household- or participant-level, rather than the measure-level. Billing analysis was performed on 2010 participants, given the availability of full years of energy consumption data, before and after the weatherization period (i.e., 2009 and 2011). Analysis results for 2010 participants were then applied to 2011 participants, reporting total 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, utilizing monthly billing data. We analyzed savings estimates for Idaho and Washington, and ran a series of diagnostics, such as a savings review by pre-consumption usage quartile and outlier analysis. A detailed discussion of the regression model used for this billing analysis follows, accompanied by resulting savings.

3.1.1 Program Description

Five programs comprise the Low-Income Weatherization Program, listed in Table 3-7. Local community action program agencies (CAPs) within Avista's Idaho and Washington service territories implemented all the low-income programs. CAPs holistically evaluate homes for energy-efficiency measure applicability, combining funding from different programs to apply appropriate measures to a home, based on results of a home energy audit.

While both states operated very similar weatherization programs, each state has individual programs, with different sovereign statewide administrators, implementation agencies, and weatherization protocols. Table 3-7 describes measures installed under each program component, along with counts of electric measures installed in each year, and included in our electric impact analysis.

Table 3-7. 2010 and 2011 Electric Efficiency Installations by Program Component

Low-Income Program Component	Measure Description	Measure Installations	
		2010	2011
Shell/Weatherization	Insulation, window/door, air infiltration, programmable thermostat	332	544
ENERGY STAR Appliance	High-efficiency refrigerator replacement	131	45
Fuel Conversion	Electric furnace and water heater replacement with gas units	216	233
Hot Water Efficiency	High-efficiency water heater replacement	6	15
HVAC Efficiency	High-efficiency gas furnace replacement	N/A	N/A

3.1.2 Data Collection

Cadmus obtained impact evaluation data from multiple sources, including:

- ***Program participant database***: Avista provided information regarding program participants and installed measures for each state. Specifically, these data included: a list of measures installed per home; and expected 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 2008 through December 2011.

- ***Weather data***: Cadmus collected Idaho and Washington weather data from eight representative stations, drawn for the corresponding time period; data derived from the NOAA.

Cadmus first matched participant accounts from program data with billing data. We then matched daily heating degree days (HDD) and cooling degree days (CDD) to each, respective monthly read date periods in billing data, for use in the weather-adjusted savings model. Finally, we paired pre- and post-consumption periods to compare consistent time frames.

3.2 Methodology

3.2.1 Sampling

The billing analysis used a census of 2010 program participants (139 electric accounts receiving conversion measures, and 218 accounts receiving non-conversion electric measures).

3.2.2 Data Collection Activities

Documentation Review/Database Review

Cadmus used the 2010–2011 Idaho and Washington Program participant database, provided by Avista, to develop a complete 2010 population for use in both billing analyses.

Billing Analysis

Avista provided monthly billing data for all participants, from January 2008 through December 2011. Avista also provided the participant database, which contained participation and measure data for 2010 and 2011, including all gas and electric measures installed per home by the different CAPs.

We obtained daily average temperature weather data from 2008 to 2011 for the eight NOAA weather stations, representing all 2010 electric participant ZIP codes in Avista's Washington and Idaho service territories. 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 stations closest to each participant.

As we received billing data through December 2011, we could only perform the billing analysis for the 2010 program year. We defined the analysis pre- period as 2009, before all participation installations occurred, and the post- period as 2011, following all installations occurring in 2010.

Analysis results for 2010 participants were then applied to the 2011 participant population, thus reporting overall impacts across the 2010 and 2011 program years.

3.2.3 Data Screening

Cadmus conducted a series of steps to screen participant usage data, ensuring analysis used a clean, reliable dataset.

General Screens

The following screens removed accounts that could have skewed the savings estimation:

- Accounts with fewer than three paired months (90 days) of billing data, in either the pre- or post-period; and
- Accounts with annual usage outside of reasonable bounds in either the pre- or post-period (i.e., less than 1,000 kWh, or more than 50,000 kWh).

PRISM Modeling Screens

The screening process then utilized PRISM models for pre- and post-billing data. We used these models to obtain weather-normalized pre- and post-annual usage for each account, and to provide an alternate check on weatherization savings obtained from the CSA model.

For each participant home, we estimated three models in both the pre- and post-periods 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 post-program period
α_i =	the participant intercept; represents the average daily kWh base load
β_1 =	the model space heating slope (used only in the heating only, heating + cooling model)
$AVGHDD_{it}$ =	the base 65 average daily HDDs for the specific location (used only in the heating only, heating + cooling model)
β_2 =	the model space cooling slope (used only in the cooling only, heating + cooling model)
$AVGCDD_{it}$ =	the base 65 average daily CDDs for the specific location (used only in the cooling only, heating + cooling model)
ε_{it} =	the error term

From the model above, we computed the weather-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
$\alpha_i =$	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)
$\beta_1 =$	the heating slope; in effect, usage per heating degree from the model above
$LRHDD_i =$	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
$\beta_2 =$	the cooling slope; in effect, the usage per cooling degree from the model above
$LRCDD_i =$	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
$\varepsilon_i =$	the error term

Table 3-8 and Table 3-9 summarize electric and conversion account attrition from the screens listed above.

Table 3-8. Electric Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original Electric Accounts (2010)	218	100%	0	0%
Dropped in Merge with Billing Data	215	99%	3	1%
Insufficient Pre- and Post-Period Months	212	97%	3	1%
Low or High Usage in Pre- or Post-Periods	210	96%	2	1%
Changed Usage from the Pre to Post (> 90%)	206	94%	4	2%
PRISM Screen: Low R-Squared, Low Heating Usage	206	94%	0	0%
Outliers	201	92%	5	2%
Final Analysis Group	201	92%	229	8%

Table 3-9. Conversion Account Attrition

Screen	Participants Remaining	Percent Remaining	Number Dropped	Percent Dropped
Original Conversion Accounts (2010)	139	100%	0	0%
Dropped in Merge with Billing Data	137	99%	2	1%
Insufficient Pre- and Post-Period Months	137	99%	0	0%
Low or High Usage in Pre- or Post-Periods	137	99%	0	0%
Changed Usage from the Pre to Post (> 90%)	137	99%	0	0%
PRISM Screen: Low R-Squared, Low Heating Usage	137	99%	0	0%
Final Analysis Group	137	99%	2	1%

3.2.4 CSA Modeling Approach

To estimate energy savings from this program, we 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 the inclusion of a separate intercept for each participant. Our modeling approach ensures model savings estimates will not be skewed by unusually high usage or low usage participants. Monthly consumption is also paired between pre- and post-months to maintain the same time frame for evaluating unique participants. We used the following model specification to determine state-level savings used for electric (non-conversion) participants:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \beta_3 POST\_ID_i + \beta_{4..14} M_t + \varepsilon_{it}$$

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \beta_4 POST\_WA_i + \beta_{4..14} M_t + \varepsilon_{it}$$

And overall savings for conversion customers:

$$ADC_{it} = \alpha_i + \beta_1 AVGHDD_{it} + \beta_2 AVGCDD_{it} + \beta_5 POST_i + \beta_{4..14} M_t + \varepsilon_{it}$$

Where, for participant ‘i’ and monthly billing period ‘t’:

ADC_{it} =	average daily kWh consumption during the pre- or post-program period
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 HDD, based on home location
β_2 =	the model space cooling slope
$AVGCDD_{it}$ =	the average daily base 65 CDD, based on home location
β_3 =	kWh savings per day for efficient measures in Idaho

$POST\_ID_i$ = an indicator variable, which is 1 in the post-period (after the weatherization installations) for Idaho participants, and 0 in the pre-weatherization period

β_4 = kWh savings per day for the efficient measures in Washington

$POST\_WA_i$ = an indicator variable, which is 1 in the post-period (after the weatherization installations) for Washington participants, and 0 in the pre-weatherization period

β_5 = the kWh savings per day for the efficient measures (conversion participant model)

$POST_i$ = an indicator variable, which is 1 in the post-period (after the weatherization installations) for participants, and 0 in the pre-weatherization period (conversion participant model)

M_t = an array of bill month dummy variables (Feb, Mar, …, Dec), 0 otherwise[33]

ε_{it} = the modeling estimation error

The above models estimate non-conversion electric savings for Idaho and Washington, respectively, with β_3 and β_4, and the conversion electric savings overall with β_5.

3.3 Results and Findings

3.3.1 Billing Analysis Results

Table 3-10 and Table 3-11 summarize model savings results of the weatherization measure installations for electric non-conversion and conversion participants, respectively.

Table 3-10. Low-Income Weatherization Non-Conversion Participant Savings Summary

Group	n	PRENAC	Normal HDDs	Normal CDDs	Model Savings (kWh)	Precision 90%	Savings Lower 90% (kWh)	Savings Upper 90% (kWh)
Idaho	73	15,773	6,551	504	1,602	28%	1,195	2,143
Washington	128	14,608	6,326	543	2,099	17%	1,823	2,551
Overall Electric	201	15,031	6,407	529	1,864	15%	1,650	2,234

Model savings averaged: 1,602 kWh in Idaho; 2,099 in Washington; and 1,864 overall.

[33] We excluded one of the dummy variables from the independent variables, otherwise the 12 monthly indicators would form perfect co-linearity with the intercepts. We excluded January, thus the intercepts include the seasonality from January.

Table 3-11. Low-Income Weatherization Conversion Participant Savings Summary

Group	n	PRENAC	Normal HDDs	Normal CDDs	Model Savings (kWh)	Precision 90%	Savings Lower 90% (kWh)	Savings Upper 90% (kWh)
Furnace Only	5	15,019	6,233	568	4,683	36%	3,227	6,844
DWH Only	58	12,981	6,246	519	4,019	11%	3,830	4,814
Combo	74	19,264	6,297	510	12,233	4%	12,604	13,704
Overall Conversion	137	16,449	6,273	516	8,394	4%	8,619	9,432

Combination conversion customers (receiving furnace and water heater conversions) saved 12,233 kWh per participant. Furnace-only participants saved 4,683 kWh, and participants only receiving hot water heater conversions saved 4,019 kWh. The overall precision at 90% confidence was 4%. The combination conversion results also shared a very high level of precision, at 4%.

Table 3-12 provides a distribution of electric measures, paid for by Avista, for participants in the final model.

Table 3-12. Measure Distribution of Final Model Sample, by State and Participant Type

Measures	Non-Conversion		Conversion
	ID	WA	WA
Air infiltration controls	45	31	2
Windows	40	31	3
Doors	28	22	2
Floor Insulation	23	19	3
Attic Insulation	39	17	3
Duct Insulation	2	4	0
Water heater replacement	0	4	0
Wall Insulation	0	3	3
T-stat (No AC)	0	1	0
Refrigerator replacement	0	88	22
Furnace replacement	0	1	35
Furnace conversion	0	0	79
Water heater conversion	0	0	132
Sample (n)	73	128	137

This distribution above indicates a similar mix of measures by state, aside from refrigerator replacements not being performed in Idaho using Avista funding. Given the 2010 average expected savings estimate for refrigerator replacement was nearly 900 kWh, this likely resulted in the discrepancy of average model savings between the two states.

Additionally, billing analysis results encompass all measure installations made at participant households, including those not paid for through Avista's program. As the program implemented through CAP agencies seeks to utilize a variety of funding sources per home, it is possible Avista-participant homes received measures paid for by federal, state, and other utility dollars. Specifically, Avista does not pay for CFLs offered through the low-income weatherization program, which likely had a significant impact on electric savings of participant homes.

Along with non-Avista funded measures, differences between state protocols for guiding agency measure installations (e.g., number of bulbs installed per home, hours of use thresholds for installation) as well as differences between agency (and individual contractor) delivery procedures (e.g., direct install vs. leave behind CFLs) likely affected savings estimates between the states.

Table 3-13 and Table 3-14 compare evaluated to expected savings, along with realization rates, for electric non-conversion and conversion participants, respectively. In these tables, expected savings estimates, along with model savings, have been calculated specifically for participant samples included in the final models (based on 2010 participants).

Table 3-13. Electric Non-Conversion Participant Realization Rate Summary

Group	n	PRENAC	Model Savings (kWh)	Expected Savings (kWh)	Realization Rate	Model Savings as Percent of Pre-Usage	Expected Savings as Percent of Pre-Usage
Idaho	73	15,773	1,602	3,626	44%	10%	23%
Washington	128	14,608	2,099	2,256	93%	14%	15%
Overall Electric	201	15,031	1,864	2,753	68%	12%	18%

For electric non-conversion participants, Washington model impacts had nearly identical expected savings, showing only a 1% difference between model and expected savings, as a percent of weather-normalized, pre-period annual consumption. Idaho model impacts were slightly lower than Washington's (10% of pre-period usage, compared to 14%), and approximately 13% lower than the expected savings percent of pre-usage (23%).[34]

Table 3-14. Conversion Participant Realization Rate Summary

Group	n	PRENAC	Model Savings (kWh)	Expected Savings (kWh)	Realization Rate	Model Savings as Percent of Pre-Usage	Expected Savings as Percent of Pre-Usage
Combo	74	19,264	12,233	14,361	85%	64%	75%
Furnace Only	5	15,019	4,683	8,902	53%	31%	59%
DWH Only	58	12,981	4,019	5,738	70%	31%	44%
Overall Conversion	137	16,449	8,394	10,511	80%	51%	64%

[34] By comparison, the 2008 Ecotope evaluation reported total expected savings of 948,427 kWh for the 117 non-conversion participants, resulting in average expected savings of 8,106—over 5,000 kWh higher than average model expected savings in 2010 (2,753 kWh). Assuming a comparable PRENAC of approximately 15,031 kWh on average, 2008 expected savings would reflect over 50% savings, relative to average pre-weatherization usage.

Model savings estimates as a percent of pre-usage were all lower for conversion participants than percentages relative to expected savings estimates.[35]

3.3.2 Review of Expected Savings

Starting in 2011, Avista reported changes to the method for calculating expected savings estimates. Table 3-15 compares the average expected savings per participant type (conversion vs. non-conversion) for 2010 and 2011.

Table 3-15. Expected Savings Comparison by State and Year

Participant Type	State	2010	2011	Percent Change
Electric (Non-Conversion)	Idaho	3,792	7,205	90%
	Washington	2,185	3,722	70%
Conversion	Washington	10,440	9,925	-5%

Average savings per participant increased for all non-conversion customers from 2010 to 2011. Average expected savings totals for conversion participant households showed a slight decrease, likely driven by a different mix of electric-savings measures installed at these sites. As shown in the measure-level expected savings summary in Table 3-16, average expected savings for furnace and water heater conversions remained constant between the two years.

Table 3-16. Expected Savings Comparison by Measure, State, and Year (in kWh)

Measures	Idaho		Washington	
	2010	2011	2010	2011
Duct insulation	427	5,485	4,329	760
Floor insulation	1,884	4,408	3,340	4,137
Wall insulation	4,726	3,466	3,333	3,447
Windows	2,623	2,432	1,516	1,205
Infiltration controls	1,539	1,871	1,552	1,456
Attic insulation	800	1,478	1,547	3,329
Water heater replacement	N/A	299	299	299
Doors	513	287	431	287
Refrigerator replacement	N/A	N/A	876	691
T-stat (no AC)	N/A	N/A	717	717
Furnace replacement (conversion)	N/A	N/A	8,655	8,655
Water heater replacement (conversion)	N/A	N/A	5,567	5,567

In considering average expected savings by measure in the table above, a few significant changes can be noted.

[35] By comparison, the 2008 Ecotope evaluation found similar conversion savings estimates for homes receiving both furnace and water heater conversions (12,687 kWh), though slightly higher estimates of water heater only conversions.

First, average duct insulation savings significantly increased in Idaho between the two years, and decreased just as drastically in Washington. In reviewing individual records, one Idaho project in 2011 listed expected savings of 15,200 kWh, while another Washington project in 2010 showed 16,644 kWh. In both cases, associated costs paid by Avista were below $1,000, while other projects showing higher costs reflected lower expected savings estimates.

Average expected floor insulation savings increased by over 2,500 kWh in Idaho and about 800 kWh in Washington. Similar to duct insulation, savings estimates for floor insulation were not consistent with cost trends (i.e., noting certain high-savings projects with lower costs, and vice versa).

Additionally, attic insulation savings increased by 85% and 115% for Idaho and Washington, respectively.

Consequently, changes in average measure-level expected savings between 2010 and 2011 appeared significant, in some cases. These measure-specific changes, along with changes in the mix of measures installed, and, potentially, these instances of outliers, affect changes in average per-participant expected savings between these years.

Table 3-17 provides more measure-specific detail for 2011 installations, including count of installations, expected savings, and average cost per installation type (using the “Cost” field in the participant database).

Table 3-17. 2011 Measure Installation Information by State

Measures	Idaho			Washington		
	Count	Avg kWh	Avg Cost	Count	Avg kWh	Avg Cost
Duct insulation	9	5,485	$402	8	760	$1,034
Floor insulation	71	4,408	$1,084	30	4,137	$1,750
Wall insulation	14	3,466	$875	9	3,447	$1,146
Windows	66	2,432	$1,469	32	1,205	$1,208
Infiltration controls	108	1,871	$710	46	1,456	$699
Attic insulation	51	1,478	$626	20	3,329	$1,596
Water heater replacement	3	299	$817	12	299	$1,220
Doors	52	287	$555	26	287	$899
Refrigerator replacement	N/A	N/A	N/A	45	691	$668
T-stat (no AC)	N/A	N/A	N/A	2	717	$373
Furnace replacement (conversion)	N/A	N/A	N/A	86	8,655	$2,594
Water heater replacement (conversion)	N/A	N/A	N/A	147	5,567	$2,128

In considering average expected savings of the final model participants, 30 electric non-conversion participants (out of a total of 201) showed expected savings as a percent of pre-usage over 30%, with three instances with this percentage over 100%. Similarly, for conversion participants, 20 accounts (out of 137) showed expected savings as a percent of pre-usage over more than 100%. While the model sample only included 2010 participants, such instances demonstrated irregularities in expected savings calculations, intimating historical consumption data may not have been used to calibrate these estimates.

3.3.3 Overall Program Results

In applying savings estimates from the billing analysis to the electric-saving 2010–2011 participant program population, total energy savings of 3,225,930 kWh were achieved. Table 3-18 provides more detail on overall savings results by state and participant type.

Table 3-18. Overall 2010-2011 Electric Savings by State and Participant Type

Participant Type	State / Type	Total Participants	Model Savings Per Participant (kWh)	Total Savings (kWh)	Total Expected Savings (kWh)	Realization Rate
Electric (Non-Conversion)	Idaho	197	1,602	315,602	1,156,559	27%
	Washington	232	2,099	487,046	650,482	75%
Conversion	Furnace Only	22	4,683	103,020	238,280	43%
	DWH Only	139	4,019	558,688	792,851	70%
	Combo	144	12,233	1,761,573	2,067,651	85%
Overall		734	N/A	3,225,930	4,905,823	66%

Table 3-19 provides the electric savings summary by state, rolling up conversion participant savings to reflect conversion and non-conversion savings in Washington.

Table 3-19. Overall 2010-2011 Electric Savings by State

State	Total Savings (kWh)	Total Expected Savings (kWh)	Realization Rate
Idaho	315,602	1,156,559	27%
Washington	2,910,327	3,749,264	78%
Overall	3,225,930	4,905,823	66%

3.3.4 Goals Comparison

We compared evaluated savings for the 734 electric participants (both conversion and non-conversion) against Avista's IRP goals. Table 3-20 provides a summary of overall evaluated savings, IRP savings goals, and realization rates overall and by state. Overall, the low-income weatherization program has achieved approximately 80% of its electric savings goals, largely driven by Washington impacts.

Table 3-20. IRP Program Goals Comparison

State	Reported Savings (kWh)	Evaluated Electric Savings (kWh)	Goal Achievement
Idaho	1,540,377	315,602	20%
Washington	2,492,905	2,910,327	117%
Overall	4,033,282	3,225,930	80%

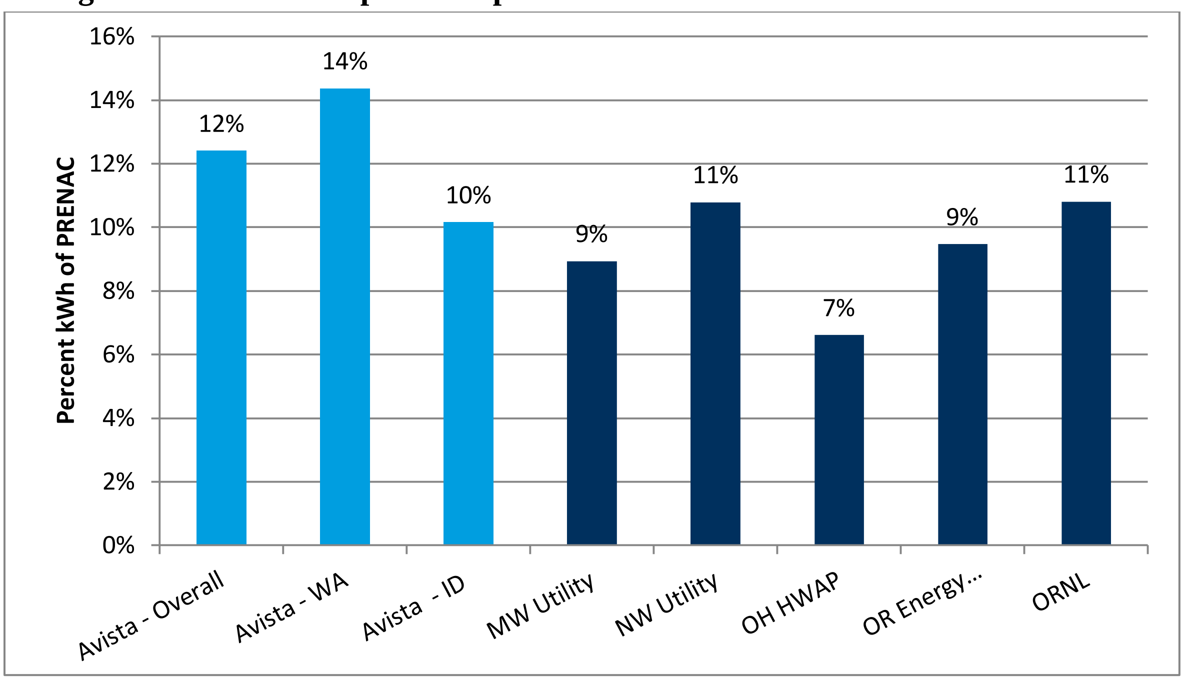
3.4 Conclusions

Billing analysis results for electric (non-conversion) and conversion participant impacts yielded high precisions, indicating reliable energy saving estimates for the program. In considering savings relative to expected savings for 2010 participants used in the billing analysis, Washington impacts were nearly 100% of expected savings totals. While a high realization rate was achieved for the model participant group, changes in expected savings calculations (increasing expected savings) resulted in reduced realization rates for the overall 2010–2011 savings totals.

3.4.1 Benchmarking

To place Avista program savings estimates in context, we compared billing analysis results from other low-income weatherization efforts from across the country. As variations in weather, costs, delivery, and measure offerings make individual programs rather distinct, comparison can be achieved by using the percent energy savings, relative to pre-usage. While conversion programs are less common, we have identified a number of other electric billing analyses of low-income weatherization impacts, as shown in Figure 3-1, comparing savings as a percent of pre-period weather-normalized annual energy consumption.

Figure 3-1. Electric Impact Comparison of Low-Income Weatherization Studies



In comparing overall Avista electric savings percentage to other studies, the Avista program achieves among higher percent savings.

3.5 Recommendations

The following subsections outline our suggestions for program enhancements to help improve program impact results.

- **Standardize calculation of expected savings between states and agencies.** This will help align actual acquisition with expectations and decrease the discrepancy in realization rates between states.

- **Work with Idaho Agencies to Provide Refrigerator Replacements.** Refrigerator replacements can result in significant electric savings; the lack of delivering these measures in Idaho likely contributes to higher savings estimates in Washington. Avista should work with local CAP agencies and other Idaho stakeholders to identify the best ways to encourage integrating these measures into program delivery.

- **Perform Quality Checks on Expected Savings Estimates.** Avista claims changes were made to expected savings calculations starting in 2011, as evident in comparing these estimates between program years; however, it appears additional quality checks on values will strengthen the robustness and reliability of these estimates.

  Specifically, Avista should screen savings relative to historical consumption, making sure the percent of savings is never more than 100% of typical annual usage, and most non-conversion projects experience no more than 50%. Typically, over 30% savings as a percent of pre-period usage is considered high, and may indicate other changes occurring within a household, aside from weatherization provided through the program (e.g., changes in occupancy, take-back, change in heating/cooling usage).

  Understanding primary heating and cooling equipment and fuel types also helps inform the accuracy of expected savings estimates. Thresholds surrounding reasonable savings estimates could be developed, based on household configurations. For example, electrically-heated participants have a much higher potential of electric savings through weatherization than gas-heated participant homes. Identifying such customer distinctions provides as opportunity to create savings ranges or thresholds, which can also be used for quality checks for calculating expected savings.

- **Track Alternative Heating Sources.** As inexpensive alternatives to gas heat, gas customers may turn to electric room heaters and wood stoves, thereby reducing impacts of weather-sensitive measures installed through weatherization (e.g., insulation). Collecting information on a customer's primary heating usage at the time of weatherization will allow more reliable estimates, in cases where, despite being a gas-heated customer, gas is used as a secondary heating source.

  We recommend working with agencies to develop explicit on-site tracking protocols surrounding participant heating sources. Agencies 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;
  - Quantity of secondary heating, if applicable (e.g., number of electric room heaters); and
  - Any indicators suggesting discrepancies between actual and reported primary heating.

- **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 with particularly high energy consumption. In fact, DOE and Washington state 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 are equipped to incorporate energy-consumption characteristics into their program participant prioritization. Not only would weatherizing high-use customers likely result in higher energy savings, it is possible some customers are overly burdened with energy bills, due to their housing characteristics, and the program could provide some relief.

Methods exist for identifying high-usage customers, while controlling for factors contributing to consumption (e.g., square footage, income, number of people per household). Using such an approach would allow Avista to identify high-use customers.

- **Consider Performing Quantitative Non-Energy Benefit Analyses.** With respect to ongoing Advisory Group discussions surrounding quantifying non-energy benefits we recommend Avista consider pursuing additional analyses, aimed at quantifying some non-energy benefits associated with low-income weatherization that are applicable to the TRC test.

  In particular, analyses of economic impacts and payment pattern improvements (including reduced arrearages, collections costs, etc.) can produce monetized values of benefits to program stakeholders, techniques which have been used by other utilities reporting low-income weatherization cost-effectiveness in both Idaho and Washington. While standard cost-effectiveness testing using the TRC test accounts for all program costs, only including energy savings as program benefits clearly omits some genuine non-energy benefits experienced by participants (as discussed in more detail in the 2010 Process Evaluation).

3.6 Future Research Areas

In light of impact evaluation findings, Cadmus recommends Avista consider the following research areas for future evaluations:

- Consider additional analyses of measure-level impacts. Cadmus has successfully performed similar analyses using combined billing and engineering analyses to refine savings estimates for low-income weatherization programs, down to the measure-level. Billing analysis is used for estimating whole-house energy savings and measure-level savings, given a sufficient sample and large energy savings relative to household consumption. Engineering analysis will supplement the evaluation for measures with smaller per-UES (e.g., faucet aerators, showerheads), and for measures where reliable billing data are unavailable. Given our previous work for Avista, and the availability of 2010 and 2011 program populations, a sufficient year of post-treatment billing data would be available by January 2013.
- Consider undertaking a non-energy benefits estimation task.

4 CFL Contingency Program

4.1 Program Description

This program was designed to deliver highly cost-effective energy-efficiency resources to Avista's customer base (both residential and small commercial) and simultaneously maintain the utility's flexibility to meet anticipated energy acquisition targets (established under (Washington's I-937) at a lower ratepayer cost and with a minimum of uncertainty.

Starting in July and running through November 2011, residences and small businesses within Avista's territory were sent 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.

Customers were also given information about returning the CFLs, at no cost to the customer, should they decide not to keep them. It was also possible for customers to request additional bulbs.

4.2 Analysis

For the evaluation of the CFL Contingency Program, Cadmus conducted two rounds of a residential surveys and one round of a commercial survey. These surveys provided both impact and process results, which were used in an engineering review to determine the adjusted gross savings achieved by the program.

Six parameters inform 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 =	Delta watt multiplier, or the difference in wattage between baseline bulb and the CFL divided by the wattage of the CFL
HOU =	Hours-of-use, daily lighting operating hours
DAYS =	Days per year, 365
WHF =	Waste heat factor is the 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 Northwest RTF. Each input is discussed in detail below.

4.2.1 CFL Wattage and Multiplier

The program delivered over 2.3 million CFLs to both residential and commercial customers in Avista's territory; the distribution is shown in Table 4-1. The CFL wattage is based on the weighted average of delivered units to each sector. For the residential sector, the average delivered CFL wattage is 18.30 watts and for commercial sector the average delivered CFL wattage is 18.25 watts.

Table 4-1. Total Units of Delivered CFLs by State and Sector Type

	Residential			Commercial			
CFL Wattage	WA Units	ID Units	Total Units	WA Units	ID Units	Total Units	Total Delivered
13	389,006	170,774	559,780	18,960	15,590	34,550	594,330
19	55,116	-	55,116	-	-	-	55,116
20	1,056,786	512,322	1,569,108	56,880	46,770	103,650	1,672,758
23	55,116	-	55,116	-	-	-	55,116
Total	1,556,024	683,096	2,239,120	75,840	62,360	138,200	2,377,320

Cadmus relied on the RTF (for residential) and 6th Power Plan (for commercial) to determine the DWM. We adjusted the RTF's residential DWM to incorporate Avista's survey results that had documented room distribution of installed bulbs. The DWM for residential installation thus changed from the RTF's 2.60 to 2.63.[36] The commercial DWM is 2.70, which is based on 6th Power Plan lighting workbook. The product of the DWM and the average CFL wattage is the reduction in wattage achieved through the installation of the average CFL.

4.2.2 HOU

Cadmus estimated CFL HOU for residential installations using Avista's survey of room types and a multistate modeling approach built on light logger data collected from four states: Missouri, Michigan, Ohio, and Maryland.[37] The average HOU was calculated using a regression statistical model using combined multistate, multiyear data. We used the multistate model's estimate of HOU by room type, which we then weighted based on Avista's survey results to determine the overall average of HOU of 2.45.

The RTF provides a value of 1.9, which is an average HOU across ***all*** bulbs in California, not just installed CFLs. One would expect CFLs to be placed in a higher use area than the average bulb. We advocate the use of the multi-state study over the California study for several reasons. The multi-state study controls not only for room type, but also for existing CFL saturation, the presence of children in the home, and day type (weekday/weekend). Not only does this result in more precise estimates than one would achieve by simply taking a weighted average, but it allows us to estimate a value more appropriate to Avista's customer base.

When compared to various TRMs across the country, our value of 2.45 is in line, and appears to be conservative, compared with the TRMs as shown in Figure 4-1.

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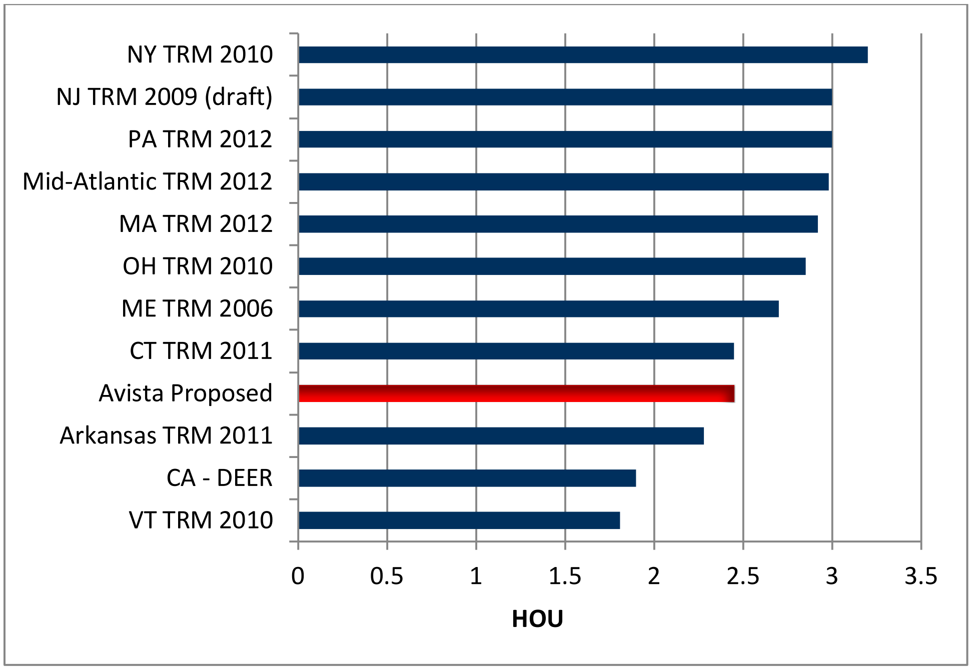
[36] The RTF DWM represents the 2011 baseline and does not include federal EISA impacts starting in 2012.

[37] The Cadmus Group, Inc. *2010 Evaluation, Measurement, and Verification Report*. Dayton Power and Light. March 15, 2011

Figure 4-1. HOU By Jurisdiction



* VT TRM 2010: Projected estimate for 2011. Daily usage is DPS-VEIC agreement March 2009 (see ref doc). Based on November 2008 CFL Reduction Model. Annual operating hours are calculated as (Daily usage * 365). CA (DEER): 2008 metered evaluation of an average across all bulbs in CA. Arkansas TRM 2011: CFL METERING STUDY FINAL REPORT 2005, Pacific Gas & Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company, 2005. CT TRM 2011: Residential Lighting Markdown Impact Evaluation, Nexus Market Research, January 20, 2009. Maine TRM 2006: Impact evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs. Nexus Market Research & RLW Analytics. October 1, 2004. OH TRM 2010 (draft): Based on weighted average daylength adjusted hours from Duke Energy, June 2010; "Ohio Residential Smart Saver CFL Program" MA TRM 2012: Nexus Market Research and RLW Analytics (2008). Residential Lighting Measure Life Study. Prepared for New England Residential Lighting Program Sponsors. Mid-Atlantic TRM 2012: Based on EmPOWER Maryland DRAFT 2010 Interim Evaluation Report; Chapter 5: Lighting and Appliances. PA TRM 2012: US Department of Energy, ENERGY STAR Calculator. Accessed 3-16-2009. NJ TRM 2009: US Department of Energy, ENERGY STAR Calculator. NY TRM 2010: "Extended residential logging results" by Tom Ledyard, RLW Analytics Inc. and Lynn Heofgen, Nexus Market Research Inc., May 2, 2005, p.1.

For 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, we weighted the 10.16 lighting hours from the 6th Power Plan to calculate 10.02 for Avista's commercial HOU.

4.2.3 Waste Heat Factor

The WHF is used to account for the change in annual HVAC energy, either lost or gained, due to the reduction in facility lighting energy. Cadmus based the WHF on SEEM building models developed by the Northwest Power and Conservation Council. The SEEM building models 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 account for the interaction using load shape profiles of the HVAC and lighting equipment based on dwelling occupancy.

The Council method is inherently conservative because it assumes a closed shell, i.e., all interior lamps including ceiling recessed cans are contained in a closed system so any heat put out by the bulbs goes into the building. In reality, the waste heat could transfer out of the conditioned space.

We based our calculation on Avista's share of electric heating equipment,[38] along with its associated efficiencies and its surveys of interior and exterior distribution, to obtain a WHF of 89.8%.[39]

Cadmus used the commercial WHF of 85.5% that is provided in the 6th Power Plan.

4.2.4 In-Service Rate

The ISR, or installation rate, represents the percentage of shipped bulbs that are installed. We determined the ISR using results of our residential survey, which was completed in two rounds: the first in November and the second in March. This allowed for different amounts of time to have passed from when a respondent was sent a box of CFLs to when they were surveyed. These data allowed Cadmus to model the change in the ISR over time.

The residential and commercial phone surveys consisted of several important questions to determine how many CFLs had been installed (at the time of the survey) and any reasons if they had not been installed. These questions were:

- How many bulbs were broken?
- How many bulbs were missing?[40]
- How many bulbs did you install?
- Have you removed any of the bulbs that you installed? If yes, how many?

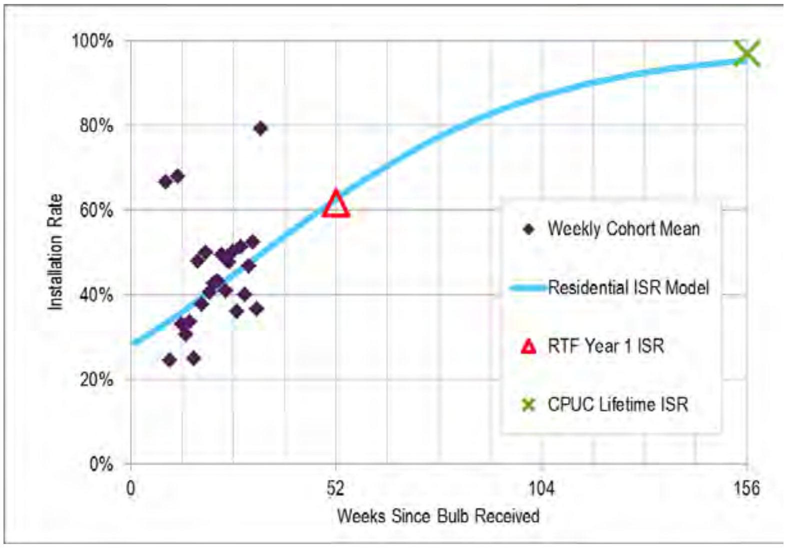
Cadmus performed a weighted least squares regression to develop a logistic function modeling ISR over time. The regression was based on survey result cohorts aggregated by the number of weeks between the bulb shipment date and the date of the survey. To account for the overall shipment breakage rate, the maximum potential ISR for the model was set to 98.1%.

The model has the following form:

Weeks =	The number of weeks since the bulbs were received.
MaxISR =	The maximum potential ISR to account for bulb breakage, 98.1%.
A, B =	Coefficients determined by the regression.

Figure 4-2 shows the weekly cohorts used to develop the regression and the resulting ISR model. For comparison, the first year ISR assumed by the RTF and the lifetime ISR assumed by the California Public Utilities Commission (CPUC) are also shown. The figure shows excellent alignment between the results of the residential surveys and the estimates by the RTF and the CPUC.[41,42,43] The RTF ISR shown in Figure 4-2 was calculated using an original install rate of 64% and a 3.57% removal rate, which resulted in the 61.7% ISR.

Figure 4-2. ISR Over Time Using Weighted Logistic Regression



Cadmus applied the ISR model to all shipments of bulbs to determine what percentage of bulbs were installed before the conclusion of the program year (which is the calendar year). The model was applied to each week's shipment separately.

We also developed a logistic regression function similar to the residential model to determine the commercial ISR. The commercial model was also applied to each week's commercial shipment to determine the ISR for the program year. Table 4-2 shows the results of the ISR modeling. No installations are estimated for 2014 or later.

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41 Research Into Action Inc. 2010. *Lighting Program Assessment: Residential Direct Distribution*. Portland, Ore.: Bonneville Power Administration.

42 KEMA, Inc. and The Cadmus Group, Inc. 2010. *Final Evaluation Report: Upstream Lighting Program, Volume 1*. San Francisco, Calif.: California Public Utilities Commission.

43 KEMA, Inc. 2005. *CFL Metering Study, Final Report*. Pacific Gas & Electric Company (San Francisco, CA); San Diego Gas & Electric Company (San Diego, CA); and Southern California Edison Company (Rosemead, CA)

Table 4-2. Annual and Cumulative In-service Rate by Sector

Program Year	Residential ISR		Commercial ISR	
	Annual	Cumulative	Annual	Cumulative
2011	39%	39%	33%	33%
Est. 2012	35%	74%	36%	68%
Est. 2013	18%	91%	21%	90%

We propose reporting PY2011 savings using only the PY2011 ISR and completing additional surveys later in 2012 and 2013 to achieve a more confident estimate of the ISR for those years.

4.3 Results and Findings

The resulting UES per bulb installed (exclusive of the ISR) for residential and commercial is 38.6 kWh and 154.3 kWh, respectively, as shown in Figure 4-3.

Table 4-3. Unit Energy Savings by Sector

Component	Residential	Commercial
CFL Watt	18.30	18.25
DWM	2.63	2.70
HOU	2.45	10.02
DAYS	365	365
WHF	90%	85%
UES (kWh)	38.58	154.30
PY2011 ISR	39%	33%
PY2011 UES (kWh)	15.05	50.92

Avista's Contingency Program started mid-year in 2011. Avista originally estimated per unit savings would be 21 kWh for all shipped residential and commercial CFL bulbs.

4.3.1 Overall Program Savings

Cadmus incorporated the ISR to determine the savings associated with the installation of bulbs in each program year. Table 4-4 shows the achieved annual savings by year, state, and sector. In 2011, the numbers are the evaluated savings; for 2012 and 2013, the numbers represent expected savings. Cadmus proposes completing additional surveys later in 2012 and 2013 to more confidently estimate savings for those years.

Table 4-4. CFL Contingency Program Evaluated and Expected Savings by State and Year

Sector	Region	2011 Evaluated	2012 Expected*	2013 Expected*	2011-2013 TOTAL*
Residential	WA	23,347,564	20,746,085	10,618,504	54,712,153
	ID	10,143,973	9,013,691	4,613,493	23,771,156
	Total	33,491,536	29,759,776	15,231,996	78,483,309
Commercial	WA	3,826,229	4,156,411	2,500,208	10,482,848
	ID	3,146,145	3,417,640	2,055,815	8,619,599
	Total	6,972,374	7,574,051	4,556,023	19,102,447
Total		40,463,910	37,333,827	19,788,019	97,585,756

* Does not include federal EISA impacts starting in 2012.

Avista's 2011 reported savings (mid-year estimate) across both sectors is 49,923,720 kWh and evaluated 2011 savings is 40,463,910 kWh, as shown in Table 4-5. For 2011, the evaluated savings is 81% of the reported savings for bulbs installed by December 31, 2011.

Table 4-5. CFL Contingency Program 2011 Reported and Evaluated Total Savings

Sector	Region	Reported Savings	2011 Evaluated Savings	Percent of Reported Savings
Residential	WA	32,676,504	23,347,564	71%
	ID	14,345,016	10,143,973	71%
	Total	47,021,520	33,491,536	71%
Commercial	WA	1,592,640	3,826,229	240%
	ID	1,309,560	3,146,145	240%
	Total	2,902,200	6,972,374	240%
Total		49,923,720	40,463,910	81%

Appendix A: Residential Weatherization Billing Model Outputs

The following tables summarize the model result outputs from our billing analysis of the PY 2010 and January 2011 participants.[44]

Table A1. Weatherization Measure Savings Regression Model (Overall Savings)

Source	Analysis of Variance				
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	926766	66198	222.69	<.0001
Error	4626	1375114	297.25757		
Corrected Total	4640	2301880			
Root MSE	17.24116		R-Square	0.4026	
Dependent Mean	-4.6706E-16		Adj R-Square	0.4008	
Coeff Variable	-3.69143E+18				
	Parameter Estimates				
Source	DF	Parameter Estimates	Standard Error	t value	Prob. t
AVGHDD	1	0.92444	0.15156	6.1	<.0001
AVGCDD	1	1.28935	0.25167	5.12	<.0001
POST * AVGHDD	1	-0.15029	0.02345	-6.41	<.0001
Feb	1	-3.59791	1.325	-2.72	0.0066
Mar	1	-6.52003	1.72455	-3.78	0.0002
Apr	1	-10.63089	2.6195	-4.06	<.0001
May	1	-12.35676	3.88904	-3.18	0.0015
Jun	1	-12.85246	4.91615	-2.61	0.009
Jul	1	-13.99908	5.61128	-2.49	0.0126
Aug	1	-14.4091	5.72553	-2.52	0.0119
Sep	1	-13.58621	4.95715	-2.74	0.0062
Oct	1	-11.89302	2.97338	-4	<.0001
Nov	1	-6.2642	1.64659	-3.8	0.0001
Dec	1	0.3675	1.27078	0.29	0.7724

[44] To minimize the output, we ran an equivalent fixed-effects approach, where the dependent and independent variables are subtracted from their respective averages for each customer. This modeling approach produces identical results to the fixed effects specification with separate intercepts and reduces the amount of output considerably.

Table A2. Windows Measure Savings Regression Model (Overall Savings)

Source	Analysis of Variance				
	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	3933681	280977	1027.93	<.0001
Error	15988	4370190	273.34188		
Corrected Total	16002	8303871			
Root MSE	16.53305		R-Square	0.4737	
Dependent Mean	5.87013E-16		Adj R-Square	0.4733	
Coeff Variable	2.81647E+18				
Source	Parameter Estimates				
	DF	Parameter Estimates	Standard Error	t value	Prob. t
AVGHDD	1	1.15045	0.07774	14.8	<.0001
AVGCDD	1	1.19448	0.12232	9.77	<.0001
POST * AVGHDD	1	-0.07667	0.01218	-6.29	<.0001
Feb	1	-3.07608	0.69015	-4.46	<.0001
Mar	1	-6.20763	0.8941	-6.94	<.0001
Apr	1	-9.64822	1.35761	-7.11	<.0001
May	1	-10.95025	1.97949	-5.53	<.0001
Jun	1	-10.27566	2.50606	-4.1	<.0001
Jul	1	-10.1097	2.83638	-3.56	0.0004
Aug	1	-9.97253	2.89142	-3.45	0.0006
Sep	1	-10.67712	2.51364	-4.25	<.0001
Oct	1	-11.50444	1.53114	-7.51	<.0001
Nov	1	-6.82986	0.84482	-8.08	<.0001
Dec	1	-1.83751	0.6597	-2.79	0.0054

Table A3. Windows Measure Savings (Gas Windows) Regression Model (Overall Savings)

	Analysis of Variance				
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	601629	42973	555.67	<.0001
Error	40718	3149002	77.33685		
Corrected Total	40732	3750630			
Root MSE	8.79414		R-Square	0.1604	
Dependent Mean	1.82642E-16		Adj R-Square	0.1601	
Coeff Variable	4.81495E+18				
	Parameter Estimates				
Source	DF	Parameter Estimates	Standard Error	t value	Prob. t
AVGHDD	1	0.52331	0.02656	19.7	<.0001
AVGCDD	1	1.79701	0.04749	37.84	<.0001
POST	1	-0.2489	0.0913	-2.73	0.0064
Feb	1	-1.70693	0.22937	-7.44	<.0001
Mar	1	-1.6126	0.29947	-5.38	<.0001
Apr	1	-0.86615	0.45369	-1.91	0.0563
May	1	1.18539	0.66831	1.77	0.0761
Jun	1	3.26945	0.84397	3.87	0.0001
Jul	1	2.70073	0.95455	2.83	0.0047
Aug	1	2.4365	0.97216	2.51	0.0122
Sep	1	2.62652	0.84397	3.11	0.0019
Oct	1	0.21556	0.51287	0.42	0.6743
Nov	1	-0.8324	0.28538	-2.92	0.0035
Dec	1	0.20087	0.22022	0.91	0.3617

*Heating savings were not expected in this model, a POST indicator was used to obtain the savings overall for this measure.

Appendix B: Residential ENERGY STAR Home Model Inputs

The following table summarizes the standard building codes in Washington and Idaho, along with the standards for new ENERGY STAR Homes.

Table B1. ENERGY STAR, Washington, and Idaho Construction Standards for New Homes

Measure	Type	ENERGY STAR Home	WA Code - Climate Zone II, R-3	ID Code - IECC 2006 Zone 5
Insulation	Ceiling	R-38	R-38	R-38
	Wall	R-19	R-19 + R-5	R-19
	Floors Over Unconditioned Space	R-30	R-30	R-30
	Slab Floors	R-10	R-10	R-10
Windows & Doors	Windows	0.35	0.35	0.35
	Max Glazing Area	0.21	Unlimited	Set to ENERGY STAR standards
	Doors	R-5	0.2 U-factor	Set to ENERGY STAR standards
Ducts	Insulation	R-8	R-10	R-8
	Sealing	Mastic only	Tapes allowed	Tapes allowed
	Max Leakage	<0.06 CFM/sqft or 75 CFM total @50Pa	Set to ENERGY STAR standards	Set to ENERGY STAR standards
Ventilation & Air Sealing	Ventilation System	Exhaust ventilation	Exhaust ventilation	Exhaust ventilation
	Envelope Tightness	0.35 normal ACH	0.35 normal ACH	0.35 normal ACH
Heating & Cooling Equipment	Gas Furnace	90 AFUE	78 AFUE	80 AFUE
	Air Conditioner	SEER 13	SEER 13	SEER 13

Appendix C: Residential High-Efficiency Heat Pump Metering Study

Introduction

This metering study was designed to investigate the energy consumption, savings, and operation of high efficiency air source heat pump equipment and their associated back up furnaces. All of the air source heat pump equipment studied was rebated as part of Avista's Residential Heating and Cooling Efficiency program.

Methodology

Site Visit Sampling

Cadmus designed a statistically significant sample for the site metering visits, based on 90% confidence and 10% precision. Avista provided Cadmus with the final FY 2010 and partial PY2011 database extracts from which to sample. Cadmus randomly selected 89 heat pump participants for metering. Some of these participants had multiple measures installed through the program so the metering site visits were also used to verify measure installations.

Forty percent of the heat pump rebate recipients in the metering sample also received a gas furnace rebate. This compares closely to the total population of heat pump rebate recipients for whom 39% also received a gas furnace rebate.

Participant Recruitment

Avista sent letters to a sample of participants and Cadmus called these customers to explain the study and schedule a time for meter installation for those who were willing to participate. Each participant received a $50 gift card during the installation of metering equipment and a second $50 gift card when the metering equipment was removed.

Sample Attrition

Of the 89 sites initially proposed for the heat pump metering project, 11 data sets were not used for analysis. The reasons for sample attrition are:

- Meter could not be retrieved because home-owner was gone for an extended period of time (2)
- Meter failure due to water damage (3)
- Installation error (3)
- HVAC technician removed meters during service visit (2)

Through quality control visits Cadmus attempted to remedy some of the issues listed above. In some cases a new meter was installed but the metering duration was too short to confidently extrapolate the meter data to estimate energy use and savings for the entire season. The composition of the heat pumps used in the final analysis is shown in the table below.

Heat Pump Metering Completes

Measure	Sample	Percent of Sample
Heating – HP with gas furnace backup	59	76%
Heating – HP with electric furnace backup	19	24%
Total	79	100%

Data Collection

Document Reviews

Cadmus reviewed rebate applications and invoices for each metering participant. We found the systems installed matched the AHRI rating reported by the HVAC contractor. The reported efficiency of each system was used to estimate savings as described in Section 1.8.1.2.

Metering Equipment and Points

To meet International Performance Measurement and Verification Protocol (IPMVP) Option A requirements, Cadmus performed the following evaluation activities to gather the necessary data capturing each unit's performance:

- **Outdoor Unit Demand/Consumption:** Grounded 240V Wattnode connected to voltage leads, 50A AC Current Transformers on each phase line (on line side), and Electronic Switch Pulse Input Adapter S-UCC-M006, data recorded on HOBO Micro Station H21-002 (2 minute logging interval)
- **Outdoor Ambient Temperature/RH**: HOBO S-THB-M00x Temperature/RH sensor mounted onto the outdoor unit via HOBO Solar Shield, data recorded on HOBO Micro Station H21-002 (2 minute logging interval)
- **Indoor Ambient Temperature/RH**: HOBO U10 mounted at thermostat (5 minute logging interval)
- **Furnace Fan Activity/Amperage**: 50A AC Current Transformer (on line side of the fan motor), HOBO SmartSensor TRMS module, data recorded on HOBO Micro Station H22-001 (2 minute logging interval)
- **Electric Back Up Heat Demand/Consumption**: 50A AC Current Transformer (on line side of the resistive coils), HOBO SmartSensor TRMS module, data recorded on HOBO Micro Station H22-001 (2 minute logging interval)
- **Supply/Return Duct Temperature/RH**: HOBO S-THB-M00x Temperature/RH sensor placed in each duct (in the center of the air stream and as close to the fan as possible), data recorded on HOBO Micro Station H22-001or H21-002 (2 minute logging interval)

All data points metered were verified by spot measurements to ensure meters were recording data accurately. Equipment was removed and sensors were tested to ensure they were not damaged during the metering period. Field staff downloaded and reviewed the data to ensure reasonable measurements were recorded for the duration of the metering study. Any discrepancies or points of interest were communicated to the analysis team. For example a typical furnace is 120V but some, especially those with backup resistance heat, are 240V. To estimate the backup electric resistance heat energy consumption and fan energy consumption, the field staff made notes to ensure the analysis was performed with the correct conversions. Spot power measurements were provided for all fans and fan power was estimated with metered current.

Analysis Methodology

Metering Heating and Cooling

Cadmus analyzed data for 79 high efficiency heat pumps. Meters were installed in either May or July 2011 and removed in February 2012. Heating and cooling savings were modeled individually for each site. Each recorded interval within a heat pump run was categorized as either heating or cooling by comparing average temperatures recorded in the system's supply and return ducts for that interval. There were a few instances where sites did not have complete or valid supply temperature data. If this occurred, indoor and outdoor temperature data were used to classify the interval as heating or cooling.

Savings Analysis

Metered energy consumption was used to estimate the heating and cooling capacity provided by the heat pump. The team used manufacturers' data to develop COP and Energy Efficiency Ratio (EER) vs. outdoor temperature curves for each installed heat pump that was metered.[45] The metered unit use was compared with a baseline 13 SEER, 7.7 HSPF code-compliant heat pump that would have been installed in the program's absence. The energy savings analysis assumes the baseline system would provide equivalent heating or cooling capacity, but at a lower COP/EER. An example of a manufacturer's cut sheet showing capacity vs. temperature is shown in the figure below for a heat pump in heating mode.

Manufacturers Heat Pump Capacity Versus System Power

INDOOR AIR		OUTDOOR COIL ENTERING AIR TEMPERATURES °F (°C)														
		−3 (−19.4)			7 (−13.9)			17 (−8.3)			27 (−2.8)			37 (2.8)		
EDB °F (°C)	CFM	Capacity MBtuh Total	Capacity MBtuh Integ*	Total Sys. KW†	Capacity MBtuh Total	Capacity MBtuh Integ*	Total Sys. KW†	Capacity MBtuh Total	Capacity MBtuh Integ*	Total Sys. KW†	Capacity MBtuh Total	Capacity MBtuh Integ*	Total Sys. KW†	Capacity MBtuh Total	Capacity MBtuh Integ*	Total Sys. KW†
25HCC518A30 Outdoor Section With FX4DNF019 Indoor Section																
65 (18.3)	525	5.13	4.72	1.02	7.34	6.75	1.07	9.76	8.90	1.12	12.54	11.13	1.18	15.15	13.78	1.24
	600	5.22	4.80	1.02	7.46	6.85	1.07	9.91	9.03	1.11	12.68	11.27	1.17	15.35	13.97	1.22
	675	5.30	4.87	1.02	7.55	6.94	1.07	10.04	9.15	1.11	12.80	11.37	1.16	15.51	14.12	1.20
70 (21.1)	525	4.84	4.45	1.07	7.04	6.47	1.12	9.43	8.60	1.18	12.28	10.90	1.24	14.86	13.52	1.31
	600	4.92	4.53	1.07	7.15	6.57	1.12	9.58	8.74	1.17	12.44	11.04	1.23	15.05	13.70	1.28
	675	4.99	4.59	1.07	7.25	6.66	1.12	9.71	8.85	1.16	12.56	11.16	1.21	15.21	13.84	1.26
75 (23.9)	525	4.50	4.14	1.11	6.70	6.16	1.17	9.09	8.29	1.23	11.98	10.64	1.30	14.56	13.25	1.37
	600	4.59	4.22	1.12	6.82	6.27	1.17	9.24	8.42	1.22	12.15	10.79	1.29	14.75	13.43	1.34
	675	4.66	4.29	1.12	6.92	6.36	1.17	9.36	8.54	1.22	12.29	10.91	1.27	14.91	13.57	1.33

The team estimated savings for meter interval 'i' and temperature 'T' as follows:

[45] COP and EER curves were created for SEER values from 13 SEER through 18.5 SEER. The SEER value for every metered heat pump was rounded to the nearest half value (ex. 13.7 became 13.5) for the purposes of applying the COP and EER curves.

Reducing Uncertainty from Physical Measurement Error

Cadmus took the following steps to minimize uncertainty resulting from bias/error that could have been introduced through the measurement process.

- **Outliers:** Field metering occasionally produces unexpected data or numbers beyond the normal range, compared with the other metered data. To identify and address possible outliers, the team divided questionable data into two categories:
  - Data physically unexplainable; and
  - Data outside the range of most other data.

  Due to outlier filtering, the study used no unexpected data. Less than 0.1% of data were identified as outliers. Almost all of the outliers occurred during the first two metering intervals.[46]

- **Calibration:** To minimize measurement error from meters, Cadmus' field staff checked all sensors used in the field to ensure they operated properly. Staff took parallel measurements with sensors to ensure variability fell within the expected tolerance.

- **Data Recording:** To ensure the team recorded realistic data, indoor conditions were monitored and compared to air conditioner use.

  To ensure data such as energy consumption and temperature were recorded simultaneously, our field staff used consistent measurement intervals, synchronized for all metering equipment at each site. This consistency ensured data from multiple sites could be compared across a uniform time period.

Reducing Uncertainty from Engineering Analysis Bias

Several types of engineering analysis bias can introduce errors and uncertainty into savings estimates, including: model types, modeler analysis bias, modeler mistakes, and data collection bias. Cadmus took these steps were taken to minimize uncertainty arising from engineering analysis error:

- ***Modeler analysis bias/mistakes***. Our team of experienced evaluation analysts reviewed all project analysis findings. We compared findings to findings from similar studies to confirm results were reasonable.

- ***CDD Model results bias.*** Metering energy consumption was compared with Energy 10 models, a well-known and widely used computer simulation model. Well-developed techniques and procedures for conducting engineering analyses with Energy 10 were utilized, subject to rigorous internal reviews.

  Every home had unique thermal characteristics; each cooling system operated differently; and homeowners often wait longer-than-predicted periods before using their cooling systems. The field staff asked questions about operation patterns. If, for example, participants noted they did not run their system until June 1, the predicted energy use model started on June 1 and the energy consumption predicted for May was set to zero.

[46] When the watt node is connected, it begins recording pulses and the first two intervals sometimes have unexpectedly high pulse counts.

Reducing Uncertainty in Sampling and Participant Operation of Units

- ***Self-selection bias.*** Self-selection bias arises if people agreeing to participate in the study differ from those refusing to participate in a way correlated with the study findings. Self-selection was not an issue for the replacement metering sample as every potential participant contacted by Cadmus (selected through a randomized process) agreed to participate.
- ***Participant operational use bias (Hawthorne Effect).*** In any human subject study, some participants may change their behaviors due to the study itself. In this case, they would use their cooling equipment differently than they normally would have. This potential bias is known in social psychology literature as the Hawthorne effect. Cadmus mitigated this potential bias by instructing all study participants not to change their equipment use habits due to participating in the study and notifying the participants that their individual usage was confidential. Compliance with this instruction is believed to be reasonably high and any minor, initial behavioral changes are likely to fade over the 7- to 10-month period the meters remained in place.

Results

The table below shows the savings of the metering study and analysis described above. The savings shown in the table below are 10% of the reported savings assumed by Avista. The resulting savings are well calibrated to the assumptions used for the other measures within the Heating and Cooling Efficiency program. The heating savings of 321 kWh for a high efficiency air source heat pump shown in the table is equivalent to a seasonal COP increase from 2.15 to 2.28 for a home requiring 41,553 kBtu of heating annually. The cooling savings shown is equivalent to an increase in efficiency from 13 SEER to 15 SEER for a home requiring 7,278 kBtu of cooling annually.

Annualized Electric Savings

Measure	Sample	Percent of Sample	Average Annual Savings (kWh)
Heating – HP with gas furnace backup	59	76%	244
Heating – HP with electric furnace backup	19	24%	321
Cooling – All HP Units	79	100%	74
Weighted Total Annual Savings			337

Note that application of the weighted energy savings to the population assumes 76% of the population uses a gas furnace for backup.

Conclusions

The following conclusions are a direct result of this study:

- ***The HSPF may be too low.*** Multiple instances existed where the HSPF threshold of 8.5 was met with a 13.5 SEER heat pump. The analysis assumes a 13 SEER system would have been installed and matched with the same furnace (and in some cases ECM motor). For these cases, the installed system is only slightly more efficient that the base case.

