2021 Washington Annual Conservation Report

May 26, 2022

All forward-looking statements contained in this document are based on underlying assumptions (many of which are based, in turn, upon further assumptions). These statements are subject to a variety of risks, uncertainties, and other factors. Most of these factors are beyond our control and may have a significant effect on our operations, results of operations, financial condition, or cash flows, which could cause actual results to differ materially from those anticipated in our statements.

Such risks, uncertainties, and other factors include, among others, those contained within our most recent annual report on Form 10-K, or quarterly report on Form 10-Q, filed with the Securities and Exchange Commission. Those reports are available at avistacorp.com.

Spokane, Washington

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View from Steptoe Butte, Washington

INTRODUCTION

For more than four decades, Avista has served its communities by developing and implementing reliable and cost-effective energy-efficiency programs. This 2021 *Annual Conservation Report* provides a synopsis of Avista's efforts to support customer energy needs, with an increased focus on innovative ways to provide benefits and reach customers that have historically not participated in efficiency programs. Avista's efficiency programs are designed not only to provide a least-cost resource, but also to help customers conserve energy, save money, and live more comfortably.

The 2021 *Annual Conservation Report* is provided consistent with WAC 480-109-120(3) which outlines requirements for annual reporting and is intended to acknowledge the verified savings recognized by Avista for meeting the targets set forth in RCW 19.285.040(1).

In 2020, Avista filed a petition with the Washington Utilities and Transportation Commission (WUTC) amending its natural gas energy-efficiency prudence review process. The former process, outlined in Docket Nos. UE-110976/UG-110877, required Avista to file supporting testimony as part of its prudence review process every two years starting in 2012. The revised process removed the requirement to file testimony and supporting evidence to demonstrate prudence requirements, instead allowing Avista to mirror the process required by the Energy Independence Act for its electric prudence review. The Commission approved this request in Order No. 09 of Dockets UE-110876 and UG-110877 (consolidated) on June 10, 2020.

Throughout 2021, COVID-19 continued to have significant impacts both on Avista's customers and on Avista's electric and natural gas conservation achievements. The pandemic required customers to adapt their day-to-day activities, causing them to reprioritize how they invest their time, money, and energy. Avista programs continued to focus on affordability and flexibility so that opportunities remained available to customers who wished to pursue efficiency in their home or business. While Avista made changes to adaptively manage its Energy-Efficiency Program, overall conservation achieved in 2021 continued to be affected by lower participation rates. Nevertheless, the company made meaningful modifications to its outreach efforts and took steps to ensure customers stayed connected. These efforts are discussed in more detail in this report.

Avista also began its transition toward programs to meet expectations of the Clean Energy Transformation Act (CETA) in 2021, convening its inaugural Equity Advisory Group (EAG) and filing the first Clean Energy Implementation Plan (CEIP) in the state. The company also obtained its first set of non-energy impact (NEI) values and began to integrate these values in its cost-effectiveness calculations for the 2022 plan. The identification and quantification of NEIs will help better inform program offerings and expand the overall value of measures for which incentives are offered.

In addition to offering a mix of programs implemented both by the company and by third-party contractors, Avista continues to support the regional market transformation effort through the Northwest Energy Efficiency Alliance (NEEA). Reported conservation energy savings, cost-effectiveness, and other related data, however, are specific to local programs unless otherwise noted.

FIGURE 1 – ELECTRIC AND NATURAL GAS SERVICE AREAS

TARIFF RIDER BALANCES

At the start of 2021, the Washington electric and natural gas (aggregate) tariff rider balances were underfunded by approximately $2.2 million, a significant decrease from prior years. Nearly $21 million in tariff rider revenue was collected to fund energy efficiency during the year, while around $18 million went to operate energy-efficiency programs. The $2.6 million excess of collections over expenditures contributed to the decrease in the underfunded balance of the tariff riders, resulting in a net overfunded balance of $432,401 by the end of the year.

Table 1 illustrates 2021 tariff rider activity by fuel type.

TABLE 1 – TARIFF RIDER ACTIVITY

	Electric	Natural Gas	Total
Beginning Balance (Underfunded)/Overfunded	**$ (1,259,579)**	**$ (958,547)**	**$ (2,218,127)**
Energy-efficiency funding	$ 16,157,657	$ 4,488,001	$ 20,645,658
Energy-efficiency expenditures	$ 12,558,548	$ 5,436,583	$ 17,995,130
Ending Balances (Underfunded)/Overfunded	**$ 2,339,530**	**$ (1,907,129)**	**$ 432,401**

WASHINGTON ACHIEVEMENTS

- ***Electric Conservation:*** For 2021, Avista's Electric Energy-Efficiency Program achieved 30,618 MWh of conservation from local programs and cost-effectiveness ratios of 1.34 for total resource cost (TRC) and 2.06 for utility cost test (UCT). After including savings from NEEA's programs, the overall savings achieved in 2021 was 39,044 MWh.

TABLE 2 – WASHINGTON ELECTRIC ACHIEVEMENTS

Sector	Savings Achieved (MWh)
Commercial/Industrial	28,743
Residential	1,568
Low-Income	306
Total Local Program	**30,618**
NEEA	8,426
Total	**39,044**

- ***Natural Gas Conservation:*** For 2021, Avista's Natural Gas Energy-Efficiency Program archived 770,447 therms of conservation from local programs and cost-effectiveness ratios of 1.68 for TRC and 2.88 for UCT. After including savings from NEEA's programs, the overall savings achieved in 2021 was 792,955.

TABLE 3 – WASHINGTON NATURAL GAS ACHIEVEMENTS

Sector	Savings Achieved (Therms)
Commercial/Industrial	327,595
Residential	430,433
Low-Income	12,455
Total Local Program	**770,483**
NEEA	22,472
Total	**792,955**

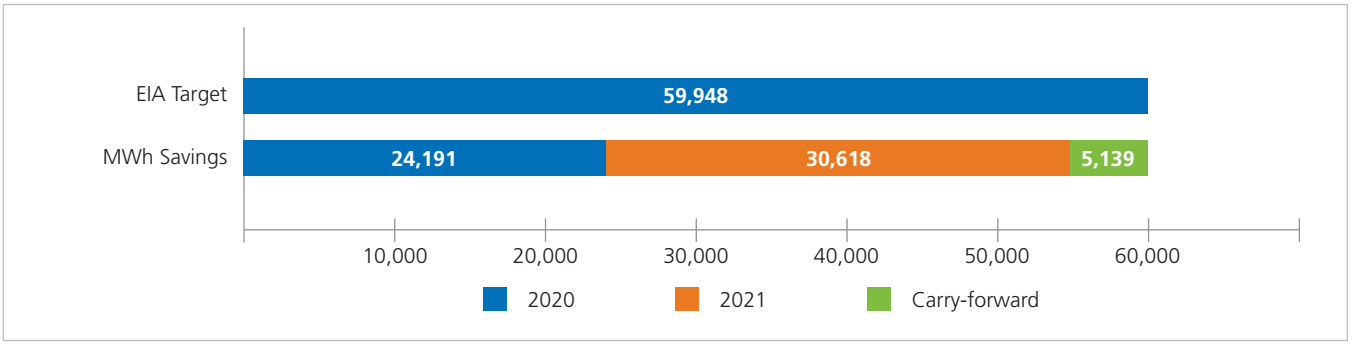
For the 2020–21 biennium, Avista's Washington Energy Independence Act (EIA) penalty threshold is 59,948 MWh, which is derived from several target elements including the conservation potential from the company's conservation potential assessment (CPA) and excluding savings derived from the NEEA program. The utility-specific conservation goal is 63,590 MWh, which is also inclusive of Avista's five percent decoupling commitment. Table 4 summarizes the target calculation.

TABLE 4 – 2020–21 ENERGY INDEPENDENCE ACT TARGET

Category	MWh
Pro rata share of 10-year conservation potential	72,340
Distribution and street light efficiency	504
EIA target	**72,844**
Decoupling penalty threshold	3,642
Total utility conservation goal	**76,486**
Excluded programs (NEEA)	(12,896)
Utility-specific conservation goal	**63,590**
EIA penalty threshold	**59,948**

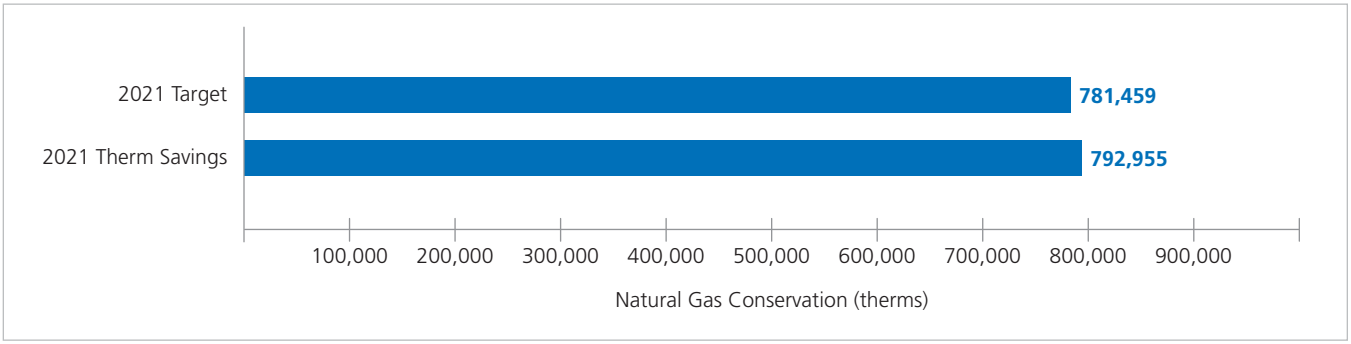
For the 2020-21 biennium, Avista met 91 percent of its electric conservation target, achieving 54,809 MWh through conservation programs. By using 5,139 MWh of surplus conservation savings carried forward from the two prior biennia, Avista met its biennial target of 59,948 MWh.

FIGURE 2 – 2020-21 CONSERVATION ACHIEVED VS ENERGY INDEPENDENCE ACT PENALTY THRESHOLD



Avista's natural gas conservation target is set according to the company's 2021 natural gas *Integrated Resource Plan (IRP)*. Based on this study, the conservation potential for 2021 was estimated to be 781,459 therms. During the 2021 program year, Avista's natural gas program achieved 792,955 therms, which is 101% percent of the *IRP* target. The 2021 achievement is inclusive of savings from the NEEA program.

FIGURE 3 – 2021 NATURAL GAS SAVINGS VS IRP TARGET



Program Impacts

COVID-19

COVID-19 continued to have multiple and far-reaching impacts on Avista's customers in 2021, although those impacts were significantly different from 2020. The job market made a strong recovery, and the region's economy is now experiencing a labor shortage. Contractors have faced increasingly challenging hiring conditions, resulting in longer turnaround times for many efficiency projects. Businesses have also experienced increasingly prevalent supply chain problems, further contributing to delays and longer turnaround timelines for efficiency projects. Avista continued to adapt its energy efficiency programs to provide support for customers to help them through this event.

COVID-19 Emergency Operating Plan Stages and Response

Early in 2020, Avista operated at the *monitoring* and *precautions stages* of its emergency operating plan (EOP), with additional precautions put in place to protect the safety of employees and customers. At the beginning of March 2020, the company moved into the *preventative* stage, which increased restrictions and limited customer interactions. Within the same month, Avista had skipped the *responsive* stage and moved to *critical*, which places the highest restrictions on meetings, public interactions, travel, and customer-related work. In addition, all non-essential employees moved to a work-from-home model. Avista remained in the *critical* stage throughout 2021.

Table 5 illustrates the four stages of the COVID-19 EOP.

TABLE 5 – AVISTA COVID-19 EMERGENCY OPERATING PLAN STAGES

Stage	Monitoring and Precautions	Preventative	Responsive	Critical
Description	A regional health or safety threat exists with potential impact to Avista operations and/or employees. Avista is monitoring and preparing to take necessary actions.	Regional organizations and/or public health officials begin recommending preventative actions. Avista is mitigating risks to ensure it can continue to provide essential services to its customers.	Either the threat has affected employees or service territory directly or an impact is clearly imminent. Avista is actively responding to protect employees, customers, and essential services.	The threat to essential services is severe. Avista is taking critical measures to protect employees and essential services.
Public Interactions	Precautions	Additional precautions	Limited	Critical only
Meetings	Normal	Large postponed, virtual encouraged	Virtual only	Virtual only
Travel	Discretionary/limit high-risk	Limit non-essential	Essential only	Emergency only
DSM Staff Desk Work	Remote work voluntary	Remote work recommended	Remote work mandatory	Remote work mandatory
DSM Customer Site Work	Call ahead to check with customer.	Ask permission to work on customer site. Go to campus only for instruments.	Ask customer for essential work only. Plan trips to Avista campus for supplies to avoid others. Meet with two or fewer people at the customer site and maintain social distance.	Request through account executive that customer send information necessary for projects. No trips to Avista campus or customer without permission from manager.

The additional restrictions placed on demand-side management (DSM) customer site work and on programs with high customer interaction created challenges for programs within Avista's Energy-Efficiency portfolio. Customer-facing offerings such as the Multifamily Direct Install (MFDI) Program and the Residential Home Energy Audit Program were both placed on hold, since their inherent design includes entering customer homes. Avista maintains that customer safety continues to be a top priority and it looks forward to resuming these programs in 2022.

Adaptive Management During COVID-19

Incentive Revisions: Throughout the biennium, Avista saw a lower level of participation in programs that have historically provided the greatest levels of conservation savings. Avista observed that customers were more cautious around their spending for efficiency upgrades and were more focused on operational challenges that came with COVID impacts. In response to this trend, Avista increased its incentive levels for customer projects from $0.20 per kilowatt to $0.23 per kilowatt and increased incentives for commercial and industrial lighting by approximately 15 percent. Avista has continued these levels into its 2022 program year. See Table 19 for more detail on lighting incentive changes. These modifications were put into effect in 2021; Avista will continue these levels into its 2022 program year.

Installation Verification: Avista continued its 2020 modified approach to installation verification in 2021. For projects normally requiring on-site verification, the company allowed customers to submit photos in lieu of an in-person site visit. For some projects, Avista participated in live video chats with owners to verify equipment installation. This approach prioritized the safety of both workers and customers.

Multifamily Direct Install: The MFDI Program has historically taken a high-touch approach to help multifamily customers to save energy. The program uses direct installation of LED lighting, faucet aerators, low-flow showerheads, and other measures to achieve savings and cost reductions. Throughout 2021, the MFDI implementation team attempted multiple approaches to program delivery that did not require installers to enter multifamily homes, including a pilot approach that enabled customers to drop off their old equipment and pick up new energy-efficient items. This pilot is discussed in more detail on page 56.

Customer Outreach: Energy fairs and outreach events were canceled throughout the biennium, leaving a significant hole in Avista's ability to engage in-person within the communities it serves. The company developed outreach kits that contained low-cost, energy-saving items, and partnered with Meals on Wheels to help distribute them. The kits included window plastic, LED lamps, nightlights, energy-saving tips, and information on assistance programs.

Portfolio Trends

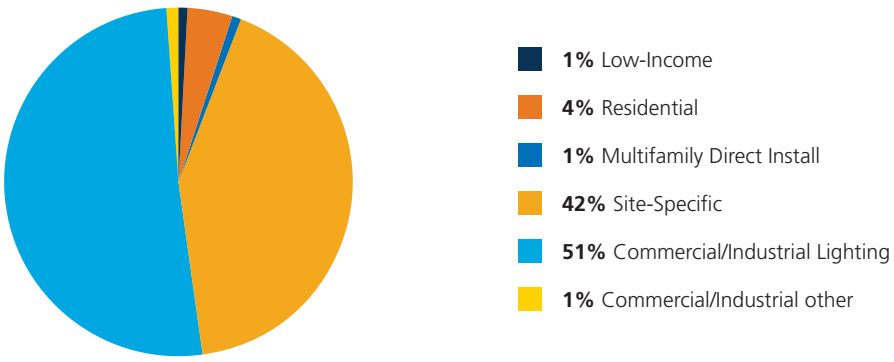
As shown in Table 6, Avista achieved higher energy savings in 2021 than in 2020 (30,618,153 kWh vs. 24,190,905 kWh). Savings acquired through the company's efficiency programs increased 27 percent, which is mostly attributable to an increase in commercial/industrial program savings.

TABLE 6 – ELECTRIC ENERGY SAVINGS (KWH)

Program Segment	2020	2021
Residential (including low-income programs)	3,601,842	1,874,877
Commercial/Industrial	20,589,063	28,743,276
Total	**24,190,905**	**30,618,153**

Of Avista's overall electric portfolio in 2021, the commercial/industrial prescriptive lighting program achieved 51 percent of savings; site-specific programs, 42 percent. All other programs combined achieved the remaining four percent (see Figure 4).

FIGURE 4 – ELECTRIC SAVINGS PORTFOLIO



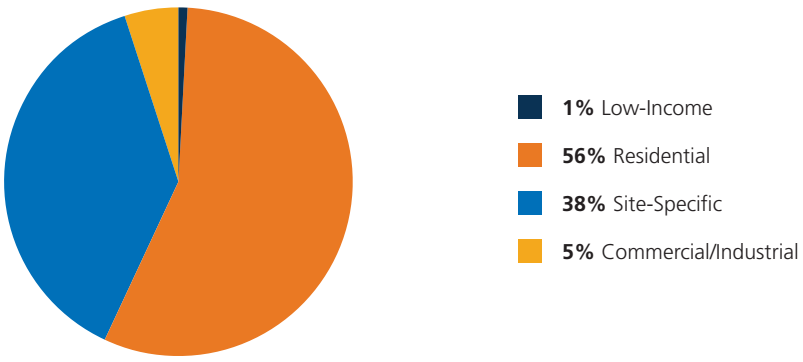
As shown in Table 7, Avista's natural gas portfolio experienced a significant increase in savings in 2021 compared to the prior year. As Avista addresses clean building requirements per House Bill 1257, its efforts to ensure that customers comply will remain a priority for the energy-efficiency team. Overall, the natural gas portfolio savings increased by 29 percent over the prior year, which illustrates those additional efforts.

TABLE 7 – NATURAL GAS ENERGY SAVINGS (THERMS)

	2020	2021
Residential (including low-income programs)	422,975	442,852
Commercial/Industrial	172,357	327,595
Total	**595,332**	**770,447**

Residential programs obtained 56 percent of the natural gas savings portfolio in 2021. This is attributed primarily to high-efficiency natural gas furnace measures, which were installed in 2,831 homes and achieved 231,063 therms. Site-specific programs achieved 38 percent of the overall total; low-income and other commercial/industrial programs made up the remaining six percent (see Figure 5).

FIGURE 5 – NATURAL GAS SAVINGS PORTFOLIO



Verified Savings

As part of the Evaluation, Measurement, and Verification (EM&V) process, Avista's evaluators review the reported savings provided by the company and adjust savings where necessary. The details of these adjustments are included in the impact evaluation reports that have been appended to this report. In 2021, the electric portfolio reported savings of 28,849 MWh and achieved evaluated savings of 30,618 MWh, resulting in a realization rate of 106 percent. The natural gas portfolio reported 738,504 therms and achieved evaluated savings of 770,447 therms, resulting in a 104 percent realization rate.

Tables 8 and 9 illustrate the reported and evaluated savings and the resulting realization rates.

TABLE 8 – ENERGY-EFFICIENCY SAVINGS BY SECTOR – ELECTRIC

Sector	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Commercial/Industrial	27,045,680	28,743,276	106%
Residential	1,499,053	1,568,411	105%
Low-Income	304,538	306,466	101%
Total	**28,849,271**	**30,618,153**	**106%**

TABLE 9 – ENERGY-EFFICIENCY SAVINGS BY SECTOR – NATURAL GAS

Sector	Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
Commercial/Industrial	296,513	327,595	110%
Residential	429,349	430,397	100%
Low-Income	12,643	12,455	99%
Total	**738,504**	**770,447**	**104%**

Expenditures

While the 2021 *Annual Conservation Plan*, filed with the Washington Utilities and Transportation Commission in November 2020, provides an expectation for operational planning, Avista is required to pursue all cost-effective measures under Tariff Schedules 90 and 190. Because of this requirement, variances may exist between planned and actual spending. For 2021, the program saw a lower level of participation than estimated, which resulted in actual spending being lower than planned.

Since customer incentives are the largest component of expenditures, customer demand can easily affect the funding level of the tariff riders. Table 10 provides a detailed comparison of budgeted to actual energy-efficiency expenditures by fuel type.

TABLE 10 – ANNUAL CONSERVATION PLAN BUDGET TO ACTUAL EXPENDITURES COMPARISON

	Electric	Natural Gas
2021 Annual Conservation Plan		
Incentives Budget	$ 9,806,269	$ 4,606,953
Non-Incentives and Labor	$ 4,630,510	$ 778,262
MT, CPA, EM&V	$ 1,611,445	$ 611,314
Total Budgeted Expenditures	**$ 16,048,224**	**$ 5,996,529**
Actual 2021 Expenditures		
Incentives	$ 6,846,169	$ 3,971,305
Non-Incentives and Labor	$ 3,907,338	$ 1,024,157
MT, CPA, EM&V	$ 1,805,041	$ 441,122
Total Actual Expenditures	**$ 12,558,548**	**$ 5,436,583**
Variance	**$ (3,489,676)**	**$ (559,946)**

Table 11 illustrates the top five programs with the highest impact on the expenditure variance across both fuel types. As expected, the largest variance occurred in programs that have historically had the most incentive expenditures. The Multifamily Direct Install Program had the highest variance, with program expenditures under budget by $2,476,699. This variance is directly related to Avista halting the program due to safety concerns related to COVID-19. The program will resume normal operation in 2022, as COVID-19 conditions allow.

TABLE 11 – PROGRAMS WITH THE HIGHEST IMPACT ON EXPENDITURE VARIANCE

Program	Planned	Actual	Variance	Variance Percentage
Multifamily Direct Install (elec)	$ 2,742,346	$ 265,647	$ 2,476,699	90%
Commercial/Industrial Lighting Exterior	$ 2,901,532	$ 1,679,329	$ 1,222,202	42%
Residential Prescriptive (elec)	$ 432,082	$ 1,090,406	$ (658,324)	(152)%
Low-Income (elec)	$ 1,117,599	$ 1,658,825	$ (541,226)	(48)%
Site-Specific (elec)	$ 3,814,510	$ 3,318,232	$ 496,278	13%

On a percentage variance basis, the Residential Prescriptive Program exceeded its estimated level of conservation, which drove the variance between planned and actual expenses. Savings achieved in 2021 reached 1,568,411 kWh – 79 percent higher than planned savings of 874,317 kWh.

EVALUATION APPROACH

Because evaluation is a critical component of any successful energy conservation program, Avista employs EM&V protocols to validate and report verified energy savings related to its energy-efficiency measures and programs. Those protocols include comprehensive analyses and assessments necessary to supply useful information to both management and stakeholders. (EM&V includes impact and process, and, taken as a whole, is analogous with industry standard terms such as *portfolio evaluation* or *program evaluation*.)

Program evaluations are generally conducted by third-party EM&V firms, selected on a biennial basis through a competitive bidding process managed by Avista's supply chain management group. The scope of work for selected evaluators is defined and managed by the company's planning and analytics team. Third-party evaluators provide recommendations pertaining to specific programs and related processes in impact and process evaluation report outputs. Avista incorporates recommendations to improve program performance, enact changes to programs, and make decisions to phase out programs and measures.

Recommendations from third-party evaluations, as well as the application of lessons learned through each program year, are incorporated into Avista's annual business planning process to further refine program design and improve their chances of success.

For 2021, Avista retained two separate firms to conduct impact and process evaluations of electric and natural gas programs in the utility's Washington program portfolio. Cadmus conducted impact evaluations of the commercial/industrial program portfolio and process evaluations of the entire program portfolio; ADM performed impact evaluations of residential and low-income programs. Evaluations took a portfolio-wide approach to provide a benchmark against which future years can be compared. Impact and process evaluations for most programs were also completed at the program level, so that customer experience could be better delineated and realization rates understood.

Several guiding EM&V documents are maintained and published to support planning and reporting requirements. These include the Avista EM&V framework, an annual EM&V plan, and EM&V contributions within other DSM and Avista corporate publications. Program-specific EM&V plans are created to inform and benefit the DSM activities. These documents are reviewed and updated as necessary to improve the processes and protocols for energy-efficiency measurement, evaluation, and verification.

EM&V efforts are also used to evaluate emerging technologies and applications in consideration of their inclusion in Avista's energy-efficiency portfolio. In its electric portfolio, Avista may spend up to 10 percent of its conservation budget on programs whose savings impacts have not yet been measured if the overall conservation portfolio passes the applicable cost-effectiveness test. These programs may include educational, behavioral change, and other investigatory projects. Specific activities can include product and application document reviews, development of formal evaluation plans, field studies, data collection, statistical analysis, and solicitation of user feedback.

Both Avista and its customers benefit from activities and resources related to energy efficiency and conservation. To contribute to regional efforts, one Avista employee has a voting role and a second a corresponding member role on the Regional Technical Forum (RTF) – the advisory committee to the Northwest Power and Conservation Council (NPCC) and a primary source of information regarding the standardization of energy savings and measurement processes for electric applications in the Pacific Northwest. This knowledge base provides Avista with energy-efficiency data, metrics, non-energy benefits, and references for inclusion in the company's *Technical Reference Manual* (TRM) relating to acquisition planning and reporting. Avista also works with other northwest utilities and NEEA in several pilot projects and subcommittee evaluations; portions of the energy-efficiency savings acquired through the latter's regional programs are attributable to Avista's portfolio.

COST-EFFECTIVENESS

Avista's portfolio offerings are evaluated throughout implementation and at the conclusion of the program year to gauge the level of cost-effectiveness. Cost-effectiveness tests determine whether that program is beneficial both from the company's and from customers' perspectives. Avista uses four metrics to evaluate cost-effectiveness: the Utility Cost Test (UCT), the Total Resource Cost (TRC) test, the Participant Cost Test (PCT), and the Ratepayer Impact Test (RIM). For Washington electric programs, the TRC is the most important; the UCT is most important for natural gas programs. Avista's cost-effectiveness goal for both the electric and natural gas program portfolios is a UCT above 1.00, which indicates that the benefits to the utility exceed the costs of implementing the program. In 2021, UCT ratios were 2.06 for electric and 2.88 for natural gas. TRC benefit/cost ratios were 1.34 for electric and 1.68 for natural gas.

TABLE 12 – PORTFOLIO COST-EFFECTIVENESS RESULTS – ELECTRIC

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
TRC	$ 24,332,473	$ 18,179,009	1.34
UCT	$ 21,713,095	$ 10,527,569	2.06
PCT	$ 38,137,362	$ 14,873,620	2.56
RIM	$ 21,713,095	$ 45,789,342	0.47

TABLE 13 – PORTFOLIO COST-EFFECTIVENESS RESULTS – NATURAL GAS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
TRC	$ 15,653,542	$ 9,340,020	1.68
UCT	$ 14,021,143	$ 4,862,834	2.88
PCT	$ 54,164,242	$ 8,463,283	6.40
RIM	$ 14,021,143	$ 197,539,500	0.07

COMMERCIAL/INDUSTRIAL SECTOR

Downtown Spokane, Washington

COMMERCIAL/INDUSTRIAL SECTOR

Overview

The commercial/industrial energy-efficiency market is served through a combination of prescriptive and site-specific programs. Any savings measure not offered through the prescriptive program path – and/or that does not meet its parameters – is automatically eligible for treatment through the site-specific program path.

The prescriptive program path is selected for smaller, straightforward equipment installations that generally have similar operating characteristics (such as lighting, simple HVAC systems, food service equipment, and variable frequency drives).

The site-specific program path is reserved for more unique or complex projects that require custom savings calculations and technical assistance from Avista's energy engineers (such as compressed air, process equipment and controls, and comprehensive lighting retrofits). In certain instances, a performance basis approach is used.

- ***2,074 commercial/industrial electric measures in 2021:*** Total savings of 28,743 MWh, an increase of 40 percent from the previous year (20,584 MWh).
- ***88 commercial/industrial natural gas measures in 2021:*** Total savings of 327,595 therms in 2021, an increase of 90 percent from the previous year (172,357 therms).

TABLE 14 – COMMERCIAL/INDUSTRIAL VERIFIED SAVINGS BY PROGRAM

Commercial/Industrial	Program Type	Electric Savings (kWh)	Natural Gas Savings (Therms)
Exterior Lighting	Prescriptive	6,075,343	
Food Services	Prescriptive	75,664	23,289
Green Motors	Prescriptive	18,905	
Interior Lighting	Prescriptive	9,574,219	
HVAC	Prescriptive	-	10,692
Motor Control HVAC (VFD)	Prescriptive	219,848	
Shell	Prescriptive	2,188	3,151
Grocer	Prescriptive	43,292	
Appliance	Site-Specific	-	
Commercial/Industrial Process	Site-Specific	500,540	
Compressed Air	Site-Specific	72,272	
HVAC Combined	Site-Specific	180,471	
HVAC Cooling	Site-Specific	-	
HVAC Heating	Site-Specific	-	5,779
Motor Controls Industrial	Site-Specific	18,822	
New Construction – Windows Shell	Site-Specific	-	
New Construction Lighting	Site-Specific	41,332	
New Construction HVAC	Site-Specific	2,320	2,055
Shell Insulation	Site-Specific	250	1,639
Other	Site-Specific	411,949	280,990
Exterior Lighting	Site-Specific	600,578	
Interior Lighting	Site-Specific	10,905,282	
Total Commercial/Industrial		**28,743,276**	**327,595**

Business Partner Program

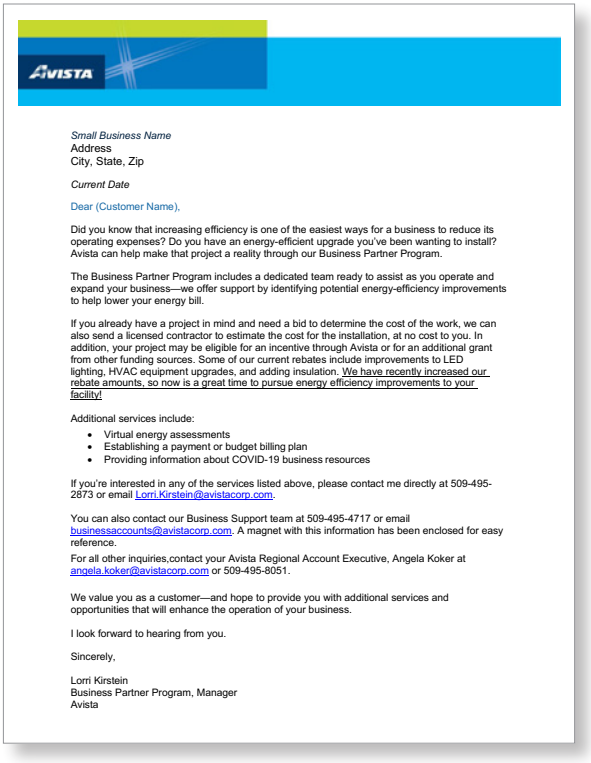
The Business Partner Program (BPP) began in fall 2019 as an outreach effort designed to target small business customers in Avista's rural service territories. The BPP brings awareness of Avista's services to rural small business customers in Washington and Idaho, and includes information on energy audits, budget billing plans, energy-efficiency rebates, and, most recently, COVID-19 related information.

To further support communities through the COVID-19 pandemic, Avista was able to leverage funding from the Community Energy Efficiency Program (CEEP) to match incentive funding for energy-efficiency improvements for businesses in rural communities. In 2021, 81 properties received CEEP match funding for energy-efficiency projects. CEEP match funding totaled nearly $110,000. Keeping these businesses operating with lower energy costs allowed them to continue to support their communities through the pandemic.

In 2021, Avista continued to offer the Trade Ally Bid Program, in which the company arranges for various vendors (e.g., lighting, HVAC, window, and insulation) to provide cost estimates to customers for energy-efficiency upgrades to their facilities. This service also helps to educate and empower business owners and their employees to use less energy.

Avista has collaborated with trade ally partners to help customers identify energy conservation projects by performing audits, walking through the efficiency incentive process, and helping customers obtain bids for projects. The Trade Ally Bid Program has enabled Avista to reach small business customers who may not have the time, budget, or access to contractors to make efficiency improvements. By the end of 2021, the program provided cost estimates to 71 small business customers in Washington.

FIGURE 6 – COMMERCIAL/INDUSTRIAL BUSINESS PARTNER PROGRAM LETTER



Small Business Name
Address
City, State, Zip

Current Date

Dear (Customer Name),

Did you know that increasing efficiency is one of the easiest ways for a business to reduce its operating expenses? Do you have an energy-efficient upgrade you've been wanting to install? Avista can help make that project a reality through our Business Partner Program.

The Business Partner Program includes a dedicated team ready to assist as you operate and expand your business—we offer support by identifying potential energy-efficiency improvements to help lower your energy bill.

If you already have a project in mind and need a bid to determine the cost of the work, we can also send a licensed contractor to estimate the cost for the installation, at no cost to you. In addition, your project may be eligible for an incentive through Avista or for an additional grant from other funding sources. Some of our current rebates include improvements to LED lighting, HVAC equipment upgrades, and adding insulation. We have recently increased our rebate amounts, so now is a great time to pursue energy efficiency improvements to your facility!

Additional services include:

- Virtual energy assessments
- Establishing a payment or budget billing plan
- Providing information about COVID-19 business resources

If you're interested in any of the services listed above, please contact me directly at 509-495-2673 or email Lorri.Kirstein@avistacorp.com.

You can also contact our Business Support team at 509-495-4717 or email businessaccounts@avistacorp.com. A magnet with this information has been enclosed for easy reference.

For all other inquiries,contact your Avista Regional Account Executive, Angela Koker at angela.koker@avistacorp.com or 509-495-8051.

We value you as a customer—and hope to provide you with additional services and opportunities that will enhance the operation of your business.

I look forward to hearing from you.

Sincerely,

Lorri Kirstein
Business Partner Program, Manager
Avista

Performance and Savings Goals

Overall, the commercial/industrial sector achieved 28,743 MWh, or 76 percent of the savings goal. While the sector did not meet the combined prescriptive and site-specific program paths' electric savings goal of 37,675 MWh, it maintained a high level of cost-effectiveness for both the TRC and UCT. These ratios indicate that more flexibility can be taken in future program designs.

For natural gas programs, the commercial/industrial sector surpassed its annual therm savings goal for combined prescriptive and site-specific programs, achieving 327,595 therms (101 percent of the natural gas savings goal of 325,078).

Cost-Effectiveness

Tables 15 and 16 show the commercial/industrial sector cost-effectiveness results by fuel type.

TABLE 15 – COMMERCIAL/INDUSTRIAL COST-EFFECTIVENESS RESULTS – ELECTRIC

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
TRC	$ 19,573,429	$ 13,078,313	1.5
UCT	$ 17,794,027	$ 6,950,818	2.56
PCT	$ 33,737,922	$ 11,651,160	2.9
RIM	$ 17,794,027	$ 35,165,075	0.51

TABLE 16 – COMMERCIAL/INDUSTRIAL COST-EFFECTIVENESS RESULTS – NATURAL GAS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
TRC	$ 1,540,262	$ 795,617	1.94
UCT	$ 1,400,239	$ 405,499	3.45
PCT	$ 1,720,267	$ 543,425	3.17
RIM	$ 1,400,239	$ 1,972,460	0.71

Program-by-Program Summaries

Commercial/Industrial Site-Specific Program

TABLE 17 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC PROGRAM METRICS

Site-Specific – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		451
Overall kWh Savings		12,733,816
Incentive Spend	$	2,695,514
Non-Incentive Utility Costs	$	622,718
Washington Energy-Efficiency Rider Spend	$	3,318,232
Site-Specific – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		7
Overall Therm Savings		290,463
Incentive Spend	$	53,535
Non-Incentive Utility Costs	$	212,048
Washington Energy-Efficiency Rider Spend	$	265,583

Description

The commercial/industrial energy-efficiency market is delivered through a combination of prescriptive and site-specific offerings. Any measure not offered through a prescriptive program is automatically eligible for treatment through the site-specific program, subject to the criteria for participation in that program. Avista's account executives work with commercial/industrial customers to help identify 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 projects include appliances, compressed air, HVAC, industrial processes, motors (non-prescriptive), shell, and lighting, with the majority being HVAC, lighting, and shell.

Program Activities

- ***Electric:*** Savings of 12,733,816 kWh, or 42 percent of the overall electric savings – an increase of approximately 79 percent from 2020 (7,102,132 kWh). Of the overall savings, over 91 percent was derived from exterior and interior lighting projects.
- ***Natural Gas:*** Savings of 290,463 therms, or 38 percent of the overall natural gas savings. The program achieved 148 percent more therms than in 2020 (117,228).

Measure type and savings are listed in Figures 7 and 8.

FIGURE 7 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC INCENTIVE DOLLARS BY MEASURE – ELECTRIC

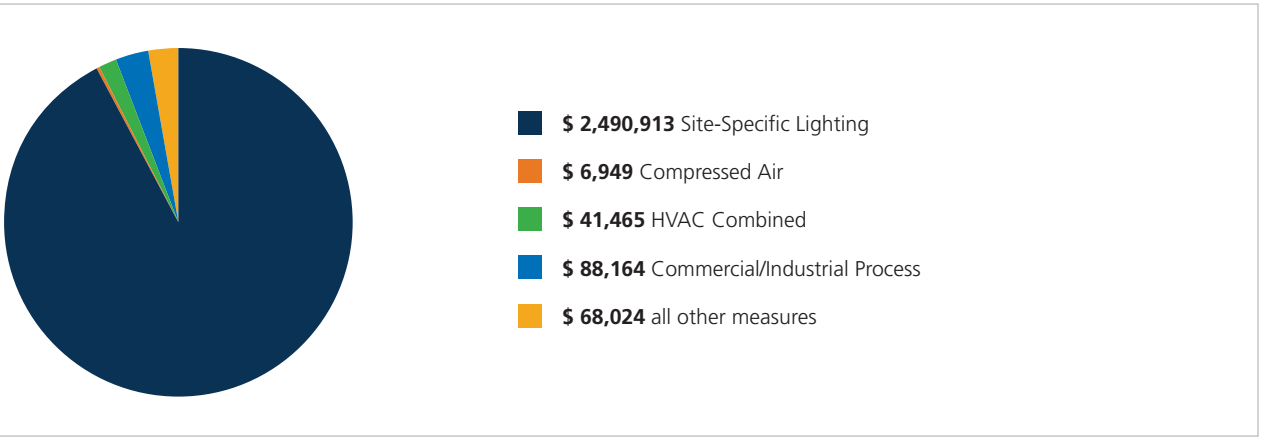
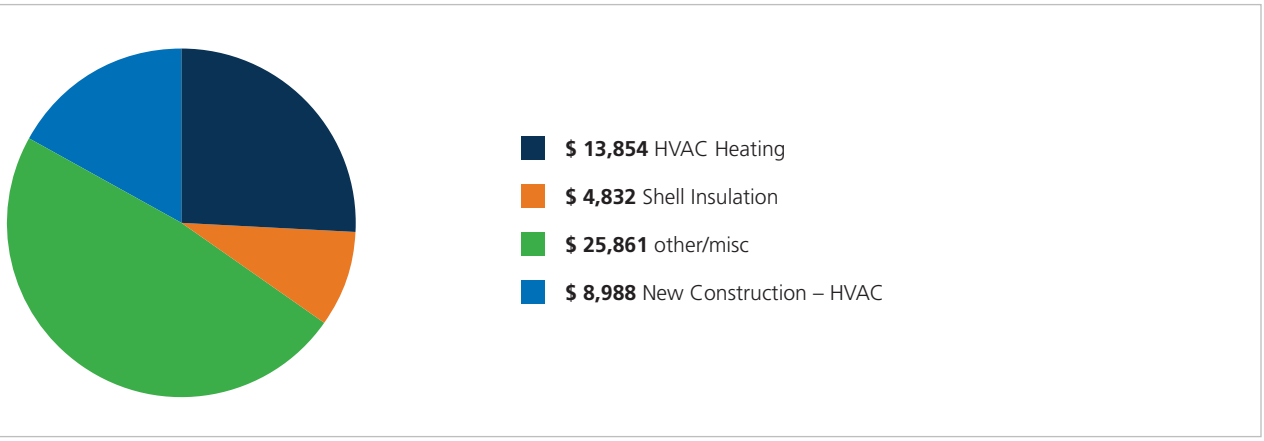


FIGURE 8 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC INCENTIVE DOLLARS BY MEASURE – NATURAL GAS



Program Changes

In 2021, Avista increased the incentive levels to $0.23 per kWh and $3.50 per therm savings for the site-specific program path. The company continues to offer an incentive for any qualifying electric or natural gas energy-saving improvements that are cost-effective with a 15-year simple payback or less.

Plans for 2022

Avista plans to continue to offer the site-specific program path in Washington for both electric and natural gas customers in 2022 and will assess the current measurement and verification process to determine whether process improvements need to be made. The company continues to offer the Business Partner Program, which is designed to reach a larger percentage of small- and medium-sized business customers, reminding them about the availability of basic scoping energy audits, budget billing plans, and energy-efficiency rebate programs. As part of the BPP, the Trade Ally Bid Program will also continue in 2022. The Trade Ally Bid Program is a collaboration between Avista and its trade ally partners to offer bid assistance for energy-efficiency upgrades. The CEEP grant program will no longer be offered after May 1, 2022.

Commercial/Industrial Prescriptive Lighting Programs

TABLE 18 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM METRICS

Prescriptive Lighting Program Summary		2021
Participation, Savings, and Costs		
Conservation Projects		1,566
Overall kWh Savings		15,649,562
Incentive Spend	$	2,763,044
Non-Incentive Utility Costs	$	786,287
Washington Energy-Efficiency Rider Spend	$	3,549,332

Description

The commercial/industrial Prescriptive Lighting Program is intended to prompt commercial electric customers to increase the energy efficiency of their lighting equipment through direct financial incentives. It indirectly supports the infrastructure and inventory necessary to ensure that the installation of high-efficiency equipment is a viable option for the customer.

There are opportunities for lighting improvements in commercial facilities; to streamline the process and make it easier for customers and vendors to participate, Avista developed a prescriptive approach in 2004. This program provides for many common retrofits to receive a predetermined incentive amount, which is calculated using a baseline average for existing wattages and the average replacement wattages from the previous year's project data. Claimed energy savings is calculated based on actual customer run times and qualified product lighting data.

This streamlined approach makes program participation easier, especially for smaller customers and vendors. The measures included in the Prescriptive Lighting Program include fluorescent lamps and fixtures, HID, MR16, and incandescent can fixture retrofits to more energy-efficient LED light sources and controls.

Program Activities

2021 savings for prescriptive lighting was 15,649,562 kWh, or 51 percent of portfolio savings. The level of savings was a 5 percent increase compared to 2020's 14,802,366 kWh.

As a response to the obstacles in implementing energy-efficiency projects that business customers and trade allies faced during the COVID-19 pandemic, Avista updated its incentive structure in July with an increased rate for the Prescriptive Lighting Program. As seen in Figure 9, apart from the typical surge seen in December, these increased incentives did little to increase overall savings throughput in the third and fourth quarters. The company did, however, see an increase in some of the more uncommon measures such as the T5HO lamp replacement and the 1000W exterior fixture retrofit.

FIGURE 9 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM SAVINGS BY MONTH

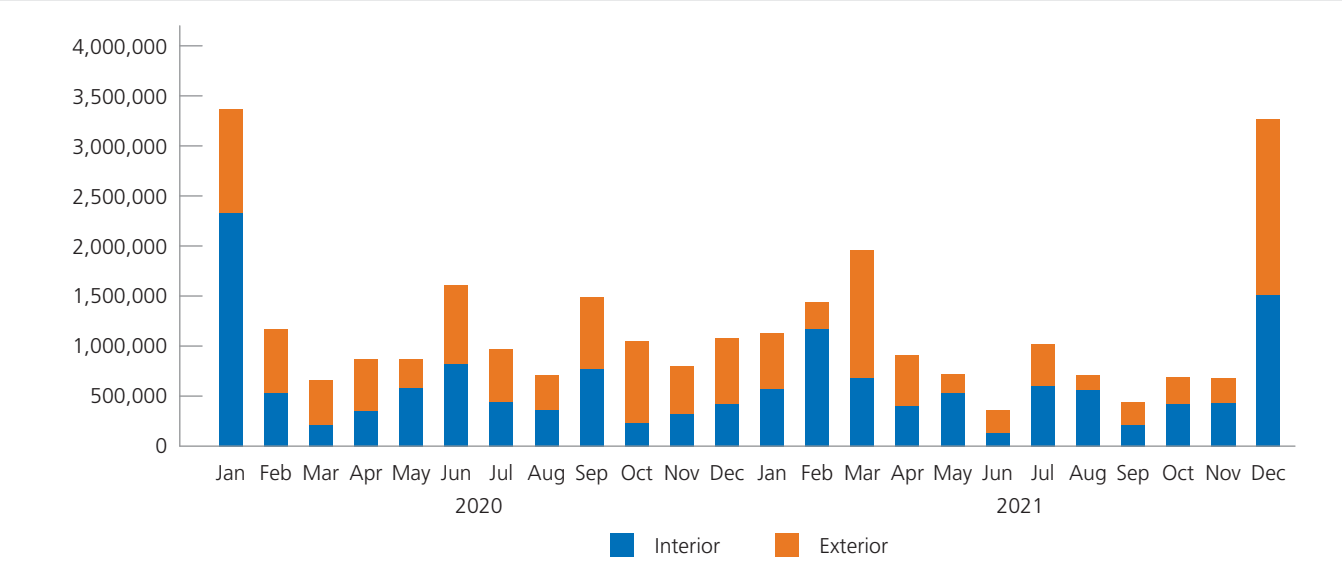


FIGURE 10 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INTERIOR LIGHTING KWH SAVINGS BY MEASURE

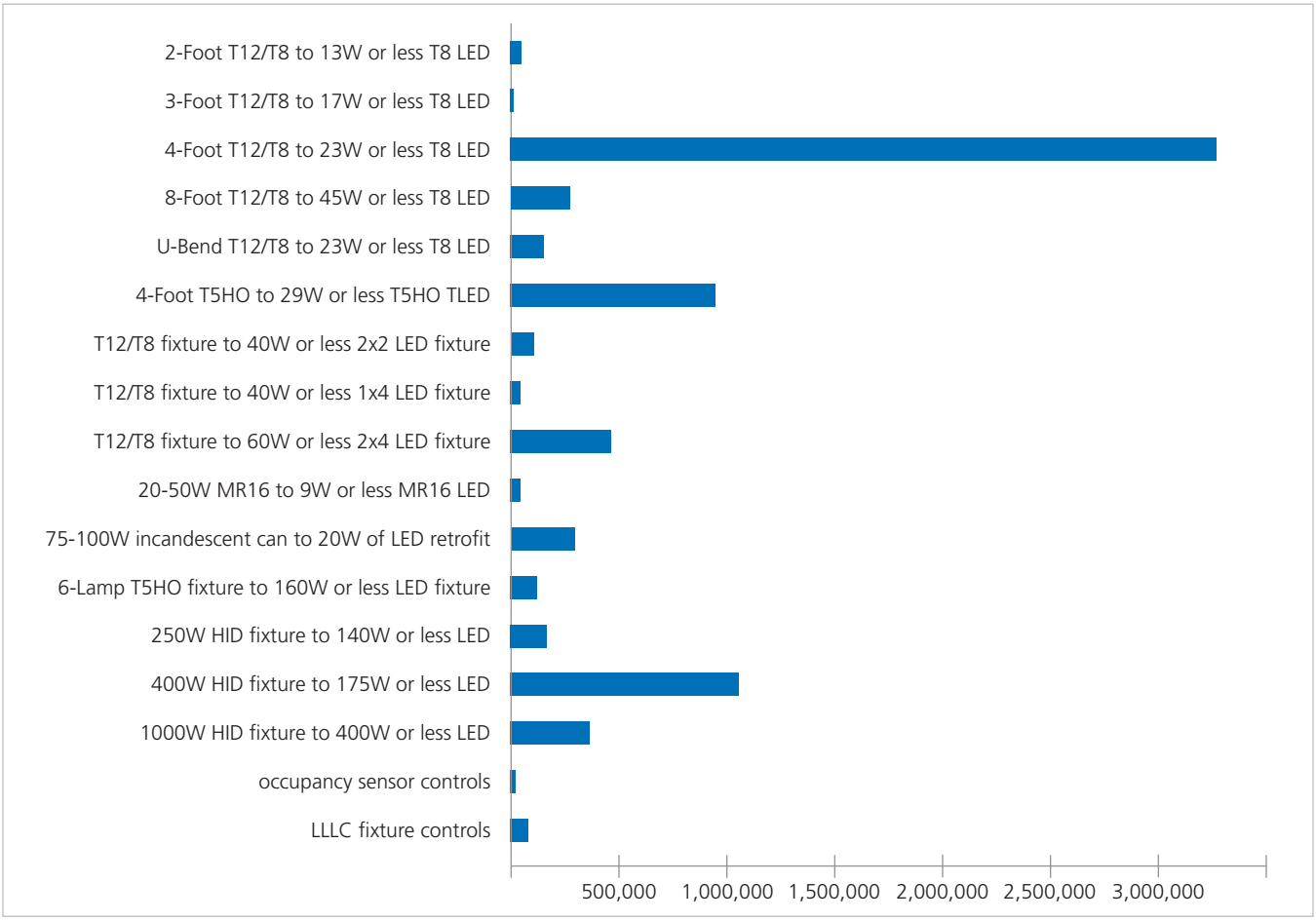
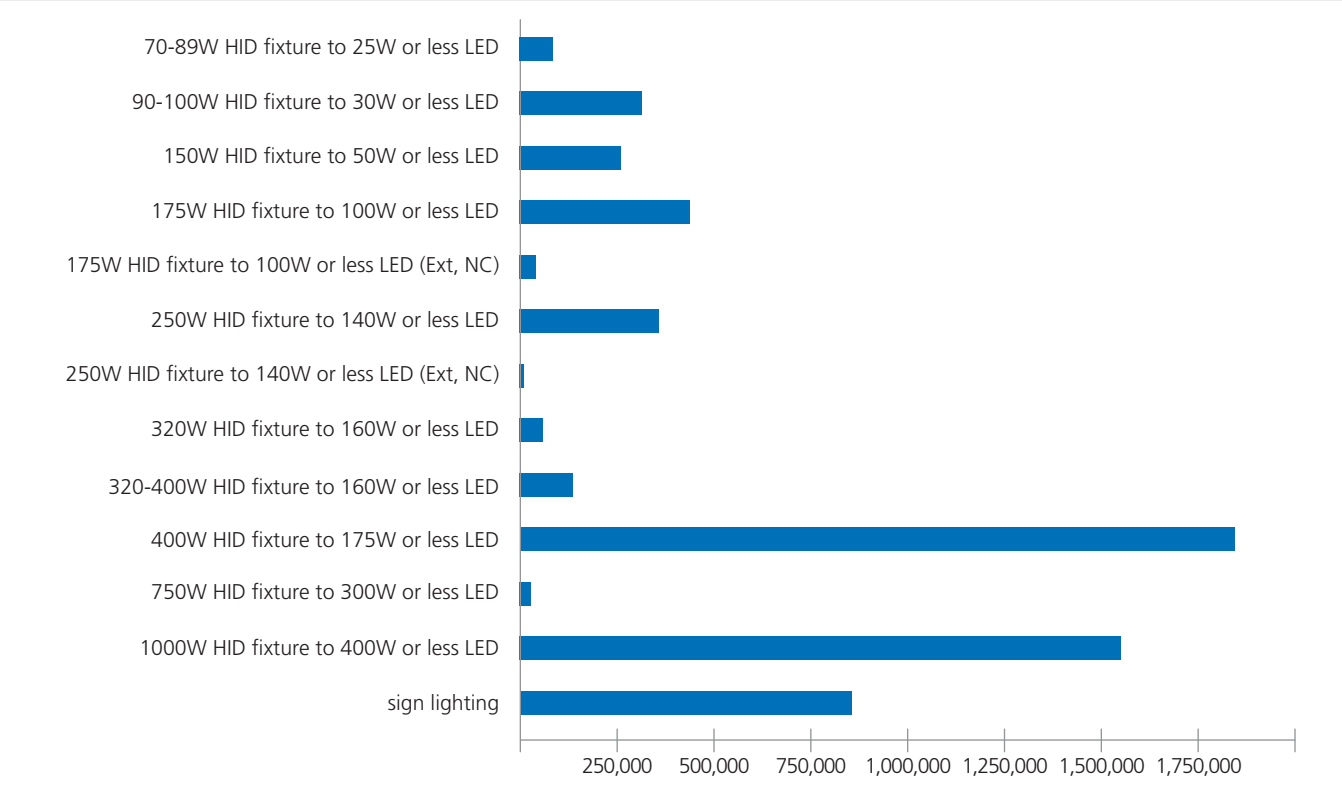


FIGURE 11 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE EXTERIOR LIGHTING KWH SAVINGS BY MEASURE



Program Changes

Table 19 shows the changes Avista made to the program in 2021.

TABLE 19 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM CHANGES

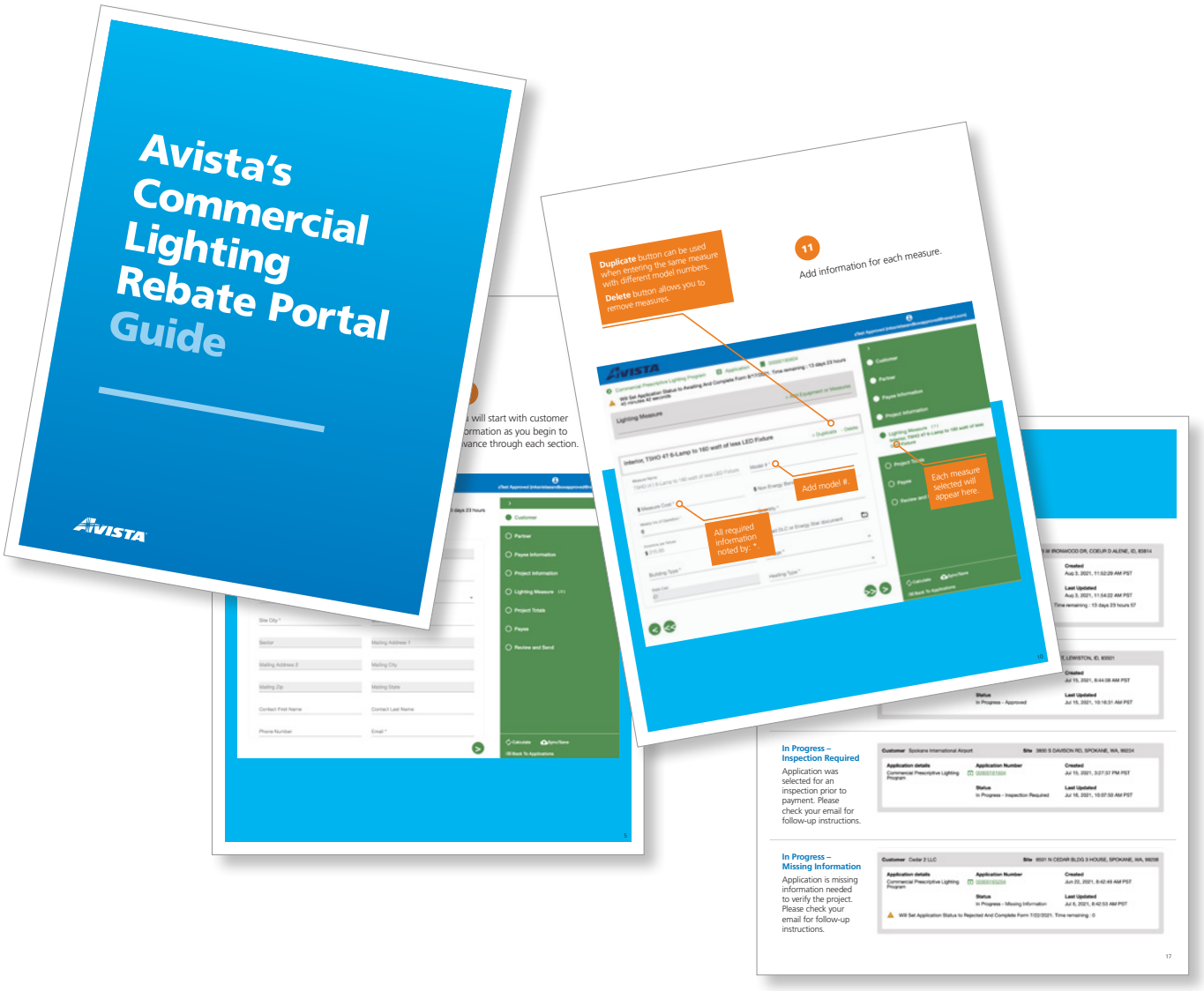
2021 Changes to Commercial Lighting Rebates	2020	2021	2021 Mid-Year
Exterior Lighting			
Replacement HID Lighting (Pole, Wallpack, or Canopy) – Requires at Least 4,288 Hours of Use per Year – Must Be DLC or ENERGY STAR-Rated			
70-89W HID fixture to ≤ 25W LED fixture, retrofit kit, or lamp	$ 65	$ 65	$ 70
90-100W HID fixture to ≤ 30W LED fixture, retrofit kit, or lamp	$ 85	$ 85	$ 100
150W HID fixture to ≤ 50W LED fixture, retrofit kit, or lamp	$ 130	$ 130	$ 150
175W HID fixture to ≤ 100W LED fixture, retrofit kit, or lamp	$ 130	$ 130	$ 155
250W HID fixture to ≤ 140W LED fixture, retrofit kit, or lamp	$ 160	$ 180	$ 200
320W HID fixture to ≤ 160W LED fixture, retrofit kit, or lamp	$ 195	$ 215	$ 270
400W HID fixture to ≤ 175W LED fixture, retrofit kit, or lamp	$ 280	$ 285	$ 325
750W HID fixture to ≤ 300W LED fixture, retrofit kit, or lamp	$ 490	$ 505	$ 575
1000W HID fixture to ≤ 400W LED fixture, retrofit kit, or lamp	$ 610	$ 640	$ 820

2021 Changes to Commercial Lighting Rebates	2020	2021	2021 Mid-Year
Exterior Lighting			
New Construction Fixtures HID Lighting – Requires at Least 4,288 Hours of Use per Year – Must Be DLC or ENERGY STAR-Rated			
175W code HID fixture to ≤ 100W LED fixture	$ 130	$ 140	$ 150
250W code HID fixture to ≤ 140W LED fixture	$ 160	$ 160	$ 175
320W code HID fixture to ≤ 160W LED fixture	$ 195	$ 195	$ 220
Sign Lighting Retrofit – Requires at Least 4,288 Hours of Use per Year			
T12 to LED sign lighting	$ 22/SQFT	$ 22/SQFT	$ 11/SQFT
Interior Lighting			
Fluorescent Tubular Lamps – Must Be DLC-Rated			
T5HO four-foot TLED	$ 12.50	$ 15.00	$ 22.00
T8 two-foot TLED	$ 0.00	$ 8.00	$ 15.00
T8 three-foot TLED	$ 0.00	$ 8.00	$ 15.00
T8 four-foot TLED	$ 6.50	$ 8.00	$ 13.50
T8 four-foot TLED to TLED (>5W reduction)	$ 0.00	$ 0.00	$ 4.00
T8 U-bend TLED	$ 10.00	$ 10.00	$ 16.00
T8 eight-foot TLED	$ 11.50	$ 11.50	$ 12.00
Fluorescent Fixtures – Must Be DLC-Rated			
2, 3, or 4-Lamp T12/T8 fixture to LED-qualified 2x4 fixture	$ 28.00	$ 30.00	$ 46.00
2-Lamp T12/T8 fixture to LED-qualified 2x2 fixture	$ 20.00	$ 20.00	$ 30.00
2-Lamp T12/T8 fixture to LED-qualified 1x4 fixture	$ 0.00	$ 20.00	$ 30.00
6-Lamp T5HO fixture to ≤ 160W LED fixture	$ 0.00	$ 0.00	$ 215.00
HID Lighting – Must Be DLC-Rated			
250W HID fixture to ≤ 140W LED fixture or lamp	$ 125.00	$ 125.00	$ 195.00
400W HID fixture to ≤ 175W LED fixture or lamp	$ 185.00	$ 195.00	$ 250.00
1000W HID fixture to ≤ 400W LED fixture or lamp	$ 270.00	$ 355.00	$ 565.00
MR16 (GU10 base) – Must be ENERGY STAR-Rated			
2-9W MR16 lamp	$ 5.50	$ 8.50	$ 8.50
Can Light Kit – Must be ENERGY STAR-Rated			
≤ 20W LED fixture retrofit	$ 20.00	$ 30.00	$ 40.00
Controls			
Occupancy sensor controls with built-in relays	$ 25.00	$ 30.00	$ 40.00
LLLC fixture controls	$ 35.00	$ 50.00	$ 150.00

Program Marketing

Key to the success of the prescriptive lighting program is clear communication to lighting supply houses, distributors, electricians, and customers regarding incentive requirements and forms. The Avista website communicates program requirements and highlights opportunities for customers. In addition, the company's regionally based account executives play an integral role in delivering the prescriptive lighting program to commercial/industrial customers. Any changes to the program typically include 90 days' advance notice to allow customers to submit applications for incentives under the old requirements and/or incentive levels if desired. This usually includes – at a minimum – direct email communication to trade allies as well as website updates.

FIGURE 12 – COMMERCIAL/INDUSTRIAL LIGHTING REBATE WEB PORTAL



Plans for 2022

With the more sophisticated measure-level detail in iEnergy, Avista has been able to update interior and exterior lighting measures annually to reflect market conditions. The refined iEnergy data now also includes the site-specific program path, allowing Avista to refine and add new measures into the prescriptive offerings in 2022. Minor refinement to the program is anticipated in 2022 as the company plans to keep the increased incentive rates adopted in mid-2021. Avista will continue to be flexible in making mid-year changes as needed to further encourage program participation. The company will continue evaluating its ideal networked lighting controls incentives and will use existing project data to right-size the Luminaire Level Lighting incentive offering.

Commercial/Industrial Non-Lighting Prescriptive Programs

TABLE 20 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NON-LIGHTING PROGRAM METRICS

Prescriptive Non-Lighting Program Summary – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		57
Overall kWh Savings		359,897
Incentive Spend	$	65,106
Non-Incentive Utility Costs	$	18,148
Washington Energy-Efficiency Rider Spend	$	83,254
Prescriptive Non-Lighting Program Summary – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		81
Overall Therm Savings		37,132
Incentive Spend	$	99,772
Non-Incentive Utility Costs	$	40,144
Washington Energy-Efficiency Rider Spend	$	139,916

Description

Commercial Food Service Equipment Program – The Commercial Food Service Equipment Program encourages customers to purchase energy-efficient equipment, ether as equipment replacement or as a new product to support food service activities. If Avista provides the fuel type of the equipment installed, customers are eligible when equipment meets the efficiency requirement. For equipment that requires hot water heat, Avista must provide that heat source for eligibility. This program offers a variety of electric and natural gas food service equipment. Customers who meet the requirements must submit rebate paperwork within 90 days of project completion. Incentives are disbursed after receipt of documentation and verification of equipment eligibility.

Compressed Air Line Isolation Program – The Compressed Air Line Isolation Program was developed to offer a prescriptive path for Avista electric customers with a 15 horsepower (HP) or greater rotary screw compressor. It offers direct installation of a compressed air leak reduction device. Energy savings are generated by reducing the impact of compressed air leaks during off-hour periods. Customers can work with compressed air contractors to do a two-week pre-logging of compressed air systems, install a line isolation device, and complete the project with a two-week post-logging. After logging is complete, a site report is presented that summarizes the kWh savings and includes photos of actual installation (including nameplate), invoices, and a completed rebate form. Incentives are paid to the contractor with no cost to the customer.

Commercial Natural Gas HVAC Program – The Commercial Natural Gas HVAC Program encourages Avista commercial natural gas customers to save energy by choosing to install energy-efficient natural gas furnaces and boilers. It offers six different equipment types that customers may select from to best fit their business needs and save energy dollars. Incentives are paid by the input kBtu and the efficiency of the equipment selected. Customers must submit rebate forms with proof-of-purchase invoices and AHRI certificates within 90 days of project completion. Incentives are disbursed after receipt of documentation.