- ***There is currently a high penetration of dual fuel participants.*** Cadmus believes 76% of participants have a heat pump that is supported by a non-electric furnace. The heat pump cannot run when backup fuel heat is used. This reduces the annual operating hours of the heat pump and therefore the savings achieved through its installation. This is not the case when the backup heat is electrical resistance since the heat pump and resistance can run simultaneously. This is supported by the study. The data shows heat pumps backed up by electric resistance heat running a greater percent of hours in the coldest weather bins than those backup up by gas.

  Cadmus agrees with Avista that the dual fuel system represents the lower operating cost for the homeowner. However, since the heat pump is serving a smaller fraction of the home's heating load, savings due to the installation of a high efficiency unit will be less.

- ***Cooling energy consumption is low.*** Meter data showed that some participants never ran their air conditioners or only ran them for a few hours during the summer. Evaluation staff reviewed the data and confirmed system runtime where possible to ensure the results were not erroneous. We believe the metered energy consumption represents the usage patterns of a typical home within this region. The table below compares cooling energy savings determined from this study with an engineering estimate determined using the RTF's SEEM model outputs. As the table shows, the two estimates are nearly identical.

Comparison of Cooling Savings

Model	Annual Cooling Savings (kWh)
SEEM 1,344 Square Foot Home	53.1
SEEM 2,200 Square Foot Home	81.2
SEEM 2,000 Square Foot Home, Linear Interpolation	*74.6*
Metering Study Result	74.0

Recommendations

Consider estimating savings and incenting systems separately for all-electric heating systems.

Consider tiered incentives by SEER rating as higher SEER systems generally require ECM fan motors to achieve certain SEER ratings.

Additional Findings

Fans with Electrically Commutated Motors

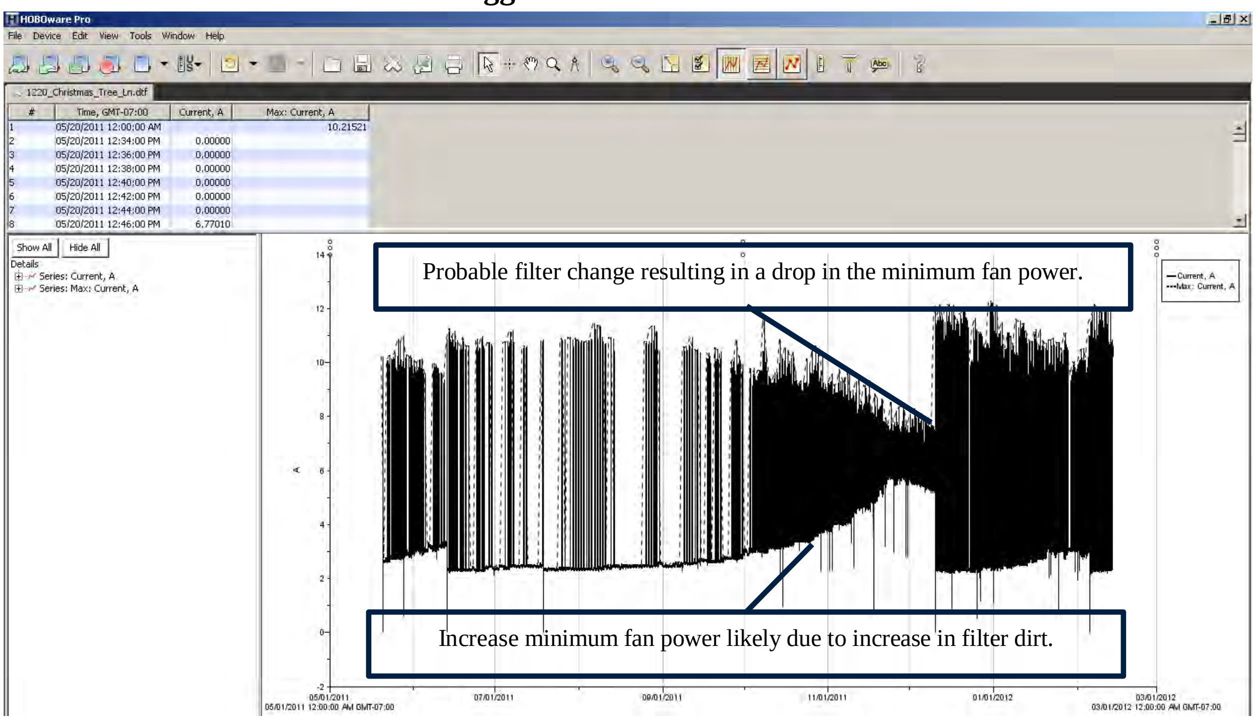
Data collected during the study show fans running during 56% of the metering period on average. This is much higher than the actual equipment runtime. Customers therefore appear to be encouraged to run fans more than just when the equipment is heating the home. When discussing their systems with metering staff, several participants said their HVAC contractor suggested they keep the fan on all the time.

An example of this is shown in the figure below. The figure shows that the metering participant ran the fan continuously. Furthermore, as the filter became dirtier the ECM motor power increased to maintain the constant airflow setpoint. The result is an increase in fan energy consumption over time while maintaining system heating and cooling efficiency.

It is not possible to quantify the effects of a similar system with a constant speed fan that cannot adjust speed as the filter collects dirt. It is reasonable to assume that the system efficiency would decrease over time requiring increased runtime to meet space temperature setpoints.

This customer stated they were encouraged to run the ECM fan continuously to maintain air quality and uniform temperature distribution throughout the home. Prior to installation of the ECM measure the participant did not run the fan continuously. The increased runtime might lead to increased fan energy consumption but the system efficiency improvements may offset the increase. Without verifying the baseline energy consumption of a furnace fan, we are unable to estimate ECM savings with the meter data collected.

Data Logger Readout of Fan Current



Appendix D: Gas Savings Achieved

The electric program achieved gas savings through multiple measures. The table below documents the savings achieved.

Measure Name	Measure Count	UES (therms)	Total Savings (therms)
E Clothes Washer	6,624	3.0	19,872
E Dishwasher	4,124	0.9	3,712
TOTAL	10,856		45,540

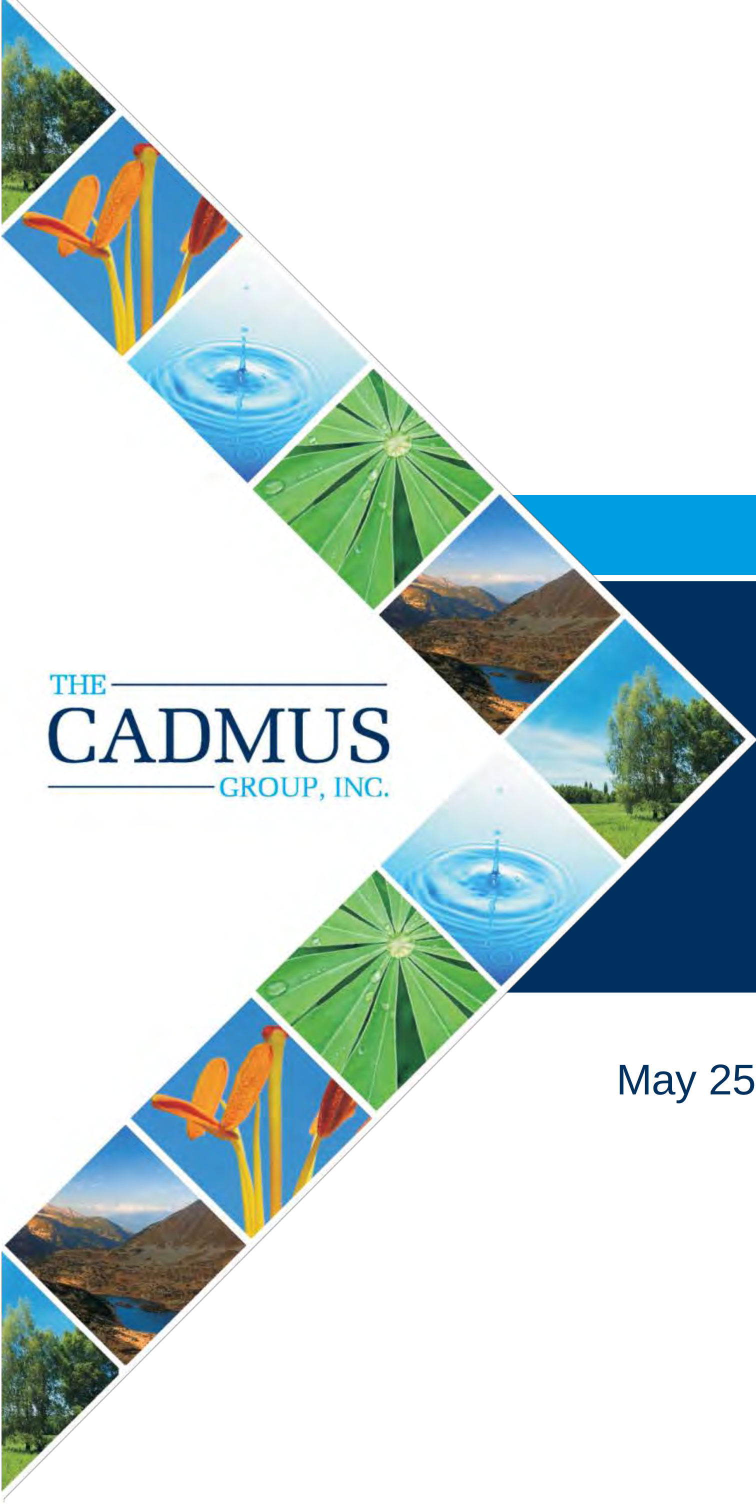
The evaluation found a significant percentage of Clothes Washer and Dishwasher participants had the incorrect domestic hot water heater fuel type on their application. This resulted in a reduction in the average electricity saved per installation and the creation of an average therms saved per installation. The numbers in the table above represent the average across all products installed, not just the applications with the incorrect fuel selected.

Appendix 4

Avista 2011 Multi-Sector Process Evaluation Report

May 25, 2012

The Cadmus Group, Inc.



THE CADMUS GROUP, INC.

Avista 2011 Multi-Sector Process Evaluation Report

May 25, 2012

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Table of Contents

Portfolio Executive Summary

Avista Corporation contracted with The Cadmus Group, Inc., to perform a portfolio-wide evaluation for the 2011 demand-side management programs. This report presents the process evaluation findings.

Evaluation Activities

Table ES-1 summarizes the process evaluation activities.

Table ES-1. Process Evaluation Activities

Activity	Residential	Nonresidential
Avista Implementation and Planning Staff Interviews*	4	12
Participant Surveys	464	162
Nonparticipant Surveys	210	101
Contractor Interviews	20	40
Nonresidential Lighting Site Visit Surveys	0	41
Implementer Interviews*	2	1
Assessment of Tracking Databases	✓	✓
Review of Program Documentation	✓	✓
Review of Marketing Materials	✓	✓
Examination of Stakeholder Reports	✓	✓

* Multiple representatives present for each interview

Residential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the residential programs examined (listed in Table ES-2).

Table ES-2. PY 2011 Residential Programs

Residential Gas and Electric Savings Programs
ENERGY STAR Appliance Rebate
ENERGY STAR Homes
High Efficiency Equipment
Weatherization and Shell Measures
Home Energy Audit Pilot
Residential Electric-Only Programs
Geographic Saturation Events
Second Refrigerator and Freezer Recycling
Space and Water Conversions
Simple Steps, Smart Savings

Program Participation

Conclusions

- Overall residential participation declined from 2010 to 2011. Decreased participation appeared most prominent in programs affected by American Recovery and Reinvestment Act (ARRA) tax credits.
- Program awareness among nonparticipants declined from 2010 to 2011.
- Home Energy Audit Pilot Program participation exceeded expectations in 2011, and showed good levels of follow-through among participants.

Recommendations

- Renew emphasis on customer outreach and mass marketing, including refreshing campaign messaging and using trade allies.
- 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.

Program Design

Conclusions

- Lower-than-expected evaluated per-unit savings indicate a need to review program eligibility criteria and measure offerings. Measure savings can be negatively affected when multiple HVAC measures are incented and installed together.
- Program managers' limited availability to focus on long-term program considerations may hinder program performance.

Recommendations

- Consider additional program requirements to ensure measure savings remain in line with expectations. 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 the possible benefits of outsourcing simple rebate processing for ENERGY STAR appliances and hot water heaters to allow program managers to focus on long-term program considerations.

Market Characteristics

Conclusions

- Avista's recent program changes have reflected documented nationwide market transformation.

Recommendations

- Ensure future program effectiveness by continuing to update program offerings and designs to reflect changes in market conditions.

Data Tracking

Conclusions

- Program tracking has proved effective, but evaluability could be improved. Consistency across programs and tracking of follow-through for audit participants could be enhanced.

Recommendations

- 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.
- 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.

Marketing and Outreach

Conclusions

- Avista adheres to best practices for energy-efficiency marketing and outreach. However, Cadmus identified opportunities for enhancing Avista Websites.

Recommendations

- Avista should maintain its multifaceted approach to reach a broad range of customers, while targeting difficult-to-reach customers, where appropriate. Possible Website enhancements include:
  - 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 e-mail, RSS feeds, or social media platforms.

Participant Experience and Satisfaction

Conclusions

- Participant satisfaction remains high across all programs and program elements.
- The Home Energy Audit Pilot Program experienced a significant increase in participant satisfaction, compared to the 2010 program.

Recommendations

- Continue to prioritize customer satisfaction, and take advantage of high satisfaction by targeting past participants for future participation.

Residential Program Freeridership

Conclusions

- Avista's increasing residential freeridership indicates market transformation is occurring.

Recommendations

- Continue conducting research to inform decision making about future program improvements/continuation.

Effectiveness of Implementers

Conclusions

- Avista's use of third-party program implementers has been appropriate and effective.
- Avista's has strong, positive relationships with its implementation contractors in both programs.

Recommendations

- Explore possible benefits of third-party program implementation. Avista's newly launched online rebate application system may alleviate staff burden associated with rebate processing. However, 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

Conclusions

- Trade allies remained key program messengers, and opportunities exist for increased involvement from them. Trade allies are looking for more support from Avista to provide them with program literature for their customers.

Recommendations

- Investigate the possibility of a more formal relationship with trade allies. 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.

Nonresidential Conclusions and Recommendations

This section describes the evaluation's conclusions and recommendations for the nonresidential programs examined (listed in Table ES-3).

Table ES-3. PY 2011 Nonresidential Programs

Prescriptive Programs
Commercial Clothes Washer
Food Service Equipment
Green Motors Rewind
HVAC Rooftop Maintenance
Lighting Incentives
Power Management for PC Networks
Premium Efficiency Motors
Other Nonresidential Programs
Site-Specific Program
ENERGY STAR Grocer Program

Program Management and Implementation

Conclusions

- In many cases, programs met or exceeded savings goals. Although the lighting program fell short of its goals, new program incentives in 2012 seek to increase customer motivation.
- Avista implementation staff expressed concerns with time constraints at preventing them from taking a more active role in planning and documentation of program procedures, and requested more real-time feedback during the evaluation process.
- The Site-Specific program, which contributes a large portion of savings to the nonresidential portfolio, lacks a central leadership role.
- The EnergySmart Grocer program implementer experienced issues with contractors.

Recommendations

Cadmus recommends Avista consider the following improvements to the nonresidential program implementation:

- Consider a method for prioritizing management tasks, thus enabling allocation of more time for planning and development of program documentation.
- Revisit the staffing needs for delivering the current programs.
- Revisit the option of using third-party implementers for some programs.
- Consider round tables with the program implementation, management, and policy team to facilitate additional communication regarding planning and evaluation.
- Consider designating a central leadership role for the Site-Specific program to oversee future planning and vision, and ensure it continues to deliver cost-effective energy savings to the C&I portfolio.
- Further investigate contractor issues to ensure high satisfaction levels of EnergySmart Grocer program participants

Customer Feedback

Conclusions

Program Satisfaction

- Overall, awareness of the Avista nonresidential programs appears to be increasing, and participant satisfaction levels have been very high.
- Certain program elements receive a large share of "somewhat satisfied" ratings, suggesting opportunities for improvements. These include: scoping audits, program materials, and application processes.
- EnergySmart Grocer program participants expressed lower satisfaction levels than the Prescriptive and Site-Specific programs, across various delivery elements. Better understanding the causes of this and addressing solutions may prove important for the program's continued success.
- Lower satisfaction levels reported by nonparticipants suggest a need to better understand why program offerings and materials have not met their needs.

Purchases and Decision Making

- While saving money ranked as the most influential factor regarding decisions to install energy-efficient equipment, the decline in reported "saving energy" influence from the prior 2010 survey should be noted, and could have implications for marketing messages.
- Learning of programs through contractors and vendors (37%) compared to nonparticipants (5%) suggests the contractor and vendor community may strongly influence participation, and may be able to intervene at critical decision moments (remodeling and replacing working equipment ranked as the second-highest factor influencing purchases).

Communications and Outreach

- The increase in participants citing contractors or vendors as a source for learning about the programs (from 15% in 2010 to 37% in 2011) suggests trade allies should be leveraged as part of the nonresidential program's outreach and communication strategies.
- Program information on Avista's Website may not effectively reach across the market or be utilized effectively to help customers. Over half of nonparticipants reported the business Website did not apply to them, and cited the need for more information about programs.

Customer Profiles

- The Site-Specific programs' cost-effectiveness may be at risk if the delivery cost becomes too great for very small facilities (less than 5,000 sq. ft.): more than one in four participants surveyed fall within this size range. The program may require different outreach and delivery strategies to ensure costs aligned with achievable savings.
- The dominance of participant-owned facilities in the surveys suggest Avista may not be reaching the decision makers in leased facilities—a more challenging target, but one

which may offer large opportunities for growth or for meeting program goals in future years.

Recommendations

- Continue to leverage contractors to reinforce the program's messages, particularly in communicating program offerings to small-to-medium customers. 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:
  - 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:
  - 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.
- Where customers expressed lower satisfaction levels, program elements should be investigated. Such investigations might include:
  - 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

Conclusions

- Avista's informal network of trade allies works well to promote the programs through word-of-mouth and strong communications with Avista representatives. Many trade allies have worked with Avista for several years or more. Overall, trade allies reported high satisfaction levels with the programs, with slight variations by contractor type. While lighting contractors indicated a high satisfaction level with program materials, they were less likely to promote the programs than general contractors.

- Trade allies suggested improved program promotions to assist customers, providing additional materials or information online. Trade allies requested greater one-on-one communication with Avista representatives, or dedicated assistance to answer questions about the programs.

Recommendations

- 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.
- 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:
  - Offering a dedicated Website, containing guidance through Webinar 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

Conclusions

- T-12 lamps and fixtures remain in many customer facilities, and customers retain many T-12 lamps in inventory for replacements. Although customers report awareness of new regulations phasing out most T12s and incandescent light bulbs, most customers do not have a sense of urgency with regard to replacing affected lighting equipment.
- Contractors are highly aware of the upcoming changes, but at least half do not discuss this with their customers, and most are not changing their business approaches or carrying out any promotions. This offers Avista an opportunity to play a helpful role in informing and preparing customers for upcoming changes, while accelerating installation of more efficient equipment in the market.

Recommendations

- Take a more proactive role in communicating with customers: upcoming changes in lighting product availability; Avista's program availability to offer them help; and 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.
- 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.

Marketing and Outreach

Conclusions

- Avista's expanded marketing campaign and increased outreach events indicate a focused strategy for nonresidential programs used in 2011 will continue in 2012. Using a wide variety of marketing channels and strategies, Avista's marketing team and program staff are pursuing more direct outreach opportunities with customers and trade allies, through Power Breakfast meetings, developing customer success stories through testimonials, and updating the Website to be more user friendly for business customers.
- Many Avista marketing strategies align with best practices for C&I energy-efficiency programs. Through these outreach events, Avista staff gather direct feedback from customers to enable more targeted marketing opportunities.

Recommendations

- 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:
  - 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 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

Conclusions

- From the review of application forms and databases, interviews with staff, and survey results, Cadmus concludes some data fields needed for program evaluation are not being tracked or are being reported inconsistently.
- Improvements to participant tracking, and data integration could enhance data quality, and ensure programs can be evaluated.
- Although application forms have been improved somewhat, some data points added to revised program worksheets currently are not accounted for in updated application forms. Adding these fields would enhance the accuracy of savings estimates.
- As Avista moves toward integrating these databases over the next few years, integration may reduce errors resulting from data transfer and reporting. An integrated customer information system may also reduce the burden of data requests for evaluations.
- Fields critical to evaluation are not being tracked in Sales Logix or reported in extract databases. Inability to identify specificity of program and measure detail created challenges in selecting unique participants for survey sampling. The lack of business or site addresses created additional challenges for site-visit sampling. Missing or inconsistent data were found in the following fields:
    - Customer Account Number
    - Contact Name
    - Business Address, Phone Number, E-mail
    - Program Type
    - Measure Descriptions, Measure Quantity, and Fuel Type

Recommendations

- Drawing upon the review of application forms and databases, interviews with staff, and survey results, Cadmus recommends the following:
    - 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.
- Consider incorporating changes to forms to account for new data collected through calculators.

QA and Verification

Conclusions

- Avista's QA procedures for Site-Specific projects have been documented well, requiring second-party approval of evaluation reports. The review process is governed through Tracker protocols, a system established to track projects' progress through the pipeline. This process is supported through ongoing efforts with the engineering team, program, and policy staff.
- Pre- and post-inspection requirements and procedures would benefit from better definition and transparency. While post-installation inspections are routinely required for Site-Specific projects, pre-inspections are not.
- Pre- and post-inspections for Prescriptive programs are not required. Post-inspections may be conducted for programs undergoing changes or projects with new contractors.

Recommendations

- 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:
  - 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.

1 2010 RESIDENTIAL PROCESS REPORT

1.1 Introduction

The residential process evaluation focuses on nine Avista programs. During the program year, Cadmus prioritized programs achieving the greatest savings (Table 1-1, in bold).

Table 1-1. PY 2011 Residential Programs

Residential Gas and Electric Savings Programs
ENERGY STAR Appliance Rebate
ENERGY STAR Homes
High Efficiency Equipment*
Weatherization and Shell Measures
Home Energy Audit Pilot
Residential Electric-Only Programs**
Geographic Saturation Events
Second Refrigerator and Freezer Recycling
Space and Water Conversions
Simple Steps, Smart Savings

* In 2011 the Heating and Cooling Efficiency program and the Water Heater Efficiency program measures were offered together under the High Efficiency Equipment Program.

** The Shade Tree program was discontinued in 2011.

1.1.1 Evaluation Activities and Objectives

The evaluation sought to assess the following research areas for each program:

- Customer participation;
- Trade ally participation;
- Effectiveness of program design and delivery; and
- Opportunities for improvements.

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

- A document review;
- In-depth interviews; and
- Telephone surveys of participants and nonparticipants.

The document review addressed the following materials, provided by Avista:

- Tracking databases;
- Business plans;

- Marketing materials; and
- Cost-effectiveness inputs and analysis spreadsheets.

1.1.2 Program Overview

Table 1-2 lists the residential energy-efficiency programs, included in the 2011 evaluation, along with associated incentive levels.

Table 1-2. PY 2011 Residential Programs and Incentives

Residential Gas and Electric Saving Programs and Measures	Incentives
ENERGY STAR Appliance Rebate	
ENERGY STAR Freezer	$20
ENERGY STAR Refrigerator	$25
ENERGY STAR Dishwasher	$25
ENERGY STAR Clothes Washer	$50
New Construction/ENERGY STAR Homes*	
ENERGY STAR Home with Electric only or Electric and Gas	$900
ENERGY STAR Home with Gas only	$650
High Efficiency Equipment*	
High Efficiency Natural Gas Boiler or Furnace	$400
High Efficiency Air Source Heat Pump	$400
Ductless Heat Pump	$200
Variable Speed Motor	$100
High Efficiency Electric Water Heater	$50
High Efficiency Natural Gas Water Heater	$50
Weatherization and Shell Measures**	
Attic Insulation	$0.25 per sq. ft.
Wall Insulation	$0.50 per sq. ft.
Floor Insulation	$0.50 per sq. ft.
Fireplace Damper	Up to $100
Home Energy Audit Pilot	Discount/varies
Residential Electric-Only Programs and Measures	**Incentives**
Second Refrigerator and Freezer Recycling	$30
Space and Water Conversions	
Electric to Natural Gas Furnace	$750
Electric to Air Source Heat Pump	$750
Electric to Natural Gas Water Heater	$200
Simple Steps, Smart Savings	Upstream/varies
Geographic Saturation Events	Giveaway

* High Efficiency Equipment incentive levels are the same for existing homes and the New Construction program.
** In prior years, high-efficiency windows were incented at $3.00 per sq. ft., but Avista discontinued the window incentive as of March 30, 2011.

Appendix 1A briefly describes each program examined through this process evaluation.

1.1.3 Evaluation Methodology and Information Sources

Cadmus' approach to this portfolio-wide process evaluation relied on three main review and data collection efforts.

Document Review

Cadmus' document review focused on providing an up-to-date understanding of 2011program offerings, planning assumptions, participation, and marketing methods. Documents reviewed included:

- Avista's in-house tracking database;
- Home Energy Audit tracking database;
- JACO International's appliance recycling tracking database;
- Avista's 2011 DSM Business Plan;
- Avista's 2012-2013 Biennial Conservation Plan;
- Everylittlebit.com Website;
- Avistautilities.com Website; and
- JACO International marketing calendars.

Program Staff, Implementer, and Trade Ally Interviews

In-depth interviews with program and implementation staff provided detailed insights into design and delivery processes, and helped in interpreting gathered information. In staff interviews (and in selecting implementer and trade ally interviewees), Cadmus focused on high-savings programs such as High Efficiency Equipment and Simple Steps, Smart Savings.

Table 1-3. PY 2011 Residential Interviews

Role In Program Delivery	Number of Completed Interviews
Avista Program Implementation Staff	3*
Avista Policy, Planning and Analysis Staff	1*
Simple Steps, Smart Savings Implementer (FMS)	1
Second Refrigerator and Freezer Recycling Implementer (JACO)	1*
Simple Steps, Smart Savings Lighting Retailers	10
Weatherization and Shell Measure Program Contractors	10

* Multiple representatives present for interview

Cadmus interviewed seven members of Avista's program staff, including:

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

Cadmus conducted these interviews by phone, using a prepared interview guide. When necessary, Cadmus requested clarifying information via phone or e-mail. Staff interviews addressed the following topics:

- Goals;
- Program design;
- Implementation:

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

Cadmus interviewed one implementation staff member at Fluid Market Strategies (FMS), the company implementing Simple Steps, Smart Savings, and three representatives from JACO, the company implementing the Second Refrigerator and Freezer Recycling program. Conducted by phone, these interviews followed a prepared interview guide, addressing:

- Goals;
- Implementation processes; and
- Tracking.

Cadmus also contacted and interviewed 20 contractors and vendors operating in Avista's service territory. Interviews targeted 10 weatherization contractors and 10 lighting retailers. Weatherization contractors were identified using a list of Avista trade allies and an Internet search of appropriate contacts with businesses in Avista's service territory. Lighting retailers were identified using Simple Steps, Smart Savings program invoice materials (provided by FMS), an Internet search, and contacts provided by FMS.

Interviews used a prepared interview guide. Contractor and vender interview data, while not statistically representative of all participating contractors or venders, provided broad anecdotal insights into contractors' experiences with Avista's programs. Contractor interviews captured information addressing the following topics:

- Program awareness:
  - Contractor awareness
  - Customer awareness
- Effect of rebates on sales;
- Contractor marketing/outreach; and
- Program satisfaction.

Telephone Surveys

Telephone surveys constituted a large part of the 2011 evaluation activities, informing both impact and process evaluations for several programs. For general population surveys (e.g., participant and nonparticipant customers), special care addressed potential issues 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 using Discovery Research Group (DRG), a survey research and telephone data collection provider. Survey response and cooperation rates were calculated for participant and nonparticipant surveys. Survey response and cooperation rates were calculated adhering to American Association for Public Opinion Research (AAPOR) minimum definitions.[1]

Response and cooperation rates were calculated using the following equations:

participants to complete a survey, but also the design and implementation of the survey's calling effort, direct comparisons to other efforts can be difficult. However, recent participant survey efforts for other utilities in the Pacific Northwest showed cooperation rates ranging from 22% to 37%, indicating Avista's participant survey was comparable in terms of cooperation.

Table 1-4. Residential Participant Details and Survey Sample

	Unique Participants	Eligible Participants*	Participants Included in Sample Frame
ENERGY STAR Appliance Rebate	10,983	10,216	3,506
High Efficiency Equipment	4,156	3,267	1,101
Weatherization and Shell Measures	3,981	3,442	1,180
Home Energy Audit Pilot	664	663	663
Second Refrigerator and Freezer Recycling	1,903	1,903	1,903
Space and Water Conversions	314	282	282
Completed Surveys			464
Number of Calls Required to Achieve Sample			4,430
Response Rate			10.5%
Cooperation Rate			24.4%
Completed Surveys Included in Analysis			464

* Reasons for not including a participant in survey sample included: 1) incomplete contact information; 2) duplicate entries (participants were only included in a sample frame once); or 3) participants in program significantly exceeding the number required to achieve the target number of completes.

Cadmus designed participant survey sample to yield, in most cases, 90% confidence and ±10% precision levels, for program-level survey results. The participant survey sampling plan 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 the 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 rebates were paid to builders, not end-use customers.

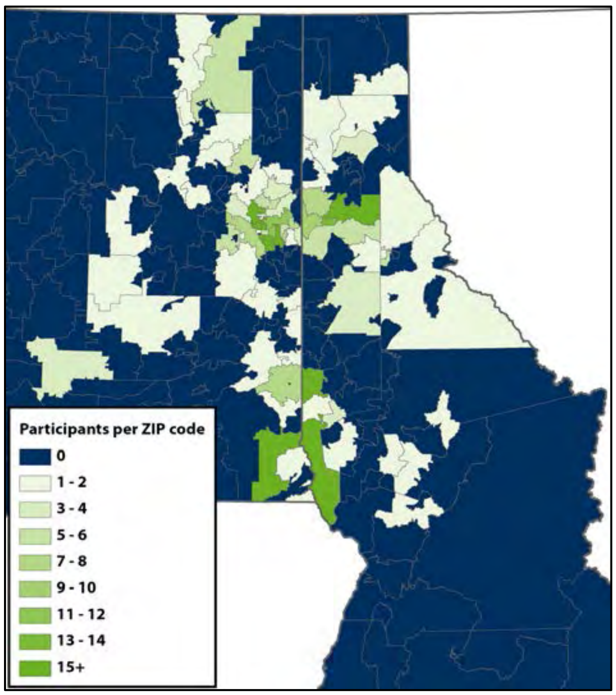
Table 1-5 shows the number of surveys achieved, and the resulting absolute precision of survey findings for each program.

Table 1-5. Participant Survey Sample Sizes and Precision Estimates by Program

Program	Total Program Participants	Survey Respondents	Absolute Precision at 90% Confidence
ENERGY STAR Appliance Rebate	10,983	79	±9.3%
High Efficiency Equipment	4,156	126	±7.2%
Weatherization and Shell Measures	3,981	72	±9.6%
Home Energy Audit Pilot	664	56	±10.3%
Second Refrigerator and Freezer Recycling	1,903	74	±9.3%
Space and Water Conversions	314	57	±9.1%
Overall	22,001	464	±5.2%

Program participant contacts included in survey sample frames were selected randomly within each program stratum. The geographic distribution of survey respondents clustered around urban centers, specifically the cities of Spokane, Pullman, Moscow, and Lewiston. This aligns with population distributions in the service territory.

Figure 1-1. Geographic Distribution of Participant Survey Completes



Given the wide range in program size, we weighted survey responses by participation when reporting responses in aggregate, ensuring feedback represented the overall population. Table 1-6 shows the weighting scheme.

Table 1-6. Participant Survey Sample Design Weights by Program

Program	Proportion of Total Participant Population	Proportion of Total Survey Respondents	Program Weight*
ENERGY STAR Appliance Rebate	49.9%	17.0%	2.93
High Efficiency Equipment	18.9%	27.2%	0.70
Weatherization and Shell Measures	18.1%	15.5%	1.17
Home Energy Audit Pilot	3.0%	12.1%	0.25
Second Refrigerator and Freezer Recycling	8.6%	15.9%	0.54
Space and Water Conversions	1.4%	12.3%	0.12

* Weights calculated to 15 places past the decimal were applied to survey frequencies.

Nonparticipant Surveys

Cadmus conducted telephone surveys with residential customers not participating in the programs. The nonparticipant survey call list included randomly selected gas and electric customers. Nonparticipant surveys collected the following information:

- Avista energy-efficiency program awareness;
- Participation barriers;
- Awareness of energy efficiency; and
- Customer characteristics.

The study selected nonparticipants by using screening questions to identify customers purchasing items or taking actions in 2011 that could have been eligible for rebates but did not apply for one. This included customers purchasing standard-efficiency versions of rebated measures. Table 1-7 details nonparticipant survey results. The 7.1% cooperation rate reflects Cadmus screened out customers who had not made energy-saving improvements in the past year.

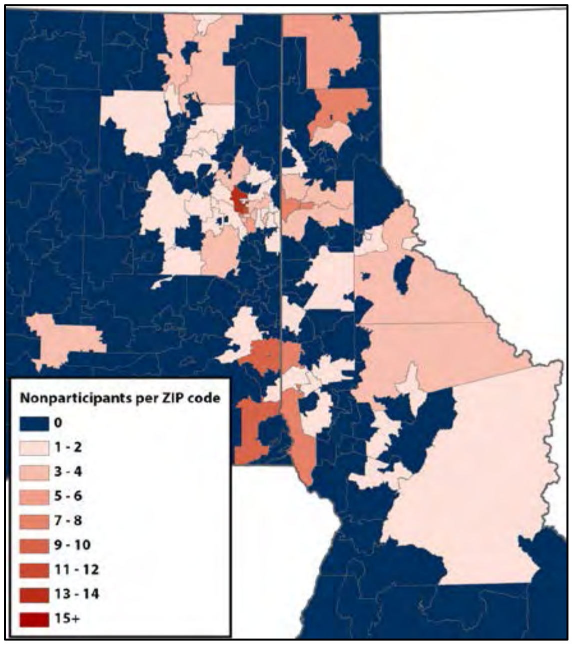
Table 1-7. Residential Nonparticipant Details and Survey Sample

	Number of Unique Nonparticipants	Number of Eligible Nonparticipants*	Number of Nonparticipants Included in Sample Frame
Total contacts	5,186	4,900	4,900
Completed Surveys			210
Number of Calls Required to Achieve Sample			12,879
Response Rate			1.6%
Cooperation Rate			7.1%
Completed Surveys Included in Analysis			210

* Reasons for not including a participant in survey sample included: 1) contact appeared in one or more 2011 participant database; or 2) incomplete contact information.

As with participant survey respondents, the geographic distribution of survey respondents clustered around urban centers (specifically, the cities of Spokane, Sandpoint, Pullman, Moscow, and Lewiston).

Figure 1-2. Geographic Distribution of Participant Survey Completes



Nonparticipant surveys results have been reported in aggregate, reflecting behaviors and attitudes of all Avista nonparticipant residential customers.

1.1.4 Organization of Key Findings

The key findings sections that follow are organized into the following major topic groups:

- Program Participation
- Program Design
- Market Characteristics
- Data Tracking
- Marketing and Outreach
- Participant Experience and Satisfaction
- Residential Program Freeridership
- Effectiveness of Implementers
- Trade Ally Participation and Satisfaction

1.2 Program Participation

1.2.1 Savings and Incentives

Table 1-8 provides adjusted gross savings and evaluated total realization rates for each program, not including the Home Audit program, as savings from that program have been included in other programs' totals.

The 2011 Avista Impact Report's explores the contents of Table 1-8 in detail. However, at a high level, adjusted gross savings realization rates for several programs are less than 1, and indicate issues with program participation and unit energy savings (UES). Both topics are explored in greater detail below.

Table 1-8. Adjusted Gross Savings and Evaluated Total Realization Rates

Residential Program	Adjusted Gross Savings		Evaluated Realization Rates	
	kWh	Therms	kWh	Therms
Residential Gas and Electric Saving Programs				
ENERGY STAR Appliance Rebate	3,623,509	22,185	121%	72%
ENERGY STAR Homes	406,972	25,006	59%	104%
High Efficiency Equipment	4,743,627	305,789	50%	84%
Weatherization and Shell Measures	2,164,907	157,874	24%	42%
Home Energy Audit Pilot	0	0	N/A	N/A
Residential Electric-Only Programs				
2nd Refrigerator and Freezer Recycling	4,054,783	N/A	90%	N/A
Space and Water Conversions	3,577,879	N/A	113%	N/A
Simple Steps, Smart Savings	24,601,728	N/A	136%	N/A
Overall	43,173,405	510,854		

1.2.2 Measure Quantities

Approximately 21% of program participants received more than one program incentive (not including the upstream Simple Steps, Smart Savings program), a finding in accord with observations from the 2010 program evaluation. Further, when comparing the 2010 and 2011 participant databases, 13% of 2011 program participants participated in at least one Avista energy-efficiency program in 2010. Such repeat participation rate is slightly higher than that observed in another, recent Pacific Northwest evaluation. We believe repeat participation indicates overall participant satisfaction with energy-efficiency rebate opportunities offered by Avista, as further supported by survey findings below.

Table 1-9. Number of Measures Installed

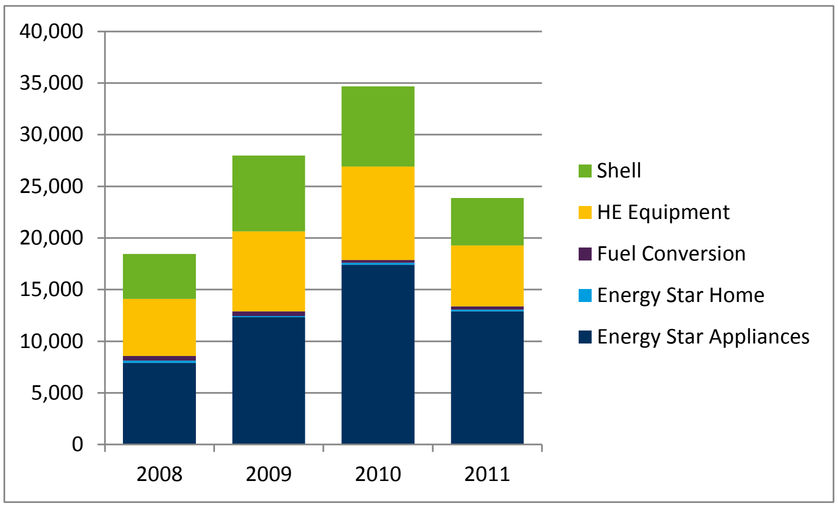
Total Number of Rebates	Participants in Category	Percentage
1	15,801	79%
2	3,279	17%
3	784	4%
4 or more	83	0%
Total Participants	19,947	100%

1.2.3 Participation Trends

In 2011, overall residential program participation fell to a 3-year low, reversing a 3-year trend of increased annual program participation. Number of measures installed in 2011 was 28% lower than 2010 (26,573 versus 36,855 incented measures, not including the upstream program). In percentage terms, the largest participation decrease occurred in Weatherization and Shell Measures (59% of 2010 participation); and HE Equipment (65% of 2010 participation). Among programs with historical data tracked in Avista's central tracking database, only the fuel conversion program increased participation from 2010 to 2011. Figure 1-3 provides additional detail.

The drop in participation was not unexpected. Avista staff reported 2010 participation was likely buoyed by the presence of generous state and federal tax credits. In 2011, many of these tax credits expired. Program planning took this into account, and, while not desirable, is in accord with expectations. Avista's 2011 DSM Business Plan provides additional detail on this subject.

Figure 1-3. Reported Number of Rebates by Program: 2008–2011



Notably, federal tax incentives were not a primary motivator cited by participating survey respondents. Cadmus collected survey data on factors motivating participants to purchase their rebated equipment, both in 2010 and 2011. Less than 1% of respondents reported tax credits as a primary motivator in both years.

Home Energy Audit Participation

The Home Energy Audit Pilot Program operated in 2010 and 2011 years, seeking to achieve energy savings by helping home owners identify opportunities for energy-saving actions in their homes. Cadmus analyzed the Home Energy Audit tracking database to characterize audit participant follow-through. The evaluation team cross-referenced the Home Energy Audit database to the general program database, determining how frequently Audit participants installed and received incentives for additional measures. Table 1-10 summarizes Audit Program participation and follow-through over the 2010–2011 period.

Table 1-10. Home Energy Audit Participation and Follow-Through

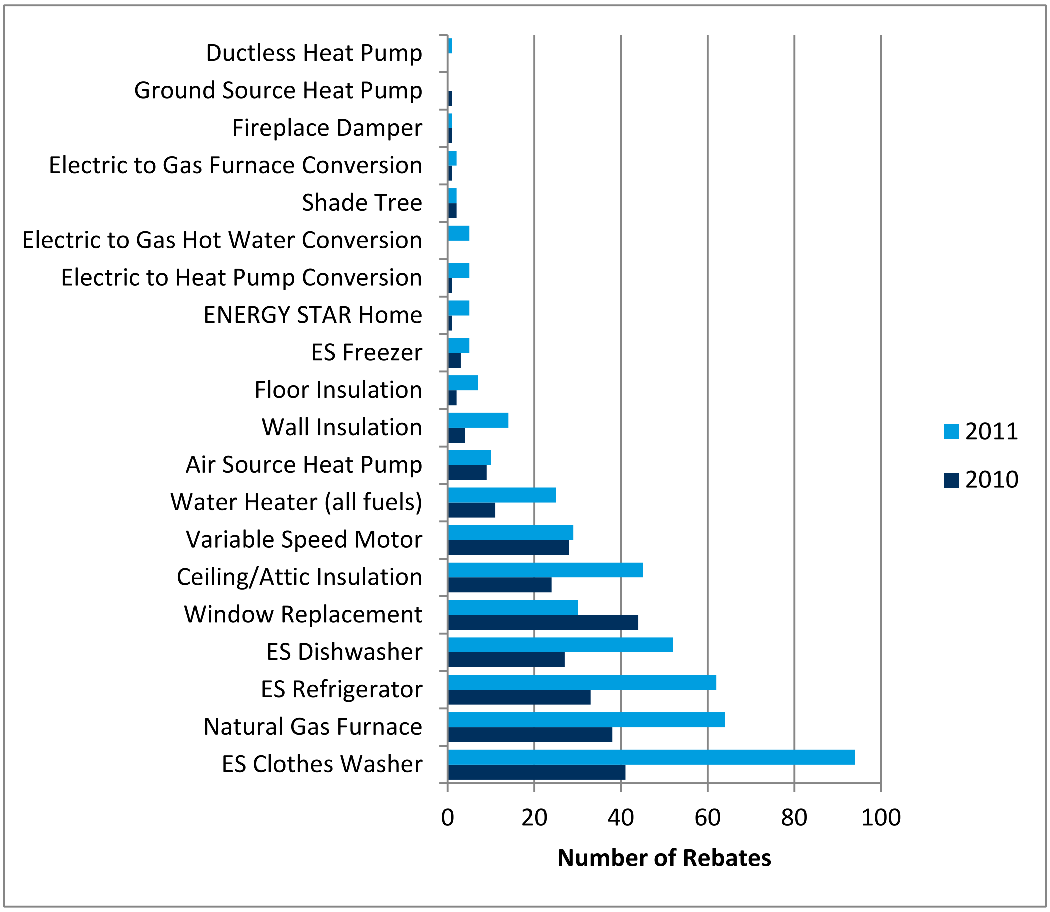
Program Year	Total Audit Participants	Participants Installing at Least One Rebated Measure	Percent of Participants Installing at Least One Rebated Measure
2010	269	111	41%
2011	659	223	34%
Total	928	334	36%

Though overall participation increased in the pilot program's second year, follow-through decreased, from 41% to 34%. Nevertheless, Avista's follow-through rates were comparable to similar single-family residential audit programs at other utilities, with follow-through achieved for:

- 20% of participants in a 2010–2011 audit program at a Pacific Northwest utility;
- 39% in a 2008 audit program at a New England utility; and
- 33% in 2009 and 12% in 2010 in an audit program at a Midwest utility.

Cadmus further analyzed participation data to determine measures most commonly installed. Figure 1-4 summarizes measure installations, showing clothes washers, gas furnaces, refrigerators, and dishwashers the most commonly installed measures among audit participants.

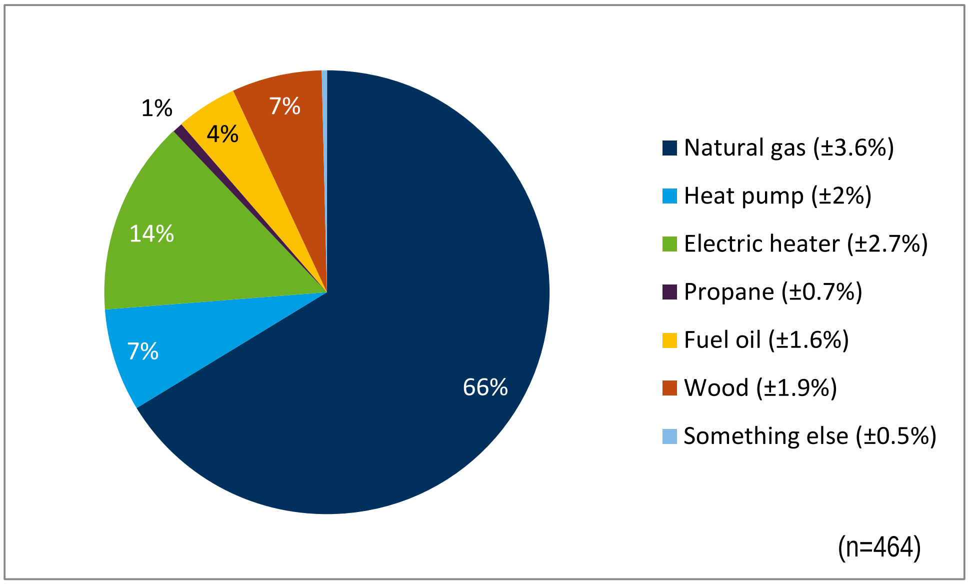
Figure 1-4. Additional Rebates Received by Home Energy Audit Participants



1.2.4 Participant Characteristics

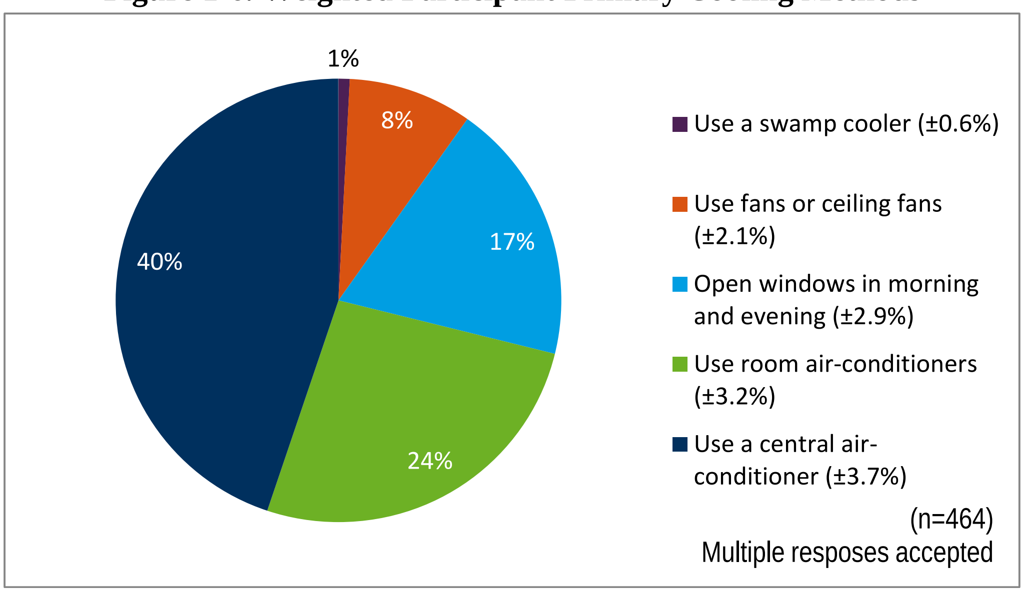
Weighted overall participant survey responses from the 2011 survey indicated over half of survey respondents (66%) heated their homes with natural gas. Electric heaters were the second most common responses, with 14% of respondents citing it as at least one way they heated their homes. The distribution of heating methods is correlated to the distribution of incented measures – for example, customers receiving gas furnace incentives would clearly report heating their home with gas. Since the measure mix varies from year to year, a direct comparison between the 2010 and 2011 heating method results is not appropriate.

Figure 1-5. Weighted Primary Participant Heating Methods



Participants reported cooling their homes with a variety of different technologies. Most common responses included: central room air conditioners (ACs) (40%) and room ACs (24%). These findings were very similar to the 2010 participant survey (37% central ACs, and 22% room ACs).[2]

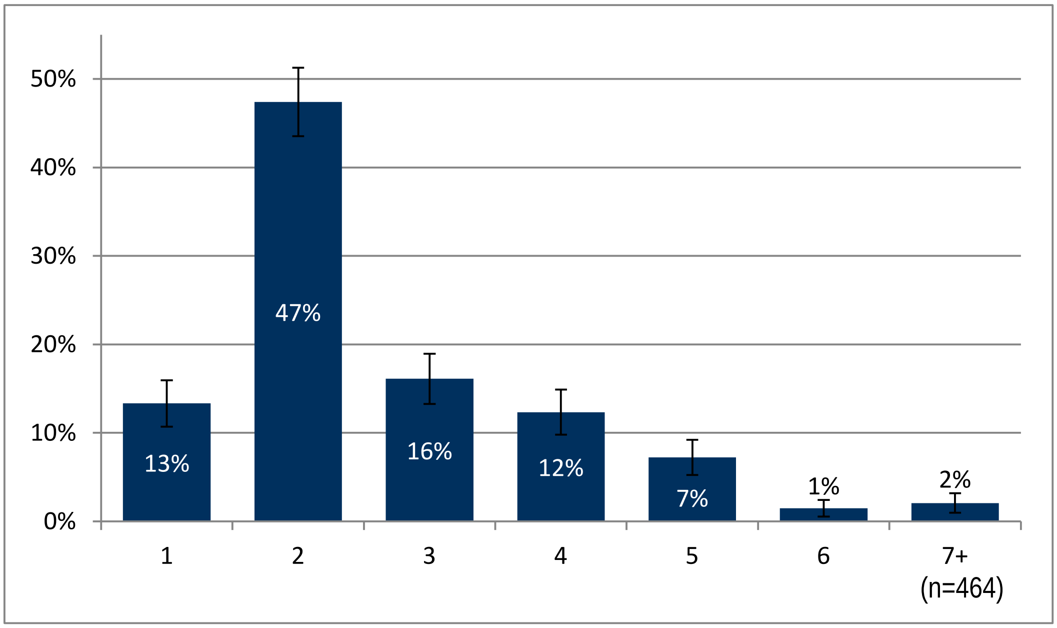
Figure 1-6. Weighted Participant Primary Cooling Methods



Similar to findings from the 2010 survey, nearly half of participant survey respondents (47%) reported two-person households.

[2] The previously mentioned concern about fuel mix is not applicable in this case because all cooling is electric.

Figure 1-7. Weighted Participant Household Size

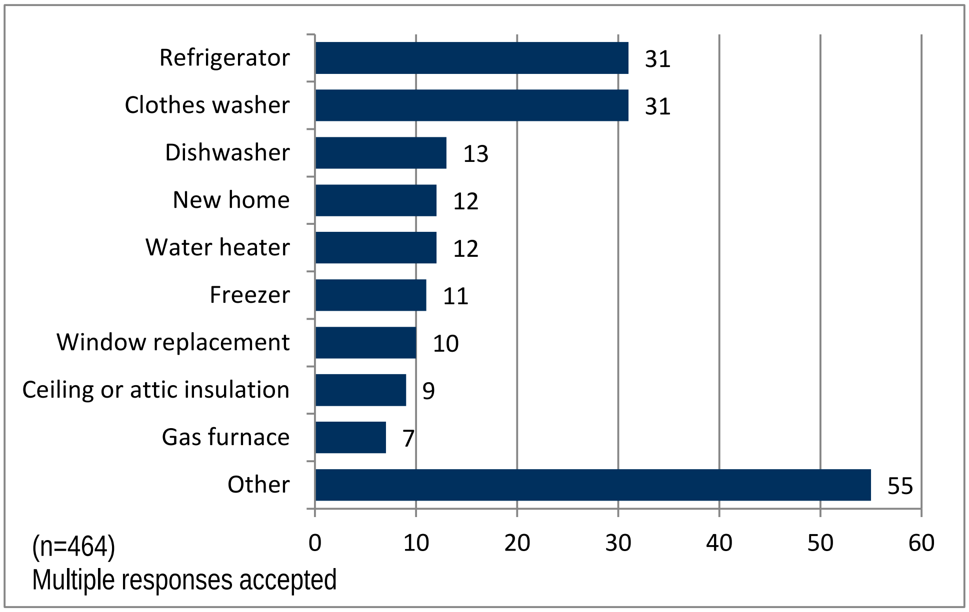


1.2.5 Nonparticipant Characteristics

Figure 1-8 shows distributions of the 10 most common measures among surveyed nonparticipants, resulting from randomly dialing Avista residential customers, and reflecting rates at which such purchases occurred, without intervention from Avista. Appliances made up approximately half of measures installed, aligning with high participation in the ENERGY STAR appliance rebate program. Following appliances, weatherization and heating, ventilation, and air conditioning (HVAC) measures were the most commonly installed measures.

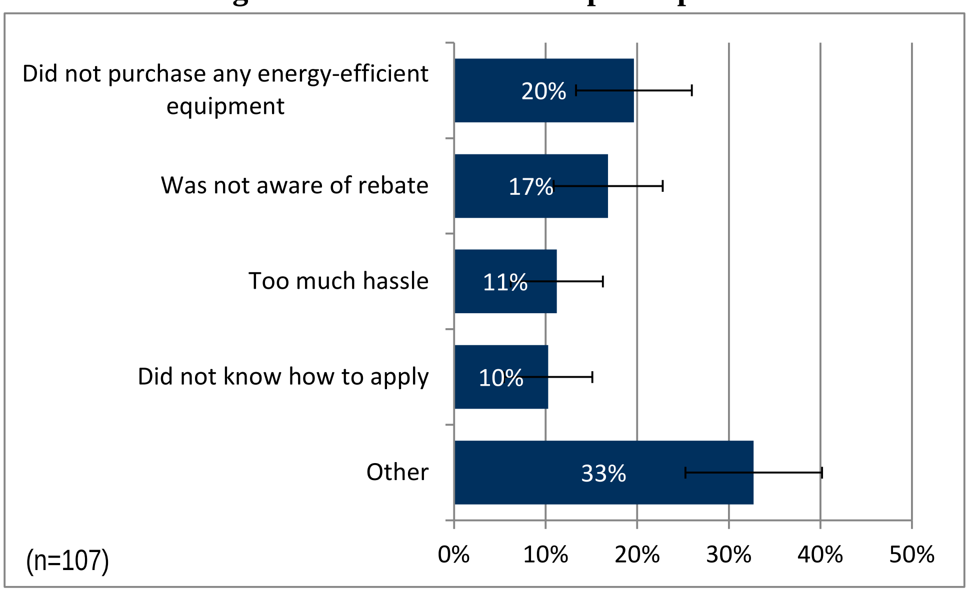
The most common equipment mentioned in the “Other” category included light bulbs (24), stoves (6) and heaters (4).

Figure 1-8. Measures Installed by Nonparticipants



Nonparticipants cited a variety of different reasons for not applying for Avista rebates regarding their newly installed equipment. Ineligible equipment (20%) and program awareness (17%) were most common reasons cited. These findings are in accord with responses from the 2010 nonparticipant survey (in which 27% cited equipment efficiency and 17% awareness). The only significant deviation from the 2010 survey findings was a decrease in the number of respondents reporting they knew about the rebates but did not know how to apply (a decrease from 27% to 10%).

Figure 1-9. Reasons for Nonparticipation



The nonparticipant survey contained a battery of home characteristic questions, which were used to help identify the ways program participants might differ from individuals installing new measures without seeking rebates and Avista's overall customer base.

Nonparticipants reported heating their homes in much the same ways as program participants, though nonparticipants were more likely to heat their homes with natural gas (50% compared to 66%), and more likely to use electric heaters (24% compared to 14%).

Nonparticipants reported cooling their homes in the same ways as participants, but the breakdown of responses differed appreciably, with notable differences including:

- Nonparticipants were less likely to use a central ACs (28% compared to 40%).
- Nonparticipants were more likely to open windows during cooler times of day (23% compared to 17%).

Nonparticipants were more likely to rely on fans (12% compared to 8%).

Figure 1-10. Nonparticipant Primary Heating Methods

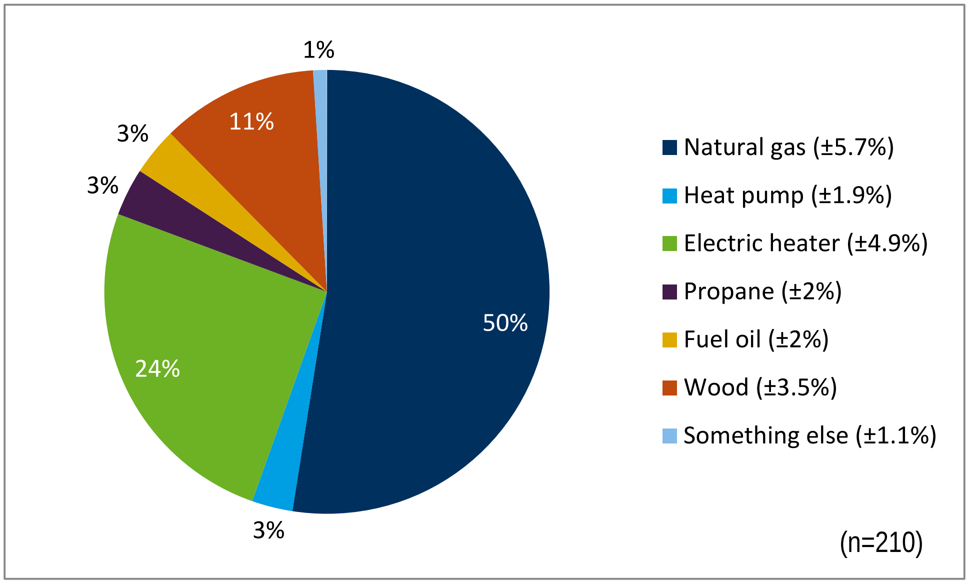
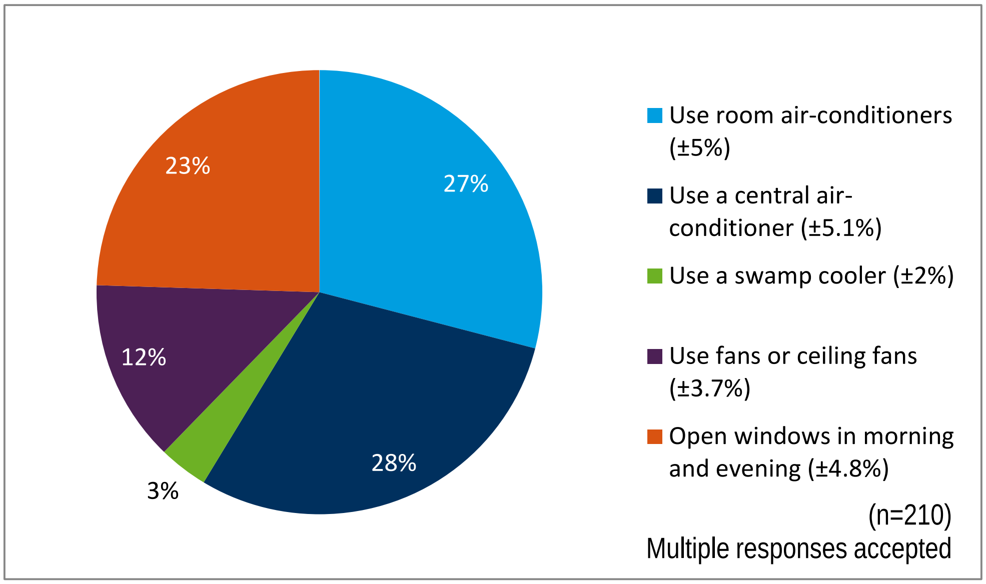


Figure 1-11. Nonparticipant Primary Cooling Methods



1.3 Program Design

This section discusses our observations regarding design of Avista's residential programs. No major program design changes occurred during the 2011 program year (excepting changes to program measure offerings), and the overall program design continued to work well in general. As Cadmus observed in the 2010 process evaluation, various descriptions and categorizations of the programs exist for different audiences. For example, the PPA team appears to consider programs on a measure-by-measure basis, while the customer-facing materials (such as online program descriptions and rebate applications) categorize measures into groups, including:

- ENERGY STAR Appliances;
- Home Improvement;
  - High-Efficiency Equipment;
  - Conversion from Electric;
  - Weatherization;
- New Construction;
- Second Refrigerator and Freezer Recycling; and
- Simple Steps, Smart Savings.