Green Motors Rewind – The Green Motors Rewind Program offers Avista commercial electric customers an instant rebate on their service center invoice for a green rewind of an existing motor. Qualifying motors must fall between 15 and 5,000 horsepower and be used in an industrial capacity. The program pays $1 per HP to the service center and another $1 per HP off the invoice for the customer. Green Motors Practices Group is the third party that manages this program and is paid an administrative fee of $.05 per kWh savings per customer rewind. Program participation is presented monthly by Green Motors Practices Group in the form of an invoice accompanied by detailed service center information per project.

Fleet Heat – The Fleet Heat Program is provided to Avista commercial electric customers who use uncontrolled block heaters to keep fleet engines warm when their vehicles are not running during colder months – typically from the end of October to the end of March. This program offers a product that provides an engine-mounted remote thermostat with an ambient temperature thermostat in a Twinstat cord to maximize energy efficiency. Upon receiving the rebate form, Avista will order the cords for customers from Hotstart according to the information provided on the form. Avista delivers the cords to the customer. The customer is responsible for the installation of the cords and the initial payment to Hotstart. After installation verification, Avista refunds the customer's Twinstat cord costs.

Commercial Grocer – The Commercial Grocer Program is offered to Avista commercial electric customers with a range of energy-saving retrofit measures associated with commercial refrigeration. The incentives within this program offer specific measures that can be installed and applied for after project completion. Customers may install any of the eligible measures – display case lighting, motors, controls, strip curtains, gaskets – and apply for an incentive by submitting a rebate form with associated invoicing and providing proof of purchase and installation within 90 days. Incentives are disbursed after receipt of documentation.

Commercial VFD Retrofit – The Commercial HVAC Variable Frequency Drive (VFD) Program is offered to encourage customers to increase the energy efficiency of their HVAC fan or pump applications with a variable frequency drive. Installing a VFD on existing equipment enables that equipment to be more energy-efficient. This program is available for Avista commercial electric customers. The incentive is calculated at $200 per HP of the motor the VFD is installed on. Post-installation verification is required before payment may be issued for all VFD projects. Customers may apply for this incentive after they install a VFD on an existing piece of eligible equipment and submit required documentation within 90 days. Incentive disbursement will be processed after an installation inspection has occurred.

Program Activities

- ***Electric:*** Savings of 359,897 kWh, an increase of 35 percent over the 2020 savings achievement of 268,293. The majority of electric savings came from motor control HVAC programs.
- ***Natural Gas:*** Savings of 37,132 therms in 2021. This is a 33 percent decrease in savings relative to the 55,129 therms achieved in 2020.

FIGURE 13 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INCENTIVE DOLLARS BY MEASURE – ELECTRIC

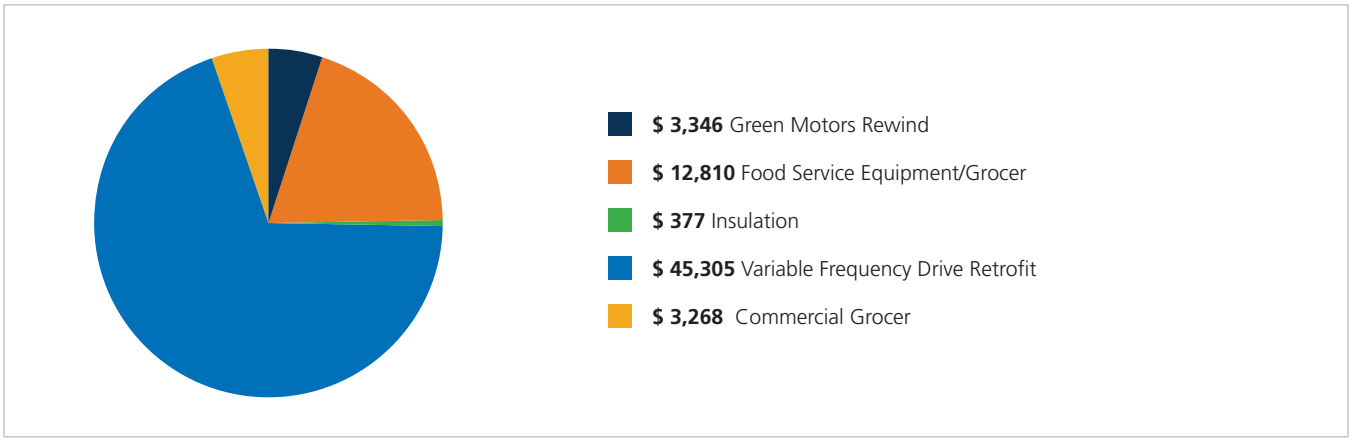
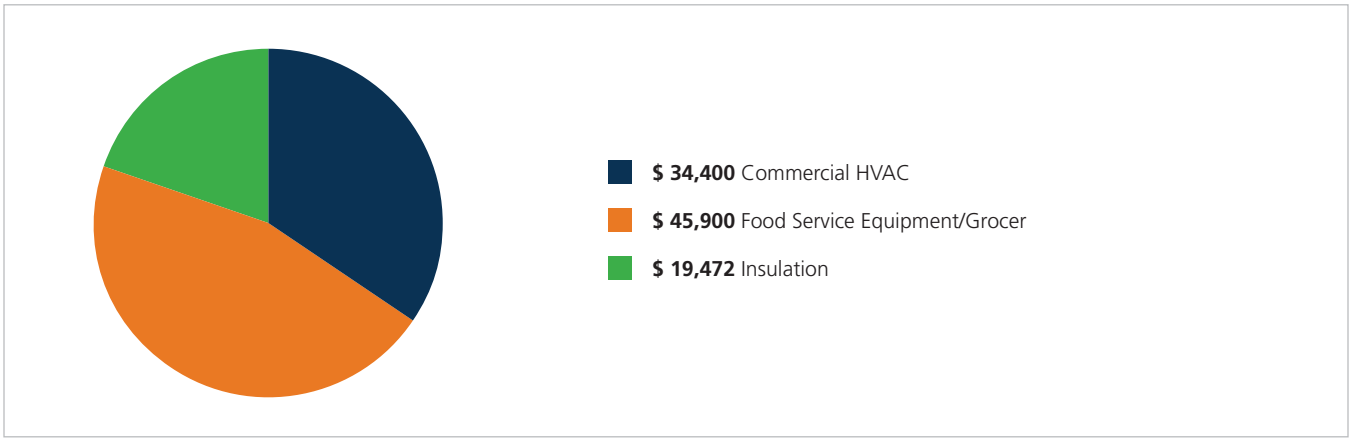


FIGURE 14 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INCENTIVE DOLLARS BY MEASURE – NATURAL GAS



Program Changes

In 2021 a new measure was added to the Commercial Natural Gas HVAC Program for 92 percent AFUE natural gas heat units sized at 300 kBtu or less. The incentive for this measure is $6 per kBtu. The incentive for the Commercial Variable Frequency Drive Retrofit Program was increased from $130 to $200 per HP.

The name of the AirGuardian Program was changed to the Commercial Compressed Air Line Isolation Retrofit Program in 2021. Program eligibility in 2021 was also expanded and all compressed air contractors were invited to participate (previously, only one contractor was participating). The Commercial Insulation Retrofit Program had increases in all measures, which are listed in Table 21.

TABLE 21 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NON-LIGHTING PROGRAM REBATE CHANGES

Prescriptive Non-Lighting Program Changes	2020	2021	Notes
Natural Gas HVAC Program			
92% AFUE natural gas unit heater <300 kBtu/hr	$ 0	$ 6/kBtu Input	New Measure
Variable Frequency Drive Retrofit			
VFD fans	$ 130	$ 200	Incentive Increase
VFD cooling pump only	$ 130	$ 200	Incentive Increase
VFD heating pump only or combined heating and cooling pump	$ 130	$ 200	Incentive Increase
Insulation Retrofit Program			
Wall less than R4 to R11-R18	$ .35/SQFT	$ .60/SQFT	Incentive Increase
Wall less than R4 to R19 or greater	$ .45/SQFT	$ .65/SQFT	Incentive Increase
Attic less than R11 to R30-R44	$ .50/SQFT	$ .75/SQFT	Incentive Increase
Attic less than R11 to R45 or greater	$ .60/SQFT	$ .85/SQFT	Incentive Increase
Roof less than R11 to R30 or greater	$ .40/SQFT	$ .60/SQFT	Incentive Increase
Compressed Air Line Isolation Retrofit Program			
New program. See myavista.com/bizrebates or the Commercial Compressed Air Line Isolation Retrofit agreement form for details			

Program Marketing

Avista account executives market this program, as do external trade allies. All commercial programs are also featured on the Avista efficiency website. Account executives worked to educate customers affected by Washington State's Clean Buildings Standard (HB1257) on the programs and services Avista offers that can help them achieve compliance.

Plans for 2022

Avista will reassess all program measures and incentive levels in 2022.

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RESIDENTIAL SECTOR

Ritzville, Washington

RESIDENTIAL SECTOR

Overview

Avista's residential sector portfolio is composed of several approaches that encourage customers to consider energy-efficiency improvements within their homes. Prescriptive rebate programs are the main component of the portfolio and are augmented by a variety of additional interventions, including a midstream buy-down of low-cost lighting and water-saving measures at the distributor level, select distribution of low-cost lighting and weatherization materials, direct-installation programs, and a multifaceted, multichannel outreach and customer engagement effort.

Nearly $3.3 million in rebates and direct benefits were provided to Washington residential customers to offset the cost of implementing these energy-efficiency measures in 2021. All programs within the residential sector portfolio combined contributed 1,568,411 MWh and 430,433 therms to the annual energy savings.

TABLE 22 – RESIDENTIAL SAVINGS BY PROGRAM

Program By Sector	Energy-Efficiency Savings	
Residential	**Electric Savings (kWh)**	**Natural Gas Savings (Therms)**
ENERGY STAR Homes	90,133	438
Multifamily Direct Install	218,057	0
Residential HVAC	535,629	306,026
Residential Water Heat	103,798	43,696
Residential Shell	390,726	76,639
Small Home & Manufactured Home Weatherization	199,562	2,912
Appliances	30,506	721
Total Residential	**1,568,411**	**430,433**

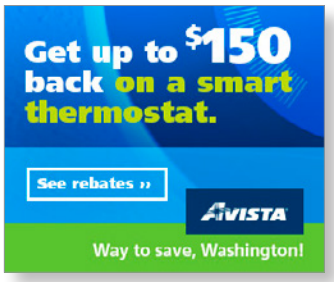
Marketing

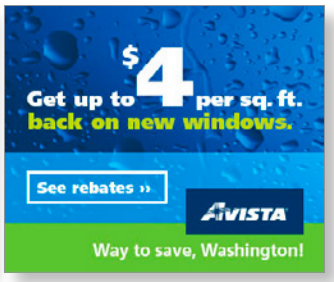
The "Way to Save" advertising campaign included TV, digital, search engine marketing, streaming, and social media. It ran three times: in the spring between March 15 and May 9, in the summer between July 23 and August 15, and in the fall between September 7 and November 1. The campaign was effective in driving website traffic: Average page views on Avista's Washington rebates page had been 175 per day; when the ads were running, that number jumped to 1,025 (spring), 1,039 (summer), and 882 (fall) – an increase of as much as 493 percent.

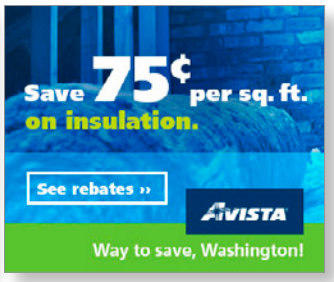
FIGURE 15 – RESIDENTIAL "WAY TO SAVE" TELEVISION COMMERCIALS

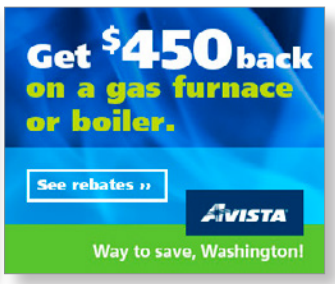
Avista continued its annual "Way to Save" digital advertising campaign in 2021 to help increase awareness of the company's rebates. The advertising included streaming and YouTube for time-shifted viewing, social media, online advertising banners, and search engine marketing. The digital campaign coincided with the same spring, summer, and fall timeframes as the overall advertising campaign described on page 34. The digital efforts drove 27,908,068 display and 1,494,811 YouTube impressions, as well as 561,686 searches and 16,910 clicks. Customer interest in particular measures varied by season; tankless gas water heaters and windows garnered the most interest in spring; insulation, ductless heat pumps, and smart thermostats took the lead in summer and fall.

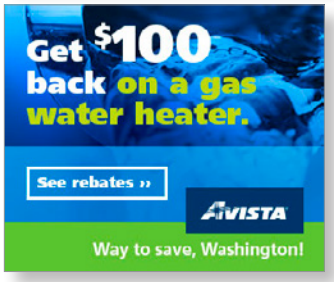
FIGURE 16 – RESIDENTIAL REBATES SOCIAL MEDIA AND DIGITAL ADS

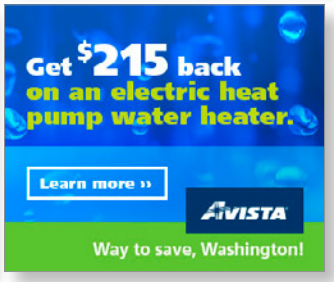


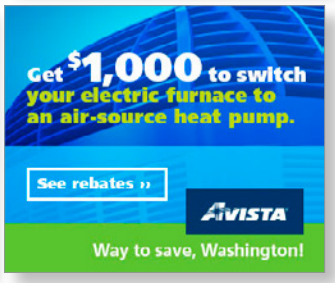


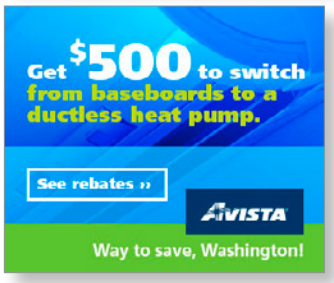


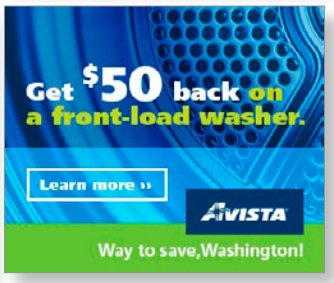












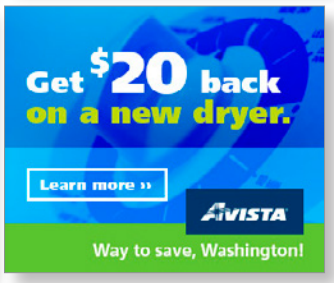
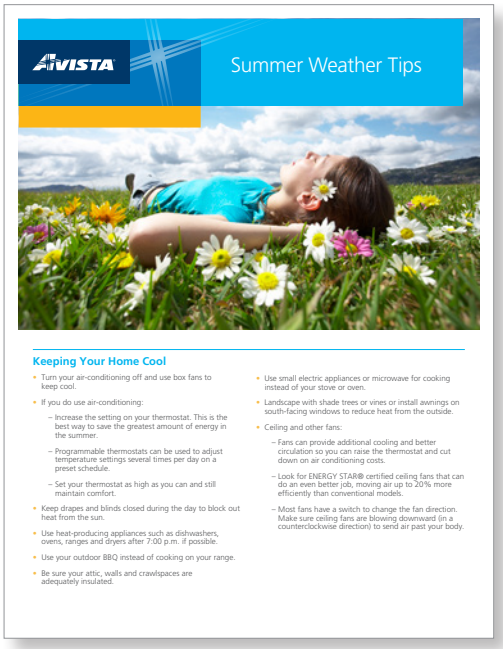


FIGURE 17 – RESIDENTIAL REBATES BILL INSERT

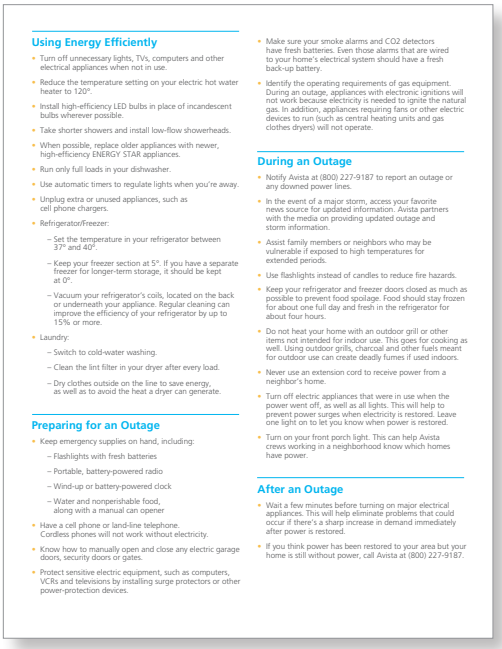
FIGURE 18 – SUMMER WEATHER TIPS FLYER


AVISTA

Summer Weather Tips

Keeping Your Home Cool

- Turn your air-conditioning off and use box fans to keep cool.
- If you do use air-conditioning:
  - Increase the setting on your thermostat. This is the best way to save the greatest amount of energy in the summer.
  - Programmable thermostats can be used to adjust temperature settings several times per day on a preset schedule.
  - Set your thermostat as high as you can and still maintain comfort.
- Keep drapes and blinds closed during the day to block out heat from the sun.
- Use heat-producing appliances such as dishwashers, ovens, ranges and dryers after 7:00 p.m. if possible.
- Use your outdoor BBQ instead of cooking on your range.
- Be sure your attic, walls and crawlspaces are adequately insulated.
- Use small electric appliances or microwave for cooking instead of your stove or oven.
- Landscape with shade trees or vines or install awnings on south-facing windows to reduce heat from the outside.
- Ceiling and other fans:
  - Fans can provide additional cooling and better circulation so you can raise the thermostat and cut down on air conditioning costs.
  - Look for ENERGY STAR® certified ceiling fans that can do an even better job, moving air up to 20% more efficiently than conventional models.
  - Most fans have a switch to change the fan direction. Make sure ceiling fans are blowing downward (in a counterclockwise direction) to send air past your body.



Using Energy Efficiently

- Turn off unnecessary lights, TVs, computers and other electrical appliances when not in use.
- Reduce the temperature setting on your electric hot water heater to 120°.
- Install high-efficiency LED bulbs in place of incandescent bulbs wherever possible.
- Take shorter showers and install low-flow showerheads.
- When possible, replace older appliances with newer, high-efficiency ENERGY STAR appliances.
- Run only full loads in your dishwasher.
- Use automatic timers to regulate lights when you're away.
- Unplug extra or unused appliances, such as cell phone chargers.
- Refrigerator/Freezer:
  - Set the temperature in your refrigerator between 37° and 40°.
  - Keep your freezer section at 5°. If you have a separate freezer for longer-term storage, it should be kept at 0°.
  - Vacuum your refrigerator's coils, located on the back or underneath your appliance. Regular cleaning can improve the efficiency of your refrigerator by up to 15% or more.
- Laundry:
  - Switch to cold-water washing.
  - Clean the lint filter in your dryer after every load.
  - Dry clothes outside on the line to save energy, as well as to avoid the heat a dryer can generate.

Preparing for an Outage

- Keep emergency supplies on hand, including:
  - Flashlights with fresh batteries
  - Portable, battery-powered radio
  - Wind-up or battery-powered clock
  - Water and nonperishable food, along with a manual can opener
- Have a cell phone or land-line telephone. Cordless phones will not work without electricity.
- Know how to manually open and close any electric garage doors, security doors or gates.
- Protect sensitive electric equipment, such as computers, VCRs and televisions by installing surge protectors or other power-protection devices.
- Make sure your smoke alarms and CO2 detectors have fresh batteries. Even those alarms that are wired to your home's electrical system should have a fresh back-up battery.
- Identify the operating requirements of gas equipment. During an outage, appliances with electronic ignitions will not work because electricity is needed to ignite the natural gas. In addition, appliances requiring fans or other electric devices to run (such as central heating units and gas clothes dryers) will not operate.

During an Outage

- Notify Avista at (800) 227-9187 to report an outage or any downed power lines.
- In the event of a major storm, access your favorite news source for updated information. Avista partners with the media on providing updated outage and storm information.
- Assist family members or neighbors who may be vulnerable if exposed to high temperatures for extended periods.
- Use flashlights instead of candles to reduce fire hazards.
- Keep your refrigerator and freezer doors closed as much as possible to prevent food spoilage. Food should stay frozen for about one full day and fresh in the refrigerator for about four hours.
- Do not heat your home with an outdoor grill or other items not intended for indoor use. This goes for cooking as well. Using outdoor grills, charcoal and other fuels meant for outdoor use can create deadly fumes if used indoors.
- Never use an extension cord to receive power from a neighbor's home.
- Turn off electric appliances that were in use when the power went off, as well as all lights. This will help to prevent power surges when electricity is restored. Leave one light on to let you know when power is restored.
- Turn on your front porch light. This can help Avista crews working in a neighborhood know which homes have power.

After an Outage

- Wait a few minutes before turning on major electrical appliances. This will help eliminate problems that could occur if there's a sharp increase in demand immediately after power is restored.
- If you think power has been restored to your area but your home is still without power, call Avista at (800) 227-9187.

FIGURE 19 – RESIDENTIAL TIPS SOCIAL MEDIA

FIGURE 20 – RESIDENTIAL ENERGY USE AND SAVINGS GUIDE FOR RESIDENTIAL CUSTOMERS

Understanding This Guide

Listed below are terms and definitions that will be used throughout this guide. All numbers and costs included are a representation based on national average use with average Avista rates.

Kilowatt Hours (kWh): We measure electrical energy in watt hours. One kilowatt hour equals 1,000 watt hours. The kilowatt hours on your bill equals the rate or speed of use (kilowatts) x the length of time electricity was used. Running a 5,000-watt (5 kilowatt) clothes dryer for 1 hour uses 5 kilowatt hours of electricity. Burning a 100-watt light bulb for 10 hours uses 1 kilowatt hour.

Therms: Your gas energy use is measured in a unit called therms. Therms identify the heating value provided by gas. One therm equals the heating capacity of approximately 100,000 wooden kitchen matches.

Approximate Watts: The wattage is the consumption rate of electricity a device exhibits while operating. This energy consumption may occur when a computer is turned on, when a kitchen mixer is in use or when light bulbs are turned on in a light fixture.

Monthly kWh Usage: The monthly kWh usage for each device is based on an assumed typical month of operation, estimating the hours the device is operating in conjunction with its power consumption as noted in the watt rating.

Estimated Monthly Cost: The estimated monthly cost is based on the energy consumption at $0.10 per kilowatt hour for electricity or $0.80 per natural gas therm which are typical for Avista residential customers.

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Water Heating Energy Saving Tips

If you do not have access to natural gas, consider a **heat pump water heater** to save energy.

Showers generally take less hot water than baths and **dishwashers** generally take less water than hand washing.

Buy **ENERGY STAR** appliances.

If you don't have hard water or you do have a water softener, consider a **tankless natural gas water heater** that reduces standby losses.

Page 12 Energy Use and Savings Guide

Water Heating

Energy Saving Checklist

- ☐ **Keep showers short.** Try to keep your shower to no longer than five minutes.
- ☐ **Adjust your temperature settings.** Set your water heater at 120° F.
- ☐ **Replace washers on faucets that drip.** A leaky faucet can waste 2,500 gallons of hot water per year at a rate of one drip per second.
- ☐ **Install a low-flow shower head.** It can reduce your home water consumption as much as 50%, and reduce your energy cost of heating the water also by as much as 50%. When purchasing a new shower head you should look for shower heads that use no more than 1.5 gallons per minute (water consumption) and preferably no more than 0.6 gallons per minute.

Energy Use Guide–Electric

Water heater, 50-gallon heat pump	182.9	$18.29
Water heater, 50-gallon high-efficiency	385.2	$38.52
Water heater, 50-gallon standard-efficiency	404.8	$40.48

Assuming 25 gallons per day

Energy Use Guide–Natural Gas

Water heater, 50-gallon	20	$16.00
Water heater, 40-gallon	17.5	$14.00
Instantaneous water heater	11.5	$9.20

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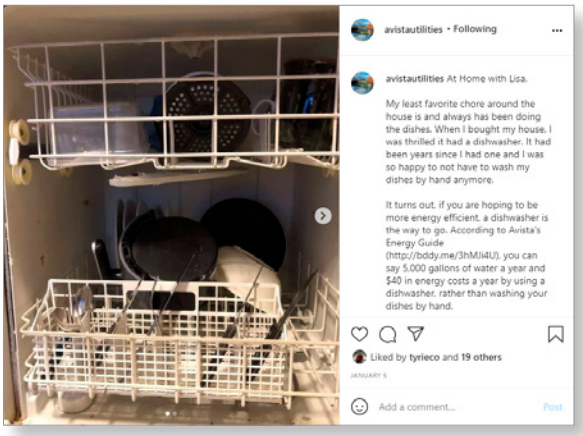
FIGURE 21 – KIDS CAN SAVE ENERGY TOO COLORING AND ACTIVITY BOOK

At Home with Lisa

Many Avista customers live in older homes with energy-efficiency challenges. In 2020, the company partnered with Lisa, an Avista customer who bought her 1910 house because she loved the old-world character – and then quickly discovered it wasn't very energy-friendly. She attended an Avista energy fair and discovered how easy implementing some efficiency measures can be. Lisa began writing weekly features sharing her experience with simple do-it-yourself projects around her house that help improve her energy use and comfort. Most of Lisa's articles focus on low- or no-cost energy-saving tips that customers can do on their own, regardless of their home's fuel type or heating system. Titled "At Home with Lisa," her articles are hosted on Avista's website at the Connections blog. They're also shared on Avista's social media pages.

In 2021, "At Home with Lisa" blogs on myavista.com were viewed 8,449 times. On social media, her posts reached 102,441 viewers. Of 49 articles written, 38 focused solely on energy-efficiency topics. Hoping to influence similar customers to act, Lisa continues to share about the steps she's taking to help control her energy use.

FIGURE 22 – AT HOME WITH LISA CONNECTIONS ARTICLE AND BLOG POSTS



Performance and Savings Goals

The electric residential program saw a large change from the previous year, achieving 1,568,411 kWh – a 52 percent decrease from 2020. This drop is attributed to COVID-19 impacts to the MFDI program, which was halted for the duration of 2021.

The natural gas program experienced significantly less volatility in achieving 430,397 therms, an increase of 5 percent over 2020's savings (408,525 therms).

- HVAC measures formed the largest percentages of savings for both the natural gas and electric programs.
- Shell measures contributed significantly to savings from electric programs.

Table 23 shows savings goals assigned to Avista's residential sector programs for 2021, as well as verified savings and the goal portion achieved in 2021.

TABLE 23 – RESIDENTIAL PROGRAMS REPORTED SAVINGS – ELECTRIC

Program	Savings Goals (kWh)	Verified Savings (kWh)	Percentage of Goal
Water Heat	163,240	103,798	64%
HVAC	285,893	535,629	187%
Shell	308,948	390,726	126%
ENERGY STAR Homes	116,025	90,133	78%
Small Home & Manufactured Home Weatherization	94,287	199,562	212%
Appliances	211	30,506	14458%
Multifamily Direct Install	3,969,977	218,057	5%
Residential Total	**4,938,581**	**1,568,411**	**32%**

The natural gas segment of the portfolio achieved 99 percent of the goal for 2021.

Table 24 shows savings goals assigned to Avista's residential sector programs for 2021, as well as verified savings and the goal portion achieved in 2021.

TABLE 24 – RESIDENTIAL PROGRAMS REPORTED SAVINGS – NATURAL GAS

Program	Savings Goals (kWh)	Verified Savings (kWh)	Percentage of Goal
Water Heat	27,593	43,696	158%
HVAC	342,173	306,026	89%
Shell	59,286	76,639	129%
ENERGY STAR Homes	1,340	438	33%
Small Home & Manufactured Home Weatherization	5,602	2,912	52%
Appliances	-	721	NA
Residential Total	**435,994**	**430,433**	**99%**

Housing Type

The residential program consists of measures that aim to maximize the inclusion of all customers while remaining cost-effective. For 2021, Avista's residential prescriptive program provided 9,670 rebates to more than 6,500 customers. (A customer can participate in more than one rebate at a time.) Of this amount, 163 participants were identified within Avista's system as having a "manufactured" housing type; an additional 165 participants were identified as living in a multifamily residence (duplex or fourplex). Table 25 illustrates the housing data from 2021's residential prescriptive program participants.

TABLE 25 – RESIDENTIAL PROGRAMS REBATES BY HOUSING TYPE

Program	Manufactured	Multifamily	Single Family	Total
HVAC	71	73	6,839	6,983
Shell	49	81	1,730	1,860
Water Heat	0	0	251	251
ENERGY STAR Homes	29	0	5	34
Appliances	14	11	517	542
Total	**163**	**165**	**9,342**	**9,670**

As part of Avista's 2021 program offerings, the company extended weatherization measures to multifamily units, condos, and small homes, tailoring offerings for each housing type. More customers will likely participate in these programs as Avista continues to identify barriers and provide opportunities for hard-to-reach markets.

Cost-Effectiveness

Tables 26 and 27 show the residential sector cost-effectiveness results by fuel type.

TABLE 26 – RESIDENTIAL COST-EFFECTIVENESS RESULTS – ELECTRIC

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 3,645,271	$ 3,358,020	1.09
Utility Cost Test (UCT)	$ 3,273,212	$ 1,834,075	1.78
Participant Cost Test (PCT)	$ 2,659,027	$ 1,926,716	1.38
Ratepayer Impact (RIM)	$ 3,273,212	$ 7,713,522	0.42

TABLE 27 – RESIDENTIAL COST-EFFECTIVENESS RESULTS – NATURAL GAS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 13,328,625	$ 6,903,947	1.93
Utility Cost Test (UCT)	$ 12,116,794	$ 2,816,879	4.30
Participant Cost Test (PCT)	$ 49,978,337	$ 6,762,782	7.39
Ratepayer Impact (RIM)	$ 12,116,794	$ 187,086,628	0.06

Residential HVAC Program

TABLE 28 – RESIDENTIAL HVAC PROGRAM METRICS

HVAC – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		409
Overall kWh Savings		535,629
Incentive Spend	$	170,994
Non-Incentive Utility Costs	$	186,282
Washington Energy-Efficiency Rider Spend	$	357,275
HVAC – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		5,476
Overall Therm Savings		306,026
Incentive Spend	$	1,663,352
Non-Incentive Utility Costs	$	77,183
Washington Energy-Efficiency Rider Spend	$	1,740,535

Description

Avista's residential rebate program provides a variety of options to assist customers with multiple energy-efficiency improvements for the home. Various rebates are available to provide a holistic approach to space and water heating systems, the building shell, and appliances.

Avista encourages customers to select a high-efficiency solution when making heating upgrades to their homes. Washington electric customers (Schedule 1) who heat their homes with Avista electricity may be eligible for a rebate for converting their electric straight-resistance space heating to an air-source or ductless heat pump system. Annual energy use in the home pre-upgrade must show 8,000 kilowatt hours or more (and less than 340 therms if natural gas is also available) of heating use. Air-source heat pumps with HSPF of 9 or higher and ductless heat pumps with HSPF of 10 or higher qualify for the program.

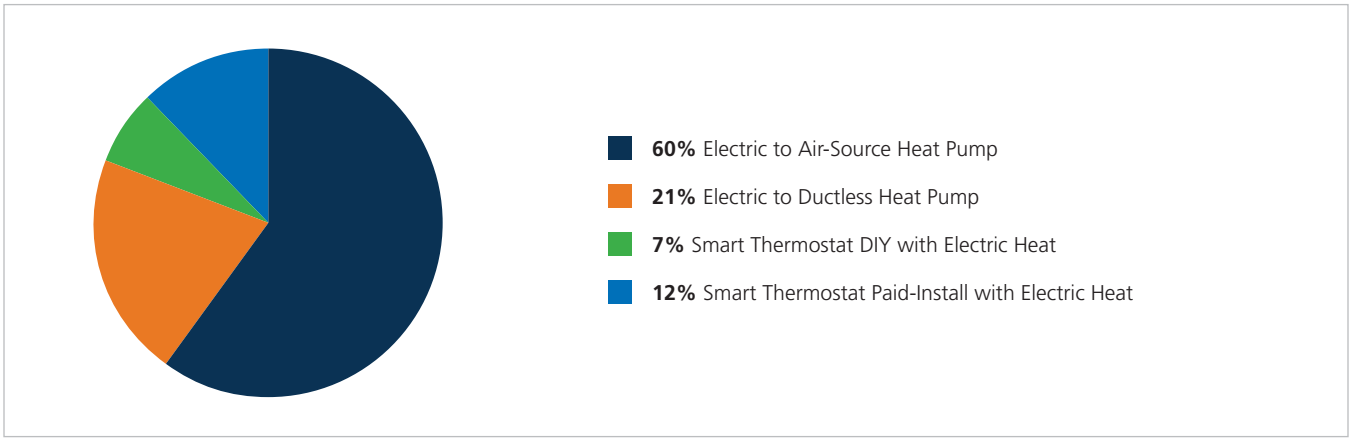
Washington residential natural gas customers (Schedule 101) who heat their homes with natural gas may be eligible for a rebate for installing a high-efficiency natural gas furnace or boiler. High-efficiency natural gas furnaces and boilers with an AFUE of 90 percent or higher are eligible. The supporting documentation required for participation includes, but may not be limited to, copies of project invoices and an Air Conditioning, Heating, and Refrigeration Institute (AHRI) certification.

The rebate is paid to the customer after the measure has been installed and associated documentation has been received. Energy-efficiency marketing efforts build awareness of opportunities in the home and drive customers to the website for rebate information. Vendors generate participation using the Avista rebate as a sales tool for their services. Additional communication methods that encourage program participation include website promotion and bill inserts. Vendor training, retail location visits, and presentations at various customer events are also part of the marketing efforts, though they've been postponed due to pandemic restrictions.

Program Activities

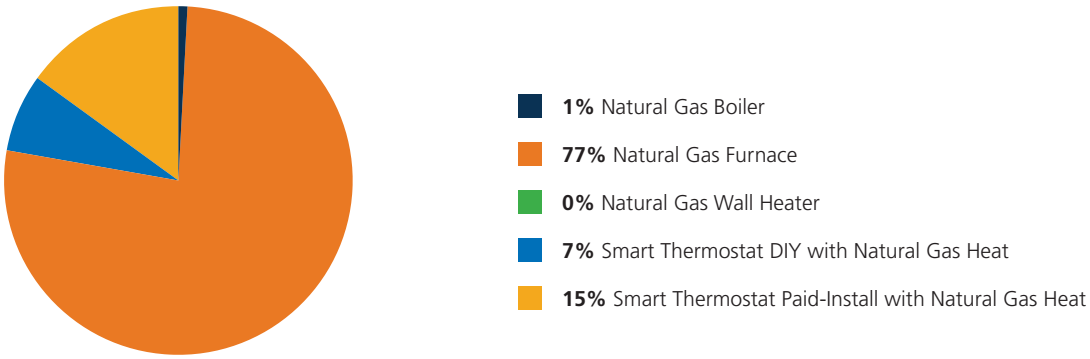
- ***Electric:*** Savings of 535,629 kWh in 2021, 34 percent of the overall savings achieved in Avista's residential portfolio. The program had a 2 percent increase over the 527,574 kWh achieved in 2020.
- ***Natural Gas:*** Savings of 306,026 therms in 2021 (71 percent of the overall residential savings), an 8 percent decrease relative to the 330,929 therms achieved in 2020.

FIGURE 23 – RESIDENTIAL HVAC INCENTIVE DOLLARS BY MEASURE – ELECTRIC



There were a significant number of HVAC projects completed in 2021 despite the plethora of supply chain challenges and other pandemic-related issues. Air-source heat pumps comprised approximately 60 percent of the residential HVAC electric incentives; 81 percent of HVAC incentives were in the air-source or ductless heat pump category.

FIGURE 24 – RESIDENTIAL HVAC INCENTIVE DOLLARS BY MEASURE – NATURAL GAS



High-efficiency natural gas furnaces continued to provide the largest portion of natural gas savings in the residential sector portfolio, comprising approximately 77 percent of Avista's 2021 residential HVAC incentives. Smart thermostats continued to be popular, with 2,829 installed in the company's Washington service territory (2,596 for natural gas HVAC systems, 233 for electric HVAC systems).

In 2021, Avista program managers kept in contact with trade allies via topical, focused email messages to notify them of upcoming program changes and deadlines. Engagement with trade allies continues to be an important marketing strategy for this program.

Program Marketing

The program was included on the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 34-40.

Plans for 2022

Avista will continue to encourage installations of all HVAC equipment listed. An increased incentive is available in the natural gas furnace category to also include multi-family units. The company will offer similar HVAC rebates, including line voltage and smart thermostats, for customers living in these housing types under the Multifamily/Small Home Program. These customers do not meet the usage minimum requirements but instead reside in condominiums (they own and maintain but may be located in an apartment-like building) or have small home footprints (less than 1,000 square feet). Customers living in these home types are often overlooked based solely on annual energy usage and type of structure they reside in.

Residential Shell Program

TABLE 29 – RESIDENTIAL SHELL PROGRAM METRICS

Shell – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		256
Overall kWh Savings		390,726
Incentive Spend	$	133,292
Non-Incentive Utility Costs	$	455,640
Washington Energy-Efficiency Rider Spend	$	588,932
Shell – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		1,345
Overall Therm Savings		76,639
Incentive Spend	$	745,372
Non-Incentive Utility Costs	$	49,514
Washington Energy-Efficiency Rider Spend	$	794,886

Description

Avista encourages residential customers to improve their home's building envelope by adding insulation, upgrading windows, and adding storm windows. Following the same energy usage requirements as the HVAC program, this rebate approach issues payment to the customer after the measure has been installed.

Washington residential electric customers (Schedule 1) who heat their homes with Avista electric and use at least 8,000 kWh a year are eligible to apply, as are Washington residential natural gas customers (Schedule 101) with an annual home heating usage of 340 therms.

Insulation rebates for attics, floors, and walls follow the same eligibility requirements for usage and contractor installation. Existing attic insulation must be R11 or lower; floor and wall insulation must not have any insulation to start. Contractor supporting documentation should include an invoice along with details that include the square footage of the space insulated and both pre- and post-installation R-values.

Window projects must be installed by a contractor and have a U-factor rating of .29 or lower to qualify. Supporting documentation should include a copy of the invoice, along with window dimensions and U-factor rating.

New storm windows can also be considered for a rebate. They must be the same size and not in direct contact with the existing window. The storm window exterior low-E coating must be facing the interior of the home. Glazing material emissivity must be less than 0.22 with a solar transmittance greater than 0.55.

Marketing efforts build awareness of opportunities in the home and drive customers to the website for rebate information. Vendors generate participation using the rebate as a sales tool for their services. Additional communication methods that encourage program participation include promotion on Avista's website and bill inserts. Vendor training, retail location visits, and presentations at various customer events have been postponed due to pandemic restrictions.

Program Activities

- ***Electric:*** Savings of 390,726 kWh in 2021 (29 percent of the overall residential savings), a 36 percent decrease from the 610,472 kWh achieved in 2020.
- ***Natural Gas:*** Savings of 76,639 therms in 2021, or 18 percent of the overall residential savings. The program had a 60 percent increase in savings relative to the 47,875 therms achieved in 2020.

The savings derived from the Residential Shell Program for both natural gas and electric homes are primarily attributed to single-pane window replacements. Program participants had been inclined to replace existing windows with regular windows rather than storm windows. For Avista's electric program, the difference in savings as compared to 2020 is due to the variance between expected and verified savings. In 2020, the company anticipated 259,211 kWh of savings for its single pane window replacement measure; however, the verified savings resulted in 465,976 kWh. For 2021, the same measure achieved 242,389 kWh for expected savings and a verified savings level of 291,909 kWh.

Program Changes

There were no substantial changes to the program in 2021.

Program Marketing

The program was included in the "Way to Save" advertising campaigns to increase awareness and drive participation. See pages 34-40.

Plans for 2022

In 2022, the Residential Shell Program will include ENERGY STAR-rated doors. All rebates will be extended for inclusion in the Multifamily/Small Home Program. Avista will consider further raising incentive levels for window measures. The current incentive is $4 per square foot; however, based on that incentive level, the rebate covers approximately 5 to 7 percent of the overall project cost.

Residential Water Heating Program

TABLE 30 – RESIDENTIAL WATER HEATING PROGRAM METRICS

Water Heat – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		83
Overall kWh Savings		103,798
Incentive Spend	$	17,845
Non-Incentive Utility Costs	$	24,095
Washington Energy-Efficiency Rider Spend	$	41,940
Water Heat – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		668
Overall Therm Savings		43,696
Incentive Spend	$	222,300
Non-Incentive Utility Costs	$	10,786
Washington Energy-Efficiency Rider Spend	$	233,086

Description

Avista customers who use either electricity or natural gas to heat their water are eligible for participation in the Residential Water Heating Program. Three different types of water heaters are available: a high-efficiency electric heat pump water heater with an efficiency rating of 1.8 or higher, a natural gas tankless water heater with an efficiency of .82 or higher, or a natural gas high-efficiency storage tank water heater with an efficiency of .65 or higher. Efficiency ratings for all equipment are verified according to the contractor invoice or the AHRI certification and should be included with the customer's rebate application.

Program Activities

- ***Electric:*** Residential water heating program savings were 103,798 kWh in 2021, a 30 percent decrease over the 148,557 kWh of savings achieved in 2020.
- ***Natural Gas:*** Overall savings were 43,696 therms, an increase of 53 percent over 2020's savings of 28,629 therms.

The program saw a small decline in participation, from 117 units in 2020 to 83 in 2021. With the regional supply chain affecting the availably of equipment, Avista anticipates that the overall participation in 2022 will increase as supply is replenished.

Program Marketing

The program was included in the "Way to Save" advertising campaigns to increase awareness and drive participation. See pages 34-40.

Plans for 2022

All three water heater products will be available in 2022, with an increase both to the incentives for and to the efficiency ratings of the heat pump water heater (2.9) and the natural gas tankless water heater (.93). These products will also be available within the Multifamily/Small Home Program mentioned previously (and described in more detail later in this report).

Residential ENERGY STAR Homes Program

TABLE 31 – RESIDENTIAL ENERGY STAR HOMES PROGRAM METRICS

ENERGY STAR Home – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		34
Overall kWh Savings		90,133
Incentive Spend	$	31,000
Non-Incentive Utility Costs	$	51,764
Washington Energy-Efficiency Rider Spend	$	82,764
ENERGY STAR Homes – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		34
Overall Therm Savings		438
Incentive Spend	$	3,000
Non-Incentive Utility Costs	$	133
Washington Energy-Efficiency Rider Spend	$	3,133

Description

Any Washington residential electric customer (Schedule 1) with a Northwest Energy-Efficient Manufactured (NEEM)-certified home with Avista electric and/or Avista residential natural gas (Schedule 101) for space and water heating is eligible for the rebate.

NEEM-certified homes provide energy savings beyond code requirements for space heating, water heating, shell measures, lighting, and appliances. Space-heating equipment can be electric forced air, an electric heat pump, or a natural gas furnace. This rebate may not be combined with other Avista individual measure rebate offers (such as high-efficiency water heaters).

The ENERGY STAR Manufactured Homes Program takes advantage of the regional and national effort surrounding the U.S. Department of Energy and U.S. Environmental Protection Agency's ENERGY STAR label. Avista and partnering member utilities of NEEA have committed significant resources to develop and implement this program to set standards, train contractors, and provide third-party verification of qualifying homes. NEEA, in effect, administers the program and Avista pays the rebates for homes that successfully complete the process and are labeled ENERGY STAR.

After the launch of NEEA's regional effort, the manufactured homes industry established manufacturing standards and a labeling program to obtain NEEM-certified manufactured homes. While the two approaches are unique, they both offer 15-25 percent savings versus the baseline.

The ENERGY STAR Manufactured Homes Program promotes to both builders and homeowners a sustainable, low-operating-cost, environmentally friendly structure as an alternative to traditional home construction. In Washington, Avista offers both electric and natural gas energy-efficiency programs; as a result, the company has structured the program to account for homes where either a single fuel or both fuels are used for space and water heating needs. Avista continues to support the regional program to encourage sustainable building practices.

Any Washington residential electric customer (Schedule 1) with a NEEM-certified home that has Avista electric and/or Avista residential natural gas (Schedule 101) for space and water heating is eligible. Space-heating equipment can be either electric forced air or electric heat pump, or a natural gas furnace. This rebate may not be combined with other Avista individual measure rebate offers (such as high-efficiency water heaters).

Program Activities

The ENERGY STAR Manufactured Homes Program accounted for less than 1 percent of program savings for both electric and natural gas programs.

- ***Electric:*** Savings of 90,133 kWh in 2021 (7 percent of the overall residential savings), a 7 percent increase over the savings of 84,256 kWh achieved in 2020.
- ***Natural Gas:*** Savings of 438 therms in 2021. The program had a 35 percent decrease in savings relative to the 670 therms achieved in 2020.

Program Marketing

The program is included on Avista's website and took advantage of the "Way to Save" advertising campaigns to increase awareness of the company's residential rebate programs. See pages 34-40.

Program Changes for 2022

There are no substantial program changes proposed for 2022.

Residential Multifamily/Small Home Program

TABLE 32 – RESIDENTIAL MULTIFAMILY/SMALL HOME PROGRAM

Multifamil/Small Home – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		68
Overall kWh Savings		199,562
Incentive Spend	$	28,265
Non-Incentive Utility Costs	$	227,873
Washington Energy-Efficiency Rider Spend	$	256,137
Multifamily/Small Home – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		46
Overall Therm Savings		2,912
Incentive Spend	$	19,598
Non-Incentive Utility Costs	$	1,884
Washington Energy-Efficiency Rider Spend	$	21,482

Description

Created in response to a gap in program availability, the Multifamily/Small Home Program addresses two unique barriers to Avista's residential rebate program: First, customers who did not meet minimum annual energy usage requirements of 8,000 kWh or 340 therms were not eligible for the program. The annual usage requirement is in place to ensure an Avista fuel is being used as a primary heat source instead of an alternative heat source (e.g., oil, wood, propane). Second, condominium owners have historically been excluded from program eligibility because condos are typically multifamily buildings.

The company has often been forced to turn away owners of condominiums or small houses for window or insulation rebates, as very little to no energy savings existed for these homes. Customers were left dissatisfied and confused as to why their condo or their 800-square-foot stick-built home would not qualify for a rebate. In 2021, Avista decided to test the interest and the energy savings that may be achieved in these types of housing structures by providing incentives for window replacement, storm windows, insulation, and line voltage thermostats.

Energy savings claimed were less than the traditional residential rebate program. Savings were determined by considering lower estimated energy use and home square footage.

Results from the 2021 evaluation and implementation review demonstrated that 199,562 kWh savings and 2,912 therms were achieved with this program, prompting consideration toward adding additional measures for these homes.

Program Activities

The Residential Multifamily/Small Homes Program accounted for 15 percent of program savings for electric and one percent of savings for natural gas programs.

- ***Electric:*** Savings of 199,562 kWh in 2021.
- ***Natural Gas:*** Savings of 2,912 therms in 2021.

Program Changes for 2022

Due to interest in the program in 2021, the measure list for these homes has been extended to offer all incentives currently obtainable through the residential rebate program.

Residential Appliances

TABLE 33 – RESIDENTIAL APPLIANCES PROGRAM

Appliances – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		327
Overall kWh Savings		30,506
Incentive Spend	$	11,820
Non-Incentive Utility Costs	$	7,674
Washington Energy-Efficiency Rider Spend	$	19,494
Appliances – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		185
Overall Therm Savings		721
Incentive Spend	$	7,300
Non-Incentive Utility Costs	$	121
Washington Energy-Efficiency Rider Spend	$	7,421

Description

Avista has historically offered incentives for high-efficiency appliances such as residential washers, dryers, and refrigerators through various avenues such as point-of-sale programs and prescriptive paths. For 2021, the company expanded its prescriptive program to include rebates for ENERGY STAR-certified appliances, including:

- front-load washer
- electric dryer
- refrigerator/freezer
- freezer

The program served more than 500 customers in 2021. More participation is anticipated in future years as market awareness grows.

Program Activities

- ***Electric:*** Savings of 30,506 kWh in 2021.
- ***Natural Gas:*** Savings of 721 therms in 2021.

Program Changes for 2022

Due to the interest in the program in 2021, the measure list for these appliances has been maintained for the 2022 program year.

Residential Multifamily Direct Install Program and Supplemental Lighting

TABLE 34 – RESIDENTIAL MULTIFAMILY DIRECT INSTALL PROGRAM AND SUPPLEMENTAL LIGHTING PROGRAM METRICS

Multifamily Direct Install – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		1,162
Overall kWh Savings		218,057
Incentive Spend	$	8,854
Non-Incentive Utility Costs	$	256,793
Washington Energy-Efficiency Rider Spend	$	265,647
Multifamily Direct Install – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		-
Overall Therm Savings		0
Incentive Spend	$	0
Non-Incentive Utility Costs	$	0
Washington Energy-Efficiency Rider Spend	$	0

Note that the MFDI program has been tracked by total measures installed, which include LED lamps, faucet aerators, showerheads, and smart strips.

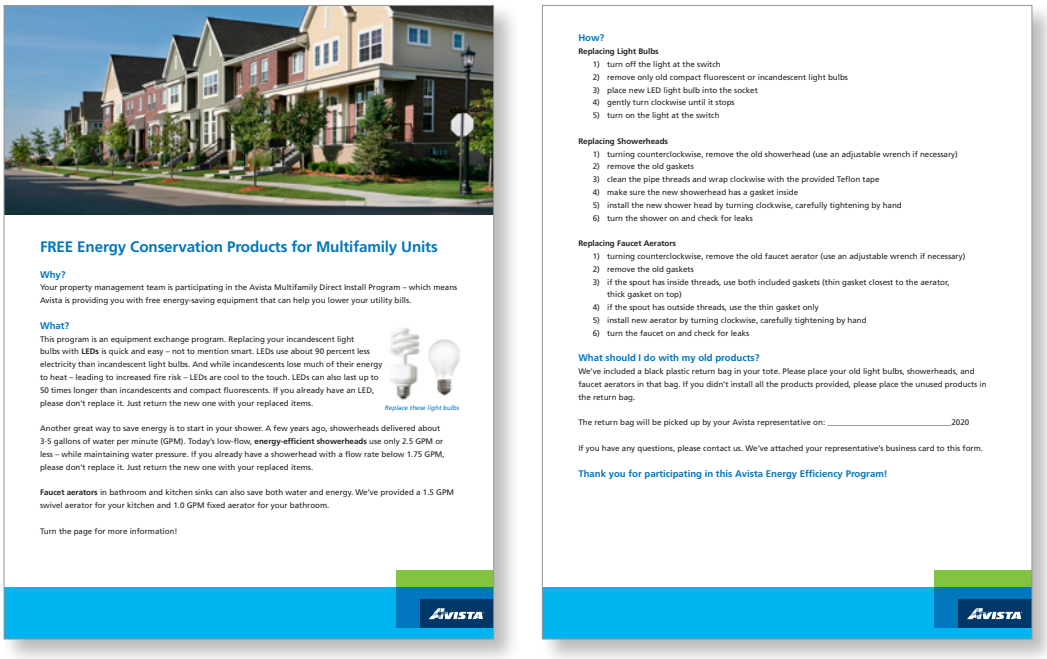
Description

The MFDI program is designed to help hard-to-reach customers save energy. Field installers coordinate with property managers of multifamily complexes of five units or more to directly install small energy savers such as LED lamps, faucet aerators, showerheads, and smart power strips, as well as vending misers in common areas. During the first site visit with properties, installers audit the complex not only for tenant needs, but also for any eligible common area lighting, which would include stairwell lighting used 24/7, exterior lamps and fixtures on a daylight sensor, and conversions from interior fluorescent T12s and T8s to LEDs used 24/7. Direct installations are completed at the complex and the supplemental lighting information is passed on to lighting contractors contracted to work in various areas. Lighting contractors communicate with the property managers to audit and put together project data that is sent to SBW, the program implementer, and Avista to ensure the project is cost-effective, after which the project is completed.

Program Activities

The MFDI Program began in 2018 and ran as designed until March 2020, at which time it was paused due to the COVID-19 pandemic. Amid safety restrictions on entering tenant units, Avista tried a number of ways to reach customers in fall 2020, including a "trunk or treat" model in which residents were invited outside to pick up free products – LED lamps, faucet aerators, showerheads, et al. – as well as a drop-off model, in which the program implementer dropped off kits for residents to self-install. Neither of these methods were effective. For 2021, the focus pivoted to supplemental lighting projects that could be completed in common areas as well as exterior lighting projects.

FIGURE 25 – RESIDENTIAL MULTIFAMILY DIRECT INSTALL PROGRAM FLYER



FREE Energy Conservation Products for Multifamily Units

Why?
Your property management team is participating in the Avista Multifamily Direct Install Program – which means Avista is providing you with free energy-saving equipment that can help you lower your utility bills.

What?
This program is an equipment exchange program. Replacing your incandescent light bulbs with **LEDs** is quick and easy – not to mention smart. LEDs use about 90 percent less electricity than incandescent light bulbs. And while incandescents lose much of their energy to heat – leading to increased fire risk – LEDs are cool to the touch. LEDs can also last up to 50 times longer than incandescents and compact fluorescents. If you already have an LED, please don't replace it. Just return the new one with your replaced items.

Replace these light bulbs

Another great way to save energy is to start in your shower. A few years ago, showerheads delivered about 3-5 gallons of water per minute (GPM). Today's low-flow, **energy-efficient showerheads** use only 2.5 GPM or less – while maintaining water pressure. If you already have a showerhead with a flow rate below 1.75 GPM, please don't replace it. Just return the new one with your replaced items.

Faucet aerators in bathroom and kitchen sinks can also save both water and energy. We've provided a 1.5 GPM swivel aerator for your kitchen and 1.0 GPM fixed aerator for your bathroom.

Turn the page for more information!

AVISTA

How?

Replacing Light Bulbs
1) turn off the light at the switch
2) remove only old compact fluorescent or incandescent light bulbs
3) place new LED light bulb into the socket
4) gently turn clockwise until it stops
5) turn on the light at the switch

Replacing Showerheads
1) turning counterclockwise, remove the old showerhead (use an adjustable wrench if necessary)
2) remove the old gaskets
3) clean the pipe threads and wrap clockwise with the provided Teflon tape
4) make sure the new showerhead has a gasket inside
5) install the new shower head by turning clockwise, carefully tightening by hand
6) turn the shower on and check for leaks

Replacing Faucet Aerators
1) turning counterclockwise, remove the old faucet aerator (use an adjustable wrench if necessary)
2) remove the old gaskets
3) if the spout has inside threads, use both included gaskets (thin gasket closest to the aerator, thick gasket on top)
4) if the spout has outside threads, use the thin gasket only
5) install new aerator by turning clockwise, carefully tightening by hand
6) turn the faucet on and check for leaks

What should I do with my old products?
We've included a black plastic return bag in your tote. Please place your old light bulbs, showerheads, and faucet aerators in that bag. If you didn't install all the products provided, please place the unused products in the return bag.

The return bag will be picked up by your Avista representative on: _____2020

If you have any questions, please contact us. We've attached your representative's business card to this form.

Thank you for participating in this Avista Energy Efficiency Program!

AVISTA

Plans for 2022

This program is currently scheduled to run through 2023 as originally planned as COVID-19 restrictions are lifted. The program is leveraging customer-level estimates of energy burden to drive its marketing and outreach plan for 2022.

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Milwaukee Road Railroad Bridge, Rosalia, Washington

LOW-INCOME SECTOR

Program-by-Program Summaries

Low-Income Program

TABLE 35 – LOW-INCOME PROGRAM METRICS

Low-Income Program Summary – Electric		2021
Participation, Savings, and Costs		
Conservation Projects		341
Overall kWh Savings		306,466
Incentive Spend	$	920,555
Non-Incentive Utility Costs	$	482,273
Washington Energy-Efficiency Rider Spend	$	1,402,828
Low-Income Program Summary – Natural Gas		**2021**
Participation, Savings, and Costs		
Conservation Projects		526
Overall Therm Savings		12,455
Incentive Spend	$	1,157,076
Non-Incentive Utility Costs	$	483,380
Washington Energy-Efficiency Rider Spend	$	1,640,456

For 2021, the Low-Income Program served 341 electric and 526 natural gas customers. Program participation for low-income programs is quantified in the number of installed units or square feet of installed insulation or windows.

Description

Avista partners with seven Community Action Agencies (CAAs) and one Tribal Housing Authority to deliver low-income energy-efficiency programs throughout the company's service territory. All these organizations have the infrastructure in place to income-qualify customers as well as provide access to a variety of funding sources to make energy-efficiency improvements to their homes. An annual funding amount of $3 million is allocated across the organizations and is based on meter count in the counties they serve.

The agencies may spend their contract amount at their discretion on either electric or natural gas efficiency measures. The home must demonstrate a minimum level of energy use of either Avista electricity or natural gas for space heating purposes to be eligible for improvements. Eligible measures include the home's shell (e.g., doors, insulation or windows) as well as space and water heating systems. The annual funding allocation includes a 30 percent reimbursement for both administrative (10 percent) and program support (20 percent) costs. Agencies may also choose to use up to 30 percent of their annual allocation for home repair as well as other health and safety improvements.

To guide the agencies toward projects that are most beneficial to Avista's energy-efficiency efforts, the company provides an approved list of measures that are considered utility cost-effective and allow for full reimbursement of the installation.

A list of acceptable measures allows for partial reimbursement of those efficiency improvements that may not be cost-effective but may be vital for the home's functionality. These measures are compensated with an amount that is equal to the utility's avoided cost of the energy savings associated with the improvement. To allow additional flexibility with their funds, the agencies may use the health, safety, and repair dollars to fully fund the remaining cost of the qualified measure.

Program Activities

In 2021, the program achieved 306,466 kWh of reported electric savings in Washington. Tables 36 and 37 show Avista savings goals for the low-income sector for 2021, as well as verified savings and the percentage of goal achieved.

TABLE 36 – LOW-INCOME VERIFIED SAVINGS – ELECTRIC

Program	Savings Goals (kWh)	Verified Savings (kWh)	Percentage of Goal
Low-Income	408,626	306,466	75%
Low-Income – Total	**408,626**	**306,466**	**75%**

TABLE 37 – LOW-INCOME VERIFIED SAVINGS – NATURAL GAS

Program	Savings Goals (Therms)	Verified Savings (Therms)	Percentage of Goal
Low-Income	24,275	12,455	51%
Low-Income – Total	**24,275**	**12,455**	**51%**

Avista continued to reimburse the agencies for 100 percent of the cost for installing most energy-efficiency measures defined on the approved measure list (see Table 38). The company deemed these measures cost-effective during the development of the 2021 Annual Conservation Plan.

TABLE 38 – LOW-INCOME PROGRAM APPROVED MEASURE LIST

Electric Measures	Natural Gas Measures
Air infiltration	Air infiltration
Air-source heat pump	Attic insulation
Attic insulation	Boiler (96%)
Doors (ENERGY STAR-rated)	Doors (ENERGY STAR-rated)
Duct insulation	Duct insulation
Duct sealing	Duct sealing
Floor insulation	Floor insulation
LED lamps	Furnace (95%)
Wall insulation	Water heater – storage <55 gallon .65
Windows (ENERGY STAR-rated)	Water heater – tankless .82 EF
Electric to air-source heat pump	Windows (ENERGY STAR-rated)
Electric to ductless heat pump	

Agencies could receive partial reimbursement for the installation of measures that are on the acceptable measures list but that did not meet the cost-effectiveness test and. The amount of reimbursement is equal to the avoided cost-energy value of the improvement. This approach focused agencies toward installing measures that had the greatest cost-effectiveness from the utility's evaluation. To allow for additional flexibility, agencies may choose to use their health and safety dollars to fully fund the cost of the measures on the acceptable measure list.

TABLE 39 – LOW-INCOME PROGRAM ACCEPTABLE MEASURE LIST

Electric Measures	Natural Gas Measures
Air-source heat pump (9 HSPF)	(none currently)
Heat pump water heater (any size; tiers 2–3)	
Refrigerator – ENERGY STAR-rated	

Program Changes

The first quarter of 2021 saw the introduction of a new Community Action Agency, which will serve approximately 200 customers in Franklin County (primarily a natural gas-only service territory for Avista). With limited in-person outreach events due to pandemic restrictions, it has been difficult to identify potential customers who may benefit from this program. A postcard and email campaign that included a Spanish translation was distributed in April 2021 and resulted in zero leads. A modified outreach event at the local food bank – where both Avista and the agency were present – in early summer also yielded no leads. Additional efforts will be initiated in 2022 to locate eligible customers.

The COVID-19 pandemic continues to influence how Avista serves income-qualified homes throughout its service territory. While the agencies have been actively working with customers since July 2020, many challenges persist, including finding willing and eligible participants, conducting work in safe conditions, navigating increases in labor and material costs, delays in receiving products, and uncertainty about in-home verification protocols. While a couple of the agencies were able to fully spend their funds, others did not have the same success, including two who were not able to serve a single home during 2021.

In addition to providing the traditional path to serving income-qualified customers with energy efficiency, Avista initiated two pilot programs in response to 9b of the company's 2020-21 *Biennial Conservation Plan* (*BCP*) conditions. In collaboration with the local community action agency in Spokane County, a small nonprofit housing provider and a resident-owned mobile home community received weatherization services. These pilots are described in more detail on page 78.

The company continues to gather information and data about where these customer groups reside and how the weatherization message is best delivered. This occurs through a variety of ways, including input from the company's Equity Advisory Group, use of its Named Communities Map derived from the Department of Health's Health Disparities Map, and the use of data to assist in locating Avista customers with a high energy burden.

Customer Outreach

Customers who participate in the low-income weatherization program are often referred through Avista's partner Community Action Agencies as recipients of various bill assistance programs. Avista often provides referrals each year from its customer service department and the company's Customer Assistance Referral and Evaluation Services program (CARES), which provides support for disabled, elderly, and low-income customers, or customers experiencing hardships related to employment, health, or finances.

Other referrals are the result of various outreach events Avista hosts or is invited to attend. In partnership with the company's energy-efficiency efforts, its community and economic vitality department conducts conservation education and outreach for low-income customers, seniors, individuals living with disabilities, and veterans. The Avista outreach team reaches this target population through workshops, energy fairs, and mobile and general outreach. Each method includes demonstrations and distribution of low- and no-cost materials with a focus on energy efficiency, conservation tips and measures, and information regarding energy assistance that may be available through Community Action Agencies. One low-income and senior outreach goal is to increase awareness of energy assistance programs such as the Low-Income Home Energy Assistance Program (LIHEAP) and Project Share. In a typical year, Avista recognizes several educational strategies as efficient and effective ways to deliver energy efficiency and conservation outreach:

- Energy conservation workshops for senior and low-income Avista customers.
- Energy fairs where attendees can receive information about low- and no-cost methods to weatherize their homes through demonstrations and limited samples – as well as learn about bill assistance and 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 and provide information about their services and accessibility. Multiple communication channels are used to promote Avista's energy fairs. Tactics included news releases, direct mail, email, flyers, community calendars, social media, signage, and print and radio advertising.

- Mobile outreach is conducted through the Avista energy resource vans, where visitors can learn about effective tips to manage their energy use, bill payment options, and community assistance resources.
- General outreach provides energy management information and resources at events (such as resource fairs) and through partnerships that reach the target populations. General outreach also includes outlining bill payment options and assistance resources in senior and low-income publications.

In 2021, Avista suspended outreach activity due to COVID-19. The outreach team continued to develop innovative ways to reach customers while safeguarding employee and customer safety and well-being.

To serve customers in a safe manner, the outreach team dropped off energy-saving items and information at food banks, participated in mobile food bank drive-through events, partnered with community-based organizations to provide home energy kits to their clients, and mailed kits to customers who responded to a business reply card from a targeted mailing to customers with past-due account balances. In addition to receiving a free energy kit, they could also request a free energy use guide (pictured on page 38) as well as the "Avista Kids" children's energy savings activities book (pictured on page 39).

With the program delivery modifications, all energy fairs were canceled, and workshops remained suspended throughout 2021. Nevertheless, the team conducted and participated in 60 events that reached 5,540 Washington residents. Table 40 shows an overview of the different activities in Washington.

TABLE 40 – VULNERABLE CUSTOMERS OUTREACH ACTIVITIES AND LED GIVEAWAY SUMMARY

Description	Number of Events/ Activities	Contacts	LEDs
Energy fairs	0	0	0
General outreach	57	3,106	7,287
Mobile outreach	8	1,598	3,196
Workshops	0	0	0
Total	**65**	**4,704**	**10,483**

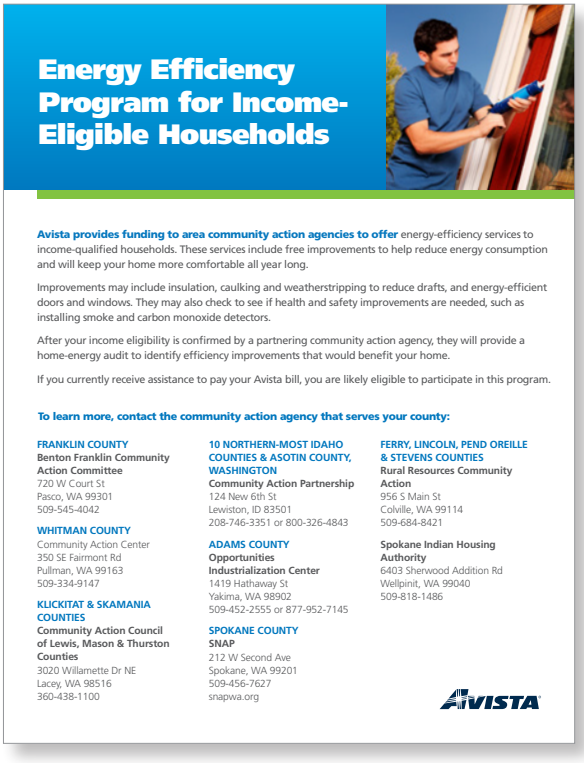
Snapshot of the brochure that was included in the home energy kits distributed through community partners to their clients:

FIGURE 26 – LOW-INCOME HOME ENERGY SAVINGS KIT BROCHURE

Marketing

Avista provided support to CAP agencies to increase awareness of its weatherization programs throughout the year. The primary goal of these marketing activities was to connect eligible households to their local CAP agency for weatherization services. Marketing tactics included direct-mail postcards, email, flyers for agencies to circulate and print, and weatherization information on Avista's website for customers also seeking bill assistance. Marketing collateral was published in both English and Spanish.

FIGURE 27 – LOW-INCOME WEATHERIZATION FLYER, POSTCARD, AND EMAIL HEADING



Cost-Effectiveness

Tables 41 and 42 show the low-income sector cost-effectiveness results by fuel type.

TABLE 41 – LOW-INCOME COST-EFFECTIVENESS RESULTS – ELECTRIC

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 1,113,773	$ 1,742,676	0.64
Utility Cost Test (UCT)	$ 645,856	$ 1,742,676	0.37
Participant Cost Test (PCT)	$ 1,740,413	$ 1,295,744	1.34
Ratepayer Impact (RIM)	$ 645,856	$ 2,910,745	0.22

TABLE 42 – LOW-INCOME COST-EFFECTIVENESS RESULTS – NATURAL GAS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 784,655	$ 1,640,456	0.48
Utility Cost Test (UCT)	$ 504,110	$ 1,640,456	0.31
Participant Cost Test (PCT)	$ 2,465,638	$ 1,157,076	2.13
Ratepayer Impact (RIM)	$ 504,110	$ 8,480,412	0.06

Plans for 2022

The agencies will start the year with a new contract that has a two-year implementation cycle to coincide with the company's Biennial Conservation Plan. The measures available for full reimbursement will be the same as last year with the addition of a heat pump water heater. The lone measure on the partial reimbursement list is for the replacement of an existing air-source heat pump with newer unit.

As a dual-fuel utility, Avista does not require the agencies to serve a certain amount of electric- or natural gas-heated homes each year. They're provided with the flexibility to serve the needs of the qualified customers identified during a program year. However, each Community Action Agency has been guided to identify those with a large energy burden as part of the eligibility review. Avista will work with each agency to identify potential customers that may fall in the high-energy-burden category. As mentioned previously, the measures that appear on the approved and acceptable measure lists may fluctuate annually based on utility cost-effectiveness tests. The flexibility given to how the dollars are used for the health, safety, and repair allocation does allow for non-cost-effective measures to be fully funded. Except for the pandemic years, the agencies have demonstrated the ability to spend most of their utility allocation. With the increase to the percentages in the administration/program support category, the company will work with its advisory group on a periodic review of this allocation.

Avista has retained a consultant to conduct a research study on non-energy impacts (NEIs) in 2021. As NEIs are quantified and verified, then added to future cost-effectiveness calculations, low-income energy-efficiency measures could see an increase in cost-effectiveness ratios.

Avista will continue to revisit unit energy savings (UES) assumptions for measures as part of its annual business planning process. The company also continues to re-evaluate the units used to set program participation goals for the year. Finally, Avista will ensure that the TRM is updated to reflect any UES adjustments.

Community Energy-Efficiency Program

TABLE 43 – COMMUNITY ENERGY-EFFICIENCY PROGRAM METRICS

Community Energy-Efficiency Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		17
Overall kWh savings		65,533
Incentive spend	$	375,189
Non-incentive utility costs	$	139,822
Washington energy-efficiency rider spend	$	515,012

Note: CEEP accomplishments have been included within the Low-Income Program.

In addition to the company's Low-Income Program – delivered by community action agencies – Avista partners with the Community Energy Efficiency Program (CEEP) to deliver energy-efficiency programs for hard-to-reach markets such as rental properties, homes with alternative heat, low- to moderate-income households, and small businesses. Created by the Washington State Legislature in 2009, CEEP was initially funded by the American Recovery and Reinvestment Act. Since then, it has developed into a mature program with support from the Washington State Capital Budget. The Washington State University Energy Program executes and manages the program in conjunction with CEEP partners to provide support to homeowners and small businesses that may not benefit from traditional energy-efficiency programs.

Avista's current CEEP contract is for $750,000 and is matched with energy-efficiency tariff rider funds. Avista's CEEP projects focus on three components: low-income homes with alternative heat, multifamily energy-efficiency improvements, and an incentive match for energy-efficiency projects completed at rural businesses. The contract was extended due to the pandemic and will end June 2022. Three of the company's community action agency partners are assisting with delivering the two residential program components across three counties in Avista's service territory.

As of the end of 2021, five income-qualified, single-family homes that use alternative heat (e.g., oil or wood) have been converted to a heat pump system plus weatherization improvements. Once the home has been converted, it becomes eligible for future utility program consideration since it now uses company-provided electricity for heat. Six multifamily projects totaling 132 units have received improvements to their complex that may include heating system retrofit, insulation, windows, air infiltration, lighting, and other health and safety measures. More than 50 rural businesses throughout six counties qualified for a utility rebate for their energy-efficiency projects and received a match from CEEP for the installation.

Avista has made multiple efforts to contact more than 40 rural communities where Avista provides utility service. The CEEP match has been for a variety of improvements that include HVAC upgrades, lighting, and insulation. This has resulted in low out-of-pocket costs for these customers – many providing relevant services in the communities they reside. Most of this activity occurred during the pandemic and kept some of these businesses from closing their doors altogether.

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CLEAN ENERGY TRANSFORMATION ACT (CETA) IMPLEMENTATION

The Blue Bridge, Clarkston, Washington

CLEAN ENERGY TRANSFORMATION ACT IMPLEMENTATION

Avista invested significant resources in implementing the provisions of the Clean Energy Transformation Act (CETA) in 2021. The company began this process by developing a working definition/designation of Named Communities – highly impacted communities and vulnerable populations – using the Washington State Health Disparities Map as an initial reference.

In May, Avista convened the inaugural meeting of the new Equity Advisory Group (EAG). Working with an outside facilitator, the EAG met monthly for the duration of the year with a primary focus on developing and adopting a set of community benefit indicators, or CBIs, that will be used to assess, measure, and monitor the equitable distribution of energy and non-energy benefits, as well as reductions in burdens, to Named Communities in Avista's Washington service territory.

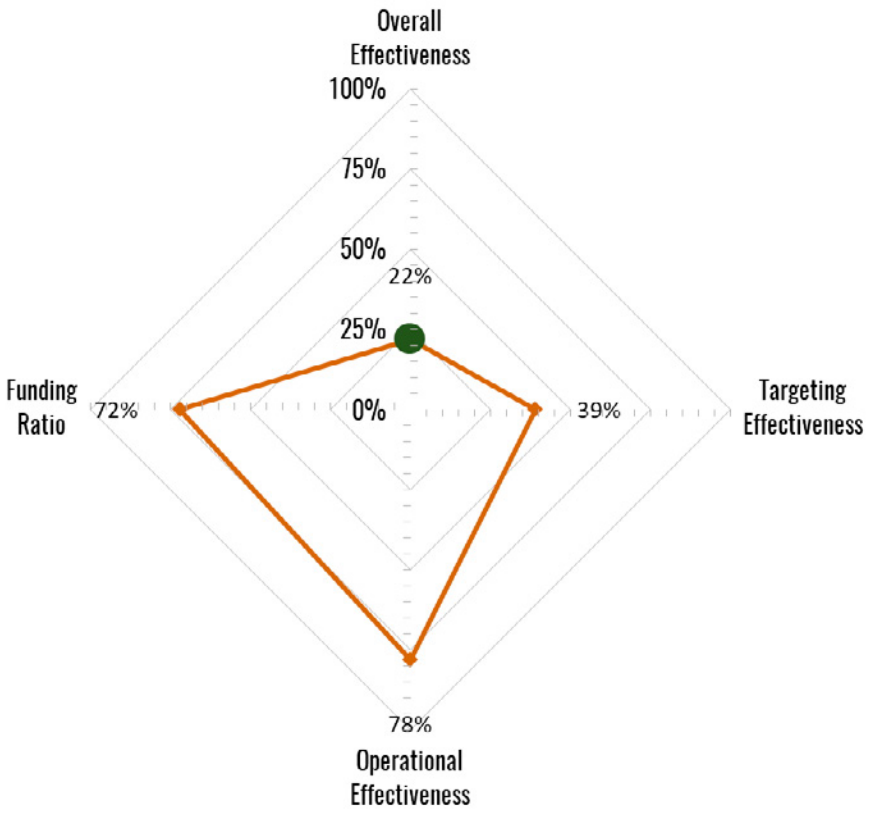
In addition to regular meetings with the EAG, Avista held a series of five public meetings, held monthly in May through September. The broad purpose of this public participation process was to create another channel for community input into the creation of the Clean Energy Implementation Plan, and to share information about Avista's plans to implement CETA.

On October 1, 2021, Avista filed its first CEIP with the Commission, becoming the first utility in the State of Washington to do so. The plan reflected extensive community input, both from the EAG and from public meetings and meetings with stakeholders across the state.

Energy Burden Reduction

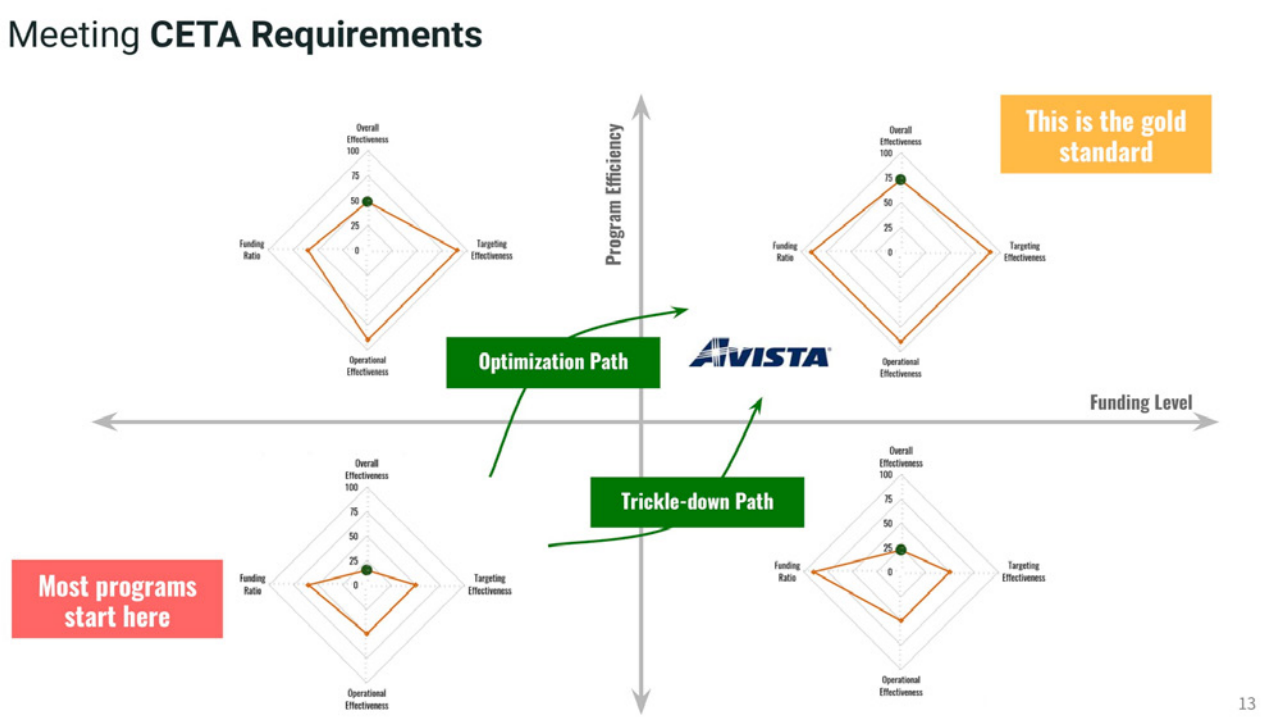
Concurrent to the CEIP drafting process, Avista partnered with Empower Dataworks, LLC to develop a plan and conduct research necessary to achieve sustained energy burden reductions for low-income households and members of Named Communities. Empower Dataworks' review of Avista programs found that Avista's energy assistance programs (including efficiency programs) are already budgeted to cover 120 percent of the energy burden reduction goal for 2030; however, current programs are not targeted at high-energy-burden customers.

FIGURE 28 – ANALYSIS OF CURRENT PROGRAMS – ACHIEVING ENERGY BURDEN REDUCTIONS



The assessment found that the best strategy for achieving sustained energy burden reduction in Named Communities is more strategic outreach, as well as targeted program marketing and design (as opposed to large increases in program budgets).

FIGURE 29 – RECOMMENDED STRATEGIES FOR ACHIEVING SUSTAINED ENERGY BURDEN REDUCTIONS



Avista relied on this insight to shape its 2021 pilot programs to serve highly impacted communities and vulnerable populations, which are covered in more detail on page 78.

Looking ahead to 2022, Avista has begun to use the Empower Dataworks data set to identify high-burden customers. Program managers, in conjunction with partner agencies and third party implementors, are developing outreach and marketing plans to target customers with high estimated energy burdens.

Non-Energy Impacts

As part of Avista's efforts to equitably distribute energy and non-energy benefits within its service territory, the company partnered with DNV to conduct its first NEI study. Within this study, each measure in Avista's efficiency portfolio was analyzed for relevant non-energy impacts, which were then quantified in a measure-level financial benefit for the program (benefits to participants, to the utility, and to society generally were quantified). NEI values were quantified on a per-kWh basis, which will then be incorporated into cost-effectiveness calculations for the program portfolio beginning in 2022.

Generally, low-income measures carried the highest non-energy impact values, with the highest of these NEI values derived from positive impacts to health and safety of participants. Measures with the highest NEI values were upgrades to windows, doors, insulation, and air infiltration. HVAC measures such as installation of ductless heat pumps, air-source heat pumps, and heat pump water heaters also carry a significant NEI value.

The Threshing Bee, Colfax, Washington

PILOT PROGRAMS

Program-by-Program Summaries

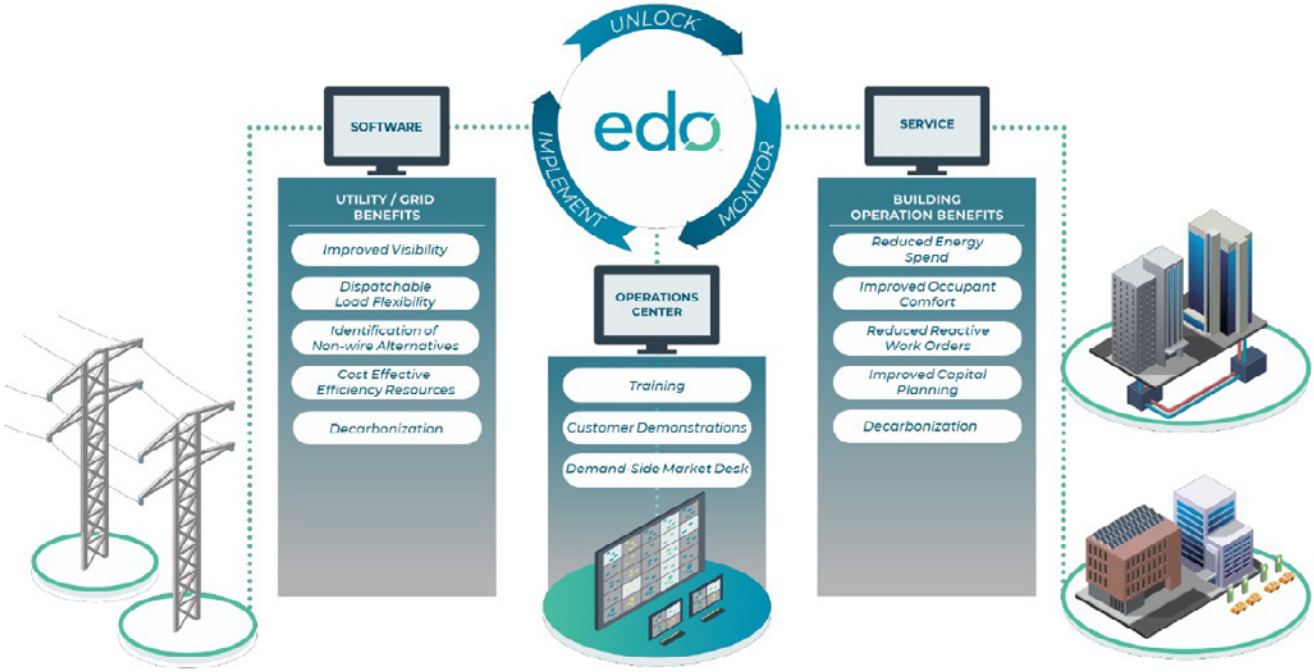
Active Energy Management

Consistent with Avista's goals to be carbon-neutral by 2030 and carbon-free by 2045 – and also aligning with efficiency requirements on commercial buildings – the Active Energy Management (AEM) pilot focuses on the exploration of clean energy transformation for commercial buildings. AEM can be defined in industry terms as a strategic energy management program that employs monitoring-based commissioning processes and the best fault detection and diagnostic tools.

Avista is partnering with Edo for this pilot. Edo, a joint investment between Avista Development and McKinstry, is a building efficiency and grid optimization business. The AEM pilot uses the newly built eco-district's communication networks, cloud services, and data-mining algorithms to capture, process, and disseminate actionable information to participants in the program. The technology platform is expected to provide a framework to evaluate building performance with or without the deployment of AEM.

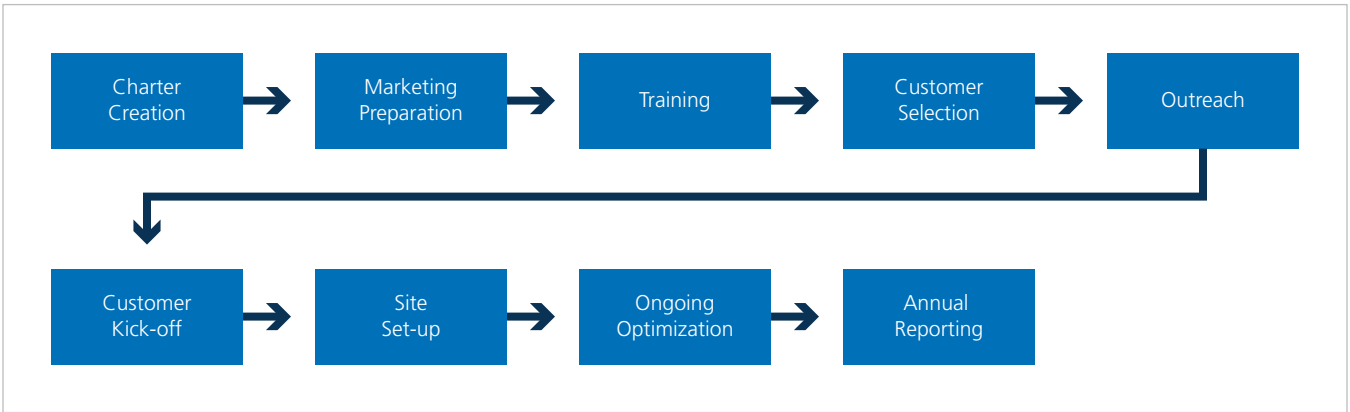
The energy management pilot represents an enhanced approach to utility customer solutions. Specifically, the pilot will enable Avista to directly provide services to customers with Edo providing a support role. This arrangement creates an integrated customer experience and expanded outcomes and skills for Avista. The illustration below represents the expected benefits for customers and Avista.

FIGURE 30 – EXPECTED BENEFITS OF THE AEM PROGRAM FOR AVISTA AND FOR CUSTOMERS



The design process, finalized in 2021, identified nine work stages.

FIGURE 31 – AEM DESIGN PROCESS



The first three works stages were completed in 2021; the others were delayed due to COVID restrictions and customer availability to coordinate equipment installations. In 2022, the *customer selection* through *ongoing optimization* stages are happening in tandem. Site setups are expected to be completed by the end of 2022.

When setup is complete, up to 10 sites will be participating in the pilot, which will encompass more than one million square feet.

Program goals include the following:

1. 4.8 million kWh of energy savings over three years.
2. Up to eight Avista account management and energy-efficiency team members trained in deploying operational energy efficiency programs.
3. Acquire rich facility operating information that can inform future rate or program design, particularly focused on future load flexibility programs.
4. Increased customer satisfaction for participating building owners and operators.
5. Insights into customer willingness to participate in future demand flexibility programs.
6. Demonstrate non-energy benefits from program participation to include: occupant comfort, reduced greenhouse gas emissions, improved equipment life expectancy.

Clean Buildings Act Early-Adopter Incentives

Washington State House Bill 1257 was codified into law late in 2019, with active rulemaking underway throughout 2020. It requires existing commercial buildings over 50,000 square feet to comply with established performance standards. Requirements will be phased in starting in 2026, with 100 percent compliance by 2028.

Avista currently supports early adoption of the Clean Buildings Act by offering incentives, ENERGY STAR Portfolio Manager services, and engineering services to help customers make energy-efficiency improvements to comply with the new law. The company also published the flyer pictured below on the myavista.com website in late 2021.

FIGURE 32 – WASHINGTON STATE CLEAN BUILDINGS STANDARDS FLYER

Understanding Washington State's New Clean Buildings Standards

Many businesses may not be aware of, or fully understand, Washington State's new Clean Buildings Standards. Avista wants to help by providing a quick overview of the law, so you can get a head start—and maybe even save money—on compliance.

House Bill 1257 was passed by the Washington State Legislature in May of 2019. The law sets new energy performance standards for all existing commercial buildings in the state that are 50,000 sq. ft. or larger.

Buildings that fit this category will be required to meet Energy-Use Intensity targets (EUIt) to reduce greenhouse gas emissions.

The Department of Commerce plans to notify impacted building owners of these performance requirements by July 1, 2021. Their website provides compliance details and links to helpful resources and information at: **commerce.wa.gov/growing-the-economy/energy/buildings**.

Some buildings are exempt from the new standard and reporting requirements vary. For example, building types such as industrial, agricultural, federal and tribal are exempt.

Tips to Help Get Started

It is most cost-effective to start your compliance process early.

- Subscribe online to the Clean Buildings Initiative Bulletin to stay informed
- Review a copy of House Bill 1257 and ASHRAE 100-2018 standards
- Watch the Clean Buildings 101 online video
- Determine if your building is exempt
- Designate an energy manager or another qualified person to review the requirements for energy management plans and operations and management protocols
- Set up a Portfolio Manager account at **EnergyStar.gov** and benchmark your building(s) to determine the EUI of each building
- Review your eligibility for the Early Adopter Incentive Program
- Participate in training offered by the Department of Commerce

AVISTA

Building-Owner Requirements (ASHRAE 100-2018)

All Buildings

- Create an Energy Management Plan (Section 5)
- Create an Operations and Maintenance Protocol (Section 6)
- Track building energy use compared to targets (Section 7)

Buildings That Aren't Meeting EUI Targets Implement Efficiency Measures by (Section 9):

- Bringing the building below EUI targets or
- Implementing all cost-effective efficiency measures

Early-Adopter Incentive Program

Washington State is offering an Early Adopter Incentive (EAI) for building owners who undertake energy efficiency improvements to bring their building(s) into compliance. Incentives of up to $0.85 per square foot can be earned.

To qualify, your building(s) must be 15 EUI or more above target (EUIt). You are eligible for payment once a building is brought down to the target EUIt.

EAI reservation applications will be available starting July 1, 2021. See the Clean Buildings Standards website.

As a participating utility, Avista is authorized to issue payments for the early adopter incentive program. Payments are made as directed by the Washington State Department of Commerce.

Help from Avista

Let Avista help you achieve Washington's new energy-use standards in your buildings.

To begin, we offer automated uploads of your energy-usage data to your Portfolio Manager account.

We also have a calculator that lets you determine how your building's EUI compares with the EUIt.

In addition, we have several programs that offer our own incentives when you improve the energy efficiency of your business.

For more information about Avista's programs and services, please visit our website at **myavista.com/bizrebates**. Or to contact your Account Executive, email **accountexecs@avistacorp.com** or call **(800) 936-6629**.

Although no buildings had signed up for early-adopter incentives by the end of 2021, Avista anticipates robust program participation in 2022 as awareness around the requirements grows.

Weatherization Programs for Named Communities

To fulfill condition 9b of the 2020-2021 BCP conditions, Avista successfully initiated two pilot programs with Named Communities in 2021. The first worked with existing partnerships to provide insulation, heating ventilation and air conditioning (HVAC) equipment, and window upgrades to a small nonprofit housing provider's entire single family and duplex portfolio.

The second pilot addressed energy needs of a resident-owned mobile home community where most residents are members of Named Communities. This pilot program provides health and safety updates, as well as window, insulation, HVAC, and hot water system upgrades to many residents in this community.

For both pilots, Avista experimented with reducing barriers to resident participation by waiving income requirements and landlord covenants. Because both organizations house people and families who are members of Named Communities, it was not necessary to add on burdensome processes requiring residents to provide proof of income. This was an especially important factor for residents of units owned by the nonprofit housing provider, many of whom do not speak English as a first language. At the resident-owned mobile home community, many residents have incomes just above the requirements for low-income weatherization programs, yet are defined by CETA as members of Named Communities. Piloting this approach enabled Avista and the partner agency to reach a broader set of customers in need of weatherization services while also removing the burden of gathering essential documentation for proof of income. By waiving these requirements, Avista and the partner agency were able to quickly begin evaluation and implementation of weatherization measures and ultimately serve more customers.

Landlord covenants were also not required for either pilot. Verifying ownership of mobile homes would have been difficult, because while many residents of the community could produce bills of sale, they did not record sales of homes with the county.

In addition to these process changes, Avista also allowed for more flexibility in funding for health, safety, and repair of mobile homes. Fixing a mobile home's roof can enable participation in additional weatherization measures for units that might not otherwise qualify for participation. Avista also allowed funding for AC units for circumstances in which there was a demonstrated health and safety-related need for cooling.

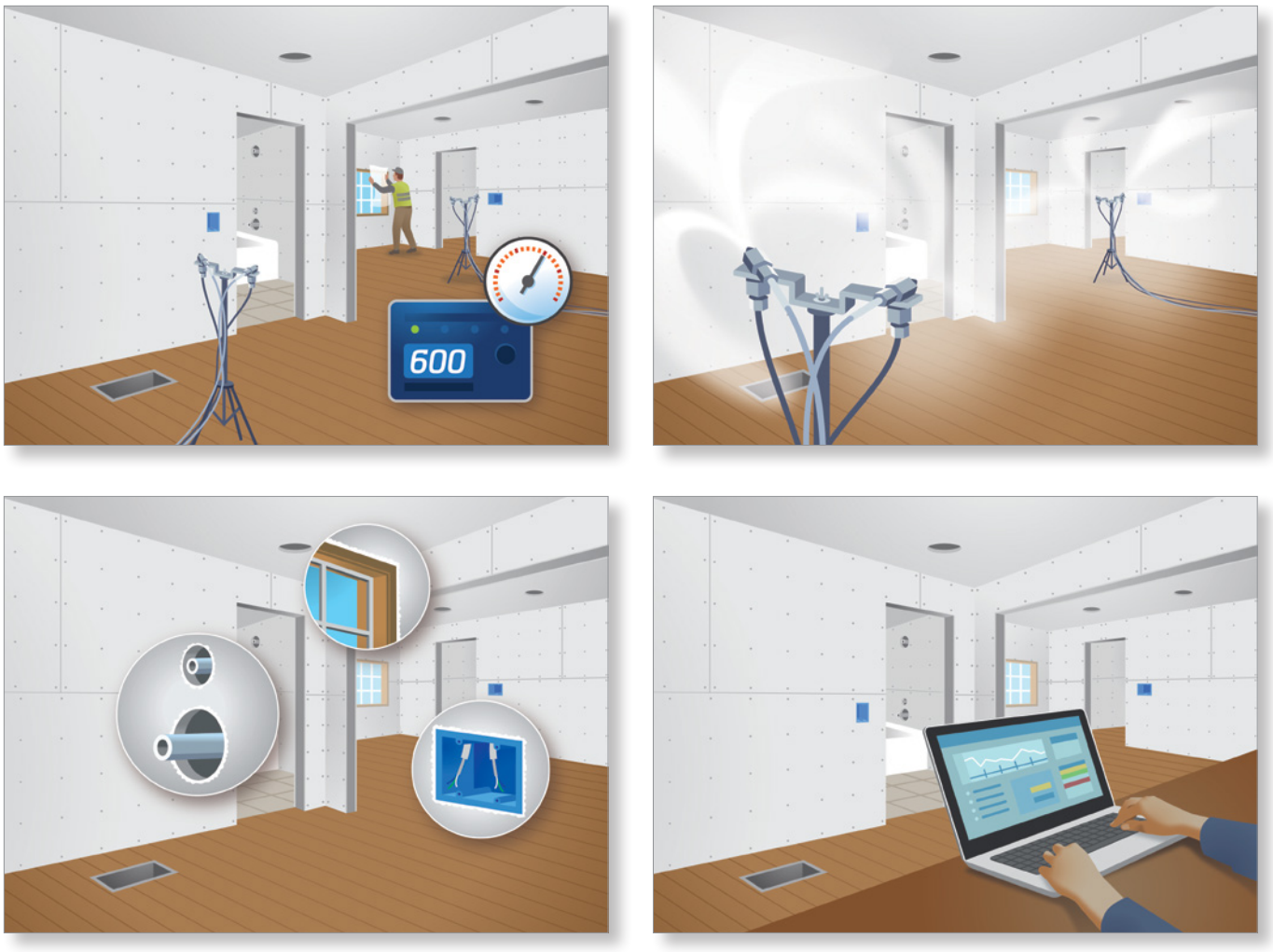
Overall, Avista provided more than 30 weatherization audits and installed efficiency improvements free of charge for four units owned by the nonprofit housing provider and eight homes in the resident-owned community in 2021. All work for the nonprofit housing provider has now been completed. In 2022, Avista will continue to partner with the agency to serve the remaining 150 units in the resident-owned mobile home community.

AeroBarrier Pilot Program

Reducing air leaks in a new-construction home results in sustainable benefits with increased comfort, reduced energy usage, and lower energy bills. Many builders recognize and promote this, but there are several value-based builders who choose not to meet air-seal code requirements. Avista is targeting all builders for this pilot and will track demographics of each to determine the value of and future potential for this program.

The pilot program offers incentives exclusively for the air-sealing method using AeroBarrier. This product differs from traditional air sealing practices that use spray foam, caulk, gaskets, and tape because AeroBarrier manufacturers its product (acrylic sealant) from technology invented, and proven, by the U.S. Department of Energy more than 20 years ago. The sealant is applied using sprayers throughout the home while it's under pressure, which delivers consistent results.

FIGURE 33 – AEROBARRIER APPLICATION PROCESS

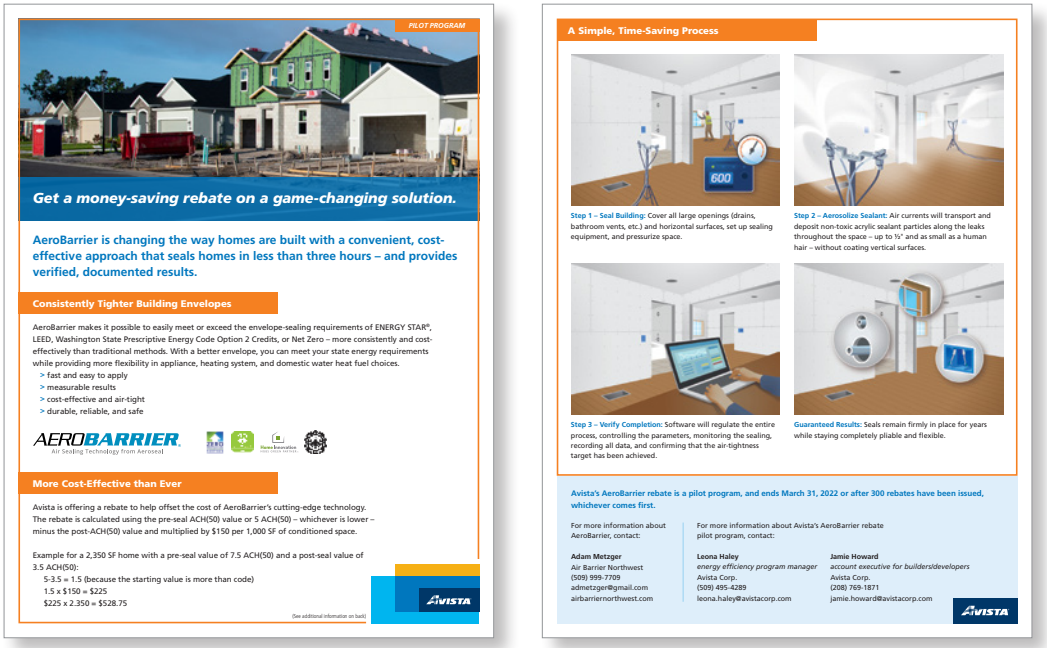


Program Implementation

The pilot was launched in April 2021 to provide home builders with an incentive to seal new homes with AeroBarrier's product. Through this pilot, Avista intends to evaluate the cost-effectiveness of this method on up to 300 homes; to accomplish this, the pilot is expected to run for a one-year term.

A comprehensive list of new home builders was created from publicly available historical building permit applications and internal trade ally lists. Marketing materials to bring awareness of this new pilot program were then mailed and/or emailed to this list of builders. Avista also promoted the pilot to the Spokane Area Home Builder's Association at monthly meetings and provided leave-behind reference materials for this group to have on hand. Website content was also created and added to myavista.com for awareness and reference.

FIGURE 34 – AEROBARRIER MARKETING COLLATERAL



Program Eligibility

Eligibility for the pilot rebate is limited to builders of residential single-family new-construction homes in Idaho and Washington using an Avista fuel for space heating. Customers who meet the eligibility requirements will receive a $100 per air change per hour at 50 pascals (ACH(50)) reduction from the pre-seal value or state building code level (whichever is less) per 1,000 square feet sealed, subject to the provision of required documents by the customer to Avista (either mailed or submitted electronically). However, online rebate processing is not currently within the scope of the pilot, as further review by Avista's technology team is still required. For the pilot, Avista will include a 50 percent incentive bonus to aid in removing the market barrier. Incentives will be capped at the total project cost.

Plans for 2022

This pilot will conclude in June of 2022. Avista will evaluate the pilot and determine whether to offer a full program. Findings and a recommendation will be presented to the EEAG at the fall 2022 meeting, and input from stakeholders will be incorporated into next steps.

Residential Home Energy Audit Pilot Program

Description

Taking advantage of previous experience and aligning with industry best practices, Avista launched a pilot Home Energy Audit Program in 2019. Eligible participants included residential customers who use Avista energy as their primary heating source and who are in Kootenai County, Idaho or in Spokane County, Washington. The program was implemented by Avista using a contract auditor.

The contract auditor conducted in-person energy audits in customer homes. Audit findings and energy-efficiency recommendations were discussed with the customer and documented in an audit report, which was later sent by both email and postal mail to customers. Customers were also given low-cost efficiency items if needed. Where applicable/feasible, items were installed by the auditor at the time of the audit. Energy savings were captured for LED lamps, power strips, low-flow showerheads, and low-flow faucet aerators. Other low-cost efficiency items were left behind for the customer to self-install if warranted. These included rope caulk, plastic window film kits, foam outlet and switch-plate gaskets, door sweeps, and weather stripping. Customers were then interviewed for feedback on the program.

Program Activities

In early 2020, Avista gained support from the Energy-Efficiency Advisory Group and commission staff for both Washington and Idaho to move the program from pilot to full program status. Modifications to program marketing materials and agreement forms were underway prior to the COVID-19 pandemic; restrictions effectively suspended the program. As a result, no audits were conducted in 2020 or 2021.

Plans for 2022

The program will resume as planned by June 2022. The Home Energy Audit Pilot Program will be scaled up and offered across the utility's entire Idaho and Washington service territory. Based on participation, Avista estimates that 200 audits will be conducted between the two states per year. Customer education about energy efficiency and cross-program awareness will be key focus areas. Avista will also continue to work closely with community agency partners to serve vulnerable populations with this program offering.

Qualifying participants are residential customers using an Avista fuel for space heating. Single-family homes, multifamily homes up to a four-plex, and condominium homes are eligible to participate. Multifamily homes with five or more units will be considered on a case-by-case basis.

Residential Always-On Behavioral Program

Description

Avista has identified a new opportunity to provide additional customer-facing value from the Washington Advanced Metering Infrastructure (AMI) deployment. The targeted load behavioral program will use AMI-based non-intrusive load monitoring to identify the electricity loads within a residence. Load information will be shared with customers to better inform them of tailored energy-efficiency solutions.

The initial target of the program will be reductions in always-on load. This target was selected because, on average, 23 percent of a customer's bill can be attributed to always-on loads – and because calculations related to determining them are accurate. An additional benefit of targeting always-on loads is that significant improvements can be achieved with low- or no-cost behavioral interventions, such as turning off computers when not in use. The pilot program will target customers in the highest third of residential always-on loads. An initial communication to customers will include their personalized information regarding always-on usage, associated costs, tips to reduce the load, and anticipated cost savings; a subset of customers will also be eligible for a bill credit if they achieve a reduction in their usage. Subsequent communications, sent monthly, will update customers on their progress. Avista will track and report on observed energy savings as a result of the program.

Program Activities

The program was in the design phase in 2021.

Plans for 2022

Design and development activities will continue into 2022, with program delivery of a soft launch planned for the second quarter of 2022 and the full-scale pilot in the third quarter of 2022.

On-Bill Repayment Program

Description

In partnership with Puget Sound Cooperative Credit Union (PSCCU), Avista launched its On-Bill Repayment Program October 1, 2021. OBR enables Avista customers to access Energy-Smart loans through PSCCU for energy-efficiency projects in Washington State. PSCCU's personalized underwriting practices and low interest rates allow participants to reap immediate benefits from energy-efficiency upgrades. The loan payments are convenient: Installments are billed monthly as a line item on customers' Avista bills until the term of the loan is completed, or until Avista is otherwise instructed by PSCCU to remove the loan. Extra principal payments or early loan payoffs are made directly to PSCCU.

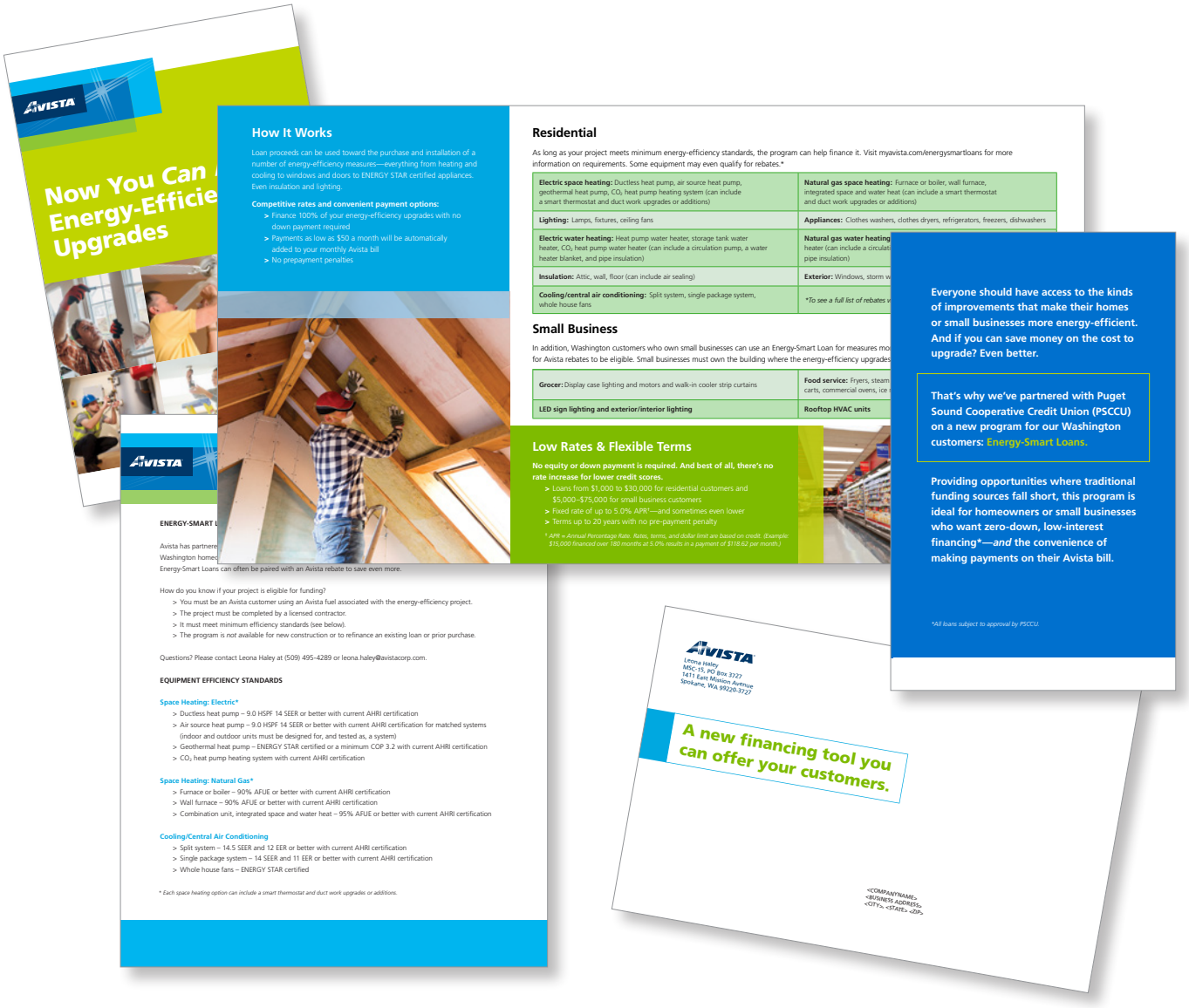
Between October 1 and December 31, Avista enrolled five customers in the On-Bill Repayment Program. The company anticipates enrolling an additional 100 in 2022.

Avista's trade allies will be the primary promoters and deliverers; multi-channel Avista marketing efforts will also drive customers to OBR.

Program Eligibility

Residential and small business customers in owner-occupied buildings may be eligible for OBR; funded measures must be fueled by Avista. An eligible projects list created by Avista and supported by Washington State's Clean Energy Fund program guidelines is maintained on both the Avista Utilities website and PSCCU's website that customers can use as a reference when considering this funding solution for their project.

FIGURE 35 – ON-BILL REPAYMENT PROGRAM LETTER AND BROCHURE



An eligible projects list created by Avista and supported by Washington State's Clean Energy Fund is maintained on both Avista's and PSCCU's websites.

Pilot Programs On Hold

The following pilot programs were put on hold in 2020 due to COVID-19:

Small Business Lighting Direct Install Pilot – The Small Business Lighting Direct Install Pilot is designed for hard-to-reach small business customers within Avista's service territory. The criteria for participation are still in development; it will, however, have similar criteria to the company's MFDI program for area lighting. Initially, the pilot will select 25 customers to participate, and its cost-effectiveness will be evaluated.

Luminaire Level Lighting Control (LLLC)/Networked Lighting Pilot – Avista will pilot LLLC for 20 customers to determine whether additional efficiencies can be gained by fine-tuning lighting within a commercial/industrial building. Avista will work with the customers to add LLLC or networked lighting in a space in the customer's building prior to a lighting upgrade of 50 percent or greater. The goal of the pilot is to show the additional energy savings derived from the additional network controls.

Energy Use Index (EUI) Retrofit Pilot – The EUI Pilot will encourage customers to move toward a more efficient use of their energy. The pilot will use a pay-for-performance approach with the goal of achieving 50 percent of the customer's previous energy use. Facilities must do at least 25 percent of their buildings' square footage, and there must be a way to accurately measure at a sub-panel for performance. The pilot will be limited to five customers.

Tool-Lending Pilot – The Tool-Lending Pilot will be a two-year program allowing tool lending to Avista customers from a public space in the eco-district. The library of tools will include the current stock of energy efficiency-related equipment but will also include some newer technologies that provide more insight into energy use. In addition to training, the program will include shipping the tools and training materials to customers who are not in the immediate area.

49 Degrees North Ski Resort, Chewelah, Washington

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 throughout its service territory through a combination of financial incentives, technical assistance, program outreach, and education.

It is not feasible for Avista to independently have a meaningful impact on regional or national markets. Consequently, utilities within the Pacific Northwest have worked together through NEEA to address opportunities that are beyond the ability or reach of individual utilities. Avista has been participating in and funding NEEA since it was founded in 1997.

Table 44 shows the 2021 NEEA savings and the associated costs for Washington, which exclude internal administrative costs associated with participation in the various NEEA activities and studies.

TABLE 44 – NEEA ENERGY SAVINGS AND PARTICIPATION COSTS

Fuel Type	2021 NEEA Energy Savings	2021 NEEA Participation Costs	Avista 2020-2024 Funding Share
Electric	8,426 MWh (0.96 aMW)	$ 1,301,204	3.95%
Natural Gas	22,472 therms	$ 367,208	8.49%

Avista and will continue to work closely with NEEA and other regional entities to identify overlapping priorities and objectives while simultaneously deploying a more thorough and customized market transformation strategy to its local market – including additional investment and direct coordination with the supply chain.

Electric Energy Savings Share

Values provided in NEEA's 2021 annual report represent the amounts allocated to Avista's service territory, which is a combination of site-based energy savings data (where available) or an allocation of savings based on funding share. Using the latter approach, the funding share for Avista is split between 30 percent for Avista Idaho and 70 percent for Avista Washington (see Table 40). The funding share for Avista varies by funding cycle and within each cycle if the funding composition changes.

Natural Gas Energy Savings Share

NEEA's costs include all expenditures for operations and value delivery; energy savings initiatives; investments in market training and infrastructure; stock assessments, evaluations, data collection, and other regional and program research; emerging technology research and development; and all administrative costs.

Avista's criteria for funding NEEA's market transformation portfolio calls for it to deliver incrementally cost-effective resources beyond what could be acquired through Avista's local portfolio alone. Avista has historically communicated with NEEA the importance of delivering cost-effective resources to the company's service territory, and remains confident that NEEA will continue to offer cost-effective electric market transformation in the foreseeable future. The company will continue to be active in the organizational oversight of NEEA, a critical step in ensuring that geographic equity, cost-effectiveness, and resource acquisition goals of market transformation are met.

Eastside Collaborative Market Transformation

During 2021, Avista began investigating new market transformation efforts with a specific focus on energy-efficiency measures and solutions that work well in eastern Washington and northern Idaho. This engagement is complementary to NEEA's efforts for the broader region. The goal of this effort is aimed at assessing market transformation opportunities that drive greater local impact and create deeper customer engagement. To do this, Avista is piloting the application of a market transformation approach that focuses on mid- and upstream interventions to remove market barriers and create lasting change.

While 2022 will focus on pilot execution and initial assessment of an eastside market transformation approach, much of the groundwork for these efforts began in 2020-21. In 2021 the team conducted a competitive bid process to identify market partners to support the pilot. The team negotiated partnerships with two major manufacturers and their distribution channels to invest additional resources and dollars aimed at removing market barriers associated with cost, awareness, and acceptance using an approach tailored to eastside markets and customers. The team has created a market transformation strategy, captured pilot logic, identified key market indicators of success, and negotiated relevant data exchanges to track pilot success and continue to explore ductless heat pump potential and specific barriers to adoption found in Avista's and Idaho Power's service territories.

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GLOSSARY OF TERMS

Manning-Rye Covered Bridge, Colfax, Washington

GLOSSARY OF TERMS

Advisory Group: Avista's group of external stakeholders who comment about the company's energy-efficiency activities.

active energy management (AEM): The implementation of continuous building monitoring to improve building performance in real time.

adjusted market baseline (AMB): Based on the RTF guidelines; represents a measurement between the energy-efficient measure and the standard efficiency case that is characterized by current market practice or the minimum requirements of applicable codes or standards, whichever is more efficient. When applying an Adjusted Market Baseline, no net-to-gross factor would be applied since the resultant unit energy savings amount would represent the applicable savings to the grid.

advanced metering infrastructure (AMI): Systems that measure, collect, and analyze energy usage from advanced devices such as electricity meters, natural gas meters, and/or water meters through various communication media on request or on a predetermined schedule.

Air-Conditioning, Heating, and Refrigeration Institute (AHRI): The trade association representing manufacturers of HVAC and water heating equipment.

aMW: The amount of energy that would be generated by one megawatt of capacity operating continuously for one full year. Equals 8,760 MWhs of energy.

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE): Devoted to the advancement of indoor-environment-control technology in the heating, ventilation, and air conditioning (HVAC) industry, ASHRAE's mission is "to advance technology to serve humanity and promote a sustainable world."

Annual Conservation Plan (ACP): An Avista-prepared resource document that outlines the company's conservation offerings and its approach to energy efficiency, as well as details on verifying and reporting savings.

Annual Conservation Report (ACR): An Avista-prepared resource document that summarizes its annual energy-efficiency achievements.

annual fuel utilization efficiency (AFUE): A measurement of how efficiently a furnace or boiler uses its fuel.

Applied Energy Group (AEG): A consulting service that provides a wide range of energy efficiency and demand response-related management services to assist clients in designing and implementing programs for their customers.

avoided cost: An investment guideline describing the value of conservation and generation resource investments in terms of the cost of more expensive resources that would otherwise have to be acquired.

baseline: Conditions, including energy consumption, that would have occurred without implementation of the subject's energy-efficiency activity. Baseline conditions are sometimes referred to as "business-as-usual" conditions.

baseline efficiency: The energy use of the baseline equipment, process, or practice that is being replaced by a more efficient approach to providing the same energy service. It is used to determine the energy savings obtained by the more efficient approach.

baseline period: The period of time selected as representative of facility operations before an energy-efficiency activity takes place.

Biennial Conservation Plan (BCP): An Avista-prepared resource document that outlines Avista's conservation offerings and its approach to energy efficiency, as well as details on verifying and reporting savings for a two-year period.

Building Owners & Managers Association (BOMA): An international federation of local associations and global affiliates that represents the owners, managers, service providers, and other property professionals of all commercial building types.

Business Partner Program (BPP): An outreach effort designed to raise awareness of utility programs and services that can assist rural small business customers in managing their energy bills.

British thermal unit (Btu): The amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit (3,413 Btus are equal to one kilowatt-hour).

busbar: The physical electrical connection between the generator and transmission system. Typically load on the system is measured at busbar.

capacity: The maximum power that a machine or system can produce or carry under specified conditions. The capacity of generating equipment is generally expressed in kilowatts or megawatts. In terms of transmission lines, capacity refers to the maximum load a line can carry under specified conditions.

Clean Energy Implementation Plan (CEIP): Introduced within a subsection of the Clean Energy Transformation Act, a CEIP must describe the utility's plan for making progress toward meeting the clean energy transformation standards while it continues to pursue all cost-effective, reliable, and feasible conservation and efficiency resources.

Clean Energy Transformation Act (CETA): Signed into law in 2019, the Clean Energy Transformation Act requires electric utilities to supply their Washington customers with 100 percent renewable or non-emitting electricity with no provision for offsets.

coefficient of performance (COP): A ratio of useful heating or cooling provided to work (energy) required for heat pumps, refrigerators, or air conditioning systems. Higher COPs equate to more efficient systems and lower operating costs.

community action agency (CAA): General term for Community Action Programs, Community Action Agencies, and Community Action Centers that provide services such as low-income weatherization through federal and state and other funding sources (e.g., utility constitutions).

Community Energy Efficiency Program (CEEP): Created by the Washington State Legislature in 2009, CEEP encourages homeowners and small businesses across the state to make energy-efficiency retrofits and upgrades.

conservation: According to the Northwest Power Act, any reduction in electric power consumption because of increases in the efficiency of energy use, production, or distribution.

conservation potential assessment (CPA): An analysis of the amount of conservation available in a defined area. Provides savings amounts associated with energy efficiency measures to input into the company's Integrated Resource Planning (IRP) process.

cooling degree days: A measure of how hot the temperature was on a given day or during a period of days. A day with a mean temperature of 80°F has 15 cooling degree days. If the next day has a mean temperature of 83°F, it has 18 cooling degree days.

cost-effective: According to the Northwest Power Act, a cost-effective measure or resource must be forecast to be reliable and available within the time it is needed, and to meet or reduce electrical power demand of consumers at an estimated incremental system cost no greater than that of the least-costly, similarly reliable, and available alternative or combination of alternatives.

curtailment: An externally imposed reduction of energy consumption due to a shortage of resources.

customer/customer classes: A category(ies) of customer(s) defined by provisions found in tariff(s) published by the entity providing service, approved by the PUC. Examples of customer classes are residential, commercial, industrial, agricultural, local distribution company, core, and non-core.

decoupling: In conventional utility regulation, utilities make money based on how much energy they sell. A utility's rates are set largely based on an estimation of costs of providing service over a certain set time period, with an allowed profit margin, divided by a forecasted amount of unit sales over the same time period. If the actual sales turn out to be as forecasted, the utility will recover all fixed costs and its set profit margin. If the actual sales exceed the forecast, the utility will earn extra profit.

deemed savings: Primarily referenced as unit energy savings, an estimate of an energy savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (b) is applicable to the situation being evaluated.

demand: The load that is drawn from the source of supply over a specified interval of time (in kilowatts, kilovolt-amperes, or amperes). Also, the rate at which natural gas is delivered to or by a system, part of a system, or piece of equipment and expressed in cubic feet, therms, Btus or multiples thereof, for a designated period such as during a 24-hour day.

demand response (DR): A voluntary and temporary change in consumers' use of electricity when the power system is stressed.

demand-side management (DSM): The process of helping customers use energy more efficiently. Used interchangeably with energy efficiency and conservation, although conservation technically means using less while DSM and energy efficiency means using less while still having the same useful output of function.

direct load control (DLC): The means by which a utility can signal a customer's appliance to stop operations to reduce the demand for electricity. Such rationing generally involves a financial incentive for the affected customer.

discount rate: The rate used in a formula to convert future costs or benefits to their present value.

distribution: The transfer of electricity from the transmission network to the consumer. Distribution systems generally include the equipment to transfer power from the substation to the customer's meter.

distributed generation (DG): An approach that employs a variety of small-scale technologies to both produce and store electricity close to the end users of power.

effective useful life (EUL): Sometimes referred to as measure life and often used to describe persistence. EUL is an estimate of the duration of savings from a measure.

emergency operating plan (EOP): A plan that assigns responsibility to organizations and individuals for carrying out specific actions to respond to an emergency. An EOP sets forth lines of authority, lays out organizational roles and responsibilities during an emergency, and illustrates how actions will be coordinated. An EOP also describes how people and property will be protected in emergencies and natural disasters, and identifies personnel, equipment, facilities, and supplies to use during recovery operations.

end-use: A term referring to the final use of energy; it often refers to the specific energy services (e.g., space heating), or the type of energy-consuming equipment (e.g., motors).

energy assistance advisory group: An ongoing energy assistance program advisory group to monitor and explore ways to improve Avista's Low-Income Rate Assistance Program (LIRAP).

Energy Efficiency Advisory Group (EEAG): A group which advises investor-owned utilities on the development of integrated resource plans and conservation programs.

energy-efficiency measure: Refers to either an individual project conducted or technology implemented to reduce the consumption of energy at the same or an improved level of service. Often referred to as simply a "measure."

Energy Independence Act (EIA): Requires electric utilities serving at least 25,000 retail customers to use renewable energy and energy conservation.

energy use intensity (EUI): A metric – energy per square foot per year – that expresses a building's energy use as a function of its size or other characteristics.

evaluation: The performance of a wide range of assessment studies and activities aimed at determining the effects of a program (and/or portfolio) and understanding or documenting program performance, program, or program-related markets and market operations, program-induced changes in energy-efficiency markets, levels of demand or energy savings, or program cost-effectiveness. Market assessment, monitoring and evaluation, and verification are aspects of evaluation.

Evaluation, Measurement, and Verification (EM&V): Term for evaluation activities at the measure, project, program and/or portfolio level; can include impact, process, market and/or planning activities. EM&V is distinguishable from Measurement and Verification (M&V), defined below.

ex-ante savings estimate: Forecasted savings value used for program planning or savings estimates for a measure; Latin for "beforehand."

ex-post evaluated estimated savings: Savings estimates reported by an independent, third-party evaluator after the energy impact evaluation has been completed. If only the term "ex-post savings" is used, it will be assumed that it is referring to the ex-post evaluation estimate, the most common usage; from Latin for "from something done afterward."

external evaluators (AKA third-party evaluators): Independent professional efficiency person or entity retained to conduct EM&V activities. Consideration will be made for those who are certified measurement and verification professionals (CMVPs) through the Association of Energy Engineers (AEE) and the Efficiency Evaluation Organization (EVO).

free rider: A common term in the energy efficiency industry meaning a program participant who would have installed the efficient product or changed a behavior regardless of any program incentive or education received. Free riders can be total, partial, or deferred.

generation: The act or process of producing electricity from other forms of energy.

Green Motors Practices Group (GMPG): A nonprofit corporation governed by electric motor service center executives and advisors whose goal is the continual improvement of the electric motor repair industry.

gross savings: The change in energy consumption and/or demand that results from energy-efficiency programs, codes, and standards, and naturally occurring adoption which have a long-lasting savings effect, regardless of why they were enacted.

heating degree days: A measure of the amount of heat needed in a building over a fixed period, usually a year. Heating degree days per day are calculated by subtracting from a fixed temperature the average temperature over the day. Historically, the fixed temperature has been set at 65 degrees Fahrenheit, the outdoor temperature below which heat was typically needed. As an example, a day with an average temperature of 45 degrees Fahrenheit would have 20 heating degree days, assuming a base of 65 degrees Fahrenheit.

Heating Seasonal Performance Factor (HSPF): Defined as the ratio of heat output over the heating season to the amount of electricity used in air-source or ductless heat pump equipment.

Heating, Ventilation, and Air Conditioning (HVAC): Sometimes referred to as climate control, HVAC is particularly important in the design of medium to large industrial and office buildings where humidity and temperature must all be closely regulated while maintaining safe and healthy conditions within.

impact evaluation: Determination of the program-specific, directly or indirectly induced, changes (e.g., energy and/or demand usage) attributable to an energy-efficiency program.

implementer: Avista employee whose responsibilities are directly related to operations and administration of energy-efficiency programs and activities, and who may have energy savings targets as part of their employee goals or incentives.

incremental cost: The difference between the cost of baseline equipment or services and the cost of alternative energy-efficient equipment or services.

Integrated Resource Plan (IRP): An IRP is a comprehensive evaluation of future electric or natural gas resource plans. The IRP must evaluate the full range of resource alternatives to provide adequate and reliable service to a customer's needs at the lowest possible risk-adjusted system cost. These plans are filed with the state public utility commissions on a periodic basis.

International Performance Measurement and Verification Protocol (IPMVP): A guidance document with a framework and definitions describing the four M&V approaches; a product of the Energy Valuation Organization (www.evo-world.org).

investor-owned utility (IOU): A utility that is organized under state law as a corporation to provide electric power service and earn a profit for its stockholders.

kilowatt (kW): The electrical unit of power that equals 1,000 watts.

kilowatt-hour (kWh): A basic unit of electrical energy that equals one kilowatt of power applied for one hour.

kilo British thermal unit (kBtu): Btu, which stands for British thermal units, measures heat energy. Each Btu equals the amount of heat needed to raise one pound of water one degree Fahrenheit; the prefix kilo means 1,000, which means that a kBtu equals 1,000 Btu.

Levelized Cost of Energy (LCOE): The present value of a resource's cost (including capital, financing, and operating costs) converted into a stream of equal annual payments. This stream of payments can be converted to a unit cost of energy by dividing them by the number of kilowatt-hours produced or saved by the resource in associated years. By levelizing costs, resources with different lifetimes and generating capabilities can be compared.

line losses: The amount of electricity lost or assumed lost when transmitting over transmission or distribution lines. This is the difference between the quantity of electricity generated and the quantity delivered at some point in the electric system.

Low-Income Home Energy Assistance Program (LIHEAP): Federal energy assistance program available to qualifying households based on income, usually distributed by community action agencies or partnerships.

Low-Income Rate Assistance Program (LIRAP): LIRAP provides funding (collected from Avista's tariff rider) to CAP agencies for distribution to Avista customers who are least able to afford their utility bill.

market effect evaluation: An evaluation of the change in the structure or functioning of a market, or the behavior of participants in a market, that results from one or more program efforts. Typically, the resultant market or behavior change leads to an increase in the adoption of energy-efficient products, services, or practices.

measure (also energy-efficiency measure, or EEM): Installation of a single piece of equipment, subsystem or system, or single modification of equipment, subsystem, system, or operation at an end-use energy consumer facility, for the purpose of reducing energy and/or demand (and, hence, energy and/or demand costs) at a comparable level of service.

measure life: See Effective Useful Life (EUL).

Measurement and Verification (M&V): A subset of program impact evaluation that is associated with the documentation of energy savings at individual sites or projects, using one or more methods that can involve measurements, engineering calculations, statistical analyses, and/or computer simulation modeling. M&V approaches are defined in the International Performance Measurement and Verification Protocol (available at www.evo- world. org).

megawatt (MW): The electrical unit of power that equals one million watts or one thousand kilowatts.

megawatt-hour (MWh): A basic unit of electrical energy that equals one megawatt of power applied for one hour.

net savings: The change in energy consumption and/or demand that is attributable to an energy efficiency program. This change in energy use and/or demand may include, implicitly or explicitly, consideration of factors such as free drivers, non-net participants (free riders), participant and non-participant spillover, and induced market effects. These factors may be considered in how a baseline is defined and/or in adjustments to gross savings values.

non-energy benefit/non-energy impact (NEB/NEI): The quantifiable non-energy impacts associated with program implementation or participation; also referred to as non-energy benefits (NEBs) or co-benefits. Examples of NEIs include water savings, non-energy consumables, and other quantifiable effects. The value is most often positive, but may also be negative (e.g., the cost of additional maintenance associated with a sophisticated, energy-efficient control system).

Northwest Energy Efficiency Alliance (NEEA): A nonprofit organization that works to accelerate energy efficiency in the Pacific Northwest through the adoption of energy-efficient products, services, and practices.

Northwest Power and Conservation Council (NWPCC): An organization that develops and maintains both a regional power plan and a fish and wildlife program to balance the environmental and energy needs of the Pacific Northwest.