Cadmus finds the customer-facing program categories easy to understand and appropriate for program management and evaluation purposes, and this evaluation addresses programs according to these categories.

1.3.1 Changes to Program Offerings

Avista's residential program offerings have been designed to meet cost-effectiveness tests, and the PPA and implementation team elected to make a number of changes in program offerings during the 2011 program year to reflect changes in measure cost-effectiveness. The following measures were discontinued, either during 2011 or at the end of 2011:

- Windows;
- Shade Trees;
- Fireplace Dampers; and
- Dishwashers.

The only measure added was for Simple Steps, Smart Savings, which added high-efficiency showerheads for the 2012 program year.

In the near future, the following additional program changes are anticipated:

- The Home Energy Audit Pilot Program is scheduled to terminate in 2012;
- Upcoming changes in Federal efficiency standards for natural gas furnaces will likely render that measure cost-ineffective; and
- The PPA team reported the ENERGY STAR New Homes program appeared marginally cost-effective, and may be considered for discontinuation.

Cadmus' impact evaluation findings indicated lower-than-expected saving for some measures; therefore, some measures previously deemed cost-effective may not continue to be cost-effective. In coming years, Avista's PPA and implementation teams may need to revisit program design to maintain the residential portfolio's cost-effectiveness, while still acquiring adequate energy savings to achieve conservation targets. This issue particularly becomes relevant for the natural gas portfolio, given measure savings have been lower than expected, and Avista anticipates lower avoided costs for natural gas this year.

1.3.2 Program Management and Implementation Approaches

Implementation of the residential programs all include internal program management and oversight, though two programs (Refrigerator and Freezer Recycling and Simple Steps, Smart Savings) are implemented externally, by third-party firms. Cadmus' interviews with Avista program managers and the PPA team gathered information about program management and implementation approaches. Overall, Cadmus found program management effective, and programs operated efficiently.

Two managers were responsible for the residential programs, including oversight of third-party implemented programs. The two program managers had responsibilities beyond residential program management, with each responsible for multiple programs. In addition to the two program managers, a team of rebate processing staff contributed to day-to-day program operations, including application review, processing, and QA/QC. Each program manager oversaw at least one externally-implemented program, and both reported conducting field visits to ensure these programs were implemented appropriately. 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.

In addition to day-to-day processes, managers were involved in program planning and goal setting, in coordination with members of the PPA team. Staff statements differed regarding responsibility for planning and goal setting: program managers depicted the 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.

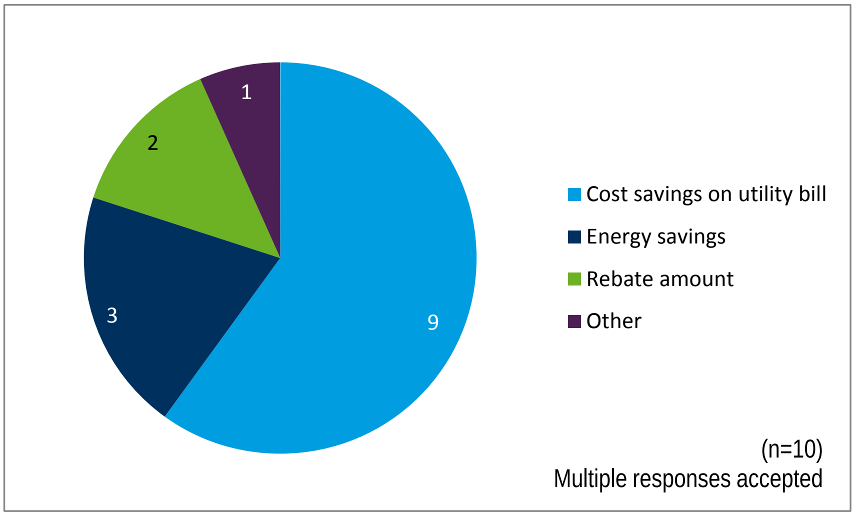
1.4 Market Characteristics

1.4.1 Customer Demand and Awareness

As part of the research effort, Cadmus asked a number of questions designed to understand customers' motivations for pursuing retrofits, and their understandings of the resulting benefits. As shown in Figure 1-12, the overwhelming response was: customers were driven by cost savings on their energy bills, followed by energy savings.

As cost savings primarily drove weatherization activities, one contractor recommended Avista periodically attach bill inserts to customers above a certain level of energy usage.

Figure 1-12. Customer Motivations for Weatherization Improvements



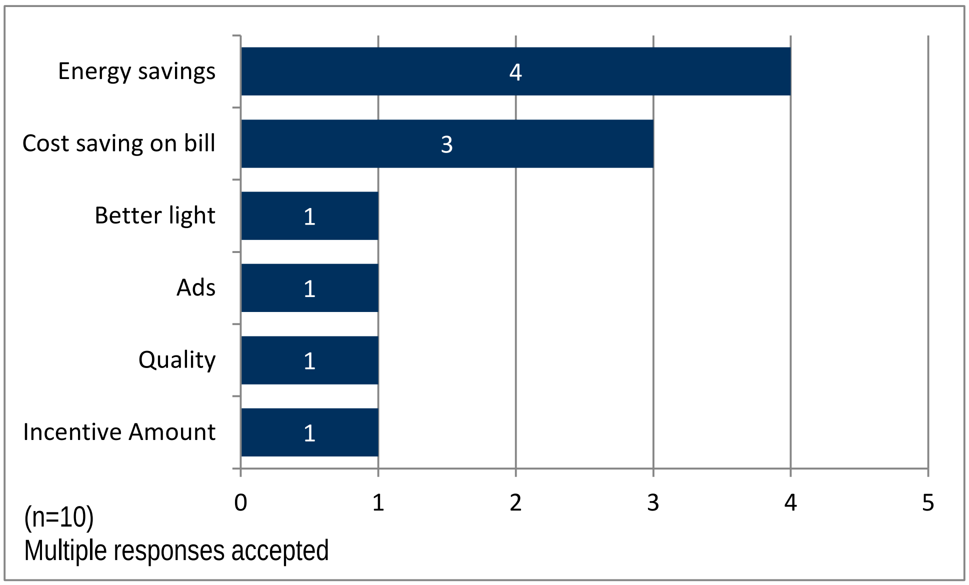
Weatherization contractors were asked to rank customer awareness using a scale ranging from "very aware" to "not aware at all" of weatherization benefits. The most common response (eight respondents) was: customers were "somewhat aware." However, the majority of contractors felt this awareness would likely increase in the future (six respondents). One contractor reported younger generations were more likely to become aware of the weatherization's environmental benefits. Two other contractors similarly indicated awareness would likely to increase due to general environmental awareness and rising energy prices.

Contractors were asked to rate customer demand for energy-efficiency measures using the same scale, ranging from "very high" to "no demand at all." The most common response was "somewhat high demand" (five respondents). Two respondents stated there was no demand or they did not know.

Six contractors believed demand would likely increase in the future. One contractor operating in Washington said that, if Avista ran more local advertisements, it would help, because very few people know about the program. Another contractor mentioned that, after Avista put up a billboard near the contractor's workplace, he would get two to three calls a week from customers asking about the rebate program. This contractor also said he could not tell customers whether or not they qualified, but, rather, directed them to visit Avista's Website. This contractor also mentioned his willingness to participate in any training Avista might put on, acknowledging Avista's rebate program likely increased his sales.

As shown in Figure 1-13, lighting retailers felt customers generally were motivated to purchase energy-efficient products to save energy and incur cost-savings on their utility bills.

Figure 1-13. Customer Motivations to Purchase High-Efficiency Products



1.4.2 ENERGY STAR Market Share

Despite decreases in program uptake, a review of available market share data indicated the market for many Avista's residential measures remained relatively untransformed, and significant opportunities for energy savings through these measures remain. Figure 1-11 provides market share estimates, by measure, from the Regional Technical Forum (RTF) and ENERGY STAR.

Table 2-11. ENERGY STAR Market Share for Residential Equipment

Measure	RTF Assumption*	ES Shipment Data 2009**	ES Shipment Data 2010**
Clothes washer	58%	N/A	64%
Dishwasher	56%	N/A	100%
Freezer	10%	N/A	25%
Refrigerator	32%	N/A	50%
Water heater	N/A	N/A	12%
Gas furnace	N/A	50%	61%
Window replacement	N/A	N/A	81%
Air Source Heat Pump	N/A	31%	46%

* RTF measure workbooks are found at: http://www.nwcouncil.org/energy/rtf/measures/Default.asp

** The 2009 ENERGY STAR Unit Shipment Data Summary Reports are found at: http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/

1.5 Data Tracking

For each residential program evaluated, Avista provided Cadmus with tracking data, derived from four separate mechanisms:

- Internal, multiprogram tracking database;
- Home Energy Audit tracking spreadsheet;
- JACO Refrigerator Recycling database; and
- Simple Steps, Smart Savings invoice material.

Cadmus examined each database to: 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 contemporary tracking processes.

1.5.1 Data Tracking Summary

The internal, multi-program tracking database included participant measure-level data for the following programs:[3]

- ENERGY STAR Products;
- HE Equipment;
- Weatherization and Shell;
- Space and Water Conversions; and
- ENERGY STAR New Homes.

[3] Fifty-two shade tree measures were also tracked.

The extract examined contained 22 fields, containing the following five kinds of information:

- Measure and program designation (*code, measure, fuel, program*);
- Payment and savings (*rebate, kWh, therms, cost*);
- Customer information (*account, customer, direction, house#, street, st sfx, unit, rural, city,*
  state, zip, phone number);
- Process date-stamps (*entry date, pmt date*); and
- Customer phone numbers (day area code, day phone ext, day phone#, home area code, home phone).

The internal, multi-program database served as an electronic repository for customer data, collected from program application forms, including data for programs Avista implements internally (excepting the Home Energy Audit Pilot Program, which is tracked in a separate database).

The Home Energy Audit Pilot Program tracking spreadsheet had eight fields, containing the following two kinds of information

- Customer information (*customer, direction, house#, street, st sfx, unit, rural, city, state, zip, phone number*); and
- Process date-stamps (*audit date*).

The Home Energy Audit database format differed from the internal, multi-program database. For example, in the Home Energy Audit database, the address field contained participant home addresses, but address formats did not appear standardized. This limited the data's usefulness, as nonstandardized addresses can be difficult to match to standardized addresses (such as those tracked in the multi-program database). The database also did not contain customer account numbers, which made it difficult to match customers to other utility tracking data. The Home Energy Audit data provided did not contain tracking of testing performed, recommendations, direct installation measures, or follow-through installations.

JACO, the implementer of the Refrigerator Recycling Program, also collected data on: participating customers; their pickup orders; and refrigerators and freezers recycled through the program. These data were provided in three separate, integrated spreadsheets, allowing comprehensive tracking of customers' and units' movements through the program. Avista provided Cadmus with unit and customer data. The customer data contained addresses in a nonstandard format, similar to that of the Home Energy Audit database.

Finally, Cadmus received invoice material for the Simple Steps, Smart Savings program, which tracks monthly reporting from FMS. Both Avista and FMS noted monthly reporting for this program often involved delays and adjustments, caused by difficulties in obtaining sales data from retailers in a timely manner. FMS 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). Each monthly invoice included two spreadsheets, Sales Data Adjustments and Sales Data, containing the following, multiple data fields:

- Store
- Address
- Manufacturer
- SKU
- PTR Code
- Allocation
- Sales Month
- Sales Adjustment
- Prior Month Unreported Sales
- kWh Savings
- Incentive Amount
- Admin Fee
- Total

Aggregated into a final annual report, these data showed adjustment totals, made after the program year's close. Neither Avista nor FMS provided an aggregated year-end database of measure-level data.

1.6 Marketing and Outreach

Avista marketed its residential programs through multiple channels during in 2011. Cadmus' examination of marketing materials included reviewing information available online, as well as the 2011 calendars for the *Every Little Bit* campaign and JACO recycling program. Further, Cadmus interviewed Avista team members to understand processes, approaches, areas of achievement, and possibilities for improvements.

1.6.1 Marketing Approach

The *Every Little Bit* campaign served as Avista's main marketing driver. A broad-based marketing and outreach campaign, launched in 2007, it sought to raise customer awareness regarding energy efficiency and rebate availability.

The campaign launched after Avista conducted a residential baseline survey to identify barriers to purchasing efficient equipment. Marketing efforts included program-specific messages as well as more general messages about energy conservation. Avista continued to promote this campaign in 2011 as a primary means to reach customers with low-cost/no cost opportunities for saving energy through rebates. The approach used many broad-based channels, including: Avista's campaign Website (www.EveryLittleBit.com), direct mail, bill inserts, print advertising, TV advertising, radio spots, community events, promotions, competitions and social media outreach.

Avista program managers reevaluated the marketing approach every six months, using a seasonal approach for their marketing campaign. Geographic distribution of customers served as another strong driver of tactics.

For the recycling program, JACO created a marketing plan, consisting of bill inserts, newsletters, a Toyota Prius contest, search engine marketing, print ads, e-blasts, and collateral. Throughout the year, Avista program managers worked closely with the JACO team to make adjustments, as necessary.

Most rebate program marketing was done through retail point-of-purchase which identified discounted products and their sponsors. Rebate materials and participating retailers were also located online. Outreach to retailers used a one-on-one approach.

1.6.2 Marketing Materials Review

In evaluating the residential marketing program, Cadmus reviewed the following program materials:

- Rebate Forms
  - Home Improvement Rebate Form
  - New Construction Rebate Form
  - New Construction ENERGY STAR® Homes Rebate Form
- Advertising Materials
  - TV ads
  - Radio ads
- Website
- Facebook
- Marketing Calendars
  - 2011 Every Little Bit Plan At-A-Glance Calendar
  - JACO 2010–2011 and 2011–2012 Marketing Campaign Calendar

Rebate Forms

The rebate forms, located conveniently online, proved user friendly. They contained auto-complete formatting. which makes it easy for customers to fill out their information before printing. The forms offered clear, concise directions and steps for customers, and followed Avista's branding with a consistent look and feel throughout. Avista contact information was also provided, should a customer have questions. During 2011, Avista program staff began development of an online rebate application process, which launched in 2012.

Advertising Materials

All TV and radio spots, located on EveryLittleBit.com, included a variety of the following:

- Use of testimonials;
- Strong calls to action;

- Compelling messaging; and
- A sense of urgency driving traffic to the Website to download rebates.

All advertising materials contained energy-efficiency marketing best practices.

Website

Table 2-13 provides an overview of the EveryLittleBit.com Website, comparing best practice elements for energy-efficiency program Websites. Our findings indicate Avista used several best practice Web elements, but additional opportunities remain to boost awareness. Online messaging was strong, consistent, clear, and concise. The core messaging focused on saving energy and money through energy efficiency: "every little bit" adds up to bigger savings.

The uncluttered Website used a clear design, with consistent branding and positive imagery, conveying a simple, direct message. Subheadings break up page content, and help users find what they seek. The site also contains a number of interactive tools, such as: the House of Rebates, videos; and Efficiency Avenue. These helps keep customers engaged, and can help them maintain their presence on the page longer, where they can learn more.

Some Website links take the customer to the corporate Website (www.avistautilities.com), which can add confusion, as this does not pop up a new window; so users have to click "back" to return to the Every Little Bit site.

Table 2-12. Website Best Practices Used in Avista's Marketing

Category	Website Best Practice Element	EveryLittleBit.com	Rationale/More Information
Navigation	Programs highlighted on the utility's home page	Yes	Users often enter utility sites through the home page. Easy "one-click" access, a vanity URL, or microsite for a program makes participation easier and provides greater program exposure. AvistaUtilites.com has a direct link to EveryLittleBit.com. Consider adding additional creative elements of the Every Little Bit campaign to further enhance placement on the Avista Utilities homepage.
Content	Description leads with benefits (i.e., What's in it for the participant?)	Yes	The benefit statement is compelling and clear, and listed on the top of the Website; so it is highlighted on every page. ("When it comes to energy efficiency, every little bit adds up.")
Content	Clear call to action	Yes	The program's "why" for the program is clearly presented(as noted above). Action words are used, such as: "click to"; "read more"; and "find a rebate."
Marketing	Contact capture	Yes	A contact us page allows users to fill out basic information if they have additional questions. The "contact us" page on EveryLittleBit.com is effective as it only requires a certain amount of information. This reduced barriers for customers to reach out.
User Experience	Participant eligibility requirements	Yes	User experience refers to the online process and interactivity from the user's perspective. Easy downloads

Category	Website Best Practice Element	EveryLittleBit.com	Rationale/More Information
User Experience	Online registration process	Yes	
Marketing	Downloadable program information in print format	Yes	Rebate forms are present for easy downloads.
Marketing	Social media "share" elements	No	When marketing materials are easy and simple to share, “word of mouth” activity, in-person or online, increases. Consider adding a share toolbar to help customers virally share promotions and information online.

Facebook

Avista utilizes a “cause” Facebook page (https://www.facebook.com/everylittlebit). The EveryLittleBit.com displays the Facebook feed, and encourages customers to “like” the page by offering incentives to renters. Every renter becoming a fan of the page receives a PowerMonger Awareness kit, which contains energy-efficiency information and tools. Today, the site has over 2,000 fans, and utilizes best practice features of the Facebook Timeline.

Marketing Calendars

We reviewed the Every Little Bit Plan calendar, which provided an at-a-glance overview of 2011. It displayed outreach, campaigns, and projects as well as the media plan for each quarter. We also reviewed the 2011 JACO marketing plan for the appliance recycling program.

Table 2-14 compares elements identified by these two calendars, comparing them to best practice elements in energy-efficiency program marketing. Our findings indicate Avista currently uses several best practice marketing channels, but additional opportunities remain, and could be used boost participation.

Table 2-13. Website Best Practices Used in Avista’s Marketing

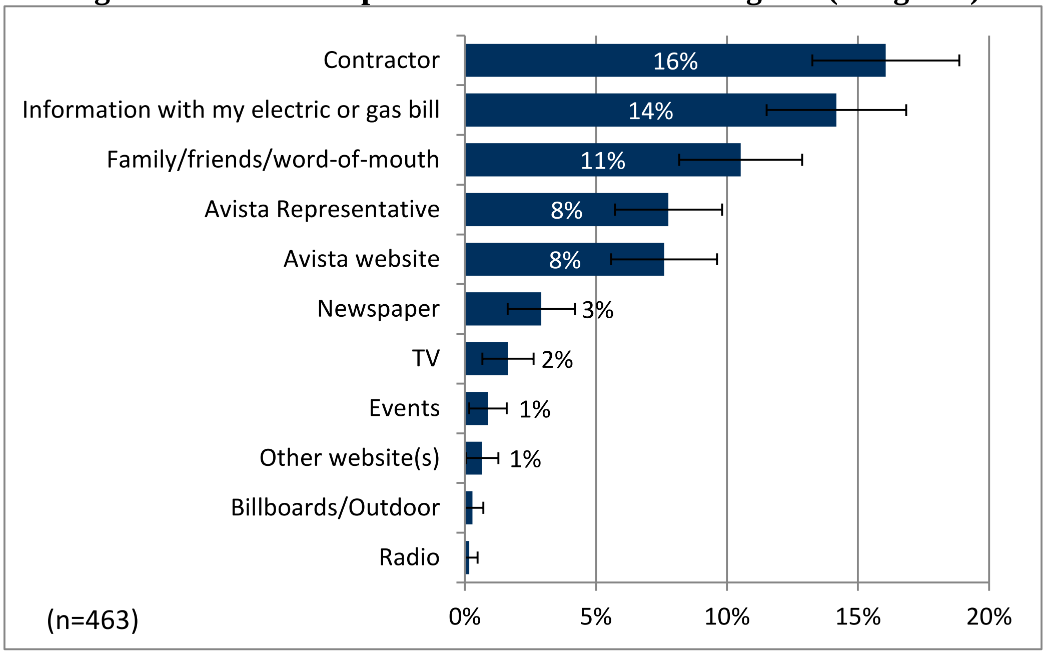
Best Practice Marketing Channels	Avista Residential Programs
Direct Mail	Yes
Newspaper Advertising	Yes
Radio/TV Advertising	Yes
Online Advertising	No
Website	Yes
Videos	Yes
Bill Inserts/Newsletters	Yes
Brochures	Yes
Presentations/Meetings	Yes
Events	Yes
Kiosks/Demonstration	Yes
Co-branding materials- Contractors, Partners, etc.	Only Simple Steps
Referral Program	No
Social Media Outreach (Facebook)	Yes
Mobile Application/Website	No, not for EE Programs

1.6.3 Sources of Participant Awareness

To help assess the effectiveness of Avista's and the implementer's marketing, we asked participants how they heard about the program they participated in. Respondents cited a variety of different sources, with responses fairly evenly distributed across: contractors (16%); information in utility bills (14%); and word of mouth (11%).

When compared to 2010 survey responses, the only significant change was in the proportion of respondents citing an Avista representative as their source of information (17% in 2010 dropping to 8% in 2011).

Figure 1-14. How Respondents First Heard of Program (Weighted)



1.6.4 Nonparticipant Awareness

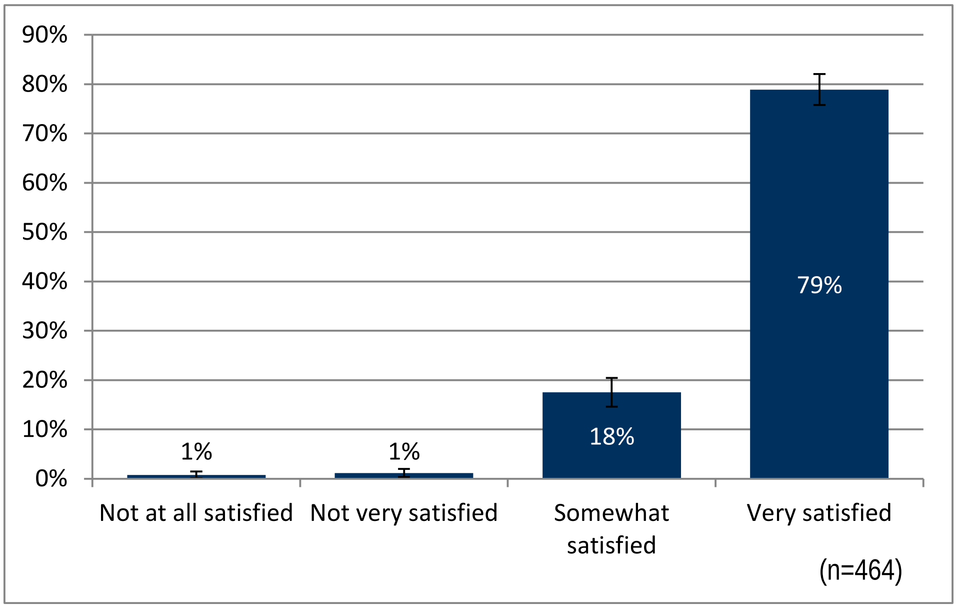
As cited above, lack of awareness among nonpartcipants proved to be the second-most common reason they did not seek program rebates for their newly installed equipment (17%). When asked if they are aware of Avista's energy-efficiency programs, only 54% answered in the affirmative, respresenting a statisitcally significant decrease from 2010 survey findings, which inidcated 67% of responses knew of Avista's programs. This appreaciable decrease in awareness indicates a renewed emphasis on mass marketing is appropriate.

1.7 Participant Experience and Satisfaction

Cadmus asked surveyed participants to rate their overall satisfaction with the program as well as their satisfaction with various program aspects. As shown in Figure 1-15, overall satisfaction with the programs was very high, with 96% of participants surveyed describing themselves as very or somewhat satisfied with the program in which they participated. This finding closely resembles 2010 survey findings, where 97% of respondents described themselves as very or somewhat satisfied with the program in which they participated, with 79% saying very satisfied.

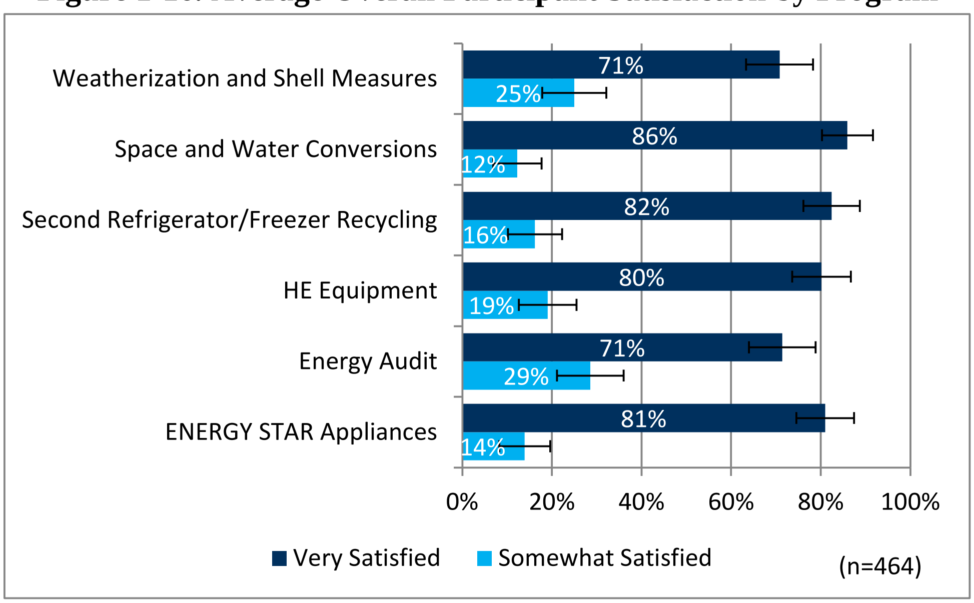
Avista's program satisfaction results compare favorably to those of a recently evaluated residential program in the Pacific Northwest: in the comparison program, only 56% of participants reported being very satisfied.

Figure 1-15. Weighted Average Overall Participant Satisfaction for All Programs



Program-level results, displayed in Figure 1-16, show satisfaction was high across all programs. Audit program results showed a comparatively lower percentage (71%) of audit participants reported being very satisfied. However, this increased from 2010 survey results, in which only 56% of audit participants indicated they were very satisfied.

Figure 1-16. Average Overall Participant Satisfaction by Program



1.7.1 Rebate Amount and Promptness Satisfaction

As shown in Figure 1-17, survey respondents reported slightly lower satisfaction levels with rebate amounts than with the overall program. As shown in Figure 1-18, participant expressed generally consistent satisfaction with rebate amounts across all programs. Similarly, when asked to rate their satisfaction with the time required to receive rebates, overall satisfaction was high across all programs (similar to 2010 survey findings). Figure 1-19 and Figure 1-20 provide additional detail.

Figure 1-17. Weighted Average Rebate Amount Satisfaction for All Programs

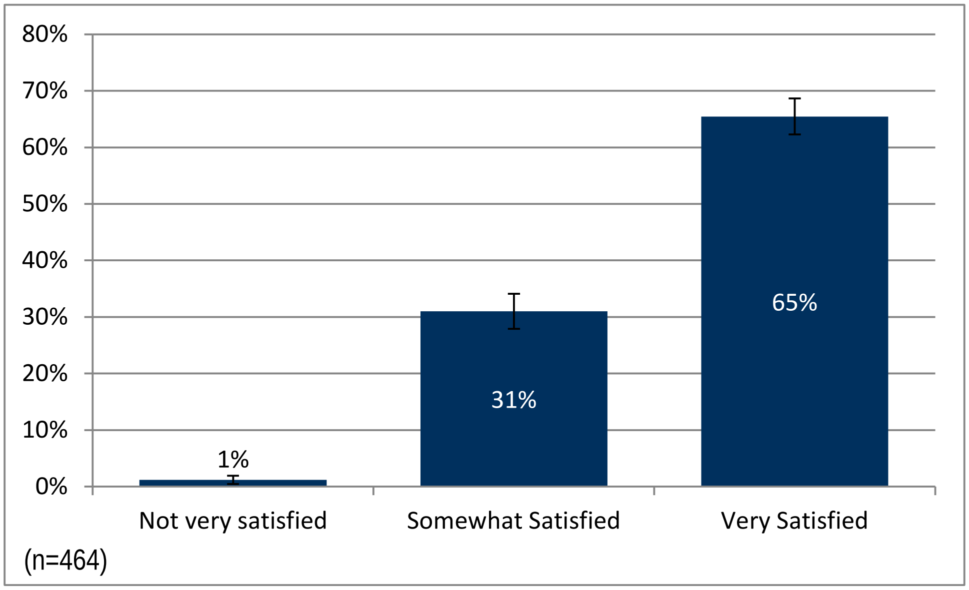


Figure 1-18. Average Rebate Amount Satisfaction by Program

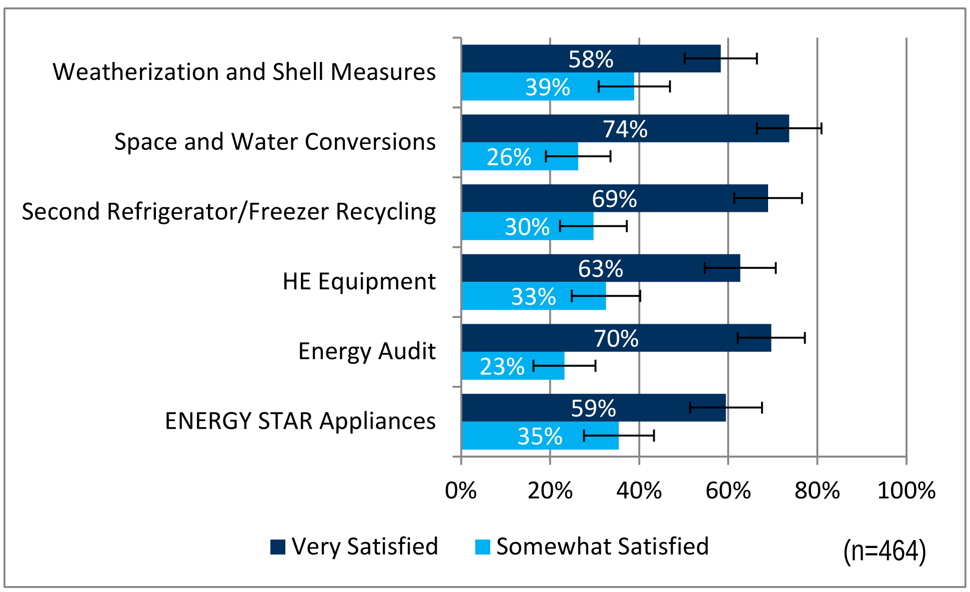


Figure 1-19. Weighted Average Rebate Promptness Satisfaction for All Programs

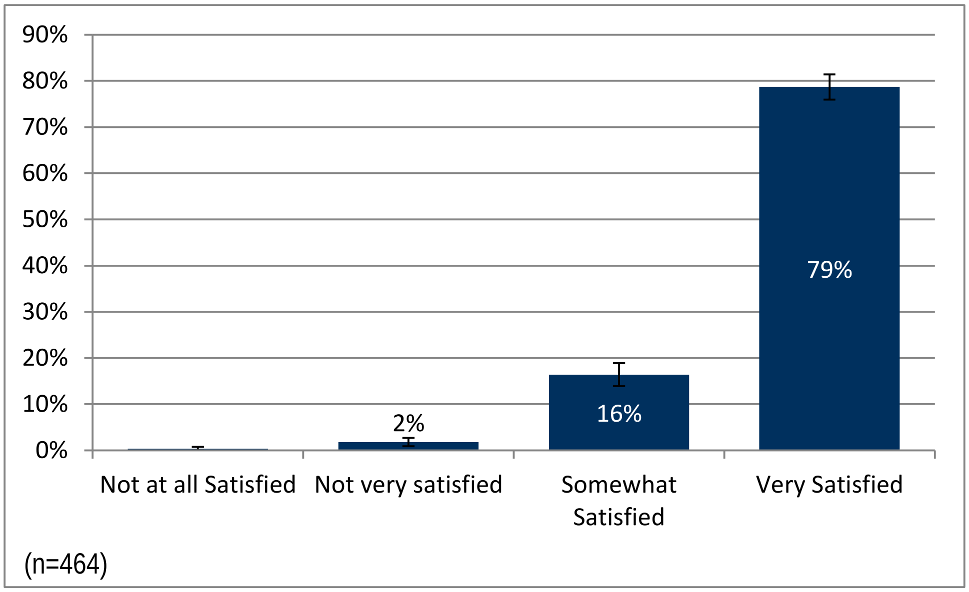
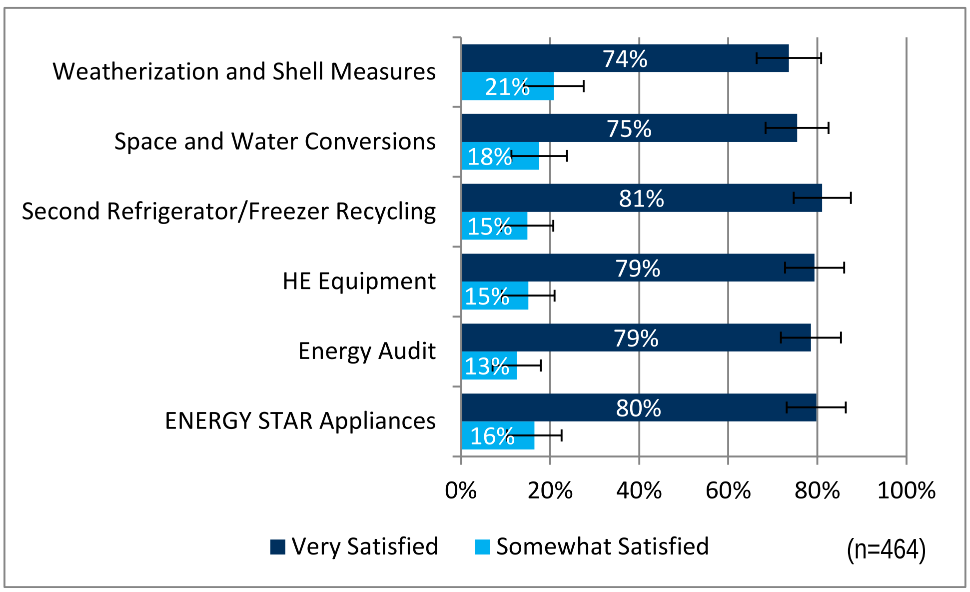


Figure 1-20. Average Rebate Amount Satisfaction by Program



1.7.2 Measure Satisfaction

The survey asked respondents participating in ENERGY STAR Appliance, HE Equipment, Conversion or Weatherization programs how they rated rebated products. Overall satisfaction was very high, with 1% and 4% of respondents indicating incented equipment was fair (depending on the program), and no respondents indicating a poor rating (a finding similar to 2010 survey responses).

Table 2-14. Measure Satisfaction Rating by Program (with 90% Confidence Intervals)

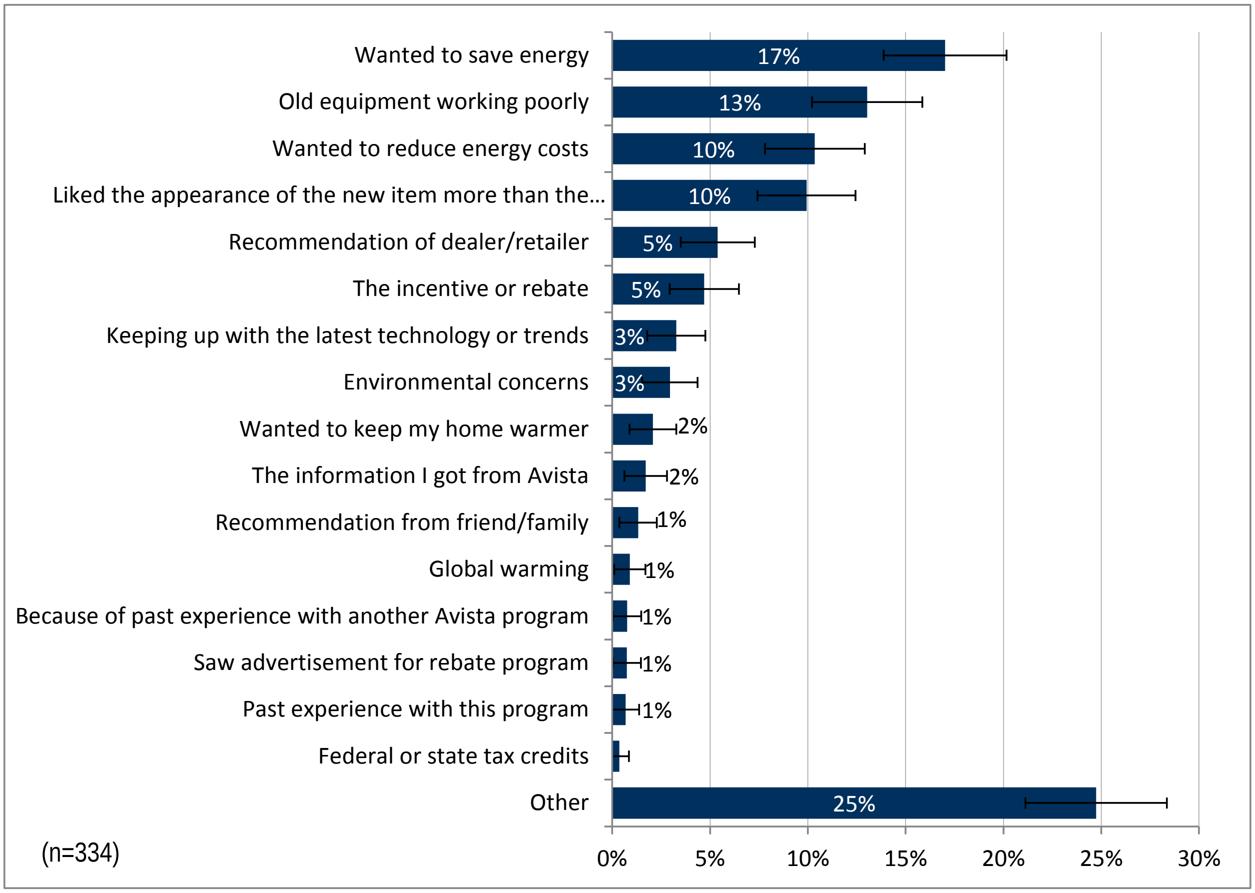
Rating	Percentage of Program Respondents*			
	ES Appliances (n=79)	HE Equipment (n=126)	Conversion (n=57)	Weatherization (n=72)
Excellent	76% ±7%	73% ±7%	74% ±7%	69% ±8%
Good	20% ±7%	25% ±7%	23% ±7%	24% ±7%
Fair	4% ±3%	1% ±1%	2% ±2%	4% ±3%
Poor	0% ±0%	0% ±0%	0% ±0%	0% ±0%

* Program columns do not add to 100%, due to respondents not knowing what rating to give, refusing to answer the question, or not installing the measure in question.

1.7.3 Motivation for Measure Purchases

Participant motivations for purchasing measures varied significantly. The most common responses were: a desire to save energy (17%); and to reduce energy costs (13%). These observations were similar to findings from the 2010 participant survey, with one appreciable difference: in the 2010 survey, replacing equipment because it did not work was the most common response (26%). In the 2011 survey, just 13% of respondents provided this response.

Figure 1-21. Weighted Average Motivation for Purchasing Measure



1.8 Residential Program Freeridership

Cadmus assessed freeridership for both the 2010 and 2011 program years. The methodologies and results of these studies are reported separately, however, this section discusses the ramifications of the findings on the residential programs. Freeridership can be indicative of the market dynamics within which programs operate, and as such, it can and should inform decision making on issues of program design and management.

1.8.1 Freeridership

Freeridership, the percentage of savings that would have occurred in the program's absence, was calculated based on surveys with program participants. Table 2-16 summarizes freeridership for the 2010 and 2011 programs, showing a notable increase in freeridership. The increase was statistically significant for two of the three program categories examined: High-Efficiency Equipment; and ENERGY STAR Appliances and Water Heaters.

Table 2-15. 2010 and 2011 Residential Program Freeridership

Program Group	2010			2011		
	n	FR	Absolute Precision	n	FR	Absolute Precision
HE Equipment	67	39%	±8%	155	60%	±4%
ES Appliances & Water Heaters	67	48%	±7%	107	63%	±5%
Weatherization	67	45%	±8%	72	48%	±6%
Residential Overall	201	44%	±4%	334	57%	±3%

The freeridership increase aligns with trends seen in other Pacific Northwest utilities in recent years. A comparable Pacific Northwest utility, for example, saw residential program freeridership increase from 29% in 2008 to 44% in 2009–2010. This trend likely indicates ENERGY STAR products' increase in market penetration (as shown in Table 2-12 and Table 2-17).

Cadmus reviewed the ENERGY STAR Unit Shipment and Market Penetration Report[4] summaries from calendar years 2009 and 2010 as well as assumptions currently used by the RTF. This review, discussed in the preceding Program Participation section, indicated notable increases in ENERGY STAR market share for a number of measures. Measures appearing to have the greatest impact on Avista's increased freeridership in 2011 were natural gas furnaces and air-source heat pumps, with market shares shown in Table 2-17.

Table 2-16. ENERGY STAR Market Share for HVAC Equipment

Measure	2009 ENERGY STAR Market Share	2010 ENERGY STAR Market Share
Residential Natural Gas Furnace	50%	61%
Air Source Heat Pump	31%	46%

[4] http://www.energystar.gov/index.cfm?c=partners.unit_shipment_data

1.9 Effectiveness of Implementers

Using third-party implementers presents advantages and disadvantages. Our research has led us to conclude Avista has thus far selected the appropriate programs for contracting to implementation firms (for appliance recycling and upstream lighting). 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, which has been tried successfully elsewhere, involve national accounts, or require certain market expertise available from a third-party firm.

As savings goals increase and “low hanging fruit” of energy-efficiency measures become exhausted, it may be advantageous for utilities to consider increasing utilization of third-party implementers for certain programs. Avista may wish to consider the following questions in planning programs in coming years:

- Does the program’s success depend heavily on the utility’s relationship with the customer or institutional knowledge?
- Do third-party implementers bring specialized knowledge or skill sets exceeding those of Avista?
- Do third-party implementers offer program implementation cost savings?
- Do third-party implementers have established relationships with upstream distribution channels, trade allies, or customers that could increase program success?
- Does the third party present greater flexibility than the utility for issues such as delivery capacity or market intervention strategies?
- Are implementers willing to take on some of the risk for not meeting goals?

As noted, Cadmus considers the current split of delivery mechanisms appropriate. We have not found strong evidence indicating the need for sweeping changes. Still, rebate processing for two programs should be considered for potential outsourcing in the coming two years: the residential ENERGY STAR Products , and components of the High Efficiency Equipment program (e.g., water heaters). We believe Avista could benefit from concentrating on direct outreach and delivery of programs involving larger customers.

The evaluation’s research into program processes included implementers’ performance, with two firms identified for the residential portfolio:

- JACO, implementer of the refrigerator recycling program; and
- FMS, implementer of the Simple Steps upstream lighting program.

For the 2011 process evaluation, Cadmus conducted an in-depth interview with the JACO implementation team as well as with the FMS program coordinator, who is responsible for Avista’s Simple Steps, Smart Savings program. Interview results informed the following sections.

1.9.1 JACO Environmental, Inc.

JACO partners with utilities in 28 states, operating turnkey appliance recycling programs. The 2011 Avista program did not meet its participation target, but participation increased over 2010. Cadmus' interviews with the JACO implementation team included:

- The program manager responsible for Avista's program;
- The Spokane facility manager;
- The call-center manager; and
- A representative of Runyon, Salzman, and Einhorn (RS&E), the marketing subcontractor.

These individuals provided information on: implementation processes, goal setting, barriers to program success, and the program's future.

Implementation Processes

The four interviewees represented four different implementation aspects:

- The program manager, in addition to being generally responsible for day-to-day program operations has responsibility for planning, goal-setting, contracting, and reporting to Avista.
- The facility manager has responsibility for the pickup staff, truck routing, and overseeing the recycling facility operations.
- The call-center manager has responsibility for managing the customer service center, which handles customer sign-up, eligibility verification (e.g., verifying customers are Avista electric customers), pickup scheduling, and subsequent customer service calls.
- RS&E has responsibility for all program marketing for Avista as well as for all of JACO's appliance recycling programs, nationwide.

JACO implements the program following its standard processes. 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). Next, the customer schedules a pickup appointment.

During pickups, a JACO team arrives at a customer's home to collect the refrigerator or freezer, again verifying eligibility and recording data on the unit, including its estimated size, age, and configuration. These data, which JACO tracks through its program database, are essential to maintaining the program's evaluability. Units are delivered to the Spokane facility, where they are processed and recycled. Using a combination of proprietary and non-proprietary techniques, JACO ensures at least 95% of materials in each unit are recycled or disposed of in an environmentally sound manner. Following pickup, JACO has responsibility for processing and mailing rebates to participating customers.

The JACO team reported implementation ran smoothly for the Avista program, and staffing levels were adequate. They also reported a strong relationship with Avista, on both the program management and marketing sides.

Goal Setting

JACO reported appliance recycling programs' goals nationwide typically are set with a 1% annual harvest rate from a customer base.[5] This participation level is considered achievable using a robust marketing campaign; however, beginning in 2008, when the economic downturn began, programs began to experience drops in participation. Since then, participation in Avista's program has been less than the 1% target harvest rate, but has remained steady and sustainable, in JACO's estimation.

Barriers to Program Success

JACO interviewees identified a few barriers to increased program participation.

First, geography plays a role: Avista has a somewhat rural service territory, which tends to have lower harvest rates. This can be attributed to factors such as greater prevalence of hunting and higher food storage needs, which can lead households to retain multiple refrigerators or freezers.

Second, the economic downturn reportedly had a strong impact on the Spokane area; consequently, customers became more likely to retain their existing appliances for longer periods before replacing them. Interviewees noted incentive levels can push against this tendency, but $30 may not be sufficiently high to counter the other issues. JACO noted the incentive level was likely appropriate for cost-effectiveness, and was in accord with similar programs in Washington and Idaho.

Finally, program awareness serves as an important participation driver, and JACO reported a need for increased marketing to improve awareness levels. Recognizing limited marketing resources, JACO has attempted to use marketing funding strategically, focusing on bill inserts, which tend to produce the strongest customer response.

Program's Future

The JACO team noted a possible future direction for the program would be to build retailer partnerships. A strategy applied in other JACO programs elsewhere in the country, these partnerships entail promoting the program through appliance retailers, where customers can sign up for the JACO program to collect their old units when they purchase a new unit. Avista reported they considered this option, but noted freeridership concerns; currently, the only interactions with appliance retailers involves distribution of program materials. JACO reported a more formalized partnership program would almost certainly increase participation by a few percentage points, and noted other utilities have not encountered freeridership issues.

1.9.2 Fluid Market Strategies

As the 2010 process evaluation contained a detailed profile of FMS, this evaluation focuses on program changes. Overall implementation process has remained the same: FMS works with

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5 The harvest rate is defined as the percentage of total residential customer households recycling an appliance through the program in a given year.

lighting and showerhead manufacturers to allow their energy-efficient products to be offered at reduced prices at area retail stores. FMS signs a three-way Memorandum of Understanding with each retailer and supplier, specifying products, incentive amounts, and retail price ranges for each product. FMS field representatives visit stores monthly, verifying retail prices fall within the specified range for each product. FMS consolidates monthly reports from all program retailers, dividing product sales between participating utilities, based on retailer locations. This process results in a monthly report to Avista, allowing program unit sales and savings to be tracked.

During 2011, planning for program changes occurred:

- Showerheads were added to Avista's Simple Steps, Smart Savings measure offerings (beginning in 2012); and
- The Bonneville Power Administration (BPA) began a planning process to determine the program's future, in light of changing Federal regulations addressing residential lighting products.

In the 2010 evaluation, Cadmus recommended adding showerheads to the program, and Avista and FMS collaborated to make this change during 2011.

With The Energy Independence and Security Act of 2007's (EISA's) limitations on high-wattage light bulbs to go take effect in October 2012, FMS reported BPA is working on a new or modified program design in the next few years. FMS was not familiar with process details or proposed modifications. The program coordinator thought the current incarnation of Simple Steps would likely continue for at least two years.

FMS noted 2011 was a fairly standard year for the Simple Steps program, with no major changes or barriers. Additionally, FMS reported the relationship with Avista continued to be positive, with the Avista program manager continuing to provide excellent program support, including making regular visits to participating retailers.

1.10 Trade Ally Participation and Satisfaction

The evaluation's research into program processes included trade allies'[6] roles, specifically two ally groups: weatherization contractors, and lighting retailers. This built on 2010 evaluation work, focusing on Home Audit field auditors and HVAC contractors.

To identify appropriate weatherization contractors to include in our interview efforts, we relied on contact information Avista provided. Avista maintains mailing lists of contractors and vendors involved with its programs. Over two weeks in March 2012, Cadmus completed interviews with representative from 10 weatherization contractor organizations. The interviews sought to achieve the following goals:

[6] For this report, Cadmus defines trade allies as organizations playing key roles in program operations, but not directly paid by the program's sponsoring utility.

- Collect information about test-in and test-out procedures for installing insulation during home weatherization retrofits;
- Gauge contractors' opinions regarding the inclusion of a preapproval step when applying for rebates;
- Assess customer demand for (and awareness of) of home insulation benefits;
- Gather contractor feedback on critical program elements, such as rebate levels and eligibility requirements; and
- Assess the effectiveness of outreach and marketing activities.

Lighting retailers selling incented bulbs through Avista's Simple Steps program proved difficult to reach. FMS provided retailer's names and addresses through lighting invoice materials. Cadmus used an Internet search to match phone numbers to stores. FMS also provided contact information for a limited number of stores likely to complete interviews. Over approximately three weeks, Cadmus completed interviews with representatives at 10 participating locations, assessing satisfaction, stocking practices, marketing efforts, and areas for program improvements.

1.10.1 Weatherization Contractor Profile

The majority of respondents reported residential insulation retrofits as a significant aspect of their work for several years. When marketing their services and performing retrofit work, most respondents promoted their experience and used professional relationships.

Weatherization retrofit survey respondents were distributed evenly across Avista's service territory. Table 2-18 shows numbers of completed surveys, by state.

Table 2-17. Geographical Distribution of Respondents

State	Numbers of Contractors Surveyed
WA	6
ID	4

Test-In and Test-Out Procedures

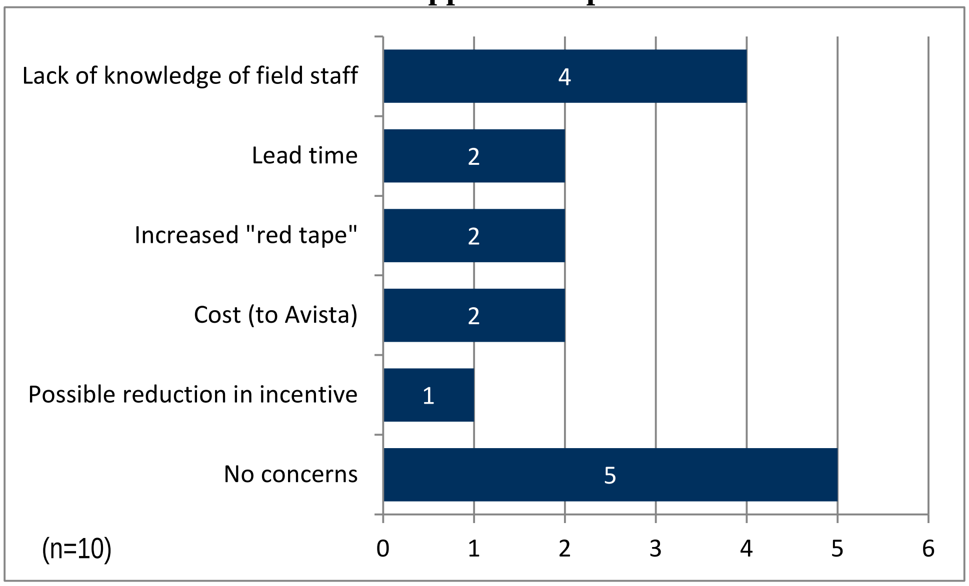
The test-in method most commonly used (seven respondents) was to measure the depth of insulation in attics. The remaining three respondents performed visual inspections before installation. Only one contractor reported using infrared thermal imaging to assess existing insulation in exterior walls.

In most cases, the same methods (measuring the depth and visual inspection) were reported as test-out procedures. Two contractors reported not performing any tests post-installation. One of these two reported his workers asked homeowner if they wanted to inspect attics for their work. However, homeowners reportedly often could not determine how a proper amount of insulation should look, or whether proper ventilation and other concerns had been addressed.

Attitudes Toward Preapproval

Contractors were asked their opinions regarding possible preapproval requirements before performing work. Contractors generally were receptive to the idea, but had concerns. Figure 1-22 shows common concerns voiced regarding preapproval (multiple responses allowed).

Figure 1-22. Contractor Concerns Regarding an Application Preapproval Step



All contractors operating in Washington said customers referred to audits as the reason for pursuing weatherization. No Idaho contractors reported customers receiving audits prior to weatherization work. Two contractors in Idaho said they were not aware of anyone performing residential audits in rural Idaho.

Common concerns among contractors in both states were knowledge levels among audit staff. An Idaho contractor cited quality as his selling point, and that you *"can't just run any minimum wage kid out there."*

Another contractor operating in Idaho volunteered to be the field auditor if Avista needed an experienced contractor to operate in rural Idaho. He also proposed that Avista compile a list of authorized contractors as an alternative to hiring a full-time individual to complete audits. He felt, with a simple form, contractors could do the audits themselves, and submit the form for Avista's approval.

One Idaho contractor stated he would like to have specific knowledge regarding which customers qualified for program incentives, noting a contact at another utility (Clearwater) helped him identify possible work in the Lewiston area, and he would find a similar relationship with Avista useful. Though it may not be appropriate for Avista to provide detailed information about its customers to contractors, an increase in communication and support for contractors interested in marketing the program might prove beneficial.

Program Elements

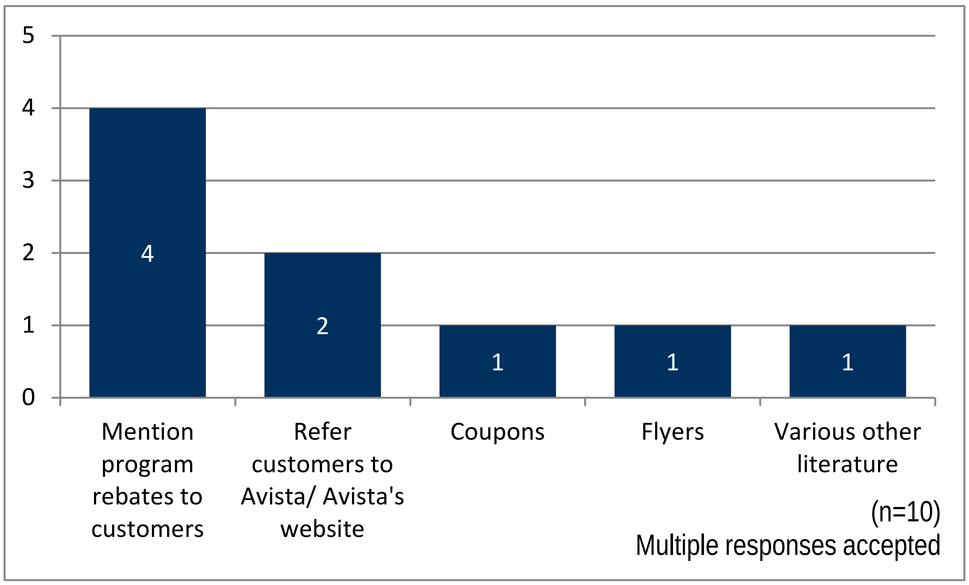
Cadmus asked contractors about the appropriateness of program rebate levels and requirements. Eight contractors surveyed reported rebate amounts were set at appropriate levels. The other two reported they preferred increased rebate amounts. One of these contractors said rebates for attic insulation should be increased as such work typically paired with remodels or other costly structural changes.

Only two contractors reported wanting changes in program requirements. Both contractors reported Avista should loosen the requirement that existing insulation be R-19 or less to qualify. They stated many customers had levels just above R-19, but should really be at R-49 to achieve comfort and affordable energy prices. One of these contractors suggested a prorated rebate as a solution to this perceived shortcoming.

Marketing and Outreach

Three contractors would like to see an increase in Avista's marketing efforts, saying customers simply did not know the program was available. Figure 1-23 shows outreach contractors reportedly engaged in.

Figure 1-23. Outreach Activities that Emphasize Rebates



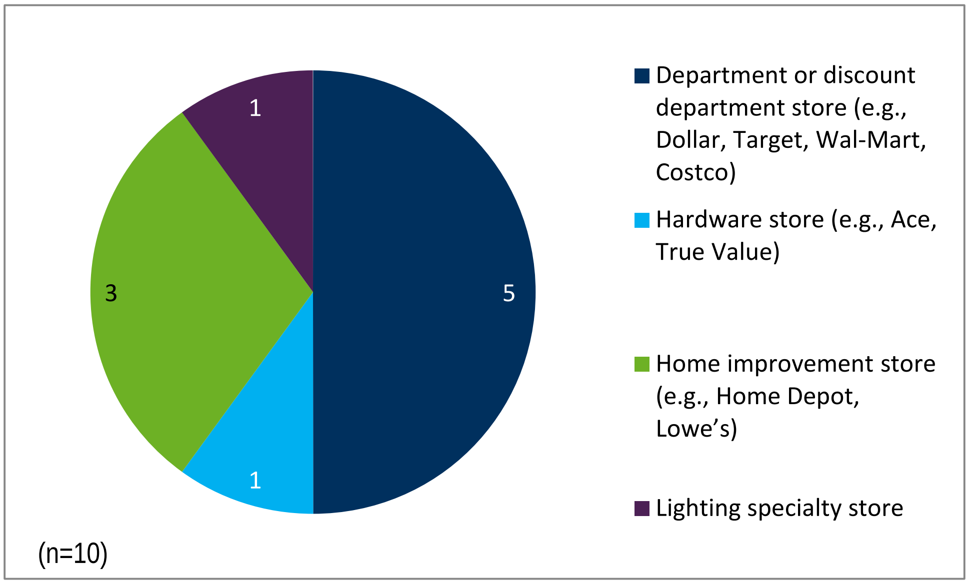
Although some contractors engaged in promotional activities, the majority indicated they mentioned the rebate to customers *only after* customers made initial calls for consultations. All promotional outreach activities (coupons, flyers, and multiple literature sources) occurred in Washington. Contractors in Idaho did not discount the value of outreach and advertising. One respondent stated his company did not conduct outreach specifically around Avista rebates, but felt they should do so.

Responses indicate that when contractors mention the rebate program to customers, they then refrain from providing guidance through the qualification steps. Once respondent mentioned he did not have any handouts or program specific literature that could help him assist customers in this way, another directed customers to Avista's website for guidance. Only one out of four respondents saying they "mention it to customers" included it in sales pitches and let customers know he could help them through the rebate process.

1.10.2 Simple Steps Lighting Retailer Profile

Simple Steps lighting retailer survey respondents represented several different market segments. As outlined in Figure 1-24, most respondents were employees of department or discount stores.

Figure 1-24. Lighting Retailer Market Segment



Interaction with Program Staff

Survey respondents were asked how they first heard about the program. For most respondents (four), this information came from their own company management or a corporate office. This is not surprising, as the retailer survey targeted store managers, and most retailers completing the survey had some regional affiliation. Other methods cited included: personal experience or past participation (two respondents); a lighting vendor or manufacturer (two respondents); and various other methods (two respondents).

Most respondents (six) never had direct interaction with Simple Steps field staff. However, the four respondents having contact with program staff indicated they were somewhat helpful (two respondents) or very helpful (two respondents). Only one indicated improvement may be possible, citing a better explanation of how the program works as helpful.

Interviewees generally found program participation very easy (five respondents) or somewhat easy (one respondent). Two felt it was not very easy, and two did not feel qualified to provide responses. Respondents indicating participation was not easy did not elaborate or provide context for their responses.