Outside Air Temperature (OAT): Refers to the temperature of the air around an object, but unaffected by the object.

on-bill repayment/financing (OBR): A financing option in which a utility or private lender supplies capital to a customer to fund energy efficiency, renewable energy, or other generation projects. It's repaid through regular payments on an existing utility bill.

portfolio: Collection of all programs conducted by an organization. In the case of Avista, its portfolio includes electric and natural gas programs in all customer segments. Portfolio can also be used to refer to a collection of similar programs addressing the market. In this sense of the definition, Avista has an electric portfolio and a natural gas portfolio with programs addressing the various customer segments.

prescriptive: A prescriptive program is a standard offer of incentives for the installation of an energy-efficiency measure. Prescriptive programs are generally applied when the measures are employed in relatively similar applications.

process evaluation: A systematic assessment of an energy-efficiency program or program component for the purposes of documenting operations at the time of the examination, and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.

program: An activity, strategy, or course of action undertaken by an implementer. Each program is defined by a unique combination of program strategy, market segment, marketing approach, and energy-efficiency measure(s) included. Examples are a program to install energy-efficient lighting in commercial buildings and residential weatherization programs.

project: An activity or course of action involving one or multiple energy-efficiency measures at a single facility or site.

Regional Technical Forum of the Northwest Power and Conservation Council (RTF): A technical advisory committee to the Northwest Power and Conservation Council established in 1999 to develop standards to verify and evaluate energy efficiency savings.

realization rate (RR): Ratio of ex-ante reported savings to ex-post evaluated estimated savings. When realization rates are reported, they are labeled to indicate whether they refer to comparisons of (1) ex-ante gross reported savings to ex-post gross evaluated savings, or (2) ex-ante net reported savings to ex-post net evaluated savings.

reliability: When used in energy-efficiency evaluation, the quality of a measurement process that would produce similar results on (a) repeated observations of the same condition or event, or (b) multiple observations of the same condition or event by different observers. Reliability refers to the likelihood that the observations can be replicated.

reported savings: Savings estimates reported by Avista for an annual (calendar) period. These savings will be based on best available information.

request for proposal (RFP): Business document that announces and provides details about a project, as well as solicits bids from potential contractors.

retrofit: To modify an existing generating plant, structure, or process. The modifications are done to improve energy efficiency, reduce environmental impacts, or to otherwise improve the facility.

rigor: The level of expected confidence and precision. The higher the level of rigor, the more confident one is that the results of the evaluation are both accurate and precise, i.e., reliable.

R-value or R-factor (resistance transfer factor): Measures how well a barrier, such as insulation, resists the conductive flow of heat.

Schedules 90 and 190: Rate schedules that show energy-efficiency programs.

Schedules 91 and 191: Rate schedules that are used to fund energy-efficiency programs.

sector(s): The economy is divided into four sectors for energy planning. These are the residential, commercial (e.g., retail stores, office, and institutional buildings), industrial, and agriculture (e.g., dairy farms, irrigation) sectors.

site-specific: A non-residential program offering individualized calculations for incentives upon any electric or natural gas efficiency measure not incorporated into a prescriptive program.

simple payback: The time required before savings from a particular investment offset costs, calculated by investment cost divided by value of savings (in dollars). For example, an investment costing $100 and resulting in a savings of $25 each year would be said to have a simple payback of four years. Simple paybacks do not account for future cost escalation or other investment opportunities.

spillover: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without direct financial or technical assistance from the program. There can be participant and/or nonparticipant spillover (sometimes referred to as "free drivers"). Participant spillover is the additional energy savings that occur because of the program's influence when a program participant independently installs incremental energy efficiency measures or applies energy-saving practices after having participated in the energy efficiency program. Non-participant spillover refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices because of a program's influence.

Technical Reference Manual (TRM): An Avista-prepared resource document that contains Avista's (ex-ante) savings estimates, assumptions and sources for those assumptions, guidelines, and relevant supporting documentation for its natural gas and electricity energy-efficiency prescriptive measures. This document is populated and vetted by the RTF and third-party evaluators.

total resource cost (TRC) test: A cost-effectiveness test that assesses the impacts of a portfolio of energy-efficiency initiatives regardless of who pays the costs or who receives the benefits. The test compares the present value of costs of efficiency for all members of society (including all costs to participants and program administrators) compared to the present value of all quantifiable benefits, including avoided energy supply and demand costs and non-energy impacts.

transmission: The act or process of long-distance transport of electric energy, generally accomplished by elevating the electric current to high voltages. In the Pacific Northwest, Bonneville operates most of the high-voltage, long-distance transmission lines.

uniform energy factor (UEF): A measurement on how efficiently a water heater utilizes its fuel.

unit estimated savings (UES): Defines the first-year kWh savings value for an energy-efficiency measure.

U-value or U-factor: The measure of a material's ability to conduct heat, numerically equal to 1 divided by the value of the material. Used to measure the rate of heat transfer in windows. The lower the U-factor, the better the window insulates.

uncertainty: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall within some degree of confidence.

utility cost test (UCT): One of the four standard practice tests commonly used to evaluate the cost-effectiveness of DSM programs. The UCT evaluates the cost-effectiveness based upon a program's ability to minimize overall utility costs. The primary benefits are the avoided cost of energy in comparison to the incentive and non-incentive utility costs.

variable frequency drive (VFD): A type of motor drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage.

verification: An assessment that the program or project has been implemented per the program design. For example, the objectives of measure installation verification are to confirm (a) the installation rate, (b) that the installation meets reasonable quality standards, and (c) that the measures are operating correctly and have the potential to generate the predicted savings. Verification activities are generally conducted during on-site surveys of a sample of projects. Project site inspections, participant phone and mail surveys, and/or implementer and consumer documentation review are typical activities association with verification. Verification may include one-time or multiple activities over the estimated life of the measures. It may include review of commissioning or retro-commissioning documentation. Verification can also include review and confirmation of evaluation methods used, samples drawn, and calculations used to estimate program savings. Project verification may be performed by the implementation team, but program verification is a function of the third-party evaluator.

Washington Utilities and Transportation Commission (WUTC): A three-member commission appointed by the governor and confirmed by the state senate, whose mission is to protect the people of Washington by ensuring that investor-owned utility and transportation services are safe, available, reliable, and fairly priced.

weighted average cost of capital (WACC): A calculation of a firm's cost of capital in which each category of capital is proportionately weighted. All sources of capital, including common stock, preferred stock, bonds, and any other long-term debt, are included in a WACC calculation.

8760: Total number of hours in a year.

APPENDICES AND SUPPLEMENTS

Hawk Creek Falls, Davenport, Washington

APPENDIX A –

CADMUS

Washington Biennium (2020-2021) Electric Impact Evaluation Report

April 8, 2022

Prepared for:

Avista Corporation

1411 East Mission Avenue

Spokane, WA 99202

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Portfolio Executive Summary

For several decades, Avista Corporation (Avista) has administered demand-side management (DSM) programs to reduce electricity and natural gas energy use by its customer portfolio. While Avista has implemented most of these programs in house, external vendors have fulfilled some of them.

Avista contracted with Cadmus to complete process and impact evaluations of its program year (PY) 2020 – PY 2021 electric DSM nonresidential and multifamily residential programs in Washington. This report presents the electric impact evaluation findings for PY 2020 – PY 2021. Cadmus did not apply net-to-gross (NTG) adjustments to savings values, except where deemed energy savings values already incorporated NTG as a function of the market baseline.

Evaluation Methodology and Activities

Table 1 shows the variety of methods and activities Cadmus completed to conduct the Washington electric portfolio evaluation.

Table 1. Electric Program Evaluation Activities

Sector	Program	Document/ Database Review	Verification/ Virtual Site Visit
Nonresidential	Prescriptive (multiple)	✓	✓
	Site Specific	✓	✓
Multifamily	Multifamily Direct install (MFDI)	✓	--
	Supplemental Lighting	✓	--

Summary of Impact Evaluation Results

The nonresidential and multifamily Washington electric energy efficiency programs achieved a 99% realization rate and acquired 51,290,558 kWh in evaluated savings, as shown in Table 2. Cadmus collected Avista's reported savings through database extracts, drawn from Avista's iEnergy database (nonresidential programs) and from data provided by the third-party implementor (MFDI program).

Despite reduced participation in the nonresidential and multifamily sectors due to the COVID-19 pandemic, most programs Cadmus evaluated performed strongly relative to reported savings in PY 2020 – PY 2021.

Table 2. Biennial Reported and Evaluated Energy Efficiency Electric Savings

Sector	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Nonresidential	49,769,074	49,332,339	99%
Multifamily	1,930,646	1,958,219	101%
Total	**51,699,721**	**51,290,558**	**99%**

Conclusions and Recommendations

During the PY 2020 – PY 2021 evaluation, Cadmus identified the areas discussed below for improvements by sector.

Nonresidential Conclusions and Recommendations

The nonresidential programs achieved total evaluated electric energy savings of 49,332 MWh, with a combined realization rate of 99%. The nonresidential sector did not meet the combined Prescriptive and Site Specific programs' electric savings goal of 72,058 MWh, achieving 68% of its goal. COVID-19 impacts to Avista's customers' finances and operations likely contributed heavily to reduced participation in PY 2020 – PY 2021.

Realization rates varied across projects, but overall the PY 2020 – PY 2021 nonresidential programs performed strongly relative to reported savings. With most projects Cadmus sampled for the evaluation, projects were well documented and verified savings matched reported savings.

Avista completed a transition from its previous InforCRM system to the new iEnergy system to track nonresidential energy efficiency applications and measures prior to the start of PY 2020 – PY 2021. The iEnergy system provides more detail than previously available, providing strong support for Cadmus' detailed and comprehensive evaluation. We encountered some challenges with inconsistent data in iEnergy report extracts (for example, reports with duplicated records) and worked with Avista's technical staff to resolve such issues. Avista continues to work with the iEnergy vendor to improve the system.

Cadmus offers the following conclusions and recommendations to improve the accuracy of reported savings and strengthen support for rigorous third-party evaluation:

- **Conclusion:** Cadmus found that lighting hours of use (HOU) reported by site contacts during verification interviews often varied substantially from the HOU reported on interior and exterior lighting applications. The HOU portion of the Prescriptive lighting application does not collect any explanation or context, and documentation for HOU lighting among Site Specific projects varied.
  - **Recommendation:** Add a line to the prescriptive lighting application for customers to briefly describe their interior lighting schedule. Review this description when entering the application to determine whether the annual HOU are consistent with the schedule described. For exterior lighting, include a line in the application to document existing controls, with checkboxes for common control types and timer settings.
  - **Recommendation:** Standardize the Site Specific lighting report template to include a description of the lighting schedule and HOU source. Ensure that meter data are clearly referenced in the report if a light state logger or power meter is used to determine HOU.
  - **Recommendation:** Benchmark the estimated annual HOU against Regional Technical Forum (RTF) values for the building type and request additional details from the customer if there is a significant difference.
  - **Recommendation:** Consider deploying light loggers on a random sample of lighting projects each year to validate reported HOU and develop an understanding of whether self-reported hours are typically over- or under-reported compared to actual usage.

- **Conclusion:** Avista noted that it offers incentives for luminaire level lighting control (LLLC) measures through the prescriptive lighting program instead of the site specific lighting program to reduce the barrier to entry and encourage participation. Only two prescriptive LLLC projects were completed in PY 2021, one of which Cadmus evaluated. Cadmus determined that the installed lighting control system did include an networked lighting control (NLC) able to adjust the lighting output level of individual fixtures in response to schedules, manual overrides at the control panel, and a single roof-mounted ambient daylight sensor; however, the system did not include individual fixture-mounted occupancy or ambient daylight sensors and thus would not be classified as LLLC. Cadmus recalculated the savings for this project using a site specific approach based on information gathered from site visit interviews and screenshots of the lighting schedule provided by the controls vendor. NLC and LLLC systems are relatively new solutions that have not seen widespread adoption in the Northwest, and similar systems installed by the same vendor in two separate buildings may operate very differently depending on the exact components installed and how the controls are commissioned.
  - **Recommendation:** Offer lighting control projects only through the site specific program to allow for a thorough understanding and evaluation of each installation. Separate luminaire replacement savings from control savings and ensure that an appropriate baseline is used for each component of the savings.
  - **Recommendation:** Thoroughly document what types of sensors are installed, whether they are installed on each individual sensor or separately for a zone, whether fixtures are networked, and how the control schedules and setpoints are configured. Review this information again during the IV inspection to capture any changes.
  - **Recommendation:** Conduct measurement and verification (M&V) using amp loggers or control system trend data exports whenever possible to validate the actual energy usage resulting from the controls. M&V should account for partial dimming and not simply calculate HOU as an on/off state. If the system includes ambient daylight sensors, then the evaluation period should cover a range of sky coverage conditions, and the analysis should account for seasonal variation in solar illuminance. If the system includes occupancy sensors, then the analysis should consider any expected seasonal variation in occupancy.
- **Conclusion:** Cadmus found that some Prescriptive lighting projects referenced the Default Proposed Wattage in the iEnergy system to calculate energy savings when the actual Proposed Wattage was also provided.
  - **Recommendation:** Review iEnergy calculations to ensure that the actual Proposed Wattage is used in the savings calculation when provided.
- **Conclusion:** Cadmus found that reported fixture quantities for Site Specific lighting projects often did not match invoice quantities, and applications often lacked detailed notes explaining these differences. It is often impractical for Avista staff conducting IV inspections or evaluators conducting verification visits to count every fixture for large lighting projects to resolve such discrepancies.

  - **Recommendation:** Include more detailed documentation for Site Specific lighting projects. Applications should include lighting drawings whenever possible and should clearly explain any difference between invoice quantities and rebated quantities. Lighting workbooks should note the locations where fixtures are installed to facilitate verification by Avista and by evaluators. Avista IV inspection reports should explicitly state the verified quantities of each fixture type and should include any notes, spreadsheets, or other documentation used to verify the eligible quantities.

- **Conclusion:** Cadmus evaluated a Site Specific New Construction project that used an eQuest model to estimate energy savings. We verified the model inputs and found that many varied from the reported metrics, including occupied and unoccupied setpoints and setbacks, hot water and chilled water setpoints, and boiler parameters.
  - **Recommendation:** For projects using energy models to estimate savings, also review the control parameters during the IV process and ensure all inputs reviewed on site are consistent with the model's inputs. Develop a checklist for projects with energy models that includes each parameter that needs to be verified before conducting the inspection.
- **Conclusion:** Cadmus found that Avista's new iEnergy system records detailed inputs on some Prescriptive measures that were not previously tracked in InforCRM and are not currently used in the savings calculations.
  - **Recommendation:** Review deemed savings values for Prescriptive measures and consider opportunities to leverage the additional data now collected in iEnergy to calculate more accurate savings for each project. For example, food service equipment measures can use the reported pounds of food cooked per day and cooking hours per day values collected in iEnergy to automatically calculate more precise savings.
- **Conclusion:** Cadmus staff found that the level of detail in IV reports varied. Many IV reports only mention that "equipment and quantities were verified," and photos sometimes show the equipment only from a distance. We recommended including additional details in IV reports in PY 2019 and PY 2020, but we did not observe additional detail in IV reports reviewed in PY 2021.
  - **Recommendation:** Provide more consistent documentation with Avista IV reports. We recommend that all IV reports include basic information explicitly stating the quantity and type of equipment found. For lighting projects, this would include confirmed fixture types, quantities, installation locations, controls, and estimated HOU. For most other equipment, this would include nameplates, model numbers, and quantities.

Multifamily Direct Install Conclusions and Recommendations

Evaluated electricity savings show a 101% realization rate on evaluated savings of 1,958,219 kWh for MFDI programs. Overall, the programs met 31% of the savings goal for PY 2020 – PY 2021.

Cadmus offers the following conclusions and recommendations to improve Avista's MFDI electric programs:

- **Conclusion:** Due to the adaptations made for pandemic restrictions, which included the Exchange and Trunk N Treat pandemic pilots, the MFDI program's participation was well below

the target, and the programs installed only lighting retrofits. Cadmus found these MFDI pandemic pilots to be an efficient mechanism for installing high-efficiency lighting in multifamily units but insufficient to reach PY 2020 – PY 2021 savings targets.

  - **Recommendation:** As pandemic restrictions are lifted in future years, return to a traditional MFDI program design by providing direct installation of energy-efficient lighting and non-lighting measures. Continue to replace high-use, low-efficiency lamps where practical to maximize program cost-effectiveness and yield higher savings.

- **Conclusion:** Cadmus did not find large-scale problems with the MFDI programs' measure tracking data but did note numerous occasions where electric HVAC interactive effects were not accounted for in the reported savings calculation for lighting measures in interior common areas or in unit spaces with documented electric heating and cooling.
  - **Recommendation:** Have the implementer clearly identify the types of spaces that should include HVAC interactive effects and those that should not, and work to ensure those guidelines are followed.
- **Conclusion:** All reported supplemental lighting program savings calculations appeared to use custom HOU values that were different from deemed HOU values for exterior spaces and did not align with what was documented in the audit detail. Also, we could not verify custom HOU values for some spaces because these spaces did not have an assigned site identification.
  - **Recommendation:** The MFDI program implementor should ensure that clear and consistent project documentation with accurate inputs are provided for all site data.

Nonresidential Impact Evaluation

Through its nonresidential portfolio of programs, Avista promotes the purchase of high-efficiency equipment to commercial and industrial utility customers. Avista provides rebates to partially offset the difference in cost between high-efficiency equipment and standard equipment. Cadmus conducted nonresidential impact evaluation activities to determine evaluated savings for all programs with participation and measurement and verification (M&V) across a sample of Prescriptive and Site Specific projects.

Program Summary

Avista completed and provided incentives for 3,899 nonresidential electric measures in Washington during PY 2020 – PY 2021 and reported total electric energy savings of 49,769,074 kWh. Through the nonresidential sector, Avista offers incentives for high-efficiency equipment and controls through two program paths: Prescriptive and Site Specific.

The Prescriptive programs apply to smaller, straightforward equipment installations that generally have similar operating characteristics (such as lighting, simple HVAC systems, food service equipment, and variable-frequency drives [VFD]). The Site Specific program applies to unique projects that require custom savings calculations and technical assistance from Avista's account executives (such as compressed air, process equipment and controls, and comprehensive lighting retrofits).

Program Participation Summary

This section summarizes nonresidential sector participation and progress toward the PY 2020 – PY 2021 goals through the Prescriptive and Site Specific programs.

Nonresidential Prescriptive Programs

Table 3 shows electric energy savings goals assigned to Avista's nonresidential Prescriptive programs for PY 2020 – PY 2021, as well as reported savings and a comparison between reported savings and goals. Avista's nonresidential Prescriptive programs met 74% of their collective savings goal in PY 2020 – PY 2021. The lower participation is likely due to the COVID-19 pandemic, which forced many businesses to reduce their operations or close entirely. For those businesses that remained open, facility and maintenance staff had to prioritize planning for health and safety impacts above energy efficiency concerns.

Table 3. Biennial Nonresidential Prescriptive Electric Savings

Program Type	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Interior Lighting	15,592,000	15,110,101	97%
Exterior Lighting	18,157,000	13,147,368	72%
Shell Measure	1,070,000	41,176	4%
Green Motors	104,000	30,883	30%
Motor Control (VFD)	1,935,000	386,318	20%
Fleet Heat	800,000	0	0%
Food Service Equipment	316,000	129,493	41%
AirGuardian	0	0	N/A
Energy Smart Grocer	884,000	44,251	5%
Total	**38,858,000**	**28,889,591**	**74%**

Table 4 summarizes program participation by unique application numbers.

Table 4. Biennial Nonresidential Prescriptive Participation by Project

Program Type	Number of Applications	Number of Measures
Interior Lighting	865	1,410
Exterior Lighting	973	1,633
Shell Measure	16	19
Green Motors	12	12
Motor Control (VFD)	8	26
Fleet Heat	0	0
Food Service Equipment	24	26
AirGuardian	0	0
Energy Smart Grocer	4	6
Total[a]	1,902	**3,132**

[a] Total participants. A single application may contain measures from multiple programs.

Nonresidential Site Specific Program

Table 5 shows electric savings goals assigned to the Site Specific program in Avista's nonresidential sector for PY 2020 – PY 2021, reported savings, and the percentage of goal achieved. The Site Specific program met 63% of its PY 2020 – PY 2021 savings goal. Participation was reduced relative to PY 2018 – PY 2019, likely due to the COVID-19 pandemic.

Table 5. Biennial Nonresidential Site Specific Electric Savings

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Site Specific	33,200,000	20,879,484	63%

Table 6 summarizes program participation for the Site Specific program.

Table 6. Biennial Nonresidential Site Specific Participation by Project

Program	Number of Applications	Number of Measures
Site Specific Lighting	124	725
Site Specific Other	38	42
Total	**162**	**767**

Nonresidential Impact Evaluation Methodology

To understand the nonresidential programs and measures slated for evaluation, Cadmus first reviewed the following documents and data records:

- Avista's annual business plans, processes, and energy savings justifications
- Project documents from external sources (such as customers, program consultants, or implementation contractors)
- Avista's iEnergy tracking system for nonresidential programs

Based on the initial review, Cadmus checked the distribution of program contributions with the overall program portfolio energy savings. The review provided insight into the sources for unit energy savings (UES) claimed for each program measure, along with sources for energy-savings algorithms, internal quality assurance, and quality control processes for large nonresidential sector projects.

Following this review, Cadmus designed a sample strategy to conduct the following impact evaluation activities in four waves:

- Selected evaluation sample and requested project documentation from Avista
- Reviewed project documentation
- Prepared M&V plans for virtual and in-person site visits
- Performed virtual site visits using the Streem platform or in-person site visits and collected on-site data (such as trend data, photos, and operating schedules) [1]
- Calculated evaluated savings by measure using site visit findings
- Determined overall evaluated savings by applying realization rates to the total reported savings population

Sample Design

Cadmus conducted sampling in four waves for PY 2020 – PY 2021:

- Sample 1 included program data from January 2020 through June 2020
- Sample 2 included program data from July 2020 through December 2020

[1] For more information on Streem: https://www.streem.com/platform-streem#platform-remote-video

- Sample 3 included program data from January 2021 through June 2021
- Sample 4 included program data from July 2021 through December 2021

Cadmus initially estimated the total annual population size by reviewing the wave 1 population data and comparing it to PY 2018 – PY 2019 population data. We developed initial sample size targets to achieve 90% confidence and ±10% precision (90/10) for the estimated annual population across the PY 2020 – PY 2021 biennium, with a target of 90/20 by program. The first sample wave met one-quarter of the total biennial target for each program. After receiving the wave 2 population data, we revised the annual sample size targets and selected the wave 2 sample to bring the 2020 sample to half of the estimated biennium target within each program. Based on the completed 2020 sample, we then revised the 2021 sample targets to achieve the sample target for the biennium, completing half of the remaining sample in each wave.

For each activity wave, Cadmus developed a stratified random sample of applications by program (such as Site Specific Other, Site Specific Lighting, Prescriptive Interior Lighting, or Prescriptive Motor Controls). In programs where individual projects represented a significant portion of the total savings in the program, we evaluated a census of the highest-savings applications as a certainty stratum. Within programs with a wide variance in savings, we stratified applications by reported savings magnitude into small and large strata, each with approximately 50% of the total noncertainty program savings. For programs with low participation or small variance in savings, Cadmus sampled from a single stratum containing all applications. We assigned random numbers within each stratum to select a random sample of noncertainty sites. In some cases, we evaluated one or more additional applications at the same location as another sampled application, as a convenience selection, if we could assess both applications in a single site visit.

Our team encountered challenges contacting customers to evaluate in each sample, primarily due to changes in participant business operations as a result of the COVID-19 pandemic. We pulled an additional backup sample for waves 2 and 4 using random sampling and recruited participants to meet each year's sample target.

Cadmus summed the evaluated savings from each of the sampled projects to calculate a realization rate by stratum and year and applied that realization rate to projects in the year's population in that stratum. We applied the project-specific evaluated savings for every project in the sample, regardless of whether it was a random, certainty, or convenience selection. To determine the evaluated savings and realization rates for each program over the biennium, we summed the annual evaluation results.

Table 7 summarizes the evaluation samples for the Washington nonresidential Prescriptive programs. Cadmus sampled 74 applications at 64 unique sites. Of the sampled applications, we selected five for certainty review based on scale of savings, 59 randomly, and 15 additional convenience applications at 12 sites based on location. There was no participation in the AirGuardian and Fleet Heat programs in PY 2020 – PY 2021, as shown in Table 4. Table 7 shows the total number of unique application identification numbers sampled in each program, including five applications containing measures from more than one program.

Table 7. Biennial Washington Nonresidential Prescriptive Electric Evaluation Sample

Program Type	Applications Sampled[a]	Sampled Savings (kWh)	Percentage of Reported Savings
Interior Lighting	27	2,343,165	16%
Exterior Lighting	27	1,303,476	10%
Shell Measure	8	21,101	51%
Green Motors	5	12,373	40%
Motor Control (VFD)	4	238,010	62%
Fleet Heat	0	0	N/A
Food Service Equipment	5	28,457	22%
AirGuardian	0	0	N/A
Energy Smart Grocer	3	43,835	99%
Nonresidential Prescriptive	**74**	**3,990,417**	14%

[a] Five applications included measures in the interior lighting and exterior lighting programs but are only counted once in the total.

Table 8 summarizes the evaluation sample for the Washington nonresidential Site Specific program. Cadmus sampled 37 Site Specific applications at 29 unique sites overall. Of the sampled applications, we selected six for certainty review based on the savings scale, 26 randomly, and five additional convenience applications at two sites based on location.

Table 8. Biennial Washington Nonresidential Site Specific Electric Evaluation Sample

Program	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Site Specific	37	13,117,371	63%

Document Review

Cadmus requested and reviewed project documentation for each sampled application and prepared M&V plans to guide its site visits. Typically, project documentation included data entered into the iEnergy system, incentive application forms, calculation workbooks, invoices, equipment specification sheets, and Avista installation verification reports.

On-Site Verification

Cadmus performed site visits at 22 unique nonresidential locations to assess electric savings for 117 unique Prescriptive and Site Specific measures from 24 different applications. During the site visits, we verified installed equipment types, make and model numbers, operating schedules, and set points, as applicable. Our team used the project documentation review and on-site findings to adjust reported savings calculations, where necessary.

Remote Verification

Cadmus performed virtual site visits and verification calls at 63 unique nonresidential locations to assess electric savings for 138 unique Prescriptive and Site Specific measures from 80 different applications. We evaluated the remaining seven applications through desk reviews that did not require participant outreach. Typically, we conducted virtual site visits using the Streem platform, which records video and audio. During the visits, the site contact conducted a detailed walkthrough to help us verify installed equipment types, make and model numbers, operating schedules, and set points, as applicable. Our

team conducted some virtual visits using Microsoft Teams with customers who were unable to access Streem or preferred using Teams. Verification calls involved a brief phone or video call to confirm key details and any information missing from the project documentation. Our team used the project documentation review and on-site findings to adjust reported savings calculations, where necessary.

Nonresidential Impact Evaluation Results

This section summarizes electric impact evaluation results for the nonresidential Prescriptive and Site Specific programs in PY 2020 – PY 2021.

Nonresidential Prescriptive Programs

Table 9 shows the reported and evaluated electric energy savings for Avista's nonresidential Prescriptive programs as well as the realization rates for PY 2020 – PY 2021. Overall, the nonresidential Prescriptive programs achieved a 102% electric realization rate.

Table 9. Biennial Nonresidential Prescriptive Electric Impact Findings

Program Type	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Interior Lighting	15,110,101	17,305,939	115%
Exterior Lighting	13,147,368	11,557,554	88%
Shell Measure	41,176	37,776	92%
Green Motors	30,883	30,883	100%
Motor Control (VFD)	386,318	386,318	100%
Fleet Heat	0	0	N/A
Food Service Equipment	129,493	129,921	100%
AirGuardian	0	0	N/A
Energy Smart Grocer	44,251	43,292	98%
Nonresidential Prescriptive	**28,889,591**	29,491,683	**102%**

Of 74 evaluated applications across the biennium, Cadmus identified discrepancies for 40, based on in-person and virtual site visits, verification calls, and project documentation reviews. Of those, we identified 26 discrepancies in PY 2020 and 14 in PY 2021. Table 10 summarizes the reasons for discrepancies between reported and evaluated savings for applications evaluated in PY 2021. The PY 2020 report summarizes the discrepancies found in PY 2020.

Table 10. PY 2021 Nonresidential Prescriptive Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	2	↓	• Cadmus reduced the lighting (HOU) for two projects based on the operating schedule verified by interviewing staff at the site.
	4	↑	• Cadmus found that the baseline fixtures for one project had a higher wattage than reported on the application. • Cadmus increased the HOU for one project based on the operating schedule verified by interviewing staff at the site. • Cadmus evaluated a prescriptive lighting control project which was described as LLLC and found the system to include NLC functionality with configurable zone control, but no luminaire-level sensors. We revised the savings to use a site specific calculation approach based on the details of the lighting controls settings. • Cadmus revised one project to use the actual installed lamp wattage instead of the default proposed lamp wattage to calculate savings.
Exterior Lighting	3	↓	• Cadmus reduced the HOU for one sign lighting project due to the verified automated lighting control settings. • Cadmus found that the installed fixtures for one project had a higher wattage than reported on the application. • Cadmus found fewer fixtures installed than reported for one project.
	2	↑	• Cadmus found that the installed fixtures for one project had two lamps per fixture, doubling the lamp quantity. Cadmus also determined that the Avista database incorrectly categorized this project as interior lighting measures and transferred these savings to exterior lighting. • Cadmus increased the HOU for one project based on the lighting schedule verified by interviewing staff at the site.
Shell	1	↓	• Cadmus found that the insulated area of the building for one application was lower than reported.
Grocer	1	↓	• Cadmus found that 10 refrigerated case lighting fixtures reported installed in low temperature cases were actually installed in medium temperature cases.
Food Services	1	↑	• Cadmus found that there was an error with the deemed savings value used for one project in iEnergy.

During the PY 2020 evaluation, Cadmus identified a systematic issue with sign lighting measures in the Prescriptive Exterior Lighting program, which resulted in particularly low realization rates for applicable projects. Avista had applied a deemed savings estimate per square footage of signage replaced based on a 2014 internal engineering review that assumed 8-foot T12 high output fluorescent lamps as the baseline for all sign lighting. Cadmus evaluated sign lighting projects by verifying the actual quantity, wattages, and HOU for the baseline and installed lamps in each sign. The average realization rate for PY 2020 sign lighting measures was approximately 30%. We advised Avista of this discrepancy upon noticing it and reported these findings in detail in the 2020 report. Avista implemented changes to the Exterior Lighting program in the first quarter of 2021 in response to the recommendations from Cadmus. Since then, no similar issues were encountered, and the Exterior Lighting program achieved a 101% realization rate in PY 2021.

Nonresidential Site Specific Program

Table 11 shows reported and evaluated electric energy savings for Avista's nonresidential Site Specific program for the biennium. Overall, the Site Specific program achieved a 95% electric realization rate.

Table 11. Biennial Nonresidential Site Specific Electric Impact Findings

Program	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Site Specific	20,879,484	19,840,656	95%

Of 37 evaluated applications across the biennium, Cadmus identified discrepancies in 19, based on site visits and project documentation. Of those, we identified 10 discrepancies in PY 2020 and nine in PY 2021. Table 12 summarizes the discrepancies between reported and evaluated savings for applications evaluated in 2021. The 2020 report summarizes the discrepancies found in PY 2020.

Table 12. PY 2021 Nonresidential Site Specific Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	4	↓	• Cadmus found that the building for one project underwent a major remodel and conversion shortly after the project was completed. Many fixtures were removed during the remodel, and operating hours were modified. • Cadmus found fewer fixtures than reported when verifying quantities for two projects. • Cadmus reduced the HOU for some fixtures on two projects based on interviews with site staff. • Cadmus found that the installed fixtures had a lower wattage than reported for one project.
	3	↑	• Cadmus increased the HOU for one project at an indoor agricultural facility based on an updated crop growth cycle. • Cadmus found that the installed fixture wattage for one project was lower than reported. • Cadmus increased the HOU for one project based on the business hours verified by a staff interview.
New Construction	1	↓	• Cadmus updated the model inputs and re-ran the eQuest model for one application based on verified parameters, including a lower occupied heating setpoint, more aggressive temperature setbacks, and shorter HOU. These updated parameters are consistent across the baseline and proposed models. Cadmus also verified additional lighting fixtures and lower HOU than reported for the new construction lighting.
	1	↑	• Cadmus increased the lighting HOU for one project based on their employee and business hours. Cadmus also corrected the electric cooling factor to match the state, construction vintage, and building type of the facility.

Cadmus found that some M&V plans, pre-installation verifications, and installation verification reports relied on customer-provided photos and data because Avista staff could not safely visit the site due to the COVID-19 pandemic. It is likely that some of the discrepancies identified above may have been avoided had Avista been able to conduct thorough in-person inspections before and after the project to verify the baseline and installed equipment.

Nonresidential Conclusions and Recommendations

The nonresidential programs achieved total evaluated electric energy savings of 49,332 MWh, with a combined realization rate of 99%. The nonresidential sector did not meet the combined Prescriptive and Site Specific programs' electric savings goal of 72,058 MWh, achieving 68% of its goal. COVID-19 impacts to Avista's customers' finances and operations likely contributed heavily to reduced participation in PY 2020 – PY 2021.

Realization rates varied across projects, but overall, the PY 2020 – PY 2021 nonresidential programs performed strongly relative to reported savings. Most projects Cadmus sampled for the evaluation were well documented and verified savings matched reported savings.

Avista completed a transition from its previous InforCRM system to the new iEnergy system to track nonresidential energy efficiency applications and measures prior to the start of PY 2020 – PY 2021. The iEnergy system provides more detail than previously available, providing strong support for Cadmus' detailed and comprehensive evaluation. We encountered some challenges with inconsistent data in iEnergy report extracts (for example, reports with duplicated records) and worked with Avista's technical staff to resolve such issues. Avista continues to work with the iEnergy vendor to improve the system.

Cadmus offers the following conclusions and recommendations to improve the accuracy of reported savings and strengthen support for rigorous third-party evaluation:

- **Conclusion:** Cadmus found that lighting HOU reported by site contacts during verification interviews often varied substantially from the HOU reported on interior and exterior lighting applications. The HOU portion of the Prescriptive lighting application does not collect any explanation or context, and documentation for HOU lighting among Site Specific projects varied.
  - **Recommendation:** Add a line to the prescriptive lighting application for customers to briefly describe their interior lighting schedule. Review this description when entering the application to determine whether the annual HOU are consistent with the schedule described. For exterior lighting, include a line in the application to document existing controls, with checkboxes for common control types and timer settings.
  - **Recommendation:** Standardize the Site Specific lighting report template to include a description of the lighting schedule and HOU source. Ensure that meter data are clearly referenced in the report if a light state logger or power meter is used to determine HOU.
  - **Recommendation:** Benchmark the estimated annual HOU against RTF values for the building type and request additional details from the customer if there is a significant difference.
  - **Recommendation:** Consider deploying light loggers on a random sample of lighting projects each year to validate reported HOU and develop an understanding of whether self-reported hours are typically over- or under-reported compared to actual usage.
- **Conclusion:** Avista noted that it offers incentives for LLLC measures through the prescriptive lighting program instead of the site specific lighting program to reduce the barrier to entry and

encourage participation. Only two prescriptive LLLC projects were completed in PY 2021, one of which Cadmus evaluated. Cadmus determined that the installed lighting control system did include an NLC able to adjust the lighting output level of individual fixtures in response to schedules, manual overrides at the control panel, and a single roof-mounted ambient daylight sensor; however, the system did not include individual fixture-mounted occupancy or ambient daylight sensors and thus would not be classified as LLLC. Cadmus recalculated the savings for this project using a site specific approach based on information gathered from site visit interviews and screenshots of the lighting schedule provided by the controls vendor. NLC and LLLC systems are relatively new solutions that have not seen widespread adoption in the Northwest, and similar systems installed by the same vendor in two separate buildings may operate very differently depending on the exact components installed and how the controls are commissioned.

  - **Recommendation:** Offer lighting control projects only through the site specific program to allow for a thorough understanding and evaluation of each installation. Separate luminaire replacement savings from control savings and ensure that an appropriate baseline is used for each component of the savings.
  - **Recommendation:** Thoroughly document what types of sensors are installed, whether they are installed on each individual sensor or separately for a zone, whether fixtures are networked, and how the control schedules and setpoints are configured. Review this information again during the IV inspection to capture any changes.
  - **Recommendation:** Conduct M&V using amp loggers or control system trend data exports whenever possible to validate the actual energy usage resulting from the controls. M&V should account for partial dimming and not simply calculate HOU as an on/off state. If the system includes ambient daylight sensors, then the evaluation period should cover a range of sky coverage conditions, and the analysis should account for seasonal variation in solar illuminance. If the system includes occupancy sensors, then the analysis should consider any expected seasonal variation in occupancy.

- **Conclusion:** Cadmus found that some Prescriptive lighting projects referenced the Default Proposed Wattage in the iEnergy system to calculate energy savings when the actual Proposed Wattage was also provided.
  - **Recommendation:** Review iEnergy calculations to ensure that the actual Proposed Wattage is used in the savings calculation when provided.
- **Conclusion:** Cadmus found that reported fixture quantities for Site Specific lighting projects often did not match invoice quantities, and applications often lacked detailed notes explaining these differences. It is often impractical for Avista staff conducting IV inspections or evaluators conducting verification visits to count every fixture for large lighting projects to resolve such discrepancies.
  - **Recommendation:** Include more detailed documentation for Site Specific lighting projects. Applications should include lighting drawings whenever possible and should clearly explain any difference between invoice quantities and rebated quantities. Lighting workbooks

should note the locations where fixtures are installed to facilitate verification by Avista and by evaluators. Avista IV inspection reports should explicitly state the verified quantities of each fixture type and should include any notes, spreadsheets, or other documentation used to verify the eligible quantities.

- **Conclusion:** Cadmus evaluated a Site Specific New Construction project that used an eQuest model to estimate energy savings. We verified the model inputs and found that many varied from the reported metrics, including occupied and unoccupied setpoints and setbacks, hot water and chilled water setpoints, and boiler parameters.
  - **Recommendation:** For projects using energy models to estimate savings, also review the control parameters during the IV process and ensure all inputs reviewed on site are consistent with the model's inputs. Develop a checklist for projects with energy models that includes each parameter that needs to be verified before conducting the inspection.
- **Conclusion:** Cadmus found that Avista's new iEnergy system records detailed inputs on some Prescriptive measures that were not previously tracked in InforCRM and are not currently used in the savings calculations.
  - **Recommendation:** Review deemed savings values for Prescriptive measures and consider opportunities to leverage the additional data now collected in iEnergy to calculate more accurate savings for each project. For example, food service equipment measures can use the reported pounds of food cooked per day and cooking hours per day values collected in iEnergy to automatically calculate more precise savings.
- **Conclusion:** Cadmus staff found that the level of detail in IV reports varied. Many IV reports only mention that "equipment and quantities were verified," and photos sometimes show the equipment only from a distance. We recommended including additional details in IV reports in PY 2019 and PY 2020, but we did not observe additional detail in IV reports reviewed in PY 2021.

Recommendation: Provide more consistent documentation with Avista IV reports. We recommend that all IV reports include basic information explicitly stating the quantity and type of equipment found. For lighting projects, this would include confirmed fixture types, quantities, installation locations, controls, and estimated HOU. For most other equipment, this would include nameplates, model numbers, and quantities.

Multifamily Direct Install (MFDI) Impact Evaluation

Cadmus designed the MFDI program's impact evaluation to verify reported program participation and energy savings. Considering that billing analysis for the PY 2018 – PY 2019 evaluation did not provide meaningful evaluation results and that a document review was out of scope for this evaluation, we determined that a database review was the most appropriate evaluation approach. We used data collected and reported in the tracking database, the Avista TRM, and RTF values to evaluate savings. This approach provided a reasonable estimate of the achieved savings practical for each program, given its delivery method, magnitude of savings, and number of participants.

Program Summary

In PY 2020 – PY 2021, Avista completed and provided incentives for 3,798 living units, common areas, or installed lighting fixtures in Washington and reported total electric energy savings of 1,930,646 kWh. Participation is defined as installed lighting fixtures for the MFDI Supplemental Lighting program and common areas or living units served for the MFDI program.

The MFDI program includes two delivery channels:

- MFDI, which provides free direct-install measures to multifamily residences (five units or more) and common areas.
- MFDI Supplemental Lighting, which revisits multifamily properties participating in the MFDI program to install additional common area lighting.

Program Participation Summary

Table 13 shows PY 2020 – PY 2021 savings goals and reported savings for the MFDI programs. During PY 2020 – PY 2021, the response to the COVID-19 pandemic disrupted the programs' direct-install design, forcing Avista to temporarily halt program processes and implement changes to adapt to pandemic restrictions. These changes included the Exchange and Trunk N Treat pandemic pilots, which reduced the face-to-face interaction that occurs in a traditional MFDI program design. As a result, the MFDI and MFDI Supplemental Lighting programs did not meet their combined savings goals, only meeting 31% of the goal.

Table 13. MFDI Programs Reported Electric Savings

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Multifamily Direct Install	N/A	1,231,012	-
Multifamily Direct Install Supplemental Lighting	N/A	699,634	-
MFDI Programs Total	**6,234,000**	**1,930,646**	**31%**

Table 14 summarizes reported participation in the MFDI programs for PY 2020 – PY 2021.

Table 14. MFDI Programs Participation

Program	Participation Reported
Multifamily Direct Install[a]	2,104
Multifamily Direct Install Supplemental Lighting[b]	1,694
MFDI Programs Total	**3,798**

[a] Participation is defined as the number of living units and common areas served.

[b] Participation is defined as the number of installed units.

Lighting measures accounted for 82.4% of the total MFDI programs' savings during PY 2020 – PY 2021. The following shows the percentage of MFDI reported savings provided by each program during PY 2020 – PY 2021:

- MFDI lighting measures provided 46.2% of reported savings.
- MFDI non-lighting measures provided 17.6% of reported savings.
- MFDI Supplemental Lighting measures provided 36.2% of reported savings.

MFDI Impact Evaluation Methodology

To determine the MFDI program's evaluated savings for PY 2020 – PY 2021, Cadmus employed a database review. For the impact evaluation database review, we applied UES values and savings methodologies outlined by the RTF to calculate savings for measures reported in the measure tracking database. Such impact activity has helped identify incorrect UES values and methods used to calculate reported savings. For this evaluation, Cadmus applied the most recent RTF UES values and standard protocols to PY 2020 – PY 2021 measures.

MFDI Impact Evaluation Results

Cadmus used the results of the database review to evaluate savings for each measure. We then rolled up measure-level evaluated savings to calculate evaluated savings and a realization rate for each program. Table 15 shows the resulting evaluated savings and realization rates.

Table 15. MFDI Programs Electric Impact Findings

Program	Reported Electric Savings (kWh)	Evaluated Electric Savings (kWh)	Realization Rates
MFDI	1,231,012	1,265,600	103%
MFDI Supplemental Lighting	699,634	692,619	99%
MFDI Programs Total	**1,930,646**	**1,958,219**	**101%**

During PY 2020 – PY 2021, Cadmus identified discrepancies between evaluated and reported savings for MFDI lighting and non-lighting measures. The PY 2020 report summarizes the discrepancies found in PY 2020. In PY 2021, Cadmus identified instances where the implementer did not properly account for electric heating interactive effects in common area spaces, which led to low evaluated realization rates for those measures. In addition, we found reported savings calculations for lighting measures that did not account for the savings that come from cooling interaction effects in interior spaces. Overall, PY 2020 – PY 2021 evaluated savings that resulted in fully realized or higher realization rates for lighting and non-lighting measures in the MFDI program outweighed those with low realization rates.

The discrepancies between evaluated and reported savings for the MFDI Supplemental Lighting program resulted from the contractors use of undefined annual HOU in the reported savings calculations instead of those hours consistent with the savings calculations methodology and site data provided. In PY 2021, all cases with undefined HOU exceeded 100% realization because these hours were lower than those documented in the calculation methodology and site data.

MFDI Conclusions and Recommendations

Evaluated electricity savings show a 101% realization rate on evaluated savings of 1,958,219 kWh for MFDI programs. Overall, the programs met 31% of the savings goal for PY 2020 – PY 2021.

Cadmus offers the following conclusions and recommendations to improve Avista's MFDI electric programs:

- **Conclusion:** Due to the adaptations made for pandemic restrictions, which included the Exchange and Trunk N Treat pandemic pilots, the MFDI program's participation was well below the target, and the programs installed only lighting retrofits. Cadmus found these MFDI pandemic pilots to be an efficient mechanism for installing high-efficiency lighting in multifamily units but insufficient to reach PY 2020 – PY 2021 savings targets.
  - **Recommendation:** As pandemic restrictions are lifted in future years, return to a traditional MFDI program design by providing direct installation of energy-efficient lighting and non-lighting measures. Continue to replace high-use, low-efficiency lamps where practical to maximize program cost-effectiveness and yield higher savings.
- **Conclusion:** Cadmus did not find large-scale problems with the MFDI programs' measure tracking data but did note numerous occasions where electric HVAC interactive effects were not accounted for in the reported savings calculation for lighting measures in interior common areas or in unit spaces with documented electric heating and cooling.
  - **Recommendation:** Have the implementer clearly identify the types of spaces that should include HVAC interactive effects and those that should not, and work to ensure those guidelines are followed.
- **Conclusion:** All reported supplemental lighting program savings calculations appeared to use custom HOU values that were different from deemed HOU values for exterior spaces and did not align with what was documented in the audit detail. Also, we could not verify custom HOU values for some spaces because these spaces did not have an assigned site identification.
  - **Recommendation:** The MFDI program implementor should ensure that clear and consistent project documentation with accurate inputs are provided for all site data.

APPENDIX B –

CADMUS

Washington Biennium (2020-2021) Natural Gas Impact Evaluation Report

April 8, 2022

Prepared for:

Avista Corporation
1411 East Mission Avenue
Spokane, WA 99202

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Portfolio Executive Summary

For several decades, Avista Corporation (Avista) has administered demand-side management (DSM) programs to reduce electricity and natural gas energy use by its customer portfolio. While Avista has implemented most of these programs in house, external vendors have fulfilled some of them.

Avista contracted with Cadmus to complete process and impact evaluations of its program year (PY) 2020 – (PY) 2021 natural gas DSM nonresidential and multifamily residential programs in Washington. This report presents the natural gas impact evaluation findings for PY 2020 – PY 2021. Cadmus did not apply net-to-gross (NTG) adjustments to savings values, except where deemed energy savings values already incorporated NTG as a function of the market baseline.

Evaluation Methodology and Activities

Table 1 shows the variety of methods and activities Cadmus completed to conduct the Washington natural gas portfolio evaluation.

Table 1. Natural Gas Program Evaluation Activities

Sector	Program	Document/ Database Review	Verification/ Virtual Site Visit
Nonresidential	Prescriptive (multiple)	✓	✓
	Site Specific	✓	✓
Multifamily	Multifamily Direct Install (MFDI)	N/A	N/A

Summary of Impact Evaluation Results

Overall, the Washington portfolio achieved a 103% realization rate on savings from natural gas measures and acquired 500,328 therms in annual gross savings, as shown in Table 2. Cadmus collected Avista's reported savings through database extracts, drawn from Avista's iEnergy database (nonresidential programs) and from data provided by the third-party implementor (MFDI program). There was no participation in the natural gas MFDI program in PY 2021. Conclusions and recommendations from the PY 2020 natural gas MFDI program are discussed in the PY 2020 annual report.

Table 2. Biennial Reported and Evaluated Energy Efficiency Natural Gas Savings

Sector	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
Nonresidential	484,300	499,952	103%
Multifamily	409	376	92%
Total	**484,709**	**500,328**	**103%**

Conclusions and Recommendations

During the PY 2020 – PY 2021 evaluation, Cadmus identified the areas addressed below for improvements by sector.

Nonresidential Conclusions and Recommendations

In PY 2020 – PY 2021, the nonresidential sector achieved total evaluated natural gas energy savings of 499,952 therms, with a combined realization rate of 103%. The nonresidential sector achieved 93% of its combined Prescriptive and Site Specific programs natural gas savings goal of 537,454 therms.

Although realization rates varied across projects, particularly within the Site Specific program, overall the nonresidential gas sector performed strongly in PY 2020 – PY 2021 relative to reported savings. With most projects Cadmus sampled for the evaluation, projects were well documented and verified savings matched reported savings..

Avista completed a transition from its previous InforCRM system to the new iEnergy system to track nonresidential energy efficiency applications and measures prior to the start of PY 2020 – PY 2021. The iEnergy system provides more detail than previously available, providing strong support for Cadmus' detailed and comprehensive evaluation. We encountered some challenges with inconsistent data in iEnergy report extracts (for example, reports with duplicated records) and worked with Avista's technical staff to resolve such issues. Avista continues to work with the iEnergy vendor to improve the system.

Cadmus offers the following conclusions and recommendations to improve the accuracy of reported savings and strengthen support for rigorous third-party evaluation:

- **Conclusion:** Cadmus evaluated a Site Specific new construction project that used an eQuest model to estimate energy savings. We verified the model inputs and found that many varied from the reported metrics, including occupied and unoccupied setpoints and setbacks, hot water and chilled water setpoints, and boiler parameters.
  - **Recommendation:** For projects using energy models to estimate savings, also review the control parameters during the IV process and ensure all inputs reviewed on site are consistent with the model's inputs. Develop a checklist for projects with energy models that includes each parameter that needs to be verified before conducting the inspection.
- **Conclusion:** Cadmus found that the billing analysis for one Site Specific "other" project estimated savings without a full year of billing data because the facility had changed ownership and operation less than one year before the project began. We found that the natural gas usage at the facility had seasonal variation influenced by seasonal production volume.
  - **Recommendation:** When conducting billing analysis for large industrial facilities that have variable production rates and utility consumption, request and review the facility's production data during the measurement and verification (M&V) process to identify any potential correlation with production.
- **Conclusion:** Cadmus found that the level of detail in IV reports varied. Many IV reports only mention that "equipment and quantities were verified," and photos sometimes show the

equipment only from a distance. We recommended including additional details in IV reports in PY 2019 and PY 2020, but we did not observe additional detail in IV reports reviewed in PY 2021.

  - **Recommendation:** Provide more consistent documentation with Avista IV reports. All IV reports should include basic information explicitly stating the quantity and type of equipment found. For most projects, this would include nameplates, model numbers, and quantities.

- **Conclusion:** Cadmus found that Avista's iEnergy system recorded detailed inputs on some Prescriptive measures that were not previously tracked in InforCRM and are not currently used in the savings calculations.
  - **Recommendation:** Review deemed savings values for Prescriptive measures and consider opportunities to leverage the additional data now collected in iEnergy to calculate more accurate savings for each project. For example, HVAC furnace measures can use the exact AHRI efficiency rating collected in iEnergy instead of a typical average to calculate more precise savings without requiring additional data entry.

Nonresidential Impact Evaluation

Through its nonresidential program portfolio, Avista promotes purchases of high-efficiency equipment to commercial and industrial utility customers. Avista provides rebates to partially offset the difference in cost between high-efficiency and standard equipment. Cadmus conducted nonresidential impact evaluation activities to determine evaluated savings for all programs with participation and M&V across a sample of Prescriptive and Site Specific projects.

Program Summary

In PY 2020 – PY 2021, Avista completed and provided incentives for 197 nonresidential natural gas measures in Washington and reported total natural gas energy savings of 484,300 therms. Through the nonresidential sector, Avista offers incentives for high-efficiency equipment and controls via two program paths: Prescriptive and Site Specific.

The Prescriptive programs apply smaller, straightforward equipment installations that generally include similar operating characteristics (such as simple HVAC systems, food service equipment, and envelope upgrades). The Site Specific program applies to unique projects, requiring custom savings calculations and technical assistance from Avista's account executives (such as process equipment, controls, and comprehensive HVAC retrofits).

Program Participation Summary

This section summarizes nonresidential sector participation and progress toward PY 2020 – PY 2021 goals through the Prescriptive and Site Specific programs.

Nonresidential Prescriptive Programs

Table 3 shows natural gas energy savings goals assigned to Avista's nonresidential Prescriptive programs for PY 2020 – PY 2021, as well as reported savings and a comparison between reported savings and goals. Avista's nonresidential Prescriptive programs met 39% of their collective savings goal in PY 2020 – PY 2021. The lower participation is likely due to the COVID-19 pandemic, which forced many businesses to reduce their operations or close entirely. For those businesses that remained open, facility and maintenance staff had to prioritize planning for health and safety impacts above energy efficiency concerns.

Table 3. Biennial Nonresidential Prescriptive Natural Gas Savings

Program Type	Savings Goals (therms)	Savings Reported (therms)	Percentage of Goal
HVAC	69,240	29,539	43%
Shell	52,000	9,869	19%
Food Service Equipment	114,214	53,412	47%
EnergySmart Grocer	0	0	N/A
Total	**235,454**	92,820	39%

Table 4 summarizes program participation by unique application numbers.

Table 4. Biennial Nonresidential Prescriptive Participation by Project

Program Type	Number of Applications	Number of Measures
HVAC	60	81
Shell	14	17
Food Service Equipment	76	81
EnergySmart Grocer	0	0
Total[a]	**150**	**179**

[a] Total participants. A single application may contain measures from multiple programs.

Nonresidential Site Specific Program

Table 5 shows natural gas savings goals assigned to the Site Specific program for Avista's nonresidential sector in PY 2020 – PY 2021, reported savings, and the percentage of goal achieved. The Site Specific program achieved 130% of the PY 2020 – PY 2021 savings goal. The majority of the Site Specific natural gas savings were realized by a single large project; overall participation by number of applications was lower compared to PY 2018 – 2019 due to the COVID-19 pandemic.

Table 5. Biennial Nonresidential Site Specific Natural Gas Savings

Program	Savings Goals (therms)	Savings Reported (therms)	Percentage of Goal
Site Specific	302,000	391,479	130%

Table 6 summarizes participation in the Site Specific program.

Table 6. Biennial Nonresidential Site Specific Participation by Project

Program Type	Number of Applications	Number of Measures
Site Specific Other	17	18
Total	**17**	**18**

Nonresidential Impact Evaluation Methodology

To understand the programs and measures slated for evaluation, Cadmus first reviewed the following documents and data records:

- Avista's annual business plans, detailing processes and energy savings justifications
- Project documents from external sources (such as customers, program consultants, or implementation contractors)
- Avista's iEnergy tracking system for nonresidential programs

Based on the initial review, Cadmus checked the distribution of program contributions with the overall program portfolio energy savings. The review provided insight into the sources for unit energy savings claimed for each program measure, along with sources for energy-savings algorithms, internal quality assurance, and quality control processes for large nonresidential sector projects.

Following this review, Cadmus designed a sample strategy to conduct the impact evaluation activities in four waves:

- Selected evaluation sample and requested project documentation from Avista
- Reviewed project documentation
- Prepared M&V plans for virtual and in-person site visits
- Performed virtual site visits using the Streem platform or in-person site visits and collected on-site data (such as trend data, photos, and operating schedules) [1]
- Calculated evaluated savings by measure using site visit findings
- Determined overall evaluated savings by applying realization rates to the total reported savings population

Sample Design

Cadmus conducted sampling in four waves for PY 2020 – PY 2021:

- Sample 1 included program data from January 2020 through June 2020
- Sample 2 included program data from July 2020 through December 2020
- Sample 3 included program data from January 2021 through June 2021
- Sample 4 included program data from July 2021 through December 2021

Cadmus initially estimated the total annual population size by reviewing the wave 1 population data and comparing it to PY 2018 – PY 2019 population data. We developed initial sample size targets to achieve 90% confidence and ±10% precision (90/10) for the estimated annual population across the PY 2020 – PY 2021 biennium, with a target of 90/20 by program. The first sample wave met one-quarter of the total biennial target for each program. After receiving the wave 2 population data, we revised the annual sample size targets and selected the wave 2 sample to bring the 2020 sample to half of the estimated biennium target within each program. Based on the completed 2020 sample, we then revised the 2021 sample targets to achieve the sample target for the biennium, completing half of the remaining sample in each wave.

For each activity wave, Cadmus developed a random sample of application by program (such as Site Specific other, shell measure, or Prescriptive HVAC). In the programs where individual projects represented a significant portion of the total savings in the program, we evaluated a census of the highest-savings applications as a certainty stratum. For noncertainty applications, we assigned random numbers within each stratum and developed a random sample. In some cases, our team evaluated one or more additional applications at the same location as another sampled application, as a convenience selection, if we could assess both applications in a single site visit.

[1] For more information about Streem: https://www.streem.com/platform-streem#platform-remote-video

Cadmus encountered challenges contacting customers to evaluate in each sample, primarily due to changes in participant business operations as a result of the COVID-19 pandemic. We pulled an additional backup sample for waves 2 and 4 using random sampling and recruited participants to meet each year's sample target.

Cadmus summed the evaluated savings from each of the sampled projects to calculate a realization rate by stratum and year and applied that realization rate to projects in the year's population in that stratum. We applied the project-specific evaluated savings for every project in the sample, regardless of whether it was a random, certainty, or convenience selection. To determine the evaluated savings and realization rates of each program over the biennium, we summed the annual evaluation results.

Table 7 summarizes the natural gas evaluation samples for Washington nonresidential Prescriptive programs. Overall, Cadmus sampled 25 Prescriptive applications at 22 unique sites. Of the sampled applications, we selected two for certainty review based on the savings scale, measure type, or location; 20 applications randomly; and three additional convenience applications at three sites based on location. There was no participation in the EnergySmart Grocer program in PY 2020 – PY 2021, as shown in Table 4. Table 7 shows the total number of unique application identification numbers sampled in each program.

Table 7. Biennial Washington Nonresidential Prescriptive Natural Gas Evaluation Sample

Program Type	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
HVAC	11	7,410	2%
Shell	7	7,493	2%
Food Service Equipment	7	6,108	1%
Nonresidential Prescriptive	**25**	**21,011**	**4%**

Table 8 summarizes the natural gas evaluation sample for the Washington nonresidential Site Specific program. Cadmus sampled nine Site Specific applications at nine unique sites. Of the sampled applications, we selected three for certainty review based on the scale of savings and six randomly.

Table 8. Biennial Washington Nonresidential Site Specific Natural Gas Evaluation Sample

Program	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
Site Specific	9	353,382	90%

Document Review

Cadmus requested and reviewed project documentation for each sampled application and prepared M&V plans to guide the site visits. Typically, project documentation included data entered into the iEnergy system, incentive application forms, calculation workbooks, invoices, equipment specification sheets, and Avista installation verification reports.

On-Site Verification

Cadmus performed site visits at five unique nonresidential locations to assess natural gas energy savings for seven unique Prescriptive and Site Specific measures from five different applications. During the site visits, we verified installed equipment types, make and model numbers, operating schedules, and set

points, as applicable. Our team used the project documentation review and on-site findings to adjust reported savings calculations, where necessary.

Remote Verification

Cadmus performed virtual site visits and verification calls at 23 unique nonresidential locations to assess natural gas energy savings for 37 unique Prescriptive and Site Specific measures from 25 different applications. We evaluated the remaining four applications through desk reviews that did not require participant outreach. Cadmus typically conducted virtual site visits using the Streem platform, which records video and audio. During the visits, the site contact conducted a detailed walkthrough to help us verify installed equipment types, make and model numbers, operating schedules, and set points, as applicable. Cadmus conducted some virtual visits using Microsoft Teams meetings with customers who were unable to access Streem or preferred using Teams. Verification calls involved a brief phone call or video call to confirm key details and any information that was missing in the project documentation. Our team used the project documentation review and on-site findings to adjust reported savings calculations, where necessary.

Nonresidential Evaluation Results

This section summarizes natural gas impact evaluation results for the nonresidential Prescriptive and Site Specific programs in PY 2020 – PY 2021.

Nonresidential Prescriptive Programs

Table 9 shows the reported and evaluated natural gas energy savings for Avista's nonresidential Prescriptive programs as well as realization rates for PY 2020 – PY 2021. Overall, the nonresidential Prescriptive programs achieved a 99% natural gas realization rate.

Table 9. Biennial Nonresidential Prescriptive Natural Gas Impact Findings

Program Type	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
HVAC	29,536	28,818	98%
Shell	9,869	10,031	102%
Food Service Equipment	53,412	53,412	100%
Nonresidential Prescriptive	**92,817**	92,261	**99%**

Of 25 evaluated applications across the biennium, Cadmus identified discrepancies for four, based on in-person and virtual site visits, verification calls, and project documentation reviews. Of those, we identified one discrepancy in PY 2020 and three in PY 2021. Table 10 summarizes reasons for discrepancies between reported and evaluated savings for applications evaluated in PY 2021. The 2020 report summarizes discrepancies found in PY 2020.

Table 10. PY 2021 Nonresidential Prescriptive Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
HVAC	2	↓	• Cadmus found that the installed furnaces for two applications were a lower capacity than reported.
Shell	1	↓	• Cadmus found that the insulated area of the building for one application was lower than reported.

Nonresidential Site Specific Program

Table 11 shows reported and evaluated natural gas energy savings for Avista's nonresidential Site Specific program for PY 2020 – PY 2021. Overall, the Site Specific program achieved a 104% natural gas realization rate.

Table 11. Biennial Nonresidential Site Specific Natural Gas Impact Findings

Program	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
Site Specific	391,479	407,691	104%

Of the nine evaluated applications, Cadmus identified discrepancies for seven, based on in-person and virtual site visits, verification calls, and project documentation review. Of those, we identified four discrepancies in PY 2020 and three in PY 2021. Table 12 summarizes reasons for discrepancies between reported and evaluated savings for applications evaluated in PY 2021. The 2020 report summarizes discrepancies found in PY 2020.

Table 12. PY 2021 Nonresidential Site Specific Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
HVAC	1	↑	• Cadmus updated the performance period heating degree days (HDD) in a billing regression analysis for one application to match the billing period dates rather than month-to-month HDD values.
New Construction	1	↓	• Cadmus updated the model inputs and re-ran the eQuest model for one application based on verified parameters, including a lower occupied heating setpoint, more aggressive temperature setbacks, and short hours of use. These updated parameters are consistent across the baseline and proposed models.
Other	1	↑	• Cadmus updated the billing analysis for one application to include more data from monthly gas bills for a more representative average.

Cadmus found that some M&V plans, pre-installation verifications, and installation verification reports relied on customer-provided photos and data because Avista staff could not safely visit the site due to the COVID-19 pandemic. It is likely that some of the discrepancies identified above may have been avoided had Avista been able to conduct thorough in-person inspections before and after the project to verify the baseline and installed equipment.

Nonresidential Conclusions and Recommendations

In PY 2020 – PY 2021, the nonresidential sector achieved total evaluated natural gas energy savings of 499,952 therms, with a combined realization rate of 103%. The nonresidential sector achieved 93% of its combined Prescriptive and Site Specific programs natural gas savings goal of 537,454 therms.

Although realization rates varied across projects, particularly within the Site Specific program, overall the nonresidential gas sector performed strongly in PY 2020 – PY 2021 relative to reported savings. With most projects Cadmus sampled for the evaluation, projects were well documented and verified savings matched reported savings.

Avista completed a transition from its previous InforCRM system to the new iEnergy system to track nonresidential energy efficiency applications and measures prior to the start of PY 2020 – PY 2021. The iEnergy system provides more detail than previously available, providing strong support for Cadmus' detailed and comprehensive evaluation. We encountered some challenges with inconsistent data in iEnergy report extracts (for example, reports with duplicated records) and worked with Avista's technical staff to resolve such issues. Avista continues to work with the iEnergy vendor to improve the system.