Regarding overall satisfaction with the program, responses followed a similar trend: six respondents were very satisfied with program participation; one was somewhat satisfied; and three did not feel qualified to provide responses. When asked for program recommendations, respondents offered the following:

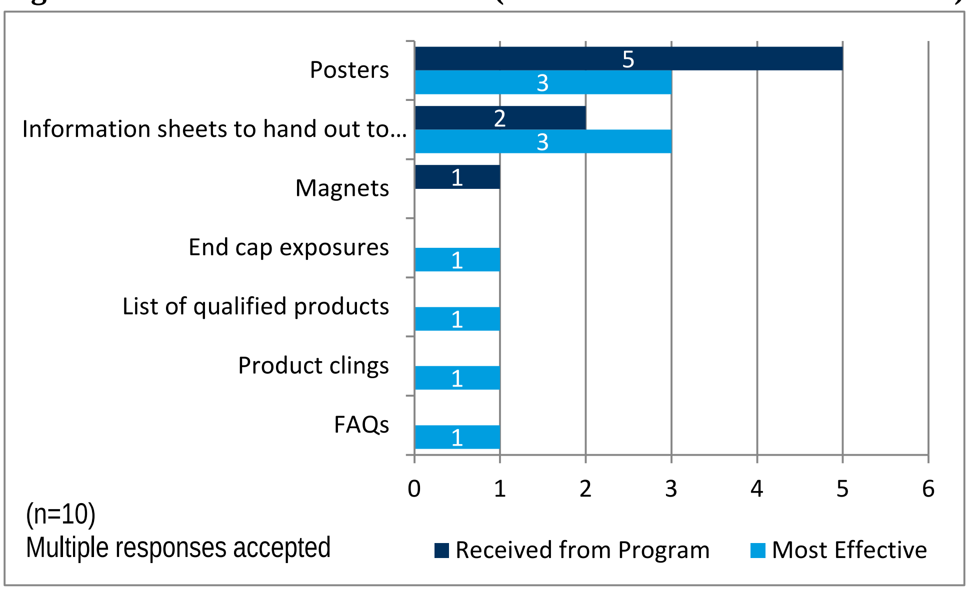
- Increase program attentiveness to changes in bulb type and technologies (and updating incentive offerings as appropriate); and
- Take steps to ensure retailers do not sell out of incented bulbs.

Program and product promotion

Respondents indicated effective marketing materials were available to program participants. The majority of respondents (six) received marketing or display material from Avista, BPA, or FMS. Five indicated satisfactory levels of information and material were provided. One respondent reported information and materials were provided, but were not enough. No respondents could point to specific areas where information was lacking.

Interviewees were asked what marketing materials they received from Avista, BPA, or FMS, and which materials they believed were generally most useful for product promotion. Figure 1-25 provides distributions of responses. While limited, responses suggest materials provided generally were also most commonly identified as the most effective.

Figure 1-25. Promotional Materials (Provided and Found to be Useful)



As shown in Figure 1-26, lighting retailers interviewed use a variety of different methods for informing customers of general product discounts, the most common of which were posters on retail floors; this was also identified as the most effective method for general product discount promotion, as shown in Figure 1-27, and was cited as the most useful and common marketing material provided for the Simple Steps program.

Figure 1-26. Advertising Methods (General Product Discounts)

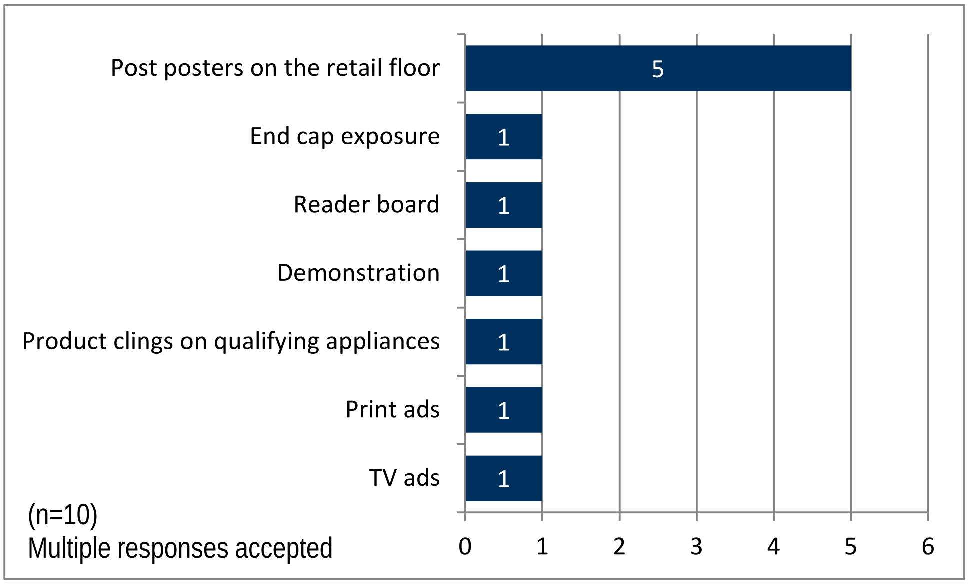
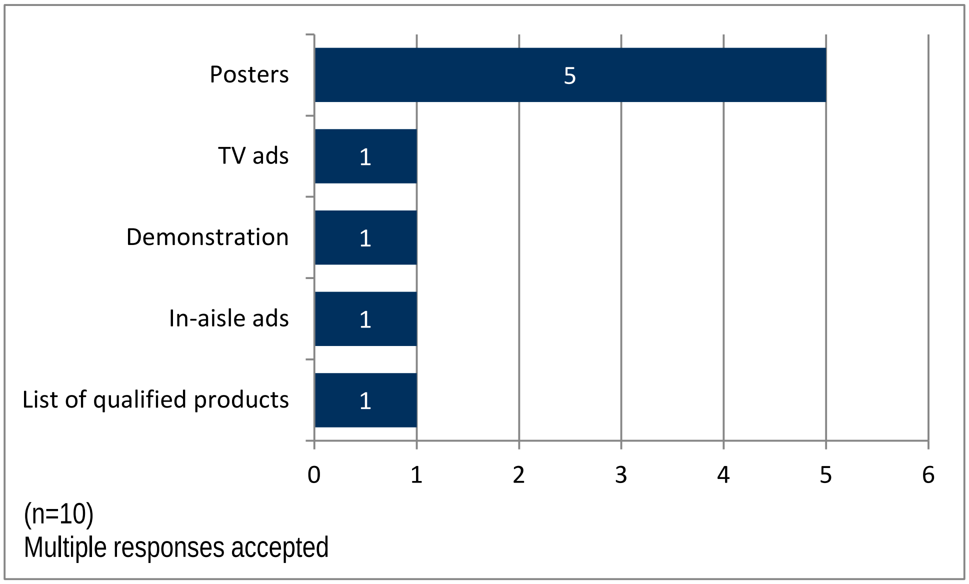


Figure 1-27. Most Effective Advertising Methods (General Product Discounts)

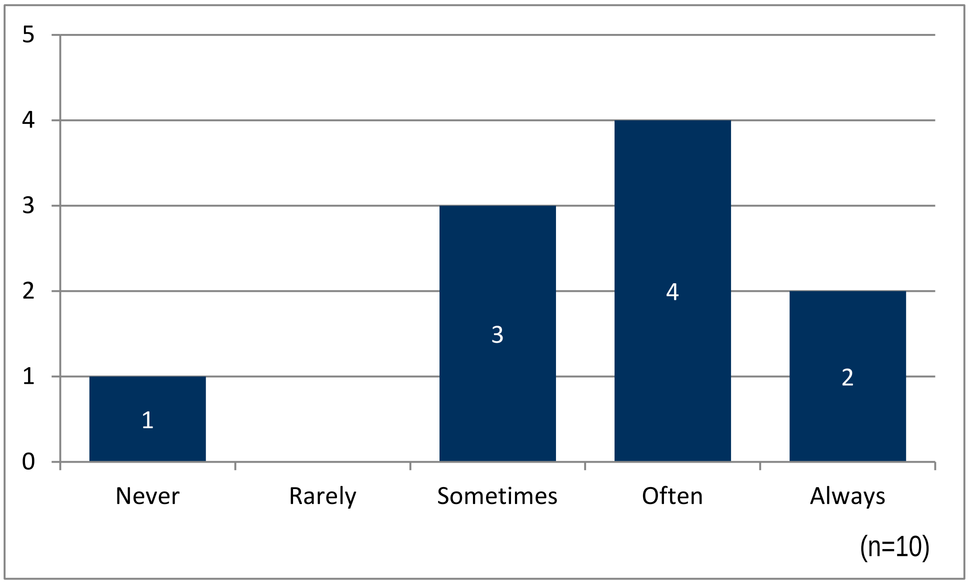


Customer Motivation

The availability of high-efficiency products proved an important motivator for CFL customers. Six out of 10 lighting retailer respondents indicated they used availability of high-efficiency products to attract customers to their business, three respondents were not sure, and only one respondent indicated they did not.

As shown in Figure 1-28, retailers also generally recommended offering more energy-efficiency equipment options to their customers. While these findings cannot be extrapolated to the population of retailers (as they are not statistically significant), they indicate the importance these retailers placed on promoting energy efficiency and Avista's energy-efficiency programs.

Figure 1-28. Suggesting High-Efficiency Equipment to Customers



1.11 Conclusions, Recommendations, and Future Research

1.11.1 Program Participation

Conclusions

- Overall participation declined from 2010 to 2011. Decreased participation appeared most prominent in programs affected by American Recovery and Reinvestment Act (ARRA) tax credits.
- Program awareness among nonparticipants has declined from 2010 to 2011.
- Home Energy Audit Pilot Program participation exceeded expectations in 2011 and showed good levels of follow-through among participants.

Recommendations

- Renew emphasis on customer outreach and mass marketing, including refreshing campaign messaging and using trade allies.
- 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.

1.11.2 Program Design

Conclusions

- Lower-than-expected evaluated per-unit savings indicate a need to review program eligibility criteria and measure offerings. Measure savings can be negatively affected when multiple HVAC measures are incented and installed together.
- Program managers' limited availability to focus on long-term program considerations may hinder program performance.

Recommendations

- Consider additional program requirements to ensure measure savings remain in line with expectations. 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.

1.11.3 Market Characteristics

Conclusions

- Avista's recent program changes have reflected documented nationwide market transformation.

Recommendations

- Ensure future program effectiveness by continuing to update program offerings and design to reflect changes in market conditions.

1.11.4 Data Tracking

Conclusions

- Program tracking has proved effective, but evaluability could be improved. Consistency across programs and tracking of follow-through for audit participants could be enhanced.

Recommendations

- Ensure consistency in data tracked across multiple databases including: the multiprogram database; the JACO database; the Home Energy Audit database; and Avista's central customer information database.
- 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.

1.11.5 Marketing and Outreach

Conclusions

- Avista adheres to best practices for energy-efficiency marketing and outreach. However, Cadmus identified opportunities for enhancing Avista Websites.

Recommendations

- 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:
  - 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.

1.11.6 Participant Experience and Satisfaction

Conclusions

- Participant satisfaction remains high across all programs and program elements.
- The Home Energy Audit Pilot Program experienced a significant increase in participant satisfaction, compared to the 2010 program.

Recommendations

- Continue to prioritize customer satisfaction, and take advantage of high satisfaction by targeting past participants for future participation.

1.11.7 Residential Program Freeridership

Conclusions

- Avista's increasing residential freeridership indicates market transformation is occurring.

Recommendations

- Continue conducting research to inform decision making about future program improvements/continuation.

1.11.8 Effectiveness of Implementers

Conclusions

- Avista's use of third-party program implementers has been appropriate and effective.
- Avista's has strong, positive relationships with its implementation contractors in both programs.

Recommendations

- Explore possible benefits of third-party program implementation. 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.

1.11.9 Trade Ally Participation and Satisfaction

Conclusions

- Trade allies remained key program messengers, and opportunities exist for increased involvement from them. Trade allies are looking for more support from Avista to provide them with program literature for their customers.

Recommendations

- Avista should investigate the possibility of a more formal relationship with trade allies. 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.

1.11.10 Future Research

Increasing freeridership, likely attributable to increasing market saturation of energy-efficient technologies, may threaten cost-effectiveness of many current measure offerings (a trend not unique to Avista's programs or service territory). Cadmus recommends a few areas of research that may inform future program direction:

- **Explore possibilities for new cost-effective measure offerings**. Emerging technologies may create new opportunities for cost-effective programs, and Avista should conduct research to identify potential for adding such measures to their existing offerings.
- **Review methods other utilities have used to address this issue.** Specifically, Avista should examine the activities of utilities serving mature energy-efficiency markets, such as California, Oregon, and Massachusetts.
- **Explore new program design possibilities, including deep home retrofitting**. This approach allows utilities to address all energy-saving opportunities within a home in single, cost-effective package. It can lower delivery costs, and improve tracking of measure interactive effects. Deep retrofit programs also can address unique customer needs, while supporting emerging technologies by pairing them with low-cost measures to maintain whole-home cost-effectiveness.
- **Conduct cost-benefit analysis on program design and implementation changes.** Through evaluation research, Cadmus identified two possible program changes that could benefit future program activities:

- Outsourcing some functions of program implementation currently conducted by Avista, such as simple rebate processing.
- Establishing a retail partnership component of the Second Refrigerator and Freezer Recycling Program.

Benefits and costs of these changes need additional examination prior to further consideration.

2 2011 NONRESIDENTIAL PROCESS REPORT

2.1 Introduction

2.1.2 Program Overview

This report provides findings and recommendations, drawn from a process evaluation of Avista's nonresidential energy-efficiency programs. These programs encourage commercial and industrial (C&I) customers to install more energy-efficient equipment in their facilities. To accomplish this, Avista offers cash incentives for installation of qualifying energy-efficient equipment. Incentives are organized by energy-efficiency measures, grouped into programs. Prescriptive programs include electric and gas measures, and may offer a single measure type or a group of measures. Eligibility of Prescriptive programs is based on installation of qualifying equipment.

The following section provides detailed descriptions of Avista's Prescriptive, Site-Specific, and EnergySmart Grocer programs. Excepting the EnergySmart Grocer program, Avista implements its nonresidential energy-efficiency programs.

Prescriptive Programs

Several of Avista's nonresidential programs were discontinued partway through the year, while a few new programs launched in 2012. Table 2-1 distinguishes existing programs from those discontinued in 2011. This section describes programs operating during the full year (and thus served as the focus of the 2011 process evaluation).

Table 2-1. Prescriptive Programs

Operated Throughout 2011	Discontinued in 2011	New Programs in 2012
Commercial Clothes Washer	Demand-Controlled Ventilation	Natural Gas HVAC
Food Service Equipment	LED Traffic Signal Program	Standby Generator Block Heater
Green Motors Rewind	Side-Stream Filtration	Variable Frequency Drives
HVAC Rooftop Maintenance	Steam Trap Replacement	Windows and Insulation Program
Lighting Incentives	Vending Machine Controls	
Power Management for PC Networks		
Premium Efficiency Motors		

Commercial Clothes Washer

To encourage customers to select high-efficiency clothes washers, this program targets nonresidential electric and natural gas customers in multifamily or commercial Laundromat facilities. The program's streamlined Prescriptive approach has been designed to reach customers quickly and effectively in promoting ENERGY STAR or Consortium for Energy Efficiency (CEE)-listed units.[7]

Food Service Equipment

Applicable to nonresidential electric and gas customers with commercial kitchens, this program provides direct incentives to customers choosing high-efficiency kitchen equipment. Equipment must meet ENERGY STAR or CEE Tier levels to qualify for incentives. Measures eligible for rebates include: ovens, fryers, griddles, heat vent hoods, hot water heaters, refrigerators, freezers, dishwashers, and ice machines.

Green Motors Rewind

Operated in partnership with the Green Motors Practices group, this program provides education to foster organization and promotion of member motor service centers' commitment to energy-saving shop rewind practices for motors ranging from 15 to 500 HP.

HVAC Rooftop Maintenance Pilot

This pilot program encourages nonresidential electric customers to perform maintenance regularly on their rooftop HVAC units. To accurately determine energy savings of regularly maintained HVAC units, the program compares energy use of like rooftop units (one maintained and one not) on one rooftop. The decision whether to implement this program will be made after data have been analyzed; so the program has no associated savings goals at this time.

Lighting Incentives

As significant opportunities exist for lighting improvements in commercial facilities, this program offers direct financial incentives to customers increasing the efficiency of their lighting equipment. The program offers rebates to existing commercial or industrial facilities. Predetermined incentive amounts can be paid for a total of 38 individual measures, including T8, T5, induction lighting, compact fluorescents, and LEDs.

Power Management for PC Networks

This program provides incentives to install a network-based power management software solution for simplifying the process of implementing power management in large numbers of networked PCs. In addition to making a commitment that the software will remain in operation for a minimum of three years, the program offers a $10 incentive per controlled PC, meeting specific criteria.

Premium Efficiency Motors

This program provides an incentive for nonresidential electric customers purchasing premium-efficiency over standard motors. The incentive pays approximately 50% of incremental costs of buying premium-efficiency motors. To qualify for incentives, motors must meet listed, premium-efficiency National Electrical Manufacturers Association (NEMA) standards.

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[7] Manufacturers submit energy and water use data for each model, as determined by test procedures set by the U.S. Department of Energy. Models are placed in a tier, based on their energy and water use. A list of qualifying commercial clothes washers and specification can be found at the CEE Website: http://www.cee1.org/com/cwsh/cwshspec.pdf, and ENERGY STAR Website: http://downloads.energystar.gov/bi/qplist/comm_clothes_washers.pdf?b17e-48a0.

Site-Specific Program

The Site-Specific program addresses energy-efficiency measures falling outside of Prescriptive applications, based on their project-specific information. The Site-Specific program is offered to all commercial, industrial, or pumping customers receiving electric or natural gas service from Avista, and choosing to undertake cost-effective, energy-efficiency improvements to their businesses. Based on their project-specific information, Site-Specific measures generally do not lend themselves to Prescriptive applications. Site-Specific measures consist of electric and gas-saving measure technologies, such as appliances, compressed air, heating and cooling equipment (HVAC), industrial processes, custom lighting, motors, shell, multifamily, and LEED. For a measure to be considered for the Site-Specific program, it must have demonstrable kWh or therm savings.

EnergySmart Grocer Program

The EnergySmart Grocer program, operated by Portland Energy Conservation Inc. (PECI) is Avista's only C&I program delivered by a third party implementer. The program offers a variety of energy-savings grocery and refrigeration equipment for nonresidential electric and gas customers, particularly grocery stores. Eligible equipment incentives include but are not limited to: compressors; controls; motors; night covers; case lighting; strip curtains; insulation for suction lines; and hot water tanks. The program assists customers with their refrigeration systems' technical aspects, while providing a clear view of achievable savings. A PECI field energy analyst provides customers with technical assistance, produces a detailed energy savings report regarding potential savings for their facility, and guides customers from enrollment to incentive payments.

2.1.3 Process Evaluation Objectives

This process evaluation primarily seeks to document and analyze how the program works in practice, and ascertain important influences on its operation and achievements.

Evaluation objectives include:

- Documenting and assessing program components and processes;
- Gathering opinions and program experience responses from customers and program partners;
- Reviewing primary data, reviewing secondary program information, and reporting on findings;
- Comparing program information to best practices; and
- Providing conclusions and actionable recommendations to improve program efficiency and effectiveness.

2.1.4 Evaluation Methodology and Information Sources

This process evaluation analyzes primary and secondary program data. Primary data have been gathered through interviews with: program staff involved in daily operations; program participants and nonparticipants; and market actors involved in promoting and implementing the programs.

Secondary data have included: program materials used to enroll participants and guide operations, marketing materials, reports for external stakeholders, and information about best practices.

2.1.5 Report Organization

This report contains the following sections:

- Introduction
- Key Findings
  - Program Management and Implementation
  - Customer Feedback
  - Trade Ally Feedback
  - Special Report: Lighting Market Changes
  - Marketing and Outreach
  - Application Processing and Data Tracking
  - Program QA/QC and Verification
- Conclusions and Recommendations

2.2 Program Management and Implementation

Avista's nonresidential energy-efficiency programs can be grouped into several program clusters, based on their delivery approach, eligibility, and evaluation, measurement, and verification (EM&V) requirements. To facilitate the 2011 evaluation, the programs were examined in three clusters: Prescriptive, Site-Specific, and EnergySmart Grocer.

Excepting the EnergySmart Grocer program, Avista implements all of its nonresidential rebate programs. Program staff plan, implement, and operate the Prescriptive and Site-Specific programs. Trade allies submit the majority of Prescriptive project rebate applications on behalf of customers. Account managers assist customers, and determine project eligibility for the Site-Specific programs, while engineers are responsible for evaluating, measuring, and verifying project savings and costs. PECI implements the EnergySmart Grocer program, a regional turnkey program.

This section examines the management and implementation of the nonresidential programs, and the planning, documentation, and processes involved in the program operations.

2.2.1 Research Objectives

Research objectives for the review of the nonresidential energy-efficiency programs' implementation sought to determine changes over the course of the year, along with goals and visions for the program's future. Review of program documentation helped evaluators understand management oversight, and the presence of operational procedures used to guide staff in implementation of nonresidential programs. The Cadmus evaluation team interviewed Avista program staff to attain a complete picture of program changes and feedback regarding program successes and challenges. Interviews also helped to refine the content of the program logic models and process flows, and to solidify key researchable issues to be examined during the 2011 evaluation.

2.2.2 Methods

During the 2010 evaluation, Cadmus looked at a number of documents to understand the delivery approach, and to assess how the programs work in practice. These documents were drawn from a number of corporate reports, such as the DSM Business Plan, and other high-level documents. For the 2011 evaluation, Cadmus requested any new program manuals developed in the past year. Although some manuals were in the planning stages, none had been finalized during the course of the 2011 evaluation; therefore, Cadmus revisited reports and documents as needed to facilitate the evaluation. These included:

- 2011 DSM Business Plan
- EM&V Framework and EM&V Plan[8]
- Program data collection procedures for Prescriptive lighting and Site-Specific programs.

In addition to the materials review, Cadmus interviewed Avista staff by phone, in conversations lasting about 60 to 90 minutes, and speaking with program and policy staff, engineers, account managers, and the marketing team.

2.2.3 Research Results

Program Logic Models

During the 2010 evaluation planning, Cadmus developed logic models by program cluster, helping to guide evaluation research and discussions with program staff and implementers. Many utilities use logic models in program planning stages to identify program theory and assumptions leading to anticipated short- and long-term outcomes.

During the 2011 process interviews, Avista program managers noted the logic models, presented for the 2010 process evaluation, appeared somewhat generic across programs. Therefore, the logic models were perceived as tools to guide external evaluations, rather than for use in planning. Program managers felt more detailed flow diagrams could provide more useful tools for planning. Based on these responses, Cadmus developed process flow diagrams for each program cluster (Prescriptive, Site-Specific, and EnergySmart Grocer program), as presented in following sections. For future reference, the logic models were simplified and combined into a single format, shown in Figure 1-1.

The combined logic model has been organized to highlight similarities and differences between program activities, indicators, and anticipated outcomes. The logic flows for marketing and outreach, program incentives enrollment, and EM&V, were similar for all programs. Due to the

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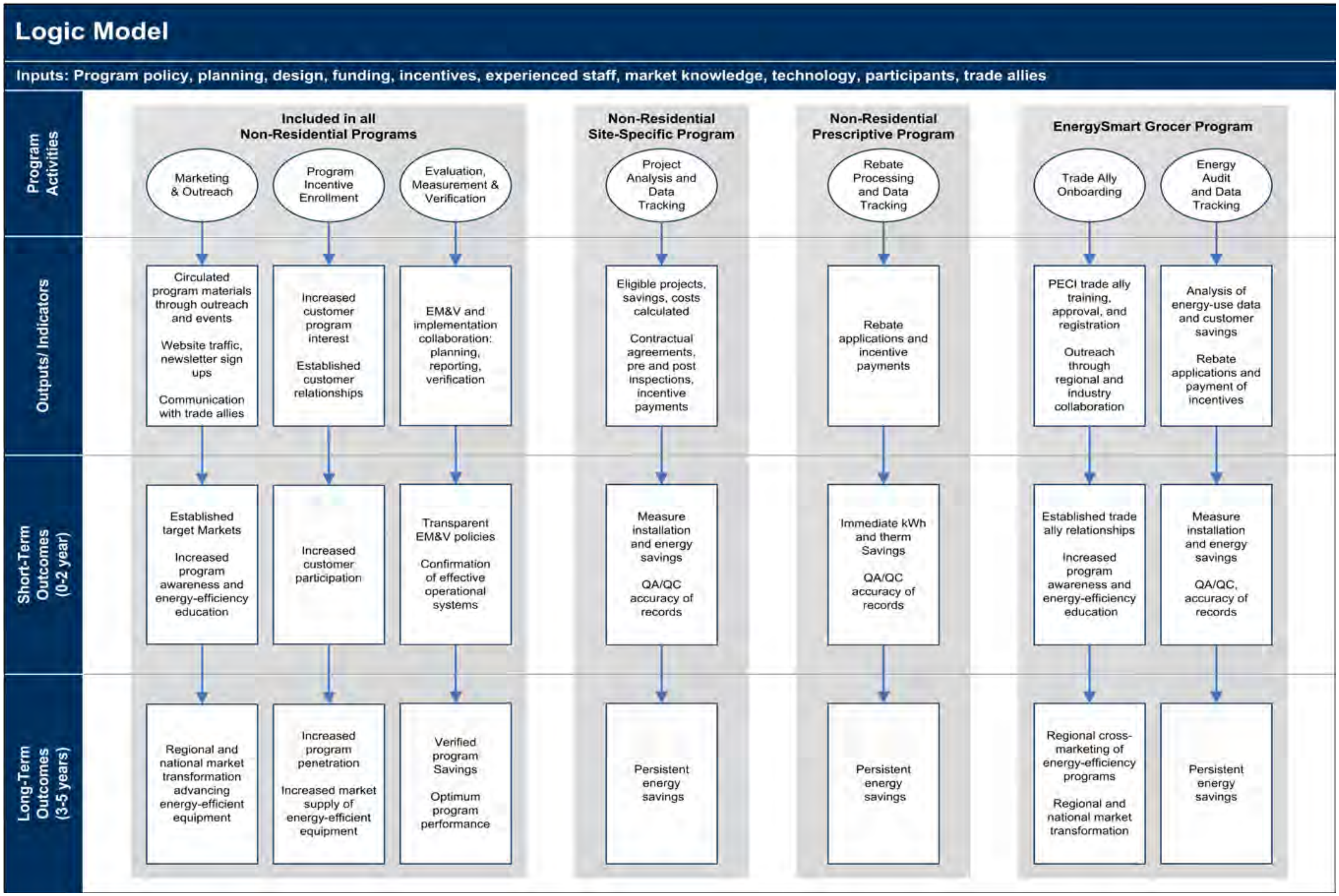
[8] Avista Utilities. Evaluation, Measurement and Verification (EM&V) Framework. In response to the Washington Utilities and Transportation Commission's Order from Docket Nos. UE-090134/UG-090135; and UG-060518, Consolidated. September 1, 2010. Avista Utilities' 2011 Evaluation, Measurement & Verification Annual Plan. November 1, 2010.

customized nature of Site-Specific programs, extensive project analysis and data collection were required to determine project eligibility, and to ensure persistent energy savings. Prescriptive program activities primarily focused on rebate processing activities, without lengthy project analysis and contractual arrangements, providing immediate energy savings for Avista customers. The EnergySmart Grocer program design has been based on the theory that these activities will enable industry-wide goals of regional market transformation. Therefore, activities have focused on collaborative outreach, trade ally training, and customer education through energy auditing.

Figure 2-1. Avista Nonresidential Program Logic Model



Program Planning and Documentation

Avista's program managers reported that time constraints of daily operations sometimes prevented a more active role in planning and documentation of program procedures. In addition, the implementation team expressed the need for more internal communications, and real-time feedback regarding the evaluation process.

During the 2010 process evaluation, the programs' complexity and lack of documented procedures made it difficult to understand the nonresidential program's delivery and operations. Consequently, Cadmus recommended Avista's implementation team compile operational procedures and verification guidelines into a program handbook. Best practice documentation for C&I programs typically provides an implementation manual, with a program overview, goals and theories, trade ally outreach strategies, and detailed operational procedures, with verification guidelines.

During 2011 evaluation interviews, program staff reported a great deal of written and unwritten procedures. Although keeping up with program delivery and operations over the past year has left little time to develop program handbooks, the implementation team noted a program manual is currently in development. Cadmus reviewed a first draft of Avista's DSM program manual, and found it provided a comprehensive portfolio overview. Operational details at the program level have yet to be completed.

To provide Avista with detailed examples of implementation guidebooks at the program level, Cadmus reviewed operational handbooks from other utility evaluations, conducted best practice research, and reviewed Websites of C&I energy-efficiency utility programs. We found a number of options available for comprehensive program manuals, depending on whether a utility wishes to present these as customer-facing handbooks, or use them as internal guidelines. Table 2-2 lists elements found in a comprehensive program handbook.

Table 2-2. Program Handbook Features

Handbook Topic Areas
Program staff and implementer roles clearly defined.
Other stakeholder's roles clearly defined (trade allies, etc.*).
Program overview and goals defined.
Presence of eligibility requirements.
Eligible program measures clearly defined.
Incentive structure clearly defined.
Presence of program processes' step-by-step instructions.
Customer touch points defined (including procedures for customer complaint resolution).
Trade ally requirements and guidelines defined.
All program systems clearly defined (for example any database software is mentioned by name, who will use it and when in the process).
Inspection and verification protocols included or referenced.
If applicable, reference to partnership with other utilities' programs.
Reference to program Website.
Presence of program staff contact information.
All acronyms clearly defined.
QA/QC & verification protocols included or referenced.

Handbook Topic Areas
Data collection protocols included or referenced.
Marketing materials included or referenced.

* This category refers to trade allies and other contractors participating in program delivery, but not part of a formal utility and implementation contractor program team.

Prescriptive Program Delivery

In 2011, the Prescriptive lighting program did not achieve forecasted program goals of 14 million kWh goals (as stated in the 2011 Business Plan). Lighting program changes in 2012 have been designed to enable meeting savings targets through increased incentives for T-12s, and investigations of additional lighting technologies. The lighting report section provides further details, following discussions of implementation.

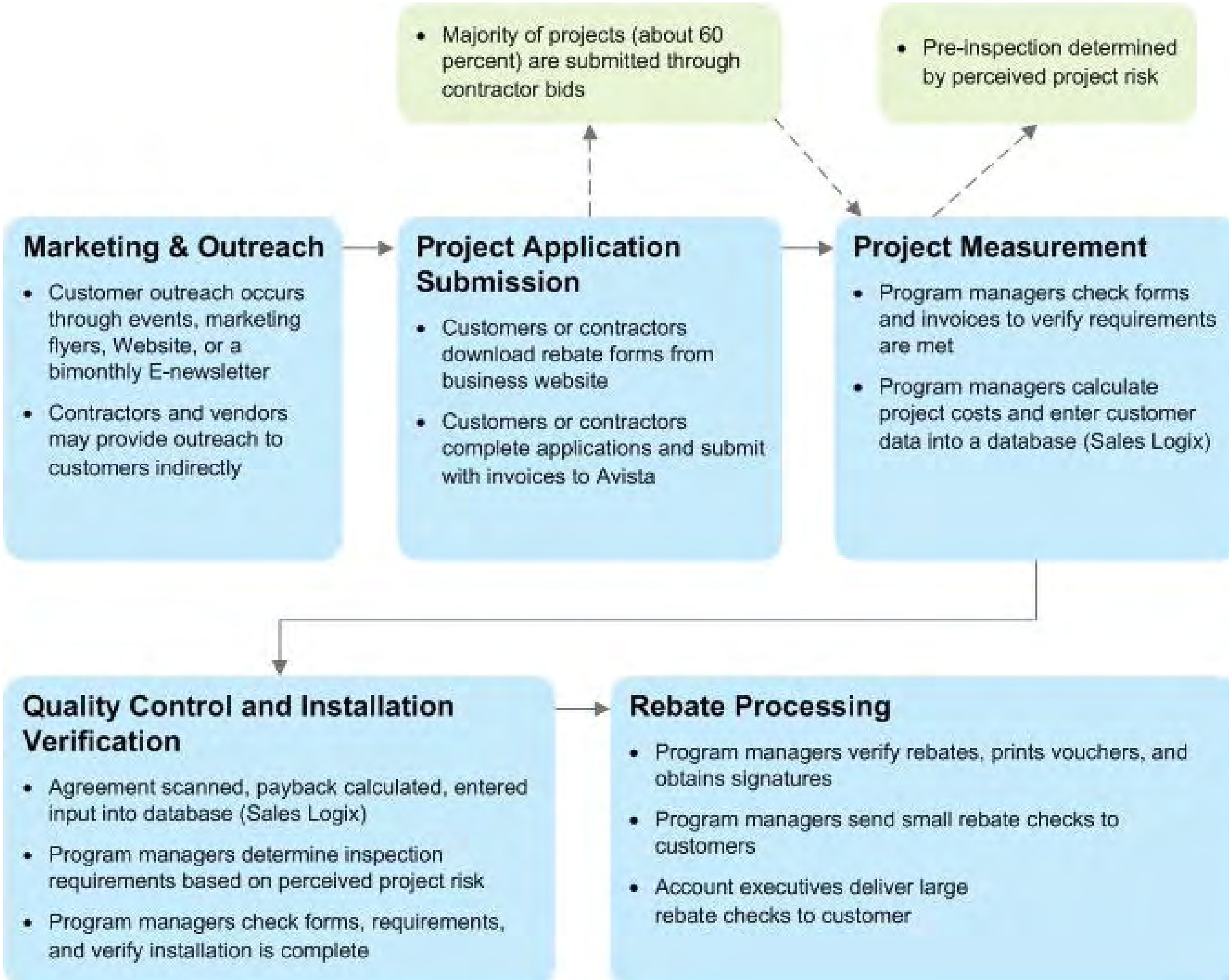
Program staff reported that some Prescriptive programs were discontinued about halfway through the year. These Prescriptive programs experience a large range of project savings, determined by the context of the site, and would be more appropriate for custom applications. Although discontinued under the Prescriptive programs, these measures may be installed by Site-Specific customers. Discontinued Prescriptive programs included:

- Prescriptive Demand-Controlled Ventilation
- Prescriptive LED Traffic Signal Program
- Prescriptive Side-Stream Filtration Program
- Prescriptive Steam Trap Replacement Program
- Vending Machine Controls

Management responsibilities for Prescriptive programs divided into two main energy-efficiency measure groups: lighting, and all other. Two Avista staff members managed delivery and operations of these distinct Prescriptive program groups. Both reported that, during the 2011 program year, they sought additional assistance to keep up with program changes and customer demands. An additional support staffer was hired to help with customer enrollment processes, data tracking, and QA, and additional support staff may be hired in the future.

Figure 2-2 illustrates the Prescriptive program's delivery process steps, from marketing and outreach to rebate payments.

Figure 2-2. Prescriptive Program Process Flowchart



Avista customers learned about the Prescriptive program rebates through: Avista-sponsored events, marketing flyers, the Website, or a monthly newsletter. Contractors also provided outreach to customers. Program managers reported, in response to customer feedback resulting from the 2010 process evaluation, more focused efforts began to provide direct outreach to customers and contractors through visitations, breakfast meetings, or focus group events.

Rebate enrollment processes were fairly straightforward, involving a number of steps to process rebates through documentation verification, and payment processing. Although pre- and post-inspections were determined through levels of project risk (by program managers), inspections were not required, and were not being routinely conducted, unless reason existed to believe a project's information may have been inaccurately reported.

Site-Specific Program Delivery

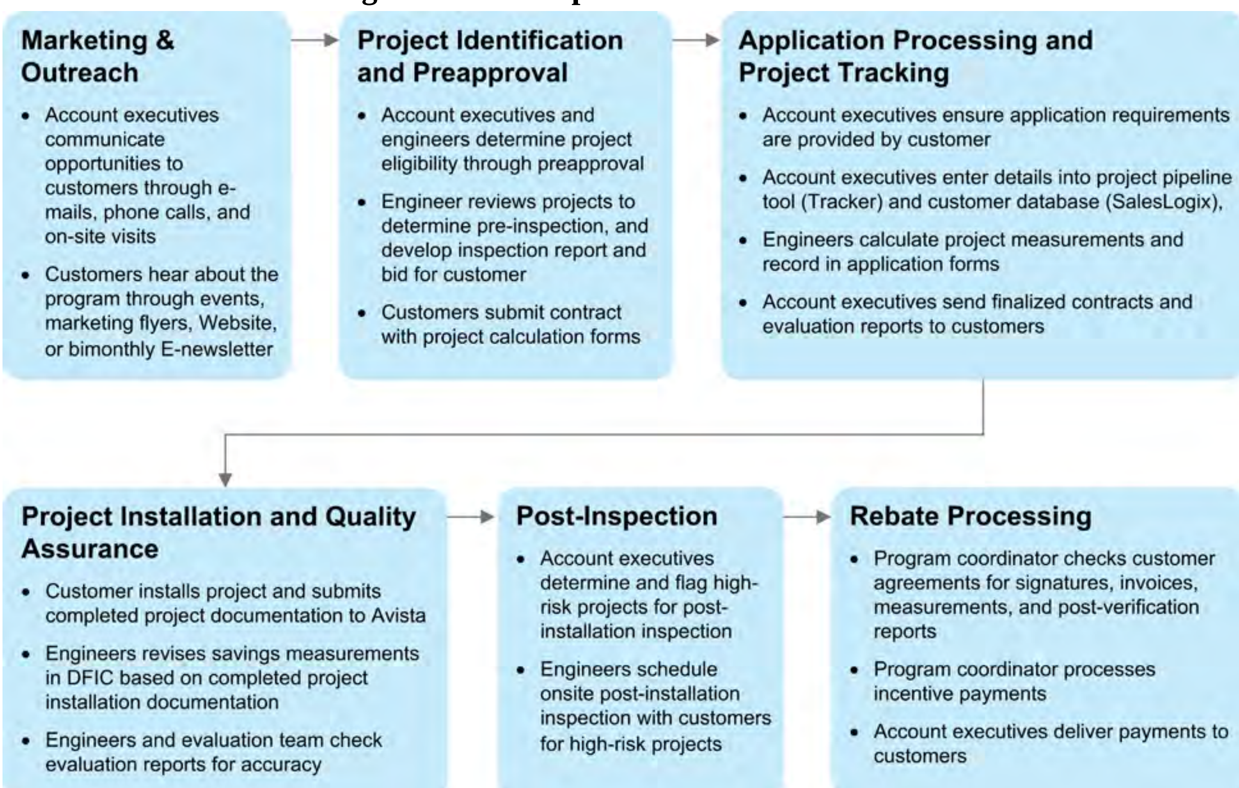
The Site-Specific program contributes a large portion of energy savings to Avista's nonresidential portfolio. Program goals of 27 million kWh (as reported in the 2011 Business Plan) were met, based on non-evaluated, year-end reported savings. The Site-Specific delivery approach sought to enable a flexible customer response to any energy-efficiency project with demonstrable kWh or therm savings.

Avista's implementation team indicated several staff were responsible for managing individual program components. Account executives, designated as the contact point for C&I customers, were responsible for recruiting and maintaining customer accounts. The engineering group oversaw project installation, and was responsible for measurement and verification (M&V). Program support staff oversaw data tracking and contractual requirements.

Cadmus noted that no central leadership role exists for overseeing the Site-Specific program. Based on evaluation experience and best practice research, Cadmus has found typically large C&I programs—in particular those contributing significant energy savings to overall portfolios—have a central point of management to oversee planning, vision, and meeting future goals cost-effectively.

Steps involved in administering and implementing the Site-Specific program differed from Avista's Prescriptive programs by: the size of projects; incentive amounts; and the complexity of project-specific information. Figure 2-3 demonstrates process steps involved in delivering the Site-Specific programs.

Figure 2-3. Site-Specific Process Flowchart



Program staff reported customers learned about the program through their account representative, marketing events, the Website, or updates through Avista's bimonthly newsletter, offered to business customers. Once customer identified a Site-Specific project, account executives and engineers determined preapproval and pre-inspection requirements. Customers worked with their account executives and engineers to submit project calculation forms and required documentation. Account executives noted customer assistance consumes as much as 50% of the work week.

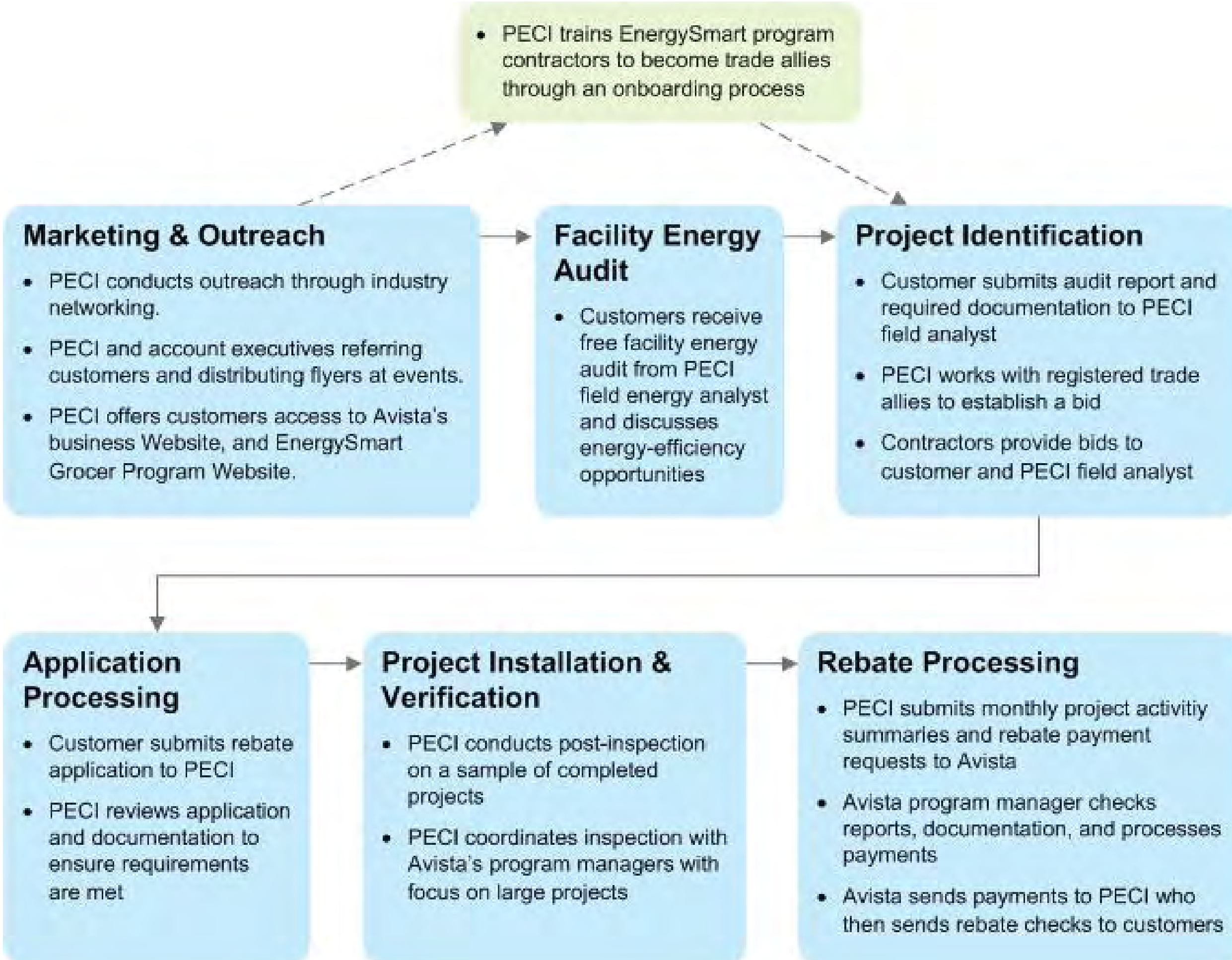
Avista engineers calculated total project costs, based on inputs from customers and contractors, and developed inspection reports and bids. Account executives then finalized contracts with customers. After project installation, account executives and engineers determined post-inspections, based on project risk. Once the installation inspection was conducted, and project documentation was completed through a final checklist, the program manager processed the incentive payment. The account executive could elect to hand-deliver the incentive check to the customer.

EnergySmart Grocer Program Delivery

PECI (a third-party implementer that has designed and delivered identical programs successfully throughout the Northwest) delivers EnergySmart Grocer program. Avista's energy smart grocer program is a customer-driven program, utilizing an extensive network of contractors, provided through PECI. For contractors to participate in the program and become a part of the trade ally network, they must sign a trade ally participation agreement outlining their roles and responsibilities. The program allows customers to choose their own contractors based on a competitive bid process. With customer approval, savings opportunities are referred to contractors, who then present customers with bids. With bid approval, customers implement the retrofit and incentives go to the customer, or directly to the contractor, if the customer chooses to release payment.

Figure 2-4 shows key enrollment and operational steps for the EnergySmart Grocer, demonstrating the unique features of this regional program, such as collaborative industry outreach activities, free energy audits, and trade ally networking.

Figure 2-4. EnergySmart Grocer Process Flowchart



During the 2011 process evaluation interview, PECI reported EnergySmart Grocer participants were typically chain retailers that, after experiencing success at one location, returned to duplicate measures at other facilities. Energy audits, required for program participants, provided an effective means for recruiting and identifying projects. Although regional marketing tactics have been very successful to date, a formal marketing approach, such as a newsletter or direct mail campaign, may also prove beneficial for keeping customers engaged and aware of other opportunities.

Overall, the approach for recruiting and adding installation contractors has been effective, but PECI recently has faced some challenges regarding contractors misrepresenting the program to customers. According to PECI, this can occur for a couple of reasons.

First, Avista requires pre-installation inspections for all EnergySmart Grocer projects, differing from other utilities involved in the regional program. Robust inspection procedures also require a sample approach to post-installation inspections. However, contractors do not always fully disclose differences in requirements by utility and region.

Second, customers can consent to have incentive payments go directly to contractors causing some overly assertive tactics by contractors. PECI voiced concerns that contractors misrepresent their roles in the program by not fully disclosing customer options.

PECI reported additional contractor challenges in 2011. The Washington Department of Labor and Industries (L&I) solicited permit information from EnergySmart Grocer program contractors, on approval from Avista. L&I found permit issues, and fined some contractors. PECI reported contractor tensions resulted, and many contractors claimed fines were unjustified. The implementer estimated this issue affected around 50% of participating contractors.

2.2.4 Findings Summary

Overall, the nonresidential program delivery strategies work well to meet the demands of implementation and operations. In many cases, programs meet or exceed savings goals. Although the lighting program fell short of goals, new program incentives in 2012 are designed to increase customer motivation. Implementation staff expressed concerns with time constraints preventing a more active role in planning and documentation of program procedures, and requested more real-time feedback during the evaluation process. The Site-Specific program, which contributes a large portion of savings to the nonresidential portfolio, lacks a central leadership role to oversee planning, vision, and meeting future goals. The EnergySmart Grocer program implementer experienced issues with contractors.

2.3 Customer Feedback

Customer feedback was obtained through surveys of program participants and nonparticipants. These groups included:

- Customers receiving rebates; and
- Eligible, nonresidential customers that did not participate in the programs during 2011.

2.3.1 Research Objectives

Participants

Cadmus designed the participant survey to inform the evaluation objectives discussed and agreed to during planning and kickoff meetings with Avista staff. Research questions (and areas of interest) emerged from interviews with implementation team, engineering staff, account executives, and policy and planning team members. Primary research objectives for participant surveys included:

- Determining participant satisfaction with key program components and delivery;
- Understanding participant decision-making influences;
- Identifying information sources and channels’ effectiveness for outreach;
- Identifying participants’ perceptions of market barriers;
- Identifying participant freeridership and spillover;
- Identifying potential areas for program improvements and future offerings;

- Compiling profile information about Avista's C&I target markets; and
- Assessing lighting trends in response to EISA regulations.

Nonparticipants

Understanding awareness and motivations of customers not participating in programs can provide insights that can be used for development of alternative strategies or programs to reach untapped energy-efficiency resource markets.

Primary research objectives for this year's study of nonparticipants included:

- Determining program awareness levels and information sources;
- Understanding decision-making influences regarding energy-using equipment;
- Identify information sources and channels' effectiveness for outreach;
- Identifying participation barriers or reasons customers aware of programs did not participate;
- Identifying nonparticipant spillover;
- Identifying potential areas for program improvements and future offerings;
- Compiling profile information about Avista's C&I target markets; and
- Assessing lighting trends in response to EISA regulations.

2.3.2 Survey Methods

Discovery Research Group (DRG)—a survey firm working regularly with Cadmus on similar evaluation projects—conducted participant and nonparticipant surveys. To minimize respondents' time requirements for the telephone surveys, the instrument was designed to take approximately 15 minutes to complete.

To streamline survey delivery, most questions utilized standardized, closed-ended responses. However, to capture subtle nuances and differences in decision-making patterns, the surveys included open-ended, "other" response options.

Participant Survey Instrument

Although administrators of Avista's commercial incentive programs make Prescriptive versus Site-Specific distinctions internally, differences proved insufficiently apparent from the participants' perspectives to warrant separate surveys for each program type. Therefore, the process evaluation team used a single survey instrument for participants, maximizing survey efficiency be combining process- and impact-related questions.

Process-related questions were designed using agreed-upon research objectives. Impact-related questions informed the net-to-gross (NTG) calculations and analysis. This survey also included questions regarding customers' currently installed lighting, future lighting installation plans, and awareness of lighting regulations; findings from these questions are included in a separate section of this report.

Table 2-3. Survey Design for Program Participants

Research Objective	Survey Elements
Determine satisfaction with key program elements and delivery	• Overall satisfaction • Satisfaction with program elements
Understand purchases and decision-making influences	• Decision influences • Program benefits perceived
Identify perceptions of market barriers	• Barriers to additional participation
Identify sources of information and effectiveness of channels for outreach	• Sources for information • Effectiveness of outreach methods
Identify potential improvements/future offerings	• Actions Avista could take to improve the program • Suggestions for new offerings
Compile customer and market profile information	• Ownership vs. leasing • Heating fuel type • Square footage of heated/cooled space • Number of employees
Assess freeridership and spillover impact	• Purchase history and budgeting • Program influence on purchase • Installation of energy-efficient equipment outside of the program
Assess lighting trends in response to EISA	• Awareness of lighting regulations • Sources of information • Saturation of T-12 lamps • Plans for future lighting projects

Participant Survey Sampling

Cadmus designed participant survey samples to represent reported savings by grouping similar program types. Survey targets were adjusted to account for numbers of survey respondents available.[9]

The survey sample was further refined to assign unique identification numbers, thus:

1. Ensuring an individual person would be contacted once, regardless of whether they participated in multiple programs; and
2. Identifying the top energy-saving measures, for reference in the NTG battery of survey questions

Each unique participant was then assigned to one of three survey groups: Site-Specific, Prescriptive, and EnergySmart Grocer. Survey grouping was based on the program type each customer participated to the greatest degree, excepting the EnergySmart Grocer program participants, who were prioritized, due to the small number of participants in the program. The

9 Considering recent NTG surveys (conducted at the beginning of 2011), and other evaluation efforts requiring site visits and surveys with large commercial customers, Avista requested some participants be removed from the sample set to prevent potential survey fatigue.

survey team developed targets for these three program groupings, based on total populations in each group. Table 2-4 shows numbers of participants, projects, original targets and completed surveys.

Table 2-4. Participant Survey Summary of Details

Program Group	Total Number of Participants*	Total Number of Projects	Survey Targets	Survey Completes	Absolute Precision at 90% Confidence**
Prescriptive	637	1,036	85	73	8.6%
Site Specific	356	741	80	72	7.9%
Energy Smart Grocer	125	518	50	17	18.4%
Total	1,121	2,338	215	162	5.6%

*For participants in multiple programs, the customer was categorized by the measure yielding the highest savings.
**Confidence and precision are measures of the degree of accuracy resulting from the use of a statistical sample. In this table, all precision estimates refer to absolute precision and are calculated using the 90% confidence level. For example, if an estimate's reported precision is 8%, the meaning is that we have 90% confidence that the true value is within 8 percentage points of the estimate.

Each participant was contacted once per day, until a final disposition (e.g., complete, refusal, ineligible) could be achieved. Each contact received up to six or seven attempts before termination of the survey effort, approximately after one week of calling. Across program clusters, 162 participant surveys were completed, (75% of target sample size).

Nonparticipant Survey Instrument Design

Table 2-5 summarizes survey elements for each research objective defined for nonparticipants.

Table 2-5. Survey Design for Program Nonparticipants

Research Objective	Survey Elements
Determine program awareness and sources of information	• Level of awareness • Primary sources of awareness • Satisfaction with program information received
Understand purchases and decision-making influences	• Decision influences • Effectiveness of outreach methods
Identifying barriers or reasons customers aware of programs did not participate	• Reasons for not participating • Perceived market barriers
Identify sources of information and effectiveness of channels for outreach	• Awareness of Avista rebate programs • Information sources • Effectiveness of outreach methods
Identify potential improvements/future offerings	• Actions Avista could take to improve the program • Suggestions for new offerings
Compile market profile information	• Ownership vs. leasing • Heating fuel type • Square footage of heated/cooled space • Number of employees
Identify spillover impact	• Installation of energy-efficiency measures outside of the program
Assess lighting trends in response to EISA	• Awareness of lighting regulations • Information sources • Saturation of T-12 lamps • Plans for future lighting projects

Nonparticipant Sample Selection

To represent customer interests and decision making for small and large energy users, Avista selected a stratified random sample by rate schedules and geographical regions (by state). Table 2-6 summarizes samples and targets for each stratum.

Table 2-6. Nonparticipant Survey Summary*

State and Rate Schedule	Electric/Gas	Contacts in Sample	Survey Targets	Surveys Completed
ID_011	Electric	1,773	25	37
WA_011	Electric	2,401	30	39
ID_021	Electric	212	17	9
WA_021	Electric	403	22	8
ID_025	Electric	2	0	0
WA_025	Electric	7	1	0
ID_111	Gas	49	8	4
WA_111	Gas	126	16	4
WA_121	Gas	6	1	0
Total		4,979	120	101

* The following Websites provide Avista nonresidential customer rate class definitions, by state:
WA: http://www.avistautilities.com/services/energypricing/wa/gas/Pages/default.aspx;
ID: http://www.avistautilities.com/services/energypricing/id/elect/Pages/default.aspx

2.3.3 Research Results

Results, discussed in this section, address research objectives for each survey topic area.

Where respondents answered "don't know," "not applicable," or refused to answer, responses were removed from the total, unless a high number of respondents fell in this category (for example, above 10% to 15%). In such cases, "don't know" and "refused" responses have been included as meaningful indicators. Individual sections discuss instances where uncertainty represented a high percentage of overall responses.

Program Satisfaction

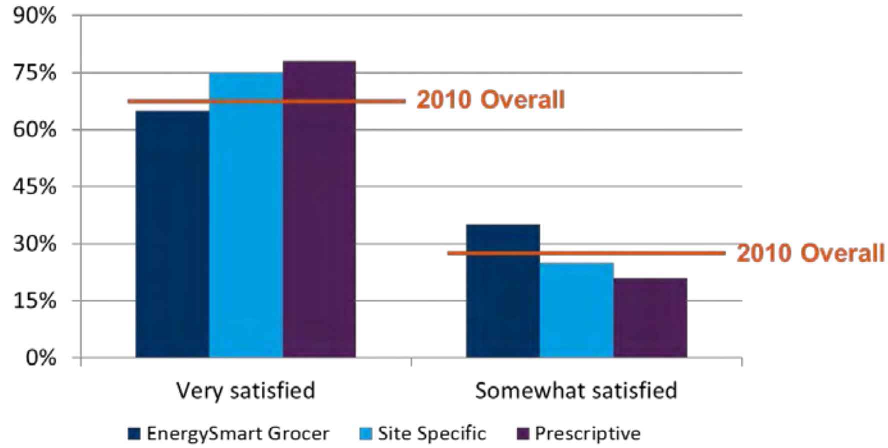
To provide insights about satisfaction with overall programs and specific program components, survey interviewers asked participants to rate each component on a four-point scale, ranging from very satisfied to very dissatisfied. A midpoint of neither satisfied nor dissatisfied was recorded only if the respondent stated this (this only happened in only one set of responses).

If respondents responded somewhat or very dissatisfied, they were asked why they gave that rating, and what Avista could have done to improve their experience. Not applicable responses were excluded from analysis.

Participant Program Satisfaction

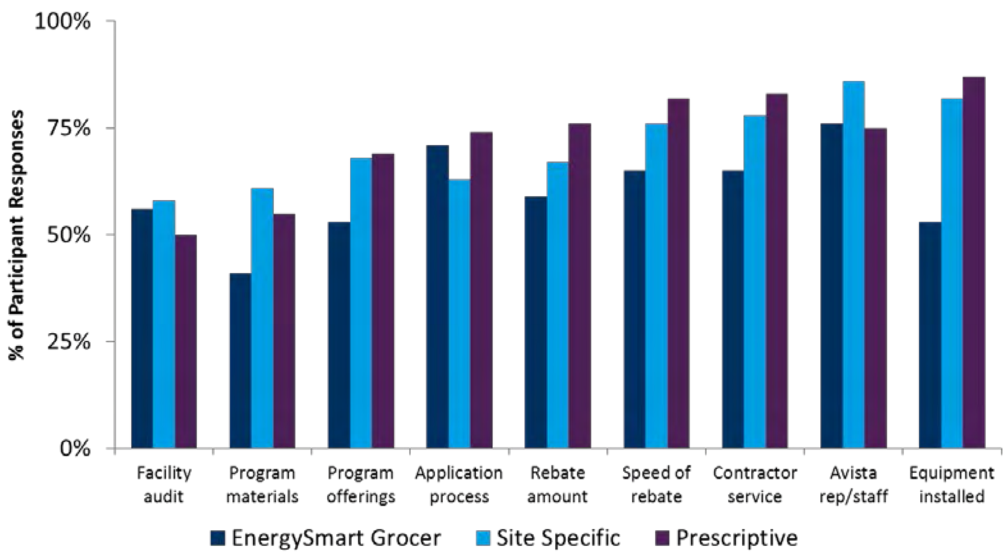
Overall program satisfaction is high, with only one of the 162 participants reporting being somewhat dissatisfied. The majority in each program cluster reported being "very satisfied," as shown in Figure 2-5. In 2010, program satisfaction was assessed at the portfolio level. Although the Energy Smart Grocer program is slightly below the average for the prior year, the larger Site-Specific and Prescriptive programs showed higher levels of very satisfied participants.

Figure 2-5. Participant Satisfaction with the Program



For specific program elements, a large number of responses indicating a customer was only "somewhat" satisfied suggested areas possibly needing improvements. Figure 2-6 summarizes respondents very satisfied with each program element.

Figure 2-6. Percent of Participants "Very Satisfied" with Program Elements



Observations at the program component level indicated:

- Energy Smart Grocer participants were less satisfied across all elements, except the facility audit, particularly regarding program materials, offerings, and equipment installed.
- Participants in Site Specific and Prescriptive programs had relatively high levels of satisfaction (>75%) with equipment installed, Avista representatives or staff, contractor service, and speed of rebates.

- Nearly one-half of participants across programs were only somewhat satisfied with facility audits and program materials.
- Roughly one out of four participants was only somewhat satisfied with program offerings, application processes, and rebate amounts.

Although few participants expressed dissatisfaction, areas where this did occur aligned with the lower-rated program elements shown in Figure 2-6. The number of responses to the follow-up question, asking why they were dissatisfied, was small, but the nature of responses may provide directions for exploration. Table 2-7 shows program elements receiving negative responses, and a summary of reasons given.

Table 2-7. Program Elements Receiving "Dissatisfied" Responses

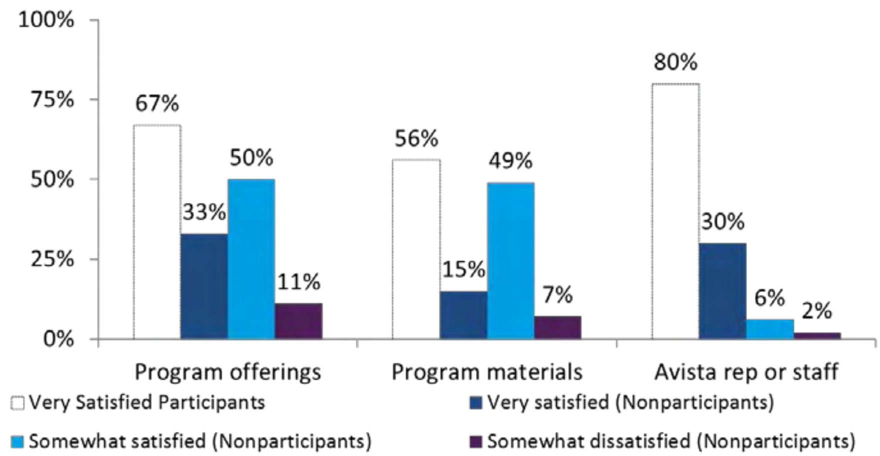
Program Element	% Somewhat Dissatisfied	% Very Dissatisfied	Total % Dissatisfied	Reasons Given for Rating
Facility scoping audit	7%	2%	9%	• Slow response • Time it took to get information • Did not understand information • Inconsistent messages • Did not do much/no additional help or tips
Program materials	3%	2%	5%	• Never received anything • Not very detailed • Prices were not clear
Application process	3%	2%	5%	• Forms/paperwork • Redundancy (multiple buildings) • Delay and loss of applications • Lack of follow-up • Massive confusion between residential and commercial
Speed of rebate	2%	2%	4%	• Lack of communication • Took too long • Required follow-up

* 1% were somewhat dissatisfied for Avista account rep or staff, rebate amount and program offerings

Nonparticipant Satisfaction with Program Elements

Forty-one percent of nonparticipants said they were aware of Avista's energy-efficiency rebate programs prior to being contacted for the survey. Those aware of the program (n=41) were asked to rate their satisfaction with Avista's program offerings and program materials. All nonparticipants were asked to rate their satisfaction with Avista account representatives or program staff. Figure 2-7 summarizes the responses, with the first column for each program cluster showing the percentage of program participants surveyed reporting being "very satisfied."

Figure 2-7. Nonparticipant Satisfaction with Program Elements (Compared to "Very Satisfied" Participants)

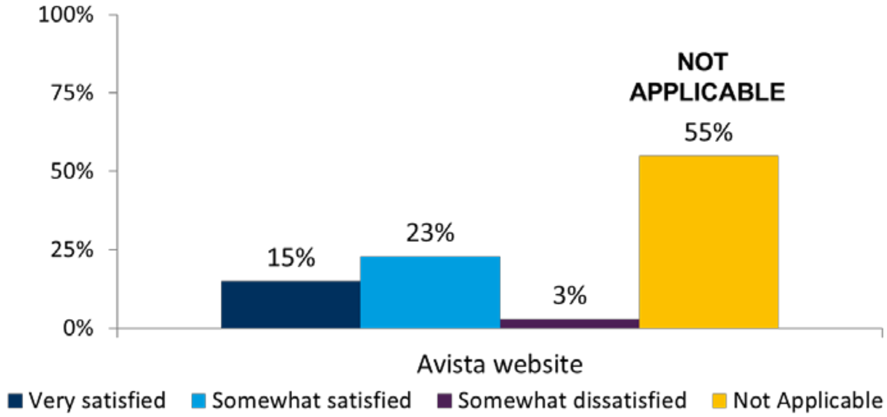


Nonparticipants clearly were less satisfied with program offerings, materials, and representatives or staff than participants. As with participants, if the customer indicated dissatisfaction, they were asked to provide reasons. Responses relating to program offerings and information suggested a lack of knowledge and not having seen information. (For example: "Avista has never laid it all out for me" and "I have not seen any program materials.") All dissatisfaction with Avista staff related to not having anyone contact them, except for one respondent, who was unhappy with their meter reader's inability to reach the property during winter months.

Nonparticipant Satisfaction with Avista's Business Website

All nonparticipants were asked to rate their satisfaction with Avista's Website for business customers. More than half (55%) stated this was not applicable to them, suggesting they had never accessed the Website or did not use the Internet. Only 15% nonparticipants reported being very satisfied with the Website, as shown in Figure 2-8.

Figure 2-8. Nonparticipant Satisfaction with Avista Business Website



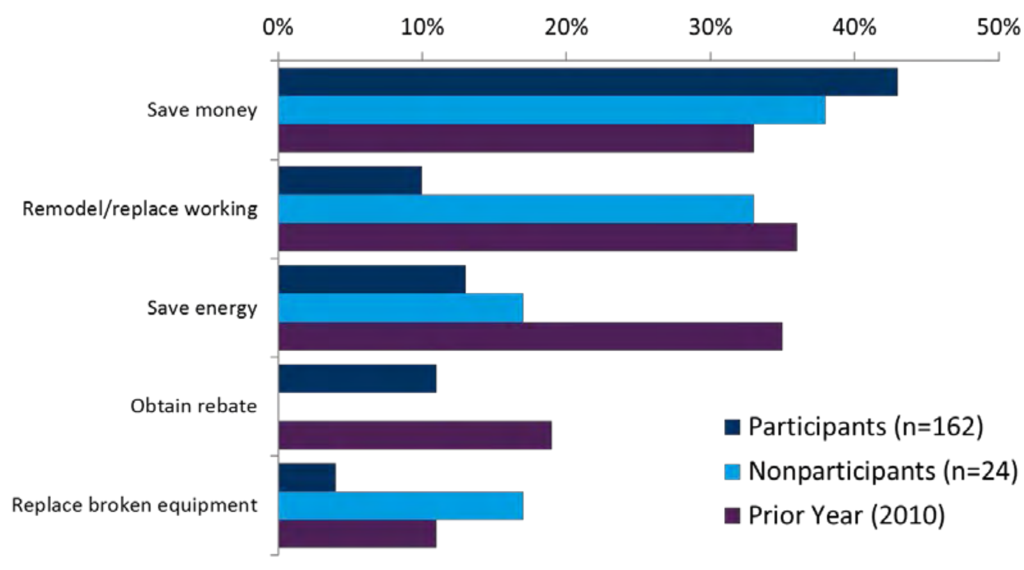
Purchases and Decision-making

Surveys again included questions to identify major influences and motivations for purchasing energy-efficient equipment. Participants and nonparticipants who installed energy-efficient equipment in the past year were asked about factors influencing their decisions, who they would turn to for more information, and, for nonparticipants aware of the rebate programs, why they had not participated.

Factors Influencing Installation of Energy-Efficient Equipment

Saving money was the reason most frequently cited for installing energy-efficient equipment this year, for both program participants and nonparticipants. In the prior year, more participants cited saving energy as an influence.

Figure 2-9. Factors Influencing Decision to Install Energy-Efficient Equipment



Freeridership

Cadmus estimated freeridership (the percentage of savings that would have occurred in the program's absence), based on 2011 participant responses. Table 2-8 compares nonresidential program freeridership scores for 2010 and 2011, finding most were similar, except for the Prescriptive program.[10] In 2011, Prescriptive freeridership jumped to 33%, compared to 13% in 2010.

Table 2-8. Nonresidential Freeridership Results*

Survey Category	2011 Evaluation			2010 Evaluation		
	n	FR	Absolute Precision**	n	FR	Absolute Precision
Prescriptive	70	32.6.0%	±7.9%	59	13.0%	±6.2%
-Lighting	37	19.2%	±10.5%	53	14.1%	±6.4%
-Non Lighting	33	44.6%	±11.9%	6	9.5%	±17.3%
Site-Specific	63	16.7%	±6.0%	61	26.0%	±7.2%
Energy Smart Grocer	17	4.0%	±13.2%	30	10.0%	±10.0%
Motors	12	47.0%	±18.9%	9	41.0%	±20.9%

* Results were weighted by each respondent's annual energy savings from the rebated energy-efficiency projects or measures.
** Confidence and precision are measures of the degree of accuracy resulting from the use of a statistical sample. In this table, all precision estimates refer to absolute precision and are calculated using the 90% confidence level. For example, if an estimate's reported precision is 8%, the meaning is that we have 90% confidence that the true value is within 8 percentage points of the estimate.

To benchmark Prescriptive program scores with comparable C&I programs at other utilities, Cadmus reviewed publicly available utility evaluation reports from 2010 and earlier. Table 3-9 demonstrates scores for Efficiency Main and PacifiCorp. In 2010, Efficiency Maine reported a 31% freeridership score with lighting (28% Efficiency Maine, and 20% for Avista) and non-lighting (50% for Efficiency Maine, and 54% for Avista), resulting in similar scores for both utilities. Overall Prescriptive freeridership estimate for Efficiency Maine increased in 2010 from reported estimates for 2003–2006, but not to the magnitude occurring between the 2010 and 2011 Avista evaluations.

Table 3-9. Prescriptive Program Benchmarking

Utility	Grouping	n	FR
	Prescriptive–ALL*	131	31%
	Prescriptive–Lighting	99	28%
Efficiency Maine 2010	Prescriptive–Non-Lighting	32	50%
Efficiency Maine 2003-2006	Prescriptive–ALL**	77	27%
PacifiCorp–UT - 2005–2008	Prescriptive–ALL (FinAnswer Express)***	68	21%
PacifiCorp–WA - 2005–2008	Prescriptive–ALL (FinAnswer Express)****	57	12%
PacifiCorp–ID - 2005–2008	Prescriptive–ALL (FinAnswer Express)*****	19	41%

* http://www.efficiencymaine.com/docs/reports/EMT-Business-Program-Report-FY2011-FINAL.pdf
** http://www.cee1.org/eval/db_pdf/545.pdf

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[10] The difference between freeridership estimates for 2011 and 2010 evaluations was statistically significant (p-value = 0.012) for the nonresidential Prescriptive program category. The difference between freeridership estimates were not statistically significant (p-value > 0.10) between the two evaluation years for Site-Specific, EnergySmart Grocer, and Motors program categories.

*** http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/ DSM_UT_FinExp.pdf
**** http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/ DSM_WA_FinExp.pdfh ttp://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/ Demand_Side_Management/DSM_WA_FinExp.pdf
***** http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/ ID_FinAnswer_Express_Report.pdf

Spillover: Purchases of Energy-Efficient Equipment Outside the Program

As in the 2010 survey, the majority of participants (77%) and nonparticipants (80%) had not installed equipment outside of the program.

Of participants describing other energy-efficient equipment purchases, nearly half (20 of 37) were lighting measures, and four were water heaters. Other measures purchased included: high-efficiency motors and variable speed drives; HVAC equipment; manufacturing equipment; an air compressor; dry cleaning machines; and a demand control system. Thirty-eight percent (14) of these customers applied for rebates for these purchases as part of an Avista program. A few (4) had not installed the purchased equipment. Roughly half of the remaining customers (9 of 19) were not aware they could obtain a rebate for the purchase. Reasons given by others for not participating in the rebate program included:

- Not able to get the paperwork together.
- Too small a project to be worth the process.
- Equipment was not covered by a program (instant water heaters).
- Did not learn about the program until it was too late.

Spillover refers to additional savings generated by customers (participants or nonparticipants) that was influenced by program activities, but not captured by program records. In 2011, there was no quantifiable participant spillover that was attributable to nonresidential programs. Although a few participants made additional purchases without applying for rebates, only two stated they were highly influenced by the Avista programs. Both purchases were small, and had insufficient information to quantify energy savings. For 21 nonparticipants installing equipment outside the program, none knew of Avista's rebate programs. Lighting and HVAC measures were installed by over half of these respondents.

Why Customers Did Not Participate When They Purchased Energy-Efficient Equipment

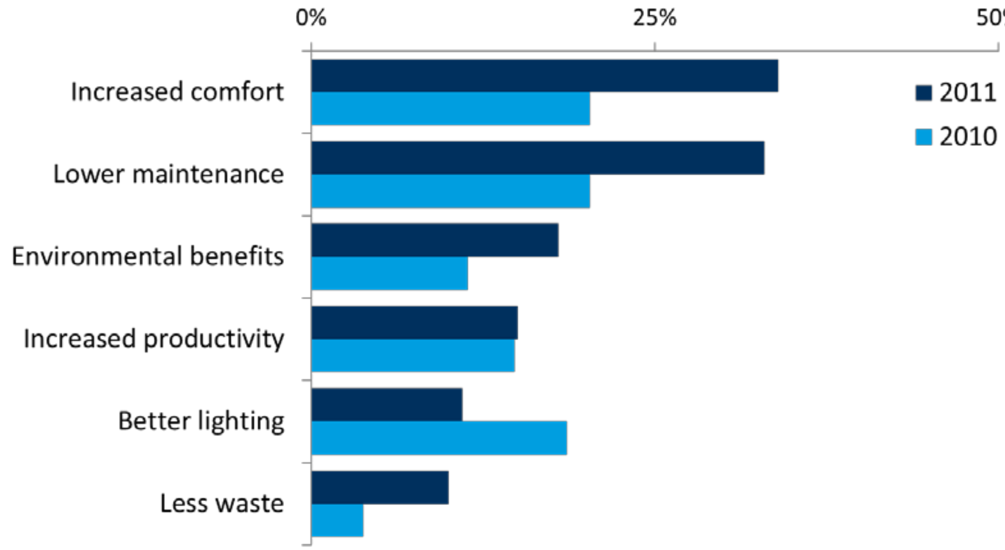
The survey also asked nonparticipants, aware of Avista's nonresidential rebate programs (41 of 101 total respondents), why they did not participate in the rebate program. In the prior survey, the majority (88%) listed reasons outside of Avista's control. This year, one-fourth of these nonparticipants cited time and money as reasons for not participating. Other reasons cited by multiple respondents included:

- Not enough information or knowledge about how to participate.
- Equipment they needed did not qualify for the program.
- Not seeing a reason to change until "the old one dies."
- Participation in prior years, but not last year.

Benefits Beyond Savings

To better understand motivating factors, in addition to energy savings, the survey asked participants whether the rebated energy project provided benefits beyond energy savings. Seventy-three percent believed it did (very similar to 75% responding positively in the 2010 survey). Most cited benefits included: increased occupant comfort; lower maintenance costs; increased productivity; better lighting; and less waste. These were not mentioned as factors in the decision to purchase energy-efficient equipment, summarized above in Figure 2-9.

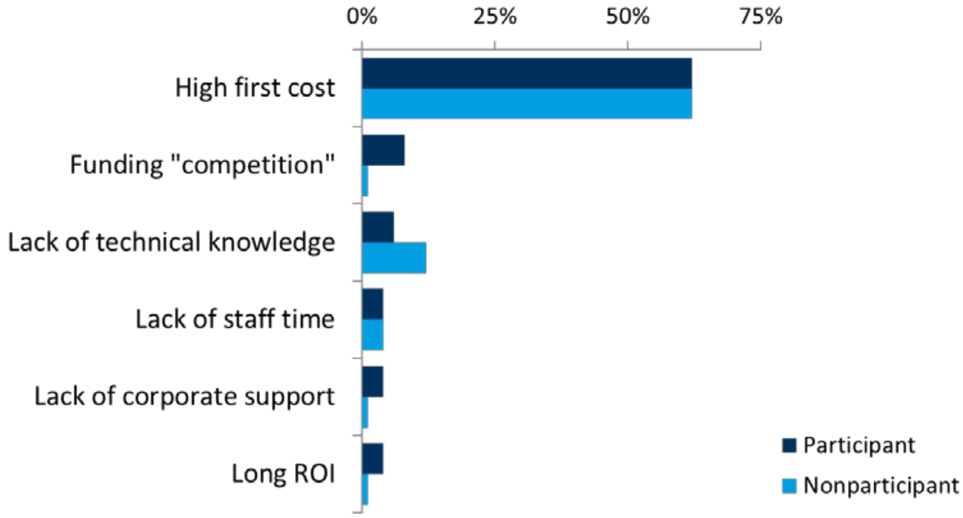
Figure 2-10. Benefits Beyond Energy Savings



Barriers to Participation

Surveys asked all customer groups what they saw as the most significant obstacles to installing energy-efficiency equipment for their company. The overwhelming majority (62% for participants and nonparticipants) identified high first-costs as the most significant obstacle. Figure 2-11 shows other barriers cited.

Figure 2-11. Barriers to Installing Energy-Efficient Equipment



How Avista Can Help Overcome These Barriers

Survey interviewers asked what Avista could do to help respondents' companies overcome the above-cited barriers. Suggestions frequently included:

- Continue/expand the rebate programs;
- Offer low-interest financing options/on-bill financing; and
- Provide more information (educate and communicate about programs).

Cadmus notes Avista offers financing through its Website; however, respondents were unaware of this at the time of the survey. Additional suggestions included:

- "Help us more clearly articulate the advantages of saving money over the long run as we go up through the hierarchy of our organization—at the engineering level we understand the need, but that does not necessarily translate through the higher administrative levels."
- "Have a better way to validate the savings…all the savings were on paper—nothing was substantive."
- "Just make the Website a little more user friendly."

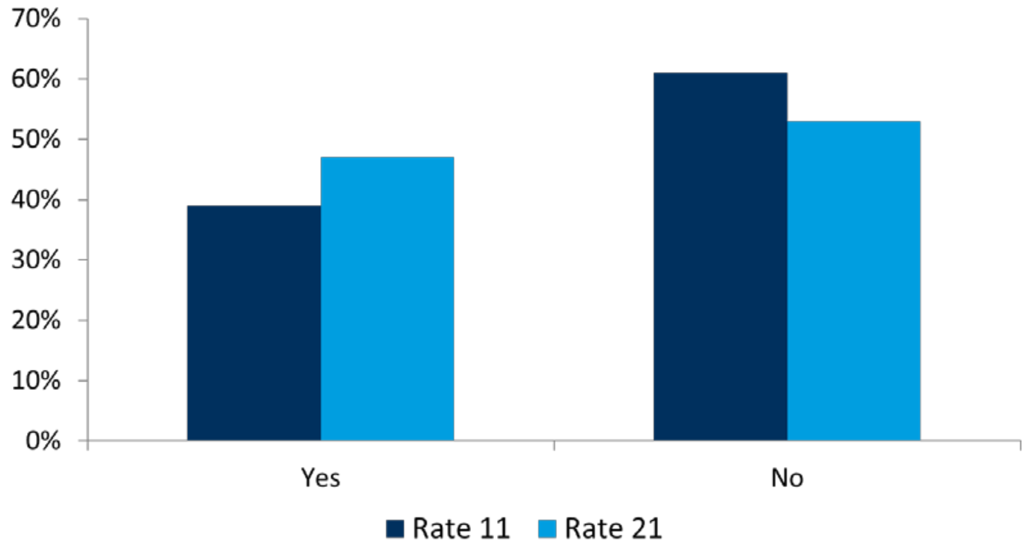
Outreach and Communication

Avista expanded efforts in 2011 to demonstrate a best practices approach to commercial programs, including "Power Breakfasts" (featuring customer testimonials), and case study print advertisements. In addition to examining survey responses to identify early results of these efforts, respondents were asked if expanded outreach and communication channels provided effective ways to reach them. This section highlights: changes in nonparticipant awareness; how customers learned about the programs; how effective information provided was; and perceptions on different ways to reach potential participants.

Nonparticipant Awareness

Program awareness among nonparticipants was higher this year, with 41% aware of the program, compared to 34% in the 2010 survey, although the majority remained unaware. Although fewer customers in the 2011 survey were on General Service Rate Schedule 21 (19%, compared to 64% in 2010), a noticeable increase occurred in the percentage aware of the program. This may indicate increased outreach and marketing by account executives to this target group have been effective. Figure 2-12 illustrates higher awareness among the larger Rate 21 customers. In 2010, no difference was found in awareness between the two rate classes.

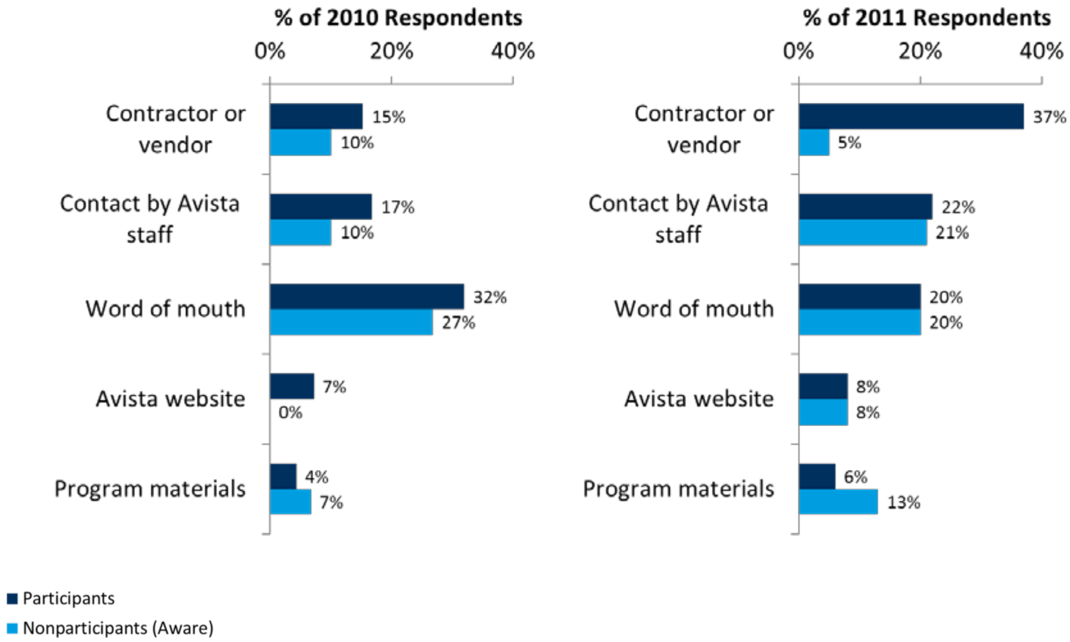
Figure 2-12. Nonparticipant Program Awareness, Comparing Schedule 11 and 21



Who Customers Talk to About Energy Efficiency

The survey asked customers who they would talk to about improving energy efficiency at their facilities. In the 2011 survey, participants and nonparticipants most frequently learned of programs through word-of-mouth, account executives, Avista staff, contractors, or vendors. Compared to the 2010 survey, the relative order of these responses reversed, with more customers learning about programs from contractors or vendors. Figure 2-13 shows results, by percentages of each customer group.

Figure 2-13. How Respondents Learned of Programs



Comparing responses regarding how customers learned about the programs between 2010 and 2011 suggest the following:

- The contractor and vendor role in communicating about the program increased significantly, with over one-third of participants (37%) crediting them for informing them about the program, compared to 15% in the previous survey.
- The gap in the proportion of participants learning from contractors, compared to nonparticipants, was quite large. This has not been observed in other sources, and suggests this may be a more effective channel, or the combination of contractors reinforcing messages from Avista could be a strong factor in decisions to participate.
- More customers learned about the programs in the last year from Avista account representatives and staff, up from 17% in 2010 to 22% for participants, and from 10% to 21% for nonparticipants.
- Few customers learn about the programs from Avista's business website, however it may be useful in the future to explore whether they use the website to obtain additional program information.
- Similarly, few customers learned about the programs from printed materials, receiving this information in mail or with bills, though more nonparticipants than participants learned about the program this way.

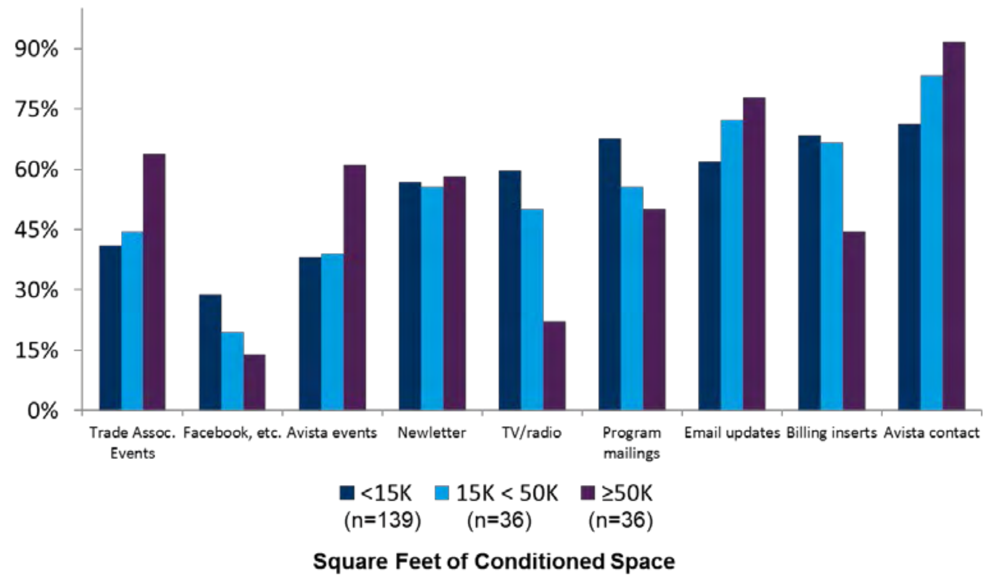
Sufficiency of Information When Customers Learned About the Program

Customers were asked if the level of information they received when learning about the program proved sufficient for their needs. Nearly all participants (96%) responded it was, but one out of four nonparticipants reported not having sufficient information. Reasons provided through follow-up questions focused on: more information about available programs; more detail about qualifying equipment and incentives; and a better understanding of processes to apply for and receive rebates.

Effectiveness of Different Marketing Channels

For outreach and marketing, Cadmus investigated additional marketing and communication channels, seeking to better understand their effectiveness in reaching customers. Few differences were observed by program; however, comparing responses by size of facility represented (square footage of heated and cooled space) determined some differences. Figure 2-14 shows the percentage of participants and nonparticipants, by facility square footage, responding as to which channel proved best for reaching them.

Figure 2-14. Most Effective Way to Reach Customers by Facility Size



Observations about responses to questions regarding different channels included the following:

- More respondents of all sizes believed direct contact from Avista was good, though this was less true for smaller-size facilities, where it also was less likely to be cost-effective (71% of facilities smaller than 15,000 square feet cited this as an effective way to reach them, compared to 92% of facilities 50,000 square feet and larger).
- On average, e-mail ranks second as a channel, although smaller customers rated program mailings and billing inserts slightly higher (68% each vs. 62% for e-mail).
- More than half of respondents in each size range responded favorably to a monthly newsletter communicating information.
- Large facility customers were less likely to be reached by billing inserts, program mailings, television, radio, or social media. They were, however, most favorable to events (Avista and trade associations) and e-mail updates (an in-person, personal theme).

- Customers in smaller facilities were more likely to respond to billing inserts, program mailings, TV/radio, a monthly newsletter, and direct contact.
- Social media, although not receiving a strong response (particularly from larger customers), still received favorable responses from 29% of smaller facility customers.

Potential Improvements and Additions to Programs

Participants and nonparticipants were asked what Avista could do to improve their program experiences. For the 16 participants who responded, the most frequently mentioned improvements included the following:

- Faster follow-up and response time/reduced delays in engineering and rebate processing;
- Better communications—in keeping the customer informed, and to provide consistent information;
- More in-depth auditing; and
- An individual to contact.

Nine of the 13 nonparticipant responses related to outreach and communications (being notified; receiving information in the mail, personal contacts). One suggested referrals to a qualified contractor, and one wanted help determining "where to start."

What Customers Want Added to Programs

Both participants and nonparticipants were asked if they wanted Avista to offer rebates for additional types of energy-efficient equipment or services. Fifty-two participants and six nonparticipants offered suggestions, with lighting and heating/HVAC equipment cited most frequently. Few were specific about technologies. Table 2-10 summarizes participant and nonparticipant responses. Respondents may not be aware of technology options in existing programs.

Table 2-10. Additional Equipment Rebates Customers Requested

Percentof Responses	Technology Type	Specific Equipment/Services
27%	Heating/HVAC/Boilers	• General heating • Gas heating • Radiant heat • Chillers
26%	Lighting	• "Anything lighting"/general response • LED • T8 replacement lamps • Exterior lighting • Street lights/parking lots • Horizontal case lighting
9%	Water heating	• General • Instant hot water heaters • Boilers

Percentof Responses	Technology Type	Specific Equipment/Services
9%	Gas	• Heating • Appliances/food service equipment
5%	Laundry equipment	• Washers and dryers
3%	Doors	• Exterior doors
3%	Insulation	• Insulation
3%	Renewable energy	• Solar, Wind, Water

Customer Profile

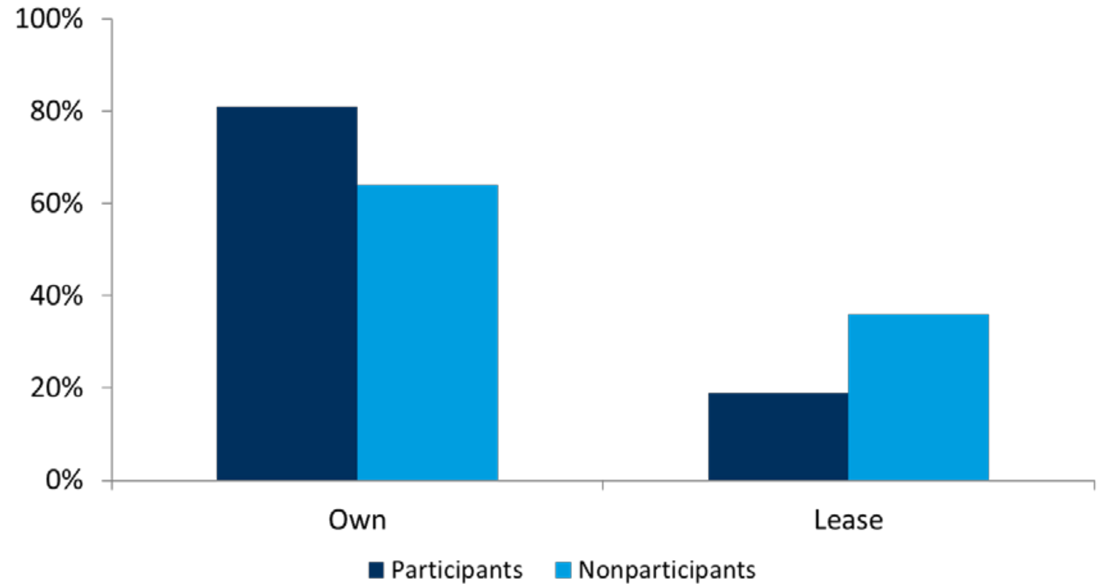
Understanding differences in customer profiles may help identify characteristics of customers effectively reached (or not reached) in current program outreach and delivery activities. The 2011 survey collected typical facility characteristics, such as: ownership versus leased space; square footage of conditioned spaces; fuel types used for space heating; and numbers of full-time employees.

Facility Ownership

Eight out of 10 participants surveyed reported owning their facilities, findings nearly identical to those in the 2010 customer survey (81%). By program cluster, 89% of participants in Site-Specific programs and 81% in Prescriptive programs owned their facilities. In the Energy Smart Grocer program, slightly more than half (53%) reported leasing their facilities. More nonparticipants in the 2011 survey reported leasing their spaces (36%, compared to 22% in 2010).

This finding is not surprising considering that leased facilities tend to be more challenging to reach and to persuade customers to make energy-efficient equipment investments. With more complex decision structures (and split-incentive challenges), owners and managers make capital investment decisions, while tenants typically pay electricity bills (and receive the investment's benefits).

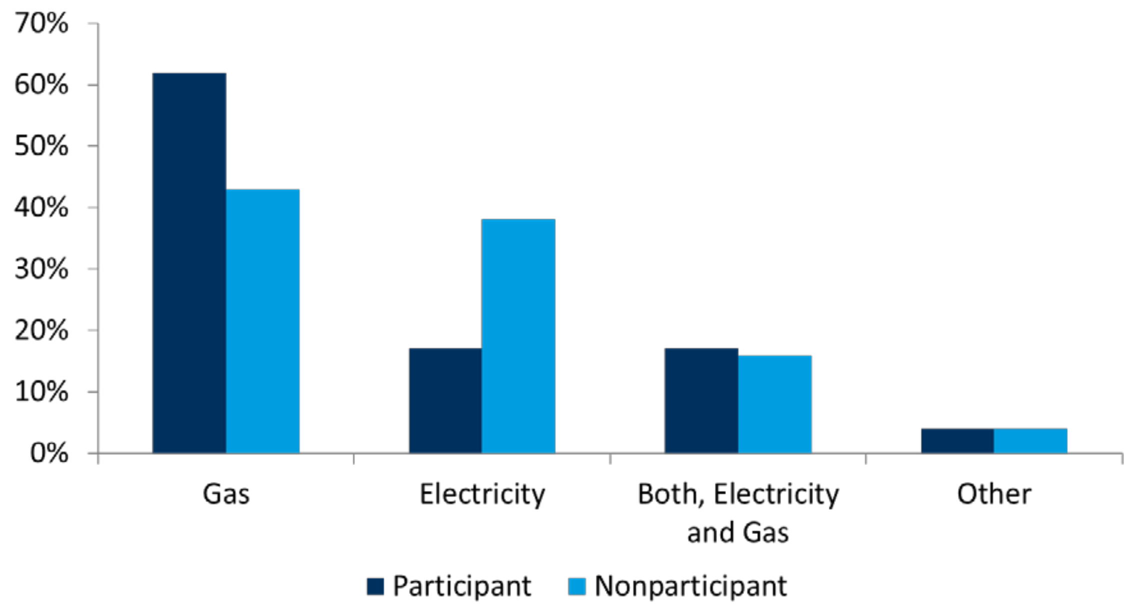
Figure 2-15. Percentage Ownership by Customer Facility



Fuel for Space Heating

Gas continued to be the dominant fuel used for heating by respondents, with higher program participation in facilities using gas for heating. Figure 2-16 illustrates fuel used for space heating for surveyed customers.

Figure 2-16. Fuel Use for Space Heating by Customer Group



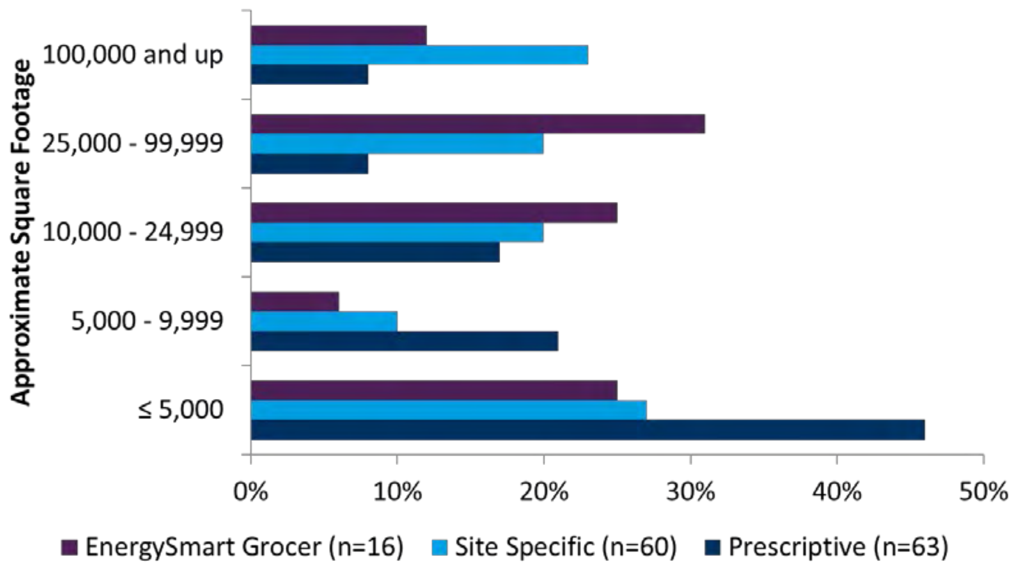
Nonparticipants were twice as likely to use electric heating. Cadmus examined the breakdown by electric rate for this group, seeking to determine if smaller facilities weighted this result. Thirty-eight percent of the respondents in Rate 011, assumed to be smaller facilities, indicated electricity as the fuel used for space heating. Close to one-half of respondents in Rate Schedule 21 indicated electricity (47%) as their space heating fuel.

Facility Size

More customized, Site-Specific programs appeared to effectively reach customers with larger facilities. Forty-three percent of participants in the Site-Specific program fell in the top two largest bands, with facilities larger than 25,000 square feet. Figure 2-17 illustrates distributions of participants across facility size ranges for program clusters.

All three program clusters reached small facilities. Nearly one-half (46%) of participants in the Prescriptive programs and 27% of those in the Site-Specific programs had facilities with less than 5,000 square feet of conditioned space. Including small facilities, which typically have much lower achievable energy and demand savings, may affect the program's cost-effectiveness.

Figure 2-17. Square Footage of Heated and Cooled Space in Facility Percentage of Respondents by Program Cluster



2.3.4 Findings Summary

Program Satisfaction

Overall, awareness of Avista nonresidential programs appeared to increase, and participant satisfaction was very high. Certain program elements receiving a large share of only "somewhat satisfied" ratings, suggesting opportunities to improve, included: scoping audits, program materials, and application processes. Concerns identified focused on: needs for better managing expectations about the depth of audits; information customers would receive; and when they would receive it.

EnergySmart Grocer program participants were less satisfied, compared to the Prescriptive and Site-Specific programs. Lower satisfaction levels reported by nonparticipants suggested a need to better understand why program offerings and materials did not meet their needs, or if outreach and marketing activities did not reach them.

Purchases and Decision Making

While saving money ranked as having the greatest influence on decisions to install energy-efficient equipment, the reported influence of "saving energy" declined from the 2010 survey, which could have implications for marketing messages.

Communications and Outreach

Increase in participants citing contractors and vendors as sources for learning about the programs increased from 15% in 2010 to 37% in 2011. Program information on Avista's Website may not be reaching across the market effectively, or be utilized to help customers. Over one-half of nonparticipants reported the business Website was not applicable to them, while citing the need for more information about programs.

Identification of effective ways to reach customers resulted in a variety of responses. Even personal contacts by Avista representatives did not please all respondents (but was most favored by three out of four).

Potential Improvements

Customers exhibited emerging concerns regarding response times for engineering analysis results and rebate receipts, with frustration also expressed about lack of communication from Avista in this regard.

Much energy-efficient equipment survey respondents identified as for possible rebates are (or could be) available in existing programs.

Customer Profiles

Cost-effectiveness of Site-Specific programs may be at risk if delivery costs are high for very small facilities (less than 5,000 sq. ft.); more than one in four participants surveyed belonged to this size range. Different outreach and delivery strategies may be needed to align costs to achievable savings.

The dominance of owned facilities represented by participants surveyed suggested Avista may not be reaching more challenging decision makers in leased facilities.

2.4 Trade Ally Feedback

Over several years, Avista has developed and maintained a mailing list of contractors and vendors providing services to residential and nonresidential energy-efficiency program customers. Avista uses this mailing list to inform trade allies of energy-efficiency program opportunities, changes, or upcoming events.

As such, the trade ally program serves as an informal network of participating contractors and vendors, which anticipate learning about energy-efficiency incentives, benefit from the business opportunities provided by the program, and interact with Avista's energy-efficiency program participants.

Avista also sponsors periodic technical training sessions for contractors interested in learning more about energy-efficiency programs through the Northwest Trade Ally Network (NW TAN), informing contractors and vendors of new program offerings. A recent addition to Avista outreach efforts has been the launch of power breakfasts, where customers and contractors are invited to learn more about Avista's spectrum of available energy-efficiency rebates.

2.4.1 Research Objectives

The trade ally research sought to gather responses from a representative sample trade allies for Avista's nonresidential energy-efficiency programs. For the 2011 evaluation, additional efforts were conducted to identify differences and similarities between general contractors and lighting contractors, and contributions towards promotion of nonresidential programs. Process evaluation objectives for the trade ally research included:

- Gathering information about contractor and lighting vendor target markets.
- Assessing awareness, experiences, and satisfaction with program design, enrollment processes, outreach, and communication.
- Identifying trade ally challenges, barriers, or recommendations for improvements.
- Understanding effects of upcoming changes to federal lighting standards on contractors and customers (discussed in a special report section).

2.4.2 Methods

The Cadmus evaluation team interviewed nonresidential program implementation staff, conducted interviews with trade ally participants, conducted best practices research, and reviewed the following materials:

- General contractor and lighting vendor mailing list;
- Lighting vendor handouts; and
- Lighting vendor communications and focus group meeting notes.

Promotional and training materials specifically targeting lighting contractors contained information regarding program updates, and sought to provide technical information about new program measures.

Cadmus interviewed 40 trade allies for the 2011 evaluation: 20 general contractors, and 20 lighting contractors selling or installing equipment to business customers receiving rebates through Avista nonresidential energy-efficiency programs. The interview guide included 37 questions, with topics addressing: program outreach and communication; satisfaction; application processing; market barriers; and recommendations for improvements. Due to the trade ally program's informal structure, nonparticipating trade allies could not be identified for the 2011 evaluation.

Contractors and lighting vendor mailing lists provided by Avista contained business names, but little contact information. Therefore, we compiled phone numbers from the Internet, and gathered additional information from Websites, seeking to highlight types of contractor and confirm whether participants worked primarily with C&I customers.

Over a two week period, Cadmus contacted 189 contractors and vendors from the nonresidential trade ally mailing list. Fifty-five contractors contacted derived from the lighting vendor mailing list, while the rest derived from the general contractor list. Many contractors in the general contractor mailing list also served as lighting vendors. The following contacted could not complete interviews for the following reasons:

- Eight had limited to no involvement with the rebate programs.
- Two were involved with rebate programs in 2010, but did not continue in 2011.
- Seventeen were only residential contractors.
- Fifteen phone numbers had been disconnected.
- Seven had incorrect phone numbers.
- One refused an interview, and one terminated an interview.

Cadmus' effort to contact trade allies in varying fields sought to capture a representative picture of Avista's trade ally network. Table 2-11 lists trade allies interviewed by measure type, as a portion of overall, commercial energy savings.

Table 2-11. Trade Ally Respondent Comparison

Trade Ally Program Type	Number of Respondents	Portion of Interview Respondents	Portion of 2011 Portfolio Savings Represented*
Lighting	20	50%	29%
HVAC	11	28%	37%
Industrial processes	1	2%	11%
Motors	2	5%	7%
Shell	4	10%	9%
Energy Smart Grocer	2	5%	5%
Total	40	100%	98%

*Trade allies were not contacted for measure categories accounting for the remaining 2% of savings. Therm savings were converted to kWh for this comparison.

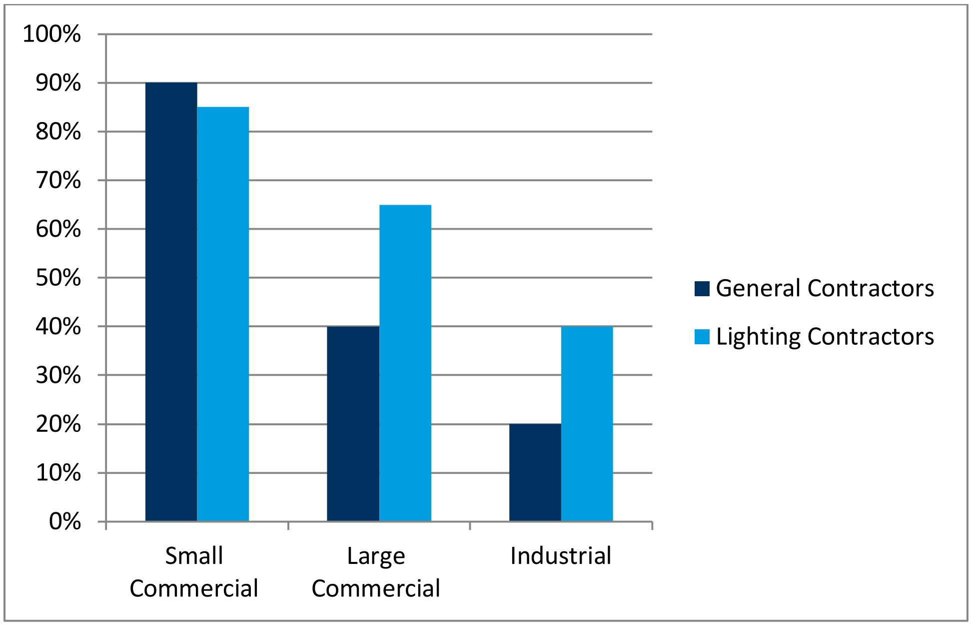
2.4.3 Research Results

Participating trade allies provided insights into many program components, highlighting strengths and weaknesses from their direct experience with the nonresidential programs. This section summarizes trade ally interviews results. To gather insights into potential differences in experiences between lighting and non-lighting contractors, an even number of contractors were interviewed from the two groups. This section analyzes and compares interview observations from these groups (20 general contractors and 20 lighting contractors).

Trade Ally Profile

Trade allies provided services to a mix of customers, serving a variety of project types, and ranging from Prescriptive to Site-Specific programs. Most contractors reported working with small commercial customers. Many lighting contractors also reported working with large C&I customers, though fewer general contractors did so. Figure 2-18 shows the customer base, reported by contractors interviewed.

Figure 2-18. Number of Trade Allies Working with Small, Large, and Industrial Customers



Contractors were asked how many projects they completed through Avista's rebate programs.

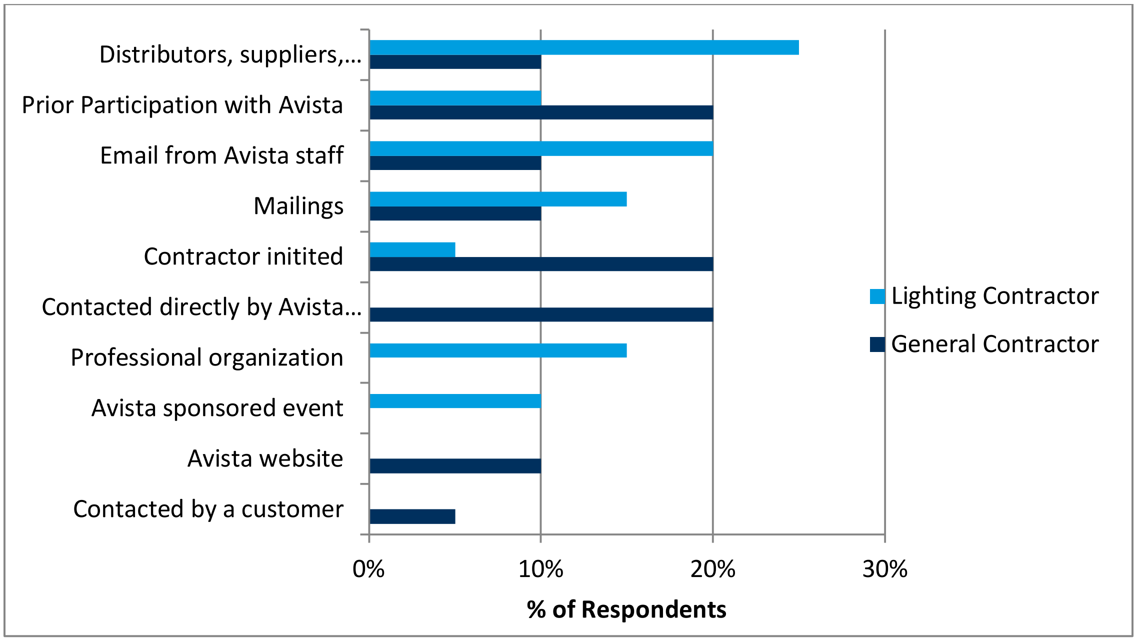
Table 2-12. Number of Avista-Rebated Projects Completed by Trade Allies

Completed Projects in 2011	General Contractors	Percentage General Contractors	Lighting Contractors	Percentage Lighting Contractors
1-10	11	55%	16	80%
11-20	5	25%	2	10%
20-50	1	5%	1	5%
51-100	1	5%	0	0%
>100	2	10%	1	5%
Total	20	100%	20	100%

Program Outreach and Communication with Trade Allies

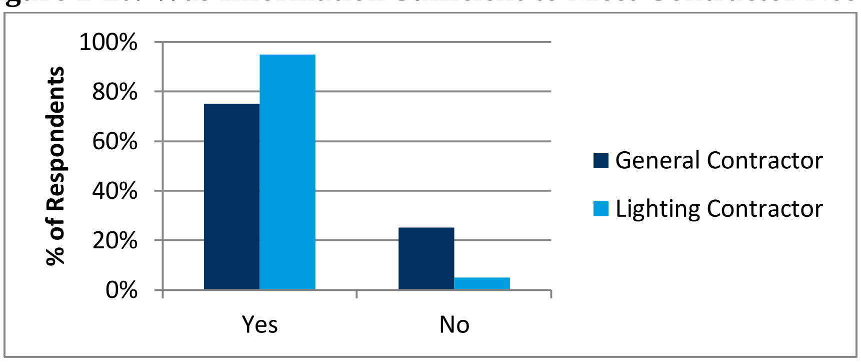
Answers varied when contractors were asked how they learned of Avista's rebate programs. An equal number of general contractors (4 of 20) heard about Avista through prior participation, by initiating communication, or were contacted directly by an Avista representative. Lighting contractors typically learned of the program through: distributors, suppliers, or industry contacts (5 of 20); by e-mail from Avista (4 of 20); or professional organizations (3 of 20). Two lighting contractors learned of the program through an Avista-sponsored event. Figure 2-19 shows additional ways trade allies learned about the program.

Figure 2-19. How Trade Allies Learned of the Programs



The majority of general contractors (75%) and most lighting contractors (95%) felt levels of information Avista provided about program opportunities was sufficient to meet their needs, as shown in Figure 2-20.

Figure 2-20. Was Information Sufficient to Meet Contractor Needs



Six respondents reported the information level was not sufficient to meet their needs. Two contractors reported it was difficult to reach representatives when calling Avista for assistance; both waited 20 minutes or more to speak with a representative.

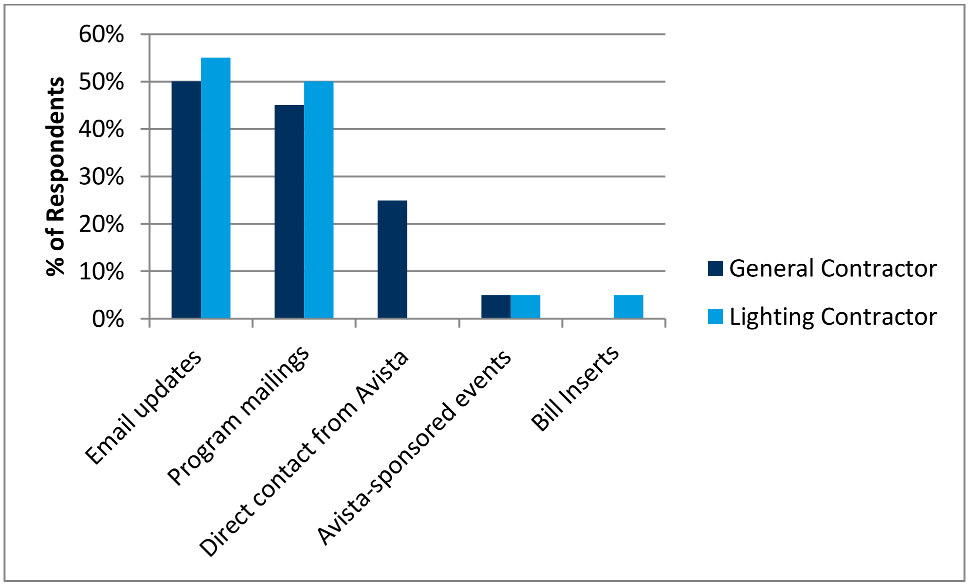
Trade allies provided a range of suggestions for meeting their communication needs:

- More direct (and frequent) communication from Avista representatives;
- Creating a designated contact person at Avista to field contractor questions;
- Providing more detail and guidance on program enrollment requirements, application processes, qualifying measures, and start and end dates;

- Supplying a brochure describing rebate programs, costs, and benefits that contractors could hand out to customers;
- Including easier access to Website forms, and providing more detailed information;
- Adding more detailed instructions regarding use of lighting calculators.

Figure 2-21, shows preferred ways of contractor communications.

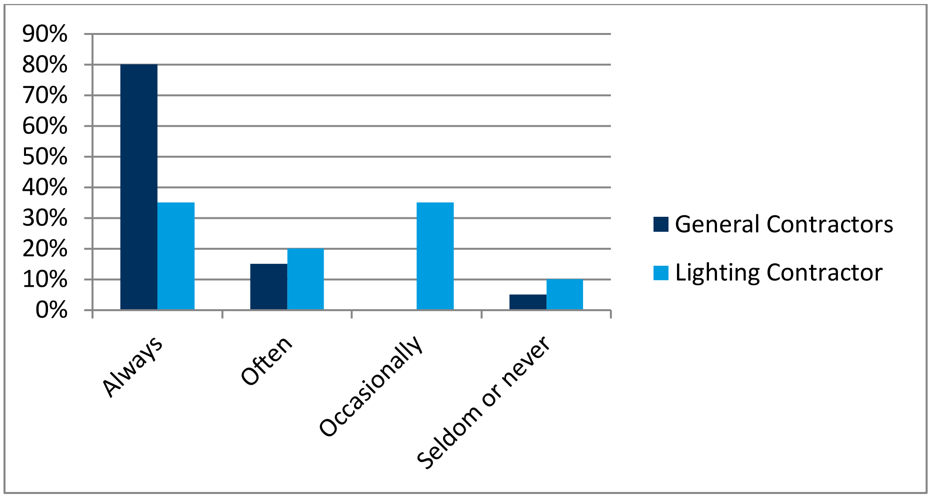
Figure 2-21. Most Effective Ways to Reach Contractors about Program Opportunities



Outreach to Customers

Most general contractors (80%) said they always promoted the program to Avista customers, while another 15% (3 of 20) often promoted it. However, lighting contractors less actively promoted the program. Thirty-five percent (7 of 20) always promoted the program, while 20% (4 of 20) often promoted the program. One high-efficiency windows contractor did not have enough information to promote the program. Figure 2-22 compares promotion activity trends of general and lighting contractor respondents.

Figure 2-22. How Often Contractors Promote the Program

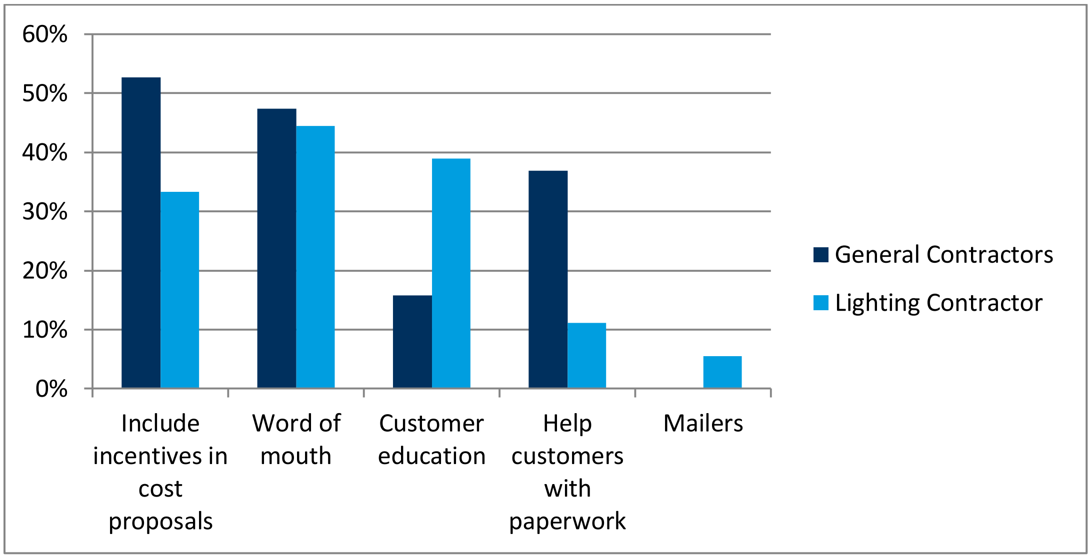


Lighting contractors promoting the program occasionally, seldom, or never, when asked why they did not promote the program more frequently, offered the following reasons:

- Some lacked time and resources;
- Many promoted the program mostly during slow times;
- Many promoted the program on a case-by-case basis, when appropriate for the customer; and
- A few reported they are gearing up to promote more in the future.

Figure 2-23 identifies contractors' promotion methods.

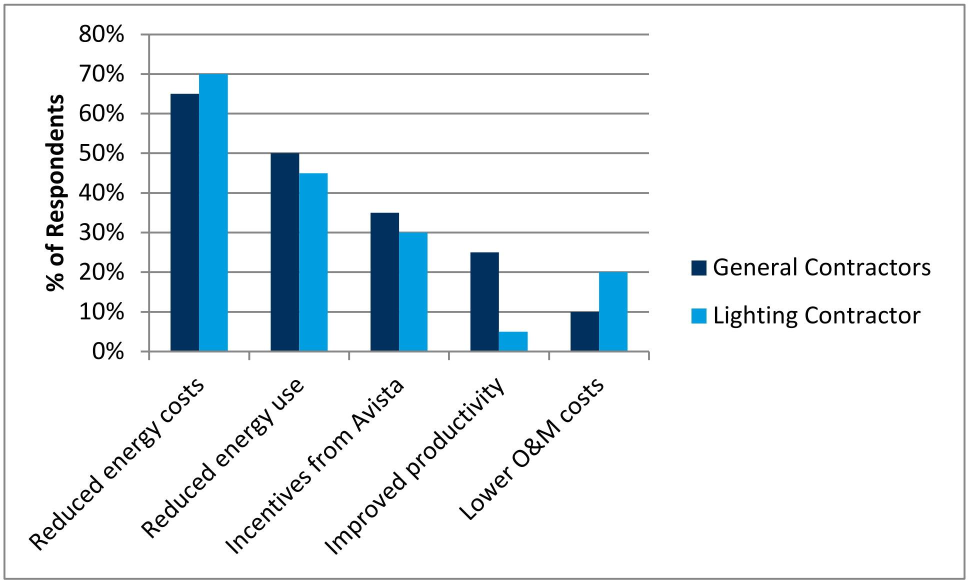
Figure 2-23. How Contractors Promote the Program



While more than one-half of general contractors (10 out of 19) including incentives in cost proposals, only one-third of the lighting contractors (six out of 18) used this approach. Next to word-of-mouth, the most common approach for general contractors (37%) was promoting through helping customers with paperwork. After word of mouth, the second most common approach taken by lighting contractors (39%) was to promote the program through customer education.

Sixty-five percent of general contractors (13 of 20) and 70% of the lighting contractors (14 of 20) more commonly promoted energy savings as a benefit, followed by reduced energy use and incentives offered by Avista. Figure 2-24 compares top benefits promoted by trade allies.

Figure 2-24. Which Benefits Trade Allies Promote to Customers

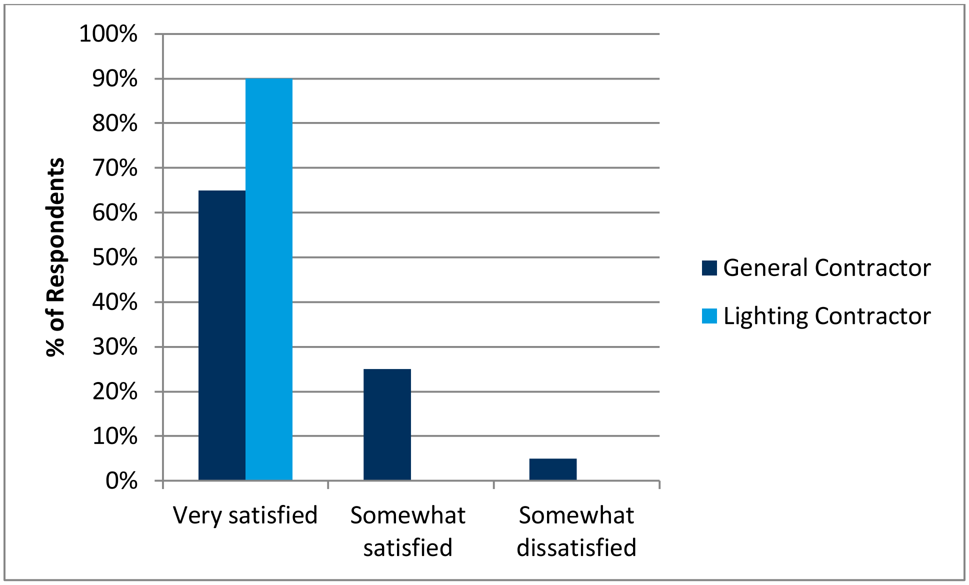


Satisfaction

The majority of lighting contractors (17 of 20) and general contractors (16 of 20) interviewed reported they were very satisfied with the overall program. Only one contractor was somewhat dissatisfied; a heating and ventilation (HVAC) contractor reported Avista should put more effort into educating contractors.