Cadmus offers the following conclusions and recommendations to improve the accuracy of reported savings and strengthen support for rigorous third-party evaluation:

- **Conclusion:** Cadmus evaluated a Site Specific new construction project that used an eQuest model to estimate energy savings. We verified the model inputs and found that many varied from the reported metrics, including occupied and unoccupied setpoints and setbacks, hot water and chilled water setpoints, and boiler parameters.
  - **Recommendation:** For projects using energy models to estimate savings, also review the control parameters during the IV process and ensure all inputs reviewed on site are consistent with the model's inputs. Develop a checklist for projects with energy models that includes each parameter that needs to be verified before conducting the inspection.
- **Conclusion:** Cadmus found that the billing analysis for one Site Specific "other" project estimated savings without a full year of billing data because the facility had changed ownership and operation less than one year before the project began. We found that the natural gas usage at the facility had seasonal variation influenced by seasonal production volume.
  - **Recommendation:** When conducting billing analysis for large industrial facilities that have variable production rates and utility consumption, request and review the facility's production data during the M&V process to identify any potential correlation with production.
- **Conclusion:** Cadmus found that the level of detail in IV reports varied. Many IV reports only mention that "equipment and quantities were verified," and photos sometimes show the

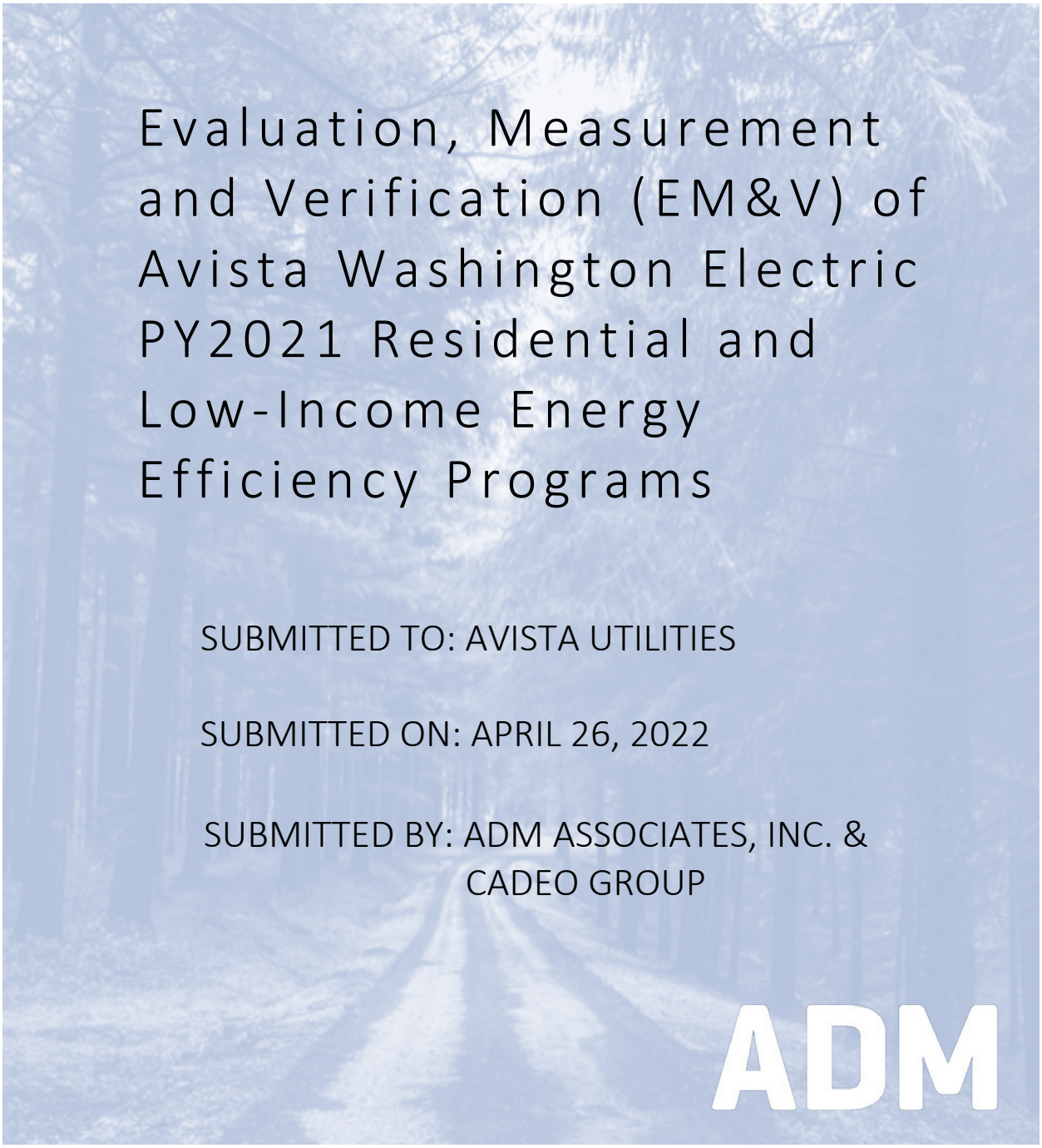
equipment only from a distance. We recommended including additional details in IV reports in PY 2019 and PY 2020, but did not observe additional detail in IV reports reviewed in PY 2021.

  - **Recommendation:** Provide more consistent documentation with Avista IV reports. All IV reports should include basic information explicitly stating the quantity and type of equipment found. For most projects, this would include nameplates, model numbers, and quantities.

- **Conclusion:** Cadmus found that Avista's iEnergy system recorded detailed inputs on some Prescriptive measures that were not previously tracked in InforCRM and are not currently used in the savings calculations.

Recommendation: Review deemed savings values for Prescriptive measures and consider opportunities to leverage the additional data now collected in iEnergy to calculate more accurate savings for each project. For example, HVAC furnace measures can use the exact AHRI efficiency rating collected in iEnergy instead of a typical average to calculate more precise savings without requiring additional data entry.

APPENDIX C –



Evaluation, Measurement and Verification (EM&V) of Avista Washington Electric PY2021 Residential and Low-Income Energy Efficiency Programs

SUBMITTED TO: AVISTA UTILITIES

SUBMITTED ON: APRIL 26, 2022

SUBMITTED BY: ADM ASSOCIATES, INC. & CADEO GROUP

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1. Executive Summary

This report is a summary of the Residential and Low-Income Electric Evaluation, Measurement, and Verification (EM&V) effort of the 2021 program year (PY2021) portfolio of programs for Avista Corporation (Avista) in the Washington service territory. The evaluation was administered by ADM Associates, Inc. and Cadeo Group, LLC (herein referred to as the "Evaluators").

1.1 Savings & Cost-Effectiveness Results

The Evaluators conducted an impact evaluation for Avista's Residential and Low-Income programs for PY2021. The Residential portfolio savings amounted to 1,346,955kWh with a 104.90% realization rate. The Low-Income portfolio savings amounted to 306,466 kWh with a 100.63% realization rate. The Evaluators summarize the Residential portfolio verified savings in Table 1-1 and the Low-Income portfolio verified savings in Table 1-2 below.

The Residential portfolio reflects a TRC value of 1.18 and a UCT value of 1.98. The Low-Income portfolio reflects a TRC value of 0.64 and a UCT value of 0.37, leading to a total Residential and Low-Income TRC of 0.98 and a UCT of 1.13. Table 1-3 summarizes the evaluated TRC and UCT values with each the Residential and Low-Income portfolios.

Table 1-1: Residential Verified Impact Savings by Program

Program	Expected Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate	Total Costs
Water Heat	96,778	103,798	107.25%	$41,940.17
HVAC	555,073	535,629	96.50%	$357,275.42
Shell	354,395	390,726	110.25%	$588,932.33
ENERGY STAR Homes	102,689	90,133	87.77%	$82,763.97
Small Home & MF Weatherization	139,894	199,562	142.65%	$256,137.19
Appliances	35,225	30,506	86.60%	$19,493.80
AeroBarrier	556	-	-	$1,350.08
Total Res	**1,284,610**	**1,346,955**	**104.90%**	**$1,347,892.96**

Table 1-2: Low-Income Verified Impact Savings by Program

Program	Expected Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate	Total Costs
Low-Income	244,279	240,933	98.63%	$1,402,827.76
CEEP	60,259	65,533	108.75%	$515,011.59
Total Low-Income	**304,538**	**306,466**	**100.63%**	**$1,917,839.35**

Table 1-3: Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$3,465,419	$2,935,143	1.18	$3,109,710	$1,568,428	1.98
Low Income	$1,113,773	$1,742,676	0.64	$645,856	$1,742,676	0.37
Total	**$4,579,192**	**$4,677,819**	**0.98**	**$3,755,566**	**$3,311,105**	**1.13**

Table 1-4 summarizes the electric programs offered to residential and low-income customers in the Washington Avista service territory in PY2021 as well as the Evaluators' evaluation tasks and impact methodology for each program.

Table 1-4: Impact Evaluation Activities by Program and Sector

Sector	Program	Database Review	Survey Verification	Impact Methodology
Residential	Water Heat	✓	✓	RTF UES
Residential	HVAC	✓	✓	RTF UES
Residential	Shell	✓	✓	RTF UES
Residential	ENERGY STAR® Homes	✓		RTF UES
Residential	Small Home & MF Weatherization	✓	✓	RTF UES
Residential	Appliances	✓	✓	RTF UES
Residential	AeroBarrier			No evaluation completed for PY2021
Low-Income	Low-Income	✓		Avista TRM
Low-Income	Community Energy Efficiency Program (CEEP)	✓		Avista TRM

*This program was not deployed for the 2021 program year. Evaluation of this program will commence in 2021.

1.2 Conclusions and Recommendations

The following section details the Evaluators' conclusions and recommendations for each the Residential Portfolio and Low-Income Portfolio program evaluations.

1.2.1 Conclusions

The following section details the Evaluator's findings resulting from the program evaluations for each the Residential Portfolio and Low-Income Portfolio.

1.2.1.1 Residential Programs

The Evaluators provide the following conclusions regarding Avista's Residential electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 1,346,955 kWh with a realization rate of 105%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio's cost-effectiveness. The resulting TRC value for this sector is

1.18 while the UCT value is 1.98. Further details on cost-effectiveness methodology can be found in Appendix C.

- The Residential Portfolio impact evaluation resulted in a realization rate of 105% due to slight differences between the Avista TRM categories and the appropriately assigned RTF UES categories for each measure. The Evaluators note several instances in which the Avista TRM value reflects an average of a range of RTF UES values for the electric measures offered in the Washington electric service territory. The values had been averaged across heating zones, water heater storage tank sizes, equipment efficiency values, and fuel types. The Evaluators, instead of applying these averages, verified the appropriate RTF UES values for each rebate for a sample of rebates in each program and applied the resulting realization rates to the population of rebates for each program. This led to a higher realization rate, as some rebates reflected RTF savings values higher than the average for that measure.
- The Evaluators conducted verification surveys for a random sample of customers who had participated in the residential prescriptive rebates programs. The Evaluators calculated in-service rates for measures in which in-service rates are not typically 100% (water heaters, furnaces, clothes washers and dryers, smart thermostats, etc). The Evaluators found that all surveyed measures responses indicated in-service rates of 92-100%. These values were applied to impact analysis results to estimate verified savings through the programs.
- The Small Home & MF Weatherization Program, which contributes 15% of the expected savings, resulted in a realization rate of 143% whereas each of the other programs resulted in a combined 100% realization rate. The Shell Program contributed to a 5% increase in the overall residential sector, which displayed a realization rate of 105%.
- The Evaluators found the CC&B tracking database consistently reflected values indicated on randomly sampled documents.
- In the HVAC Program, the E Smart Thermostat DIY with Electric Heat and E Smart Thermostat Paid Install with Electric Heat realization rates are lower than 100% because the Avista TRM uses an average of retail and direct install savings values as well as an average across heating types, while the Evaluators assigned the appropriate RTF UES value for each installation type and heating zone. The appropriate categories in the RTF led to a lower-than-expected savings and higher than expected savings across individual projects within these measures, with an overall downward adjustment for these measures.
- In the HVAC Program, the Evaluators verified smart thermostat model specifications through the ENERGY STAR qualified products list to verify if the thermostat met all conditions required from the RTF measure specifications. The Evaluators verified that 6 of the 68 thermostats did not meet RTF measure specifications (6% of sampled thermostat rebates). The 6% of thermostats verified to not meet the conditions had lacked occupancy detection and/or geofencing capabilities, a specification required by the RTF.
- In the Shell Program, the Evaluators imputed home type and space heating type for a large number of sampled rebates, as the tracking database does not contain values for these characteristics or remain outdated. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information.

- In the ENERGY STAR Homes Program, the Evaluators found that realization rates differed from 100% due to application of heating zone and cooling zone via the RTF, which the Avista TRM lacks. In addition, the realization for the E ENERGY STAR® Home – Manufactured, Gas & Electric measure is low because the expected savings employed an additive methodology between a gas-heated home and an electric-heated home for the electric savings. However, the Evaluators reviewed the RTF and determined manufactured home electric savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. Therefore, the Evaluators assigned electric savings from the RTF associated with a fully natural gas-heated home at 43 kWh saved per year. Finally, two projects were verified to have natural gas furnace space heating for the home and therefore verified savings did not include full electric savings. This led to two projects displaying 1.30% realization for electric savings, leading to a large downward adjustment in the population realization rates.
- In the Small Home & MF Weatherization Program, the Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate “Multifamily” home type. Rather, the current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”.
- In the Appliance Program, the Evaluators found that 3 of the sampled clothes washer projects did not qualify due to minimum volume requirements specified by the RTF. The Evaluators also found that the Avista TRM applied RTF savings from the “Front Load” measure description for clothes washers. However, the Evaluators found that 3 of the clothes washer equipment were “Top loading”, which the RTF assigns significantly lower annual savings. This change in addition to the disqualification of 3 rebates led to a downward adjustment in realization rate for this program.
- The Evaluators did not complete an impact analysis for the AeroBarrier Program. Therefore, the AeroBarrier program’s savings is not included in the portfolio expected savings total or the portfolio verified savings total displayed in Table 1-1. A full impact analysis will be completed for the program in PY2022.

1.2.1.2 Low-Income Programs

The Evaluators provide the following conclusions regarding Avista’s Residential electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 306,466 kWh with a realization rate of 101%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio’s cost-effectiveness. The resulting TRC value for this sector is 0.64 while the UCT value is 0.37. These values are expected, as the Low-Income portfolio is not expected to meet cost-effectiveness but are implemented in order to provide energy efficiency benefits to low-income customers. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Low-Income Portfolio impact evaluation resulted in a 100% realization rate. The Low-Income Program and CEEP individually resulted in a 99% and 109% realization, respectively. The realization rates for each program deviate from 100% due to differences between the Avista

TRM values applied to the quantities displayed in the tracking data. The Evaluators note several instances in which the tracking data displayed correct quantity values, but the expected savings calculated for the project did not indicate Avista TRM values were applied properly to the quantities. The Evaluators applied the correct Avista TRM values for the Low-Income Program and CEEP. For the Low-Income Program, the Evaluators applied a realization rate from a sample of rebates after verifying documentation for quantity and efficiency of measures.

- The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolate each unique measure. However, participation for the Low-Income program resulted in a small number of customers with isolated measures and therefore the Evaluators conducted a whole-home billing analysis for all the electric measures combined in the Low-Income in order to estimate savings for the average household participating in the program, across all measures. The Evaluators found a realization rate of 65% for all electric measures in the program, which is significantly lower than the realization rate of 99% from the desk review. However, due to requirements for measure-level verified savings for cost-effectiveness testing, the Evaluators designated the desk review savings as verified.
- In the Low-Income Program, The Evaluators found the LED bulbs unit-level savings were inaccurately referenced. Avista TRM specifies 1 kWh per bulb, while expected savings uses 9 kWh savings per bulb, leading to 11% realization for LED bulb projects under the program.
- CEEP contained 17 unique customers across all measures. Due to the requirement of a sufficient number of pre/post billing month and the requirement that customers do not participate in more than one program, the Evaluators determined that a billing analysis was not feasible. Instead, verified savings was estimated using Avista TRM values.
- In CEEP, the Evaluators note that of the 17 projects completed in CEEP, the three conversion projects' and one LED project's expected savings did not align with the expected savings indicated in the Avista TRM, leading to significantly low realization rate for these projects. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values where appropriate to the documented number of equipment indicated in the documentation.
- In addition, the two line voltage thermostat measures rebated through CEEP indicated verified savings approximately 56% of the assigned expected savings. These measures are not included in the Avista TRM and therefore the Evaluators used RTF line voltage savings for this measure. Although the above adjustments decrease the realization rates for the measures mentioned, the dominant measures indicate 100% or more realization (attic insulation, floor insulation, and air infiltration measures), leading to a 108% realization rate for CEEP overall.

1.2.2 Recommendations

The following section details the Evaluator's recommendations resulting from the program evaluations for each the Residential Portfolio and Low-Income Portfolio.

1.2.2.1 Residential Programs

The Evaluators offer the following recommendations regarding Avista's Residential electric programs:

- The Evaluators imputed home type and space heating type for a large number of sampled rebates, as the tracking database does not contain values for these characteristics or remain outdated. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information. The Evaluators recommend verifying home type and space heating type during rebate application approval in order to apply correct savings values to each project.
- In addition, the Evaluators note that the current program rebate applications for the Small Home & MF Weatherization Program do not provide an option to indicate “Multifamily” home type. For the Small Home & MF Weatherization Program, project savings largely depends on the home type (single family vs. multifamily vs. manufactured). The current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”. The Evaluators recommend including an option for “Multifamily” in order to consistently apply RTF savings for each of the measures. The Evaluators recommend Avista verify home type prior to applying Avista TRM values in order to ensure proper categorization of measure savings.
- The Evaluators note several instances in which the web-based rebate data indicates the household has electric space heating, but all other sources (project data and document verification) indicate natural gas space heating, and vice versa. The Evaluators recommend updating data collection standards in order for all sources of information to reflect the same values as the project documentation.
- The Evaluators found that space heating type and water heating type indicated on the household’s characteristics in the CC&B database did not consistently match the values indicated on the rebate application forms. This may be due to lack of customer knowledge about the household, or due to change in space and/or water heating type without Avista knowledge. The Evaluators recommend verifying space and water heating values with the customer and updating the CC&B database to reflect the most updated information for the home.
- The Evaluators found that many projects claimed under the Small Home & MF Weatherization Program exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Shell Program.
- The ENERGY STAR Homes rebates depend on heating zone and cooling zone specifications to calculate RTF savings. In addition, the savings applied largely depends on space heating type. The program realization rate differs from 100% due to changes in heating zone/cooling zone savings assignment as well as verified space heating type (electric vs. natural gas). The Evaluators recommend verifying space heating type prior to claiming savings for each ENERGY STAR homes project and specifying separate savings for heating zone and cooling zone in the Avista TRM.
- A number of smart thermostat rebates included equipment that did not meet RTF measure specifications to receive verified savings through the RTF workbooks, which the Avista TRM values are drawn from. The Evaluators recommend providing a qualified product list for customers to ensure purchased smart thermostat meets program requirements. In addition, the Evaluators recommend Avista verify each program rebate to verify qualifications after rebates are submitted.
- In the Appliances Program, the Evaluators found that the Avista TRM applied RTF savings from the “Front Load” measure description for clothes washers. However, the Evaluators found that 3

of the clothes washer equipment were “Top loading”, which the RTF assigns significantly lower annual savings. This change in addition to the disqualification of 3 rebates led to a downward adjustment in realization rate for this program. The Evaluators recommend adding “top loading” clothes washers to the Avista TRM and applying savings for those measures appropriately.

- The Avista TRM assigns the savings values for water heaters of any size. During document review, the Evaluators found most of the water heaters to have a storage tank under 55 gallons, which has a higher savings value in the RTF than water heaters with unknown tank sizes (larger systems have a more stringent code baseline). The Evaluators applied the RTF UES value for the associated tank size and tier found for each model number in the sampled rebates. These changes led to the high realization rate for the E Heat Pump Water Heater measure in the Water Heat Program. The Evaluators recommend updating the Avista TRM value for this measure based on actual tank size, in addition to collecting information on the tank size of the measure in the rebate applications.
- The Evaluators note that the realization for the E ENERGY STAR® Home – Manufactured, Gas & Electric measure is low because the Avista TRM savings was employed using an additive methodology between a gas-heated home and an electric-heated home for the electric savings. However, the Evaluators reviewed the RTF and determined manufactured home electric savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. The Evaluators recommend adjusting Avista TRM electric savings for this measure to reflect the RTF values associated with a fully natural gas-heated home at 43 kWh saved per year.

1.2.2.2 Low-Income Programs

The Evaluators offer the following recommendations regarding Avista's Low-Income electric programs:

- The Evaluators note that most deviations from 100% realization rate is due to differences between the limited measure category options Avista TRM values and the more detailed categories referencing heating zone, cooling zone, heating type, and bulb types present in the RTF. The Evaluators recommend that Avista reference the more detailed RTF measures when calculating expected savings for the programs.
- The Evaluators reviewed the project documentation provided by Avista and identified conflicting square footage or number of units between the aggregated project data from the expected savings calculated for each project. The Evaluators found very few instances in which the tracking data quantity differed from the quantity displayed in sampled documentation and invoices. The Evaluators recommend providing corrections to the application of Avista TRM values to tracking data quantity.
- The Evaluators note that of the 17 projects completed in CEEP, the three conversion projects' and one LED project's expected savings did not align with the expected savings indicated in the Avista TRM, leading to significantly low realization rate for these projects. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values where appropriate to the documented number of equipment indicated in the documentation. The Evaluators recommend that Avista apply savings values consistent with the Avista TRM or the RTF when calculating expected savings.

2. General Methodology

The Evaluators performed an impact evaluation on each of the programs summarized in Table 1-4. The Evaluators used the following approaches to calculate energy impact defined by the International Performance Measurement and Verification Protocols (IPMVP)[1] and the Uniform Methods Project (UMP)[2]:

- Simple verification (web-based surveys)
- Document verification (review project documentation)
- Deemed savings (RTF UES and Avista TRM values)
- Whole facility billing analysis (IPMVP Option C)

The Evaluators completed the above impact tasks for each the electric impacts and the natural gas impacts for projects completed in the Washington Avista service territory.

The M&V methodologies are program-specific and determined by previous Avista evaluation methodologies as well as the relative contribution of a given program to the overall energy efficiency impacts. Besides drawing on IPMVP, the Evaluators also reviewed relevant information on infrastructure, framework, and guidelines set out for EM&V work in several guidebook documents that have been published over the past several years. These include the following:

- Northwest Regional Technical Forum (RTF)[3]
- National Renewable Energy Laboratory (NREL), United States Department of Energy (DOE) The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures, April 2013[4]
- International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization (EVO) with sponsorship by the U.S. Department of Energy (DOE)[5]

The Evaluators kept data collection instruments, calculation spreadsheets, and monitored/survey data available for Avista records.

2.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators have provided a glossary of terms to follow:

- **Deemed Savings** – An estimate of an energy savings outcome (gross savings) for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources

[1] https://www.nrel.gov/docs/fy02osti/31505.pdf
[2] https://www.nrel.gov/docs/fy18osti/70472.pdf
[3] https://rtf.nwcouncil.org/measures
[4] Notably, The Uniform Methods Project (UMP) includes the following chapters authored by ADM. Chapter 9 (Metering Cross-Cutting Protocols) was authored by Dan Mort and Chapter 15 (Commercial New Construction Protocol) was Authored by Steven Keates.
[5] Core Concepts: International Measurement and Verification Protocol. EVO 100000 – 1:2016, October 2016.

and analytical methods that are widely accepted for the measure and purpose and (b) are applicable to the situation being evaluated.

- **Expected Savings** – Calculated savings used for program and portfolio planning purposes.
- **Adjusted Savings** – Savings estimates after database review and document verification has been completed using deemed unit-level savings provided in the Avista TRM. It adjusts for such factors as data errors and installation rates.
- **Verified Savings** – Savings estimates after the unit-level savings values have been updated and energy impact evaluation has been completed, integrating results from billing analyses and appropriate RTF UES and Avista TRM values.
- **Gross Savings** – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, regardless of why they participated.
- **Free Rider** – A program participant who would have implemented the program measure or practice in absence of the program.
- **Net-To-Gross** – A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.
- **Net Savings** – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, with adjustments to remove savings due to free ridership.
- **Non-Energy Benefits** – Quantifiable impacts produced by program measures outside of energy savings (comfort, health and safety, reduced alternative fuel, etc).
- **Non-Energy Impacts** – Quantifiable impacts in energy efficiency beyond the energy savings gained from installing energy efficient measures (reduced cost for operation and maintenance of equipment, reduced environmental and safety costs, etc).

2.2 Summary of Approach

This section presents our general cross-cutting approach to accomplishing the impact evaluation of Avista's Residential and Low-Income programs listed in Table 1-4. The Evaluators start by presenting our general evaluation approach. This chapter is organized by general task due to several overlap across programs. Section 3.3 describes the Evaluators' program-specific residential impact evaluation methods and results in further detail and Section 4.1 describes the Evaluator's program-specific low-income impact evaluation methods and results.

The Evaluators outline the approach to verifying, measuring, and reporting the residential portfolio impacts as well as cost-effectiveness and summarizing potential program and portfolio improvements. The primary objective of the impact evaluation is to determine ex-post verified net energy savings. On-site verification and equipment monitoring was not conducted during this impact evaluation due to stay-at-home orders due to the COVID19 pandemic.

Our general approach for this evaluation considers the cyclical feedback loop among program design, implementation, and impact evaluation. Our activities during the evaluation estimate and verify annual energy savings and identify whether a program is meeting its goals. These activities are aimed to provide guidance for continuous program improvement and increased cost effectiveness for the 2021 and 2021 program years.

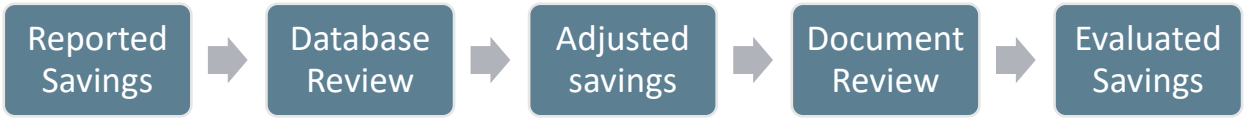
The Evaluators employed the following approach to complete impact evaluation activities for the programs. The Evaluators define two major approaches to determining net savings for Avista's programs:

- A *Deemed Savings* approach involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. These prescriptive savings may also include an adjustment for certain measures, such as lighting measures in which site operating hours may differ from RTF values.
- A *Billing Analysis* approach involves estimating energy savings by applying a linear regression to measured participant energy consumption utility meter billing data. Billing analyses included billing data from nonparticipant customers. This approach does not require on-site data collection for model calibration. This approach aligns with the IPMVP Option C.

The Evaluators accomplished the following quantitative goals as part of the impact evaluation:

- Verify savings with 10% precision at the 90% confidence level;
- Where appropriate, apply the RTF to verify measure impacts; and
- Where available data exists, conduct billing analysis with a suitable comparison group to estimate measure savings.

For each program, the Evaluators calculated adjusted savings for each measure based on the Avista TRM and results from the database review. The Evaluators calculated verified savings for each measure based on the RTF UES, Avista TRM, or billing analysis in combination with the results from document review. For the HVAC, Water Heat, and Fuel Efficiency programs, the Evaluators also applied in-service rates (ISRs) from verification surveys.



The Evaluators assigned methodological rigor level for each measure and program based on its contribution to the portfolio savings and availability of data.

The Evaluators analyzed billing data for all electric measure participants in the HVAC and Low-Income programs. The Evaluators applied billing analysis results to determine evaluated savings only for measures where savings could be isolated (that is, where a sufficient number of participants could be identified who installed only that measure). Program-level realization rates for the HVAC, Water Heat, and Fuel Efficiency programs incorporate billing analysis results for some measures.

2.2.1 Database Review

At the outset of the evaluation, the Evaluators reviewed the databases to ensure that each program tracking database conforms to industry standards and adequately tracks key data required for evaluation.

Measure-level net savings were evaluated primarily by reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied using the Avista TRM. The Evaluators then aggregated and cross-check program and measure totals.

The Evaluators reviewed program application documents for a sample of incented measures to verify the tracking data accurately represents the program documents. The Evaluators ensured the home installed measures that meet or exceed program efficiency standards.

2.2.2 Verification Methodology

The Evaluators verified a sample of participating households for detailed review of the installed measure documentation and development of verified savings. The Evaluators verified tracking data by reviewing invoices and surveying a sample of participant customer households. The Evaluators also conducted a verification survey for program participants.

The Evaluators used the following equations to estimate sample size requirements for each program and fuel type. Required sample sizes were estimated as follows:

Equation 2-1: Sample Size for Infinite Sample Size

$$n = \left(\frac{Z \times CV}{d}\right)^2$$

Equation 2-2: Sample Size for Finite Population Size

$$n_0 = \frac{n}{1 + \left(\frac{n}{N}\right)}$$

Where,

- n = Sample size
- Z = Z-value for a two-tailed distribution at the assigned confidence level.
- CV = Coefficient of variation
- d = Precision level
- N = Population

For a sample that provides 90/10 precision, *Z* = 1.645 (the critical value for 90% confidence) and *d* = 0.10 (or 10% precision). The remaining parameter is *CV*, or the expected coefficient of variation of measures for which the claimed savings may be accepted. A *CV* of .5 was assumed for residential programs due to the homogeneity of participation[6], which yields a sample size of 68 for an infinite population. Sample sizes were adjusted for smaller populations via the method detailed in Equation 2-2.

The following sections describe the Evaluator's methodology for conducting document-based verification and survey-based verification.

[6] Assumption based off California Evaluation Framework:

https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/EE_and_Energy_Savings_Assist/CAEvaluationFramework.pdf

2.2.2.1 Document-Based Verification

The Evaluators requested rebate documentation for a subset of participating customers. These documents included invoices, rebate applications, pictures, and AHRI certifications for the following programs.

- Water Heat Program
- HVAC Program
- Shell Program
- ENERGY STAR® Homes Program
- Small Home & MF Weatherization Program
- Prescriptive appliances rebates
- Low-Income Program
- Community Energy Efficiency Program

This sample of documents was used to cross-verify tracking data inputs. In the case the Evaluators found any deviations between the tracking data and application values, the Evaluators reported and summarized those differences in the Database Review sections presented for each program in Section 3.3 and Section 4.1.

The Evaluators developed a sampling plan that achieves a sampling precision of ±10% at 90% statistical confidence – or "90/10 precision" – to estimate the percentage of projects for which the claimed savings are verified or require some adjustment.

The Evaluators developed the following samples for each program's document review using Equation 2-1 and Equation 2-2. The Evaluators ensured representation in each state and fuel type for each measure.

Table 2-1: Document-based Verification Samples and Precision by Program

Sector	Program	Electric Population	Sample (With Finite Population Adjustment)*	Precision at 90% CI
Residential	Water Heat	109	42	±10.0%
Residential	HVAC	648	64	±9.8%
Residential	Shell	386	66	±9.2%
Residential	ENERGY STAR® Homes	51	31	±9.3%
Residential	Small Home & MF Weatherization	93	43	±9.3%
Residential	Appliances	479	61	±9.9%
Residential	AeroBarrier	N/A	N/A	N/A
Low-Income	Low-Income	408	87	±7.8%
Low-Income	CEEP	17	17	±0.0%

*Assumes sample size of 68 for an infinite population, based on *CV* (coefficient of variation) = 0.5, *d* (precision) = 10%, *Z* (critical value for 90% confidence) = 1.645.

The table above represents the number of rebates in both Washington and Idaho territories. The Evaluators ensured representation of state and fuel type in the sampled rebates for document verification.

2.2.2.2 Survey-Based Verification

The Evaluators conducted survey-based verification for the Water Heat Program and HVAC Program. The primary purpose of conducting a verification survey is to confirm that the measure was installed and is still currently operational and whether the measure was early retirement or replace-on-burnout.

The Evaluators summarize the final sample sizes shown in Table 2-2 for the Water Heat and HVAC for the Washington Electric Avista projects. The Evaluators developed a sampling plan that achieved a sampling precision of ±6.50% at 90% statistical confidence for ISRs estimates at the measure-level during web-based survey verification.

Table 2-2: Survey-Based Verification Sample and Precision by Program

Sector	Program	Population	Respondents	Precision at 90% CI
Residential	Water Heat	109	8	±28.1%*
Residential	HVAC	648	77	±8.8%
Residential	Small Home & MF Weatherization	93	6	±32.7%*
Residential	Appliances	479	86	±8.0%
Total		**1,329**	**177**	**±5.8%**

*These programs did not achieve 90/10 precision. However, responses indicated 100% ISRs

The Evaluators implemented a web-based survey to complete the verification surveys. The Evaluators to reach the 90/10 precision goal. The findings from these activities served to estimate ISRs for each measure surveyed. These ISRs were applied to verification sample desk review rebates towards verified savings, which were then applied to the population of rebates. The measure-level ISRs resulting from the survey-based verification are summarized in Section 3.1.

2.2.3 Impact Evaluation Methodology

The Evaluators employed the following approach to complete impact evaluation activities for the programs. The Evaluators define two major approaches to determining net savings for Avista's programs:

- Deemed Savings
- Billing Analysis (IPMVP Option C)

In the following sections, the Evaluators summarize the general guidelines and activities followed to conduct each of the above analyses.

2.2.3.1 Deemed Savings

This section summarizes the deemed savings analysis method the Evaluators employed for the evaluation of a subset of measures for each program. The Evaluators completed the validation for specific measures across each program using the RTF unit energy savings (UES) values, where available. The Evaluators ensured the proper measure unit savings were recorded and used in the calculation of Avista's ex-ante measure savings. The Evaluators requested and used the technical reference manual Avista employed during calculation of ex-ante measure savings (Avista TRM). The Evaluators documented any cases where recommend values differed from the specific unit energy savings workbooks used by Avista.

In cases where the RTF has existing unit energy savings (UES) applicable to Avista's measures, the Evaluators verified the quantity and quality of installations and apply the RTF's UES to determine verified savings.

2.2.3.2 Billing Analysis

This section describes the billing analysis methodology employed by the Evaluators as part of the impact evaluation and measurement of energy savings for measures with sufficient participation. The Evaluators performed billing analyses with a matched control group and utilized a quasi-experimental method of producing a post-hoc control group. In program designs where treatment and control customers are not randomly selected at the outset, such as for downstream rebate programs, quasi-experimental designs are required.

For the purposes of this analysis, a household is considered a treatment household if it has received a program incentive. Additionally, a household is considered a control household if the household has not received a program incentive. To isolate measure impacts, treatment households are eligible to be included in the billing analysis if they installed only one measure during the 2019 and 2021 program years. Isolation of individual measures are necessary to provide valid measure-level savings. Households that installed more than one measure may display interactive energy savings effects across multiple measures that are not feasibly identifiable. Therefore, instances where households installed isolated measures are used in the billing analyses. In addition, the pre-period identifies the period prior to measure installation while the post-period refers to the period following measure installation.

The Evaluators utilized propensity score matching (PSM) to match nonparticipants to similar participants using pre-period billing data. PSM allows the evaluators to find the most similar household based on the customers' billed consumption trends in the pre-period and verified with statistical difference testing.

After matching based on these variables, the billing data for treatment and control groups are compared, as detailed in IPMVP Option C. The Evaluators fit regression models to estimate weather-dependent daily consumption differences between participating customer and nonparticipating customer households.

Cohort Creation

The PSM approach estimates a propensity score for treatment and control customers using a logistic regression model. A propensity score is a metric that summarizes several dimensions of household characteristics into a single metric that can be used to group similar households. The Evaluators created a post-hoc control group by compiling billing data from a subset of nonparticipants in the Avista territory to compare against treatment households using quasi-experimental methods. This allowed the Evaluators to select from a large group of similar households that have not installed an incented measure. With this information, the Evaluators created statistically valid matched control groups for each measure via seasonal pre-period usage. The Evaluators matched customers in the control group to customers in the treatment group based on nearest seasonal pre-period usage (e.g., summer, spring, fall, and winter) and exact 3-digit zip code matching (the first three digits of the five-digit zip code). After matching, the Evaluators conducted a *t*-test for each month in the pre-period to help determine the success of PSM.

While it is not possible to guarantee the creation of a sufficiently matched control group, this method is preferred because it is likely to have more meaningful results than a treatment-only analysis. Some

examples of outside variables that a control group can sufficiently control for are changes in economies and markets, large-scale social changes, or impacts from weather-related anomalies such as flooding or hurricanes. This is particularly relevant in 2021 due to COVID-19 related lockdowns and restrictions.

After PSM, the Evaluators ran the following regression models for each measure:

- Fixed effect Difference-in-Difference (D-n-D) regression model (recommended in UMP protocols)[7]
- Random effects post-program regression model (PPR) (recommended in UMP protocols)
- Gross billing analysis (treatment only)

The second model listed above (PPR) was selected because it had the best fit for the data, identified using the adjusted R-squared. Further details on regression model specifications can be found below.

Data Collected

The following lists the data collected for the billing analysis:

1. Monthly billing data for program participants (treatment customers)
2. Monthly billing data for a group of non-program participants (control customers)
3. Program tracking data, including customer identifiers, address, and date of measure installation
4. National Oceanic and Atmospheric Administration (NOAA) weather data between January 1, 2020 and December 31, 2022)
5. Typical Meteorological Year (TMY3) data

Billing and weather data were obtained for program year 2021 and for one year prior to measure install dates (2020).

Weather data was obtained from the nearest weather station with complete data during the analysis years for each customer by mapping the weather station location with the customer zip code.

TMY weather stations were assigned to NOAA weather stations by geocoding the minimum distance between each set of latitude and longitude points. This data is used for extrapolating savings to long-run, 30-year average weather.

Data Preparation

The following steps were taken to prepare the billing data:

1. Gathered billing data for homes that participated in the program.
2. Excluded participant homes that also participated in the other programs, if either program disqualifies the combination of any other rebate or participation.
3. Gathered billing data for similar customers that did not participate in the program in evaluation.
4. Excluded bills missing address information.
5. Removed bills missing fuel type/Unit of Measure (UOM).
6. Removed bills missing usage, billing start date, or billing end date.

[7] National Renewable Energy Laboratory (NREL) Uniform Methods Project (UMP) Chapter 17 Section 4.4.7.

7. Remove bills with outlier durations (<9 days or >60 days).
8. Excluded bills with consumption indicated to be outliers.
9. Calendarized bills (recalculates bills, usage, and total billed such that bills begin and end at the start and end of each month).
10. Obtained weather data from nearest NOAA weather station using 5-digit zip code per household.
11. Computed Heating Degree Days (HDD) and Cooling Degree Days (CDD) for a range of setpoints. The Evaluators assigned a setpoint of 65°F for both HDD and CDD. The Evaluators tested and selected the optimal temperature base for HDDs and CDDs based on model *R*-squared values.
12. Selected treatment customers with only one type of measure installation during the analysis years and combined customer min/max install dates with billing data (to define pre- and post-periods).
13. Restricted to treatment customers with install dates in specified range (typically January 1, 2021 through June 30, 2021) to allow for sufficient post-period billing data.
14. Restricted to control customers with usage less than or equal to two times the maximum observed treatment group usage. This has the effect of removing control customers with incomparable usage relative to the treatment group.
15. Removed customers with incomplete post-period bills (<4 months).
16. Removed customers with incomplete pre-period bills.
17. Restricted control customers to those with usage that was comparable with the treatment group usage.
18. Created a matched control group using PSM and matching on pre-period seasonal usage and zip code.

Regression Models

The Evaluators ran the following models for matched treatment and control customers for each measure with sufficient participation. For net savings, the Evaluators selected either Model 1 or Model 2. The model with the best fit (highest adjusted R-squared) was selected. The Evaluators utilized Model 3 to estimate gross energy savings.

Model 1: Fixed Effects Difference-in-Difference Regression Model

The following equation displays the first model specification to estimate the average daily savings due to the measure.

Equation 2-3: Fixed Effects Difference-in-Difference (D-n-D) Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Post)_{it} + \beta_2(Post \times Treatment)_{it} + \beta_3(HDD)_{it} + \beta_4(CDD)_{it} + \beta_5(Post \times HDD)_{it} + \beta_6(Post \times CDD)_{it} + \beta_7(Post \times HDD \times Treatment)_{it} + \beta_8(Post \times CDD \times Treatment)_{it} + \beta_9(Month)_t + \beta_{10}(Customer\ Dummy)_i + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period

- ADC_{it} = Average daily usage reading *t* for household *i* during the post-treatment period
- $Post_{it}$ = A dummy variable indicating pre- or post-period designation during period *t* at home *i*
- $Treatment_i$ = A dummy variable indicating treatment status of home *i*
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- $Month_t$= A set of dummy variables indicating the month during period *t*
- $Customer\ Dummy_i$ = a customer-specific dummy variable isolating individual household effects
- ε_{it} = The error term
- α_0= The model intercept
- β_{1-10} = Coefficients determined via regression

The Average Daily Consumption (ADC) is calculated as the total monthly billed usage divided by the duration of the bill month. β_2 represents the average change in daily baseload in the post-period between the treatment and control group and β_7 and β_8 represent the change in weather-related daily consumption in the post-period between the groups. Typical monthly and annual savings were estimated by extrapolating the β_7 and β_8 coefficients with Typical Meteorological Year (TMY) HDD and CDD data. However, in the case of gas usage, only the coefficient for HDD is utilized because CDDs were not included in the regression model.

The equation below displays how savings were extrapolated for a full year utilizing the coefficients in the regression model and TMY data. TMY data is weighted by the number of households assigned to each weather station.

Equation 2-4: Savings Extrapolation

$$Annual\ Savings = \beta_2 * 365.25 + \beta_7 * TMY\ HDD + \beta_8 * TMY\ CDD$$

Model 2: Random Effects Post-Program Regression Model

The following equation displays the second model specification to estimate the average daily savings due to the measure. The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post-program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the treatment and control customers; in particular, energy use in calendar month *t* of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between treatment and control customers will be reflected in the differences in their past energy use, which is highly correlated with their current energy use. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

The model specification is as follows:

Equation 2-5: Post-Program Regression (PPR) Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Treatment)_i + \beta_2\,(PreUsage)_i + \beta_3\,(PreUsageSummer)_i + \beta_4(PreUsageWinter)_i + \beta_5(Month)_t + \beta_6(Month \times PreUsage)_{it} + \beta_7(Month \times PreUsageSummer_{)it} + \beta_8(Month \times PreUsageWinter)_{it} + \beta_9(HDD)_{it} + \beta_{10}(CDD)_{it} + \beta_{11}(Treatment \times HDD)_{it} + \beta_{12}(Treatment \times CDD)_{it} + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period
- ADC_{it} = Average daily usage for reading *t* for household *i* during the post-treatment period
- $Treatment_i$ = A dummy variable indicating treatment status of home *i*
- $Month_t$ = Dummy variable indicating month of month *t*
- $PreUsage_i$ = Average daily usage across household *i*'s available pre-treatment billing reads
- $PreUsageSummer_i$ = Average daily usage in the summer months across household *i*'s available pretreatment billing reads
- $PreUsageWinter_i$ = Average daily usage in the winter months across household *i*'s available pre-treatment billing reads
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- ε_{it} = Customer-level random error
- α_0= The model intercept for home *i*
- β_{1-12} = Coefficients determined via regression

The coefficient β_1 represents the average change in consumption between the pre-period and post-period for the treatment group and β_{11} and β_{12} represent the change in weather-related daily consumption in the post-period between the groups. Typical monthly and annual savings were estimated by extrapolating the β_{11} and β_{12} coefficients with Typical Meteorological Year (TMY) HDD and CDD data.

The equation below displays how savings were extrapolated for a full year utilizing the coefficients in the regression model and TMY data.

Equation 2-6: Savings Extrapolation

$$Annual\ Savings = \beta_1 * 365.25 + \beta_{11} * TMY\ HDD + \beta_{12} * TMY\ CDD$$

Model 3: Gross Billing Analysis, Treatment-Only Regression Model

The sections above detail the Evaluator's methodology for estimating net energy savings for each measure. The results from the above methodology report net savings due to the inclusion of the counterfactual comparison group. However, for planning purposes, it is useful to estimate gross savings for each measure. To estimate gross savings, the Evaluators employed a similar regression model; however, only including participant customer billing data. This analysis does not include control group

billing data and therefore models energy reductions between the pre-period and post-period for the measure participants (treatment customers).

To calculate the impacts of each measure, the Evaluators applied linear fixed effects regression using participant billing data with weather controls in the form of Heating Degree Days (HDD) and Cooling Degree Days (CDD). The following equation displays the model specification to estimate the average daily savings due to the measure.

Equation 2-7: Treatment-Only Fixed Effects Weather Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Post)_{it} + \beta_2(HDD)_{it} + \beta_3(CDD)_{it} + \beta_4(Post \times HDD)_{it} + \beta_5(Post \times CDD)_{it} + \beta_6(Customer\ Dummy)_i + \beta_7(Month)_t + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period
- ADC_{it} = Average daily usage for reading *t* for household *i* during the post-treatment period
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- $Post_{it}$ = A dummy variable indicating pre- or post-period designation during period *t* at home *i*
- $Customer\ Dummy_i$ = a customer-specific dummy variable isolating individual household effects
- ε_{it} = Customer-level random error
- α_0= The model intercept for home *i*
- β_{1-6} = Coefficients determined via regression

The results of the treatment-only regression models are gross savings estimates. The gross savings estimates are useful to compare against the net savings estimates. However, the treatment-only models are unable to separate the effects of the COVID19 pandemic. The post-period for PY2021 are affected by the stay-at-home orders that had taken effect starting March 2020 in Washington. The stay-at-home orders most likely affect the post-period household usage. Because there is insufficient post-period data before the shelter-in-place orders, the Evaluators were unable to separate the effects on consumption due to the orders and the effects on consumption due to the measure installation. Therefore, the results from this additional gross savings analysis are unable to reflect actual typical year savings. However, for planning purposes, these estimates may be useful.

2.2.4 Net-To-Gross

The Northwest RTF UES measures do not require NTG adjustments as they are built into the deemed savings estimates. In addition, billing analyses with counterfactual control groups, as proposed in our impact methodology, does not require a NTG adjustment, as the counterfactual represents the efficiency level at current market (i.e. the efficiency level the customer would have installed had they not participated in the program).

2.2.5 Cost-Effectiveness Tests

The Evaluators calculated each program's cost-effectiveness, avoided energy costs, and implementation costs. The Evaluators used our company-developed cost-effectiveness tool to provide cost-effectiveness assessments for the Residential Portfolio by program, fuel type, program year, and measure, for each state.

As specified in this solicitation, the Evaluators determined the economic performance with the following cost-effectiveness tests:

- Total Resource Cost (TRC) test;
- Utility Cost Test (UCT);
- Participant Cost Test (PCT); and
- Rate Impact Measure (RIM).

2.2.6 Non-Energy Benefits

The Evaluators used the Regional Technical Forum (RTF) to quantify non-energy benefits (NEBs) for residential measures with established RTF values where available. Measures with quantified NEBs include residential insulation, high efficiency windows, air source heat pumps, and ductless heat pumps.

In addition to the residential NEBs, the Evaluators applied the end-use non-energy benefit and health and human safety non-energy benefit to the Low-Income Program. The Evaluators understand that the two major non-energy benefits referenced above are uniquely applicable to the Low-Income Program. The Evaluators applied those benefits to the program impacts as well as additional non-energy benefits associated with individual measures included in the program. The Evaluators incorporated additional NEBs to the impact evaluation, as applicable. Additional details on the non-energy benefits applied can be found in Section 7.2.

3. Residential Impact Evaluation Results

The Evaluators completed an impact evaluation on Avista's Residential portfolio to verify program-level and measure-level energy savings for PY2021. The following sections summarize findings for each electric impact evaluation in the Residential Portfolio in the Washington service territory. The Evaluators used data collected and reported in the tracking database, online application forms, Avista TRM, RTF, and billing analysis of participants and nonparticipants to evaluate savings. This approach provided the strongest estimate of achieved savings practical for each program, given its delivery method, magnitude of savings, number of participants, and availability of data. Table 3-1 summarizes the Residential verified impact savings by program. Table 3-2 summarizes the Residential portfolio's cost-effectiveness.

Table 3-1: Residential Verified Impact Savings by Program

Program	Expected Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
Water Heat	96,778	103,798	107.25%
HVAC	555,073	535,629	96.50%
Shell	354,395	390,726	110.25%
ENERGY STAR Homes	102,689	86,735	84.46%
Small Home & MF Weatherization	139,894	199,562	142.65%
Appliances	35,225	30,506	86.60%
AeroBarrier	556	-	-
Total Res	**1,284,610**	**1,346,955**	**104.90%**

Table 3-2: Residential Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$3,465,419	$2,935,143	1.18	$3,109,710	$1,568,428	1.98

In PY2021, Avista completed and provided incentives for residential electric measures in Washington and reported total electric energy savings of 1,346,955 kWh. All programs except the HVAC Program, ENERGY STAR® Homes Program, and appliances prescriptive rebates exceeded savings goals based on reported savings, leading to an overall achievement of 104.90% of the expected savings for the residential programs. The Evaluators estimated the TRC value for the Residential portfolio is 1.18 while the UCT value is 1.98. Further details of the impact evaluation results by program are provided in the sections following.

3.1 Simple Verification Results

The Evaluators surveyed 302 unique customers that participated in Avista's residential energy efficiency program in September and October 2021 and in February 2022 using an email survey approach.

Customers with a valid email were sent the survey via an email invitation. Fifty-three did not have email addresses in program records. The Evaluators also conducted targeted follow-up outreach to customers for certain measures.

The Evaluators surveyed customers that received rebates for HVAC, Water Heater, and Small Home & MF Weatherization, and Appliances Programs.

Table 3-3: Summary of Survey Response Rate

Population	Respondents
Initial email contact list	1,376
Invalid or bounced	53
Invalid or bounced email (%)	*4%*
Invitations sent (unique valid)	1,323
Completions	302
Response rate (%)	23%

3.1.1 In-Service Rates

The Evaluators calculated in-service rates of installed measures from simple verification surveys deployed to program participants for the Water Heat, HVAC, Small Home & MF Weatherization, and Appliances Programs. The Evaluators asked participants if the rebated equipment is currently installed and working, in addition to questions about the new equipment fuel type. The Evaluators achieved 5.8% precision across the programs surveyed for the electric measures in Avista's service territory, summarized in Table 3-4.

Table 3-4: Simple Verification Precision by Program

Sector	Program	Population	Respondents	Precision at 90% CI
Residential	Water Heat	109	8	±28.1%*
Residential	HVAC	648	77	±8.8%
Residential	Small Home & MF Weatherization	93	6	±32.7%*
Residential	Appliances	479	86	±8.0%
Total		**1,329**	**177**	**±5.8%**

*These programs did not achieve 90/10 precision. However, responses indicated 100% ISRs

The measure-level ISRs determined from the verification survey for each program in which simple verification was conducted is presented in Table 3-5 through Table 3-8.

Table 3-5: Water Heat Program ISRs by Measure

Measure	Respondents	ISR
E Heat Pump Water Heater	8	100%

Table 3-6: HVAC Program ISRs by Measure

Measure	Respondents	ISR
E Electric To Air Source Heat Pump	19	95%
E Electric to Ductless Heat Pump	10	100%
E Smart Thermostat DIY with Electric Heat	23	96%
E Smart Thermostat Paid Install with Electric Heat	25	92%

Table 3-7: Small Home & MF Weatherization Program ISRs by Measure

Measure	Respondents	ISR
E Multifamily Thermostat with Baseboard Electric Heat	3	100%
E Multifamily WIFI Thermostat with Baseboard Electric Heat	3	100%

Table 3-8: Appliance Program ISRs by Measure

Measure	Respondents	ISR
E Electric To Natural Gas Furnace	35	100.00%
E Electric To Natural Gas Furnace & Water Heat	51	98.04%

These ISR values were utilized in the desk reviews for the Water Heat, HVAC, Small Home & MF Weatherization, and Appliances Programs in order to calculate verified savings. Additional insights from the survey responses are summarized in Appendix B.

3.2 Impacts of COVID-19 Pandemic

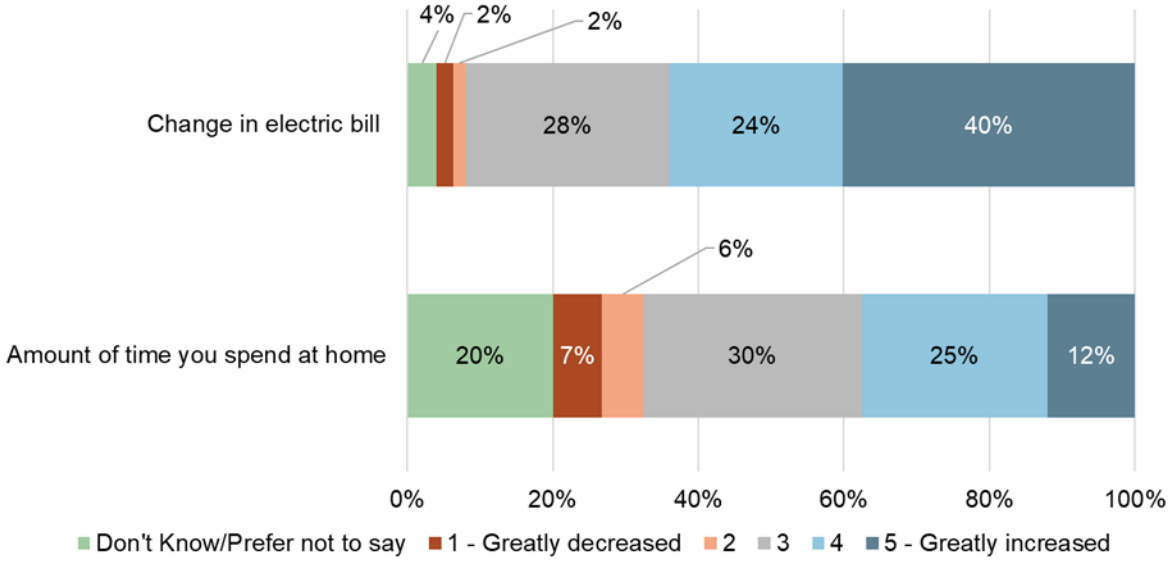
On average, about three people lived at the residence that had the rebated equipment installed and about 65% of respondents said that two or fewer lived at the residence that had the rebated equipment installed.

About two-thirds of respondents observed that the pandemic had not changed the number of people in their household that worked or went to school remotely.[8] Eighteen percent of respondents said that more members of their household were attending school remotely or working from home since the COVID-19 pandemic began. Sixteen percent of respondents indicated that more members of their household had gone to work or school remotely before the COVID-19 pandemic.

Sixty-four percent of respondents said that the amount of time they spend at home has increased since the COVID-19 pandemic began. Thirty-seven percent of respondents indicated that their utility bill had increased. Figure 3-1 displays the change in amount of time spent at home and the change in electricity bills since the COVID-19 pandemic began.

[8] n=257

Figure 3-1: Change in amount of time spent at home and change in electricity bill since COVID-19 pandemic began



3.3 Program-Level Impact Evaluation Results

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Residential sector in the section below.

3.3.1 Water Heat Program

The Water Heat Program encourages customers to replace their existing electric or natural gas water heater with high efficiency equipment. Customers receive incentives after installation and after submitting a completed rebate form. Table 3-9 summarizes the measures offered under this program.

Table 3-9: Water Heat Program Measures

Measure	Description	Impact Analysis Methodology
E Heat Pump Water Heater	Electric water heater (0.94 EF or higher)	RTF UES

The following table summarizes the verified electric energy savings for the Water Heat Program impact evaluation.

Table 3-10: Water Heat Program Verified Electric Savings

Measure	PY2021 Participation	Expected Savings	Adjusted Savings	Verified Savings	Realization Rate
E Heat Pump Water Heater	83	96,778	96,778	103,798	107.25%
Total	**83**	**96,778**	**96,778**	**103,798**	**107.25%**

The Water Heat Program displayed verified savings of 103,798 kWh with a realization rate of 107.25% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-11: Water Heat Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Heat Pump Water Heater	$17,845.00	$24,095.17	$41,940.17
Total	**$17,845.00**	**$24,095.17**	**$41,940.17**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Water Heat Program in the section below.

3.3.1.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Water Heat Program.

3.3.1.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Water Heat Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators found all Water Heat Program rebates to have completed rebate applications with the associated water heater model number and efficiency values filled in either the Customer Care & Billing (CC&B) web rebate data or mail-in rebate applications.

The Evaluators note that the CC&B web rebate data consistently reflected the same values found in the mail-in rebate applications, invoices, and AHRI certification documents submitted with the rebate application.

In addition, the majority of rebates were accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are required to be submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification. The Evaluators were able to easily verify each sampled rebate's equipment due to inclusion of these documents.

However, the Evaluators found that space heating type and water heating type indicated on the household's characteristics in the CC&B database did not consistently match the values indicated on the rebate application forms. This may be due to lack of customer knowledge about the household, or due to change in space and/or water heating type without Avista knowledge. The Evaluators recommend verifying space and water heating values with the customer and updating the CC&B database to reflect the most updated information for the home.

The Evaluators found all sampled rebate equipment met or exceeded the measure efficiency requirements for the Water Heat Program.

3.3.1.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure. The Evaluators included questions such as:

- Was this water heater a new construction, or did it replace another water heater?
- Was the previous water heater functional?
- Is the newly installed water heater still properly functioning?

In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to this verification survey were used to calculate ISRs for the measures offered in the Water Heat Program.

Table 3-12 displays the ISRs for each of the Water Heat measures for Idaho and Washington territory combined.

Table 3-12: Water Heat Verification Survey ISR Results

Measure	Number of Rebates	Number of Survey Completes	Program-Level Precision at 90% Confidence	In-Service Rate
E Heat Pump Water Heater	83	8	±28.1%	100%

The Evaluators contacted HVAC participants in the program to calculate in-service rates for the measures. Although 90/10 precision was not achieved through the census of web surveys for this program, the responses received from this measure (8 responses for E Heat Pump Water Heater measure) indicated 100% in-service rates. 100% in-service rates were assumed. The Evaluators applied these ISRs to each rebate to quantify verified savings for each measure.

3.3.1.4 Impact Analysis

This section summarizes the verified savings results for the Water Heat Program. The Evaluators calculated verified savings for the E Heat Pump Water Heater measure using the RTF workbook in place at the time the savings goals for the program was finalized. The UES value associated with this measure was applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.1.5 Billing Analysis

The Evaluators did not conduct a billing analysis for the electric measures in the Water Heat Program.

3.3.1.6 Verified Savings

The Evaluators reviewed and applied the current RTF UES values for the E Heat Pump Water Heater measure along with verified tracking data to estimate net program savings for this measure. The verified savings for the program is 103,798 kWh with a realization rate of 107.25%, as displayed in Table 3-10.

The realization rate for the electric savings in the Water Heat Program deviate from 100% due to the Avista TRM prescriptive savings value. The Avista TRM assigns a combination of the values the RTF assigns for Tier 2 and Tier 3 heat pump water heaters. However, among document verification, the Evaluators found a majority of water heaters to be Tier 3 or higher, which the RTF UES assigns a higher savings value.

In addition, the Avista TRM assigns the savings values for water heaters of any size. During document review, the Evaluators found most of the water heaters to have a storage tank under 55 gallons, which

has a higher savings value in the RTF than water heaters with unknown tank sizes. The Evaluators applied the RTF UES value for the associated tank size and tier found for each model number in the sampled rebates. These changes led to the high realization rate for the E Heat Pump Water Heater measure in the Water Heat Program. The ISRs for each of the measures in the Water Heat Program was 100% and therefore did not affect the verified savings realization rates.

3.3.2 HVAC Program

The HVAC program encourages installation of high efficiency HVAC equipment and smart thermostats through customer incentives. The program is available to residential electric or natural gas customers with a winter heating season usage of 4,000 or more kWh, or at least 160 Therms of space heating in the prior year. Existing or new construction homes are eligible to participate in the program. Table 3-13 summarizes the measures offered under this program.

Table 3-13: HVAC Program Measures

Measure	Description	Impact Analysis Methodology
E Electric To Air Source Heat Pump	Electric forced air furnace replacement with air source heat pump	RTF UES
E Electric to Ductless Heat Pump	Electric forced air furnace replacement with ductless heat pump	RTF UES
E Smart Thermostat DIY with Electric Heat	Self-installed connected thermostats in electrically heated home	RTF UES
E Smart Thermostat Paid Install with Electric Heat	Professionally installed connected thermostats in electrically heated home	RTF UES
E Variable Speed Motor	Variable speed motor in electrically heated home	Billing Analysis

The following table summarizes the verified electric energy savings for the HVAC Program impact evaluation.

Table 3-14: HVAC Program Verified Electric Savings

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
E Electric To Air Source Heat Pump	104	315,180	321,386	315,336	100.05%
E Electric to Ductless Heat Pump	72	65,376	65,376	66,791	102.16%
E Smart Thermostat DIY with Electric Heat	102	75,649	76,347	73,834	97.60%
E Smart Thermostat Paid Install with Electric Heat	131	98,868	98,054	79,669	80.58%
Total	**409**	**555,073**	**561,163**	**535,629**	**96.50%**

The HVAC Program displayed verified savings of 535,629 kWh with a realization rate of 96.50% against the expected savings for the program.

Table 3-15: HVAC Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Electric To Air Source Heat Pump	$103,000.00	$106,124.55	$209,124.55

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Electric to Ductless Heat Pump	$36,000.00	$27,858.69	$63,858.69
E Smart Thermostat DIY with Electric Heat	$12,193.56	$25,155.30	$37,348.86
E Smart Thermostat Paid Install with Electric Heat	$19,800.00	$27,143.32	$46,943.32
Total	**$170,993.56**	**$186,281.86**	**$357,275.42**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the HVAC Program in the section below.

3.3.2.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the HVAC Program.

3.3.2.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the HVAC Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in in Section 2.2.2.1.

The Evaluators found all HVAC Program rebates to have project documentation with the associated HVAC model number and efficiency values in either the CC&B web rebate data or mail-in rebate applications. The majority of project files contained associated AHRI certifications for the installed equipment. This allowed the Evaluators to easily verify equipment specifications to assign savings values to each sampled project.

The Evaluators note that not all rebate applications contained existing/new construction field and single family home/manufactured home fields. This field is an input to apply correct RTF UES values. The Evaluators recommend requiring this field be completed in rebate applications, both mail-in and web-based.

The Evaluators verified smart thermostat model specifications through the ENERGY STAR database and to verify if thermostat met all conditions required from the RTF measure specifications. The Evaluators was unable to verify 2 of the 68 sampled thermostats due to missing information (4% of sampled thermostat rebates). The Evaluators verified that 6 of the 68 thermostats did not meet RTF measure specifications (6% of sampled thermostat rebates). The 6% of thermostats verified to not meet the conditions had lacked occupancy detection and/or geofencing capabilities, a specification required by the RTF. The remaining smart thermostats were verified to qualify for RTF measure savings (92% of sampled thermostat rebates). The thermostats that were verified to not meet RTF measure specifications were removed from verified savings (6 thermostats). These 6 smart thermostat rebates encompassed 2 different smart thermostat models (Honeywell RTH9585WF1004 and AccuLink Platinum 850 Control).

The Evaluators found all other sampled rebate equipment met or exceeded the measure efficiency requirements for the HVAC Program.

3.3.2.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure described in Section 2.2.2.2. The Evaluators included questions such as:

- What type of thermostat did this thermostat replace?
- Is your home heating with electricity, natural gas, or another fuel?
- Was the previous equipment functional?
  Is the newly installed equipment still properly functioning?

The responses to this verification survey were used to calculate ISRs for the measures offered in the HVAC Program. In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to these additional questions can be found in Appendix B.

Table 3-16 displays the ISRs for each of the HVAC measures for Idaho and Washington electric territory combined. The ISRs resulted in 8.8% precision at the 90% confidence interval for the program.

Table 3-16: HVAC Verification Survey ISR Results

Measure	Number of Rebates	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
E Electric To Air Source Heat Pump	104	19	±8.8%	95%
E Electric to Ductless Heat Pump	72	10		100%
E Smart Thermostat DIY with Electric Heat	102	23		96%
E Smart Thermostat Paid Install with Electric Heat	131	25		92%

The majority of survey respondents described equipment to be currently functioning, leading to a 92% to 100% ISR for all measures. Although the E Electric to Air Source Heat Pump and smart thermostat measures displayed ISRs less than 100%, all measure still exceeded ISRs of 90%. The Evaluators applied the ISRs listed in Table 3-16 to each rebate to quantify verified savings for each measure.