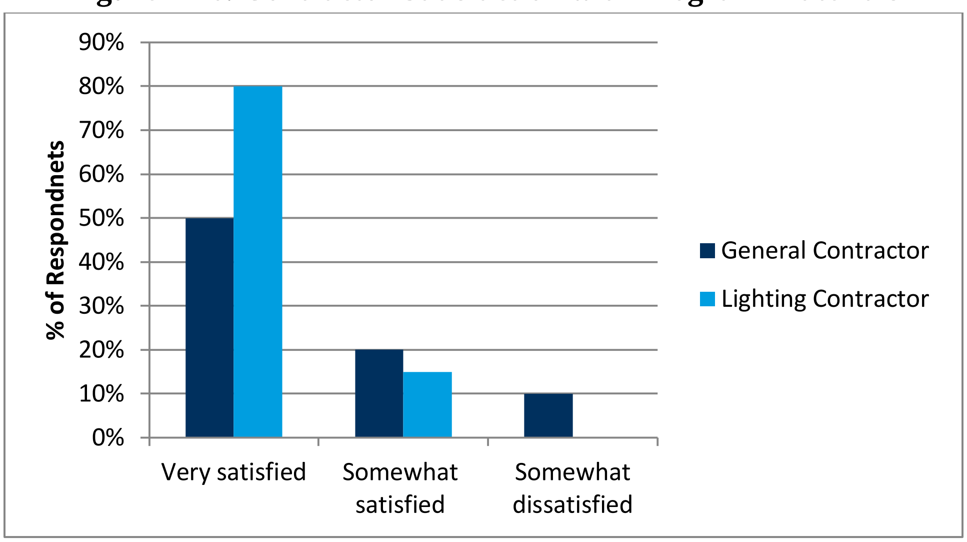
Ninety percent of lighting contractors (18 out of 20), and 65% of general contractors (13 of 20) were very satisfied with Avista representatives. Twenty-five percent of general contractors (5 of 20) were somewhat satisfied. But a few comments addressed room for program improvements. One contractor did not have an Avista contact; another reported a long wait time on the phone to get information; and another had mixed experiences (with more good than bad). One contractor was somewhat dissatisfied, reporting Avista should promote the program more. Figure 2-25 demonstrates distributions of responses.

Figure 2-25. Trade Ally Satisfaction with Avista Representatives



The majority of trade allies either received program information in the mail, through e-mail, or picked up materials at an event. Figure 2-26 shows lighting contractors expressed the highest satisfaction with materials received from Avista. While 80% of lighting contractors (16 of 20) were very satisfied, only 50% of general contractors (10 of 20) were very satisfied with program materials.

Figure 2-26. Contractor Satisfaction with Program Materials



Twenty percent of general contractors (4 of 16) were somewhat satisfied, and two were somewhat dissatisfied. Both dissatisfied contractors said detail levels provided in materials was insufficient to explain programs to customers. One commented that Avista could have done a better job letting contractors know the type of programs and incentives available.

Application Process

Most trade allies reported it fairly common to help customers fill out applications. Most general contractors (17 of 20) completed application paperwork, leaving customers to fill in personal information and submit applications to Avista. The three respondents typically not helping customers reported they believed the forms were easy to work with, and they referred customers to the Website.

General contractors who typically helped customers fill out the forms said, after several years of involvement with the program, they were familiar with the application process. One contractor noted Avista representatives did not consistently require invoices, while another contractor reported difficulty in identifying and recording efficiencies for older equipment.

The majority of lighting contractors (16 out of 20) helped their customers complete rebate applications on a regular basis. Two reported they typically tried not to get involved, while the remaining two said they did not help customers at all with the application process.

Lighting contractors indicated the application process was straightforward and easy to understand. One noted the application process became easier with the new forms. Almost all (19 of 20) reported no problems with the applications. The remaining lighting contractor did not know of application updates, and had to resubmit the updated version of the form.

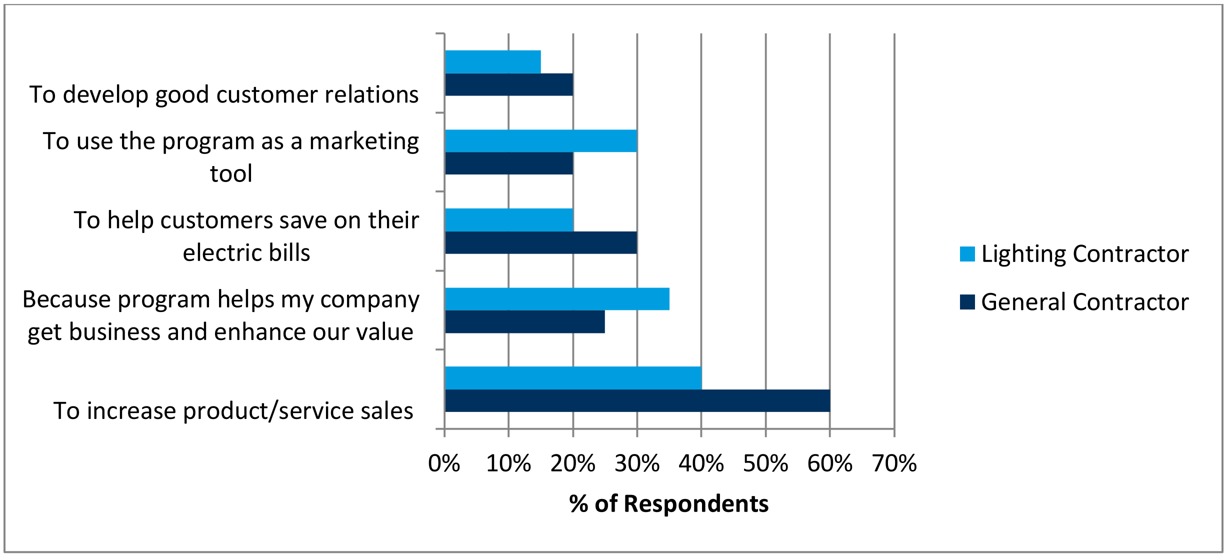
The survey sought to identify whether contractors could recommend changes to the application forms. None of the lighting contractors offered recommendations. Most general contractors (16 of 20) thought applications were fine as is; the remainder offered the following suggestions for improvements:

- Enable applications to be filled in and submitted online.\
- Applications could provide more clarity about high-efficiency window requirements.
- Overall paperwork could be reduced.

Perceived Value of Rebate Programs

When asked the Avista program's value to their businesses, trade allies agreed the primary benefit came through increased sales. As shown in Figure 27, the top three responses for general contractors were: increase in sales (12 of 20); helping customers save money on their electric bills (6 of 12); and enhancing company value (5 of 12). The top three responses for lighting contractors were: increase in sales (8 of 12), helping to add value to their business (7 of 12); and for use as a marketing tool (5 of 20).

Figure 2-27. Value Avista Programs Bring to the Company



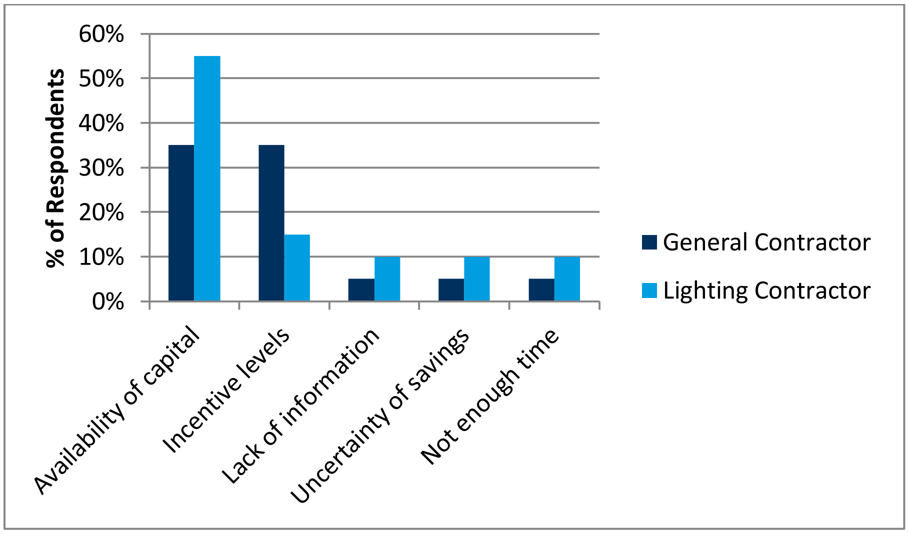
Additional points offered regarding value of programs included the following:

- There would be less business without the rebate programs.
- Customers were pleasantly surprised to hear about the rebate.
- Four general contractors reported good reputation was a selling point.

Participation Barriers

Trade allies were asked to speak about obstacles to installing energy-efficiency equipment for customers. More than half of lighting contractors (55%) cited availability of capital as the most significant obstacle, while only one-third of general contractors (35%) cited capital as an obstacle. Incentive levels proved equally relevant for general contractors. Figure 2-28 shows a range of additional responses to perceived customer participation barriers.

Figure 2-28. Trade Ally Perceived Barriers to Customer Participation



More than one-third of general contractors (7 of 20) also reported they did not perceive any obstacles to installing energy-efficiency equipment. The contractors felt that, if the customer needed to install equipment, and as long as rebates were available, the customer would not encounter obstacles. To a lesser extent, lighting contractors (3 of 22) reported incentive levels as an obstacle, while the remainder cited: lack of information, uncertainty of savings, and lack of time.

When asked how Avista could assist trade allies and customers in overcoming obstacles to financing energy-efficiency projects, not all trade allies had a ready answer. Some contractors felt there was little that could be done until the economy improves. However, contactors also offered a number of suggestions:

- Offer additional marketing to customers, particularly a handout to identify costs and benefits of upgrading to high-efficiency equipment.
- Increasing rebates, or include incentives to help pay for permit costs.
- Offer a more extensive financing program.
- Reduce waiting times for incentives, or establish a program similar to that developed by PECI for EnergySmart Grocer, which reduced customer upfront costs and wait times.

Final Thoughts and Recommendations from Trade Allies

Many trade allies working with Avista customers also had experiences with other utilities. Over one-half of general contractors (12 of 20), and just under one-half of lighting contractors (9 of 19), reported experiences working with nonresidential, energy-efficiency rebate programs at other utilities.

Comparing Avista's program with other utilities, trade allies provided unprompted, positive benefits. Of those experienced in working with other utility rebate programs, trade allies felt Avista offered the following:

- Rebate programs were straightforward and offered a relatively simple process;
- Less paperwork was required;
- Fewer barriers, such as complicated calculators or burdensome amounts of paperwork;
- Better communication, and representatives often had better responses to unusual situations; and
- Higher rebates.

More than one-half of general contractors (55%) believed Avista could offer additional energy-efficient equipment rebates. However, nearly half of the lighting contractors did not offer an opinion in this regard. Trade allies offered the following suggestions for new technologies or changes to existing technologies:

- Geothermal heat pumps;
- Tankless water heaters;

- Ductless mini-splits;
- Incentives for a resource conservation manager position;
- Incentives for long-term measurement and savings;
- Increased rebates for Powersaver capacitor to LEDs; and
- Remove cold cathode lighting products from rebate list.

A few contractors suggested incentives already offered by Avista (or offered in the past). These included: steam trap replacements; demand control ventilation; and retro-commissioning.

2.4.4 Findings Summary

Avista's informal network of trade allies works well, through word-of-mouth and strong communication with Avista representatives. Many trade allies have worked with Avista for several years or more. Overall, trade allies reported high satisfaction levels, with slight variations by contractor type. While lighting contractors indicated high satisfaction levels with program materials, they were also less likely to promote the programs than general contractors. Trade allies made suggestions for improvements in program promotions to assist customers, through additional materials or more information available online. Trade allies wanted more one-on-one communication with Avista representatives, or dedicated assistance to answer questions about the programs.

2.5 Special Report: Lighting

New federal regulations and efficiency standards will affect Avista's nonresidential customers and their lighting incentive programs. Customers will no longer be able to buy or replace widely used lighting technologies, including: magnetic ballasts; T-12 fluorescent tubes; and high-wattage, conventional incandescent light bulbs. As lighting represents a major portion of Avista's commercial portfolio electricity savings, this increase in standards (and associated non-program baselines) could significantly impact future energy savings Avista will be able to achieve.

To better understand the current status and perceptions in the market related to these changes, Cadmus added a focused set of research questions to this year's evaluation activities. These questions were integrated into planned data collection activities, and were supported by secondary research. Understanding impact levels these changes will have, and how the lighting market is changing, will prove critical for future program planning.

2.5.1 Research Objectives

Specific research objectives for this investigation, developed with Avista, included the following:

- Assess awareness of T-12 phase-outs and new lighting standards;
- Understand current use of T-12 tubes and inventories in facilities;
- Gauge customer sentiment surrounding increased standards from Energy Independence and Security Act (EISA) legislation;

- Identify trends in near-future plans for installing energy-efficient lamps and fixtures; and
- Identify the most important factors influencing lighting purchases at this time.

2.5.2 Methodology

Cadmus conducted primary and secondary research to expand our existing knowledge of the lighting market to specifically include the Avista markets. A multifaceted approach included: staff interviews; trade ally interviews; site-visit surveys; telephone surveys with participants and nonparticipants; and secondary research related to the regulations and relevant best practices.

Cadmus reviewed EISA and U.S. Department of Energy (DOE) commercial lighting regulations, and scanned publicly available information to identify trends regarding new federal lighting regulations and the lighting baseline.

Customer Data Collection

Customer data collection was integrated with other evaluation activities. All participants and nonparticipants responding to telephone surveys were asked a standard battery of lighting questions, which were more quantitative and direct (close-ended). Cadmus field technicians conducting on-site surveys asked more in-depth, lighting-specific interview questions. Table 2-13 summarizes topics included in the surveys.

Table 2-13. Research Focus for Surveys

Participant and Nonparticipant Phone Survey (n=263)	On-Site Surveys (n=41)
• Awareness of lighting regulations and the phase-out of less-efficient lighting • Sources customers rely on to procure information about energy-saving lighting technologies • Factors customers consider in purchasing lighting • Perceived benefits of higher-efficiency standards • Presence of T-12 lamps installed and in storage in the customer's facility • Plans for lighting upgrades within the next year	All questions asked in the phone survey, plus: • Specifically, which lighting types customers plan to remove or replace • Specifically. which lighting types customers plan to install in upcoming lighting projects

Sampling

Samples for telephone and on-site surveys were selected based on the impact evaluation sampling methodology. Overall, Cadmus conducted 50 site-visit surveys during the last round of the impact evaluators' scheduled verifications. Of these, Cadmus completed 21 on-site lighting surveys. Some on-site contacts were not lighting decision makers, or did not know the information required to complete the survey. Cadmus completed another 20 lighting interviews through follow-up phone calls, producing 41 in-depth surveys. In the remaining cases, customers did not have the time to go beyond site-visit engineering requirements, already required for the on-site visit.

Sampling methodologies for the telephone surveys can be found in this report's Participant Survey Sampling and Nonparticipant Survey Sampling sections.

2.5.3 Research Results: Customer Perspectives

Background: Federal Lighting Regulations

The lighting market is in early stages of a major transformation, driven largely by federal actions, in combination with recent years' new lighting technology developments. The DOE began phasing in new efficiency standards for magnetic ballasts in 2005, with additional rules created by the Energy Policy Act of 2005 going into effect between July 2009 and July 2010, and resulting in a shift to higher-efficiency ballasts (i.e., electronic). Recently enacted DOE regulations to eliminate most T12 and some low-color-rendering 4-foot T8 lamps will take effect on July 14, 2012, for new products manufactured in the United States. Although the share of T12 lamps sold has declined, in late 2011, they still accounted for 30% of sales.[11]

Conventional incandescent light bulbs also must use less energy, following a bipartisan energy bill passed by Congress and signed by President Bush. EISA took effect January 2012, with a goal of reducing the nation's dependence on foreign energy sources by increasing production of clean renewable fuels within the United States. Part of this effort includes establishing new, federally mandated, energy-efficiency standards.

Within the new standards, ranging from fuel economy targets to training a "green collar" workforce, EISA establishes consumption limits for appliances and lighting. Lighting standards place restrictions on incandescent and fluorescent lamps. Specifically, EISA sets forth a schedule for phasing out incandescent lamps of a given wattage, and replacing them with lower-wattage lamps with a minimum lamp life. EISA also sets minimum average lamp efficacy standards, measured in lumens per watt. Finally, EISA establishes requirements for ballast efficiency in new metal halide luminaires for 150- to 500-watt fixtures.

Implications for Avista

Lighting measures comprise a significant portion of program offerings. Due to the number of lighting incentives and the frequency of lighting projects, this branch of Avista's nonresidential efficiency program accounted for approximately 40% of 2011 gross savings.[12] These savings can be broken down as follows:

- Over 80% of the savings from nonresidential Prescriptive programs relate to lighting measures, equating to 18% of savings across the entire portfolio.
- Thirty percent of the savings from nonresidential, Site-Specific programs relate to lighting measures, equating to 20% of savings across the entire portfolio.

Avista currently offers numerous nonresidential rebates for interior and exterior lighting retrofits. These include incentives: of up to $500 for complete retrofits from high-intensity discharge (HID) lamps to qualifying light-emitting diodes (LEDs), induction lamps, and digital HID lamps. Replacement of incandescent lamps can qualify for rebates, when replaced with qualifying

[11] NEMA News. December 22, 2011. "Linear Fluorescent Lamp Shipments Increase During Third Quarter." http://www.nema.org/media/pr/20100831a.cfm

[12] Non-evaluated totals from Avista's program database extract (including multifamily participants).

fluorescent lamps or LEDs. Avista also provides varying rebates on custom or Site-Specific retrofits from T-12 fixtures to T-8, T-5, or qualified LED fixtures.

Implementation of efficiency standards resulting in the phase out of T-12 lighting in commercial applications has created ambiguity surrounding the new baseline for lighting measures once T-12s are removed from the market. This uncertainty about baseline efficiency assumptions directly affects future lighting program design savings projections.

Currently, the RTF is developing protocols for monitoring and verification of commercial lighting; these should be available by July 2012 to provide guidance on this issue to utilities and stakeholders.

In addition to baseline and savings potential concerns, a better understanding of customer awareness and plans in response to these changes will help Avista design and plan for future program success.

Avista Lighting Program Delivery Changes

Cadmus interviewed Avista's lighting program manager to identify any changes introduced in the past year, and to understand future goals and vision for the program. Actions taken this year include:

- Aggressive efforts to replace and remove T-12 lamps from customer facilities;
- Phase outs of HID technologies with low participation levels;
- Introduction of a more detailed rebate form;
- Expanding outreach activities to lighting vendors focused on regulated changes; and
- Updating the Website to reflect program changes.

Regarding lighting technologies affected by the new regulations and standards, Avista launched a "fire sale," offering substantially higher incentives (up to $4 per foot of T-12 removed) to remove as many T-12s from customer businesses as possible.

Avista staff also noted increased outreach activities in 2011, when they began offering additional lighting vendor training morning meetings, and focus groups, informing vendors of changes, raising awareness, and gathering trade ally feedback. Avista is drawing upon standardized industry lighting information (offered through the Bonneville Power Administration and the Northwest Energy Efficiency Alliance) to develop marketing materials for use in lighting vendor outreach. Avista has been able to offer a more formalized network to lighting vendors, with the help of events sponsored by NW TAN; however, improving overall contractor and vendor outreach remains an ongoing goal.

Finally, the Website will be updated to reflect program changes. The interviewees expect this recharged advertising approach to have a positive effect on the program, resulting in savings of 15 million kWh for the program year.

The program manager noted a consistent barrier in meeting program goals has been lack of awareness and participation among customers, which partly may be due to a struggling economy.

Customer Awareness of T-12 and Incandescent Phase Out

Cadmus asked all customers whether they were aware of the new EISA lighting standards and the required phase-out of T-12s and certain incandescent lamps. Majorities in all groups were aware, particularly Avista program participants surveyed by telephone (86%, or 139 of 162). In on-site surveys, 65% of 41 were aware of these changes; however, five of the 16 participating in a lighting rebate program were not aware.

Customer Attitudes

Customers in the telephone survey were asked what benefits they saw to the higher-efficiency standards. Nonparticipants placed significantly less emphasis on saving energy (24% of nonparticipants, compared to 41% of participants). Fewer, but multiple mentions of other benefits included: better lighting quality, and quality products.

Table 2-14 summarizes benefits identified by at least 10% of respondents. Slightly more than one-half of all respondents (participants and nonparticipants) expected to save money. Nonparticipants placed significantly less emphasis on saving energy: 24% of nonparticipants, compared to 41% of participants. Fewer, but multiple mentions of other benefits included better lighting quality and quality products.

Table 2-14. What Customers See As Benefits of New Efficient Lighting Standards

	Participant Telephone Survey	Nonparticipant Telephone Survey
Saving money	53%	55%
Saving energy	41%	24%
Lower maintenance costs	15%	~
Increased productivity	13%	~

Negative benefits identified by multiple respondents included:

- Higher costs;
- Concern that new lighting would be more hazardous;
- “No benefit to us at all”; and
- “More government controls…don’t like the government telling us to do anything.”

Cadmus also asked on-site respondents if they had concerns about the new standards’ impacts on their facilities. A strong majority (14 of 19) said they were not at all worried, with only two managers stating they were concerned. They identified costs to comply and mercury as primary issues for their concerns.

Current Use of T-12 Tubes and Inventory In Facilities

T-12s have been widely used in nonresidential facilities for decades. As part of this study, Cadmus posed a series of questions related to current and future usage of T-12 lamps. When asked if they had T-12 lamps currently installed:

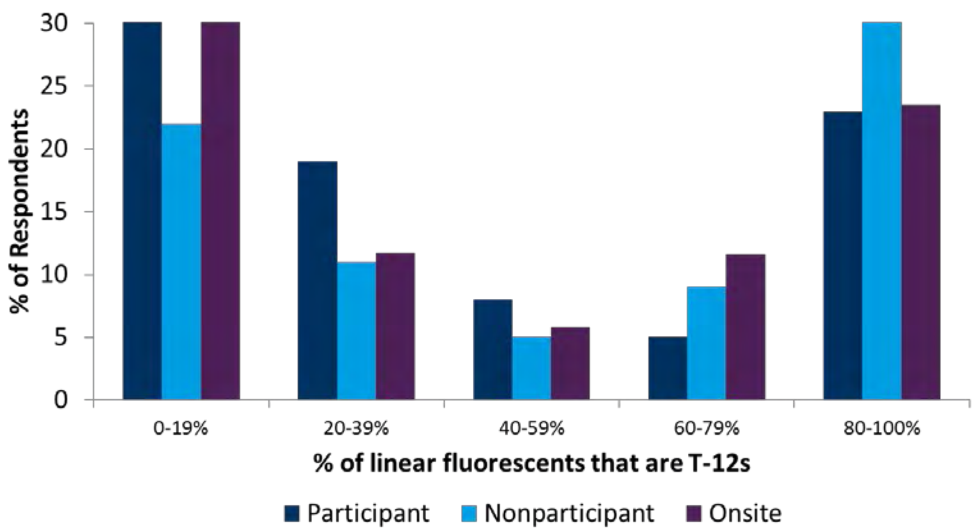
- Forty-three percent (69 of 162) of participants were sure they had T-12s installed.
- Fifty-five percent (55 of 101) of nonparticipants knew they had T-12s installed.
- Forty-one percent (17 of 41) of on-site respondents had T-12s in their facilities.

Some telephone survey respondents could not answer the question. One-quarter of nonparticipants stated they were unsure whether they had this lamp type, a significant response compared to participants, where less than 7% were unsure. Cadmus has observed communications from other utilities, distributors, and energy-service providers explaining how customers can determine if they have T-12 lighting. Several make effective use of circles drawn to "actual size" showing the 1.5" diameter for a T-12, compared to a 1-inch circle for a T8.

Respondents who knew their facilities had T-12s were then asked what percentage of all linear fluorescent lamps in their facilities were T-12s. Responses across the survey groups were polarized, showing some customers with 80% or more of T-12s and, at the other end, a majority with less than 20% of their lighting utilizing T-12s. Figure 2-29 summarizes the percentage of lamps installed in customer facilities.

- Avista program participants were less likely to have a large share of T-12s remaining in their facilities: 39% of participants (27 of 69) compared to 22% (17 of 55) of nonparticipants reported less than 20% of their fluorescent lighting had T-12s.
- Conversely, more nonparticipants had higher percentages of T-12s in their fluorescent lighting (31% had more than 80% T-12s, compared to 23% of participants).

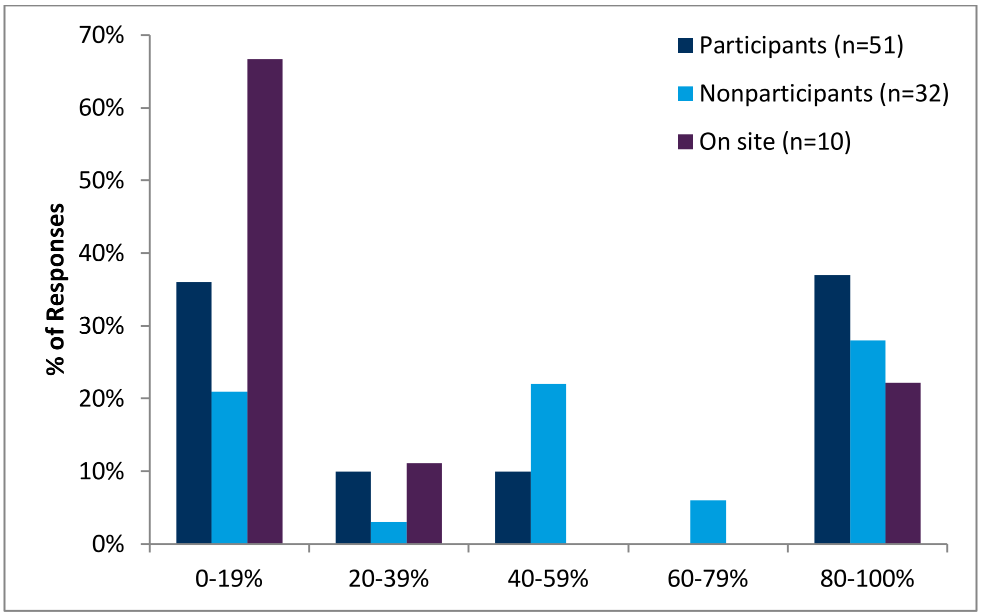
Figure 2-29. What percentage of all linear fluorescent lighting in your facility is T-12s?



In follow-up questions for those knowing they used T-12s, customers were asked whether they had T-12s in storage, and, if so, what percentage of their current T-12s could be replaced with those in storage. The majority of customers surveyed kept replacement T-12s in inventory in preparation for future burn-outs. Figure 2-30 summarizes the percentage of installed lamps that could be replaced by stock in inventory.

- Overall, 74% (51 of 69) of participants using T-12s had replacement lamps available. Approximately equal numbers had significant stock as those with only had a few extra lamps: 36% said they could replace either 0% to 9% or 10% to 19% of their T-12s, while 37% could replace 90% to 100% of their T-12s.
- Fifty-eight percent of the 55 nonparticipants using T-12s had more T-12s in storage. The other 23 nonparticipants will have to change bulb types when their currently installed T-12s burn out. Of the 32 with T-12s in storage, nine said they had enough to replace 90% to 100% of currently installed lamps.
- Fifty-nine percent of on-site survey respondents (10 of 17) had replacement T-12s in storage, but only two respondents said they had enough to replace all T-12s in their facilities; the other eight respondents only had enough T-12s in storage to replace 20% or less.

Figure 2-30. What percent of T-12s currently installed could be replaced by T-12s in storage?



In the on-site surveys, customers were asked about ballast types. The most common responses from managers were: they did not know (33%); or they only had magnetic ballasts (33%). As EISA has separate standards for magnetic and electronic ballasts, it will be necessary to ensure customers learn about their ballast types to know whether they can replace their fixtures with the same types.

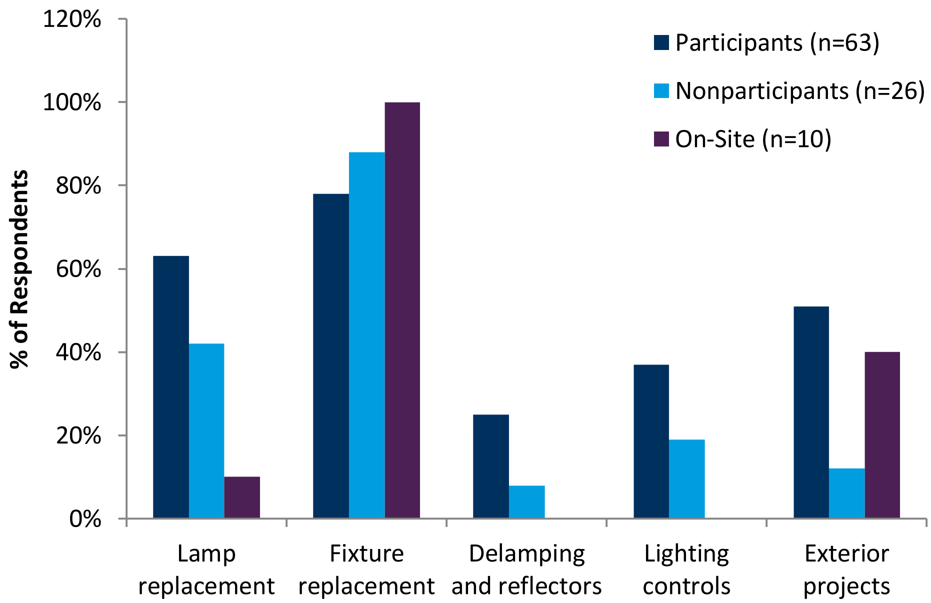
Future Lighting Projects

Cadmus asked customers whether they planned on upgrading their lighting, and if so, what types of changes such projects would include. Despite the phase-out of T12s and changing standards, nearly two-thirds of all customers surveyed did not have plans for lighting upgrades. More program participants (40%) planned upgrades than nonparticipants (28%) or on-site survey respondents (24%).

As shown in Figure 2-31, the majority of those planning projects will include indoor fixture replacements. All respondents to the on-site survey included fixtures in their plans. The majority of these were removing T-12s with magnetic ballasts, with other planned lighting removals including: high-pressure sodium bulbs; HIDs; T-5s; T-8s; and T-12s with electronic ballasts. For replacement fixtures and bulbs, the most common response was to use T-8s. Other responses included: T-5s; LEDs; and ceramic metal halide HIDs. According to facility managers, fixtures replaced tend to be in high- or medium-use areas.

Exterior lighting upgrades were planned by four of the 10 respondents in the on-site survey. Each of these four respondents planned to replace a different type of bulb (HID, CFL, LED, and other).

Figure 2-31. Which of these do you think the project will include?

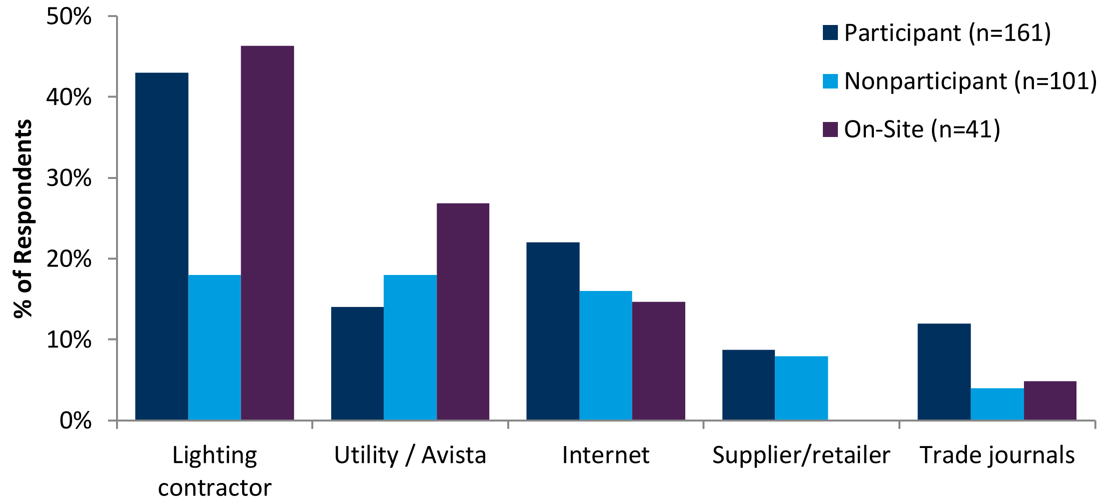


Information Sources

Cadmus asked customers and facility managers where they typically received information about energy-efficient lighting. As shown in Figure 2-32, the most common response was: lighting contractors provided the best source for learning how to save money on lighting-related energy costs. For program participants, the high percentage (43%) identifying lighting contractors was partly influenced by participation in Prescriptive programs. Fifty-three percent of participants in Prescriptive programs (37 of 70) cited lighting contractors as information sources. Avista and the Internet were also mentioned as information sources.

Nonparticipant responses show less consensus regarding information sources, with approximately equal numbers of nonparticipants identifying utilities, contractors, and the Internet.

Figure 2-32. Where do you usually get information about lighting technologies that could save energy and money for your business?



Respondents were asked the most important factors they consider when purchasing lighting. Results included:

- Overall, total project costs and energy efficiency of equipment were most frequently mentioned.
- Lighting quality was mentioned by more than 20% of respondents, the only non-cost related factor mentioned frequently.
- Achieving energy savings sufficient to pay for the project and return on investment were mentioned more frequently in the on-site surveys.
- Other factors receiving multiple mentions included: aesthetics, reliability, and codes and regulations.

These responses indicate that, while energy efficiency certainly matters, cost continues to be a dominant factor in purchasing decisions.

2.5.4 Research Results: Trade Ally Perspectives

Cadmus interviewed 40 contractors, 23 of whom worked on lighting projects, and were asked four questions related to EISA legislation. Specifically, Cadmus inquired about: their awareness of the near-future phase-out; whether their customers' were informed; what the reactions have been; and how the new standards might affect their businesses.

Awareness of DOE and EISA Changes

A significant majority of the lighting contractors (19 of 23, or 83%) knew (and were knowledgeable) about EISA legislation concerning phasing-out of T-12s and incandescent bulbs. Only two respondents did not know of the upcoming changes; and two had heard something about EISA, but did not know any details.

Cadmus probed further to find out what these contractors had heard about the new standards. Contractors generally said they were familiar with the changes, and were planning ahead, moving customers away from T-12s, and targeting additional projects for removals of T-12s. One respondent stated some general confusion existed about the date of enforcement, and he had heard it was being postponed. Another contractor commented he did not think T-12s would suddenly disappear. He predicted stockpiling would become common, and the bulbs would be traded around the market for several years.

Discussions and Reactions with Customers

When asked whether they had discussed the new lighting standards with their customers, about one-half of lighting contractors (13 of 23, or 57%) confirmed they went over the details of the changes, and suggested alternatives for future installation. Four contractors stated they had mentioned it to customers, but not discussed it. Six contractors (26%) had not brought the topic up with customers. These results show most contractors have been explaining the issue to customers, but a notable proportion has not passed on the information. Further, in expanding on this issue, contractors identified other obstacles related to customers. Contractors said, when bringing the standards up with customers, customer responses included:

- Thinking they were being forced to use CFLs, and not being pleased with that option;
- Being concerned about the quality, dimming, and cost of new bulbs; and,
- Disliking federal regulations on lighting, and worrying about the limited lighting alternatives.

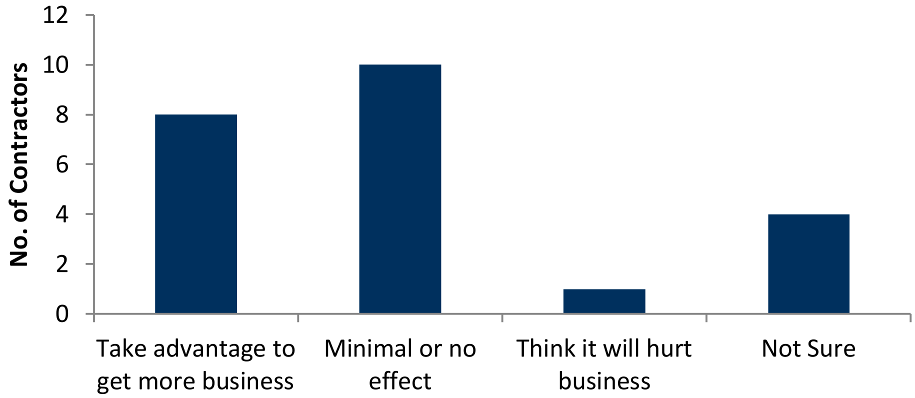
Some contractors noted some customers “are in for a rude awakening,” particularly those uninformed and “who are not forward thinking” (putting off upgrading). Two contractors specifically stated their customers were worried they would upgrade to T-8s, and then those would be phased out as well.

Only two contractors noted positive feedback from customers regarding the new standards, with both saying their customers generally wanted to get the conversion over with, and take advantage of rebates while they remained available.

Effects on Contractor Business

Given the reach of changing standards and the recent flood of newly available rebates, Cadmus asked contractors if they have adjusted their business approaches to account for the changes. Responses are shown in Figure 2-33.

Figure 2-33. How do the changing standards affect your business approach, products, or promotions?

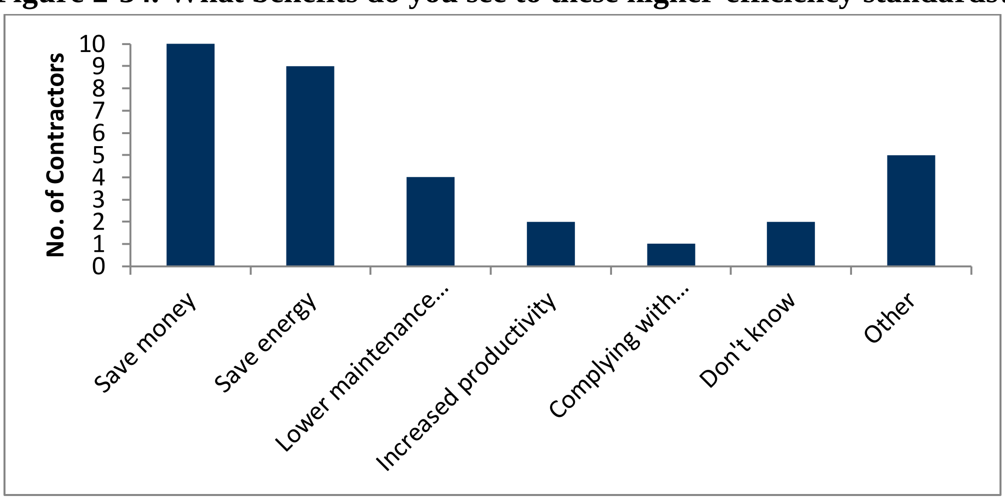


The largest group (10 of 23, or 43%) stated the new standards would have minimal or no effect on their business plans. These contractors stated the phase-out does not come up in their work, or they might suggest some new bulb types, but leave most decisions to customers, without additional marketing.

Eight contractors (35%), however, said they planned to use or are already using the new standards to their advantage. This group actively markets required upgrades, promoting specific lamps and bulbs as part of their sales pitches, and using the rebate opportunities to push and create new projects. A much smaller group (4 of 32, or 17%) were unsure, and said they may figure out methods for incorporating the phase-out into their business plans, but had not yet done so. Finally, one contractor was concerned the changes would hurt his company, and might put him out of business.

In a final question, Cadmus gave contractors the opportunity to comment on any benefits they saw to the higher-efficiency standards. Responses were coded, based on a predetermined list of potential answers, as shown in Figure 2-34.

Figure 2-34. What benefits do you see to these higher-efficiency standards?



Contractors generally noted higher standards would save money and energy. Among those providing an “other” answer, responses identified the possibility of better products being offered, easier installations, and more work for contractors.

Response by Other Utilities and the Lighting Industry

The response to the new lighting standards and regulations varies across the United States. Many utilities have offered enhanced incentive programs, typically high-level incentives or a bonus program with an extra percent added to the incentive (i.e., 10%). Many of these have time limitations or have already ended. SMUD took a slightly different approach, offering a special “Large Prescriptive Lighting Program,” with incentives up to 50% of the project cost, paid only to lighting contractors or Energy Services Companies doing the installations, with a requirement that all T-12 general lighting fixtures in a facility had to be upgraded.[13]

Table 2-15. Example of T-12 Rebate Communication via Trade Ally

PG&E extends rebates past federal deadline on lamp efficacy standards

Are you still using T12 linear fluorescent lamps? If so, please read the following information about new laws, rebates, and deadlines!

You may already be aware that new general service fluorescent lamp efficacy standards will take effect on July 14, 2012. This comes as a result of the legislation from the DOE, and will impact the availability of many of the 4-foot T12 and 2-foot T12 U-shaped lamps, 8-foot T12 lamps and some 4-foot T8 lamps in the marketplace.

PG&E understands the significant impact this will have on the industry and in particular customers who plan to use PG&E's existing incentives. In an effort to support their business customers and facilitate a smooth transition to the new standards, PG&E will continue to offer incentives until 12/31/12 for the following energy efficiency improvements:

- Upgrade from T12 to a T8 lamp and electronic ballast
- De-lamp T12s
- Upgrade T12 fixtures to more efficient interior fixtures

After December 31, 2012, PG&E will no longer offer incentives on these specific measures. Lighting projects must be completed by the end of the year and related applications submitted by March 1, 2013 to qualify for a rebate.

Please contact me if you are interested in seeing how you can take advantage of the rebates temporarily available before it's too late! The cost of T12 lamps after they are no longer manufactured will be dramatically higher and there will be no rebates to help you switch over to energy-efficient T8 systems

Notice sent out by Sales Manager
American Wholesale Lighting

Some companies, such as Duke Energy in Indiana, have already ended rebates for replacements of T-12s by T-8s in Prescriptive programs. Duke allows customers to continue to apply for incentives for T-8s through its custom program, which requires pre-approval and additional process steps. PG&E, on the other hand, is communicating about changes to customers through

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13 https://www.smud.org/en/business/save-energy/rebates-incentives-financing/documents/Commercial-Prescriptive-Lighting-Large.pdf

trade allies, and offering additional time beyond the date when the new standards take effect, and a nearly a year's notice that the incentive program will end.

Utilities have adopted different communications strategies regarding the upcoming changes. As with Avista, many are first communicating with lighting contractors and trade allies. Some utilities are also calling explicit attention to upcoming changes through Websites and newsletters, taking a more proactive and informing role, to make sure customers know the utility offers help in incentive programs (for a limited time).

With the obvious concern about the baseline to be used in future energy calculations, debate exists about when the shift should take place. For example:

- Wisconsin regulators and evaluators determined there would not be a T-12 baseline after 2010.
- Mass Save, the state-wide Massachusetts program, proposed to regulators that they should not account for the shift immediately. They proposed delaying the decision until more is known in 2013 about the installed base, stockpiling, prevalence of exempt lamps, and other factors.
- Vermont regulators and evaluators initially directed there should no longer be a T-12 baseline after 2011. Efficiency Vermont renegotiated and proposed a baseline shift to occur in 2015, on the basis of installed base lamp life, exempting lamps and price/scarcity concerns with rare earth phosphors.
- The Energy Trust of Oregon contends programs should be able to claim market transformation savings for the standard itself until 2017, crediting the efficiency programs for the successful penetration of higher-efficiency T8s and HPT8s.

Presently, the RTF is in the process of developing protocols for the evaluation, measurement, and verification of commercial lighting. The project has been defined to include: "definition of best practices and analysis of baselines under new state building codes and federal lighting equipment standards."[14] This work should become available by July 2012 to provide utilities and stakeholders with guidance regarding this issue.

2.5.5 Findings Summary

- T-12 lamps remain present in significant numbers, both in facilities and in inventory stock for replacements within Avista's territory.
- Although some customers have already taken action to upgrade lighting fixtures, many have not. With one in three nonparticipants unaware of upcoming changes, and only 57% of lighting contractors talking to their customers about these changes, a substantial portion of customers may not understand the need to act or the options available.
- One-fourth of nonparticipants and 7% of the participants were unsure whether they had T-12s in their facilities. Reviews of industry and other utility promotions used pictures

[14] http://www.nwcouncil.org/energy/rtf/subcommittees/comlighting/SOW_ERS_RTFLightingProtocol_020912.pdf

and explanations to describe T-12s. This suggests this may be a common problem in some parts of the nonresidential market.

- Customers who have not participated in Avista energy-efficiency programs are more likely to have higher percentages of T-12s in their facilities, and more than half of these have T-12s in inventory for replacements.
- Although survey respondents most commonly cited total project, lighting quality also rated highly as an influence in lighting purchase decisions, and should be addressed in communications about new technology.
- Lighting contractors were most frequently cited as the sources where customers received efficient lighting information from, yet not all contractors surveyed were communicating about the upcoming changes in the lighting market.

2.6 Marketing and Outreach

Avista utilized a variety of marketing and outreach channels to promote its programs to business customers in 2011. These included: a Website; a monthly newsletter; direct communications; collateral; and print ads. A new marketing campaign was launched during the 2011 program year, and continues throughout 2012, with additional dedicated marketing funds for nonresidential programs. This stands in contrast to prior years, where marketing funds primarily were focused on residential programs. These new marketing efforts have included a Power Breakfast series, followed by: a print advertising campaign; Website improvements; updated program handouts; and targeted outreach efforts, designed to provide more face-to-face communications with customers and trade allies.

2.6.1 Research Objectives

Research objectives for the marketing and outreach component included gathering information about how programs are promoted to nonresidential customers. Research included the following objectives:

- Identifying marketing strategies;
- Identifying how accessible customers and trade allies found the program;
- Identifying marketing and outreach efforts for leveraging the existing supply chain;
- Determining marketing strategy's ability to target C&I audiences; and
- Gaining insights into marketing efforts to remove participation barriers and to facilitate customer communication.

2.6.2 Methods

Cadmus' review of marketing and outreach has been based on interviews with Avista's marketing team, program staff, account executives, customer surveys, trade ally interviews, and a review of marketing resources online and in print. Marketing materials reviewed for the 2011 evaluation included the following:

- 2011 ELB Plan At-A-Glance
- Business customer Websites (including Efficiency Avenue)[15]
- Print advertisement, featuring Jack and Jerry
- Business Incentives Brochure
- Power Breakfast materials (workshop presentation and E-blast)
- Commercial Lighting Incentives Program Announcement Flyer
- Commercial Lighting Focus Group Meeting Notes

2.6.3 Research Results

Marketing Strategy

During process evaluation interviews, Avista's marketing team highlighted the successful launch of a new nonresidential program marketing campaign, featuring:

- Customer testimonials during a Power Breakfast series;
- Development of print advertisements with case studies; and
- Planned improvements to the business Website.

Marketing staff will also allocate more time in the coming year to enable updates and improvements to the nonresidential Website. While a detailed marketing plan exists for the residential programs (under the umbrella of the Every Little Bit campaign), no detailed strategy was identified for the nonresidential programs. The marketing team collaborated with the nonresidential program staff to determine expanded marketing efforts in 2011, including the following activities:

1. Website use for provision of key program information and forms;
2. Collateral (newsletter and brochures) development and dispersal;
3. Print advertising campaign, featuring business case studies;
4. Direct communications with new and existing business customers via face-to-face meetings, phone, and e-mail;
5. Customer outreach through Power Breakfast series; and
6. Trade Ally outreach, divided into non-lighting and lighting categories.

Direct Outreach

Avista account managers are responsible for recruiting and assisting large customers with nonresidential energy-efficiency programs. Direct outreach is provided consistently through daily contact, e-mails, phone calls, and personal visits. Account managers report that much of their work, including providing assistance with the enrollment application process, helps

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[15] http://www.avistautilities.com/business/pages/default.aspx

customers identify project opportunities. Through these efforts, account staff generate interest in the programs, and maintain long-term relationships with customers. This approach ensures high customer satisfaction, and often encourages repeat program participation.

Program staff reported a number of efforts currently underway to increase outreach efforts to customers through face-to-face meetings, focus groups, breakfast meetings, and other featured events. The Prescriptive lighting program manager reported a launch of focus groups at the end of 2011, continuing throughout 2012. The focus groups seek to inform lighting vendors of new program changes, and gather direct feedback regarding the proposed changes. Avista's lighting program manager noted that, although the first meeting resulted in a small turnout, the informal meeting was well received by lighting vendors.

Power Breakfast Series

Avista conducted a Power Breakfast series to reach out to business customers and trade allies. On separate occasions, the meetings were held in Spokane Valley, Washington, and Moscow, Idaho. This series was promoted with an E-blast and mail invite, encouraging business customers to attend. The meetings showcased successful projects presented by Avista business customers. Customers shared their stories about selected projects, and how their businesses benefited from Avista's energy-efficiency programs.

A total of 66 customers attended the Spokane Valley Power Breakfast, and 48 customers attended the Moscow Power Breakfast. The marketing team, program staff, and account managers reported the Power Breakfast meetings were well received by attendees, and considerable positive feedback was gathered. The majority of attendees found the meetings useful or very useful.[16] Attendees provided feedback on topics of interest for future meetings and types of energy-efficiency programs they would like to see offered.

The marketing team noted that, although they could show anecdotally an increase in program interest following these breakfast meetings, they have yet to find a way to track these metrics.

Print Advertisements

During the 2011 program year, Avista launched a business-focused print advertising campaign, spotlighting the testimonials gathered for the Power Breakfast events. The case studies featured in the print ads highlighted program benefits and easy steps to program participation. Images of facility managers were large and engaging, creating an emotional connection for viewers. These and other case studies will continue to be developed for print advertisements throughout 2012.

Program Brochure

Avista's Business Incentives Brochure was updated in 2011, and provides key energy-saving information and benefits for the C&I customer. Messaging on the cover—"Cut Costs, Minimize Impact, Meet Growing Energy Demand through Efficiency"—quickly and clearly emphasized benefits. The messaging is overlaid with photographs of people in business settings, providing information about Avista's standard and custom program offerings. The interior of the brochure highlighted energy-saving tips for commercial customers. Bold headlines emphasized key topics,

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[16] Information provided *Energy Solutions Power Breakfast Series*, October 4 & 5, 2011.

and enabled the reader to scan the program information quickly. The evaluation team did not find the program brochure on the business Website.

Business Website

During 2011, Avista updated the business Website's content and organization, reflecting program changes, adding new forms, and featuring customer testimonials highlighted during the Power Breakfast series.[17] The business Website opens to an example of a successful customer project, and five easy steps to reduce energy and save money. The business Website visitor can then: choose from a variety of links, identifying energy-efficiency options by state; review a number of nonresidential project case studies; or visit Efficiency Avenue. Efficiency Avenue—a feature of the Every Little Bit residential program campaign Website, where customers can tour an imaginary business park, and click on pop-outs, demonstrating energy-efficiency opportunities and rebates by sector (for example, mixed use, agricultural, industrial, warehouses, and schools).

The Washington and Idaho Commercial Energy Efficiency Programs Webpage (linked from the business Webpage) provides a hyperlinked list of all available programs.[18] The Prescriptive programs include downloadable application forms for each program, with detailed program information, benefits to customers, and eligibility requirements for each program. The Site-Specific Webpage contains a description of the program, but no detailed guidelines.

Findings Summary

Avista's expanded marketing campaign, and increased number of outreach events, indicate a focused strategy for nonresidential programs in 2011, with plans for continuation of these efforts in 2012. Using a wide variety of marketing channels and strategies, Avista's marketing team and program staff are pursuing more direct outreach opportunities with customers and trade allies through: Power Breakfast meetings; developing customer success stories through testimonials; and updating the Website to be more user friendly for business customers. Many of Avista's marketing strategies align with best practices for C&I energy-efficiency programs.[19] Through these outreach events, Avista staff can gather direct feedback from customers, enabling more targeted marketing opportunities.

2.7 Application Processing and Data Tracking

During the 2010 process evaluation, Avista's implementation team and account managers indicated they wished to learn more about the ease of enrollment processes from participants' perspectives. Feedback gathered from customers and trade allies indicated that, in some cases, additional assistance or guidelines would be helpful, especially for complex projects requiring more documentation. With this information, Avista updated some application forms (and

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[17] avistautilities.com/business

[18] http://www.avistautilities.com/business/rebates/washington_idaho/Pages/default.aspx

[19] Best Practices Benchmarking for Energy Efficiency Programs; http://www.eebestpractices.com/index.asp Study managed by Pacific Gas and Electric Company, under the auspices of the California Public Utility Commission and in association with the California Energy Commission, San Diego Gas and Electric, Southern California Edison, and Southern California Gas Company.

corresponding worksheets), and instituting these changes on the Website. This section discusses some changes made to the application forms, and revisits participant data tracking issues identified during the 2010 evaluation.

2.7.1 Research Objectives

For the 2011 evaluation, research topics were gathered from staff to assess the ease of forms' use, and any changes instituted with participant tracking systems over the past year. Therefore, the application form and database review sought to achieve the following objectives:

- Assess the ease of use of program enrollment forms and data processing;
- Assess completeness, accuracy, and consistency of forms and the data tracking database; and
- Assess the ability to provide useful information for tracking and evaluation.

2.7.2 Methods

Methods used to assess the application processing and data tracking components for the nonresidential energy-efficiency programs included: review of application forms and data tracking systems; and collection of feedback from staff interviews. Feedback collected from customers and trade allies have been discussed in previous sections.

To better understand and assess the enrollment forms and data tracking procedures, the evaluation team reviewed the following materials:

- Prescriptive rebate applications;
- Site-Specific contracts and worksheets; and
- Database participant extracts.

2.7.3 Research Results

Review of Prescriptive and Site-Specific Application Forms

To enroll in nonresidential programs, customers must fill out application forms or contractual agreements to apply for Prescriptive and Site-Specific rebates. The number and type of required application forms and documents varied, depending on program types, eligibility requirements, and types of measures installed.

For projects eligible for a Prescriptive rebate, customers complete and submit one application for each measure type, following the project's completion. Avista provides measure-specific rebate forms on its Website (downloadable as PDFs), with each providing instructions and specifying eligibility requirements, payment amounts, payment procedures, and terms and conditions. Typically, Prescriptive enrollment forms provide Avista customers and contractors with the information necessary for completing a program-qualifying project. Upon project completion, customers or contractors submit rebate applications with necessary materials, outlined in the forms.

In contrast to Prescriptive program requirements, customers receive Site-Specific forms, once contact has been established between an account executive and a customer, determining eligibility for program rebates. Site-Specific projects usually are more complex, and require supplemental forms, such as calculation worksheets and customer contracts. Avista's business home Website provides basic, Site-Specific program information to customers, including incentives and eligibility requirements. However, by design, Site-Specific forms are not included on the Website.

Changes to Forms

Avista's account executives reported they spend a fair amount of time helping customers fill out application forms for the program's contractual requirements. Some customers indicated the forms contain some redundant questions. Based on this feedback, account managers noted the Site-Specific forms particularly could be streamlined. However, the engineering team noted the difficulty in balancing the customer desire to streamline Site-Specific forms when all fields are needed to collect necessary project information and ensure accuracy of savings estimates.

Avista updated and revised some application forms, based on input from the 2010 evaluation. These included: lighting incentive forms; and the new programs for 2012, including the Natural Gas HVAC, Standby Generator Block Heater, and Window and Insulation programs. The revised and newly added program forms use a new format, with the changes enabling customers to fill in the information electronically, print the document, and mail it to Avista.

At Avista's request, Cadmus' engineering team revised several project calculation worksheets at the end of the 2011 program year, including updated measures, corrections, and other improvements. Cadmus recommended form changes to correspond with the calculation worksheets, and improve accuracy of savings estimations.[20] Such adjustments included questions collecting additional data points for lighting incentives, food service equipment, and premium efficiency motors forms; these address: operating hours and days per year, holiday hours, confirmation of usage variables differing by measure type, and other measurements to improve savings estimates. During the review of updated forms online, Cadmus found these additional data points had not been incorporated in the forms.

The lighting program manager reported that several changes were made to the lighting forms, launched in 2012, which enabled Avista to separate lighting incentives into two forms, and to incentivize different configurations. One form, established to promote a "fire sale," sought to motivate customers to change out as many T-12s as possible through increased incentives, paying $4 per linear foot of T-12s replaced. The second form lists all other interior and exterior lighting, including some new incentives added for digital HID and LED lighting measures. The program manager explained that, as a part of this upgrade, some of the prior 400-watt HID to 200-watt HID forms were discontinued, due to low participation.

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[20] Specific recommendations were outlined in a memo from Cadmus to Avista: "Suggested Changes to Forms." November 23, 2011.

Review of Participant Tracking Processes

Avista maintains two primary databases for tracking participants and projects:

- Sales Logix tracks program participant activity; and
- Tracker follows Site-Specific projects through the pipeline, from eligibility and installation, to inspection.

Program staff uses Sales Logix to enter customer participant information, following engagement in the enrollment process. Account managers or program staff enter names of eligible participants and installed measures into the database, and record savings, costs, and incentive payments. Avista's Prescriptive program manager reported a new system was instituted in 2011, which checked for missing data on a weekly or monthly basis. At the time of this evaluation, documentation of these procedures were still in development.

Participant Database Review

The 2010 evaluation of Avista's database sought to ensure necessary information existed in the forms and databases. During the review, Cadmus found a number of data inconsistencies, and missing data fields, which presented evaluation challenges. To assist Avista's implementation team's understanding of the information required to ensure program information could be evaluated, Cadmus provided an evaluability assessment table. (Appendix 2A presents the evaluability checklist provided in the 2010 process evaluation report.)

During the 2011 database review, Cadmus found many similar issues. Several data fields, identified as existing in Sales Logix, and participant extract database fields contained incomplete or inaccurate data. In many cases, data simply were missing (as in account and phone number fields); in other cases, a zero or a series of zeros was entered to fill empty cells. Nuances in contact name spellings, phone numbers, and e-mail addresses caused evaluation challenges, such as in comparing of participant and nonparticipant databases, and difficulties in developing survey and site-visit samples.

To specifically highlight some data tracking issues problematic for the 2011 evaluation, Table 2-16 lists the most critical data types where information has not been collected or reported, or where inconsistencies appeared. The middle two columns indicate whether the data field exists in Sales Logix and the extract database. The last column provides an explanation of specific issues.

Table 2-16. Prescriptive and Site-Specific Data Tracking

Data for Tracking and Evaluation	Sales Logix	Field in Extract Database	Explanation
Customer Acct Number	No	Yes	Inaccurate or Missing Data
Project Site Address	No	No	Not in Sales Logix or Extract
Contact Name (first, last)	No	Yes	Not in Sales Logix & Inconsistent in Extract
Phone	No	Yes	Inaccurate or Missing Data
Fuel Type	Yes	Yes	Missing Data
Program Type	Yes	No	Missing Field in Extract
Measure Type	Yes	Yes	Need Separate Field with More Detailed Measure Type
Measures Quantity Installed	No	No	Collected in Forms but Not in Sales Logix or Extract
Equipment Details (Manufacturer, model…)	No	No	Collected in Forms but Not in Sales Logix or Extract
Installation/Completion Date	Yes	No	Tracked in Sales Logix but not in Extract

2.7.4 Findings Summary

From the review of application forms and databases, interviews with staff, and survey results, Cadmus concludes some data fields needed for program evaluation are not being tracked or are being reported inconsistently. Data tracking improvements could enhance data quality and ensure programs can be evaluated. Although improvements have been made to some application forms, participant and tracking databases still exhibit a lack of integration. As Avista moves toward integrating these databases over the next few years, this integration may reduce errors resulting from data transfer and reporting. Having an integrated customer information system may also reduce the burden of data requests for evaluations.

Evaluation of the participant database resulted in the following, specific observations:

- Missing or inconsistent data were found in the following fields:
  - ➢ Customer Account Number
  - ➢ Contact Name
  - ➢ Phone Number
  - ➢ E-mail Address
  - ➢ Fuel Type
- Fields critical to the evaluation are not being tracked in Sales Logix or being reported in extract databases. Inability to identify specificity of program and measure detail created challenges in selecting unique participants for survey sampling. Lack of business or site addresses created additional challenges for site-visit sampling. Missing fields include:
  - ➢ Business Address
  - ➢ Program Type

- Measure Descriptions
- Measure Quantity

- Updated application forms do not account for some data points, added to revised program worksheets. Adding these fields would enhance the accuracy of savings estimates.

2.8 Program QA and Verification

Avista's QA and inspection procedures for nonresidential projects differ by program size and type. Site-Specific projects in particular, and projects that require measurement, verification, and evaluation require more rigorous QA processes. Avista's account managers and engineers use a database called Tracker to follow these type of projects throughout the pipeline, checking that program requirements are met, flagging high risk projects for inspection, and reviewing M&V. A project authorization protocol for Tracker enables communication regarding the approval process.

Database QA is handled through a separate process. As discussed in the previous section, program staff enters participant data into SalesLogix, the program database used for tracking enrollment, installation, and incentive payments. Data is checked periodically to ensure more accurate reporting. This section discusses Avista's QA and inspection requirements for nonresidential programs.

2.8.1 Research Objectives

Reviewing Avista's QA and verification procedures sought to determine the extent and documentation of systems used to track and verify program savings. Research objectives included:

- Identifying and documenting procedures for determining program eligibility;
- Identifying and documenting procedures for pre- and post-project inspections; and
- Identifying and documenting QA procedures for data collection, large project calculations, and rebate processing.

2.8.2 Methods

For the 2011 QA research, Cadmus interviewed Avista program staff, account managers, engineers, and members of the PPA team. We reviewed specific materials outlining QA and verification procedures, including:

- Energy Solutions DSM Portfolio Process Analysis, and other reports;[21]
- E-mail communications from staff, discussing verification requirements and procedures; and
- Dual Fuel Incentive Calculation (DFIC) policy procedures.[22]

[21] Energy Solutions DSM Portfolio Process Analysis.