3.3.2.4 Impact Analysis

This section summarizes the verified savings results for the HVAC Program. The Evaluators attempted to conduct a billing analysis for the HVAC measures, but participation was insufficient to complete verified savings using this methodology. Therefore, the Evaluators calculated verified savings for the HVAC measures using the RTF workbook in place at the time the savings goals for the program was finalized These UES values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.2.5 Billing Analysis

The Evaluators did not conduct a billing analysis for the electric measures in the HVAC Program.

3.3.2.6 Verified Savings

The HVAC Program in total displays a realization rate of 96.50% with 535,629 kWh verified electric energy savings in the Washington service territory, as displayed in Table 3-14. The realization rate for

the electric savings in the HVAC Program deviate from 100% due to the differences between the applied Avista TRM prescriptive savings value and the true Avista TRM or appropriate RTF UES value.

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program adjusted savings. In addition, the Evaluators reviewed and applied the current RTF UES values for the electric measures along with verified tracking data to estimate net program verified savings for this measure.

The E Smart Thermostat DIY with Electric Heat realization rate is low because the Avista TRM uses an average of retail and direct install savings values as well as an average across heating types, while the Evaluators assigned the appropriate RTF UES value for each installation type and heating zone. The appropriate categories in the RTF led to a lower-than-expected savings for the direct install and retail rebates for this measure. In addition, the measure-level ISRs were applied to the measures, further decreasing the realization rate for the E Electric to Air Source Heat Pump and smart thermostat measures.

3.3.3 Shell Program

The Shell Program provides incentives to customers for improving the integrity of the home's envelope with upgrades to windows and storm windows. Rebates are issued after the measure has been installed for insulation and window measures. Participating homes must have electric or natural gas heating and itemized invoices including measure details such as insulation levels, window values, and square footage. In order to be eligible for incentive, the single-family households, including fourplex or less, must demonstrate an annual electricity usage of at least 8,000 kWh or an annual gas usage of at least 340 Therms. Multifamily homes have no usage requirement. This program includes free manufactured home duct sealing implemented by UCONS. Table 3-17 summarizes the measures offered under this program.

Table 3-17: Shell Program Measures

Measure	Description	Impact Analysis Methodology
E Attic Insulation with Electric Heat	Attic insulation for homes heated with electricity	RTF UES
E Floor Insulation with Electric Heat	Floor insulation for homes heated with electricity	RTF UES
E IGU Window Replc from Single Pane W Electric Heat	IGU window replacement for homes heated with electricity	RTF UES
E Storm Window with Electric Heat	High-efficiency storm window replacement for homes heated with electricity	RTF UES
E Wall Insulation with Electric Heat	Wall insulation for homes heated with electricity	RTF UES
E Window Replc from Double Pane W Electric Heat	High-efficiency double pane window replacement for homes heated with electricity	RTF UES
E Window Replc from Single Pane W Electric Heat	High-efficiency single pane window replacement for homes heated with electricity	RTF UES

The following table summarizes the adjusted and verified electric energy savings for the Shell Program impact evaluation.

Table 3-18: Shell Program Verified Electric Savings

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
E Attic Insulation with Electric Heat	39	81,984	81,984	66,179	80.72%
E Floor Insulation with Electric Heat	10	10,288	10,288	10,288	100.00%
E IGU Window Replc from Single Pane W Electric Heat	2	2,156	2,256	2,450	113.64%
E Storm Window with Electric Heat	1	81	81	91	112.95%
E Wall Insulation with Electric Heat	9	16,151	16,438	18,597	115.14%
E Window Replc from Double Pane W Electric Heat	2	1,347	1,347	1,212	90.01%
E Window Replc from Single Pane W Electric Heat	193	242,389	242,389	291,909	120.43%
Total	**256**	**354,395**	**354,782**	**390,726**	**110.25%**

The Shell Program displayed verified savings of 390,726 kWh with a realization rate of 110.25% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-19: Shell Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Attic Insulation with Electric Heat	$35,136.00	$77,184.82	$112,320.82
E Floor Insulation with Electric Heat	$7,716.00	$11,998.88	$19,714.88
E IGU Window Replc from Single Pane W Electric Heat	$784.00	$2,857.43	$3,641.43
E Storm Window with Electric Heat	$21.00	$43.46	$64.46
E Wall Insulation with Electric Heat	$4,931.25	$21,689.11	$26,620.36
E Window Replc from Double Pane W Electric Heat	$468.00	$1,413.69	$1,881.69
E Window Replc from Single Pane W Electric Heat	$84,236.00	$340,452.68	$424,688.68
Total	**$133,292.25**	**$455,640.08**	**$588,932.33**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Shell Program in the section below.

3.3.3.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Shell Program.

3.3.3.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Shell Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators reviewed each measure number of units, square footage, and insulation where available. The Evaluators found no instances in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. The Evaluators also note that Avista

consistently verified square footage and R-values with customers when information was unclear. The tracked quantity and U-values were then documented in the tracking database consistently.

The Evaluators imputed home type (single family home vs. manufactured home) and space heating type for a number of sampled rebates, as the tracking database did not contain values for these accounts, and rebate applications were not available to draw values from. This allows the Evaluators to accurately assign RTF values. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information. The Evaluators recommend verifying home type and space heating type during rebate application approval in order to apply correct savings values to each project.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.3.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Shell Program. Weatherization measures historically have high verification rates.

3.3.3.4 Impact Analysis

This section summarizes the verified savings results for the Shell Program. The Evaluators calculated verified savings for the electric measures using the RTF workbook in place at the time the savings goals for the program was finalized. The Evaluators calculated adjusted savings for each measure using the active Avista TRM values and verified tracking data. These UES values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.3.5 Billing Analysis

The Evaluators did not conduct a billing analysis for the electric Shell measures, as the RTF provides valid UES savings for all measures incented through the program.

3.3.3.6 Verified Savings

The Shell Program in total displays a realization rate of 110.25% with 390,726 kWh verified electric energy savings in the Washington service territory, as displayed in Table 3-18. The realization rate for the electric savings in the Shell Program deviate from 100% due to the differences between the categories applied in the Avista TRM prescriptive savings values and the more detailed categories present with unique RTF UES values.

The Evaluators did not conduct a verification survey for the Shell Program and therefore did not adjust verified savings with an ISR.

3.3.4 ENERGY STAR® Homes Program

The ENERGY STAR® Homes Program provides rebates for homes within Avista's service territory that attain an ENERGY STAR® certification. This program incentivizes for ENERGY STAR® Eco-rated homes. Table 3-20 summarizes the measures offered under this program.

Table 3-20: ENERGY STAR® Homes Program Measures

Measure	Description	Impact Analysis Methodology
G ENERGY STAR Home - Manufactured, Gas & Electric	ENERGY STAR-rated manufactured home with gas and electric	RTF UES
E ENERGY STAR Home - Manufactured, Furnace	ENERGY STAR-rated manufactured home with electric furnace	RTF UES
E ENERGY STAR Home - Manufactured, Gas & Electric	ENERGY STAR-rated manufactured home with gas and electric	RTF UES

The following table summarizes the verified electric energy savings for the ENERGY STAR® Homes Program impact evaluation.

Table 3-21: ENERGY STAR® Homes Program Verified Electric Savings

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
G ENERGY STAR Home - Manufactured, Gas & Electric	3	9,888	9,945	3,398	34.36%
E ENERGY STAR Home - Manufactured, Furnace	27	89,505	89,505	77,843	86.97%
E ENERGY STAR Home - Manufactured, Gas & Electric	4	13,184	13,260	8,892	67.45%
Total	**34**	**112,577**	**112,710**	**90,133**	**80.06%**

The ENERGY STAR® Homes Program displayed verified savings of 90,133 kWh with a realization rate of 80.06% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program

Table 3-22: ENERGY STAR® Homes Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G ENERGY STAR Home - Manufactured, Gas & Electric*	N/A	N/A	N/A
E ENERGY STAR Home - Manufactured, Furnace	$27,000.00	$47,903.47	$74,903.47
E ENERGY STAR Home - Manufactured, Gas & Electric	$4,000.00	$3,860.50	$7,860.50
Total	**$31,000.00**	**$51,763.97**	**$82,763.97**

*The costs associated with this measure are claimed in the Washington Gas Impact Evaluation Report

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the ENERGY STAR® Homes Program in the section below.

3.3.4.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the ENERGY STAR® Homes Program.

3.3.4.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the ENERGY STAR® Homes Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.4.3 Verification Surveys

The Evaluators did not conduct verification surveys for the ENERGY STAR® Homes Program.

3.3.4.4 Impact Analysis

This section summarizes the verified savings results for the ENERGY STAR® Homes Program. The Evaluators calculated verified savings for the electric measures using the RTF workbook in place at the time the savings goals for the program was finalized. These RTF UES values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.4.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate adjusted program savings for each of the ENERGY STAR® Homes measures. In addition, the Evaluators reviewed and applied the current RTF UES values for each measure along with verified tracking data to estimate net program savings.

The ENERGY STAR® Homes Program in total displays a realization rate of 80.06% with 90,133 kWh verified electric energy savings in the Washington service territory, as displayed in Table 3-21. The realization rate for the electric savings in the ENERGY STAR® Homes Program deviate from 100% due to the categorical differences between the applied Avista TRM prescriptive savings value and the more detailed RTF UES categories.

The Avista TRM applies RTF savings values from heating zone 2 to all rebates. In addition, the Avista TRM does not take into account cooling zone, which also affects savings assigned in the RTF. The Evaluators applied the appropriate RTF savings values for the heating zone and cooling zone for each rebated household. This change led to low realization rates for some rebates and high realization rates for others within the same Avista E ENERGY STAR® Home – Manufactured Furnace measure category. The overall effect this change had on the measure is a downward adjustment on savings.

The realization for the E ENERGY STAR® Home – Manufactured, Gas & Electric measure is low because the expected savings employed an additive methodology between a gas-heated home and an electric-heated home for the electric savings. However, the Evaluators reviewed the RTF and determined manufactured home electric savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. Therefore, the Evaluators assigned electric savings from the RTF associated with a fully natural gas-heated home at 43 kWh saved per year.

In addition, two projects were verified to have natural gas furnace space heating for the home and therefore verified savings did not include full electric savings. This led to two projects displaying 1.30%

realization for electric savings, leading to a large downward adjustment in the population realization rates.

The Evaluators did not conduct a verification survey for the ENERGY STAR® Homes Program and therefore did not adjust verified savings with an ISR.

3.3.5 Small Home & MF Weatherization Program

The Small Home & MF Weatherization Program is a residential prescriptive program that waives the energy usage requirement that is typically employed for residential prescriptive programs. This benefits small homes (less than 1,000 square feet in size) and multifamily dwellings (specifically customers in condominiums larger than five units in size). While this program is designed for all customers, it could also benefit members of Named Communities who reside in smaller homes.

This program encourages consumer to complete energy efficient home upgrades such as attic, floor, or wall insulation, replacing windows with high efficiency windows, or upgrading thermostats to increase energy efficiency in these homes.

This section summarizes the impact results of the evaluation results for the Small Home & MF Weatherization Program. Table 3-23 summarizes the measures offered under this program.

Table 3-23: Small Home & MF Weatherization Program Measures

Measure	Description	Impact Analysis Methodology
E Multifamily Attic Insulation With Electric Heat	Attic insulation for multifamily homes with electric heat	RTF UES
E Multifamily Floor Insulation With Electric Heat	Floor insulation for multifamily homes with electric heat	RTF UES
E Multifamily IGU Window Replc With Electric Heat	Window replacement for multifamily homes with electric heat	RTF UES
E Multifamily Storm Window Replc With Electric Heat	Storm window replacement for multifamily homes with electric heat	RTF UES
E Multifamily Thermostat with Baseboard Electric Heat	Thermostats for multifamily homes with electric heat	RTF UES
E Multifamily Wall Insulation With Electric Heat	Wall insulation for multifamily homes with electric heat	RTF UES
E Multifamily WIFI Thermostat with Baseboard Electric Heat	Connected thermostat for multifamily homes with electric heat	RTF UES
E Multifamily Window Replc With Electric Heat	Window replacement for multifamily homes with electric heat	RTF UES

The following table summarizes the verified electric energy savings for the Small Home & MF Weatherization Program impact evaluation.

Table 3-24: Small Home & MF Weatherization Program Verified Electric Savings

Measure	PY2021 Units	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate

E Multifamily Attic Insulation With Electric Heat	3	2,427	2,555	2,427	100.00%
E Multifamily Floor Insulation With Electric Heat	1	1,560	2,086	1,200	76.92%
E Multifamily IGU Window Replc With Electric Heat	1	1,710	1,710	2,528	147.81%
E Multifamily Storm Window Replc With Electric Heat	2	6,444	6,443	3,509	54.46%
E Multifamily Thermostat with Baseboard Electric Heat	2	152	152	162	106.58%
E Multifamily Wall Insulation With Electric Heat	2	2,783	2,785	2,046	73.53%
E Multifamily WIFI Thermostat with Baseboard Electric Heat	3	275	275	2,817	1,026.23%
E Multifamily Window Replc With Electric Heat	54	124,543	126,444	184,873	148.44%
Total	**68**	**139,894**	**142,451**	**199,562**	**142.65%**

The Small Home & MF Weatherization Program displayed verified savings of 199,562 kWh with a realization rate of 142.65% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-25: Small Home & MF Weatherization Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Multifamily Attic Insulation With Electric Heat	$1,820.25	$2,830.61	$4,650.86
E Multifamily Floor Insulation With Electric Heat	$900.00	$1,399.56	$2,299.56
E Multifamily IGU Window Replc With Electric Heat	$316.00	$2,948.40	$3,264.40
E Multifamily Storm Window Replc With Electric Heat	$957.00	$1,675.85	$2,632.85
E Multifamily Thermostat with Baseboard Electric Heat	$40.00	$55.19	$95.19
E Multifamily Wall Insulation With Electric Heat	$767.25	$2,386.25	$3,153.50
E Multifamily WIFI Thermostat with Baseboard Electric Heat	$100.00	$959.76	$1,059.76
E Multifamily Window Replc With Electric Heat	$23,364.00	$215,617.08	$238,981.08
Total	**$28,264.50**	**$227,872.69**	**$256,137.19**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Small Home & MF Weatherization Program in the section below.

3.3.5.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Small Home & MF Weatherization Program.

3.3.5.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for Small Home & MF Weatherization Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The rebate application form sufficiently collects all required RTF measure specification details. All rebate applications and tracking data contain smart thermostat manufacturer and model number. The Evaluators were able to verify the models for RTF specifications for connected thermostats.

The Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Shell Program.

In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate “Multifamily” home type. Rather, the current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”. The Evaluators recommend including an option for “Multifamily” in order to consistently apply RTF savings for each of the measures.

The Evaluators reviewed each measure number of units, square footage, and insulation where available. The Evaluators found no instances in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. The Evaluators also note that Avista consistently verified square footage and R-values with customers when information was unclear. The tracked quantity and U-values were then documented in the tracking database consistently.

Although quantity in the CC&B database were consistent, the Avista TRM savings values differed from verified RTF UES values for each of the projects. The majority of projects displayed realization rates larger than 100% due to differences in home type. The Evaluators verified home type via Zillow to apply correct RTF workbook savings from the single family, multifamily, and manufactured home RTF workbooks. These adjustments led to high realization rates for the overall program.

The Evaluators imputed home type (single family home vs. manufactured home vs. multifamily home) and space heating type for a number of sampled rebates, as the tracking database did not contain values for these accounts, and rebate applications were not available to draw values from. This allows the Evaluators to accurately assign RTF values. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information. The Evaluators recommend verifying home type and space heating type during rebate application approval in order to apply correct savings values to each project.

The realization rate for the 3 E Multifamily WIFI Thermostat with Baseboard Electric Heat projects are high due to verification that the equipment qualified for RTF connected thermostat savings at 939 kWh annual savings rather than the Avista TRM value of 91.5 kWh saved. The Evaluators recommend verifying proper measure assignment for the equipment provided in the rebate application.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.5.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure described in Section 2.2.2.2. The Evaluators included questions such as:

- What type of thermostat did this thermostat replace?
- Is your home heating with electricity, natural gas, or another fuel?
- Was the previous equipment functional?
- Is the newly installed equipment still properly functioning?

The responses to this verification survey were used to calculate ISRs for the measures offered in the Small Home & MF Weatherization Program. In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to these additional questions can be found in Appendix B.

Table 3-26 displays the ISRs for each of the Small Home & MF Weatherization measures for Idaho and Washington electric territory combined. The ISRs resulted in 32.7% precision at the 90% confidence interval for the program.

Table 3-26: Small Home & MF Weatherization Verification Survey ISR Results

Measure	Number of Rebates	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
E Multifamily Thermostat with Baseboard Electric Heat	4	3	±32.7%	100%
E Multifamily WIFI Thermostat with Baseboard Electric Heat	9	3		100%

The Evaluators contacted all thermostat participants in the program to calculate in-service rates for the measures. Although 90/10 precision was not achieved through the census of web surveys for this program, the responses received from these measures (3 responses for E Multifamily Thermostat with Baseboard Electric Heat and 4 responses for E Multifamily WIFI Thermostat with Baseboard Electric Heat) also indicated 100% in-service rates. 100% in-service rates were assumed. The Evaluators applied the ISRs listed in Table 3-26 to each rebate to quantify verified savings for each measure.

3.3.5.4 Impact Analysis

This section summarizes the verified savings results for the Small Home & MF Weatherization Program. The Evaluators calculated verified savings for the electric measures using the RTF workbook in place at the time the savings goals for the program was finalized.

3.3.5.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net adjusted program savings for those measures. Small Home & MF Weatherization Program displayed 142.65% realization with 199,562 kWh saved, as displayed in Table 3-24.

Although quantity in the CC&B database were consistent, the Avista TRM savings values differed from verified RTF UES values for each of the projects. The majority of projects displayed realization rates

larger than 100% due to differences in home type. The Evaluators verified home type via Zillow to apply correct RTF workbook savings from the single family, multifamily, and manufactured home RTF workbooks. These adjustments led to high realization rates for the overall program. The Evaluators recommend Avista verify home type prior to applying Avista TRM values in order to ensure proper categorization of measure savings.

3.3.6 Appliances Program

The Appliances Program is residential prescriptive program that offers incentives for customers to upgrade their existing clothes washers and dryers to ENERGY STAR-rated clothes dryers and washers.

This section summarizes the impact results of the evaluation results for the Appliances Program. Table 3-27 summarizes the measures offered under this program.

Table 3-27: Appliances Program Measures

Measure	Description	Impact Analysis Methodology
E Energy Star Rated Clothes Dryer	ENERGY STAR-certified clothes dryer for residential homes	RTF UES
E Energy Star Rated Front Load Washer	ENERGY STAR-certified clothes washer for residential homes	RTF UES

The following table summarizes the verified electric energy savings for the Appliances Program impact evaluation.

Table 3-28: Appliances Program Verified Electric Savings

Measure	PY2021 Units	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
E Energy Star Rated Clothes Dryer	151	10,200	10,268	10,664	104.55%
E Energy Star Rated Front Load Washer	176	25,025	25,168	19,842	79.29%
Total	**327**	**35,225**	**35,436**	**30,506**	**86.60%**

The Appliances Program displayed verified savings of 30,506 kWh with a realization rate of 86.60% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-29: Appliances Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Energy Star Rated Clothes Dryer	$3,020.00	$2,682.45	$5,702.45
E Energy Star Rated Front Load Washer	$8,800.00	$4,991.35	$13,791.35
Total	**$11,820.00**	**$7,673.80**	**$19,493.80**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Appliances Program in the section below.

3.3.6.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Appliances Program.

3.3.6.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Appliance Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The rebate application form sufficiently collects all required RTF measure specification details. All rebate applications and tracking data contain AHRI documentation or model numbers to verify model specifications. The Evaluators were able to verify the models for RTF specifications for the majority of projects.

The Evaluators found that two of the 664 projects had no assigned savings. ADM applied savings to these projects, as no duplicates were displayed for this project. The Evaluators verified each model specification with values provided by ENERGY STAR qualified product lists. The Evaluators found that 3 of the sampled clothes washer projects did not qualify due to minimum volume requirements specified by the RTF. All other sampled projects qualified for RTF savings.

The Evaluators found that the Avista TRM applied RTF savings from the "Front Load" measure description for clothes washers. However, the Evaluators found that 3 of the clothes washer equipment were "Top loading", which the RTF assigns significantly lower annual savings. This change in addition to the disqualification of 3 rebates led to a downward adjustment in realization rate for this program. The Evaluators recommend adding "top loading" clothes washers to the Avista TRM and applying savings for those measures appropriately.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.6.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure described in Section 2.2.2.2. The Evaluators included questions such as:

- What type of clothes washer/dryer did this clothes washer/dryer replace?
- Is your home space heating with electricity or natural gas?
- Was the previous equipment functional?
- Is the newly installed equipment still properly functioning?

The responses to this verification survey were used to calculate ISRs for the measures offered in the Appliances Program. In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to these additional questions can be found in Appendix B.

Table 3-30 displays the ISRs for each of the Appliances measures for Idaho and Washington electric territory combined. The ISRs resulted in 8.0% precision at the 90% confidence interval for the program.

Table 3-30: Small Home & MF Weatherization Verification Survey ISR Results

Measure	Number of Rebates	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
E Energy Star Rated Clothes Dryer	219	35	±8.0%	100%
E Energy Star Rated Front Load Washer	260	51		98%

The Evaluators applied the ISRs listed in Table 3-30 to each rebate to quantify verified savings for each measure.

3.3.6.4 Impact Analysis

This section summarizes the verified savings results for the Appliances Program. The Evaluators calculated verified savings for the electric measures using the RTF workbook in place at the time the savings goals for the program was finalized.

3.3.6.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net adjusted program savings for those measures. Small Home & MF Weatherization Program displayed 86.60% realization with 30,506 kWh saved, as displayed in Table 3-28.

The program verified savings resulted in a realization rate of less than 100% due to three projects in which clothes washers were “top loading” instead of “front loading” and three instances in which the equipment was disqualified due to lack of RTC measure specification requirements in minimum volume. The Evaluators recommend adding “top loading” clothes washers to the Avista TRM and applying savings for those measures appropriately.

3.3.7 AeroBarrier Program

The AeroBarrier program provides incentives for customers to complete envelope sealing improvements using the AeroBarrier product, a convenient, cost-effective approach that seal homes in less than three hours and provides documented results.

This section summarizes the estimated savings Avista has calculated for the AeroBarrier Program. The Evaluators did not conduct an impact evaluation for the measures in this program for PY2021 due to low participation. A full impact analysis will be completed for PY2022 projects. Table 3-31 summarizes the measures offered under this program.

Table 3-31: AeroBarrier Program Measures

Measure	Description	Impact Analysis Methodology
E AeroBarrier Rebate	Whole home insulation with AeroBarrier	No impact evaluation completed for PY2021

The following table summarizes the estimated electric energy savings for the Appliances Program impact evaluation.

Table 3-32: AeroBarrier Program Verified Electric Savings

Measure	PY2021 Units	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
E AeroBarrier Rebate	1	556	N/A	N/A	N/A
Total	**1**	**556**	**N/A**	**N/A**	**N/A**

The Aerobarrier Program displayed estimated savings of 556 kWh. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-33: AeroBarrier Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E AeroBarrier Rebate	$702.00	$648.08	$1,350.08
Total	**$702.00**	**$648.08**	**$1,350.08**

The Evaluators did not conduct an impact analysis for this program for PY2021.

3.4 Conclusions and Recommendations

The Evaluators provide the following conclusions and recommendations for Avista's Residential Portfolio program implementation.

3.4.1 Conclusions

The Evaluators provide the following conclusions regarding Avista's Residential electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 1,346,955 kWh with a realization rate of 105%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio's cost-effectiveness. The resulting TRC value for this sector is 1.18 while the UCT value is 1.98. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Residential Portfolio impact evaluation resulted in a realization rate of 105% due to slight differences between the Avista TRM categories and the appropriately assigned RTF UES categories for each measure. The Evaluators note several instances in which the Avista TRM value reflects an average of a range of RTF UES values for the electric measures offered in the Washington electric service territory. The values had been averaged across heating zones, water heater storage tank sizes, equipment efficiency values, and fuel types. The Evaluators, instead of applying these averages, verified the appropriate RTF UES values for each rebate for a sample of rebates in each program and applied the resulting realization rates to the population of rebates for each program. This led to a higher realization rate, as some rebates reflected RTF savings values higher than the average for that measure.
- The Evaluators conducted verification surveys for a random sample of customers who had participated in the residential prescriptive rebates programs. The Evaluators calculated in-service rates for measures in which in-service rates are not typically 100% (water heaters, furnaces, clothes washers and dryers, smart thermostats, etc). The Evaluators found that all

surveyed measures responses indicated in-service rates of 92-100%. These values were applied to impact analysis results to estimate verified savings through the programs.

- The Small Home & MF Weatherization Program, which contributes 15% of the expected savings, resulted in a realization rate of 143% whereas each of the other programs resulted in a combined 100% realization rate. The Shell Program contributed to a 5% increase in the overall residential sector, which displayed a realization rate of 105%.
- The Evaluators found the CC&B tracking database consistently reflected values indicated on randomly sampled documents.
- In the HVAC Program, the E Smart Thermostat DIY with Electric Heat and E Smart Thermostat Paid Install with Electric Heat realization rates are lower than 100% because the Avista TRM uses an average of retail and direct install savings values as well as an average across heating types, while the Evaluators assigned the appropriate RTF UES value for each installation type and heating zone. The appropriate categories in the RTF led to a lower-than-expected savings and higher than expected savings across individual projects within these measures, with an overall downward adjustment for these measures.
- In the HVAC Program, the Evaluators verified smart thermostat model specifications through the ENERGY STAR qualified products list to verify if the thermostat met all conditions required from the RTF measure specifications. The Evaluators verified that 6 of the 68 thermostats did not meet RTF measure specifications (6% of sampled thermostat rebates). The 6% of thermostats verified to not meet the conditions had lacked occupancy detection and/or geofencing capabilities, a specification required by the RTF.
- In the Shell Program, the Evaluators imputed home type and space heating type for a large number of sampled rebates, as the tracking database does not contain values for these characteristics or remain outdated. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information.
- In the ENERGY STAR Homes Program, the Evaluators found that realization rates differed from 100% due to application of heating zone and cooling zone via the RTF, which the Avista TRM lacks. In addition, the realization for the E ENERGY STAR® Home – Manufactured, Gas & Electric measure is low because the expected savings employed an additive methodology between a gas-heated home and an electric-heated home for the electric savings. However, the Evaluators reviewed the RTF and determined manufactured home electric savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. Therefore, the Evaluators assigned electric savings from the RTF associated with a fully natural gas-heated home at 43 kWh saved per year. Finally, two projects were verified to have natural gas furnace space heating for the home and therefore verified savings did not include full electric savings. This led to two projects displaying 1.30% realization for electric savings, leading to a large downward adjustment in the population realization rates.
- In the Small Home & MF Weatherization Program, the Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate “Multifamily” home type.

Rather, the current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”.

- In the Appliance Program, the Evaluators found that 3 of the sampled clothes washer projects did not qualify due to minimum volume requirements specified by the RTF. The Evaluators also found that the Avista TRM applied RTF savings from the “Front Load” measure description for clothes washers. However, the Evaluators found that 3 of the clothes washer equipment were “Top loading”, which the RTF assigns significantly lower annual savings. This change in addition to the disqualification of 3 rebates led to a downward adjustment in realization rate for this program.
- The Evaluators did not complete an impact analysis for the AeroBarrier Program. Therefore, the AeroBarrier program’s savings is not included in the portfolio expected savings total or the portfolio verified savings total displayed in Table 1-1. A full impact analysis will be completed for the program in PY2022.

3.4.2 Recommendations

The Evaluators offer the following recommendations regarding Avista’s Residential electric programs:

- The Evaluators imputed home type and space heating type for a large number of sampled rebates, as the tracking database does not contain values for these characteristics or remain outdated. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information. The Evaluators recommend verifying home type and space heating type during rebate application approval in order to apply correct savings values to each project.
- In addition, the Evaluators note that the current program rebate applications for the Small Home & MF Weatherization Program do not provide an option to indicate “Multifamily” home type. For the Small Home & MF Weatherization Program, project savings largely depends on the home type (single family vs. multifamily vs. manufactured). The current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”. The Evaluators recommend including an option for “Multifamily” in order to consistently apply RTF savings for each of the measures. The Evaluators recommend Avista verify home type prior to applying Avista TRM values in order to ensure proper categorization of measure savings.
- The Evaluators note several instances in which the web-based rebate data indicates the household has electric space heating, but all other sources (project data and document verification) indicate natural gas space heating, and vice versa. The Evaluators recommend updating data collection standards in order for all sources of information to reflect the same values as the project documentation.
- The Evaluators found that space heating type and water heating type indicated on the household’s characteristics in the CC&B database did not consistently match the values indicated on the rebate application forms. This may be due to lack of customer knowledge about the household, or due to change in space and/or water heating type without Avista knowledge. The Evaluators recommend verifying space and water heating values with the customer and updating the CC&B database to reflect the most updated information for the home.
- The Evaluators found that many projects claimed under the Small Home & MF Weatherization Program exceed the "Small Home" definition from Avista - that a home is single family with less

than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Shell Program.

- The ENERGY STAR Homes rebates depend on heating zone and cooling zone specifications to calculate RTF savings. In addition, the savings applied largely depends on space heating type. The program realization rate differs from 100% due to changes in heating zone/cooling zone savings assignment as well as verified space heating type (electric vs. natural gas). The Evaluators recommend verifying space heating type prior to claiming savings for each ENERGY STAR homes project and specifying separate savings for heating zone and cooling zone in the Avista TRM.
- A number of smart thermostat rebates included equipment that did not meet RTF measure specifications to receive verified savings through the RTF workbooks, which the Avista TRM values are drawn from. The Evaluators recommend providing a qualified product list for customers to ensure purchased smart thermostat meets program requirements. In addition, the Evaluators recommend Avista verify each program rebate to verify qualifications after rebates are submitted.
- In the Appliances Program, the Evaluators found that the Avista TRM applied RTF savings from the "Front Load" measure description for clothes washers. However, the Evaluators found that 3 of the clothes washer equipment were "Top loading", which the RTF assigns significantly lower annual savings. This change in addition to the disqualification of 3 rebates led to a downward adjustment in realization rate for this program. The Evaluators recommend adding "top loading" clothes washers to the Avista TRM and applying savings for those measures appropriately.
- The Avista TRM assigns the savings values for water heaters of any size. During document review, the Evaluators found most of the water heaters to have a storage tank under 55 gallons, which has a higher savings value in the RTF than water heaters with unknown tank sizes (larger systems have a more stringent code baseline). The Evaluators applied the RTF UES value for the associated tank size and tier found for each model number in the sampled rebates. These changes led to the high realization rate for the E Heat Pump Water Heater measure in the Water Heat Program. The Evaluators recommend updating the Avista TRM value for this measure based on actual tank size, in addition to collecting information on the tank size of the measure in the rebate applications.
- The Evaluators note that the realization for the E ENERGY STAR® Home – Manufactured, Gas & Electric measure is low because the Avista TRM savings was employed using an additive methodology between a gas-heated home and an electric-heated home for the electric savings. However, the Evaluators reviewed the RTF and determined manufactured home electric savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. The Evaluators recommend adjusting Avista TRM electric savings for this measure to reflect the RTF values associated with a fully natural gas-heated home at 43 kWh saved per year.

4. Low-Income Impact Evaluation Results

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Washington service territory with a partnership with five network Community Action Agencies ("Agencies") and one tribal weatherization organization. The Agencies qualify income to prioritize and treat households based on several characteristics. In-house or contract crews install approved program measures. In addition, the Agencies have access to other monetary resources which allow them to weatherize a home or install additional energy efficiency measures.

The Evaluators completed an impact evaluation on Avista's Low-Income portfolio to verify program-level and measure-level energy savings for PY2021. The following sections summarize findings for each electric impact evaluation in the Low-Income Portfolio in the Washington service territory. The Evaluators used data collected and reported in the tracking database, online application forms, Avista TRM, and RTF values to evaluate verified savings. This approach provided the strongest estimate of achieved savings practical for each program, given its delivery method, magnitude of savings, number of participants, and availability of data. Table 4-1 summarizes the Low-Income verified impact savings by program. Table 4-2 summarizes the Low-Income portfolio cost-effectiveness results.

Table 4-1: Low-Income Verified Impact Savings by Program

Program	Expected Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
Low-Income	244,279	240,933	98.63%
CEEP	60,259	65,533	108.75%
Total Low-Income	**304,538**	**306,466**	**100.63%**

Table 4-2: Low-Income Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Low Income	$1,113,773	$1,742,676	0.64	$645,856	$1,742,676	0.37

In PY2021, Avista completed and provided incentives for low-income electric measures in Washington and achieved total electric energy savings of 306,466 kWh. The Community Energy Efficiency Program (CEEP) exceeded savings expectations based on reported savings while the Low-Income Program did not meet savings expectations. However, the low-income sector had achieved 100.63% of the savings expectations. The Evaluators estimated the TRC value for the Low-Income portfolio is 0.64 while the UCT value is 0.37. Further details of the impact evaluation results by program are provided in the sections following.

4.1 Program-Level Impact Evaluation Results

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Low-Income sector in the section below.

4.1.1 Low-Income Program

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Washington service territory with a partnership with five network Community Action Agencies ("Agencies") and one tribal weatherization organization. The Agencies qualify income to prioritize and treat households based on several characteristics. In-house or contract crews install approved program measures. In addition, the Agencies have access to other monetary resources which allow them to weatherize a home or install additional energy efficiency measures.

Avista provides CAP agencies with the following approved measure list, which are reimbursed in full by Avista. Avista also provides a rebate list of additional energy saving measures the CAP agencies are able to utilize which are partially reimbursed. Weatherization measures under this program may also be funded by CEEP. The following table summarizes the measures offered under this program.

Table 4-3 summarizes the measures offered under this program.

Table 4-3: Low-Income Program Measures

Measure	Impact Analysis Methodology
Air Infiltration	Avista TRM
Air source heat pump	
Attic insulation	
Duct insulation	
Duct sealing	
Electric to air source heat pump	
Electric to ductless heat pump	
ENERGY STAR® door	
ENERGY STAR® refrigerator	
ENERGY STAR® window	
Floor insulation	
Heat pump water heater	
LED lighting	
Wall insulation	
High efficiency furnace	
High efficiency tankless natural gas water heater	
Natural gas boiler	

Table 4-4 summarizes the verified electric energy savings for the Low-Income Program impact evaluation.

Table 4-4: Low-Income Program Verified Electric Savings

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
E Air Infiltration	41	21,377	21,654	21,654	101.30%

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
E Duct Sealing	8	5,679	5,679	5,679	100.02%
E Ductless Heat Pump	10	21,468	24,063	24,063	112.09%
E ENERGY STAR® Doors	33	8,437	6,625	6,625	78.52%
E ENERGY STAR® Refrigerator	1	39	39	39	100.00%
E ENERGY STAR® Windows	45	17,419	17,821	17,821	102.30%
E HE Air Heat Pump	1	3,281	281	281	8.55%
E INS - Attic	26	14,075	14,076	14,076	100.01%
E INS - Duct	11	3,725	3,149	3,149	84.54%
E INS - Floor	40	38,835	39,435	39,435	101.54%
E INS - Wall	6	6,345	6,344	6,344	99.99%
E To Heat Pump Conversion	29	101,538	101,539	101,539	100.00%
Health And Safety	70	0	0	0	N/A
LED Bulbs	20	2,061	228	228	11.06%
Total	**341**	**244,279**	**240,933**	**240,933**	**98.63%**

The Low-Income Program displayed verified savings of 240,933 kWh with a realization rate of 98.63% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 4-5: Low-Income Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Air Infiltration	$65,970.17	$23,164.14	$89,134.31
E Duct Sealing	$4,160.90	$8,516.48	$12,677.38
E Ductless Heat Pump	$44,103.38	$25,427.03	$69,530.41
E ENERGY STAR® Doors	$59,774.19	$21,395.69	$81,169.88
E ENERGY STAR® Refrigerator	$710.00	$46.81	$756.81
E ENERGY STAR® Windows	$116,071.94	$65,258.76	$181,330.70
E HE Air Heat Pump	$7,782.19	$296.55	$8,078.74
E INS - Attic	$54,797.59	$51,546.48	$106,344.07
E INS - Duct	$18,703.61	$11,532.68	$30,236.29
E INS - Floor	$147,079.78	$144,409.57	$291,489.35
E INS - Wall	$18,642.99	$23,230.89	$41,873.88
E To Heat Pump Conversion	$206,570.95	$107,295.15	$313,866.10
Health And Safety	$174,851.66	$0.00	$174,851.66
LED Bulbs	$1,335.56	$152.61	$1,488.17
Total	**$920,554.91**	**$482,272.85**	**$1,402,827.76**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Low-Income Program in the section below.

4.1.1.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Low-Income Program.

4.1.1.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Low-Income Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

During review, the Evaluators found that all the requested project information clearly outlined measure details and calculations. In addition, the Evaluators found database quantity information to be consistent with documents verified.

However, the Evaluators found some instances in which 20% savings cap was not applied to all measures found to be installed in the household, leading to low realization rates for some projects in the program. In addition, the Evaluators found some instances in which electric savings were applied to gas measures.

The Evaluators found the LED bulbs unit-level savings were inaccurately referenced. Avista TRM specifies 1 kWh per bulb, while expected savings uses 9 kWh savings per bulb, leading to 11% realization for LED bulb projects under the program. The Evaluators recommend updating database calculations to use Avista TRM values during expected savings calculations.

These few instances of downward adjustment led to a realization rate of 99% for the Low-Income Program.

4.1.1.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Low-Income Program.

4.1.1.4 Impact Analysis

This section summarizes the verified savings results for the Low-Income Program. The Evaluators calculated verified savings for Low-Income Program measures using the Avista TRM. However, a whole building billing analysis was completed to supplement the findings from the desk review.

4.1.1.5 Billing Analysis

The results of the billing analysis for the Low-Income Program are provided below.

The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolate each unique measure. In doing so, the Evaluators also isolate the measure effects using the customer's consumption billing data. However, participation for the Low-Income program resulted in a small number of customers with isolated measures and therefore the Evaluators were unable to estimate measure-level savings through billing analysis.

The Evaluators instead conducted a whole-home billing analysis for all the electric measures combined in order to estimate savings for the average household participating in the program, across all measures. The Evaluators successfully created a matched cohort for the electric measure households. Customers were matched on zip code (exact match) and their average pre-period seasonal usage, including summer, fall, winter, and spring for each control and treatment household. The Evaluators were provided a considerable pool of control customers to draw upon. The Evaluators used nearest neighbor

matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers.

Table 4-6 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Low-Income Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an sufficient fit for the data.

Table 4-6: Measure Savings, Low-Income Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (kWh)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
All Electric Measures	31	308	827	351.07	1302.81	0.7	Model 2: PPR

The Evaluators applied these regression savings estimates to the program, by the number of unique households in the program and found a realization rate of 64.84% for all electric measures in the program. Further details of the billing analysis can be found in Appendix A.

4.1.1.6 Verified Savings

Due to insufficient participation to conduct measure-level billing analyses, the Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program savings for those measures. Adjusted savings were estimated using the Avista TRM. The Low-Income Program in total displays a realization rate of 98.63% with 240,933 kWh verified electric energy savings in the Washington service territory, as displayed in Table 4-4. The billing analysis provided lower savings estimates at 64.84% realization against expected savings. However, due to requirements for measure-level verified savings for cost-effectiveness testing, the Evaluators designated the adjusted savings as final.

The Evaluators note that the majority of deviations from 100% realization rate is due to the change in square footage or number of units verified in the project documentation. The Evaluators updated the quantity based on new project data.

4.1.2 Community Energy Efficiency Program (CEEP)

The Community Energy Efficiency Program was created from the Washington State Legislature in 2009 to tackle hard to reach markets in both the residential and commercial sectors by encouraging energy efficiency improvements. The CEEP pilot was funded by the U.S. Department of Energy's State Energy Program and the American Recovery and Reinvestment Act. CEEP partners are selected by a competitive request for proposals and independent review committee. Avista has been a CEEP recipient since 2014.

The Company received a $750,000 CEEP allocation for the 202-21 funding year that is set to complete in June 2021. Avista is providing a $750,000 match along with in-kind program administrative support. Three community action agencies have partnered with Avista to implement the CEEP funds under two programs: energy efficiency improvements for multifamily housing and converting income qualified homes with alternative heat sources (e.g. wood, oil) to a heat pump system. In addition, CEEP funds are being used to match utility rebates for energy efficiency work done in small businesses in rural communities.

This section summarizes the impact results of the evaluation results for CEEP. Table 4-7 summarizes the measures offered under this program.

Table 4-7: CEEP Measures

Measure	Description	Impact Analysis Methodology
CEEP Multi Family - E Ductless Heat Pump Conversion Zonal	Ductless heat pump for multi-family units	Avista TRM
CEEP Multi Family - E Windows	Window replacement for multi-family units	Avista TRM
CEEP Multi Family - E Air Infiltration	Air infiltration for multi-family units	Avista TRM
CEEP Multi Family - E Attic Insulation	Attic insulation for multi-family units	Avista TRM
CEEP Multi Family - E Ductless Heat Pump Conversion	Ductless heat pump for multi-family units	Avista TRM
CEEP Multi Family - E Line Voltage Thermostat	Line voltage thermostats for multi-family units	Avista TRM
CEEP Multi Family - G Boiler	Boiler replacement for multi-family units	Avista TRM
CEEP Multi Family - E Health & Safety	Health and safety improvements for multi-family units	Avista TRM
CEEP Multi Family - E Lighting	Efficient lighting giveaways for multi-family units	Avista TRM
CEEP Single Family - E Alternative Heat Conversion	Alternative fuel conversion to electric in multi-family units	Avista TRM
CEEP Multi Family - E Floor Insulation	Floor insulation for multi-family units	Avista TRM
CEEP Single Family - E Ductless Heat Pump	Ductless heat pump for single-family homes	Avista TRM
CEEP Single Family - E Lighting	Efficient lighting giveaways for single-family units	Avista TRM

The following table summarizes the verified electric energy savings for the CEEP impact evaluation.

Table 4-8: CEEP Verified Electric Savings

Measure	PY2021 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
CEEP Multi Family - E Attic Insulation	3	22,989	23,943	23,943	104.15%
CEEP Multi Family - E Ductless Heat Pump Conversion	1	10,572	5,448	5,448	51.53%
CEEP Multi Family - E Floor Insulation	1	2,228	2,369	2,369	106.34%
CEEP Multi Family - E Health & Safety	3	0	0	0	N/A
CEEP Multi Family - E Line Voltage Thermostat	2	4,794	2,668	2,668	55.65%
CEEP Multi Family - G Boiler	1	0	18,097	18,097	N/A
CEEP Single Family - E Air Infiltration	1	631	631	631	100.00%
CEEP Single Family - E Alternative Heat Conversion	2	18,039	11,731	11,731	65.03%
CEEP Single Family - E Attic Insulation	1	616	616	616	100.00%
CEEP Single Family - E Health & Safety	1	0	0	0	N/A
CEEP Single Family - E Lighting	1	390	30	30	7.69%
Total	**17**	**60,259**	**65,533**	**65,533**	**108.75%**

CEEP displayed verified savings of 65,533 kWh with a realization rate of 108.75% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 4-9: CEEP Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
CEEP Multi Family - E Attic Insulation	$38,574.97	$87,677.76	$126,252.73
CEEP Multi Family - E Ductless Heat Pump Conversion	$30,821.18	$5,756.83	$36,578.01
CEEP Multi Family - E Floor Insulation	$14,736.65	$8,676.10	$23,412.75
CEEP Multi Family - E Health & Safety	$79,473.71	$0.00	$79,473.71
CEEP Multi Family - E Line Voltage Thermostat	$19,707.16	$2,854.07	$22,561.23
CEEP Multi Family - G Boiler	$161,152.40	$19,359.55	$180,511.95
CEEP Single Family - E Air Infiltration	$115.75	$675.01	$790.76
CEEP Single Family - E Alternative Heat Conversion	$20,353.15	$12,548.79	$32,901.94
CEEP Single Family - E Attic Insulation	$1,721.99	$2,254.30	$3,976.29
CEEP Single Family - E Health & Safety	$7,894.11	$0.00	$7,894.11
CEEP Single Family - E Lighting	$638.03	$20.08	$658.11
Total	**$375,189.10**	**$139,822.49**	**$515,011.59**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for CEEP in the section below.

4.1.2.1 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for CEEP. The Evaluators requested additional documentation for the census of CEEP participants in order to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators collected and reviewed measure-level quantity and efficiencies for each project and found the project data to be consistent with the documentation.

The Evaluators note that of the 17 projects completed in CEEP, the three conversion projects expected savings did not align with the expected savings indicated in the Avista TRM, leading to significantly low realization rate for these projects. One project had 6 ductless heat pumps installed. However, expected savings aligns with 12 ductless heat pumps installed. One alternative heat conversion project displayed expected savings 3 times higher than the Avista TRM for one unit. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values where appropriate to the documented number of equipment indicated in the documentation. The Evaluators recommend that Avista apply savings values consistent with the Avista TRM or the RTF when calculating expected savings.

In addition, the two line voltage thermostat measures indicated verified savings approximately 56% of the assigned expected savings. These measures are not included in the Avista TRM and therefore the Evaluators used RTF line voltage savings for this measure. Two projects had 23 line voltage thermostats installed, each. However, the expected savings aligns with double the number of line voltage thermostats.

The Evaluators found that one project had converted from oil to ductless heat pump, but expected savings and measure assignment for this project was for a gas boiler. The Evaluators adjusted the measure savings for this project to a ductless heat pump conversion project and assigned savings accordingly.

Finally, the LED bulbs incented through the program had calculated expected savings that were 20 times higher than the Avista TRM indicates for the number of light bulbs installed. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values for this project appropriate to the documented number of equipment indicated in the documentation.

Although the above adjustments decrease the realization rates for the measures mentioned, the dominant measures indicate 100% or more realization (attic insulation, floor insulation, and air infiltration measures), leading to a 108% realization rate for CEEP overall.

4.1.2.2 Verification Surveys

The Evaluators did not conduct verification surveys for CEEP.

4.1.2.3 Impact Analysis

This section summarizes the verified savings results for CEEP. The Evaluators calculated verified savings for the electric measures using the RTF workbook in place at the time the savings goals for the program was finalized.

4.1.2.4 Billing Analysis

The program contained 17 unique customers across all measures. Due to the requirement of a sufficient number of pre/post billing month and the requirement that customers do not participate in more than one program, the Evaluators determined that a billing analysis was not feasible.

4.1.2.5 Verified Savings

Due to insufficient participation to conduct measure-level billing analyses, the Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net adjusted program savings for those measures. Final verified savings were estimated using the RTF UES values associated with each measure. CEEP displayed 108.75% realization with 65,533 kWh saved, as displayed in Table 4-8.

The Evaluators note that most deviations from 100% realization rate is due to unsubstantiated and large expected savings for the conversion measures and the LED lighting measures. The Evaluators applied the Avista TRM values with the appropriate categories to calculate verified savings.

4.2 Conclusions and Recommendations

The Evaluators provide the following conclusions and recommendations for Avista's Low-Income Portfolio program implementation.

4.2.1 Conclusions

The Evaluators provide the following conclusions regarding Avista's Residential electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 306,466 kWh with a realization rate of 101%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio's cost-effectiveness. The resulting TRC value for this sector is 0.64 while the UCT value is 0.37. These values are expected, as the Low-Income portfolio is not expected to meet cost-effectiveness but are implemented in order to provide energy efficiency benefits to low-income customers. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Low-Income Portfolio impact evaluation resulted in a 100% realization rate. The Low-Income Program and CEEP individually resulted in a 99% and 109% realization, respectively. The realization rates for each program deviate from 100% due to differences between the Avista TRM values applied to the quantities displayed in the tracking data. The Evaluators note several instances in which the tracking data displayed correct quantity values, but the expected savings calculated for the project did not indicate Avista TRM values were applied properly to the quantities. The Evaluators applied the correct Avista TRM values for the Low-Income Program and CEEP. For the Low-Income Program, the Evaluators applied a realization rate from a sample of rebates after verifying documentation for quantity and efficiency of measures.
- The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolate each unique measure. However, participation for the Low-Income program resulted in a small number of customers with isolated measures and therefore the Evaluators conducted a whole-home billing analysis for all the electric measures combined in the Low-Income in order to estimate savings for the average household participating in the program, across all measures. The Evaluators found a realization rate of 65% for all electric measures in the program, which is significantly lower than the realization rate of 99% from the desk review. However, due to requirements for measure-level verified savings for cost-effectiveness testing, the Evaluators designated the desk review savings as verified.
- In the Low-Income Program, The Evaluators found the LED bulbs unit-level savings were inaccurately referenced. Avista TRM specifies 1 kWh per bulb, while expected savings uses 9 kWh savings per bulb, leading to 11% realization for LED bulb projects under the program.
- CEEP contained 17 unique customers across all measures. Due to the requirement of a sufficient number of pre/post billing month and the requirement that customers do not participate in more than one program, the Evaluators determined that a billing analysis was not feasible. Instead, verified savings was estimated using Avista TRM values.
- In CEEP, the Evaluators note that of the 17 projects completed in CEEP, the three conversion projects' and one LED project's expected savings did not align with the expected savings indicated in the Avista TRM, leading to significantly low realization rate for these projects. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values where appropriate to the documented number of equipment indicated in the documentation.
- In addition, the two line voltage thermostat measures rebated through CEEP indicated verified savings approximately 56% of the assigned expected savings. These measures are not included in the Avista TRM and therefore the Evaluators used RTF line voltage savings for this measure. Although the above adjustments decrease the realization rates for the measures mentioned, the

dominant measures indicate 100% or more realization (attic insulation, floor insulation, and air infiltration measures), leading to a 108% realization rate for CEEP overall.

4.2.2 Recommendations

The Evaluators offer the following recommendations regarding Avista's Low-Income electric programs:

- The Evaluators note that most deviations from 100% realization rate is due to differences between the limited measure category options Avista TRM values and the more detailed categories referencing heating zone, cooling zone, heating type, and bulb types present in the RTF. The Evaluators recommend that Avista reference the more detailed RTF measures when calculating expected savings for the programs.
- The Evaluators reviewed the project documentation provided by Avista and identified conflicting square footage or number of units between the aggregated project data from the expected savings calculated for each project. The Evaluators found very few instances in which the tracking data quantity differed from the quantity displayed in sampled documentation and invoices. The Evaluators recommend providing corrections to the application of Avista TRM values to tracking data quantity.
- The Evaluators note that of the 17 projects completed in CEEP, the three conversion projects' and one LED project's expected savings did not align with the expected savings indicated in the Avista TRM, leading to significantly low realization rate for these projects. The calculations behind these expected savings are unclear, however, the Evaluators applied Avista TRM values where appropriate to the documented number of equipment indicated in the documentation. The Evaluators recommend that Avista apply savings values consistent with the Avista TRM or the RTF when calculating expected savings.

5. Appendix A: Billing Analysis Results

This appendix provides additional details on the billing analyses conducted for each program.

5.1 Low-Income Program

The Evaluators conducted a whole-home billing analysis for all the electric measures combined in order to estimate savings for the average household participating in the program, across all measures. The Evaluators successfully created a matched cohort for the electric measure households. Customers were matched on zip code (exact match) and their average pre-period seasonal usage, including summer, fall, winter, and spring for each control and treatment household.

The Evaluators were provided a considerable pool of control customers to draw upon, as shown in Table 5-1. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. Also shown in Table 5-1, are the impact of various restrictions on the number of treatment and control customers that were included in the final regression model. The "Starting Count" displays the beginning number of customers available prior to applying the data restrictions, while the "Ending Count" displays the number of customers after applying data restrictions and final matching.

Table 5-1: Cohort Restrictions, Low-Income Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
Whole home electric	Starting Count	412	8,045
	Install Date Range: January 1, 2020 to June 30, 2021	47	8,045
	Control Group Usage Outlier (>2X max treatment usage)	47	8,045
	Incomplete Post-Period Bills (<4 months)	46	7,162
	Incomplete Pre-Period Bills (<10 months)	31	4749
	Ending Count (Matched by PSM)	31	315/308

Figure 5-1 and Figure 5-2 display the density of each variable employed in propensity score matching for the combined electric measures before and after conducting matching.

The distributions prior to matching appear to be less similar in summer, with control customers averaging higher usage. However, after matching, the pre-period usage distribution in summer is more similar between the groups. The remaining pre-period seasons (winter, summer, fall), closely overlap before and after matching, indicating little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-1: Covariate Balance Before Matching, Low-Income Electric Measures

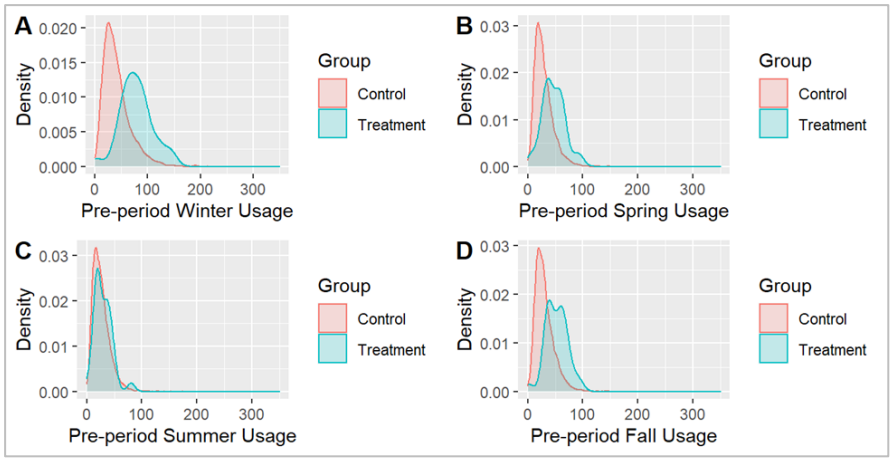
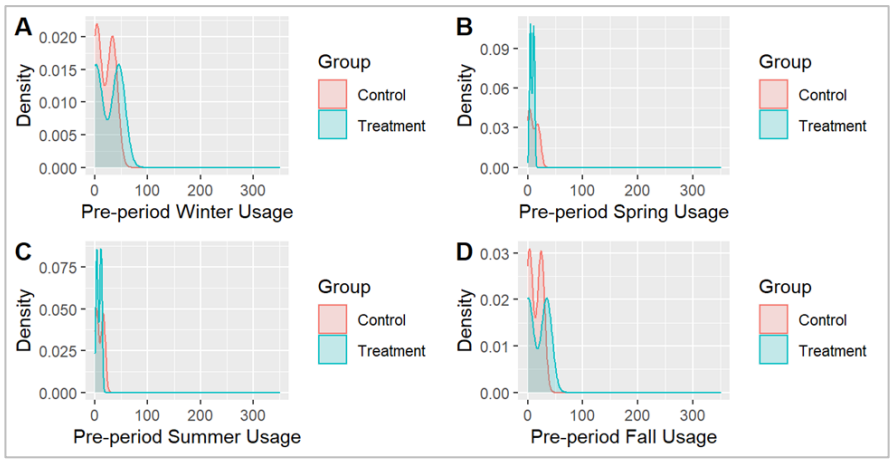


Figure 5-2: Covariate Balance After Matching, Low-Income Electric Measures



The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure. The t-test displayed no statistically significant differences at the 95% level in average daily consumption between the treatment and control groups for any month in the pre-period. In addition, the chi-squared test returned a p-value well over 0.05 for all measures, indicating that pre-period usage was balanced between the groups. Lastly, the standardized difference test returned values were under 10 (well under the recommended cutoff of 25), further indicating the groups were well matched on all included covariates.

Table 5-2 provides results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Low-Income program. The P-Value is over 0.05 for each month, meaning pre-period usage between treatment and control groups is similar at the 95% confidence level.

Table 5-2: Pre-period Usage T-test for Electric Measures, Low-Income Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	28.926	29.498	-0.241	2.371	0.809	No
Feb	27.695	27.928	-0.105	2.203	0.916	No
Mar	24.674	25.378	-0.374	1.886	0.709	No
Apr	21.803	21.716	0.053	1.628	0.958	No
May	19.853	19.733	0.08	1.503	0.936	No
Jun	21.393	21.452	-0.033	1.782	0.973	No
Jul	25.695	26.272	-0.254	2.27	0.8	No
Aug	26.904	27.217	-0.135	2.319	0.893	No
Sep	22.217	21.801	0.241	1.725	0.81	No
Oct	22.956	23.387	-0.253	1.701	0.8	No
Nov	27.493	28.509	-0.453	2.243	0.651	No
Dec	29.415	30.491	-0.431	2.496	0.667	No

Table 5-3 provides customer counts for customers in the final regression model by assigned weather station ID for each measure. In addition, TMY HDD and CDD from the nearest available TMY weather station is provided as well as the weighted HDD/CDD for each measure. The HDD and CDD was weighted by the number of treatment customers assigned to a weather station.

Table 5-3: TMY Weather, Low-Income Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
All Electric Measures	727827	8	727827	5,428	731	6,292	510
	727830	22	727830	5,510	906	6,292	510
	727834	23	727834	6,915	376	6,292	510
	727850	9	727850	6,246	519	6,292	510
	727855	5	727855	7,360	439	6,292	510
	727856	104	727856	6,246	519	6,292	510
	727857	32	727857	6,467	299	6,292	510

In addition to the net savings value represented above, the Evaluators also conducted a treatment-only regression model for each of the measures described above. Table 5-4 provides annual savings/customer for the Low-Income program for all electric measures and regression model. The PPR model was selected for ex-post net savings because it provided the best fit for the data (highest adjusted R-squared). The treatment-only model represents estimated gross savings for this measure. The Evaluators estimate gross savings for each Low-Income participant is 1,303 kWh per year.

Table 5-4: Household Savings for All Regression Models, Low-Income Program

Measure	Model	# of Treatment Customers	# of Control Customers	Annual Savings/Customer	90% Lower CI	90% Upper CI	Adjusted R-Squared
All Electric Measures	Diff-in-diff	31	308	387.59	0	1,223.79	0.13
	PPR	31	308	826.98	351.07	1,302.81	0.70
	Treatment Only (Gross)	31	308	520.36	0	1,459.29	0.14

6. Appendix B: Summary of Survey Respondents

This section summarizes additional insights gathered from the simple verification surveys deployed by the Evaluators for the impact evaluation of Avista's Residential and Low-Income Programs.

Survey respondents confirmed installing between one and three measures that were rebated by Avista, displayed in Table 6-1.

Table 6-1: Type and Number of Measures Received by Respondents

Measure Category	Total	Percent
One Measure	171	56%
Two Measures	91	30%
Three Measures	34	11%
Four Measures	7	2%
Five Measures	2	1%
HVAC	108	35%
Water Heater	87	29%
Smart Thermostat	127	42%
Clothes Washer	99	32%
Clothes Dryer	66	22%

The Evaluators asked respondents to provide information regarding their home, as displayed in Table 6-2. Similar to the previous impact evaluation findings, the majority of respondents noted owning a single-family home between 1,000 and 3,000 square feet with central air conditioning.

Table 6-2: Survey Respondent Home Characteristics[9]

Question	Response	Percent
Do you rent or your home? (n=300)	Own	98%
	Rent	2%
Which of the following best describe your home? (n=301)	Single-family house detached from any other house	85%
	Single-family house attached to one or more other houses (e.g., duplex, condominium, townhouse)	4%
	Mobile or manufactured home	10%
	Apartment	1%
Does your home have central air conditioning, window air conditioning, or neither? (n=301)	Window air conditioning / a room AC unit	18%
	Central air conditioning	73%
	Neither	8%
	Don't Know	1%
About how many square feet is your home? (n=300)	Less than 1,000 square feet	8%
	1,000-1,999 square feet	48%
	2,000-2,999 square feet	25%
	3,000-3,999 square feet	11%
	4,000 or more square feet	6%
	Don't know	2%
When was your home built? (n=301)	Before 1960	27%
	1960 to 1969	6%
	1970 to 1979	15%
	1980 to 1989	9%
	1990 to 1999	13%
	2000 to 2009	11%
	2010 to 2018	18%
	Don't know	1%

[9] Four contractors or construction companies were not asked these questions.

7. Appendix C: Cost Benefit Analysis Results

The Evaluators estimated the cost-effectiveness for the Avista Residential and Low-Income Programs using evaluated savings results, economic inputs provided by Avista, and incremental costs and non-energy impacts from the RTF. The table below presents the cost-effectiveness results for the PY2021 portfolio.

Table 7-1: Cost-effectiveness Results

Program	TRC	UCT	RIM	PCT	TRC Net Benefits
Residential	1.18	1.98	0.43	1.37	$530,276
Low Income	0.64	0.37	0.22	N/A*	($628,903)
Total	**0.98**	**1.13**	**0.37**	**N/A***	**($98,627)**
***Low Income is offered at no cost to participants; PCT is not calculable.**					

7.1 Approach

The California Standard Practice Model was used as a guideline for the calculations. The cost-effectiveness analysis methods that were used in this analysis are among the set of standard methods used in this industry and include the Utility Cost Test (UCT)[10], Total Resource Cost Test (TRC), Ratepayer Impact Measure Test (RIM), and Participant Cost Test (PCT). All tests weigh monetized benefits against costs. These monetized amounts are presented as NPV evaluated over the lifespan of the measure. The benefits and costs differ for each test based on the perspective of the test. The definitions below are taken from the California Standard Practice Manual.

- The TRC measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.
- The UCT measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.
- The PCT is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.
- The RIM test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation is less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels.

[10] The UCT is also referred to as the Program Administrator Cost Test (PACT).

A common misperception is that there is a single best perspective for evaluation of cost-effectiveness. Each test is useful and accurate, but the results of each test are intended to answer a different set of questions. The questions to be addressed by each cost test are shown in the table below.[11]

Table 7-2: Questions Addressed by the Various Cost Tests

Cost Test	Questions Addressed
Participant Cost Test (PCT)	▪ Is it worth it to the customer to install energy efficiency?
	▪ Is it likely that the customer wants to participate in a utility program that promotes energy efficiency?
Ratepayer Impact Measure (RIM)	▪ What is the impact of the energy efficiency project on the utility's operating margin?
	▪ Would the project require an increase in rates to reach the same operating margin?
Utility Cost Test (UCT)	▪ Do total utility costs increase or decrease?
	▪ What is the change in total customer bills required to keep the utility whole?
Total Resource Cost Test (TRC)	▪ What is the regional benefit of the energy efficiency project (including the net costs and benefits to the utility and its customers)?
	▪ Are all of the benefits greater than all of the costs (regardless of who pays the costs and who receives the benefits)?
	▪ Is more or less money required by the region to pay for energy needs?

Overall, the results of all four cost-effectiveness tests provide a more comprehensive picture than the use of any one test alone. The TRC cost test addresses whether energy efficiency is cost-effective overall. The PCT, UCT, and RIM address whether the selection of measures and design of the program are balanced from the perspective of the participants, utilities, and non-participants. The scope of the benefit and cost components included in each test are summarized in the table below.[12]

Table 7-3: Benefits and Costs Included in Each Cost-Effectiveness Test

Test	Benefits	Costs
PCT (Benefits and costs from the perspective of the customer installing the measure)	▪ Incentive payments ▪ Bill Savings ▪ Applicable tax credits or incentives	▪ Incremental equipment costs ▪ Incremental installation costs

[11] http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf
[12] Ibid.

Test	Benefits	Costs
UCT (Perspective of utility, government agency, or third party implementing the program	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Utility/program administrator incentive costs
TRC (Benefits and costs from the perspective of all utility customers in the utility service territory)	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution ▪ Additional resource savings ▪ Monetized non-energy benefits	▪ Program overhead costs ▪ Program installation costs ▪ Incremental measure costs
RIM (Impact of efficiency measure on non-participating ratepayers overall)	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Lost revenue due to reduced energy bills ▪ Utility/program administrator installation costs

7.2 Non-Energy Benefits

Non-energy Benefits (NEBs) were sourced from the RTF workbook in place at the time the savings goals for the program was finalized. NEBs included wood fuel credits, increased comfort, and reductions in PM 2.5 emissions.

- Residential measures with NEBs included air source heat pumps, ductless heat pumps, windows, and insulation measures.
- Low Income NEBs included the NEBs described for Residential as well as a dollar-for-dollar benefit adder for health and safety spending.