[22] DFIC Version T: Policy Rules for the Calculation of Customer Incentives.

2.8.3 Research Results

Pre- and Post-Inspections

Program staff reported Prescriptive programs had no specific requirements for pre-inspections, and post-inspections were only conducted for projects perceived as high risk. These could include programs undergoing recent changes or projects with new contractors. For example, additional post-inspections are being conducted in 2012 for lighting projects, due to recent changes to the lighting program, and identification of new lighting contractors.

Though Site-Specific projects did not require pre-inspections, in contrast to Prescriptive programs, all Site-Specific projects required post-inspections. Program staff indicated facility scoping audits, conducted for about 20% of Site-Specific projects, also served as informal pre-inspections. Account executives helped to determine which projects should receive pre-inspections. This information was flagged and communicated in Tracker, the project database enabling program staff and engineers to follow Site-Specific projects (or projects requiring evaluation reports) throughout the pipeline.

Cadmus researched industry standards regarding project inspections for C&I energy-efficiency programs, identified by reviewing best practice reports at the Best Practice Benchmarking for Energy Efficiency Programs Website.[23] Table 2-17 lists best practices identified for pre- and post-inspections for lighting, HVAC, large comprehensive projects, and new construction programs.

Table 2-17. Pre- and Post-Inspection Best Practices

Category	Best Practice	Rationale
Frequency of inspections	Based on a program's relationship with vendors, numbers of vendors, types of measures, project volumes, variability, and project sizes.	• Prescriptive rebate programs without control over vendors may need to require greater quality control. A turnkey program training a small pool of vendors and using a pre-screened list of products may require less post-product quality review.
Inspection sampling	Obtain a random sample of vendor and measure types.	• A stratified random sample ensures different job types, measure and vendors are inspected.
Pre- and post-inspections	Clearly define inspection policies and procedures.	• Policies and procedures should address issues such as: when and how to sample, how to address data gaps, etc.
Pre-inspections	Require pre-project inspections for all large projects with highly uncertain baseline conditions.	• Pre-project inspections play an important part of developing defensible savings for projects such as complex compressed air and industrial process retrofits.
Post-inspections	Conduct on-site, post-installation inspections. Random inspections of 10% to 20% of projects are usually adequate for Prescriptive programs.	• On-site inspections discourage vendors from failing to fully and properly install all rebated measures. The fraction of on-site inspections should be higher for direct installation programs, and may need to be increased for any program as conditions warrant.

[23] Best Practices Benchmarking for Energy Efficiency Programs; http://www.eebestpractices.com/index.asp Study managed by Pacific Gas and Electric Company, under the auspices of the California Public Utility Commission, and in association with the California Energy Commission, San Diego Gas and Electric, Southern California Edison, and Southern California Gas Company.

Category	Best Practice	Rationale
Post-inspections	Govern post-inspection by cost-effectiveness, and results from initial set of inspections early in the program's implementation process.	• A rule of thumb is post-inspection for 10%–20% of the projects for a high-volume program, and 100% for very large projects and problem vendors.
Post-Inspections	Consider using third-party M&V contractors to oversee or conduct M&V	• Contracting out the M&V task for an entire program can free program participants from the responsibility and financial burden of M&V, achieve consistency in M&V procedures, and produce results more cost-effectively.

Project QA

During the 2010 process evaluation, Cadmus reviewed QA recommendations made by a third-party evaluator, Moss Adams.[24] Based on these recommendations, Avista implemented improvements to Tracker to integrate robust QA procedures. In 2011, interviews with program staff and the policy and planning team identified ongoing processes to ensure review and approval for small and large project QA.

Over the past year, a number of issues have been identified through performance reviews of large projects. The PPA staff reported these issues are undergoing review and resolution by the engineering team. Identified issues primarily have to do with:

- Missing data;
- Lack of detailed costs, savings estimations, and calculation assumptions;
- Discrepancies found during site visits; and
- Inconsistences with applications of DFIC policies.[25]

Avista developed DFIC policies to ensure consistent approaches for data collection, incentive calculations, and determination of project eligibility for projects typically requiring M&V.

Avista's engineers have developed and documented QA procedures to reduce risks of customer contracts being issued for incomplete or non-compliant evaluation reports.[26] QA procedures require two engineers review and approve projects. While small projects can be reviewed and approved by a second engineer, large projects require review by a PPA team member.

2.8.4 Findings Summary

Avista's QA procedures for Site-Specific projects are well documented, requiring second-party approval of evaluation reports. Tracker protocols, a system established to track projects through the pipeline, govern the review process, which is supported through ongoing efforts with the engineering team, program, and policy staff. However, pre- and post-inspections requirements

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24 Avista Utilities and Moss Adams. May 2011. *Data Management Review for Demand Side Management Programs*.

25 DFIC Version T: Policy Rules for the Calculation of Customer Incentives.

26 Energy Solutions DSM Portfolio Process Analysis.

and procedures would benefit from greater definition and transparency. While post-installation inspections are routinely required for Site-Specific projects, pre-inspections are not. Further, pre- and post-inspections are not required for Prescriptive programs. Post-inspections may be conducted for programs undergoing changes or for projects with new contractors.

2.9 Conclusions, Recommendations, and Future Research

2.9.1 Program Management and Implementation

Conclusions

- In many cases, programs met or exceeded savings goals. Although the lighting program fell short of its goals, new program incentives in 2012 seek to increase customer motivation.
- Avista implementation staff expressed concerns with time constraints sometimes preventing them from having a more active role in planning and documentation of program procedures, and requested more real-time feedback during the evaluation process.
- The site-specific program, which contributes a large portion of savings to the nonresidential portfolio, lacks a central leadership role.
- The EnergySmart Grocer program implementer experienced issues with contractors.

Recommendations

Cadmus recommends Avista consider the following improvements to the nonresidential program implementation:

- Consider method for prioritizing management tasks, thus enabling allocation of more time for planning and development of program documentation.
- Revisit the staffing needs of delivering the current programs.
- Revisit the option of using third party implementers for some programs.
- Consider round tables with the program implementation, management, and policy team to facilitate additional communication regarding planning and evaluation.
- 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.
- Further investigate contractor issues to ensure high satisfaction levels of EnergySmart Grocer program participants

2.9.2 Customer Feedback

Conclusions

Program Satisfaction

- Overall, awareness of the Avista nonresidential programs appears to be increasing, and participant satisfaction levels have been very high.
- Certain program elements receive a large share of "somewhat satisfied" ratings, suggesting opportunities for improvements. These include: scoping audits, program materials, and application processes.
- EnergySmart Grocer program participants expressed lower satisfaction levels than the prescriptive and site-specific programs, across various delivery elements. Better understanding of the causes of this and addressing solutions may prove important for the program's continued success.
- Lower satisfaction levels reported by nonparticipants suggest a need to better understand why program offerings and materials have not met their needs.

Purchases and Decision Making

- While saving money ranked as the most influential factor regarding decisions to install energy-efficient equipment, the decline in reported "saving energy" influence from the prior 2010 survey should be noted, and could have implications for marketing messages.
- Learning of programs through contractors and vendors (37%) compared to nonparticipants (5%) suggests the contractor and vendor community may strongly influence participation, and may be able to intervene at critical decision moments (remodeling and replacing working equipment ranked as the second-highest factor influencing purchases).

Communications and Outreach

- The increase in participants citing contractors or vendors as a source for learning about the programs (from 15% in 2010 to 37% in 2011) suggests trade allies should be leveraged as part of the nonresidential program's outreach and communication strategies.
- Program information on Avista's Website may not effectively reach across the market or be utilized effectively to help customers. Over half of nonparticipants reported the business Website did not apply to them, and cited the need for more information about programs.

Customer Profiles

- The Site-Specific programs' cost-effectiveness may be at risk if the delivery cost becomes too great for very small facilities (less than 5,000 sq. ft.): more than one in four participants surveyed fall within this size range. The program may require different outreach and delivery strategies to ensure costs aligned with achievable savings.
- The dominance of participant-owned facilities in the surveys suggest Avista may not be reaching the decision makers in leased facilities—a more challenging target, but one

which may offer large opportunities for growth or for meeting program goals in future years.

Recommendations

- Continue to leverage contractors to reinforce the program's messages, particularly in communicating program offerings to small-to-medium customers. 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:
    - 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:
    - 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.
- Where customers expressed lower satisfaction levels, program elements should be investigated. Such investigations might include:
    - 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.

2.9.3 Trade Ally Feedback

Conclusions

- Avista's informal network of trade allies works well to promote the programs through word-of-mouth and strong communications with Avista representatives. Many trade allies have worked with Avista for several years or more. Overall, trade allies reported high satisfaction levels with the programs, with slight variations by contractor type. While lighting contractors indicated a high satisfaction level with program materials, they were less likely to promote the programs than general contractors.
- Trade allies suggested improved program promotions to assist customers, providing additional materials or information online. Trade allies requested greater one-on-one communication with Avista representatives, or dedicated assistance to answer questions about the programs.

Recommendations

- 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.
- 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:
    - Offering a dedicated Website, containing guidance through Webinar 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.

2.9.4 Special Report: Lighting

Conclusions

- T-12 lamps and fixtures remain in many customer facilities, and customers retain many T-12 lamps in inventory for replacements. Although customers report awareness of new regulations phasing out most T12s and incandescent light bulbs, most customers do not have a sense of urgency with regard to replacing affected lighting equipment.
- Contractors are highly aware of the upcoming changes, but at least half do not discuss this with their customers, and most are not changing their business approaches or carrying out any promotions. This offers Avista with an opportunity to play a helpful role

in informing and preparing customers for upcoming changes, while accelerating installation of more efficient equipment in the market.

Recommendations

- Take a more proactive role in communicating with customers: upcoming changes in lighting product availability; Avista's program availability to offer them help; and 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.
- 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.

2.9.5 Marketing and Outreach

Conclusions

- Avista's expanded marketing campaign and increased outreach events indicate a focused strategy for nonresidential programs used in 2011 will continue in 2012. Using a wide variety of marketing channels and strategies, Avista's marketing team and program staff are pursuing more direct outreach opportunities with customers and trade allies, through Power Breakfast meetings, developing customer success stories through testimonials, and updating the Website to be more user friendly for business customers.
- Many Avista marketing strategies align with best practices for C&I energy-efficiency programs. Through these outreach events, Avista staff gather direct feedback from customers to enable more targeted marketing opportunities.

Recommendations

- 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:
    - ➢ 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 information tools (such as Efficiency Avenue), testimonials, general program brochures; and encourage easier access for trade allies through featured guidelines and tips.

2.9.6 Application Processing and Data Tracking

Conclusions

- From the review of application forms and databases, interviews with staff, and survey results, Cadmus concludes some data fields needed for program evaluation are not being tracked or are being reported inconsistently.
- Improvements to participant tracking, and data integration could enhance data quality and ensure programs can be evaluated.
- Although application forms have been improved somewhat, some data points added to revised program worksheets currently are not accounted for in updated application forms. Adding these fields would enhance the accuracy of savings estimates.
- As Avista moves toward integrating these databases over the next few years, integration may reduce errors resulting from data transfer and reporting. An integrated customer information system may also reduce the burden of data requests for evaluations.
- Fields critical to evaluation are not being tracked in Sales Logix or reported in extract databases. Inability to identify specificity of program and measure detail created challenges in selecting unique participants for survey sampling. The lack of business or site addresses created additional challenges for site-visit sampling. Missing or inconsistent data were found in the following fields:
  - Customer Account Number
  - Contact Name
  - Business Address, Phone Number, E-mail
  - Program Type
  - Measure Descriptions, Measure Quantity, and Fuel Type

Recommendations

- Drawing upon the review of application forms and databases, interviews with staff, and survey results, Cadmus recommends the following:
  - 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.
  - Consider incorporating changes to forms to account for new data collected through calculators.

2.9.7 QA and Verification

Conclusions

- Avista's QA procedures for Site-Specific projects have been documented well, requiring second-party approval of evaluation reports. The review process is governed through Tracker protocols, a system established to track projects' progress through the pipeline. This process is supported through ongoing efforts with the engineering team, program, and policy staff.
- Pre- and post-inspection requirements and procedures would benefit from better definition and transparency. While post-installation inspections are routinely required for Site-Specific projects, pre-inspections are not.
- Pre- and post-inspections for Prescriptive programs are not required. Post-inspections may be conducted for programs undergoing changes or projects with new contractors.

Recommendations

- 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:
    - 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.

2.9.8 Future Research

The 2011 process evaluation research expanded from the previous year, examining important program influences, achievements, and experiences of customers and trade allies. In subsequent process evaluations, Avista may consider additional comprehensive research or market studies to determine the feasibility of new, cost-effective programs and offerings. Research areas Avista may consider as starting points include:

- Examine top incentive offering (such as lighting, boilers, burners), and determine how these will change over the next few years.
- Identify the quantity of water heating and steam systems in Avista's service territory to determine the potential for replacements.
- Examine natural gas conversions for new construction and multifamily facilities

- Identify new, cost-effective measures (such as lighting, cooking, and heating technologies).
- Assess the feasibility of new lighting programs such as an audit assessment that provides educational and outreach opportunities for the lighting program's T-12 phase out, and examine the feasibility of removing T-12 lamps from storage.

  Assess the feasibility of strategies for reaching managers and tenants of leased spaces. Avista may have a large market opportunity to evaluate and explore, which will require determining the market's size and the applicability of best practices from other utilities. Examples include audit and direct-install programs, on-bill financing, and energy-aligned or "green" lease arrangements.[27]

[27] See The Green Lease Library at http://www.greenleaselibrary.com/index.html, a collaborative effort of DOE, EERE, the Commercial Real Estate Energy Alliance, and others to provide examples and resources for implementing lease arrangements that enable investments in energy-efficiency improvements.

3 CFL Contingency Plan Process Evaluation

3.1 Program Description

This program was designed to provide highly cost-effective energy-efficiency resources to Avista's customer base (both residential and small commercial), while simultaneously offering the flexibility to meet anticipated energy-acquisition targets, established under Washington I-937. Actively developed from April to June 2011, the program was implemented from July through November 2011. Through the program, eligible residences and business, within Avista's territory, were sent a box of eight CFLs of varying sizes, accompanied by literature describing the benefits of using CFLs and method for their proper installation and disposal.

The box also included information on how to return the CFLs, at no cost to the customer, should the customer not want to keep them. Returned CFLs provided a ready source for customers desiring more CFLs than their initial allotment, or for physical distribution through other Avista programs.

3.2 Survey

In addition to surveying participants in Avista's residential programs, Cadmus surveyed 676 residential recipients of CFLs and 361 small commercial recipients of CFLs. The main aim of these surveys was to determine program impacts. However, the surveys also asked a number of questions related to process metrics. This section reports process findings for the CFL Contingency Program, and additional findings from the surveys are reported in the 2010-2011 Electric Impact Evaluation.

Table 3-1 and Table 3-2 show the survey sample and response for the residential and small commercial surveys.

Table 3-1. CFL Contingency Program Residential Survey Sample and Response

	Number of Unique Recipients	Number of Survey-Eligible Recipients	Number of Recipients Included in Sample Frame
Residential Customers	279,890	254,802	7,500
Completed Surveys			676
Number of Calls Required to Achieve Sample			5,226
Response Rate			9.0%
Cooperation Rate			29.0%
Completed Surveys Included in Analysis			676

Table 3-2. CFL Contingency Program Small Commercial Survey Sample and Response

	Number of Unique Recipients	Number of Survey-Eligible Recipients	Number of Recipients Included in Sample Frame
Small Commercial Customers	17,275	17,061	4,000
Completed Surveys			361
Number of Calls Required to Achieve Sample			3,919
Response Rate			9.6%
Cooperation Rate			16.0%
Completed Surveys Included in Analysis			361

3.3 CFL Contingency Plan Survey Results

Results from the residential CFL Contingency Plan phone survey reveal the majority of respondents (90%) supported Avista's giveaway. Ninety-two percent were satisfied with the CFLs they installed.

Sixty-nine percent of respondents already used CFLs in their home at the time they received the eight bulbs from Avista.

Program boxes included a brochure, addressing the benefits of using CFLs. Sixty-one percent of respondents reported reading the brochure included in the box. Among those reading the brochure, 23% said, after reviewing the material, they turned off lights when leaving rooms.

Table 3-3. Ways Respondents has Changed the Way they Used Lights After Reading Program Brochure (n=461)

Means	Percent
None/Have not changed use of lights	47%
Turn out lights when leaving room	23%
Replace incandescent with CFLs	17%
Rely on natural light when available	8%
Use task lighting instead of overhead lighting	3%
Use lighter colored lamp shades	1%
Other	2%

When asked whether or not they purchased additional CFLs after receiving the giveaway from Avista, 11% said they had. Among those individuals, 71% said the giveaway influenced their decision to do so.

Seventy-nine percent of respondents said they were aware Avista offers rebates for equipment that can help them use less energy in their home. Over one-third (36%) of these respondents reported having used an Avista energy-efficiency rebate. Among those aware of the rebates, 71% said they would likely apply for an Avista energy-efficiency rebate in the future.

3.4 Commercial Survey Results

Among commercial survey respondents, less than half (41%) had already been using CFLs in their businesses at the time they received the eight program bulbs from Avista.
A little over one-half (55%) of respondents said they read the brochures included in the box of CFLs sent to their business. Among those respondents, 39% said the material influenced them to turn out lights when leaving rooms, and 31% said they replaced incandescent bulbs with CFLs.

Table 3-4. Ways Respondents Changed the Way they Use Lights After Reading Program Brochure

Means	Percent
Turn out lights when leaving room	39%
Replace incandescent with CFLs	31%
Rely on natural light when available	8%
Use task lighting instead of overhead lighting	2%
Other	20%
Total	49

Ten percent of respondents said they purchased additional CFLs since receiving the giveaway from Avista. Among those respondents, 65% said the giveaway was influential in their decision to purchase those bulbs.

The majority of respondents said expressed support of Avista's giveaway, and were satisfied with CFLs they installed (87% and 94%).

Similarly to residential respondents, 80% of commercial respondents know Avista offered rebates for equipment that can help them use less energy in their business. Among these respondents, 25% had used an Avista energy-efficiency rebate. Additionally, 72% said they would likely apply for an Avista energy-efficiency rebate in the future.

3.5 Key Findings and Conclusions

- Before receiving program bulbs, CFL usage was reported higher among residences than businesses.
- Over one-half of all respondents read brochures sent with the CFLs. This provides an avenue for educating customers about energy-saving opportunities.
- The majority of respondents expressed support for Avista's giveaway and satisfaction with the CFLs they installed. This could indicate Avista's customers would be open to adopting additional energy-saving measures.

Appendix 1A. Residential Program Descriptions

ENERGY STAR Appliance Rebate

This program offers direct financial incentives to motivate customers to use more energy-efficient appliances. The program indirectly encourages market transformation by increasing demand for ENERGY STAR products.

ENERGY STAR New Homes

This program offers builders incentives to construct single-family or multifamily homes complying with ENERGY STAR Homes criteria. One incentive targets Avista electric or Avista electric and natural gas for space heat and water heat, and a lower incentive targets homes using only Avista natural gas (for both hot water and space heating).

High Efficiency Equipment

This program combines the 2010 Heating and Cooling Efficiency and Water Heater Efficiency programs, which are combined in customer-facing materials to help simplify the application process. This program offers incentives for electric and gas customers seeking to purchase:

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

Weatherization and Shell Measures

This program incents three measure categories, available to residential electric and gas customers with homes heated by an Avista fuel:

- Ceiling and attic insulation (both fitted/batt type and blown-in);
- Floor and wall insulation (both fitted/batt type and blown-in); and
- Upgrades of windows with low u-factors (available only through April 1, 2011).

Home Energy Audit Pilot

This pilot program, launched in May 2010, seeks to determine home energy audits' cost-effectiveness for capturing electric and gas savings. Eligible Avista customers must reside in single-family homes, duplexes, and manufactured homes, located in the Spokane area. The program offers energy audits, conducted by Building Performance Institute-certified auditors, at a reduced cost to eligible customers. An Energy-Efficiency Community Block Grant, under ARRA, partially funded this program.

Geographic Saturation Events

Targeting Washington and Idaho electric and gas customers, this program promotes energy-efficiency measures in homes by providing energy-efficiency education, distributing measures (such as CFLs and weatherization products), and promoting options and rebates available through Avista and state programs.

Second Refrigerator and Freezer Recycling

This program, applying to Washington and Idaho electric and electric/gas customers, provides financial incentives to customers recycling refrigerators and freezers. The program seeks to reduce energy consumption by recycling up to two inefficient refrigerators or freezers per home. JACO Environmental, Inc., serves as the implementation contractor, responsible for program scheduling, pickup, recycling, rebate payment, and data tracking.

Space and Water Conversions

This program offers Avista customers incentives for two types of fuel conversion:

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

Simple Steps, Smart Savings Program (CFLs)

Avista sponsors an upstream, buy-down CFL program, administered by the BPA and implemented by FMS. The program, available to electric customers in Washington and Idaho, offers discounted twist and specialty CFLs at most big-box stores.

CFL Contingency Plan Program Description

This program was designed as a scalable means to deliver highly cost-effective, energy-efficiency resources to Avista's customer base (both residential and commercial), while simultaneously offering the flexibility to meet anticipated energy acquisition targets, established under Washington I-937, at a lower ratepayer cost and a minimum of uncertainty. From April to June 2011, the program was actively developed. Through the program, eligible residences and business within Avista's territory received sent a box of eight CFLs of varying sizes, accompanied by literature on the benefits of using CFLs and methods for properly disposing of them. Information also included instructions regarding how to return the CFLs at no cost to the customer, should the customer not want to keep the CFLs.

Appendix 2A. Participant Database Evaluability

Table 2A-1 provides a checklist for identifying data fields necessary to evaluate programs. The first column lists kinds of data typically required to enable a comprehensive evaluation. The second, third, and fourth columns indicate whether the data field has been requested in the application forms, and whether data appeared to be consistently collected in database extracts received throughout the evaluation. Inconsistencies in data tracking can be identified where the first and second columns do not match. Discrepancies where fields do not exist, but where their addition would prove beneficial, have been marked in bold.

Table 2A-1. Prescriptive and Site-Specific Data Tracking

Data for Tracking and Evaluation	Sales Logix	Field in Database Extract	Collected in Prescriptive Forms	Collected in Site-Specific Forms
Customer Acct Number	No	Yes	Yes	Yes
App Number	Yes	Yes	No	Yes
Tracker Number	Yes	No	N/A	N/A
Business Name	Yes	Yes	Yes	Yes
Business Mailing Address	No	No	Yes	Yes
Project Site Address	No	No	Yes	Yes
Contact Name (first, last)	No	Yes	Yes	Yes
Phone	No	Yes	Yes	Yes
E-mail Address (Fax on some)	No	Yes	Yes	No
Fuel Type	Yes	Yes	Yes	When applicable
Program Type	Yes	No	Rebate Forms are specific for each measure	Rebate Forms are specific for measures, Asks for description
Project Type	Yes	Yes		
Measure Type	Yes	Yes		
Measure Description	Yes	No		
Measures Quantity Installed	No	No	Yes	Yes
Equipment Details (Manufacturer, model…)	No	No	Yes	Yes
Type of Facility	No	No	When applicable	When applicable
Total square feet affected by measure	No	No	When applicable	When applicable
Occupancy	No	No	When applicable	When applicable
Site verified/inspected	Yes	No	NA	NA
Account Executive	Yes	Yes	No	No
Tech Lead	Yes	Yes	N/A	N/A
kWh/Therm	Yes	Yes	No	No
Incentive Electric/Gas	Yes	Yes	No	No
Measure Cost	No	Yes	Yes	Yes
Incentive Cost	Yes	Yes	Yes	No
CE Cost	Yes	Yes	N/A	N/A
Phase	Yes	Yes	N/A	N/A
Measure Life	Yes	Yes	N/A	N/A
Program Participation Year	No	No	No	No
Customer Signature	NA	NA	Yes	Yes
Installation/Completion Date	Yes	No	Yes	Yes

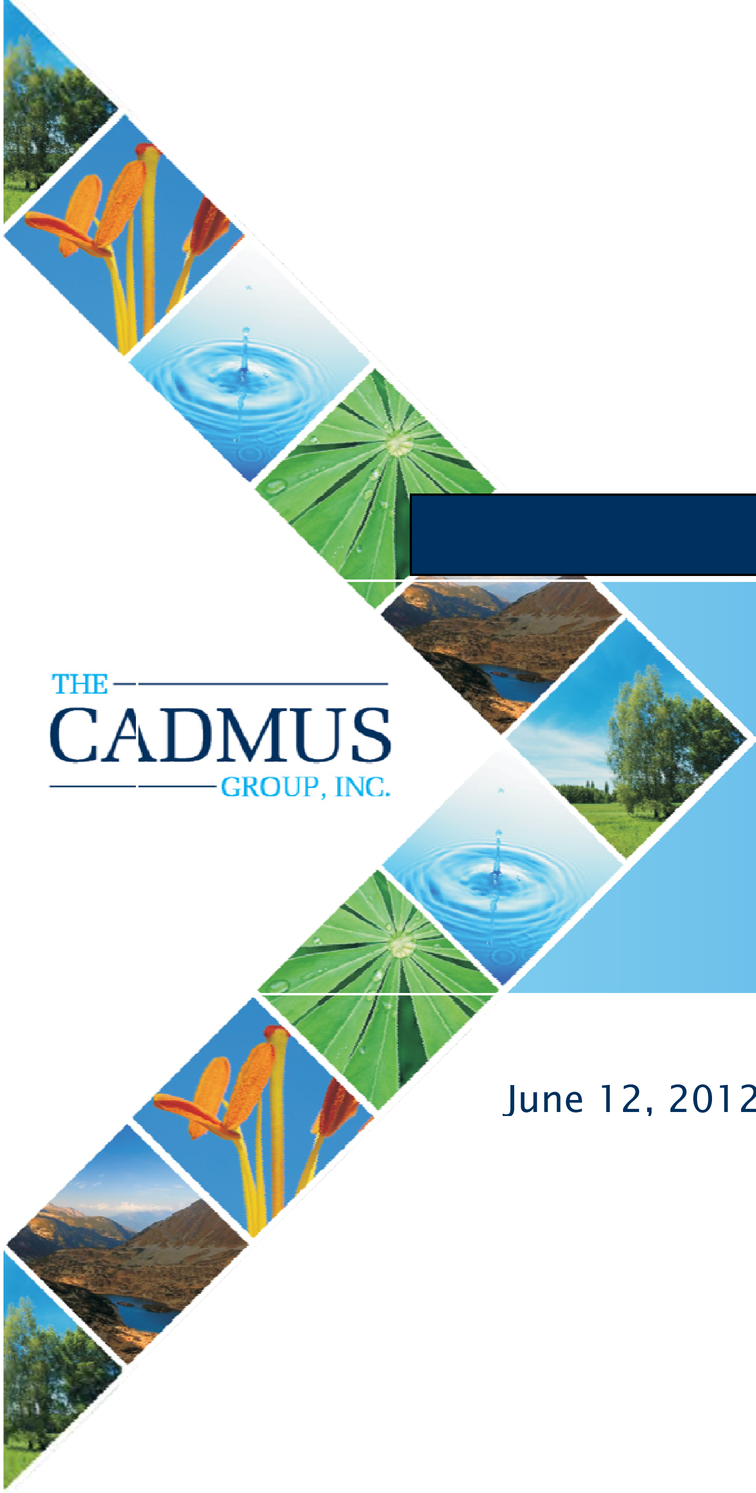
Data for Tracking and Evaluation		Sales Logix	Field in Database Extract	Collected in Prescriptive Forms	Collected in Site-Specific Forms
Site-Specific Information only	Rate Schedule	No	Yes		Yes
	Tier	No	No		Yes
	Existing Equip Details	No	No		Yes
	Contractor Name	No	No		Yes
	Contractor Contact	No	No		Yes
	Taxpayer ID No.	No	No		Yes
	Contract No.	Yes	No		Yes

Appendix 5

Net-to-Gross Evaluation of Avista's 2011 Demand-Side Management Programs

June 12, 2012

The Cadmus Group, Inc.



THE CADMUS GROUP, INC.

Net-to-Gross Evaluation of Avista's 2011 Demand-Side Management Programs

June 12, 2012

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Contents

Executive Summary

This report summarizes The Cadmus Group's (Cadmus) analysis of net-to-gross (NTG) ratios in Avista's 2011 demand-side management (DSM) programs. As part of the 2011 process and impact evaluation, Cadmus conducted various NTG analyses of the residential and nonresidential programs.

NTG is composed of freeridership, participant spillover, and nonparticipant spillover. Freeriders—customers who would have purchased a measure without a program's influence—reduce savings attributable to Avista's programs. Spillover—additional savings obtained by customers decision to invest in additional efficiency measures or activities due to their program participation—increase savings attributable to the program and improve cost-effectiveness. NTG is computed as *(1-Freeridership+Spillover)*.

The freeridership component was based on a previously developed approach, which ascertained the estimates using patterns or responses of a series of six simple questions. The questions—which allowed "yes," "no," or "don't know" responses—dealt with whether participants would have installed the same equipment in the program's absence, at the same time, the same amount, and at the same efficiency. Response patterns to these questions were assigned freerider scores, and the confidence and precision estimates were calculated on score distributions. The 2011 approach was virtually identical, with one minor addition (an open-ended explanatory question for confirmation of the residential battery), and one minor scoring change (to better account for social acceptance response bias).

We calculated participant and nonparticipant spillover by estimating savings attributable to additional measures installed and whether respondents credited Avista with influencing the decision. Measures were counted if they were eligible for program incentives even if no incentives were requested.

Summary of Results

Table 1, Table 2 and Table 3 summarize freeridership and spillover percentages calculated for the Appliance Recycling Program as well as for the Compact Fluorescent Light (CFL) Contingency Plan. Table 4 summarizes freeridership and spillover percentages calculated for the nonresidential programs.

Table 1. 2011 Residential NTG Ratios

Program	Responses	FR%	Participant SO%	Nonparticipant SO%	NTG
Appliances	94	61.8%	3.6%	0.1%	41.9%
HE Equipment	155	57.8%	2.4%	1.0%	45.5%
Shell	37	33.1%	0.0%	1.5%	68.3%

Table 2. 2010/2011 Combined Residential Appliance Recycling Freeridership Ratios

Measure	Responses	FR%
Refrigerator	134	41%
Freezer	46	42%

Table 3. 2011 CFL Contingency NTG

Program	Responses	FR%	Participant Spillover %	NTG
CFL Contingency	625	35%	0.8%	65.8%

Table 4. 2011 Nonresidential NTG Ratios

Program	Responses	FR%	Participant Spillover %	NTG
Energy Smart Grocer	17	4.0%	0%	96.0%
Motors	12	47.0%	0%	53.0%
Prescriptive	70	32.6%	0%	67.4%
Site-Specific	63	16.7%	0%	83.3%

The programs show low levels of spillover. Participant spillover develops slowly and is dependent on the customer's increasing familiarity with energy efficiency and experience with program-incented measures. While freeridership accuracy depends on eliciting responses close to the adoption decision, spillover occurs in the longer term. Survey instruments attempting to gather both pieces of the NTG puzzle usually fall short with one or the other estimate. As such, we believe that our estimates of spillover are understated, potentially quite significantly.

It appears Avista programs could be even more efficient if eligibility requirements were tightened. Our survey asked respondents if they had already installed equipment *before* hearing about the Avista program. A number of respondents answered "yes" and were classified as full freeriders. The obvious trade-off here is between customer satisfaction and freeridership. If Avista were to decrease the period during which customers may apply for a rebate after equipment purchase, they may significantly decrease freeridership at the expense of customer satisfaction.

A strong inverse relationship occurs between the proportion of the total measure cost covered by the incentive and the freeridership ratio. Avista can decrease freeridership by increasing the incentive amounts.

Conclusions

- Nonresidential freeridership has remained fairly steady over the two evaluation years and was in line with other studies. The absence of attributable program spillover is not unusual, given the size and cost of efficiency projects for these customers.
- Residential freeridership was higher for 2011 than for 2010. The reason for this spike is not completely clear, and it is outside the normal range seen in other utilities. Residual

effects from ARRA funding or fundamental market transformation could be contributing factors. Caution should be taken in making significant program changes until a clear trend has been demonstrated.

Recommendations

- Because of the uncertain nature of the 2011 residential freeridership values, we believe a weighted average of the 2010 and 2011 surveys should be used for calculating residential cost-effectiveness as presented in Table 5. We strongly advocate continued measurement of residential NTG in coming years to help determine whether the 2011 residential freeridership is an aberration or a trend. This practice will give Avista several years of analysis that could be combined into a single estimate or could help reinforce each new year's evaluation by establishing or refuting a trend.

Table 5. 2010 / 2011 Combined Residential NTG Ratios

Program	Responses	FR%	Participant SO %	Nonparticipant SO %	NTG
Appliances	161	56.1%	2.1%	0.1%	46.1%
HE Equipment	222	52.1%	1.6%	1.0%	50.5%
Shell	104	40.8%	5.7%	1.5%	66.4%

- Cadmus did not combine 2010 and 2011 nonresidential NTG estimates due to the uniqueness of projects during the individual program years.

- Avista programs might be even more efficient if eligibility requirements were tightened. Our survey asked respondents if they had already installed equipment *before* hearing about the Avista program. For example, 21% of residential appliance and 19% of high-efficiency equipment rebate program participants replied that they had already installed the rebated equipment before learning about the Avista program. These respondents fit the definition of a *pure freerider*, are being scored as 100% freeriders, and are driving the high freeridership estimate for the residential appliance and high-efficiency equipment survey categories. Avista currently allows customers to apply for a rebate three months after purchase of equipment or appliances.

- Avista should capture additional effects its programs have had on participant's energy-efficient purchases by surveying prior participants; their answers could be an additional source of spillover attributable to the program.

- We recommend that Avista conduct or contract market research into the areas of residential appliances and heating and cooling equipment to determine if there has truly been a transformation in the market or if Avista's high freeridership results are due to increasing consumer adoption of energy-efficient measures.

- Increasing incentives in the residential programs may lower the programs' freeridership ratios. In order to reduce freeridership substantially, our analysis suggests that incentive levels may need to be increased to between 30% and 50% of total measure cost. This may not be feasible for some measures, for example, in cases where the increased incentive would exceed the incremental cost.

- Avista may want to consider better tracking of market shares of various energy using (saving) technologies through a panel of trade allies. A sample of trade allies (participants and nonparticipants) can be identified and included in the panel. They get compensated for their time filling out forms showing their annual sales for various technologies and associated efficiency levels. They are also asked to provide an assessment of the impact of the program on the various sales (incented and non-incented equipment). We believe this will provide a more accurate estimate of the impact of Avista programs on market shares of energy efficient equipment.

Organization of this Report

This report presents the following sections:

- Section 1, Net-to-Gross Evaluation Overview, describes Cadmus' freeridership and spillover evaluation methodologies.
- Section 2, Freeridership Analysis.
- Section 3, Spillover Analysis.
- Section 4, Net-to-Gross Analysis, explains how spillover and freeridership analyses have been combined to calculate a NTG ratio for each program category.
- Section 5, CFL Contingency program NTG calculation.
- Section 6, NTG Benchmarking, provides comparisons with NTG ratios in similar programs at other utilities.
- Section 6, Conclusions and Recommendations, offers explanations for NTG scores, provides comparisons with NTG ratios in similar programs at other utilities, and concludes with recommendations for future Avista NTG evaluations.
- Appendix A, Program Categorization, maps program measures into homogeneous categories.
- Appendix B, Survey Design details.
- Appendix C, Freeridership Scoring Methodology
- Appendix D, Residential Freeridership Results Detail shows analysis results by program category.
- Appendix E, Nonresidential Freeridership Results Detail shows analysis results by program category.
- Appendix F, Appliance Recycling Program NTG Results Detail

1. Net-to-Gross Evaluation Overview

Net-to-gross (NTG) estimates serve as a critical component of demand-side management (DSM) program impact evaluations as they allow utilities to determine the portion of gross energy savings influenced by and attributable to their DSM programs. Freeridership and spillover comprise NTG's two components. Freeriders are customers who would have purchased the measure without any program influence. Spillover is the amount of additional savings obtained by customers who invest in additional energy-efficient measures or activities due to their program participation. NTG is defined as *1-Freeridership+spillover*. Various methods can be used to estimate program freeridership and spillover. Our baseline evaluation approach uses self-reported data gathered through participant surveys.

After program review, Cadmus aggregated Avista's DSM programs into the following categories:[1]

- Residential Appliances
- Residential High-Efficiency Equipment
- Residential Shell
- Residential Appliance Recycling
- CFL Contingency
- Energy Smart Grocer
- Nonresidential Motors
- Nonresidential Prescriptive
- Nonresidential Site-Specific

For the four residential programs—Residential Appliances, Residential high-efficiency Equipment, Residential Shell, and Residential Appliance Recycling—we administered NTG questions as part of one survey. The nonresidential programs—Energy Smart Grocer, Nonresidential Motors, Nonresidential Prescriptive, and Nonresidential Site-Specific—were all also part of a single survey. The CFL Contingency program had its own survey.

Freeridership Methodology

Cadmus developed a transparent, straightforward Excel-based matrix approach to assign a freeridership score to participants; this score is based on the participant's objective responses to six survey questions. Question response *patterns* are assigned freeridership scores, and the confidence and precision estimates are calculated on the distribution of these scores. This specific approach is cited in the National Action Plan for Energy Efficiency's Model Energy Efficiency Program Impact Evaluation Guide (2007 edition, page 5-1).[2]

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[1] Aggregation of measures into program categories is shown in Appendix A.

[2] http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf

The response patterns and scoring weights remain explicit so they can be discussed and changed and so the results can be shown in real time. Our approach provided these other important features:

- Derivation of a partial freeridership score, based on the likelihood of a respondent taking similar actions in the incentive's absence.
- Use of a rules-based approach for consistency among multiple respondents.
- Use of consistency checks and open-ended questions to ensure that quantitative scores matched respondents' more detailed explanations regarding program attribution.
- Ability to change weightings in a "what if" exercise, testing the response set's stability.

This method offers a key advantage by introducing the concept of partial freeridership. Experience has taught us that program participants do not fall neatly into freerider and non-freerider categories. For example, partial freeridership scores were assigned to participants who had plans to install the measure; although the program exerted some influence over these participants' decision, other market characteristics beyond the program also proved influential. In addition, with partial freeridership, we could utilize "Don't Know" and "Refused" responses by classifying them as partial credit, rather than removing the entire set of responses from a particular participant from the analysis.

We assessed freeridership at three levels. First, each participant survey response was converted into freeridership matrix terminology. Once each participant's responses were combined, we assigned a freeridership score from the scoring matrix. Finally, all participants were aggregated into an average freeridership score for the entire program category (discussed further in the following section). Details on the freeridership methods can be found in Appendix C.

Program Category Freeridership Scoring

For residential programs, the average freerider score was a straight average of respondent scores. For nonresidential programs, given the wide variation in nonresidential program participant energy savings, we weighted the respondent freeridership scores by the estimated savings of all equipment installed through the program.

Spillover Methodology

Spillover refers to additional savings generated by the program's influence but which is not captured by program records. Spillover occurs when customers purchase energy-efficient measures or adopt energy-efficient practices influenced by the program, but they choose not to participate or are otherwise unable to participate in the program.

Examples of spillover include:

- Program participants adopt additional measures without an incentive.
- Consumers act on the programs' influence, which has resulted from changes in available energy-using equipment in the marketplace.
- Change is brought about by more efficient practices employed by architects and engineers, ultimately forcing consumer behavior into desired patterns.

- Changes in nonparticipant's behaviors results from direct marketing or changes in stocking practices.

Participant Spillover Analysis

In Avista's programs, Cadmus measured spillover by asking a sample of participants if, due to the program, they had installed any other energy-efficient measure or undertook any other energy-efficiency activity. Respondents were asked to rate, on a scale of 1 through 5 (with 1 meaning not at all influential and 5 meaning highly influential), the relative influence of Avista's program and rebate on their decision to pursue additional savings. Nonresidential survey respondents were also asked to explain why they chose not to pursue a rebate for measures installed because they were asked only about *like* spillover measures.[3]

For calculating spillover savings, we started the analysis with a subset containing only survey respondents who indicated they installed additional energy-saving measures after participating in an Avista program. From this subset, we removed participants who indicated the program had little influence on their decision, keeping only participants who rated the influence as 5 (highly influential). Camus also removed participants who indicated they applied for Avista rebates for the additional measures they installed.

For the remaining participants with legitimate spillover savings (those who indicated they installed additional energy-saving measures after participating in an Avista program), we estimated the energy savings from the additional measures installed. Participants were asked detailed questions to determine the new measures' efficiency levels and characteristics. Participants were also asked for details about the baseline equipment that the new energy-efficient equipment replaced. We used these two detailed measure attributes and the fuel mix to establish the most appropriate deemed savings value to assign (this value is from Cadmus' evaluated savings or Avista's Technical Resource Manual (TRM)). In cases where Cadmus' evaluated savings or Avista's TRM did not have applicable energy savings values, we used the Regional Technical Forum values and engineering calculations by Cadmus staff. For some measures where either the TRM database or the respondent did not provide enough information, we were unable to estimate spillover savings.

The spillover percentage per program category was calculated by dividing the sum of the additional spillover savings reported by respondents for a given program category by total rebated gross savings achieved by all respondents in the program category:

$$Spillover\ \%\ Estimate\ = \frac{\sum Sum\ of\ Survey\ Sample\ Spillover\ kWh}{\sum Sum\ of\ Survey\ Sample\ Program\ kWh}$$

Nonparticipant Spillover Analysis

Cadmus estimated self-reported nonparticipant spillover for residential program measures. We asked nonparticipants of Avista's energy-efficiency programs if they had implemented non-rebated high-efficiency measures during the 2011 program year that are similar to the those offered by Avista. For each measure, we asked the respondent to rate the relative influence that

[3] "Like spillover measures" refers to measures that are similar to Avista program offerings.

their knowledge of Avista's energy-efficiency program had on this energy-efficient purchasing decision.

Respondents who answered that their knowledge of Avista's energy-efficiency programs was "somewhat influential," "somewhat not influential," or "not at all influential" were dropped from the nonparticipant spillover analysis. If respondents said what they learned through the Avista program was "highly influential" on their purchasing decision, they were attributed to program nonparticipant spillover.

2. Freeridership Analysis

Residential Program Categories

Table 6 shows the results of freeridership calculations for the residential programs. We discuss freeridership analysis for each residential program category in further detail in the following three sections.

Table 6. Residential Freeridership Results

Program	Responses	FR %
Appliances	94	61.8% (± 4.9%)
HE Equipment	155	57.8% (± 4.3%)
Shell	37	33.1% (± 9.5%)

Of the three residential program categories, residential appliances had the highest freeridership level, with an average of 61.8% across all respondents and an absolute precision of 4.9 percentage points.

Table 7 compares 2010 and 2011 residential freeridership analysis. The difference of freeridership estimates for Avista's 2011 and 2010 evaluations is statistically significant for the residential appliances (p-value = 0.004) and residential high-efficiency equipment (p-value = 0.001) program categories. The residential appliances freeridership estimate in 2010 was 48% and in 2011 increased to almost 62%. The residential high-efficiency equipment freeridership estimate increased from 39% in 2010 to almost 58% in 2011. For the residential shell program category, the difference in these estimates for 2010 and 2011 is not statistically significant (p-value > 0.10).

Table 7. Comparing 2010 / 2011 Residential Freeridership

Program	2010 Responses	2010 FR %	2011 Responses	2011 FR %
Appliances	67	48% (± 7.2%)	94	61.8% (± 4.9%)
HE Equipment	67	39% (± 7.6%)	155	57.8% (± 4.3%)
Shell	67	45.1% (± 7.7%)	37	33.1% (± 9.5%)

Details on freeridership analysis for the three residential program categories can be found in Appendix D.

Nonresidential Programs

Table 8 shows freeridership results for the nonresidential programs. The calculations are weighted by each respondent's annual energy savings from the rebated energy-efficiency projects or measures.

Table 8. Nonresidential Freeridership Results

Program Category	Responses	FR %
Energy Smart Grocer	17	4.0% (± 13.2%)
Motors	12	47.0% (± 18.9%)
Prescriptive	70	32.6% (± 7.9%)
Site-Specific	63	16.7% (± 6.0%)

Table 9 compares 2010 and 2011 freeridership analysis. The difference in freeridership estimates for Avista's 2011 and 2010 evaluations is statistically significant (p-value = 0.012) for the prescriptive program category. In 2010 the residential prescriptive program category freeridership estimate was 13%; in 2011 the estimate increased to 33%. For the other three nonresidential program categories (Energy Smart Grocer, motors and site-specific), the difference in freeridership estimates for 2010 and 2011 is not statistically significant (p-value > 0.10).

Table 9. Comparing 2010 / 2011 Nonresidential Freeridership

Program	2010 Responses	2010 FR %	2011 Responses	2011 FR %
Energy Smart Grocer	30	10% (± 10%)	17	4.0% (± 13.2%)
Motors	9	41% (± 21%)	12	47.0% (± 18.9%)
Prescriptive	59	13% (± 6%)	70	32.6% (± 7.9%)
Site-Specific	61	26% (± 7%)	63	16.7% (± 6.0%)

Details on freeridership analysis for the four nonresidential program categories can be found in Appendix E.

3. Spillover Analysis

The tables below indicate that, while many participants subsequently installed other energy-efficient measures after receiving a rebate from Avista, few reported the program significantly influenced their purchases, and therefore this cannot be considered spillover. Additionally, some participants who reported being significantly influenced by the program have applied for rebates for additional measures they installed, and they cannot be included in the spillover analysis.

Residential Participant Spillover

Table 10 shows spillover analysis results for the residential program categories.

Table 10. Residential Spillover Summary

Program	Survey Participant Spillover Savings (BTU's)	Survey Participant Program Savings (BTU's)	SO %
Appliances	3,663,123	102,833,545	3.6%
HE Equipment	20,769,706	905,041,192	2.3%
Shell	0	236,234,662	0.0%

During the 2011 evaluation period, residential appliances and high-efficiency equipment had measurable spillover savings but there was no attributable spillover savings for the residential shell program category. The 2010 evaluation period resulted in no attributable spillover for the appliances and high-efficiency program categories but the residential shell program experienced spillover of about 9%. Though the potential spillover savings were higher, most residential participants installing additional energy-efficient equipment reported the program did not have much influence on their purchasing decisions.

Table 11 lists the number of participants who installed additional energy-efficient measures outside the program, participants who indicated high program influence on the purchasing decisions, and measures whose purchase were reported as highly influenced by the program.

Table 11. Effects of Program Influence and Rebates on Residential Spillover

Program	Respondents Installing Additional Measures	Respondent Indicated High Program Influence	Measures Highly Influenced By Program
Appliances	19	3	9
HE Equipment	35	2	3
Shell	23	1	0

Nineteen residential appliance participants reported installing additional measures after participating in an Avista appliance program. Three of the nineteen reported the program had influenced their decision to purchase a total of nine energy-efficient measures. Of these nine measures, we determined we could accurately estimate savings for five of the measures.

Thirty-five residential high-efficiency equipment participants reported installing additional energy-efficient measures after participating in this program. Two of the thirty-five participants reported the high-efficiency equipment program proved highly influential in their decision and these two participants reported installing a total of three measures. Of these three measures, Cadmus engineers determined they could accurately estimate savings for two of the measures.

Table 12 displays the additional measures residential participants installed that qualified as spillover and where we could quantify savings estimates.

Table 12. Residential Spillover Measures

		Electric		Gas		
Program Category	Spillover Measure	Savings (kWh)	Savings (kWh to BTU's)	Savings (therms)	Savings (therms to BTU's)	Total BTU's
Appliances	Dishwasher	22.2	75,750	1.3	130,000	205,750
Appliances	Clothes washer	318	1,085,061	8	800,000	1,885,061
Appliances	Refrigerator	65.5	223,495			223,495
Appliances	Dishwasher	22.2	75,750	1.3	130,000	205,750
Appliances	Heat Pump	335	1,143,067			1,143,067
HE Equipment	E to G Wall unit	6,087	20,769,706			20,769,706
HE Equipment	Clothes Washer	159	542,531	4	400,000	942,531

The spillover survey's timing may be a reason residential spillover savings were small. For many participants interviewed, little time may have elapsed between participating in the program and responding to the survey.

Residential Nonparticipant Spillover

We asked nonparticipants of Avista's energy-efficiency programs if they had implemented non-rebated high-efficiency measures during the 2011 program year that are similar to the measures for which Avista offers rebates in its residential portfolio. For each measure a respondent indicated, we asked the respondent to rate the relative influence that their knowledge of Avista's energy-efficiency program had on this energy-efficient purchasing decision.

If respondents said what they learned through the Avista program was "highly influential" on their purchasing decision, they were attributed to program nonparticipant spillover. Table 13 summarizes the nonparticipant spillover responses.

Evaluated savings developed by Cadmus were applied to the nonparticipant "like" spillover measures that are being attributed to the program. ("Like" spillover measures, as explained in the spillover methodology section, refer to measures that are similar to Avista program offerings.) We integrated household heating and cooling information to inform the savings estimates being applied to measures. Electric kWh savings and natural gas therm savings were both converted to BTUs for the analysis. We applied an adjustment factor to Total Per Unit BTU Savings in Table 13 to account for the market share of high-efficiency unit shipments compared to total unit shipments. The resulting computation is reported in the column Total Per Unit BTU Savings – Market Share Adjusted.

Table 13. Nonparticipant Spillover Response Summary

Program Category	Measure	Purchased & Aware & Because of Avista Info	Total Per Unit BTU Savings	Market Share*	Total Per Unit BTU Savings - Market Share Adjusted	Total BTU Savings as % of Total Spillover Savings
Appliances	Clothes washer	2	888,729	64%	568,786	4.9%
Appliances	Dishwasher	1	89,398	100%	89,398	
Appliances	Freezer	1	158,665	25%	39,666	
Appliances	Refrigerator	1	223,495	50%	111,748	
HE Equipment	Gas furnace	2	10,300,000	61%	6,283,000	38.5%
HE Equipment	Water heater	2	654,945	12%	78,593	
Shell	Floor insulation	1	4,609,111	100%	4,609,111	56.6%
Shell	Wall insulation	1	4,755,735	100%	4,755,735	
Weighted Average					2,133,311	

*Market share percentages are from 2010 ENERGY STAR shipment data except for floor and wall insulation, where no values were available. http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2010_USD_Summary_Report.pdf

As shown in Table 13, 65 respondents answered they purchased a high-efficiency measure similar to measures for which Avista offers rebates and they were aware that Avista offered energy efficiency programs. Of the 65, eleven responded that their knowledge of Avista's energy efficiency programs was "high influential" on their decision to make the energy-efficient purchase. We calculated a weighted average (using figures in the column Total Per Unit BTU Savings – Market Share Adjusted) of the eleven total measures being attributed to nonparticipant spillover to arrive at a single savings estimate of 2,133,311 BTUs (Variable A). This represents the average BTU savings per nonparticipant spillover response attributable to Avista's residential programs.

Table 14 below contains the nonparticipant spillover analysis results for the residential program as a whole.

- **A** is average BTU savings per nonparticipant spillover response.
- **B** is the number of nonparticipant spillover responses attributed to the program.
- **C** is the number of nonparticipants contacted by the survey implementer.
- **D** is the kWh savings per spillover response.
- **E** is the total residential customer population obtained from the customer databases.
- **F**, nonparticipant spillover kWh savings extrapolated to the customer population, is calculated by dividing B by C then multiplying this result by D and E.
- **G** is total evaluated savings for the 2011 program year.

- **H** represents nonparticipant spillover as a percentage of total evaluated savings and is the nonparticipant percentage that is being used in the NTG calculations.

Table 14. Nonparticipant Spillover Analysis

Variable	Metric	Value	Source
A	Average BTU savings per spillover response	2,133,311	Survey Data / Impact Evaluation
B	# of Like Spillover Nonparticipant Measures	11	Survey data
C	# Contacted	749	Survey disposition
D	Average kWh savings per spillover response	625	A ÷ 3,412.3 (BTU to kWh conversion factor)
E	Total Residential Population	279,020	Customer database
F	Non-Part SO kWh Savings Applied to Population	2,561,965	((B÷C)×D)) × E
G	Total Evaluated Savings	99,709,690	2011 Evaluation
H	Nonparticipant Spillover as % of Total Evaluated Savings	2.6%	F ÷ G

Table 15 uses the figures in the column Total BTU Savings as % of Total Spillover Savings for each measure to distribute the 2.6% program-level nonparticipant spillover estimate to the individual program categories. This estimate represents the program category nonparticipant spillover percentage estimates that are being applied in the NTG calculations for the 2011 program year.

Table 15. Nonparticipant Spillover Results

Program Category	Nonparticipant Spillover as % of Total Reported Savings	Total BTU Savings as % of Total	Program Category Nonparticipant Spillover %
Appliances	2.6%	4.9%	0.1%
HE Equipment		38.5%	1.0%
Shell		56.6%	1.5%

Nonresidential Participant Spillover

None of the nonresidential program categories had measurable spillover savings. Comparatively, in the 2010 evaluation, only the site-specific program category had spillover that was attributable to the program, which equaled 0.2%. Most participants who installed additional energy-efficient equipment reported the program did not have much influence on their purchasing decisions. Some had not installed the measures and some did apply for rebates for the additional measures they purchased.

4. Net-to-Gross

Final NTG ratios for each program category were calculated using this formula:

Net-to-gross ratio = (1 – Freeridership) + Participant Spillover + Nonparticipant Spillover

Table 16 presents freeridership and spillover percentages and the NTG ratios calculated for the residential program categories.

Table 16. Residential NTG Ratios

Program	Responses	FR%	Participant SO%	Nonparticipant SO	NTG
Appliances	94	61.8%	3.6%	0.1%	41.9%
HE Equipment	155	57.8%	2.3%	1.0%	45.5%
Shell	37	33.1%	0.0%	1.5%	68.3%

Table 17 summarizes freeridership and spillover percentages and the NTG ratios calculated for the nonresidential program categories.

Table 17. Nonresidential NTG Ratios

Program	Responses	FR%	Participant SO%	NTG
Energy Smart Grocer	17	4.0%	0%	96.0%
Motors	12	47.0%	0%	53.0%
Prescriptive	70	32.6%	0%	67.4%
Site-Specific	63	16.7%	0%	83.3%

5. CFL Contingency Program Net-to-Gross Analysis

Freeridership Methodology

The residential CFL contingency program NTG was analyzed using a different methodology than the residential and nonresidential rebate programs. The method orients survey questions toward customers who received a box of eight free CFLs from Avista. The two questions, as listed in the freeridership analysis, are:

F1. In the 12 months before receiving the box, did you install any CFLs?
F2. How many CFLs did you install during that year? [Record]

Depending on the response, the following conditions were used in the freeridership analysis:

If F1 equals "No" then freeridership score = 0%
If F2 is more than or equal to 8 then freeridership score = 100%
If F2 is less than 8 then freeridership score = F2 ÷ 8

Spillover Methodology

The CFL Contingency program spillover analysis uses a slightly adjusted design compared to the residential and nonresidential rebate programs. The questions used in the analysis are:

F3. Since receiving the giveaway from Avista, have you purchased any additional CFLs?
F5. [Ask If F3 = Yes] How many of those have you installed?
F6. [ASK IF F3 = 1] How influential would you say the Avista CFL giveaway was in your decision to purchase additional CFLs?

Only installed CFL purchases—that is, where the respondent rated the Avista CFL contingency program as highly influential on subsequent CFL purchases—were attributed to the survey sample spillover CFLs for the program.

We calculated the spillover estimate for the residential CFL contingency program using the following equation:

$$Spillover\ \%\ Estimate = \frac{\text{Survey Sample Spillover CFLs}}{\text{Survey Sample Giveaway CFLs Installed}}$$

Where:

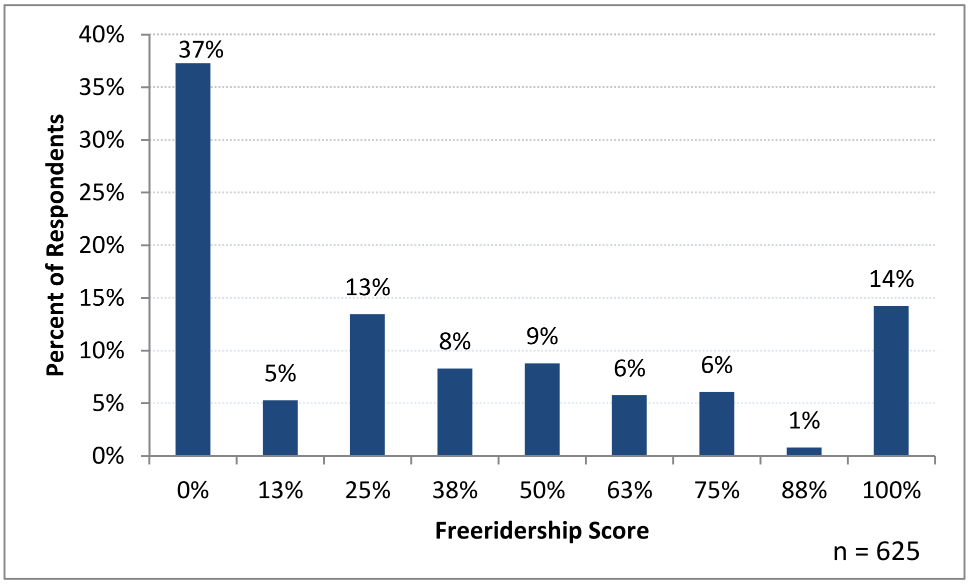
$$Survey\ Sample\ Spillover\ CFLs = Additional\ Highly\ Influenced\ CFL\ Installed\ Purchases$$

$$Survey\ Sample\ Giveaway\ CFLs\ Installed = Giveaway\ CFLs\ Reported\ Installed\ From\ Participant\ Survey\ Sample$$

Freeridership Analysis

The distribution of individual freeridership scores for the residential CFL contingency program is presented in Figure 1. The program's overall freeridership is 35%, which we calculated using a simple average across all respondent's freeridership scores.

Figure 1. Distribution of Residential CFL Giveaway Participant Freeridership Scores



Spillover Analysis

Table 18 contains participant spillover results. The spillover estimate attributable to the program is 0.8%.

Table 18. CFL Giveaway Participant Spillover Results

Variable	Metric	Value	Source
A	Spillover CFLs	20	Survey Data
B	# Included in FR Analysis	625	Survey Data
C	# of CFLs Given to Customers	8	Program Info
D	Total CFLs Installed By Customers	2,419	Survey Data
E	Spillover CFLs as % of Total Installed	0.8%	A ÷ D

Results

The NTG value for the 2011 program year can be seen in Table 19.

Table 19. CFL Contingency NTG

Program Category	Responses	FR%	Participant Spillover %	NTG
CFL Contingency Program	625	35%	0.8%	65.8%

6. Net-to-Gross Benchmarking

Residential NTG Benchmarking

The following sections show other recent NTG study results.

High-Efficiency Equipment Rebate Programs

The 58% freeridership estimate for Avista's 2011 high-efficiency equipment rebate program is the highest compared to similar utility programs in other parts of the country; however, five of seven of these utilities estimate freeridership at 49% or higher (Table 18). This benchmarking shows that is clearly within the range of comparable energy-efficiency programs across the United States.

Table 18. High-Efficiency Equipment Rebate Program Benchmarking

Utility	Grouping	n	FR	Part SO	NTG
Avista – 2010	HE Equipment – ALL	67	39.0%	0.0%	61.0%
Avista – 2011	HE Equipment – ALL	155	57.8%	2.3%	45.5%*
Southwest Utility – 2011	CAC's/Evaporative Coolers	265	52.1%	2.3%	50.3%
Northwest Utility – 2011	Heat Pump Measures	60	42.5%	0.0%	57.5%
California Utility – 2011	Heat Pump Measures	9	33.3%	0.0%	66.7%
Northeast Utility – 2011	CAC's/Heat Pumps/Tune-Ups	131	57.0%	0.2%	43.2%
Northeast Utility – 2010	CAC's/Heat Pumps/Furnaces	53	56.1%	2.8%	46.7%
Midwest Utility – 2011	CAC's/HE Furnace/Boilers/Heat Pumps	141	54.0%	0.0%	46.0%
Midwest Utility – 2011	CAC's/Heat Pumps/ECM's	27	49.0%	1.0%	52.0%

*Includes 1.0% nonparticipant spillover estimate for 2011 Avista HE Equipment rebate program category

Appliance Rebate Programs

The 62% freeridership estimate for Avista's 2011 appliance rebate program is the highest compared to similar utility programs in other parts of the country.