7.3 Economic Inputs for Cost Effectiveness Analysis

The Evaluators used the economic inputs provided by Avista for the cost benefit analysis. Avista provided the Evaluators with avoided costs on the following basis:

- Hourly avoided commodity costs
- Modifications for the Clean Premium
- Avoided capacity costs
- Avoided transmission

- 10% Conservation Adder
- Line losses
- Discount rate (after tax Weighted Average Cost of Capital)

The values were aggregated to provide a single benefit multiplier on a kWh basis for every hour of the year (8,760). Savings by measure were then parsed out to the following load shapes provided by Avista:

- Residential Space Heating
- Residential Air Conditioning
- Residential Lighting
- Residential Refrigeration
- Residential Water Heating
- Residential Dishwasher
- Residential Washer/Dryer
- Residential Furnace Fan
- Residential Miscellaneous

The Evaluators in addition created a Residential Heat Pump load shape by weighting the relative magnitude of cooling versus heating savings from a heat pump and assigning these to weight the Residential Space Heating and Residential Air Conditioning load shapes.

7.4 Results

The tables below outline the results for each test, for both the programs and the portfolio as a whole. Summations may differ by $1 due to rounding.

Table 7-4: Cost-Effectiveness Results by Sector

Sector	TRC	UCT	RIM	PCT
Residential	1.18	1.98	0.43	1.37
Low Income	0.64	0.37	0.22	N/A*
Total	**0.98**	**1.13**	**0.37**	**N/A***
***Low Income is offered at no cost to participants; PCT is not calculable.**				

Table 7-5: Cost-Effectiveness Benefits by Sector

Program	TRC Benefits	UCT Benefits	RIM Benefits	PCT Benefits
Residential	$3,465,419	$3,109,710	$3,109,710	$2,418,761
Low Income	$1,113,773	$645,856	$645,856	$1,740,413
Total	**$4,579,192**	**$3,755,566**	**$3,755,566**	**$4,159,174**

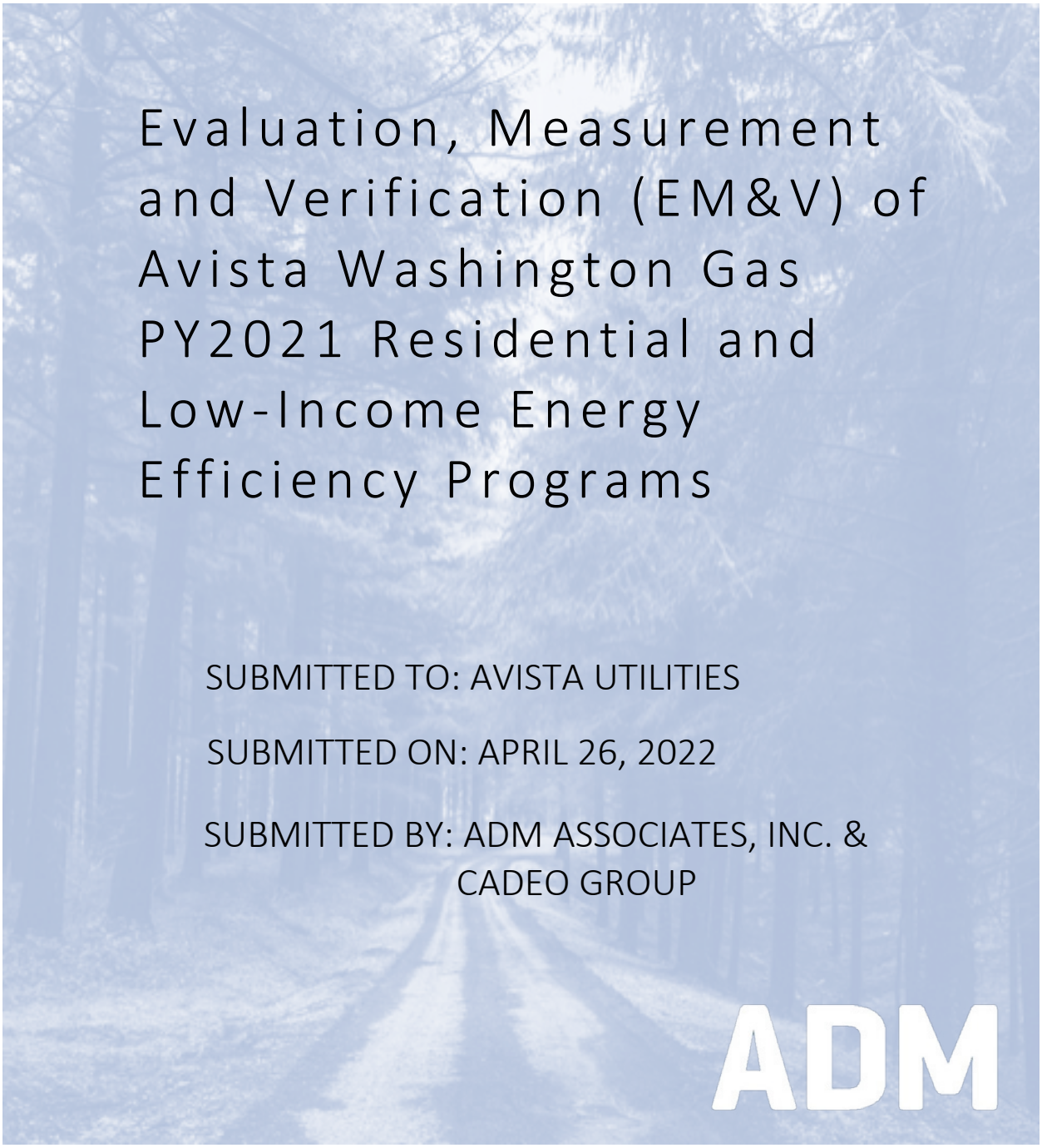
Table 7-6: Cost-Effectiveness Costs by Sector

Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs
Residential	$2,935,143	$1,568,428	$7,216,463	$1,760,632
Low Income	$1,742,676	$1,742,676	$2,910,745	$1,295,744
Total	**$4,677,819**	**$3,311,105**	**$10,127,208**	**$3,056,376**

Table 7-7: Cost-Effectiveness Net Benefits by Sector

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits
Residential	$530,276	$1,541,281	($4,106,753)	$658,129
Low Income	($628,903)	($1,096,820)	($2,264,889)	$444,669
Total	**($98,627)**	**$444,461**	**($6,371,642)**	**$1,102,798**

APPENDIX D –



Evaluation, Measurement and Verification (EM&V) of Avista Washington Gas PY2021 Residential and Low-Income Energy Efficiency Programs

SUBMITTED TO: AVISTA UTILITIES

SUBMITTED ON: APRIL 26, 2022

SUBMITTED BY: ADM ASSOCIATES, INC. & CADEO GROUP

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1. Executive Summary

This report is a summary of the Residential and Low-Income Gas Evaluation, Measurement, and Verification (EM&V) effort of the 2021 program year (PY2021) portfolio of programs for Avista Corporation (Avista) in the Washington service territory. The evaluation was administered by ADM Associates, Inc. and Cadeo Group, LLC (herein referred to as the "Evaluators").

1.1 Savings & Cost-Effectiveness Results

The Evaluators conducted an impact evaluation for Avista's Residential and Low-Income programs for PY2021. The Residential portfolio savings amounted to 430,396.82 Therms with a 100.24% realization rate. The Low-Income portfolio savings amounted to 12,454.82 Therms with a 98.51% realization rate. The Evaluators summarize the Residential portfolio verified savings in Table 1-1 and the Low-Income portfolio verified savings in Table 1-2 below.

The Residential portfolio reflects a TRC value of 1.93 and a UCT value of 4.30. The Low-Income portfolio reflects a TRC value of 0.48 and a UCT value of 0.31, leading to a total Residential and Low-Income TRC of 1.65 and a UCT of 2.83. Table 1-3 summarizes the evaluated TRC and UCT values with each the Residential and Low-Income portfolios.

Table 1-1: Residential Verified Impact Savings by Program

Program	Expected Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate	Total Costs
Water Heat	43,695.80	43,695.80	100.00%	$299,483.28
HVAC	306,474.86	306,026.45	99.85%	$1,712,865.15
Shell	76,017.75	76,639.48	100.82%	$745,372.25
ENERGY STAR Homes	334.96	401.94	120.00%	$1,884.35
Small Home & MF Weatherization	1,924.83	2,912.03	151.29%	$19,718.56
Appliances	900.40	721.11	80.09%	$8,373.21
AeroBarrier	1,658.52	-	-	$14,791.95
Total Res	**429,348.60**	**430,396.82**	**100.24%**	**$2,802,488.76**

Table 1-2: Low-Income Verified Impact Savings by Program

Program	Expected Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate	Total Costs
Low-Income	12,642.97	12,454.82	98.51%	$1,640,455.89
CEEP	9,153.00	0.00	0.00%	$0.00
Total Low-Income	**12,642.97**	**12,454.82**	**98.51%**	**$1,640,455.89**

*Savings from CEEP are not included in Low-Income portfolio total expected savings

Table 1-3: Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$13,328,625	$6,903,476	1.93	$12,116,794	$2,816,408	4.30
Low Income	$784,655	$1,640,456	0.48	$504,110	$1,640,456	0.31
Total	**$14,113,281**	**$8,543,932**	**1.65**	**$12,620,904**	**$4,456,864**	**2.83**

Table 1-4 summarizes the gas programs offered to residential and low-income customers in the Washington Avista service territory in PY2021 as well as the Evaluators' evaluation tasks and impact methodology for each program.

Table 1-4: Impact Evaluation Activities by Program and Sector

Sector	Program	Database Review	Survey Verification	Impact Methodology
Residential	Water Heat	✓	✓	Avista TRM
Residential	HVAC	✓	✓	Avista TRM/IPMVP Option A
Residential	Shell	✓	✓	Avista TRM
Residential	ENERGY STAR® Homes	✓		Avista TRM
Residential	Small Home & MF Weatherization	✓	✓	Avista TRM
Residential	Appliances	✓	✓	Avista TRM
Residential	AeroBarrier			No evaluation completed for PY2021
Low-Income	Low-Income	✓		Avista TRM
Low-Income	Community Energy Efficiency Program (CEEP)	✓		Avista TRM

1.2 Conclusions and Recommendations

The following section details the Evaluators' conclusions and recommendations for each the Residential Portfolio and Low-Income Portfolio program evaluations.

1.2.1 Conclusions

The following section details the Evaluator's findings resulting from the program evaluations for each the Residential Portfolio and Low-Income Portfolio.

1.2.1.1 Residential Programs

The Evaluators provide the following conclusions regarding Avista's Residential gas programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 430,396.82 Therms with a realization rate of 100.24%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio's cost-effectiveness. The resulting TRC value for this sector is 1.93 while the UCT value is 4.30. Further details on cost-effectiveness methodology can be found in Appendix C.

- The Residential Portfolio impact evaluation resulted in a realization rate of 100.24% due to slight differences between the applied Avista TRM values and the active Avista TRM value or applied measure-level quantities for each measure in addition to the difference in savings values between the results from billing analyses and the Avista TRM.
- The HVAC Program, which contributes 71% of the expected savings, resulted in a realization rate of 99.85%. Each of the other programs resulted in a combined 101% realization rate.
- The Evaluators conducted verification surveys via web survey to collect information from customers who participated in the Water Heat, HVAC, and Appliance Programs. A total of 305 unique customers were surveyed between August 2021 and February 2022. The Evaluators collected information including the functionality of the efficient equipment, the functionality of the replaced equipment, and information on how the COVID19 stay-at-home orders have affected the household energy usage. The Evaluators calculated in-service rates for the measures within these two programs in order to apply findings to the verified savings results for each program.
- The realization rate for the natural gas savings in the Water Heat Program was 100.00%. The Evaluators found no instances in which a project savings deviated from the expected savings.
- The Evaluators explored a billing analysis for the natural gas water heater measures within the Water Heat Program. However, the G 50 Gallon Natural gas Water Heater and the G Tankless Gas Water Heater measures resulted in savings that were not statistically significant. Therefore, the Evaluators elected to use Avista TRM values to estimate verified savings. The Evaluators will explore further billing analyses for these measures during the next program year if participation permits.
- The HVAC Program in total displays a realization rate of 99.85% with 306,026.45 Therms verified natural gas savings in the Washington service territory. The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to one project which was verified to be a duplicate. The Evaluators removed savings for this project. All other rebates were assigned savings equivalent to the expected savings through Avista TRM values. The furnace measure has nearly identical billing analysis results to the Avista TRM value (billing analysis indicated 81.5 Therms saved for G Natural Gas Furnace, while Avista TRM indicated 81.66 Therms).
- The Evaluators attempted to estimate smart thermostat measure savings values for the HVAC Program. However, because the results from the billing analyses for smart thermostats were contradicting and/or inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for these measures. The findings from the PY2021 billing analyses for these measures may have been impacted by the COVID19 pandemic. The Evaluators will explore additional billing analyses for these measures during program year 2022.
- The Shell Program displayed verified savings of 76,639.48 Therms with a realization rate of 100.82% against the expected savings for the program. The realization rate for the natural gas savings in the Shell Program deviate from 100% due to the slight differences between R-values or quantities between the Avista tracking database and the verified documents. The Evaluators conducted a billing analysis for the attic insulation and window replacement measures, however, due to unexpectedly low savings estimates, the Evaluators chose to verify savings through the Avista TRM.
- The ENERGY STAR Homes Program displayed a realization rate of 93.33% at 437.67 Therms saved in PY2021. The Evaluators found expected savings to differ for the G ENERGY STAR Home –

Manufactured, Gas & Electric one of the three projects had expected gas savings equal to half of the Avista TRM value. The Evaluators used Avista TRM values, leading to a 200% realization rate for this project and a 120% realization rate for the gas measures overall. The realization rate had an overall downward adjustment due to low verified gas savings for the electric measures.

- In the Small Home & MF Weatherization Program, the Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate “Multifamily” home type. Rather, the current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”.
- The gas measures rebated through the Appliance Program are not contained in the Avista TRM. Therefore, the Evaluators applied savings for these projects by converting Avista TRM electric savings to gas savings by dividing approved Avista TRM savings for the equipment by 29.3. This application led to 85% realization for clothes dryers and 79% realization for clothes washers.
- The Evaluators did not complete an impact analysis for the AeroBarrier Program. Therefore, the AeroBarrier program’s savings is not included in the portfolio expected savings total or the portfolio verified savings total displayed in Table 1-1. A full impact analysis will be completed for the program in PY2022.

1.2.1.2 Low-Income Programs

The Evaluators provide the following conclusions regarding Avista’s Low-Income natural gas programs:

- The Evaluators found the Low-Income portfolio to demonstrate a total of 12,454.82 Therms with a realization rate of 98.51%. The Low-Income Portfolio impact evaluation resulted verified savings that exceeded expected savings.
- The Evaluators conducted a cost-benefit analysis in order to estimate the Low-Income portfolio’s cost-effectiveness. The resulting TRC value for this sector is 0.48 while the UCT value is 0.31. These values are expected, as the Low-Income portfolio is not expected to meet cost-effectiveness but are implemented in order to provide energy efficiency benefits to low-income customers. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolate each unique measure. However, participation for the Low-Income program resulted in a small number of customers with isolated measures and therefore the Evaluators conducted a whole-home billing analysis for all the natural gas measures combined in the Low-Income in order to estimate savings for the average household participating in the program, across all measures. However, the billing analysis results were not statistically significant. Therefore, the Evaluators found a realization rate of 98.51% from the desk review with Avista TRM values.
- The Evaluators note that the majority of deviations from 100% realization rate in the Low-Income Program is due to the change in square footage or number of units verified in the project documentation as well as verifying 20% annual household energy caps were properly applied.

- In evaluating CEEP, the Evaluators found that the project indicated as “CEEP Multi Family – G Boiler” had instead indicated a conversion from electric to ductless heat pump. Therefore, the Evaluators assigned electric savings to the project rather than gas savings, leading to 0 Therms savings claimed through the program.
- There were no natural gas saving measures rebated in CEEP in PY2021, and there are no Therms penalties for the electric measures presented above. Therefore, the total natural gas savings for CEEP is 0. In addition, the total incentive and non-incentive costs for the program is $0.

1.2.2 Recommendations

The following section details the Evaluator’s recommendations resulting from the program evaluations for each the Residential Portfolio and Low-Income Portfolio.

1.2.2.1 Residential Programs

The Evaluators offer the following recommendations regarding Avista’s Residential natural gas programs:

- The Evaluators note instances found in which the web-based rebate data indicates the household has electric space heating, but all other sources (project data and document verification) indicate natural gas space heating, and vice versa. The Evaluators recommend updating data collection standards in order for all sources of information to reflect the same values as the project documentation.
- The Evaluators found that many projects claimed under the Small Home & MF Weatherization Program exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Shell Program.
- The Evaluators found expected savings to differ significantly for 8 of the 23 sampled projects in the Small Home & MF Weatherization Program. The expected savings calculated for these projects did not align with the values indicated in the Avista TRM. The Evaluators recommend updating the CC&B database to correct for these issues.
- The gas measures rebated through the Appliances Program are not contained in the Avista TRM. Therefore, the Evaluators applied savings for these projects by converting Avista TRM electric savings to gas savings by dividing approved Avista TRM savings for the equipment by 29.3. This application led to 85% realization for clothes dryers and 79% realization for clothes washers. The Evaluators recommend Avista include savings estimates for these measures in the Avista TRM for future evaluations.

1.2.2.2 Low-Income Programs

The Evaluators offer the following recommendations regarding Avista’s Low-Income natural gas programs:

- The Evaluators note that the majority of deviations from 100% realization rate in the Low-Income Program is due to the change in square footage or number of units verified in the project

documentation as well as verifying 20% annual household energy caps were properly applied. The Evaluators recommend verifying each of these values are documented and applied.

- In evaluating CEEP, the Evaluators found that the project indicated as "CEEP Multi Family – G Boiler" had instead indicated a conversion from electric to ductless heat pump. Therefore, the Evaluators assigned electric savings to the project rather than gas savings, leading to 0 Therms savings claimed through the program. The Evaluators recommend verifying any projects in which large gas savings are applied.

2. General Methodology

The Evaluators performed an impact evaluation on each of the programs summarized in Table 1-4. The Evaluators used the following approaches to calculate energy impact defined by the International Performance Measurement and Verification Protocols (IPMVP)[1] and the Uniform Methods Project (UMP)[2]:

- Simple verification (web-based surveys)
- Document verification (review project documentation)
- Deemed savings (RTF UES and Avista TRM values)
- Whole facility billing analysis (IPMVP Option C)

The Evaluators completed the above impact tasks for each the natural gas impacts for projects completed in the Washington Avista service territory.

The M&V methodologies are program-specific and determined by previous Avista evaluation methodologies as well as the relative contribution of a given program to the overall energy efficiency impacts. Besides drawing on IPMVP, the Evaluators also reviewed relevant information on infrastructure, framework, and guidelines set out for EM&V work in several guidebook documents that have been published over the past several years. These include the following:

- Northwest Regional Technical Forum (RTF)[3]
- National Renewable Energy Laboratory (NREL), United States Department of Energy (DOE) The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures, April 2013[4]
- International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization (EVO) with sponsorship by the U.S. Department of Energy (DOE)[5]

The Evaluators kept data collection instruments, calculation spreadsheets, and monitored/survey data available for Avista records.

2.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators have provided a glossary of terms to follow:

- **Deemed Savings** – An estimate of an energy savings outcome (gross savings) for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources

[1] https://www.nrel.gov/docs/fy02osti/31505.pdf
[2] https://www.nrel.gov/docs/fy18osti/70472.pdf
[3] https://rtf.nwcouncil.org/measures
[4] Notably, The Uniform Methods Project (UMP) includes the following chapters authored by ADM. Chapter 9 (Metering Cross-Cutting Protocols) was authored by Dan Mort and Chapter 15 (Commercial New Construction Protocol) was Authored by Steven Keates.
[5] Core Concepts: International Measurement and Verification Protocol. EVO 100000 – 1:2016, October 2016.

and analytical methods that are widely accepted for the measure and purpose and (b) are applicable to the situation being evaluated.

- **Expected Savings** – Calculated savings used for program and portfolio planning purposes.
- **Adjusted Savings** – Savings estimates after database review and document verification has been completed using deemed unit-level savings provided in the Avista TRM. It adjusts for such factors as data errors and installation rates.
- **Verified Savings** – Savings estimates after the updated unit-level savings values have been updated and energy impact evaluation has been completed, integrating results from billing analyses and appropriate RTF UES and Avista TRM values.
- **Gross Savings** – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, regardless of why they participated.
- **Free Rider** – A program participant who would have implemented the program measure or practice in absence of the program.
- **Net-To-Gross** – A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.
- **Net Savings** – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, with adjustments to remove savings due to free ridership.
- **Non-Energy Benefits** – Quantifiable impacts produced by program measures outside of energy savings (comfort, health and safety, reduced alternative fuel, etc).
- **Non-Energy Impacts** – Quantifiable impacts in energy efficiency beyond the energy savings gained from installing energy efficient measures (reduced cost for operation and maintenance of equipment, reduced environmental and safety costs, etc).

2.2 Summary of Approach

This section presents our general cross-cutting approach to accomplishing the impact evaluation of Avista's Residential and Low-Income programs listed in Table 1-4. The Evaluators start by presenting our general evaluation approach. This chapter is organized by general task due to several overlap across programs. Section 3.3 describes the Evaluators' program-specific residential impact evaluation methods and results in further detail and Section 4.1 describes the Evaluator's program-specific low-income impact evaluation methods and results.

The Evaluators outline the approach to verifying, measuring, and reporting the residential portfolio impacts as well as cost-effectiveness and summarizing potential program and portfolio improvements. The primary objective of the impact evaluation is to determine ex-post verified net energy savings. On-site verification and equipment monitoring was not conducted during this impact evaluation due to stay-at-home orders due to the COVID19 pandemic.

Our general approach for this evaluation considers the cyclical feedback loop among program design, implementation, and impact evaluation. Our activities during the evaluation estimate and verify annual energy savings and identify whether a program is meeting its goals. These activities are aimed to provide guidance for continuous program improvement and increased cost effectiveness for the 2021 and 2021 program years.

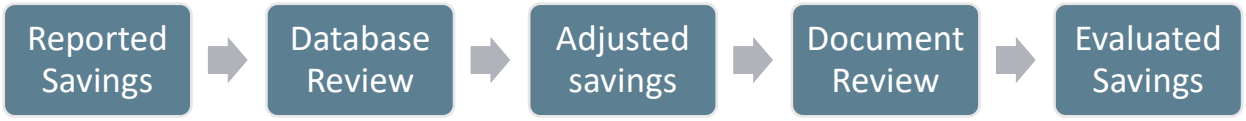
The Evaluators employed the following approach to complete impact evaluation activities for the programs. The Evaluators define two major approaches to determining net savings for Avista's programs:

- A *Deemed Savings* approach involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. These prescriptive savings may also include an adjustment for certain measures, such as lighting measures in which site operating hours may differ from RTF values.
- A *Billing Analysis* approach involves estimating energy savings by applying a linear regression to measured participant energy consumption utility meter billing data. Billing analyses included billing data from nonparticipant customers. This approach does not require on-site data collection for model calibration. This approach aligns with the IPMVP Option C.

The Evaluators accomplished the following quantitative goals as part of the impact evaluation:

- Verify savings with 10% precision at the 90% confidence level;
- Where appropriate, apply the RTF to verify measure impacts; and
- Where available data exists, conduct billing analysis with a suitable comparison group to estimate measure savings.

For each program, the Evaluators calculated adjusted savings for each measure based on the Avista TRM and results from the database review. The Evaluators calculated verified savings for each measure based on the RTF UES, Avista TRM, or billing analysis in combination with the results from document review. For the HVAC, Water Heat, and Fuel Efficiency programs, the Evaluators also applied in-service rates (ISRs) from verification surveys.



The Evaluators assigned methodological rigor level for each measure and program based on its contribution to the portfolio savings and availability of data.

The Evaluators analyzed billing data for all natural gas measure participants in the HVAC and Low-Income programs. The Evaluators applied billing analysis results to determine evaluated savings only for measures where savings could be isolated (that is, where a sufficient number of participants could be identified who installed only that measure). Program-level realization rates for the HVAC, Water Heat, and Fuel Efficiency programs incorporate billing analysis results for some measures.

2.2.1 Database Review

At the outset of the evaluation, the Evaluators reviewed the databases to ensure that each program tracking database conforms to industry standards and adequately tracks key data required for evaluation.

Measure-level net savings were evaluated primarily by reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied using the Avista TRM. The Evaluators then aggregated and cross-check program and measure totals.

The Evaluators reviewed program application documents for a sample of incented measures to verify the tracking data accurately represents the program documents. The Evaluators ensured the home installed measures that meet or exceed program efficiency standards.

2.2.2 Verification Methodology

The Evaluators verified a sample of participating households for detailed review of the installed measure documentation and development of verified savings. The Evaluators verified tracking data by reviewing invoices and surveying a sample of participant customer households. The Evaluators also conducted a verification survey for program participants.

The Evaluators used the following equations to estimate sample size requirements for each program and fuel type. Required sample sizes were estimated as follows:

Equation 2-1: Sample Size for Infinite Sample Size

$$n = \left(\frac{Z \times CV}{d}\right)^2$$

Equation 2-2: Sample Size for Finite Population Size

$$n_0 = \frac{n}{1 + \left(\frac{n}{N}\right)}$$

Where,

- n = Sample size
- Z = Z-value for a two-tailed distribution at the assigned confidence level.
- CV = Coefficient of variation
- d = Precision level
- N = Population

For a sample that provides 90/10 precision, *Z* = 1.645 (the critical value for 90% confidence) and *d* = 0.10 (or 10% precision). The remaining parameter is *CV*, or the expected coefficient of variation of measures for which the claimed savings may be accepted. A *CV* of .5 was assumed for residential programs due to the homogeneity of participation[6], which yields a sample size of 68 for an infinite population. Sample sizes were adjusted for smaller populations via the method detailed in Equation 2-2.

[6] Assumption based off California Evaluation Framework:

https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/EE_and_Energy_Savings_Assist/CAEvaluationFramework.pdf

The following sections describe the Evaluator's methodology for conducting document-based verification and survey-based verification.

2.2.2.1 Document-Based Verification

The Evaluators requested rebate documentation for a subset of participating customers. These documents included invoices, rebate applications, pictures, and AHRI certifications for the following programs.

- Water Heat Program
- HVAC Program
- Shell Program
- ENERGY STAR® Homes Program
- Small Home & MF Weatherization Program
- Appliances
- Low-Income Program
- Community Energy Efficiency Program

This sample of documents was used to cross-verify tracking data inputs. In the case the Evaluators found any deviations between the tracking data and application values, the Evaluators reported and summarized those differences in the Database Review sections presented for each program in Section 3.3 and Section 4.1.

The Evaluators developed a sampling plan that achieves a sampling precision of ±10% at 90% statistical confidence – or "90/10 precision" – to estimate the percentage of projects for which the claimed savings are verified or require some adjustment.

The Evaluators developed the following samples for each program's document review using Equation 2-1 and Equation 2-2. The Evaluators ensured representation in each state and fuel type for each measure.

Table 2-1: Document-based Verification Samples and Precision by Program

Sector	Program	Gas Population	Sample (With Finite Population Adjustment)*	Precision at 90% CI
Residential	Water Heat	1,230	66	±9.9%
Residential	HVAC	9,193	70	±9.8%
Residential	Shell	1,715	72	±9.5%
Residential	ENERGY STAR® Homes	8	8	±0.0%
Residential	Small Home & MF Weatherization	66	36	±9.3%
Residential	Appliances	253	55	±9.8%
Residential	AeroBarrier	N/A	N/A	N/A
Low-Income	Low-Income	516	102	±7.3%
Low-Income	CEEP	1	1	±0.0%

*Assumes sample size of 68 for an infinite population, based on *CV* (coefficient of variation) = 0.5, *d* (precision) = 10%, *Z* (critical value for 90% confidence) = 1.645.

The table above represents the number of rebates in both Washington and Idaho territories. The Evaluators ensured representation of state and fuel type in the sampled rebates for document verification.

2.2.2.2 Survey-Based Verification

The Evaluators conducted survey-based verification for the Water Heat Program and HVAC Program. The primary purpose of conducting a verification survey is to confirm that the measure was installed and is still currently operational and whether the measure was early retirement or replace-on-burnout.

The Evaluators summarize the final sample sizes shown in Table 2-2 for the Water Heat, HVAC, and the Appliances Programs for the Washington Gas Avista projects. The Evaluators developed a sampling plan that achieved a sampling precision of ±5.2% at 90% statistical confidence for ISRs estimates at the measure-level during web-based survey verification.

Table 2-2: Survey-Based Verification Sample and Precision by Program

Sector	Program	Population	Respondents	Precision at 90% CI
Residential	Water Heat	1,230	66	±9.9%
Residential	HVAC	9,193	117	±7.6%
Residential	Appliances	253	65	±8.8%
Total		**10,676**	**248**	**±5.2%**

The Evaluators implemented a web-based survey to complete the verification surveys. The findings from these activities served to estimate ISRs for each measure surveyed. These ISRs were applied to verification sample desk review rebates towards verified savings, which were then applied to the population of rebates. The measure-level ISRs resulting from the survey-based verification are summarized in Section 3.1.

2.2.3 Impact Evaluation Methodology

The Evaluators employed the following approach to complete impact evaluation activities for the programs. The Evaluators define two major approaches to determining net savings for Avista's programs:

- Deemed Savings
- Billing Analysis (IPMVP Option C)

In the following sections, the Evaluators summarize the general guidelines and activities followed to conduct each of the above analyses.

2.2.3.1 Deemed Savings

This section summarizes the deemed savings analysis method the Evaluators employed for the evaluation of a subset of measures for each program. The Evaluators completed the validation for specific measures across each program using the RTF unit energy savings (UES) values, where available. The Evaluators ensured the proper measure unit savings were recorded and used in the calculation of Avista's ex-ante measure savings. The Evaluators requested and used the technical reference manual Avista employed during calculation of ex-ante measure savings (Avista TRM). The Evaluators

documented any cases where recommend values differed from the specific unit energy savings workbooks used by Avista.

In cases where the RTF has existing unit energy savings (UES) applicable to Avista's measures, the Evaluators verified the quantity and quality of installations and apply the RTF's UES to determine verified savings. For gas measures, this applies to the Therms penalties found in electric measures in the RTF.

2.2.3.2 Billing Analysis

This section describes the billing analysis methodology employed by the Evaluators as part of the impact evaluation and measurement of energy savings for measures with sufficient participation. The Evaluators performed billing analyses with a matched control group and utilized a quasi-experimental method of producing a post-hoc control group. In program designs where treatment and control customers are not randomly selected at the outset, such as for downstream rebate programs, quasi-experimental designs are required.

For the purposes of this analysis, a household is considered a treatment household if it has received a program incentive. Additionally, a household is considered a control household if the household has not received a program incentive. To isolate measure impacts, treatment households are eligible to be included in the billing analysis if they installed only one measure during the 2021 program year. Isolation of individual measures are necessary to provide valid measure-level savings. Households that installed more than one measure may display interactive energy savings effects across multiple measures that are not feasibly identifiable. Therefore, instances where households installed isolated measures are used in the billing analyses. In addition, the pre-period identifies the period prior to measure installation while the post-period refers to the period following measure installation.

The Evaluators utilized propensity score matching (PSM) to match nonparticipants to similar participants using pre-period billing data. PSM allows the evaluators to find the most similar household based on the customers' billed consumption trends in the pre-period and verified with statistical difference testing.

After matching based on these variables, the billing data for treatment and control groups are compared, as detailed in IPMVP Option C. The Evaluators fit regression models to estimate weather-dependent daily consumption differences between participating customer and nonparticipating customer households.

Cohort Creation

The PSM approach estimates a propensity score for treatment and control customers using a logistic regression model. A propensity score is a metric that summarizes several dimensions of household characteristics into a single metric that can be used to group similar households. The Evaluators created a post-hoc control group by compiling billing data from a subset of nonparticipants in the Avista territory to compare against treatment households using quasi-experimental methods. This allowed the Evaluators to select from a large group of similar households that have not installed an incented measure. With this information, the Evaluators created statistically valid matched control groups for each measure via seasonal pre-period usage. The Evaluators matched customers in the control group to customers in the treatment group based on nearest seasonal pre-period usage (e.g., summer, spring, fall, and winter) and exact 3-digit zip code matching (the first three digits of the five-digit zip code). After

matching, the Evaluators conducted a *t*-test for each month in the pre-period to help determine the success of PSM.

While it is not possible to guarantee the creation of a sufficiently matched control group, this method is preferred because it is likely to have more meaningful results than a treatment-only analysis. Some examples of outside variables that a control group can sufficiently control for are changes in economies and markets, large-scale social changes, or impacts from weather-related anomalies such as flooding or hurricanes. This is particularly relevant in 2021 due to COVID-19 related lockdowns and restrictions.

After PSM, the Evaluators ran the following regression models for each measure:

- Fixed effect Difference-in-Difference (D-n-D) regression model (recommended in UMP protocols)[7]
- Random effects post-program regression model (PPR) (recommended in UMP protocols)
- Gross billing analysis (treatment only)

The second model listed above (PPR) was selected because it had the best fit for the data, identified using the adjusted R-squared. Further details on regression model specifications can be found below.

Data Collected

The following lists the data collected for the billing analysis:

1. Monthly billing data for program participants (treatment customers)
2. Monthly billing data for a group of non-program participants (control customers)
3. Program tracking data, including customer identifiers, address, and date of measure installation
4. National Oceanic and Atmospheric Administration (NOAA) weather data between January 1, 2020 and December 31, 2021)
5. Typical Meteorological Year (TMY3) data

Billing and weather data were obtained for program year 2021 and for one year prior to measure install dates (2020).

Weather data was obtained from the nearest weather station with complete data during the analysis years for each customer by mapping the weather station location with the customer zip code.

TMY weather stations were assigned to NOAA weather stations by geocoding the minimum distance between each set of latitude and longitude points. This data is used for extrapolating savings to long-run, 30-year average weather.

Data Preparation

The following steps were taken to prepare the billing data:

1. Gathered billing data for homes that participated in the program.
2. Excluded participant homes that also participated in the other programs, if either program disqualifies the combination of any other rebate or participation.
3. Gathered billing data for similar customers that did not participate in the program in evaluation.

[7] National Renewable Energy Laboratory (NREL) Uniform Methods Project (UMP) Chapter 17 Section 4.4.7.

4. Excluded bills missing address information.
5. Removed bills missing fuel type/Unit of Measure (UOM).
6. Removed bills missing usage, billing start date, or billing end date.
7. Remove bills with outlier durations (<9 days or >60 days).
8. Excluded bills with consumption indicated to be outliers.
9. Calendarized bills (recalculates bills, usage, and total billed such that bills begin and end at the start and end of each month).
10. Obtained weather data from nearest NOAA weather station using 5-digit zip code per household.
11. Computed Heating Degree Days (HDD) and Cooling Degree Days (CDD) for a range of setpoints. The Evaluators assigned a setpoint of 65°F for both HDD and CDD. The Evaluators tested and selected the optimal temperature base for HDDs and CDDs based on model *R*-squared values.
12. Selected treatment customers with only one type of measure installation during the analysis years and combined customer min/max install dates with billing data (to define pre- and post-periods).
13. Restricted to treatment customers with install dates in specified range (typically January 1, 2021 through June 30, 2021) to allow for sufficient post-period billing data.
14. Restricted to control customers with usage less than or equal to two times the maximum observed treatment group usage. This has the effect of removing control customers with incomparable usage relative to the treatment group.
15. Removed customers with incomplete post-period bills (<4 months).
16. Removed customers with incomplete pre-period bills.
17. Restricted control customers to those with usage that was comparable with the treatment group usage.
18. Created a matched control group using PSM and matching on pre-period seasonal usage and zip code.

Regression Models

The Evaluators ran the following models for matched treatment and control customers for each measure with sufficient participation. For net savings, the Evaluators selected either Model 1 or Model 2. The model with the best fit (highest adjusted R-squared) was selected. The Evaluators utilized Model 3 to estimate gross energy savings.

Model 1: Fixed Effects Difference-in-Difference Regression Model

The following equation displays the first model specification to estimate the average daily savings due to the measure.

Equation 2-3: Fixed Effects Difference-in-Difference (D-n-D) Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Post)_{it} + \beta_2(Post \times Treatment)_{it} + \beta_3(HDD)_{it} + \beta_4(CDD)_{it} + \beta_5(Post \times HDD)_{it} + \beta_6(Post \times CDD)_{it} + \beta_7(Post \times HDD \times Treatment)_{it} + \beta_8(Post \times CDD \times Treatment)_{it} + \beta_9(Month)_t + \beta_{10}(Customer\ Dummy)_i + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period
- ADC_{it} = Average daily usage reading *t* for household *i* during the post-treatment period
- $Post_{it}$ = A dummy variable indicating pre- or post-period designation during period *t* at home *i*
- $Treatment_i$ = A dummy variable indicating treatment status of home *i*
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- $Month_t$= A set of dummy variables indicating the month during period *t*
- $Customer\ Dummy_i$ = a customer-specific dummy variable isolating individual household effects
- ε_{it} = The error term
- α_0= The model intercept
- β_{1-10} = Coefficients determined via regression

The Average Daily Consumption (ADC) is calculated as the total monthly billed usage divided by the duration of the bill month. β_2 represents the average change in daily baseload in the post-period between the treatment and control group and β_7 and β_8 represent the change in weather-related daily consumption in the post-period between the groups. Typical monthly and annual savings were estimated by extrapolating the β_7 and β_8 coefficients with Typical Meteorological Year (TMY) HDD and CDD data. However, in the case of gas usage, only the coefficient for HDD is utilized because CDDs were not included in the regression model.

The equation below displays how savings were extrapolated for a full year utilizing the coefficients in the regression model and TMY data. TMY data is weighted by the number of households assigned to each weather station.

Equation 2-4: Savings Extrapolation

$$Annual\ Savings = \beta_2 * 365.25 + \beta_7 * TMY\ HDD + \beta_8 * TMY\ CDD$$

Model 2: Random Effects Post-Program Regression Model

The following equation displays the second model specification to estimate the average daily savings due to the measure. The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post-program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the treatment and control customers; in particular, energy use in calendar month *t*

of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between treatment and control customers will be reflected in the differences in their past energy use, which is highly correlated with their current energy use. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

The model specification is as follows:

Equation 2-5: Post-Program Regression (PPR) Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Treatment)_i + \beta_2\,(PreUsage)_i + \beta_3\,(PreUsageSummer)_i + \beta_4(PreUsageWinter)_i + \beta_5(Month)_t + \beta_6(Month \times PreUsage)_{it} + \beta_7(Month \times PreUsageSummer_{)it} + \beta_8(Month \times PreUsageWinter)_{it} + \beta_9(HDD)_{it} + \beta_{10}(CDD)_{it} + \beta_{11}(Treatment \times HDD)_{it} + \beta_{12}(Treatment \times CDD)_{it} + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period
- ADC_{it} = Average daily usage for reading *t* for household *i* during the post-treatment period
- $Treatment_i$ = A dummy variable indicating treatment status of home *i*
- $Month_t$ = Dummy variable indicating month of month *t*
- $PreUsage_i$ = Average daily usage across household *i*'s available pre-treatment billing reads
- $PreUsageSummer_i$ = Average daily usage in the summer months across household *i*'s available pretreatment billing reads
- $PreUsageWinter_i$ = Average daily usage in the winter months across household *i*'s available pre-treatment billing reads
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- ε_{it} = Customer-level random error
- α_0= The model intercept for home *i*
- β_{1-12} = Coefficients determined via regression

The coefficient β_1 represents the average change in consumption between the pre-period and post-period for the treatment group and β_{11} and β_{12} represent the change in weather-related daily consumption in the post-period between the groups. Typical monthly and annual savings were estimated by extrapolating the β_{11} and β_{12} coefficients with Typical Meteorological Year (TMY) HDD and CDD data.

The equation below displays how savings were extrapolated for a full year utilizing the coefficients in the regression model and TMY data.

Equation 2-6: Savings Extrapolation

$$Annual\ Savings = \beta_1 * 365.25 + \beta_{11} * TMY\ HDD + \beta_{12} * TMY\ CDD$$

Model 3: Gross Billing Analysis, Treatment-Only Regression Model

The sections above detail the Evaluator's methodology for estimating net energy savings for each measure. The results from the above methodology report net savings due to the inclusion of the counterfactual comparison group. However, for planning purposes, it is useful to estimate gross savings for each measure. To estimate gross savings, the Evaluators employed a similar regression model; however, only including participant customer billing data. This analysis does not include control group billing data and therefore models energy reductions between the pre-period and post-period for the measure participants (treatment customers).

To calculate the impacts of each measure, the Evaluators applied linear fixed effects regression using participant billing data with weather controls in the form of Heating Degree Days (HDD) and Cooling Degree Days (CDD). The following equation displays the model specification to estimate the average daily savings due to the measure.

Equation 2-7: Treatment-Only Fixed Effects Weather Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Post)_{it} + \beta_2(HDD)_{it} + \beta_3(CDD)_{it} + \beta_4(Post \times HDD)_{it} + \beta_5(Post \times CDD)_{it} + \beta_6(Customer\ Dummy)_i + \beta_7(Month)_t + \varepsilon_{it}$$

Where,

- *i* = the *i*th household
- *t* = the first, second, third, etc. month of the post-treatment period
- ADC_{it} = Average daily usage for reading *t* for household *i* during the post-treatment period
- HDD_{it} = Average heating degree days (base with optimal Degrees Fahrenheit) during period *t* at home *i*
- CDD_{it} = Average cooling degree days (base with optimal Degrees Fahrenheit) during period *t* at home i *(if electric usage)*
- $Post_{it}$ = A dummy variable indicating pre- or post-period designation during period *t* at home *i*
- $Customer\ Dummy_i$ = a customer-specific dummy variable isolating individual household effects
- ε_{it} = Customer-level random error
- α_0= The model intercept for home *i*
- β_{1-6} = Coefficients determined via regression

The results of the treatment-only regression models are gross savings estimates. The gross savings estimates are useful to compare against the net savings estimates. However, the treatment-only models are unable to separate the effects of the COVID19 pandemic. The post-period for PY2021 are affected by the stay-at-home orders that had taken effect starting March 2020 in Washington. The stay-at-home orders most likely affect the post-period household usage. Because there is insufficient post-period data before the shelter-in-place orders, the Evaluators were unable to separate the effects on consumption due to the orders and the effects on consumption due to the measure installation. Therefore, the results from this additional gross savings analysis are unable to reflect actual typical year savings. However, for planning purposes, these estimates may be useful.

2.2.4 Net-To-Gross

The Northwest RTF UES measures do not require NTG adjustments as they are built into the deemed savings estimates. In addition, billing analyses with counterfactual control groups, as proposed in our impact methodology, does not require a NTG adjustment, as the counterfactual represents the efficiency level at current market (i.e. the efficiency level the customer would have installed had they not participated in the program).

2.2.5 Cost-Effectiveness Tests

The Evaluators calculated each program's cost-effectiveness, avoided energy costs, and implementation costs. The Evaluators used our company-developed cost-effectiveness tool to provide cost-effectiveness assessments for the Residential Portfolio by program, fuel type, program year, and measure, for each state.

As specified in this solicitation, the Evaluators determined the economic performance with the following cost-effectiveness tests:

- Total Resource Cost (TRC) test;
- Utility Cost Test (UCT);
- Participant Cost Test (PCT); and
- Rate Impact Measure (RIM).

2.2.6 Non-Energy Benefits

The Evaluators used the Regional Technical Forum (RTF) to quantify non-energy benefits (NEBs) for residential measures with established RTF values where available. Measures with quantified NEBs include residential insulation, high efficiency windows, air source heat pumps, and ductless heat pumps.

In addition to the residential NEBs, the Evaluators applied the end-use non-energy benefit and health and human safety non-energy benefit to the Low-Income Program. The Evaluators understand that the two major non-energy benefits referenced above are uniquely applicable to the Low-Income Program. The Evaluators applied those benefits to the program impacts as well as additional non-energy benefits associated with individual measures included in the program. The Evaluators incorporated additional NEBs to the impact evaluation, as applicable. Additional details on the non-energy benefits applied can be found in Section 7.2.

3. Residential Impact Evaluation Results

The Evaluators completed an impact evaluation on Avista's Residential portfolio to verify program-level and measure-level energy savings for PY2021. The following sections summarize findings for each natural gas impact evaluation in the Residential Portfolio in the Washington service territory. The Evaluators used data collected and reported in the tracking database, online application forms, Avista TRM, RTF, and billing analysis of participants and nonparticipants to evaluate savings. This approach provided the strongest estimate of achieved savings practical for each program, given its delivery method, magnitude of savings, number of participants, and availability of data. Table 3-1 summarizes the Residential verified impact savings by program. Table 3-2 summarizes the Residential portfolio's cost-effectiveness.

Table 3-1: Residential Verified Impact Savings by Program

Program	Expected Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
Water Heat	43,695.80	43,695.80	100.00%
HVAC	306,474.86	306,026.45	99.85%
Shell	76,017.75	76,639.48	100.82%
ENERGY STAR Homes	334.96	401.94	120.00%
Small Home & MF Weatherization	1,924.83	2,912.03	151.29%
Appliances	900.40	721.11	80.09%
AeroBarrier	1,658.52	-	-
Total Res	**429,348.60**	**430,396.82**	**100.24%**

Table 3-2: Residential Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$13,328,625	$6,903,476	1.93	$12,116,794	$2,816,408	4.30

In PY2021, Avista completed and provided incentives for residential natural gas measures in Washington and reported total natural gas savings of 430,396.82 Therms. All programs except the HVAC Program and the Small Home & MF Weatherization Program met savings goals based on reported savings, leading to an overall achievement of 100.24% of the expected savings for the residential programs. The Evaluators estimated the TRC value for the Residential portfolio is 1.93 while the UCT value is 4.30. Further details of the impact evaluation results by program are provided in the sections following.

3.1 Simple Verification Results

The Evaluators surveyed 305 unique customers that participated in Avista's residential energy efficiency program from September-October 2021 and in February 2022 using an email survey approach. The Evaluators also conducted targeted follow-up outreach to customers for certain measures.

The Evaluators surveyed customers that received rebates for HVAC, Water Heater, and Appliance Programs.

Table 3-3: Summary of Survey Response Rate

Population	Respondents
Initial email contact list	1,376
Invalid or bounced	53
Invalid or bounced email (%)	*4%*
Invitations sent (unique valid)	1,323
Completions	302
Response rate (%)	23%

3.1.1 In-Service Rates

The Evaluators calculated in-service rates of installed measures from simple verification surveys deployed to program participants for the Water Heat, HVAC, and Appliance Programs. Evaluators asked participants if the rebated equipment is currently installed and working, in addition to questions about the new equipment fuel type. The Evaluators achieved ±5.2% precision across the programs surveyed for the natural gas measures in Avista's service territory, summarized in Table 3-4.

Table 3-4: Simple Verification Precision by Program

Sector	Program	Population	Respondents	Precision at 90% CI
Residential	Water Heat	1,230	66	±9.9%
Residential	HVAC	9,193	117	±7.6%
Residential	Appliances	253	65	±8.8%
Total		**10,676**	**248**	**±5.2%**

The measure-level ISRs determined from the verification survey for each program in which simple verification was conducted is presented in Table 3-5 through Table 3-7.

Table 3-5: Water Heat Program ISRs by Measure

Measure	Respondents	ISR
G 50 Gallon Natural Gas Water Heater	12	100.00%
G Tankless Water Heater	54	100.00%

Table 3-6: HVAC Program ISRs by Measure

Measure	Respondents	ISR
G Natural Gas Boiler	4	100.00%
G Natural Gas Furnace	56	98.21%
G Smart Thermostat DIY with Natural Gas Heat	14	85.71%
G Smart Thermostat Paid Install with Natural Gas Heat	43	100.00%

Table 3-7: Appliance Program ISRs by Measure

Measure	Respondents	ISR
G Energy Star Rated Clothes Dryer	27	100.00%
G Energy Star Rated Front Load Washer	38	97.37%

These ISR values were utilized in the desk reviews for the Water Heat, HVAC, and Appliance Programs in order to calculate verified savings. Additional insights from the survey responses are summarized in Appendix B.

3.2 Impacts of COVID-19 Pandemic

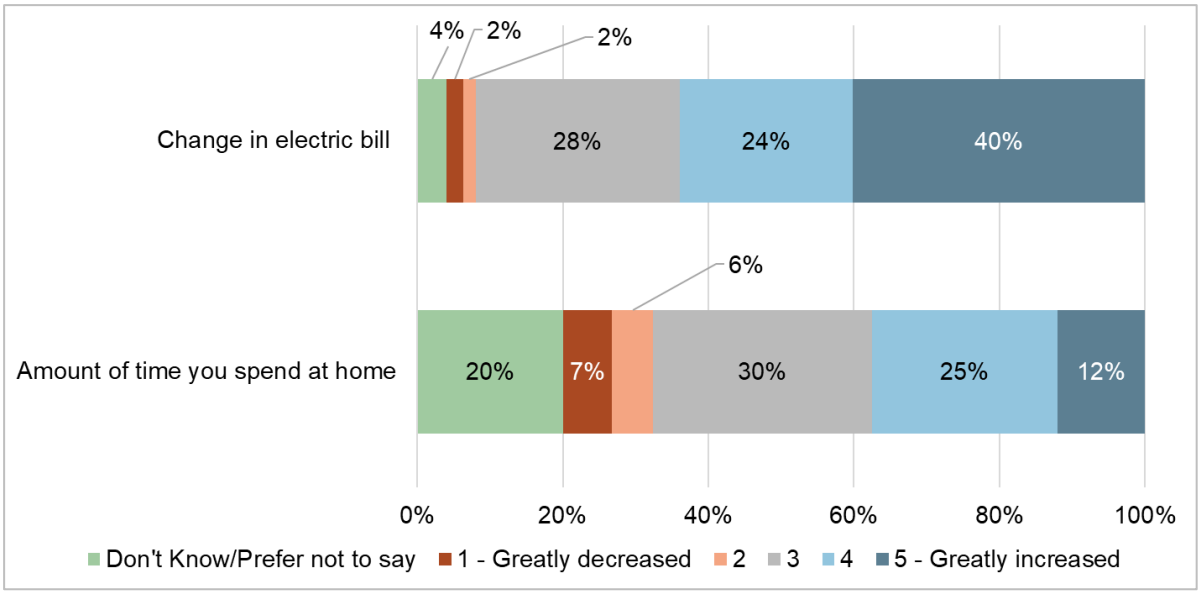
On average, about three people lived at the residence that had the rebated equipment installed and 65% of respondents said that two or fewer lived at the residence that had the rebated equipment installed.

Two-thirds of respondents observed that the pandemic had not changed the number of people in their household that worked or went to school remotely.[8] Eighteen percent of respondents said that more members of their household were attending school remotely or working from home since the COVID-19 pandemic began. Sixteen percent of respondents indicated that more members of their household had gone to work or school remotely before the COVID-19 pandemic.

Sixty-four percent of respondents said that the amount of time they spend at home has increased since the COVID-19 pandemic began. Thirty-seven percent of respondents indicated that their utility bill had increased. Figure 3-1 displays the change in amount of time spent at home and electricity bills since the COVID-19 pandemic began.

[8] n=257

Figure 3-1: Change in amount of time spent at home and electricity bill since COVID-19 pandemic began



3.3 Program-Level Impact Evaluation Results

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Residential sector in the section below.

3.3.1 Water Heat Program

The Water Heat Program encourages customers to replace their existing electric or natural gas water heater with high efficiency equipment. Customers receive incentives after installation and after submitting a completed rebate form. Table 3-8 summarizes the measures offered under this program.

Table 3-8: Water Heat Program Measures

Measure	Description	Impact Analysis Methodology
G 50 Gallon Natural Gas Water Heater	Storage tank natural gas water heater, 50 gallons or less	Avista TRM
G Tankless Water Heater	Tankless natural gas water heater	Avista TRM

The following table summarizes the verified natural gas savings for the Water Heat Program impact evaluation.

Table 3-9: Water Heat Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G 50 Gallon Natural Gas Water Heater	149	3,291.80	3,248.20	3,291.80	100.00%
G Tankless Water Heater	519	40,404.00	40,482.00	40,404.00	100.00%
Total	**668**	**43,695.80**	**43,730.20**	**43,695.80**	**100.00%**

The Water Heat Program displayed verified savings of 43,696.80 Therms with a realization rate of 100.00% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs from the program.

Table 3-10: Water Heat Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G 50 Gallon Natural Gas Water Heater	$15,100.00	$596.14	$15,696.14
G Tankless Water Heater	$207,200.00	$10,190.34	$217,390.34
Total	**$222,300.00**	**$10,786.47**	**$233,086.47**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Water Heat Program in the section below.

3.3.1.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Water Heat Program.

3.3.1.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Water Heat Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators found all Water Heat Program rebates to have completed rebate applications with the associated water heater model number and efficiency values filled in either the Customer Care & Billing (CC&B) web rebate data or mail-in rebate applications.

In addition, the Evaluators note that the CC&B web rebate data reflected consistent values between the mail-in rebate applications, invoices, and AHRI certification documents submitted with the rebate application. The Evaluators found no deviations in any project rebated through the program.

The Evaluators found all sampled rebate equipment met or exceeded the measure efficiency requirements for the Water Heat Program.

3.3.1.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure. The Evaluators included questions such as:

- Was this water heater a new construction, or did it replace another water heater?
- Was the previous water heater functional?
- Is the newly installed water heater still properly functioning?

In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to this verification survey were used to calculate ISRs for the measures offered in the Water Heat Program.

Table 3-11 displays the ISRs for each of the Water Heat measures for Idaho and Washington territory combined.

Table 3-11: Water Heat Verification Survey ISR Results

Measure	Number of Rebates*	Number of Survey Completes	Program-Level Precision at 90% Confidence	In-Service Rate
G 50 Gallon Natural Gas Water Heater	177	12	±9.9%	100%
G Tankless Water Heater	1,053	54		100%

*This count includes rebates from Washington and Idaho

All survey respondents for each water heater measure described equipment to be currently functioning, leading to a 100% ISR. The Evaluators applied these ISRs to each rebate to quantify verified savings for each measure.

3.3.1.4 Impact Analysis

This section summarizes the verified savings results for the Water Heat Program. The Evaluators conducted a billing analysis for measures where participation allowed. The Evaluators calculated verified savings for the remaining measures using active values from the Avista TRM workbook. These values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.1.5 Billing Analysis

The results of the billing analysis for the Water Heat Program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2.

Table 3-12 displays customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis.

Table 3-12: Measures Considered for Billing Analysis, Water Heat Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
G 50 Gallon Natural Gas Water Heater	✓	107	✓
G Tankless Gas Water Heater	✓	399	✓

*This count includes rebates from Washington and Idaho

The Evaluators were provided a considerable pool of control customers to draw upon. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. The final number of customers in each the treatment and control group are listed in Table 3-13.

The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure and the Evaluators conducted a linear regression using the matched participant and nonparticipant monthly billing data.

Table 3-13 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Water Heat Program as it provided the highest adjusted R-squared among the regression models. However, savings for each the G 50 Gallon Natural Gas Water Heater and the G Tankless Water Heater are not statistically significant at the 90% level.

Table 3-13: Measure Savings, Water Heat Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
G 50 Gallon Natural Gas Water Heater	65	325	37.79*	-16.23	91.81	0.89	Model 2: PPR
G Tankless Water Heater	203	1,013	-3.65*	-25.62	18.32	0.82	Model 2: PPR

*Not statistically significant

Because the results from these two billing analyses are inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for these measures. The findings from the PY2021 billing analyses for these measures may have been impacted by the COVID19 pandemic. Further details of the billing analysis for the variable speed motor measure can be found Appendix A.

3.3.1.6 Verified Savings

The Evaluators reviewed and applied the current Avista TRM values along with verified tracking data to estimate net program savings for this measure. The verified savings for the program is 43,696.80 Therms with a realization rate of 100.00%, as displayed in Table 3-9.

The realization rate for the natural gas savings in the Water Heat Program did not deviate from 100% for any of the projects in PY2021.

3.3.2 HVAC Program

The HVAC program encourages installation of high efficiency HVAC equipment and smart thermostats through customer incentives. The program is available to residential electric or natural gas customers with a winter heating season usage of 4,000 or more kWh, or at least 160 Therms of space heating in the prior year. Existing or new construction homes are eligible to participate in the program. Table 3-14 summarizes the measures offered under this program.

Table 3-14: HVAC Program Measures

Measure	Description	Impact Analysis Methodology
G Natural Gas Boiler	Natural gas boiler	Avista TRM
G Natural Gas Furnace	Natural gas forced air furnace	IPMVP Option A with billing data
G Natural Gas Wall Heater	Natural gas wall heater	Avista TRM
G Smart Thermostat DIY with Natural Gas Heat	Professionally installed connected thermostats in natural gas-heated home	Avista TRM
G Smart Thermostat Paid Install with Natural Gas Heat	Variable speed motor in natural gas-heated home	Avista TRM

The following table summarizes the verified natural gas savings for the HVAC Program impact evaluation.

Table 3-15: HVAC Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Natural Gas Boiler	49	5,507.60	5,507.60	5,507.60	100.00%
G Natural Gas Furnace	2,831	231,516.78	231,190.78	231,063.16	99.80%
G Smart Thermostat DIY with Natural Gas Heat	888	23,789.52	23,658.10	23,791.31	100.01%
G Smart Thermostat Paid Install with Natural Gas Heat	1,708	45,660.96	45,504.54	45,664.39	100.01%
Total	**5,476**	**306,474.86**	**305,861.02**	**306,026.45**	**99.85%**

The HVAC Program displayed verified savings of 306,026.45 Therms with a realization rate of 99.85% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-16: HVAC Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Natural Gas Boiler	$22,050.00	$1,389.08	$23,439.08
G Natural Gas Furnace	$1,277,123.52	$58,276.70	$1,335,400.22
G Smart Thermostat DIY with Natural Gas Heat	$107,386.85	$6,000.43	$113,387.28
G Smart Thermostat Paid Install with Natural Gas Heat	$256,791.14	$11,517.07	$268,308.21
Total	**$1,663,351.51**	**$77,183.28**	**$1,740,534.79**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the HVAC Program in the section below.

3.3.2.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the HVAC Program.

3.3.2.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the HVAC Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in in Section 2.2.2.1.

The Evaluators found all HVAC Program rebates to have project documentation with the associated HVAC model number and efficiency values in either the CC&B web rebate data or mail-in rebate applications. In addition, all projects contained associated AHRI certifications, allowing the Evaluators to easily verify model specifications.

3.3.2.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure described in Section 2.2.2.2. The Evaluators included questions such as:

- What type of thermostat did this thermostat replace?
- Is your home heating with electricity, natural gas, or another fuel?
- Was the previous equipment functional?
- Is the newly installed equipment still properly functioning?

The responses to this verification survey were used to calculate ISRs for the measures offered in the HVAC Program. In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to these additional questions can be found in Appendix A.

Table 3-17 displays the ISRs for each of the HVAC measures for Idaho and Washington natural gas territory combined. The ISRs resulted in ±7.6% precision at the 90% confidence interval for the program.

Table 3-17: HVAC Verification Survey ISR Results

Measure	Number of Rebates*	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
G Natural Gas Boiler	81	25	±7.6%	100%
G Natural Gas Furnace	4,840	4		98%
G Smart Thermostat DIY with Natural Gas Heat	1,197	56		86%
G Smart Thermostat Paid Install with Natural Gas Heat	3,075	14		100%

*This count includes rebates from Washington and Idaho

Survey respondents described equipment to be currently functioning, leading to a 100% ISR for all measures except the G Natural Gas Furnace and G Smart Thermostat DIY with Natural Gas Heat. Although less than 100%, the ISR for the referenced two measures measure still exceeded ISRs of 85%. The Evaluators applied the ISRs listed in Table 3-17 to each rebate to quantify verified savings for each measure.

3.3.2.4 Impact Analysis

This section summarizes the verified savings results for the HVAC Program. The Evaluators conducted a billing analysis for measures where participation allowed. The Evaluators calculated verified savings for

the remaining measures using active values from the Avista TRM workbook. These values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.2.5 Billing Analysis

The results of the billing analysis for the HVAC program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2.

Table 3-18 displays customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis.

Table 3-18: Measures Considered for Billing Analysis, HVAC Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations*	Sufficient Participation for Billing Analysis
G Natural Gas Boiler	✓	35	
G Natural Gas Furnace	✓	2,327	✓
G Natural Gas Wall Heater	✓	0	
G Smart Thermostat DIY with Natural Gas Heat	✓	1,067	✓
G Smart Thermostat Paid Install with Natural Gas Heat	✓	1,077	✓

*This count includes rebates from Washington and Idaho

The Evaluators were provided a considerable pool of control customers to draw upon. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. The final number of customers in each the treatment and control group are listed in Table 3-19.

The Evaluators performed three tests to determine the success of PSM:

4. *t*-test on pre-period usage by month
5. Joint chi-square test to determine if any covariates are imbalanced
6. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure and the Evaluators conducted a linear regression using the matched participant and nonparticipant monthly billing data.

Table 3-19 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the HVAC Program as it provided the highest adjusted R-squared among the regression models. Savings are not statistically significant at the 90% level for the G Natural Gas Furnace or the DIY smart thermostat measure. In addition, the paid install smart thermostat displayed negative savings that were not statistically significant.

Table 3-19: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
G Natural Gas Furnace	671	3,347	16.97	9.82	24.13	0.92	Model 2: PPR
G Smart Thermostat Paid Install with Natural Gas Heat*	267	1,335	-7.59	-19.77	4.59	0.91	Model 2: PPR
G Smart Thermostat DIY with Natural Gas Heat*	272	1,354	3.12	-7.45	13.68	0.93	Model 2: PPR

*Not statistically significant

Because the results from these three billing analyses are contradicting and/or inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for the smart thermostat measures. The findings from the PY2021 billing analyses for these measures may have been impacted by the COVID19 pandemic.

However, the Evaluators explored a retrofit isolation analysis for the G Natural Gas Furnace, which indicated statistically significant savings and were used for verifying savings for this measure. Details for this analysis are provided in the following section. Further details of the billing analysis can be found Appendix A.

Retrofit Isolation Results

A retrofit isolation approach was used to estimate savings for Natural Gas Furnaces in addition to the billing analysis. Because the retrofit isolation approach relies on extracting baseload usage estimate from summer (June – August) billing data, the sample was restricted to customers with installations in January, 2021 and 11 months of post installation data.

Table 3-20 presents the total number of customers and the number of sampled customers.

Table 3-20: Customer Counts for Natural Gas Furnaces, HVAC Program

Measure	Data Restriction	# of Treatment Customers
G Natural Gas Furnace	Starting Count	2,327
	11 Months of Post Data:2021-02-01 – 2021-12-31	160

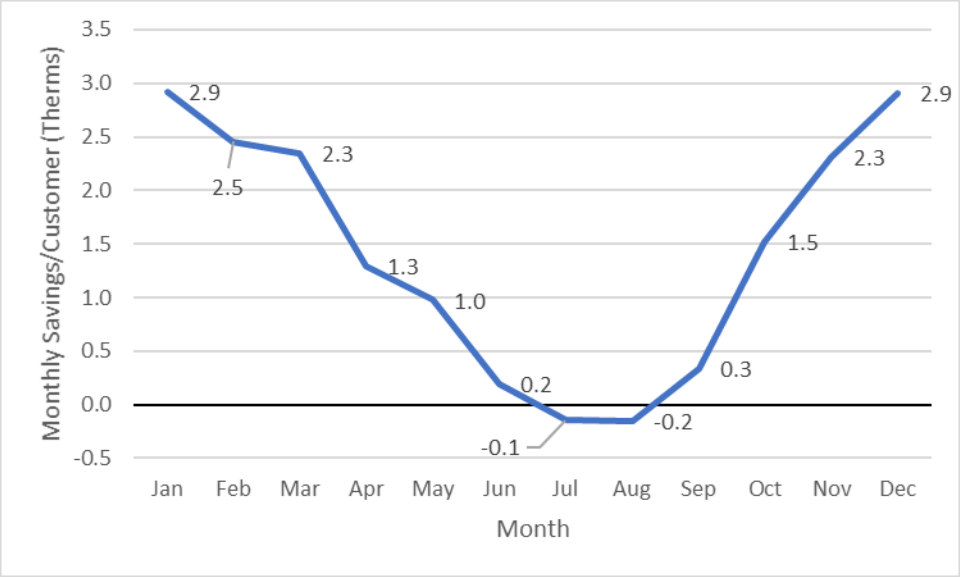
Table 3-21 provides annual savings for Natural Gas Furnaces. The Evaluators estimate the G Natural Gas Furnace measure to display an annual savings of 81.46 Therms. This verified value was applied to all associated rebates in the Washington gas service territory.