Table 19. Appliance Rebate Program Benchmarking

Utility	Grouping	n	FR	Part SO	NTG
Avista – 2010	Appliance	67	48.0%	0.0%	52.0%
Avista – 2011	Appliance	94	61.8%	3.6%	41.9%*
Northwest Utility - 2011	Appliance Measures	217	43.4%	0.0%	56.6%
Northwest Utility - 2011	Appliance Measures	217	33.0%	0.0%	67.0%
California Utility - 2011	Appliance Measures	154	42.9%	0.0%	57.1%
Southwest Utility - 2011	Appliance Measures	223	40.4%	0.0%	59.6%
Midwest Utility - 2011	Appliance Measures	293	45.9%	13.7%	67.8%
Northeast Utility 2010	Appliance Measures	76	56.6%	2.8%	46.2%

*Includes 0.1% nonparticipant spillover estimate for 2011 Avista Appliance rebate program category

Shell Rebate Programs

The 33% freeridership estimate for Avista's 2011 shell rebate program is the highest compared to similar utility programs in other parts of the country; but Avista's 2011 residential shell rebate program freeridership estimate is lower than its 2010 estimate.

Table 20. Shell Rebate Program Benchmarking

Utility	Grouping	n	FR	Part SO	NTG
Avista – 2010	Shell	67	45.0%	8.8%	63.8%
Avista – 2011	Shell	37	33.1%	0.0%	68.3%*
Northwest Utility – 2011	Insulation	146	26.7%	1.6%	74.9%
Northwest Utility – 2011	Insulation	111	13.2%	0.5%	87.3%
Midwest Utility – 2011	Insulation	41	14.6%	2.6%	88.0%

* Includes 1.5% nonparticipant spillover estimate for 2011 Avista Shell rebate program category

Nonresidential NTG Benchmarking

Prescriptive Programs

The 2011 estimates are comparable to recent freeridership estimates for Efficiency Maine's 2010 nonresidential prescriptive program category. When we stratified the results by lighting versus non-lighting measures, Avista's 2011lighting estimate is 19% compared to 2010 Efficiency Maine's of 28%. Avista's 2011 non-lighting estimate is 45% and Efficiency Maine's is 50%.

Avista's 2010 overall prescriptive estimate is the second lowest compared to other utilities (Table 21). In fact, the 2010 Avista prescriptive estimate of 13% appears unusually low.

Custom Programs

Avista's site-specific categorization is comparable to other utilities in Table 22. The 2011 and 2010 Avista site-specific program category estimates are in the middle range of freeridership estimates developed for other utilities' nonresidential custom energy efficiency programs.

Table 21. Prescriptive Program Benchmarking

Utility	Grouping	n	FR	SO	NTG
Avista 2010	Prescriptive - ALL	59	13%	0.0%	87%
Avista 2010	Prescriptive – Lighting	53	14%	0.0%	86%
Avista 2010	Prescriptive – Non-Lighting	6	10%	0.0%	90%
Avista 2011	Prescriptive - ALL	70	33%	0.0%	67%
Avista 2011	Prescriptive – Lighting	37	19%	0.0%	81%
Avista 2011	Prescriptive – Non-Lighting	33	45%	0.0%	55%
Efficiency Maine 2010	Prescriptive - ALL[4]	131	31%	0.3%	69%
Efficiency Maine 2010	Prescriptive – Lighting	99	28%	0.2%	72%
Efficiency Maine 2010	Prescriptive – Non-Lighting	32	50%	0.1%	50%
Efficiency Maine 2003-2006	Prescriptive - ALL[5]	77	27%	4.0%	77%
Pacific Corp, UT - 2005 – 2008	Prescriptive - ALL[6]	68	21%	0.0%	79%
Pacific Corp, WA - 2005 – 2008	Prescriptive - ALL[7]	57	12%	0.0%	88%
Pacific Corp, ID - 2005 – 2008	Prescriptive - ALL[8]	59	13%	0.0%	87%

Table 22. Custom Program Benchmarking

Utility	Grouping	n	FR	Part SO	NTG
Avista 2010	Site-Specific - ALL	61	26%	2.0%	76%
Avista 2011	Site-Specific - ALL	63	17%	0.0%	83%
Efficiency Maine 2010	Custom - ALL	36	39%	0.1%	61%
Efficiency Maine 2003-2006	Custom - ALL	63	23%	1.0%	78%
Pacific Corp - UT - 2005 - 2008	Custom - ALL (FinAnswer)	37	13%	0.0%	87%
Pacific Corp - WA - 2005 - 2008	Custom - ALL (FinAnswer)	37	11%	0.0%	89%
Pacific Corp - ID - 2005 - 2008	Custom - ALL (FinAnswer)	3	25%	0.0%	75%

4 http://www.efficiencymaine.com/docs/reports/EMT-Business-Program-Report-FY2011-FINAL.pdf

5 http://www.cee1.org/eval/db_pdf/545.pdf

6 http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_UT_FinExp.pdf

7http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_WA_FinExp.pdfhttp://www.pacificorp.com/content/dam/pacificorp/d oc/Energy_Sources/Demand_Side_Management/DSM_WA_FinExp.pdf

8 http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/ID_FinAnswer_Express_Report.pdf

7. Conclusions and Recommendations

Conclusions

- Nonresidential freeridership was fairly steady over the two years and was in line with other studies. The absence of attributable program spillover is not unusual, given the size and cost of efficiency projects for these customers.
- Residential freeridership was higher for 2011 than for 2010. The reason for this spike is not completely clear, and it is outside the normal range seen in other utilities. Residual effects from ARRA funding or fundamental market transformation could be contributing factors. Caution should be taken in making significant program changes until a clear trend has been demonstrated.

Freeridership is More than a Ratio

Response distributions used for calculating an average freeridership ratio contain information that can help program managers more effectively manage their programs. Two interesting issues emerged in our review of these distributions.

First, it appears Avista programs could be even more efficient if eligibility requirements were tightened. Our survey asked respondents whether they had already installed equipment *before* hearing about the Avista program. A number of respondents answered "yes" and were classified as freeriders, along with respondents who consistently responded they would not have installed the equipment at all except for the program. Removing the "already installed" responses from the analysis significantly improved the freerider ratios, as shown in Table 23. This may indicate program requirements and program incentive quality control could be tightened.

Table 23. Effect on Freeridership of Removing "Already Installed" Responses

	With "Already Installed"		Without "Already Installed"	
Survey Category	Responses	FR %	Responses	FR %
Residential Appliances	94	62%	74	51%
Residential HVAC	155	58%	123	47%
Residential Shell	37	33%	35	29%
Energy Smart Grocer	17	4%	15	0%
Motors	12	47%	9	18%
Prescriptive	70	33%	56	19%
Site-Specific	63	19%	58	7%

Second, to test the hypothesis that incentive levels affect freeridership, we compared the proportion of total measure cost covered by the incentive with the freeridership ratio found in our analysis. We employed a regression to estimate the effect of incentive level on the rate of freeridership. We estimated OLS (Ordinary Least Squares) models both for residential programs overall as well as models by program. These models took the following form:

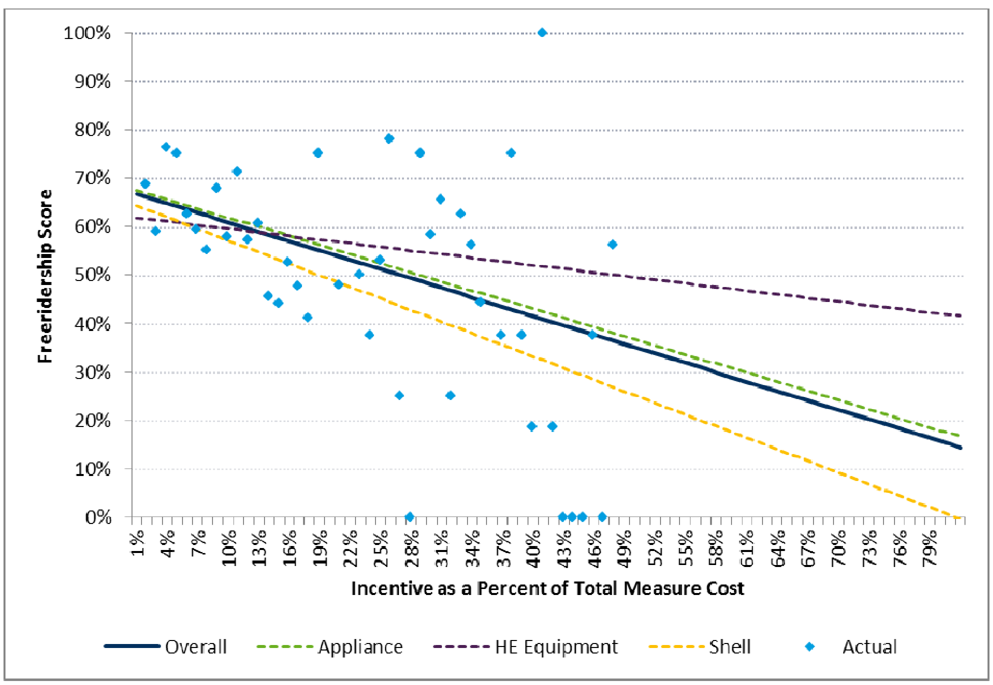
As shown in Table 24, the overall residential portfolio had a coefficient of -0.65 for the incentive relative to measure cost. This implies that a 1% increase in the proportion of the measure cost paid by Avista would result in a 0.65% decrease in the freeridership rate. The size of this coefficient can be thought of the responsiveness of non-freeriders to incentives. Therefore, the sum of the coefficients on the intercept (the rate of freeridership in a hypothetical program with no incentive) and the incentive would be the predicted freeridership ratio in a program that offers an incentive covering 100% of the measure cost.

Table 24. Residential NTG Model Results

Program	Model Coefficients		Incentive %		
	Intercept	Incentive	Mean	Min	Max
Appliance	0.67	-0.63	9%	1%	50%
HE Equipment	0.62	-0.25	16%	1%	50%
Shell	0.64	-0.80	39%	16%	50%
Overall	0.67	-0.65	17%	1%	50%

As illustrated in Figure 2, shell measures were the most responsive to price and appliances were near the average. Equipment measures did not appear to respond as strongly to price.

Figure 2. Freeridership and Incentive as a Percentage of Total Measure Cost*



*Actual values represent the average freeridership score for all participants receiving an incentive at the given proportion of total measure cost.

Recommendations

- Because of the uncertain nature of the 2011 residential freeridership values, we believe a weighted average of the 2010 and 2011 surveys should be used for calculating residential cost-effectiveness as presented in Table 25. We strongly advocate continued measurement of residential NTG in coming years to help determine whether the 2011 residential freeridership is an aberration or a trend. This practice will give Avista several years of analysis that could be combined into a single estimate or could help reinforce each new year's evaluation by establishing or refuting a trend.

Table 25. 2010/2011 Combined Residential NTG Ratios

Program	Responses	FR%	Participant SO%	Nonparticipant SO %	NTG
Appliances	161	56.1%	2.1%	0.1%	46.1%
HE Equipment	222	52.1%	1.6%	1.0%	50.5%
Shell	104	40.8%	5.7%	1.5%	66.4%

Cadmus did not combine 2010 and 2011 nonresidential NTG estimates due to the uniqueness of projects during the individual program years.

- Avista programs might be even more efficient if eligibility requirements were tightened. Our survey asked respondents if they had already installed equipment *before* hearing about the Avista program. For example, 21% of residential appliance and 19% of high-efficiency equipment rebate program participants replied that they had already installed the rebated equipment before learning about the Avista program. These respondents fit the definition of a *pure freerider*, are being scored as 100% freeriders, and are driving the high freeridership estimate for the residential appliance and high-efficiency equipment survey categories. It is understood that the impact on customer views of Avista may make this recommendation difficult to implement.

- Avista should capture additional effects its programs have had on participant's energy-efficient purchases by surveying prior participants; their answers could be an additional source of spillover attributable to the program.

- We recommend that Avista conduct or contract market research into the areas of residential appliances and heating and cooling equipment to determine if there has truly been a transformation in the market or if Avista's high freeridership results are due to increasing consumer adoption of energy-efficient measures.

- Increasing incentives in the residential programs may lower the programs' freeridership ratios. In order to reduce freeridership substantially, our analysis suggests that incentive levels may need to be increased to between 30% and 50% of total measure cost. This may not be feasible for some measures, for example, in cases where the increased incentive would exceed the incremental cost.

- Avista may want to consider better tracking of market shares of various energy using (saving) technologies through a panel of trade allies. A sample of trade allies (participants and nonparticipants) can be identified and included in the panel. They get compensated for their time filling out forms showing their annual sales for various technologies and associated efficiency levels. They are also asked to provide an assessment of the impact of the program on the various sales (incented and non-incented equipment). We believe this will provide a more accurate estimate of the impact of Avista programs on market shares of energy efficient equipment.

Appendix A: Program Categorization

Table 26. Residential Program Categorization

Program Category	Measure
Appliances	Clothes Washer Refrigerator Freezer Natural Gas Water Heater Electric Water Heater
HE Equipment	Natural Gas Furnace 40 Gallon Natural Gas Hot Water Heater 50 Gallon Natural Gas Hot Water Heater Air Source Heat Pump Ductless or Mini-Split Heat Pump Fire Place Damper
Shell	Attic Insulation Floor Insulation Exterior Wall Insulation

Table 27. Nonresidential Program Categorization

Program Category	Measure
Energy Smart Grocer	Energy Smart-Case Lighting Energy Smart-Industrial Process Energy Smart-Audit
Motors	Motors Controls HVAC Prescriptive Motors Motors Controls Industrial
Prescriptive	Prescriptive Interior Lighting Prescriptive Exterior Lighting Prescriptive Commercial HVAC Prescriptive Commercial Shell Prescriptive Food Service Prescriptive LED Traffic Signals Prescriptive Commercial Clothes Washer Prescriptive Side-Stream Filtration Standby Generator Block Heater
Site-Specific	Appliances Interior Lighting Exterior Lighting HVAC Heating HVAC Cooling HVAC Combined ENERGY STAR Dishwasher ENERGY STAR Clothes Washer ENERGY STAR Refrigerator Prescriptive Demand Controlled Ventilation Compressed Air Industrial Process Shell Measures

Appendix B: Survey Design

Direct questions (such as, "Would you have installed measure X without the program incentive?") tend to result in exaggerated "yes" responses. Participants surveyed likely provide answers they believe surveyors seek so this question becomes the equivalent of asking: "Would you have done the right thing on your own?" An effective solution to avoid such bias involves asking the question several different ways to check for consistent responses.

Cadmus designed survey questions to determine why customers installed a given measure and the program's influence over those decisions. The survey goal was to establish what the decision-maker might have done in the program's absence. Five core freeridership questions addressed that answer:

- Would the participant have installed the measure without the program?
- Had the participant already ordered or installed the measure before learning about the program?
- Would the participant have installed the measure to the same efficiency level without the program incentive?
- Would the participant have installed the same quantity of measures without the program?
- In the absence of the program, when would the respondent have installed the measures?

Nonresidential program surveys seek to answer an additional freeridership question pertaining to whether participants had purchased and installed the measure in their most recent capital budget. The question was not included in the surveys for residential program participants. Our experience has shown most residential customers do not maintain long-term budgets, and they are often replacing equipment on failure; therefore, they likely would not have included the purchase in their budgets.

The spillover survey sought to answer three primary questions:

- Since participating in the program being evaluated, has the participant installed additional energy-efficient equipment or services that were not rebated through a utility program?
- How influential was the evaluated program in the participant's decision to install additional energy-efficient equipment in their home?
- What was the additional energy-efficient equipment installed, and how much or how many?

Freeridership Survey Questions

Cadmus reviewed each program category's unique aspects to determine whether each core freeridership question was appropriate and worded correctly. Six questions were included in the residential survey's freeridership portion. In the list below, a general description of each question precedes the full text of the question appearing in the survey. We use the general description in tables throughout the rest of this report when referring to the residential freeridership questions.

1. **Already Ordered or Installed.** When you first heard about the rebate from AVISTA for the [MEASURE], had you already purchased the [MEASURE]?
2. **Planning to Purchase.** When you first heard about the rebate from AVISTA, had you already been planning to purchase, or had you already begun collecting information about the [MEASURE]?
3. **Would Have Installed without Rebate.** Without a rebate from Avista would you still have purchased the same [MEASURE] for your home?
4. **Purchased Exact Same Measure.** Help me understand. When you say you would have bought the same [MEASURE_REF], would you have bought exactly the same [MEASURE_REF]?
5. **Same Efficiency.** Without the rebate, would you have still purchased a [MEASURE] that was just as energy efficient, more efficient, or less efficient?
6. **Planning to Install Soon.** And without the rebate, would you have bought the [MEASURE] sooner, bought it at about the same time, bought it later in the same year, bought it in one to two years, bought it in three to five years, or bought it five or more years later?

Six questions also were included in the nonresidential survey's freeridership portion. In the list below, a general description of each question precedes the full text of the question appearing in the survey. We use the following general description in figures throughout the rest of this report when referring to nonresidential freeridership questions.

1. **Already Ordered or Installed.** When you first heard about the rebate from AVISTA for the [MEASURE], had you already purchased the [MEASURE]?
2. **Already in Budget**. Was buying the [MEASURE] included in your most recent capital budget before you participated in the program?
3. **Purchased Same Measure Previously**. Before your organization participated in the Avista program for the first time, had you ever purchased the same type of [MEASURE]?
4. **Would Have Installed without Rebate.** Would you have purchased the [MEASURE] without the rebate?
5. **Same Efficiency.** Without the rebate, would you have still purchased a [MEASURE] that was just as energy efficient, more efficient, or less efficient?
6. **Planning to Install Soon.** And without the rebate, would you have bought the [MEASURE] sooner, bought it at about the same time, bought it later in the same year, bought it in one to two years, bought it in three to five years, or bought it five or more years later?

Spillover Survey Questions

As noted, the spillover questions sought to determine whether program participants had installed any other energy-saving measures since participating in the program. Savings participants received from additional measures would be considered spillover savings if the program significantly influenced their decisions to purchase additional measures and if they did not receive additional rebates for those measures.

For residential participants, we specifically asked whether they had installed the following types of measures:

- Energy-efficient appliances
- Efficient HVAC equipment
- Windows or insulation
- Stopped using or recycled a refrigerator or freezer
- Sealed air leaks

We also asked whether respondents moved into an ENERGY STAR home in the past year.

For nonresidential participants, we specifically asked whether they had installed the following types of measures:

- Building controls
- Energy efficient appliances
- Custom measures
- Food service equipment
- HVAC equipment
- Lighting and lighting controls
- Economizer
- LEED certification
- Motors
- PC network controls
- Steam-trap replacement
- Side-stream filtration
- Variable frequency drives
- Ventilation
- Windows or insulation

For residential surveys, if the participant installed one or more of these measures, they were asked additional questions about what the installed equipment replaced and in some cases specific characteristics of the new equipment. Nonresidential survey respondents were asked the quantity of equipment they installed, whether they applied for a rebate from Avista, and their reason for not applying for a rebate if they had not done so. This additional information allowed us to estimate the energy savings associated with the spillover measures more accurately. The participant was then asked to rate how influential (on a scale of 1 to 5, with 1 being not at all influential and 5 being very influential) the Avista program was on their decision to install the additional measure.

Cadmus combined the freeridership and spillover questions in the same survey, asking them simultaneously through telephone interviews of randomly selected program participants. Prior to beginning the live participant phone calls, Cadmus worked with the survey company to pretest the survey, ensuring all appropriate prompts and skip patterns were followed. Cadmus also monitored the initial phone calls to verify: (1) the survey respondents understood the questions; and (2) adjustments were not required.

Appendix C: Freeridership Scoring Methodology

Convert Responses to Matrix Terminology

We independently evaluated each survey question's response to assess participants' freeridership level for each question. Each survey response option was converted into a value of "yes" (100% freerider), "no" (0% freerider), or "partial" (50% freerider).

Table 28 lists six residential survey questions, their corresponding response options, and the value which we converted them to (in parentheses). "Don't know" and "refused" responses were converted to "partial" for all but the first question. For that question, we determined if a participant was unsure whether they had already purchased the measure before learning about the rebate, they were unlikely to be a freerider.

Table 28. Assignments of Residential Response Options into Matrix Terminology

Already Ordered or Installed	Planning to Purchase	Installed without Program	Installed Exact Measure	Same Efficiency	Planning to Install Soon
Yes (Yes)	Yes (Yes)	Yes (Yes)	Yes (Yes)	More energy efficient (Yes)	Yes, later in the same year (Partial)
No (No)	No (No)	No (No)	No (No)	Less energy efficient (No)	Yes, in one or more years (No)
Don't Know (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (Partial)	Just as energy efficient but a different model or type (Yes)	I would have bought it at the same time or sooner (Yes)
Refused (No)	Refused (Partial)	Refused (Partial)	Refused (Partial)	Don't Know (Partial)	Don't Know (Partial)
				Refused (Partial)	Refused (Partial)

Table 29 lists six nonresidential survey questions, their corresponding response options, and the value to which we converted them (in parentheses). For the same reasons cited for the residential questions, "don't know" and "refused" responses were converted to "partial" for all but the first question.

Table 29. Assignments of Nonresidential Response Options into Matrix Terminology

Already Ordered or Installed	Already In Budget	Purchased Same Measure Previously	Would have Installed without Program	Same Efficiency	Planning to Install Soon
Yes (Yes)	Yes (Yes)	Yes (Yes)	Yes (Yes)	Same efficiency (Yes)	Bought it sooner (Yes)
No (No)	No (No)	No (No)	No (No)	More efficient (Yes)	Bought it at the same time (Yes)
Don't Know (No)	Don't Know (Partial)	Don't Know (Partial)	Don't Know (Partial)	Less efficient (No)	Bought it later in the same year (Partial)
Refused (No)	Refused (Partial)	Refused (Partial)	Refused (Partial)	Don't Know (Partial)	Bought it in 1 to 2 years (No)
				Refused (Partial)	Bought it in 3-5 years (No)
					Bought it 5 or more years later (No)
					Don't Know (Partial)
					Refused (Partial)

Participant Freeridership Scoring

After converting survey responses into matrix terminology, we created a freeridership matrix so the combination of each participant's responses to the six questions could be assigned a freeridership score. To create the matrix, we determined every combination of possible responses to the six survey questions and then assigned a freeridership score of 0 to 100% to each combination.

Using these matrices, every participant combination of responses was assigned a score of 0% to 100%. For example, participants not purchasing the measure when first hearing about the rebate, but answering affirmatively to every subsequent question, were assigned a 100% freeridership score. For participants not purchasing the measure upon first hearing about the rebate, but answering affirmatively to every subsequent question (except stating they would not have purchased the exact same measure without the rebate), we reduced the freeridership score to 50%. This process was used to determine the base freeridership scoring matrices for both residential and nonresidential analysis. The nonresidential freeridership analysis uses the base freeridership scoring matrix as the final nonresidential scoring matrix. A reduction of 25% was applied to each of the residential scores in the base residential scoring matrix to arrive at the final residential scoring matrix used for the analysis. The adjustment was implemented to account for the increasing evidence that social acceptance response bias on energy may adversely affect freerider self-reports.

Additionally, residential survey respondents were asked to describe in their own words what role the program rebate played in their decision to purchase the program measure. Respondent's whose answer contradicted the matrix score were assigned an adjusted freeridership score. Rather than subject Avista's customers to further questioning about their contradictory responses, we assigned a final freeridership score of 50%. This adjustment affected 28 residential respondents who are scored as 100% freerider in the matrix, but whose decision description indicated that the rebate played no role in the purchase decision. Additionally, three respondents who scored '0%' in the freeridership matrix, but who said that the rebate played little or no role in the purchase decision, were also assigned a freeridership score of 50%.

The Cadmus Freeridership Scoring Model

Cadmus has developed an Excel-based model to assist with freeridership calculation and improve consistency and quality of results. Our model translates raw survey responses into matrix terminology and then assigns each participant's response pattern a score from the matrix. Program participants in the sample can then be aggregated by program category to calculate the average freerider score.

The model incorporates the follow inputs described in this methodology:

- Raw survey responses for each participant, along with the program category for their rebated measure, and energy savings from that measure, if applicable.
- Figures converting the raw survey responses into matrix terminology for each program category, similar to those presented in Table 28 and Table 29.
- Custom freeridership scoring matrices for each unique survey type. For Avista, we created two unique matrices, one for residential programs and one for nonresidential programs.

The model uses a simple interface, allowing users to quickly reproduce a scoring analysis for any program category. It displays each participant's combination of responses and corresponding freeridership score and then produces a summary table that shows the average score and precision estimates for the program category. The model uses the sample size and a two-tailed test target at the 90% confidence interval to determine the average score's precision.

Table 30 shows a summary table example for the residential appliances program category. The figure shows the final freeridership score in the lower right corner. The residential appliances program category averaged freeridership of 62%, meaning that 62% of the energy savings were derived from freeriders and therefore should be removed from gross program savings. Based on a 94 response sample size, the program's absolute precision was 4.9 percentage points.

Table 30. Freerider Scoring Model Output

Population (P):	10,216	SE of Mean (SEMean):	0.0299	Adj. Relative Precision:	8%
Total Responses (n):	94	Relative Precision:	7.95%	Coefficient of Variation:	0.4688
Responses Removed:	0	Absolute Precision:	0.049	Upper Bound Score:	0.67
Variance of Mean:	0.0839	Finite Pop. Correction:	1	Weighted Mean Score:	0.62
Standard Deviation:	0.2897	Adjusted SE:	0.03	Lower Bound Score:	0.57

Appendix D: Residential Program Freeridership Results Detail

Residential Appliances

Table 31, below, shows the unique response combinations from the residential appliance participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

Table 31. Frequency of Freeridership Scoring Combinations—Residential Appliances

Already Ordered or Installed	Planning to Purchase	Installed without Program	Installed Exact Measure	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	21
No	Yes	Yes	Yes	x	Yes	75%	33
No	Yes	Yes	Yes	x	Partial	56%	1
No	Yes	Yes	Yes	x	No	0%	4
No	Yes	Yes	Partial	Yes	Yes	75%	2
No	Yes	Yes	No	Yes	Yes	75%	2
No	Yes	Partial	x	x	Yes	56%	3
No	Yes	No	x	x	Yes	38%	3
No	Partial	Yes	Yes	x	Yes	56%	2
No	No	Yes	Yes	x	Yes	38%	11
No	No	Yes	Partial	Partial	Yes	19%	2
No	No	Yes	No	Yes	Yes	38%	2
No	No	Yes	No	Partial	Partial	9%	1
No	No	Partial	x	x	Yes	19%	2
No	No	Partial	x	x	Partial	9%	1
No	No	No	x	x	Yes	9%	3
No	No	No	x	x	Partial	0%	1

Three patterns appeared in the residential appliance respondents' answers to freeridership questions, which represented 69% (65 out of the 94) of residential appliance participants interviewed:

- Twenty-one respondents (22% of total) had already purchased the measure before hearing about an Avista rebate and are being scored as 100% freeriders.
- Thirty-three respondents (35% of total) would have purchased the measure without the Avista rebate, to the same level of efficiency and within one year of their program-rebated purchase. They were scored as 75% freeriders because they had not already ordered or installed the measures before learning about the program and thus are not considered a pure freerider.

- Eleven respondents (27% of total) were not planning to purchase the same measure when first hearing about the Avista appliance rebate program and had not already ordered or installed the measure before learning about the program. However, they would have installed the exact same measure without a rebate and within a year. These respondents showed indications of being freeriders and, as a result, received partial credit, with a score of 38%.

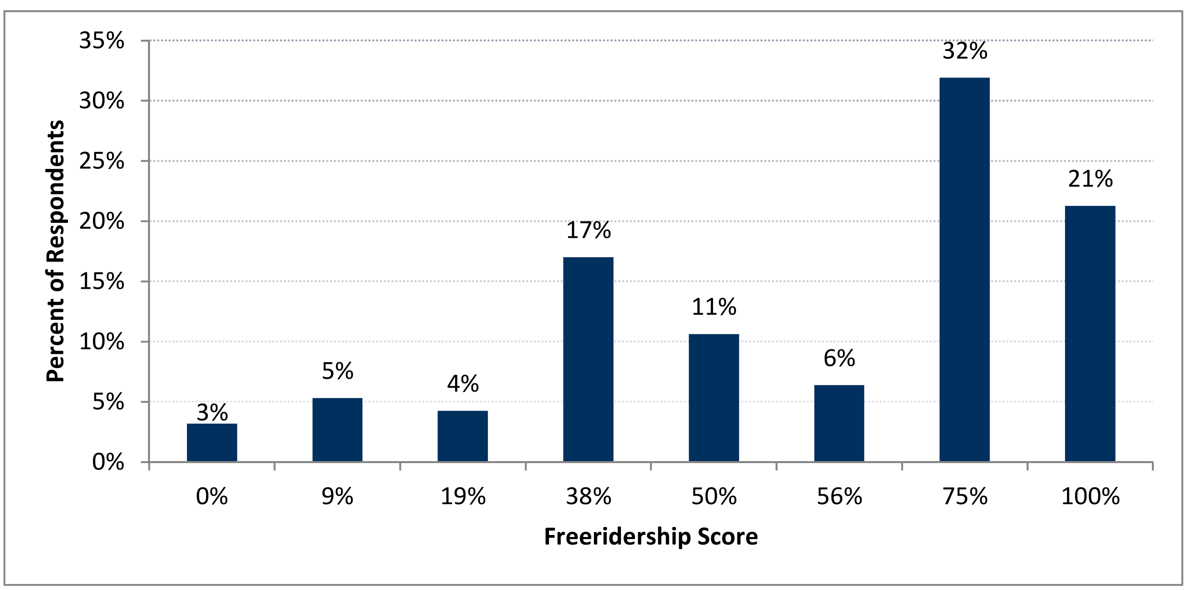
Adjustments were made to freeridership estimates obtained from the scoring matrix if a respondent's open-ended answer indicated that the rebate played a role in their purchasing decision. Table 32 summarizes respondents whose freeridership estimate from the scoring matrix was adjusted based on additional information obtained from their open-ended response.

Table 32. Adjusted Scoring Matrix Estimates—Residential Appliances

Response String	Number of Responses	Matrix FR %	Adjusted FR %
Yesxxxxx	1	100%	50%
NoYesYesYesxYes	5	100%	50%
NoYesYesYesxNo	2	0%	50%
NoYesYesPartialYesYes	1	75%	50%
NoYesYesNoYesYes	1	75%	50%

Figure 3 shows a distribution of residential appliances survey respondents by the freeridership score assigned to each. Approximately 21% of residential appliance survey respondents were 100% freeriders. Additionally, almost 32% of respondents were considered 75% freeriders, while only 12% indicated low levels of freeridership (0% to 19%). Moderate levels of freeridership (38% to 56%) were observed for 34% of respondents.

Figure 3. Distribution of Residential Appliance Freeridership Scores



Residential High-Efficiency Equipment

Table 33 shows the unique response combinations from the residential high-efficiency equipment participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

Table 33. Frequency of Freeridership Scoring Combinations—Residential HE Equipment

Already Ordered or Installed	Planning to Purchase	Installed without Program	Installed Exact Measure	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	35
No	Yes	Yes	Yes	x	Yes	75%	45
No	Yes	Yes	Yes	x	Partial	56%	4
No	Yes	Yes	Yes	x	No	0%	2
No	Yes	Yes	Partial	Yes	Yes	75%	3
No	Yes	Yes	Partial	Partial	Yes	56%	3
No	Yes	Yes	Partial	No	x	0%	1
No	Yes	Yes	No	Yes	Yes	75%	4
No	Yes	Yes	No	No	x	0%	3
No	Yes	Partial	x	x	Yes	56%	3
No	Yes	Partial	x	x	Partial	38%	4
No	Yes	Partial	x	x	No	0%	2
No	Yes	No	x	x	Yes	38%	6
No	Yes	No	x	x	Partial	19%	2
No	Yes	No	x	x	No	0%	4
No	Partial	Yes	Yes	x	Yes	56%	1
No	Partial	Yes	Yes	x	Partial	38%	1
No	Partial	Yes	Yes	x	No	0%	1
No	No	Yes	Yes	x	Yes	38%	14
No	No	Yes	Yes	x	Partial	19%	3
No	No	Yes	Partial	Yes	Yes	38%	1
No	No	Yes	Partial	Partial	Yes	19%	2
No	No	Yes	No	Partial	Yes	19%	1
No	No	Yes	No	Partial	Partial	9%	1
No	No	Partial	x	x	Yes	19%	2
No	No	Partial	x	x	Partial	9%	2
No	No	Partial	x	x	No	0%	1
No	No	No	x	x	Partial	0%	2
No	No	No	x	x	No	0%	2

Three patterns appeared in the residential high-efficiency equipment respondents' answers to freeridership questions, representing 61% (94 out of the 155) of residential high-efficiency equipment participants interviewed.

- Thirty-five respondents (23% of total) had already purchased the measure before hearing about an Avista rebate and are being scored as 100% freeriders.
- Forty-five respondents (29% of total) would have purchased the measure without the Avista rebate, to the same level of efficiency and within one year of their program-rebated purchase. They were scored as 75% freeriders because they had not already ordered or installed the measures before learning about the program and thus are not considered a pure freerider.
- Fourteen respondents (9% of total) were not planning to purchase the same measure when first hearing about the Avista appliance rebate program and had not already ordered or installed the measure before learning about the program. However, they would have installed the exact same measure without a rebate and within a year. These respondents showed indications of being freeriders and, as a result, received partial credit, with a score of 38%.

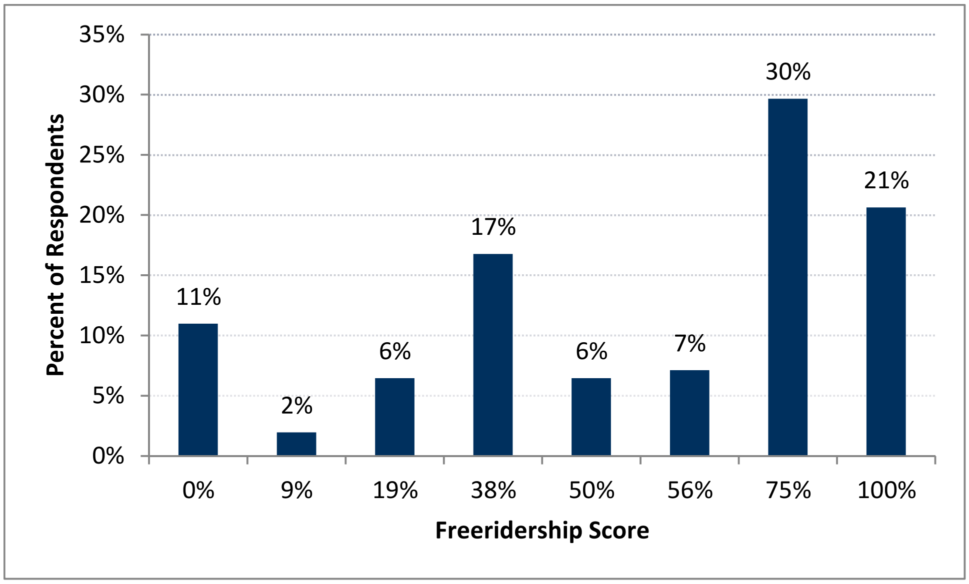
Adjustments were made to freeridership estimates obtained from the scoring matrix if a respondent's open-ended answer indicated that the rebate played a role in their purchasing decision. Table 34 summarizes respondents whose freeridership estimate from the scoring matrix was adjusted based on additional information obtained from their open-ended response.

Table 34. Adjusted Scoring Matrix Estimates—Residential HE Equipment

Response String	Number of Responses	Matrix FR %	Adjusted FR %
Yesxxxxx	4	100%	50%
NoYesYesYesxYes	6	100%	50%
NoYesYesNoNox	1	0%	100%

Figure 4 shows a distribution of residential high-efficiency equipment survey respondents by each one's assigned freeridership score. Over 11% of all respondents were not considered freeriders, compared to about 21% who were 100% freeriders. Of remaining respondents scored as partial freeriders, 30% of respondents were scored as 75% freeriders, 30% of respondents were scored from 38% to 56% freerider, and 8% were scored from 9% to 19%.

Figure 4. Distribution of Residential HE Equipment Freeridership Scores



Residential Shell

Table 35 shows unique response combinations from the residential shell participant survey, the freeridership score assigned to each combination, and the number of responses for each combination

Table 35. Frequency of Freeridership Scoring Combinations—Residential Shell

Already Ordered or Installed	Planning to Purchase	Installed without Program	Installed Exact Measure	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	3
No	Yes	Yes	Yes	x	Yes	75%	8
No	Yes	Yes	Yes	x	No	0%	1
No	Yes	Yes	Partial	Yes	Yes	75%	1
No	Yes	Partial	x	x	Yes	56%	1
No	Yes	No	x	x	Yes	38%	1
No	Yes	No	x	x	No	0%	2
No	Partial	Yes	Yes	x	Yes	56%	1
No	Partial	Yes	Partial	Yes	No	0%	1
No	Partial	Yes	Partial	Partial	No	0%	1
No	Partial	Partial	x	x	Partial	19%	1
No	Partial	No	x	x	No	0%	1
No	No	Yes	Yes	x	Yes	38%	2
No	No	Yes	Partial	Yes	No	0%	1
No	No	Yes	Partial	Partial	Partial	9%	1
No	No	Partial	x	x	Yes	19%	1
No	No	No	x	x	Yes	9%	3
No	No	No	x	x	Partial	0%	1
No	No	No	x	x	No	0%	6

Three patterns appeared in the residential shell respondents' answers to freeridership questions, representing 46% (17 out of the 37) of residential shell participants interviewed.

- Three respondents (8% of total) had already purchased the measure before hearing about an Avista rebate. They were not asked anymore questions, as they were considered 100% freeriders.
- Eight respondents would have purchased the measure without the Avista rebate, to the same level of efficiency and within one year of their program-rebated purchase. They were scored as 75% freeriders because they had not already ordered or installed the measures before learning about the program and thus are not considered a pure freerider.
- Six respondents (16% of total) were not planning on purchasing the measure before learning about the program, would not have installed the measure in absence of the program, and would not have installed the measure within one year.

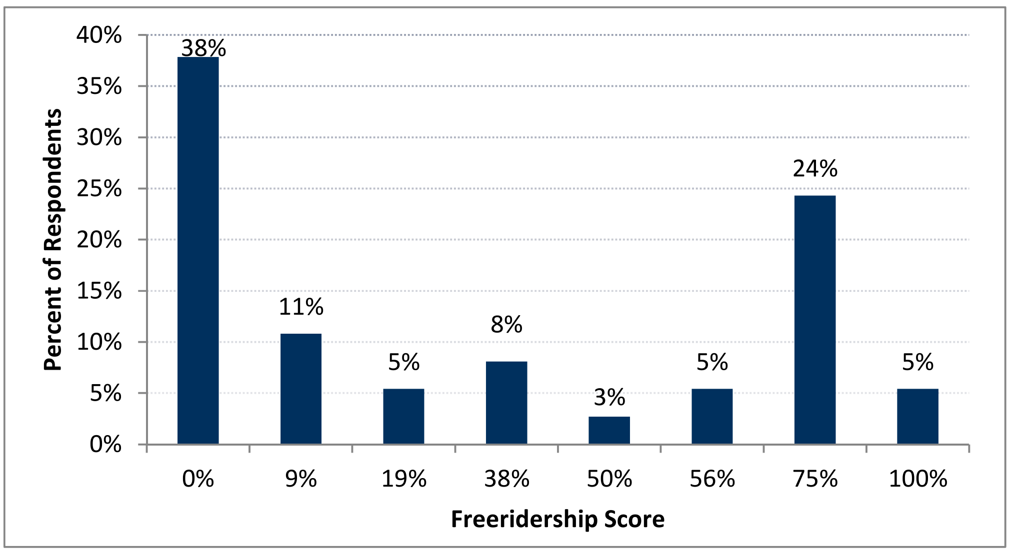
Adjustments were made to freeridership estimates obtained from the scoring matrix if a respondent's open-ended answer indicated that the rebate played a role in their purchasing decision. Table 36 summarizes respondents whose freeridership estimate from the scoring matrix was adjusted based off additional information obtained from their open-ended response.

Table 36. Adjusted Scoring Matrix Estimates—Residential Shell

Response String	Number of Responses	Matrix FR %	Adjusted FR %
Yesxxxxx	1	100%	50%

Figure 5 shows distributions of residential shell survey respondents by each one's assigned freeridership score. Almost 38% of all respondents were not considered freeriders, compared to about 5% that were 100% freeriders. Of the remaining respondents scored as partial freeriders, 24% were scored as 75% freeriders, while low to moderate levels of freeridership (9% to 56%) was observed for 32% of respondents.

Figure 5. Distribution of Residential Shell Freeridership Scores



Appendix E: Nonresidential Program Freeridership Results Detail

Energy Smart Grocer

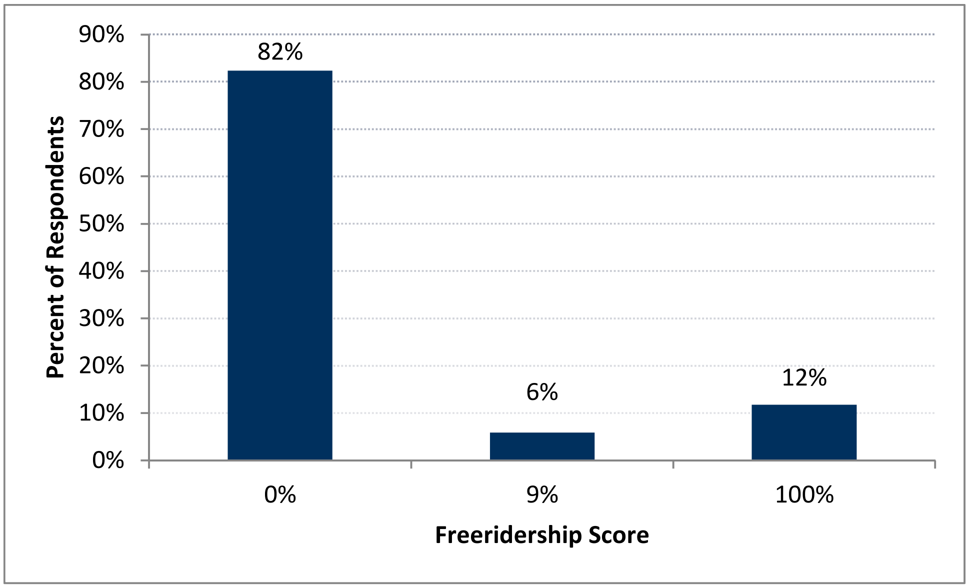
Table 37, below, shows the unique response combinations from the Energy Smart grocer participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

Table 37. Frequency of Freeridership Scoring Combinations—Energy Smart Grocer

Already Ordered or Installed	Already In Budget	Purchased Same Measure Previously	Would Have Installed without Program	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	2
No	Yes	No	No	Yes	Yes	9%	1
No	Yes	No	No	No	Partial	0%	1
No	Partial	Partial	Partial	Partial	Partial	0%	1
No	No	Yes	Yes	No	Partial	0%	1
No	No	Yes	No	Yes	Partial	0%	1
No	No	Yes	No	Yes	No	0%	1
No	No	Yes	No	No	No	0%	1
No	No	Partial	No	Yes	No	0%	1
No	No	No	No	Yes	No	0%	3
No	No	No	No	Partial	No	0%	3
No	No	No	No	No	No	0%	1

Unlike the residential survey responses, where two to three combinations were more prevalent than others, few Energy Smart grocer participants responded in the same pattern as the others. Table 37 notably shows most respondent's combinations were assigned a score of 0%, indicating most of the participants were not freeriders. This becomes more obvious in Figure 6, which shows 82% of the Energy Smart grocer survey respondents were not freeriders.

Figure 6. Distribution of Energy Smart Grocer Freeridership Scores



Prescriptive

Table 38 shows unique response combinations from the nonresidential prescriptive participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

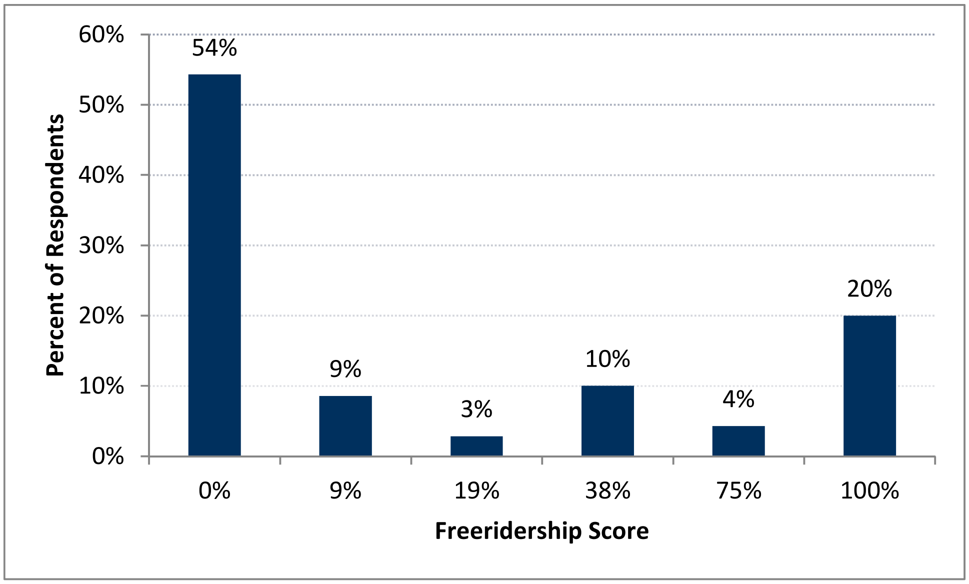
Table 38. Frequency of Freeridership Scoring Combinations—Prescriptive

Already Ordered or Installed	Already In Budget	Purchased Same Measure Previously	Would Have Installed without Program	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	X	x	100%	14
No	Yes	Yes	Yes	Yes	Yes	75%	3
No	Yes	Yes	Yes	Yes	No	0%	1
No	Yes	Yes	Yes	No	Yes	0%	1
No	Yes	No	Yes	Yes	Yes	38%	5
No	Yes	No	Yes	Yes	No	0%	1
No	Yes	No	No	Yes	Partial	0%	1
No	Yes	No	No	No	Yes	0%	1
No	Yes	No	No	No	No	0%	2
No	Partial	Yes	Yes	No	Yes	0%	1
No	No	Yes	Yes	Yes	Yes	38%	2
No	No	Yes	Yes	Yes	Partial	19%	1
No	No	Yes	Yes	Yes	No	0%	3
No	No	Yes	Yes	No	No	0%	1
No	No	Yes	No	Partial	No	0%	2
No	No	Partial	Yes	Yes	Yes	19%	1
No	No	Partial	Partial	Yes	Yes	9%	1
No	No	Partial	No	Yes	No	0%	1
No	No	No	Yes	Yes	Yes	9%	5
No	No	No	Yes	Yes	Partial	0%	3
No	No	No	Yes	Yes	No	0%	3
No	No	No	Yes	No	Yes	0%	1
No	No	No	Partial	Yes	Yes	0%	1
No	No	No	No	Yes	Yes	0%	1
No	No	No	No	Yes	Partial	0%	4
No	No	No	No	Yes	No	0%	3
No	No	No	No	Partial	Yes	0%	1
No	No	No	No	Partial	Partial	0%	2
No	No	No	No	No	Yes	0%	1
No	No	No	No	No	No	0%	3

As with Energy Smart grocer participants, there was a wide variety of response combinations for the prescriptive program category. Seventeen respondents were assigned a 100% freeridership score because they had already ordered or installed the rebated equipment when they heard about the Avista program. Fifty-four percent of respondents were scored as 0% freeriders while 22% of respondents received low to moderate (9% to 38%) freeridership scores.

Figure 7 shows distributions of nonresidential prescriptive responses by freeridership score assigned.

Figure 7. Distribution of Prescriptive Freeridership Scores



Motors

Table 39 shows unique response combinations from the nonresidential motors participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

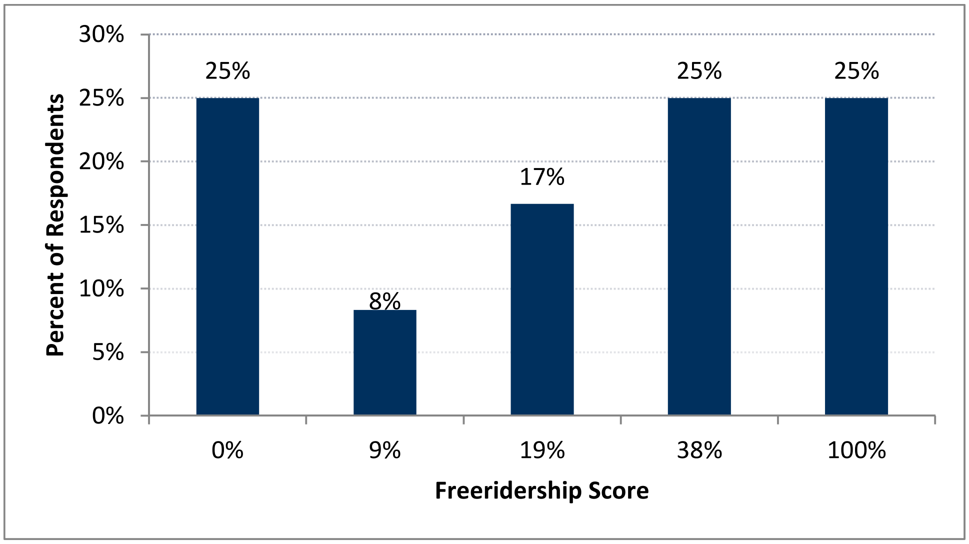
Table 39. Frequency of Freeridership Scoring Combinations—Motors

Already Ordered or Installed	Already In Budget	Purchased Same Measure Previously	Would Have Installed without Program	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	3
No	Yes	No	Yes	Yes	Yes	38%	1
No	Yes	No	No	Yes	No	0%	1
No	Partial	Partial	Yes	Yes	Yes	38%	1
No	Partial	Partial	Partial	Yes	Yes	19%	1
No	No	Yes	Yes	Yes	Yes	38%	1
No	No	Yes	Yes	Yes	Partial	19%	1
No	No	Partial	No	Partial	Partial	0%	1
No	No	No	Yes	Yes	Yes	9%	1
No	No	No	Partial	Partial	Yes	0%	1

Avista's motors programs had few participants in 2011. Cadmus was unable to reach most of the participants, interviewing only twelve of them. With the small sample size, each response had a significant impact on the average freeridership score for the motors program category. Three of the twelve respondents were 100% freeriders as they had already purchased and installed the motor equipment before learning about Avista's rebate. Two other respondents were determined to be 0% freeriders as they had not already purchased the equipment, the purchase was not in their capital budgets, they had not previously purchased similar equipment, and they would not have or were unsure if they would have installed it without the program.

Figure 8 shows distributions of nonresidential motors responses by assigned freeridership score.

Figure 8. Distribution of Motors Freeridership Scores



Site-Specific

Table 40 shows the unique response combinations from the nonresidential, site-specific participant survey, the freeridership score assigned to each combination, and the number of responses for each combination.

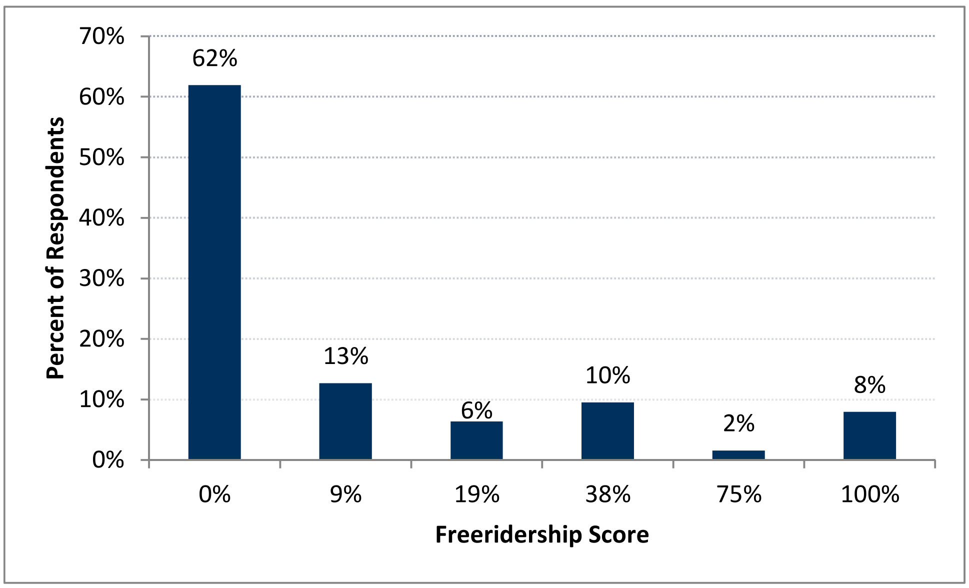
Table 40. Frequency of Freeridership Scoring Combinations—Site-Specific

Already Ordered or Installed	Already In Budget	Purchased Same Measure Previously	Would Have Installed without Program	Same Efficiency	Planning to Install Soon	FR Estimate	Number of Responses
Yes	x	x	x	x	x	100%	5
No	Yes	Yes	Yes	Yes	Yes	75%	1
No	Yes	Yes	Yes	Yes	No	0%	2
No	Yes	Yes	Yes	No	Yes	0%	3
No	Yes	No	Yes	Yes	Yes	38%	5
No	Yes	No	Yes	Yes	Partial	19%	2
No	Yes	No	Yes	No	Yes	0%	1
No	Yes	No	Yes	No	No	0%	1
No	Yes	No	Partial	Yes	Yes	19%	1
No	Yes	No	No	Yes	No	0%	2
No	Yes	No	No	No	Yes	0%	1
No	Partial	Partial	Partial	Partial	Partial	0%	1
No	Partial	Partial	No	Partial	Yes	0%	1
No	Partial	Partial	No	No	No	0%	1
No	Partial	No	Yes	Yes	Yes	19%	1
No	Partial	No	Partial	Yes	No	0%	1
No	Partial	No	No	Yes	No	0%	1
No	No	Yes	Yes	Yes	Yes	38%	1
No	No	Yes	Yes	Yes	No	0%	1
No	No	Yes	No	Yes	No	0%	2
No	No	Yes	No	Partial	Partial	0%	1
No	No	Yes	No	Partial	No	0%	1
No	No	Yes	No	No	No	0%	1
No	No	Partial	No	Yes	No	0%	1
No	No	No	Yes	Yes	Yes	9%	8
No	No	No	Yes	Yes	No	0%	3
No	No	No	Yes	No	No	0%	2
No	No	No	No	Yes	No	0%	6
No	No	No	No	Partial	No	0%	3
No	No	No	No	No	No	0%	3

Similar to other nonresidential program categories, no apparent pattern emerged as a common response combination for the site-specific survey respondents, which appeared to have a variety of slightly different reasons for participating in the program and varying freeridership levels. Six respondents were classified as 100% freeriders because they either had already purchased the equipment before hearing about Avista's rebate, or they had included the equipment purchase in their capital budget, planned on purchasing the equipment soon anyway, and would have made the purchase even if Avista's rebate had not been available. Eight respondents were classified as 9% freeriders because they had not already purchased the equipment, the purchase was not in their capital budgets, they had not previously purchased similar equipment, but they would have installed a unit to the same efficiency and within a year without the existence of the program.

Figure 9 shows distribution of responses by assigned freeridership score. About 62% of site-specific survey respondents were not freeriders.

Figure 9. Distribution of Site-Specific Freeridership Scores



Appendix F: Appliance Recycling Program NTG Results Detail

Cadmus' analysis estimated net savings for recycled refrigerators and freezers using the following formula:

$$
\begin{aligned}
Net\ savings &= Gross\ Savings * (1 - Freeridership\ Ratio) \\
&\quad - (Replacement\ kWh * Induced\ Replacment\ Proportion)
\end{aligned}
$$

Where:

Gross Savings =	average evaluated UEC for a recycled unit, adjusted for part-use;
Freeridership Ratio =	the proportion of program savings that would have occurred in the program's absence;
Replacement kWh =	average UEC for a replacement unit, adjusted for part-use; and
Induced Replacement Proportion =	the proportion of participants reporting they purchased a replacement unit due to the program.

Freeridership

Assessing freeridership for appliance recycling programs can be challenging, as the programs not only seek to remove inefficient appliances from the customers' homes, but seek to remove them from the utility grid. Thus, freeridership must be estimated based on participants' reports of what would have happened to the appliance in the program's absence. This invites the risk of biased responses from participants, as participants must consider what they would have done hypothetically. Such considerations often suffer from social desirability bias, which results from the respondents' tendency to answer questions in a manner that will be viewed favorably by others. To counteract this potential bias, Cadmus collected additional data from nonparticipants about how they actually disposed of their appliances.[9]

Table 41 presents four possible scenarios, assuming participating refrigerators or freezers had not been recycled through the program. Scenarios 1 and 3 indicate freeridership.

[9] Nonparticipants were defined as Avista customers disposing of a working refrigerator or freezer outside of the ARP in 2010 or 2011.

Table 41. Potential Freeridership Scenarios

Scenarios Independent of Program	Scenario	Indicative of Freeridership
Unit Kept But Not Used	1	Yes
Unit Kept And Used	2	No
Unit Discarded and Destroyed	3	Yes
Unit Discarded, Transferred, Used	4	No

For participants reporting they would have kept units had they not participated in the program (scenarios 1 and 2), the survey asked whether they would have used the unit or would have stored it unplugged. These responses provided the proportion of units that would have been kept and not used at this time. These units are therefore not drawing electricity from the grid—an indication of freeridership.

Calculating freeridership associated with units discarded or destroyed in the program's absence (scenarios 3 and 4) was slightly more complex, as data on this scenario are collected for both participants and nonparticipants. For participants, freeridership is defined based on self-reported hypothetical actions. For nonparticipants, freeridership is defined based on self-reported actions actually taken. By averaging these two estimates, we help mitigate any potential self-report bias.

The freeridership ratios estimated based on participant and nonparticipant surveys are presented in Table 42.

Table 42. Participant and Nonparticipant Freeridership Ratios

Respondent Group	Measure	n	Freerider Ratio	Absolute Precision (90% confidence)
Participant	Refrigerator	182	42%	±6%
Participant	Freezer	31	51%	±14%
Nonparticipant	Refrigerator	52	40%	±11%
Nonparticipant	Freezer	15	31%	±15%

Cadmus averaged the freeridership ratio estimates for participating and nonparticipating appliances to arrive at final, measure-level freeridership ratios.[10]

Table 43. Freeridership Ratios

Measure	Freerider Ratio Weighted Average	Absolute Precision (90% confidence)
Refrigerator	41%	±5%
Freezer	42%	±10%

[10] Cadmus calculated the average using inverse-variance weights to ensure placing greater weight on values with a higher degree of certainty.

Replacement

Cadmus adjusted for replacement of recycled units when replacement was induced by the program. Induced replacement occurs when a participant purchases a replacement unit as a result of the program. A percentage of participants who fit this profile was determined through surveys. This percentage was multiplied by the part-use adjusted UEC for the average replacement unit[11] to determine the adjustment for induced replacement in kWh. Table 44 summarizes replacement findings, by measure.

Table 44. Replacement kWh by Measure

Measure	Induced Replacement Proportion	Part-Use Adjusted Replacement Unit UEC (kWh)	Induced Replacement Adjustment (kWh)	Relative Precision (90% confidence)
Recycled Refrigerator	4.1%	472	19	±60%
Recycled Freezer	4.0%	410	16	±149%

Final Net Savings

As summarized in Table 45, our evaluation determined final net savings as gross savings, adjusted for freeridership, less induced replacement consumption.

Table 45. Final Per-Unit Net Savings

Year	Measure	Per-Unit Gross Energy Savings (kWh)	Induced Replacement kWh	Freeridership Ratio	Per-Unit Net Energy Savings (kWh)	Relative Precision (90% confidence)
2010	Recycled Refrigerator	1,093	19	0.41	621	±10%
	Recycled Freezer	940	16	0.42	532	±24%
2011	Recycled Refrigerator	1,083	19	0.41	615	±11%
	Recycled Freezer	881	16	0.42	497	±34%

As a point of comparison, the per-unit savings values found in the RTF measure database are 482 kWh for refrigerators and 555 kWh for freezers.[12] These can be compared to Cadmus' net savings values, as the RTF uses NTG as a proxy for a baseline adjustment. For refrigerators, Cadmus' estimated savings are higher, due largely to the fact that the portion of program-induced replacement was determined through participant surveys to be lower than the RTF's assumption.

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[11] Cadmus assumed a new unit consumes 500 kWh. This assumption is consistent with the underlying assumptions in RTF's measure database. See http://www.nwcouncil.org/energy/rtf/measures/res/FrigRecycle_FY10v2_3.xls

[12] http://www.nwcouncil.org/energy/rtf/measures/res/FrigRecycle_FY10v2_3.xls