Table 3-21: Measure Savings for Natural Gas Furnaces, HVAC Program

Measure	# of Treatment Customers	Annual Savings/Customer (Therms)	90% Lower CI	90% Upper CI	Relative Precision (90% CI)
G Natural Gas Furnace	160	81.46	78.99	83.94	3.0%

Figure 3-2 provides monthly weather-normalized savings for natural gas furnaces.

Figure 3-2 Natural Gas Furnaces Monthly Savings, HVAC Program



The savings for the natural gas furnace range between 15 and 22 Therms per month in the winter months, with summer months displaying no Therms savings.

3.3.2.6 Verified Savings

The HVAC Program in total displays a realization rate of 99.85% with 306,026.45 Therms verified natural gas savings in the Washington service territory, as displayed in Table 3-15.

The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to one project which was verified to be a duplicate project. The Evaluators removed savings for this project. All other rebates were assigned savings equivalent to the expected savings through Avista TRM values. The furnace measure has nearly identical billing analysis results to the Avista TRM value (billing analysis indicated 81.5 Therms saved for G Natural Gas Furnace, while Avista TRM indicated 81.66 Therms).

The Evaluators attempted to estimate smart thermostat measure savings values for the HVAC Program. However, because the results from the billing analyses for smart thermostats were contradicting and/or inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for these measures. The findings from the PY2021 billing analyses for these measures may have been impacted by the COVID19 pandemic. The Evaluators will explore additional billing analyses for these measures during program year 2022.

3.3.3 Shell Program

The Shell Program provides incentives to customers for improving the integrity of the home's envelope with upgrades to windows and storm windows. Rebates are issued after the measure has been installed for insulation and window measures. Participating homes must have natural gas or natural gas heating and itemized invoices including measure details such as insulation levels, window values, and square footage. In order to be eligible for incentive, the single-family households, including fourplex or less,

must demonstrate an annual electricity usage of at least 8,000 kWh or an annual gas usage of at least 340 Therms. Multifamily homes have no usage requirement. This program includes free manufactured home duct sealing implemented by UCONS. Table 3-22 summarizes the measures offered under this program.

Table 3-22: Shell Program Measures

Measure	Description	Impact Analysis Methodology
G Attic Insulation With Natural Gas Heat	Attic insulation for homes heated with natural gas	Avista TRM
G Floor Insulation With Natural Gas Heat	Floor insulation for homes heated with natural gas	Avista TRM
G IGU Window Replc With Natural Gas Heat	IGU window replacement for homes heated with natural gas	Avista TRM
G Storm Windows with Natural Gas Heat	High-efficiency storm window replacement for homes heated with natural gas	Avista TRM
G Wall Insulation With Natural Gas Heat	Wall insulation for homes heated with natural gas	Avista TRM
G Window Replc With Natural Gas Heat	High-efficiency window replacement for homes heated with natural gas	Avista TRM

The following table summarizes the adjusted and verified natural gas savings for the Shell Program impact evaluation.

Table 3-23: Shell Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Attic Insulation With Natural Gas Heat	250	42,015.75	42,064.05	42,015.75	100.00%
G Floor Insulation With Natural Gas Heat	17	937.20	997.20	937.20	100.00%
G IGU Window Replc With Natural Gas Heat	10	314.88	91.84	308.47	97.96%
G Storm Windows with Natural Gas Heat	5	200.94	200.35	200.35	99.71%
G Wall Insulation With Natural Gas Heat	68	4,556.58	4,482.03	4,556.58	100.00%
G Window Replc With Natural Gas Heat	995	27,992.40	27,960.71	28,621.13	102.25%
Total	**1,345**	**76,017.75**	**75,796.18**	**76,639.48**	**100.82%**

The Shell Program displayed verified savings of 76,639.48 Therms with a realization rate of 100.82% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-24: Shell Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Attic Insulation With Natural Gas Heat	$210,603.75	$27,188.03	$237,791.78

G Floor Insulation With Natural Gas Heat	$11,715.00	$606.45	$12,321.45
G IGU Window Replc With Natural Gas Heat	$5,248.00	$199.61	$5,447.61
G Storm Windows with Natural Gas Heat	$1,773.00	$50.53	$1,823.53
G Wall Insulation With Natural Gas Heat	$48,820.50	$2,948.52	$51,769.02
G Window Replc With Natural Gas Heat	$467,212.00	$18,520.49	$485,732.49
Total	**$745,372.25**	**$49,513.64**	**$794,885.89**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Shell Program in the section below.

3.3.3.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Shell Program.

3.3.3.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Shell Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators reviewed each measure number of units, square footage, and insulation where available. The Evaluators found six instances in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. The Evaluators used verified quantity to estimate savings through the program, leading to small changes in realization rate for the projects.

The Evaluators recommend collecting information on single-family/multi-family/manufactured in the web rebate form. This allows the Evaluators to categorize home type during the impact evaluation methodologies. The mail-in rebates collect this information; however, it does not seem to be required to complete the rebate and therefore many rebates are missing this information.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.3.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Shell Program. Weatherization measures historically have high verification rates.

3.3.3.4 Impact Analysis

This section summarizes the verified savings results for the Shell Program. The Evaluators calculated verified savings for the natural gas measures using the active Avista TRM values. The Evaluators calculated adjusted savings for each measure using the active Avista TRM values and verified tracking data. The Evaluators conducted a billing analysis for measures where participation allowed. These values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.3.5 Billing Analysis

The results of the billing analysis for the Shell program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2.

Table 3-25 displays customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis.

Table 3-25: Measures Considered for Billing Analysis, Shell Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
G Attic Insulation With Natural Gas Heat	✓	230	✓
G IGU Window Replc With Natural Gas Heat	✓	11	
G Floor Insulation With Natural Gas Heat	✓	9	
G Storm Windows with Natural Gas Heat	✓	4	
G Wall Insulation With Natural Gas Heat	✓	32	
G Window Replc With Natural Gas Heat	✓	1,075	✓

The Evaluators were provided a considerable pool of control customers to draw upon. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. The final number of customers in each the treatment and control group are listed in Table 3-26.

The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure and the Evaluators conducted a linear regression using the matched participant and nonparticipant monthly billing data.

Table 3-26 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Shell Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an excellent fit for the data (adjusted R-squared > 0.90).

Table 3-26: Measure Savings, Shell Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
G Attic Insulation With Natural Gas Heat	49	245	26.35	6.09	46.62	0.93	Model 2: PPR
G Window Replc With Natural Gas Heat	425	2,107	20.27	10.98	29.56	0.92	Model 2: PPR

The Evaluators found the G Attic Insulation With Natural Gas Heat measure to display a statistically significant verified savings value of 26.35 Therms per year. In addition, the Evaluators found statistically significant savings of 20.27 Therms per year for the G Window Replacement with Natural Gas Heat measure. Although the Evaluators estimated savings for these measures through billing analysis, the verified savings for the measures were calculated via Avista TRM due to unexpectedly low savings estimates. Further details of the billing analysis for the variable speed motor measure can be found Appendix A.

3.3.3.6 Verified Savings

The Shell Program in total displays a realization rate of 100.82% with a verified natural gas savings of 47,874.54 Therms in the Washington service territory, as displayed in Table 3-23. The realization rate for the natural gas savings in the Shell Program are close to 100% and only deviate due to slight differences in quantity or applied Avista TRM values.

The Evaluators did not conduct a verification survey for the Shell Program and therefore did not adjust verified savings with an ISR.

3.3.4 ENERGY STAR® Homes Program

The ENERGY STAR® Homes Program provides rebates for homes within Avista's service territory that attain an ENERGY STAR® certification. This program incentivizes for ENERGY STAR® Eco-rated homes. Table 3-27 summarizes the measures offered under this program.

Table 3-27: ENERGY STAR® Homes Program Measures

Measure	Description	Impact Analysis Methodology
G ENERGY STAR Home - Manufactured, Gas & Electric	ENERGY STAR-rated manufactured home with gas and electric	RTF UES
E ENERGY STAR Home - Manufactured, Furnace	ENERGY STAR-rated manufactured home with natural gas Furnace	RTF UES
E ENERGY STAR Home - Manufactured, Gas & Electric	ENERGY STAR-rated manufactured home with gas and electric	RTF UES

The following table summarizes the verified natural gas savings for the ENERGY STAR® Homes Program impact evaluation.

Table 3-28: ENERGY STAR® Homes Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G ENERGY STAR Home - Manufactured, Gas & Electric	3	334.96	0.00	401.94	120.00%
E ENERGY STAR Home - Manufactured, Furnace	27	0.00	0.00	0.00	N/A
E ENERGY STAR Home - Manufactured, Gas & Electric	4	134.00	0.00	35.73	3.56%
Total	**34**	**468.96**	**0.00**	**437.67**	**93.33%**

The ENERGY STAR® Homes Program displayed verified savings of 437.67 Therms with a realization rate of 93.33% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-29: ENERGY STAR® Homes Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G ENERGY STAR Home - Manufactured, Gas & Electric	$3,000.00	$132.59	$3,132.59
E ENERGY STAR Home - Manufactured, Furnace*	N/A	N/A	$0.00
E ENERGY STAR Home - Manufactured, Gas & Electric*	N/A	N/A	$0.00
Total	**$3,000.00**	**$132.59**	**$3,132.59**

*Costs associated with this measure are claimed in the Washington Electric Impact Evaluation Report

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the ENERGY STAR® Homes Program in the section below.

3.3.4.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the ENERGY STAR® Homes Program.

3.3.4.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the ENERGY STAR® Homes Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The Evaluators found expected savings to differ for the G ENERGY STAR Home – Manufactured, Gas & Electric one of the three projects had expected gas savings equal to half of the Avista TRM value. The Evaluators used Avista TRM values, leading to a 200% realization rate for this project and a 120% realization rate for the gas measures overall. In addition, four of the E ENERGY STAR Home – Manufactured Gas & Electric measures rebated under the Washington Electric territory had claimed and verified savings amounting to 35.73 Therms.

3.3.4.3 Verification Surveys

The Evaluators did not conduct verification surveys for the ENERGY STAR® Homes Program.

3.3.4.4 Impact Analysis

This section summarizes the verified savings results for the ENERGY STAR® Homes Program. The Evaluators calculated verified savings for the natural gas measures using the most recent RTF workbook for the ENERGY STAR® Homes measures. These RTF UES values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.4.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate adjusted program savings for each of the ENERGY STAR® Homes measures. In addition, the Evaluators reviewed and applied the current RTF UES values for each measure along with verified tracking data to estimate net program savings.

The ENERGY STAR® Homes Program in total displays a realization rate of 93.33% with 437.67 Therms verified natural gas energy savings in the Washington service territory, as displayed in Table 3-28. The realization rate for the natural gas savings in the ENERGY STAR® Homes Program deviate from 100% due to the differences between the applied expected savings and the Avista TRM prescriptive savings value.

The realization for the E ENERGY STAR® Home – Manufactured, Gas & Natural gas measure is high because the expected savings employed an additive methodology between a gas-heated home and an natural gas-heated home for the natural gas savings. However, the Evaluators reviewed the RTF and determined manufactured home natural gas savings for a fully natural gas heated home would be closer to the savings a gas heated home with electricity would save. Therefore, the Evaluators assigned natural gas savings from the RTF associated with a fully natural gas-heated home at 133.98 Therms saved per year.

The Evaluators did not conduct a verification survey for the ENERGY STAR® Homes Program and therefore did not adjust verified savings with an ISR.

3.3.5 Small Home & MF Weatherization Program

The Small Home & MF Weatherization Program is a residential prescriptive program that waives the energy usage requirement that is typically employed for residential prescriptive programs. This benefits small homes (less than 1,000 square feet in size) and multifamily dwellings (specifically customers in condominiums larger than five units in size). While this program is designed for all customers, it could also benefit members of Named Communities who reside in smaller homes.

This section summarizes the impact results of the evaluation results for the Small Home & MF Weatherization Program. Table 3-30 summarizes the measures offered under this program.

Table 3-30: Small Home & MF Weatherization Program Measures

Measure	Description	Impact Analysis Methodology
G Multifamily Attic Insulation With Natural Gas Heat	Attic insulation for multifamily homes with natural gas heat	RTF UES
G Multifamily Window Replc With Natural Gas Heat	Window replacement for multifamily homes with natural gas heat	RTF UES

The following table summarizes the verified natural gas savings for the Small Home & MF Weatherization Program impact evaluation.

Table 3-31: Small Home & MF Weatherization Program Verified Natural Gas Savings

Measure	PY2021 Units	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Multifamily Attic Insulation With Natural Gas Heat	5	136.32	163.29	163.29	119.78%
G Multifamily Window Replc With Natural Gas Heat	41	1,788.51	3,028.47	2,748.74	153.69%
Total	**46**	**1,924.83**	**3,191.76**	**2,912.03**	**151.29%**

The Small Home & MF Weatherization Program displayed verified savings of 2,912.03 Therms with a realization rate of 151.29% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-32: Small Home & MF Weatherization Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Multifamily Attic Insulation With Natural Gas Heat	$3,398.11	$105.66	$3,503.77
G Multifamily Window Replc With Natural Gas Heat	$16,199.80	$1,778.69	$17,978.49
Total	**$19,597.91**	**$1,884.35**	**$21,482.26**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Small Home & MF Weatherization Program in the section below.

3.3.5.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Small Home & MF Weatherization Program.

3.3.5.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Small Home & MF Weatherization Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

The rebate application form sufficiently collects all required RTF measure specification details. All rebate applications and tracking data contain smart thermostat manufacturer and model number. The Evaluators were able to verify the models for RTF specifications for connected thermostats.

The Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Small Home & MF Weatherization Program.

In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate "Multifamily" home type. Rather, the current rebate application includes an option for "Single family", "Manufactured", "New construction", and "Other". The Evaluators recommend including an option for "Multifamily" in order to consistently apply RTF savings for each of the measures.

The Evaluators reviewed each measure number of units, square footage, and insulation where available. The Evaluators found no instances in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. The Evaluators also note that Avista consistently verified square footage and R-values with customers when information was unclear. The tracked quantity and U-values were then documented in the tracking database consistently.

The Evaluators found expected savings to differ significantly for 8 of the 23 sampled projects. The expected savings calculated for these projects did not align with the values indicated in the Avista TRM. The Evaluators recommend updating the CC&B database to correct for these issues.

The Evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings.

3.3.5.3 Verification Surveys

The Evaluators did not conduct verification surveys for the gas measures in the Small Home & MF Weatherization Program. The insulation measures offered typically display high in-service rates.

3.3.5.4 Impact Analysis

This section summarizes the verified savings results for the Small Home & MF Weatherization Program. The Evaluators calculated verified savings for the natural gas measures using the most recent RTF workbook for the Small Home & MF Weatherization measures. These RTF UES values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.5.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate adjusted program savings for each of the Small Home & MF Weatherization Program measures. In addition, the Evaluators reviewed and applied the current Avista TRM values for each measure along with verified tracking data to estimate net program savings.

The Small Home & MF Weatherization Program in total displays a realization rate of 151.29% with 2,912.03 Therms verified natural gas energy savings in the Washington service territory, as displayed in Table 3-31. The realization rate for the natural gas savings in the Small Home & MF Weatherization Program deviate from 100% due to differences between the savings values assigned to the project quantities and the verified Avista TRM prescriptive savings value.

The Evaluators did not conduct a verification survey for the gas measures in the Small Home & MF Weatherization Program and therefore did not adjust verified savings with an ISR.

3.3.6 Appliance Program

The Appliances Program is residential prescriptive program that offers incentives for customers to upgrade their existing clothes washers and dryers to ENERGY STAR-rated clothes dryers and washers.

This section summarizes the impact results of the evaluation results for the Appliances Program. Table 3-33 summarizes the measures offered under this program.

Table 3-33: Appliance Program Measures

Measure	Description	Impact Analysis Methodology
G Energy Star Rated Clothes Dryer	ENERGY STAR-certified clothes dryer for residential homes	RTF UES
G Energy Star Rated Front Load Washer	ENERGY STAR-certified clothes washer for residential homes	RTF UES

The following table summarizes the verified natural gas savings for the Appliance Program impact evaluation.

Table 3-34: Appliance Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Energy Star Rated Clothes Dryer	65	176.80	150.85	150.85	85.32%
G Energy Star Rated Front Load Washer	120	723.60	585.67	570.25	78.81%
Total	**185**	**900.40**	**736.52**	**721.11**	**80.09%**

The Appliance Program displayed verified savings of 721.11 Therms with a realization rate of 80.09% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-35: Appliance Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Energy Star Rated Clothes Dryer	$1,300.00	$25.24	$1,325.24
G Energy Star Rated Front Load Washer	$6,000.00	$95.41	$6,095.41
Total	**$7,300.00**	**$120.65**	**$7,420.65**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Appliance Program in the section below.

3.3.6.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Appliance Program.

3.3.6.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Appliance Program. The Evaluators selected a random subset of rebate applications to cross-verify tracking data inputs, summarized in in Section 2.2.2.1.

The Evaluators found all Appliance Program rebates to have project documentation with the associated model number and efficiency values in either the CC&B web rebate data or mail-in rebate applications. In addition, documents included AHRI certifications or model numbers necessary to verify AHRI certifications. This allowed Evaluators to easily verify model specifications and apply savings.

The Evaluators note that one G Energy Star Rated Front Load Washer had claimed 3,296 kWh and 6.03 Therms savings, however, this project had provided no clarification for the large electric energy savings and therefore the Evaluators removed the savings for this project through the program. The Evaluators recommend verifying any gas measures that receive electric savings have an approved reasoning for these savings, and a referenced workbook to verify the savings values.

The gas measures rebated through this program are not contained in the Avista TRM. Therefore, the Evaluators applied savings for these projects by converting Avista TRM electric savings to gas savings by dividing approved Avista TRM savings for the equipment by 29.3. This application led to 85% realization for clothes dryers and 79% realization for clothes washers. The Evaluators recommend Avista include savings estimates for these measures in the Avista TRM for future evaluations.

3.3.6.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure described in Section 2.2.2.2. The Evaluators included questions such as:

- What type of clothes washer/dryer did this clothes washer/dryer replace?
- Is your home's water heated with electricity, natural gas, or another fuel?
- Was the previous equipment functional?
- Is the newly installed equipment still properly functioning?

The responses to this verification survey were used to calculate ISRs for the measures offered in the Appliance Program. In addition, the Evaluators asked participants how the COVID19 pandemic stay-at-home orders have affected their household's energy consumption. The responses to these additional questions can be found in Appendix A.

Table 3-36 displays the ISRs for each of the Appliance measures for Idaho and Washington natural gas territory combined. The ISRs resulted in ±8.8% precision at the 90% confidence interval for the program.

Table 3-36: Appliance Verification Survey ISR Results

Measure	Number of Rebates*	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
G Energy Star Rated Clothes Dryer	94	27	±8.8%	100%
G Energy Star Rated Front Load Washer	159	38		97%

*This count includes rebates from Washington and Idaho

Survey respondents described equipment to be currently functioning, leading to a 97-100% ISR for all measures. Although less than 100%, the ISR for the G Energy Star Rated Front Load Washer still exceeded an ISR of 95%. The Evaluators applied the ISRs listed in Table 3-36 to each rebate to quantify verified savings for each measure.

3.3.6.4 Impact Analysis

This section summarizes the verified savings results for the Appliance Program. The Evaluators calculated verified savings for the remaining measures using active values from the Avista TRM

workbook. These values were applied to a random sample of participants, with verification of project documents such as rebate applications to verify installation, quantity, and efficiency of the equipment.

3.3.6.5 Billing Analysis

The Evaluators did not complete a billing analysis for the measures in the Appliance Program.

3.3.6.6 Verified Savings

The Appliance Program in total displays a realization rate of 80.09% with 721.11 Therms verified natural gas savings in the Washington service territory, as displayed in Table 3-34. The realization rate for the natural gas savings in the Appliance Program deviate from 100% due to lack of Avista TRM values for the measure. The Evaluators estimated savings by converting measure electric savings into Therms savings.

In addition, the Evaluators applied in-service rates for each of these measures, leading to a downward adjustment for the clothes washer measure.

3.3.7 AeroBarrier Program

The AeroBarrier program provides incentives for customers to complete envelope sealing improvements using the AeroBarrier product, a convenient, cost-effective approach that seal homes in less than three hours and provides documented results.

This section summarizes the estimated savings Avista has calculated for the AeroBarrier Program. The Evaluators did not conduct an impact evaluation for the measures in this program for PY2021 due to low participation. A full impact analysis will be completed for PY2022 projects. Table 3-37 summarizes the measures offered under this program. Table 3-38 summarizes the measures offered under this program.

Table 3-37: AeroBarrier Program Measures

Measure	Description	Impact Analysis Methodology
G AeroBarrier Rebate	Whole home insulation with AeroBarrier	No impact evaluation completed for PY2021

The following table summarizes the estimated natural gas savings for the AeroBarrier Program impact evaluation.

Table 3-38: AeroBarrier Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G AeroBarrier Rebate	13	1,658.52	N/A	N/A	N/A
Total	**13**	**1,658.52**	**N/A**	**N/A**	**N/A**

The AeroBarrier Program displayed estimated savings of 1,658.52 Therms. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-39: AeroBarrier Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs

E AeroBarrier Rebate	$14,791.95	$1,073.21	$15,865.16
Total	**$14,791.95**	**$1,073.21**	**$15,865.16**

The Evaluators did not conduct an impact analysis for this program for PY2021.

3.4 Conclusions and Recommendations

The Evaluators provide the following conclusions and recommendations for Avista's Residential Portfolio program implementation.

3.4.1 Conclusions

The Evaluators provide the following conclusions regarding Avista's Residential natural gas programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 430,396.82 Therms with a realization rate of 100.24%. The Evaluators also conducted a cost-benefit analysis in order to estimate the Residential portfolio's cost-effectiveness. The resulting TRC value for this sector is 1.93 while the UCT value is 4.30. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Residential Portfolio impact evaluation resulted in a realization rate of 100.24% due to slight differences between the applied Avista TRM values and the active Avista TRM value or applied measure-level quantities for each measure in addition to the difference in savings values between the results from billing analyses and the Avista TRM.
- The HVAC Program, which contributes 71% of the expected savings, resulted in a realization rate of 99.85%. Each of the other programs resulted in a combined 101% realization rate.
- The Evaluators conducted verification surveys via web survey to collect information from customers who participated in the Water Heat, HVAC, and Appliance Programs. A total of 305 unique customers were surveyed between August 2021 and February 2022. The Evaluators collected information including the functionality of the efficient equipment, the functionality of the replaced equipment, and information on how the COVID19 stay-at-home orders have affected the household energy usage. The Evaluators calculated in-service rates for the measures within these two programs in order to apply findings to the verified savings results for each program.
- The realization rate for the natural gas savings in the Water Heat Program was 100.00%. The Evaluators found no instances in which a project savings deviated from the expected savings.
- The Evaluators explored a billing analysis for the natural gas water heater measures within the Water Heat Program. However, the G 50 Gallon Natural gas Water Heater and the G Tankless Gas Water Heater measures resulted in savings that were not statistically significant. Therefore, the Evaluators elected to use Avista TRM values to estimate verified savings. The Evaluators will explore further billing analyses for these measures during the next program year if participation permits.
- The HVAC Program in total displays a realization rate of 99.85% with 306,026.45 Therms verified natural gas savings in the Washington service territory. The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to one project which was verified to be a duplicate. The Evaluators removed savings for this project. All other rebates were assigned savings equivalent to the expected savings through Avista TRM values. The furnace measure has

nearly identical billing analysis results to the Avista TRM value (billing analysis indicated 81.5 Therms saved for G Natural Gas Furnace, while Avista TRM indicated 81.66 Therms).

- The Evaluators attempted to estimate smart thermostat measure savings values for the HVAC Program. However, because the results from the billing analyses for smart thermostats were contradicting and/or inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for these measures. The findings from the PY2021 billing analyses for these measures may have been impacted by the COVID19 pandemic. The Evaluators will explore additional billing analyses for these measures during program year 2022.
- The Shell Program displayed verified savings of 76,639.48 Therms with a realization rate of 100.82% against the expected savings for the program. The realization rate for the natural gas savings in the Shell Program deviate from 100% due to the slight differences between R-values or quantities between the Avista tracking database and the verified documents. The Evaluators conducted a billing analysis for the attic insulation and window replacement measures, however, due to unexpectedly low savings estimates, the Evaluators chose to verify savings through the Avista TRM.
- The ENERGY STAR Homes Program displayed a realization rate of 93.33% at 437.67 Therms saved in PY2021. The Evaluators found expected savings to differ for the G ENERGY STAR Home – Manufactured, Gas & Electric one of the three projects had expected gas savings equal to half of the Avista TRM value. The Evaluators used Avista TRM values, leading to a 200% realization rate for this project and a 120% realization rate for the gas measures overall. The realization rate had an overall downward adjustment due to low verified gas savings for the electric measures.
- In the Small Home & MF Weatherization Program, the Evaluators found that many projects exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). In addition, the Evaluators note that the current program rebate applications do not provide an option to indicate “Multifamily” home type. Rather, the current rebate application includes an option for “Single family”, “Manufactured”, “New construction”, and “Other”.
- The gas measures rebated through the Appliance Program are not contained in the Avista TRM. Therefore, the Evaluators applied savings for these projects by converting Avista TRM electric savings to gas savings by dividing approved Avista TRM savings for the equipment by 29.3. This application led to 85% realization for clothes dryers and 79% realization for clothes washers.
- The Evaluators did not complete an impact analysis for the AeroBarrier Program. Therefore, the AeroBarrier program’s savings is not included in the portfolio expected savings total or the portfolio verified savings total displayed in Table 1-1. A full impact analysis will be completed for the program in PY2022.

3.4.2 Recommendations

The Evaluators offer the following recommendations regarding Avista’s Residential natural gas programs:

- The Evaluators note instances found in which the web-based rebate data indicates the household has electric space heating, but all other sources (project data and document verification) indicate natural gas space heating, and vice versa. The Evaluators recommend

updating data collection standards in order for all sources of information to reflect the same values as the project documentation.

- The Evaluators found that many projects claimed under the Small Home & MF Weatherization Program exceed the "Small Home" definition from Avista - that a home is single family with less than 1,000 SQFT or is a multifamily home (5 or more units). The Evaluators recommend claiming projects on single family homes that are larger than 1,000 SQFT into the Shell Program.
- The Evaluators found expected savings to differ significantly for 8 of the 23 sampled projects in the Small Home & MF Weatherization Program. The expected savings calculated for these projects did not align with the values indicated in the Avista TRM. The Evaluators recommend updating the CC&B database to correct for these issues.
- The gas measures rebated through the Appliances Program are not contained in the Avista TRM. Therefore, the Evaluators applied savings for these projects by converting Avista TRM electric savings to gas savings by dividing approved Avista TRM savings for the equipment by 29.3. This application led to 85% realization for clothes dryers and 79% realization for clothes washers. The Evaluators recommend Avista include savings estimates for these measures in the Avista TRM for future evaluations.

4. Low-Income Impact Evaluation Results

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Washington service territory with a partnership with five network Community Action Agencies ("Agencies") and one tribal weatherization organization. The Agencies qualify income to prioritize and treat households based on several characteristics. In-house or contract crews install approved program measures. In addition, the Agencies have access to other monetary resources which allow them to weatherize a home or install additional energy efficiency measures.

The Evaluators completed an impact evaluation on Avista's Low-Income portfolio to verify program-level and measure-level energy savings for PY2021. The following sections summarize findings for each natural gas impact evaluation in the Low-Income Portfolio in the Washington service territory. The Evaluators used data collected and reported in the tracking database, online application forms, Avista TRM, and RTF values to evaluate verified savings. This approach provided the strongest estimate of achieved savings practical for each program, given its delivery method, magnitude of savings, number of participants, and availability of data. Table 4-1 summarizes the Low-Income verified impact savings by program. Table 4-2 summarizes the Low-Income portfolio cost-effectiveness results.

Table 4-1: Low-Income Verified Impact Savings by Program

Program	Expected Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
Low-Income	12,642.97	12,454.82	98.51%
CEEP	9,153.00	0.00	0.00%
Total	**12,642.97**	**12,454.82**	**98.51%**

Table 4-2: Low-Income Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Low Income	$784,655	$1,640,456	0.48	$504,110	$1,640,456	0.31

In PY2021, Avista completed and provided incentives for low-income gas measures in Washington and achieved total natural gas savings of 12,454.82 Therms. The Low-Income Program exceeded savings expectations based on reported savings with an achieved realization rate of 98.51%. The Evaluators estimated the TRC value for the Low-Income portfolio is 0.48 while the UCT value is 0.31. Further details of the impact evaluation results by program are provided in the sections following.

4.1 Program-Level Impact Evaluation Results

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Low-Income sector in the section below.

4.1.1 Low-Income Program

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Washington service territory with a partnership with five network Community Action Agencies ("Agencies") and one tribal weatherization organization. The Agencies qualify income to prioritize and treat households based on several characteristics. In-house or contract crews install approved program measures. In addition, the Agencies have access to other monetary resources which allow them to weatherize a home or install additional energy efficiency measures.

Avista provides CAP agencies with the following approved measure list, which are reimbursed in full by Avista. Avista also provides a rebate list of additional energy saving measures the CAP agencies are able to utilize which are partially reimbursed. Weatherization measures under this program may also be funded by CEEP. The following table summarizes the measures offered under this program.

Table 4-3 summarizes the measures offered under this program.

Table 4-3: Low-Income Program Measures

Measure	Impact Analysis Methodology
Air Infiltration	Avista TRM
Air source heat pump	
Attic insulation	
Duct insulation	
Duct sealing	
Natural gas to air source heat pump	
Natural gas to ductless heat pump	
ENERGY STAR® door	

Measure	Impact Analysis Methodology
ENERGY STAR® refrigerator	
ENERGY STAR® window	
Floor insulation	
Heat pump water heater	
LED lighting	
Wall insulation	
High efficiency furnace	
High efficiency tankless natural gas water heater	
Natural gas boiler	

Table 4-4 summarizes the verified natural gas savings for the Low-Income Program impact evaluation.

Table 4-4: Low-Income Program Verified Natural Gas Savings

Measure	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Air Infiltration	60	836.38	857.19	857.19	102.49%
G Duct Sealing	8	124.68	125.08	125.08	100.32%
G Energy Star Doors	63	1,091.20	1,125.73	1,125.73	103.16%
G Energy Star Windows	81	1,883.47	1,606.88	1,606.88	85.31%
G HE Furnace	54	3,299.10	3,285.99	3,285.99	99.60%
G HE WH 50G	6	39.96	40.13	40.13	100.43%
G INS - Attic	64	2,216.52	2,198.93	2,198.93	99.21%
G INS - Duct	10	281.14	279.01	279.01	99.24%
G INS - Floor	36	1,609.82	1,619.71	1,619.71	100.61%
G INS - Wall	11	442.96	443.26	443.26	100.07%
G Tankless Water Heater	16	817.74	872.91	872.91	106.75%
Health And Safety	117	0.00	0.00	0.00	N/A
Total	**526**	**12,642.97**	**12,454.82**	**12,454.82**	**98.51%**

The Low-Income Program displayed verified savings of 12,454.82 Therms with a realization rate of 98.51% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 4-5: Low-Income Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Air Infiltration	$70,588.01	$8,327.17	$78,915.18
G Duct Sealing	$6,300.09	$1,692.23	$7,992.32
G Energy Star Doors	$82,288.06	$33,974.85	$116,262.91
G Energy Star Windows	$206,345.99	$55,827.50	$262,173.49
G HE Furnace	$249,752.30	$44,456.87	$294,209.17
G HE WH 50G	$18,292.47	$331.01	$18,623.48
G INS - Attic	$103,095.72	$76,328.27	$179,423.99
G INS - Duct	$14,884.54	$9,684.87	$24,569.41

G INS - Floor	$104,549.98	$56,222.64	$160,772.62
G INS - Wall	$25,002.29	$15,386.24	$40,388.53
G Tankless Water Heater	$45,931.36	$11,809.79	$57,741.15
Health And Safety	$230,045.15	$169,338.48	$399,383.63
Total	**$1,157,075.96**	**$483,379.93**	**$1,640,455.89**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Low-Income Program in the section below.

4.1.1.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the Low-Income Program.

4.1.1.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Low-Income Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.2.1.

During review, the Evaluators found that all the requested project information clearly outlined measure details and calculations. In addition, the Evaluators found database quantity information to be consistent with documents verified.

The Evaluators reviewed the project documentation provided by Avista and identified very few instances in which there existed conflicting square footage or number of units between the aggregated project data from the CC&B and the rebate project documentation provided in the data request for document verification. The Evaluators, updated two project quantities quantity based on project documentation.

The Evaluators found some instances in which 20% savings cap was not applied to all measures found to be installed in the household, leading to low realization rates for some projects in the program. In addition, the Evaluators found some instances in which electric savings were applied to gas measures.

4.1.1.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Low-Income Program.

4.1.1.4 Impact Analysis

This section summarizes the verified savings results for the Low-Income Program. The Evaluators calculated verified savings for Low-Income Program measures using the Avista TRM. However, a whole building billing analysis was completed to supplement the findings from the desk review.

4.1.1.5 Billing Analysis

The results of the billing analysis for the Low-Income Program are provided below.

The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolated each unique measure. In doing so, the Evaluators also isolate the measure effects using the customer's consumption billing data. However, participation for the Low-

Income program resulted in a small number of customers with isolated measures and therefore the Evaluators were unable to estimate measure-level savings through billing analysis.

The Evaluators instead conducted a whole-home billing analysis for all the natural gas measures combined in order to estimate savings for the average household participating in the program, across all measures. The Evaluators successfully created a matched cohort for the natural gas measure households. Customers were matched on zip code (exact match) and their average pre-period seasonal usage, including summer, fall, winter, and spring for each control and treatment household. The Evaluators were provided a considerable pool of control customers to draw upon. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers.

Table 4-6 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Low-Income Program as it provided the highest adjusted R-squared among the regression models. However, savings for this model are not statistically significant at the 90% level, indicated by the lower 90% confidence bound at 0 Therms saved per year.

Table 4-6: Measure Savings, Low-Income Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
All Gas Measures (Therms)*	67	335	1	0	16.31	0.9	Model 2: PPR

*Not statistically significant

Due to lack of statistical significance from the billing analysis results, The Evaluators did not apply these regression savings estimates to the program. Instead, the Evaluators estimated savings through the program by applying Avista TRM values to verified quantities. Further details of the billing analysis can be found in Appendix A.

4.1.1.6 Verified Savings

Due to lack of significance in the billing analyses, the Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program savings for those measures. Adjusted savings were estimated using the Avista TRM. The Low-Income Program in total displays a realization rate of 98.51% with 12,454.82 Therms verified natural gas savings in the Washington service territory, as displayed in Table 4-4.

The Evaluators note that the majority of deviations from 100% realization rate is due to the change in square footage or number of units verified in the project documentation as well as verifying 20% annual household energy caps were properly applied. The Evaluators updated the quantity based on new project data.

4.1.2 Community Energy Efficiency Program (CEEP)

The Community Energy Efficiency Program was created from the Washington State Legislature in 2009 to tackle hard to reach markets in both the residential and commercial sectors by encouraging energy efficiency improvements. The CEEP pilot was funded by the U.S. Department of Energy's State Energy

Program and the American Recovery and Reinvestment Act. CEEP partners are selected by a competitive request for proposals and independent review committee. Avista has been a CEEP recipient since 2014.

The Company received a $750,000 CEEP allocation for the 202-21 funding year that is set to complete in June 2021. Avista is providing a $750,000 match along with in-kind program administrative support. Three community action agencies have partnered with Avista to implement the CEEP funds under two programs: energy efficiency improvements for multifamily housing and converting income qualified homes with alternative heat sources (e.g. wood, oil) to a heat pump system. In addition, CEEP funds are being used to match utility rebates for energy efficiency work done in small businesses in rural communities.

This section summarizes the impact results of the evaluation results for CEEP. Table 4-7 summarizes the measures offered under this program.

Table 4-7: CEEP Measures

Measure	Description	Impact Analysis Methodology
CEEP Multi Family - E Ductless Heat Pump Conversion Zonal	Ductless heat pump for multi-family units	Avista TRM
CEEP Multi Family - E Windows	Window replacement for multi-family units	Avista TRM
CEEP Multi Family - E Air Infiltration	Air infiltration for multi-family units	Avista TRM
CEEP Multi Family - E Attic Insulation	Attic insulation for multi-family units	Avista TRM
CEEP Multi Family - E Ductless Heat Pump Conversion	Ductless heat pump for multi-family units	Avista TRM
CEEP Multi Family - E Line Voltage Thermostat	Line voltage thermostats for multi-family units	Avista TRM
CEEP Multi Family - G Boiler	Boiler replacement for multi-family units	Avista TRM
CEEP Multi Family - E Health & Safety	Health and safety improvements for multi-family units	Avista TRM
CEEP Multi Family - E Lighting	Efficient lighting giveaways for multi-family units	Avista TRM
CEEP Single Family - E Alternative Heat Conversion	Alternative fuel conversion to electric in multi-family units	Avista TRM
CEEP Multi Family - E Floor Insulation	Floor insulation for multi-family units	Avista TRM
CEEP Single Family - E Ductless Heat Pump	Ductless heat pump for single-family homes	Avista TRM
CEEP Single Family - E Lighting	Efficient lighting giveaways for single-family units	Avista TRM

The following table summarizes the verified electric energy savings for the CEEP impact evaluation.

Table 4-8: CEEP Verified Gas Savings

Program	PY2021 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
CEEP	21	9,153.00	0	0	-

The Evaluators found that the project indicated as “CEEP Multi Family – G Boiler” had instead indicated a conversion from electric to ductless heat pump. Therefore, the Evaluators assigned electric savings to the project rather than gas savings, leading to 0 Therms savings claimed through the program.

There were no natural gas saving measures rebated in CEEP in PY2021, and there are no Therms penalties for the electric measures presented above. Therefore, the total natural gas savings for CEEP is 0. In addition, the total incentive and non-incentive costs for the program is $0.

4.2 Conclusions and Recommendations

The Evaluators provide the following conclusions and recommendations for Avista's Low-Income Portfolio program implementation.

4.2.1 Conclusions

The Evaluators provide the following conclusions regarding Avista's Low-Income natural gas programs:

- The Evaluators found the Low-Income portfolio to demonstrate a total of 12,454.82 Therms with a realization rate of 98.51%. The Low-Income Portfolio impact evaluation resulted verified savings that exceeded expected savings.
- The Evaluators conducted a cost-benefit analysis in order to estimate the Low-Income portfolio's cost-effectiveness. The resulting TRC value for this sector is 0.48 while the UCT value is 0.31. These values are expected, as the Low-Income portfolio is not expected to meet cost-effectiveness but are implemented in order to provide energy efficiency benefits to low-income customers. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Evaluators attempted to estimate measure-level Low-Income Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolate each unique measure. However, participation for the Low-Income program resulted in a small number of customers with isolated measures and therefore the Evaluators conducted a whole-home billing analysis for all the natural gas measures combined in the Low-Income in order to estimate savings for the average household participating in the program, across all measures. However, the billing analysis results were not statistically significant. Therefore, the Evaluators found a realization rate of 98.51% from the desk review with Avista TRM values.
- The Evaluators note that the majority of deviations from 100% realization rate in the Low-Income Program is due to the change in square footage or number of units verified in the project documentation as well as verifying 20% annual household energy caps were properly applied.
- In evaluating CEEP, the Evaluators found that the project indicated as "CEEP Multi Family – G Boiler" had instead indicated a conversion from electric to ductless heat pump. Therefore, the Evaluators assigned electric savings to the project rather than gas savings, leading to 0 Therms savings claimed through the program.
- There were no natural gas saving measures rebated in CEEP in PY2021, and there are no Therms penalties for the electric measures presented above. Therefore, the total natural gas savings for CEEP is 0. In addition, the total incentive and non-incentive costs for the program is $0.

4.2.2 Recommendations

The Evaluators offer the following recommendations regarding Avista's Low-Income natural gas programs:

- The Evaluators note that the majority of deviations from 100% realization rate in the Low-Income Program is due to the change in square footage or number of units verified in the project documentation as well as verifying 20% annual household energy caps were properly applied. The Evaluators recommend verifying each of these values are documented and applied.
- In evaluating CEEP, the Evaluators found that the project indicated as “CEEP Multi Family – G Boiler” had instead indicated a conversion from electric to ductless heat pump. Therefore, the Evaluators assigned electric savings to the project rather than gas savings, leading to 0 Therms savings claimed through the program. The Evaluators recommend verifying any projects in which large gas savings are applied.

5. Appendix A: Billing Analysis Results

This appendix provides additional details on the billing analyses conducted for each program.

5.1 Water Heat Program

The results of the billing analysis for the Water Heat program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2. Table 5-1 displays customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis.

The Evaluators attempted to estimate measure-level Water Heat Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolated each unique measure. In doing so, the Evaluators also isolate the measure effects using the customer's consumption billing data.

A billing analysis was completed for measures that had at least 75 customers with single-measure installations. This ensured that measures would have a sufficient sample size after applying PSM data restrictions (e.g. sufficient pre- and post-period data). The billing analysis included participants in both PY2019 and PY2021 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2021 participants.

Table 5-1: Measures Considered for Billing Analysis, Water Heat Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
G 50 Gallon Natural Gas Water Heater	✓	107	✓
G Tankless Gas Water Heater	✓	399	✓

The Evaluators were provided a considerable pool of control customers to draw upon for each measure, as shown in Table 5-2.

The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. Also shown in Table 5-8, are the impact of various restrictions on the number of treatment and control customers that were included in the final regression model. The "Starting Count" displays the beginning number of customers available prior to applying the data restrictions, while the "Ending Count" displays the number of customers after applying data restrictions and final matching.

Table 5-2: Cohort Restrictions, Water Heat Program

Measure	Data Restriction	Treatment Customers	Control Customers
	Starting Count	107	70,444
	Install Date Range: 2021-01-01 to 2021-08-31	72	70,444

G 50 Gallon Natural Gas Water Heater	Customers w/ Multiple Accounts for one Premise in Tracking Data	71	70,444
	Treatment Customers Found in Billing Data	68	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	68	70,228
	Restrict to Pre- Post-Period	68	56,803
	Post-Period Date Range Restriction: 2021-09-01 through 2021-12-31	68	55,266
	Require Minimum Post Period: 3 Months	67	41,612
	Incomplete Pre-Period Bills	65	31,782
	Ending Count (Matched by PSM)	65	325
G Tankless Water Heater	Starting Count	399	70,444
	Install Date Range: 2021-01-01 to 2021-06-30	253	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	251	70,444
	Treatment Customers Found in Billing Data	247	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	247	70,393
	Restrict to Pre- Post-Period	247	56,930
	Post-Period Date Range Restriction: 2021-07-01 through 2021-12-31	247	55,986
	Require Minimum Post Period: 5 Months	235	39,856
	Incomplete Pre-Period Bills	204	31,827
	Ending Count (Matched by PSM)	203	1,013

Figure 5-1 through Figure 5-4 display the density of each variable employed in propensity score matching for the G Tankless Gas Water Heater and G 50 Gallon Natural Gas Water Heater, before and after conducting matching. The figures following display the density of each variable employed in propensity score matching for the other billing analysis measures, before and after matching.

The distributions prior to matching show only small differences between the treatment and controls groups. After matching, the pre-period usage distribution is very similar between the groups, indicating little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-1: Covariate Balance Before Matching, 50 Gallon Water Heater

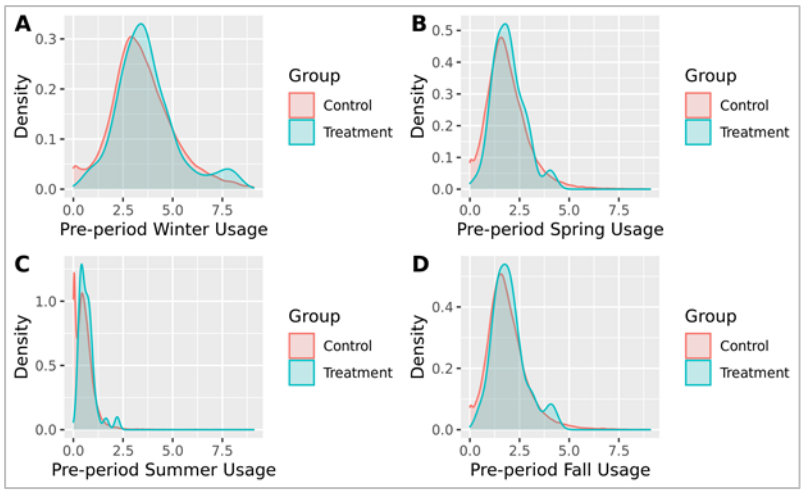


Figure 5-2: Covariate Balance After Matching, 50 Gallon Water Heater

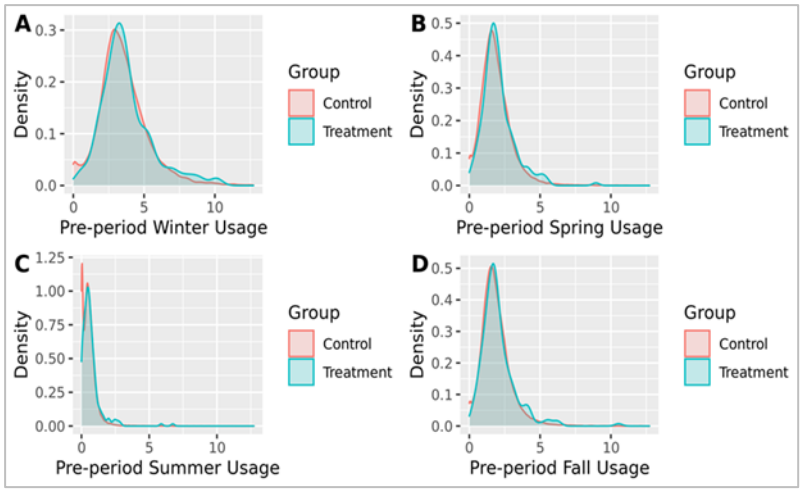


Figure 5-3: Covariate Balance Before Matching, G Tankless Gas Water Heater

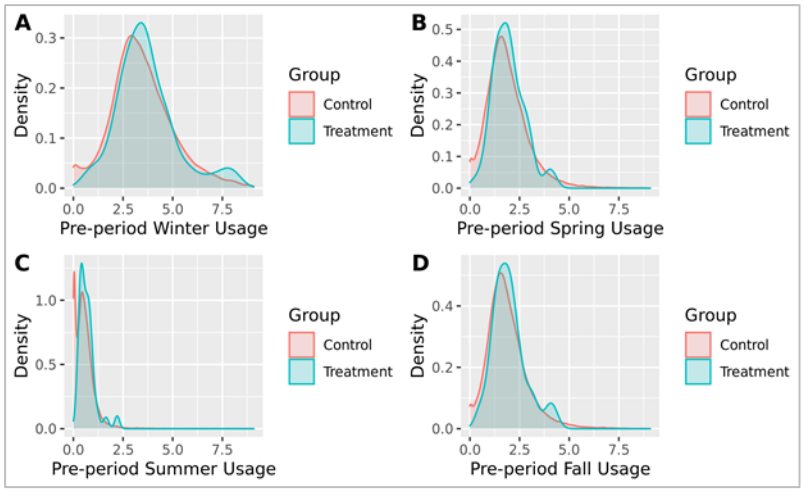
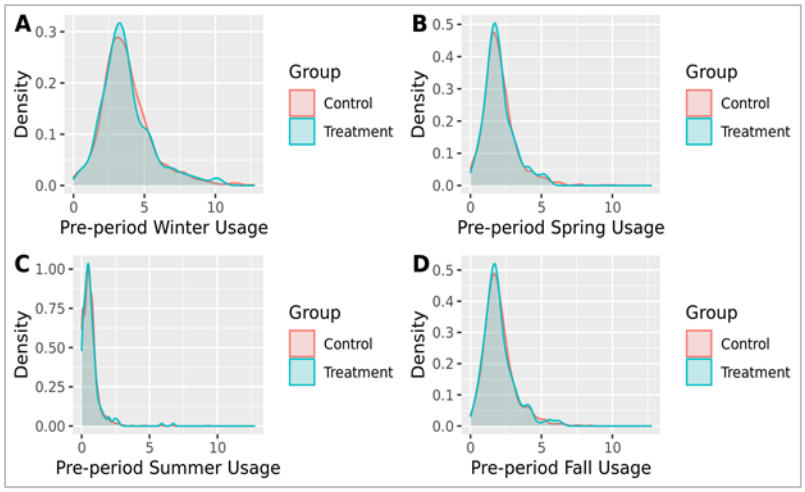


Figure 5-4: Covariate Balance After Matching, G Tankless Gas Water Heater



The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure. The t-test displayed no statistically significant differences at the 95% level in average daily consumption between the treatment and control groups for any month in the pre-period. In addition, the chi-squared test returned a p-value well over 0.05 for all measures, indicating that pre-period usage was balanced between the groups. Lastly, the standardized difference test returned values well under the recommended cutoff of 25, further indicating the groups were well matched on all included covariates.

Table 5-3 and Table 5-4 provide results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Water Heat program. The P-Value is over 0.05 for each month, meaning pre-period usage between treatment and control groups is similar at the 95% confidence level.

Table 5-3: Pre-period Usage T-test for 50 Gallon Water Heater, Water Heat Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.877	3.728	0.696	0.215	0.488	No
Feb	3.648	3.485	0.814	0.200	0.417	No
Mar	3.008	2.926	0.483	0.169	0.630	No
Apr	1.834	1.834	-0.003	0.117	0.997	No
May	1.070	1.088	-0.240	0.076	0.811	No
Jun	0.765	0.814	-0.782	0.064	0.436	No
Jul	0.530	0.635	-1.598	0.066	0.113	No
Aug	0.493	0.593	-1.683	0.059	0.095	No
Sep	0.684	0.744	-1.002	0.060	0.319	No

Oct	1.953	1.910	0.363	0.119	0.717	No
Nov	3.416	3.284	0.659	0.199	0.512	No
Dec	3.830	3.719	0.498	0.223	0.620	No

Table 5-4: Pre-period Usage T-test for Tankless Gas Water Heater, Water Heat Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.880	3.806	0.492	0.150	0.623	No
Feb	3.667	3.577	0.660	0.137	0.510	No
Mar	3.147	3.067	0.672	0.118	0.502	No
Apr	1.961	1.899	0.762	0.082	0.447	No
May	1.141	1.138	0.045	0.061	0.964	No
Jun	0.812	0.864	-0.770	0.067	0.442	No
Jul	0.565	0.611	-0.863	0.053	0.389	No
Aug	0.528	0.564	-0.665	0.054	0.507	No
Sep	0.727	0.730	-0.055	0.053	0.956	No
Oct	1.968	1.956	0.147	0.085	0.883	No
Nov	3.348	3.310	0.294	0.129	0.769	No
Dec	3.771	3.787	-0.110	0.146	0.912	No

Table 5-5 provides customer counts for customers in the final regression model by assigned weather station ID for each measure. In addition, TMY HDD and CDD from the nearest available TMY weather station is provided as well as the weighted HDD/CDD for each measure. The HDD and CDD was weighted by the number of treatment customers assigned to a weather station.

Table 5-5: TMY Weather, Water Heat Program

Measure	USAF Station ID	Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
G 50 Gallon Natural Gas Water Heater	727830	2	727830	5,511	907	6,334	500
	727834	6	727834	6,915	376	6,334	500
	727850	3	727850	6,707	379	6,334	500
	727855	1	727855	7,360	439	6,334	500
	727856	50	727856	6,246	519	6,334	500
	727857	3	727857	6,467	299	6,334	500
G Tankless Water Heater	720322	2	727834	6,915	376	6,560	457
	720923	2	727834	6,915	376	6,560	457
	726817	7	727834	6,915	376	6,560	457
	727830	7	727830	5,511	907	6,560	457
	727834	80	727834	6,915	376	6,560	457
	727850	8	727850	6,707	379	6,560	457

	727855	3	727855	7,360	439	6,560	457
	727856	82	727856	6,246	519	6,560	457
	727857	4	727857	6,467	299	6,560	457
	727870	8	727856	6,246	519	6,560	457

Table 5-6 provides annual savings/customer for the Water Heat program for each measure and regression model. However, savings are not statistically significant at the 90% level for any of the models explored for the Tankless Gas Water Heater and 50 Gallon Natural Gas Water Heater measures.

Table 5-6: Measure Savings for All Regression Models, Water Heat Program

Measure	Model	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared
G 50 Gallon Natural Gas Water Heater	Diff-in-diff	65	325	37.39*	-97.33	172.11	0.52
	PPR	65	325	37.79*	-16.23	91.81	0.89
	Treatment Only (Gross)	65	N/A	30.69*	-53.88	115.27	0.83
G Tankless Water Heater	Diff-in-diff	203	1,013	0.86*	-50.96	52.68	0.49
	PPR	203	1,013	-3.65*	-25.62	18.32	0.82
	Treatment Only (Gross)	203	N/A	20.47*	-10.17	51.10	0.81

*Not statistically significant

5.2 HVAC Program

The results of the billing analysis for the HVAC program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2. The Evaluators attempted to estimate measure-level HVAC Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolated each unique measure. In doing so, the Evaluators also isolate the measure effects using the customer's consumption billing data.

A billing analysis was completed for measures that had at least 75 customers with single-measure installations. This ensured that measures would have a sufficient sample size after applying PSM data restrictions (e.g. sufficient pre- and post-period data). The billing analysis included participants in both in both Washington and Idaho service territories in order to acquire the maximum number of customers possible.

Table 5-7 displays customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis.

The Evaluators attempted to estimate measure-level HVAC Program energy savings through billing analysis regression with a counterfactual group selected via propensity score matching. The Evaluators attempted to isolated each unique measure. In doing so, the Evaluators also isolate the measure effects using the customer's consumption billing data.

A billing analysis was completed for measures that had at least 75 customers with single-measure installations. This ensured that measures would have a sufficient sample size after applying PSM data restrictions (e.g. sufficient pre- and post-period data). The billing analysis included participants in both in both Washington and Idaho service territories in order to acquire the maximum number of customers possible.

Table 5-7: Measures Considered for Billing Analysis, HVAC Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
G Natural Gas Boiler	✓	35	
G Natural Gas Furnace	✓	2,327	✓
G Natural Gas Wall Heater	✓	0	
G Smart Thermostat DIY with Natural Gas Heat	✓	1,067	✓
G Smart Thermostat Paid Install with Natural Gas Heat	✓	1,077	✓

The Evaluators conducted a separate analysis for the G Natural Gas Furnace measure, displayed in Section 3.3.2.5 as it provided more reasonable and statistically significant results than the billing analysis. The following details the billing analysis for the remaining measures.

The Evaluators were provided a considerable pool of control customers to draw upon, as shown in Table 5-8. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. Also shown in Table 5-8, are the impact of various restrictions on the number of treatment and control customers that were included in the final regression model. The "Starting Count" displays the beginning number of customers available prior to applying the data restrictions, while the "Ending Count" displays the number of customers after applying data restrictions and final matching.

Table 5-8: Cohort Restrictions, HVAC Program

Measure	Data Restriction	Treatment Customers	Control Customers
G Natural Gas Furnace	Starting Count	2,327	70,444
	Install Date Range: 2021-01-01 to 2021-06-30	1,170	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	1,104	70,444
	Treatment Customers Found in Billing Data	1,089	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	1,089	70,422
	Restrict to Pre- Post-Period	1,063	56,957
	Post-Period Date Range Restriction: 2021-07-01 through 2021-12-31	1,004	56,013
	Require Minimum Post Period: 5 Months	801	39,877
	Incomplete Pre-Period Bills	672	31,845
	Ending Count (Matched by PSM)	671	3,347
	Starting Count	1,077	70,444

G Smart Thermostat Paid Install with Natural Gas Heat	Install Date Range: 2021-01-01 to 2021-06-30	465	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	429	70,444
	Treatment Customers Found in Billing Data	426	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	426	70,436
	Restrict to Pre- Post-Period	425	56,969
	Post-Period Date Range Restriction: 2021-07-01 through 2021-12-31	423	56,025
	Require Minimum Post Period: 5 Months	404	39,887
	Incomplete Pre-Period Bills	268	31,855
	Ending Count (Matched by PSM)	267	1,335
G Smart Thermostat DIY with Natural Gas Heat	Starting Count	1,067	70,444
	Install Date Range: 2021-01-01 to 2021-06-30	461	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	460	70,444
	Treatment Customers Found in Billing Data	430	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	430	70,379
	Restrict to Pre- Post-Period	430	56,920
	Post-Period Date Range Restriction: 2021-07-01 through 2021-12-31	430	55,976
	Require Minimum Post Period: 5 Months	412	39,850
	Incomplete Pre-Period Bills	272	31,821
	Ending Count (Matched by PSM)	272	1,354

The figures below display the density of each variable employed in propensity score matching for each installed HVAC measure, before and after matching.

The distributions prior to matching show only small differences between the treatment and controls groups. After matching, the pre-period usage distribution is very similar between the groups, indicating

little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-5: Covariate Balance Before Matching, Natural Gas Furnace

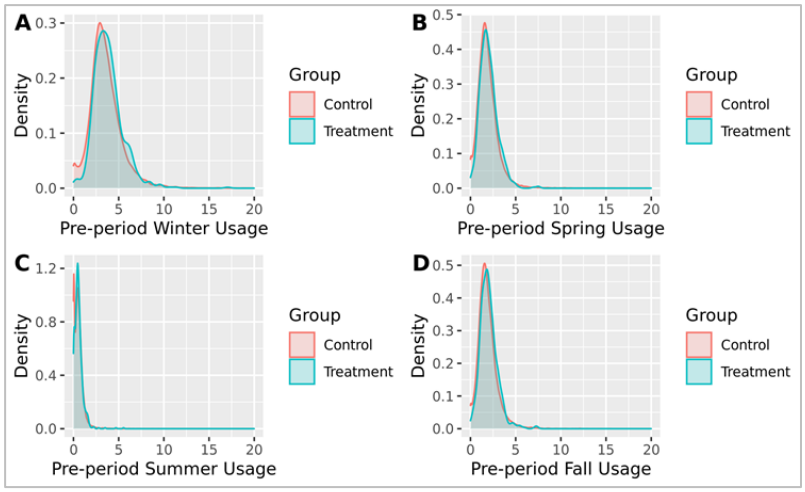


Figure 5-6: Covariate Balance After Matching, Natural Gas Furnace

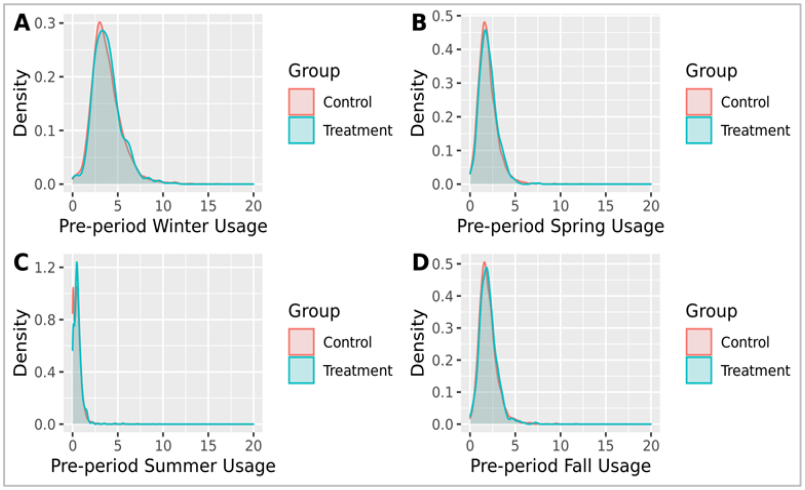


Figure 5-7: Covariate Balance Before Matching, Smart Thermostat Paid Install with Natural Gas Heat

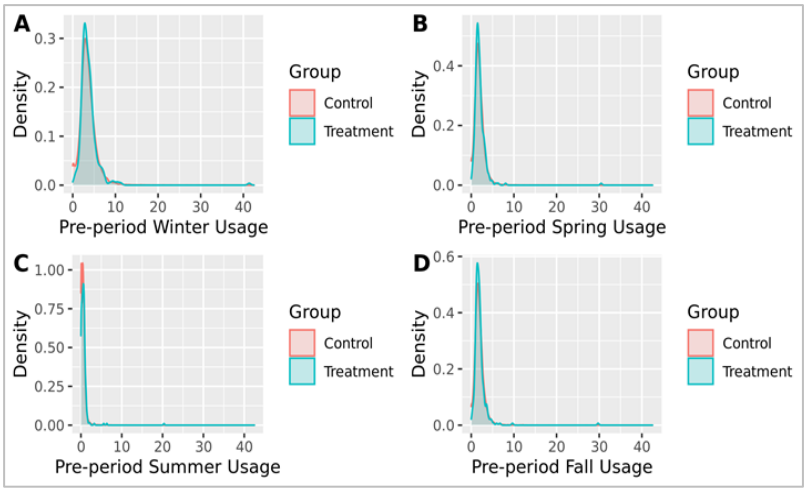


Figure 5-8: Covariate Balance After Matching, Smart Thermostat Paid Install with Natural Gas Heat

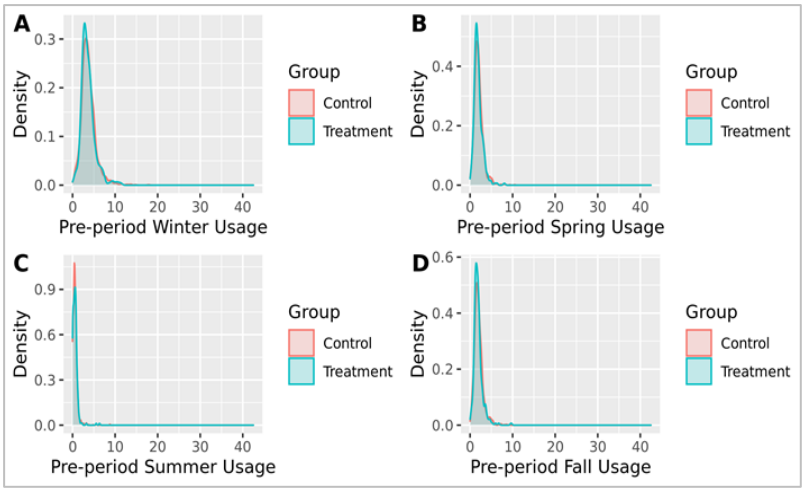


Figure 5-9: Covariate Balance Before Matching, Smart Thermostat DIY with Natural Gas Heat

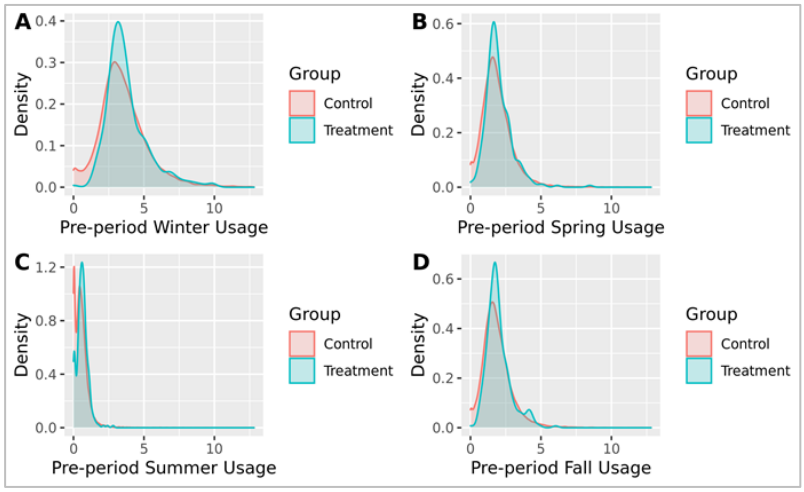
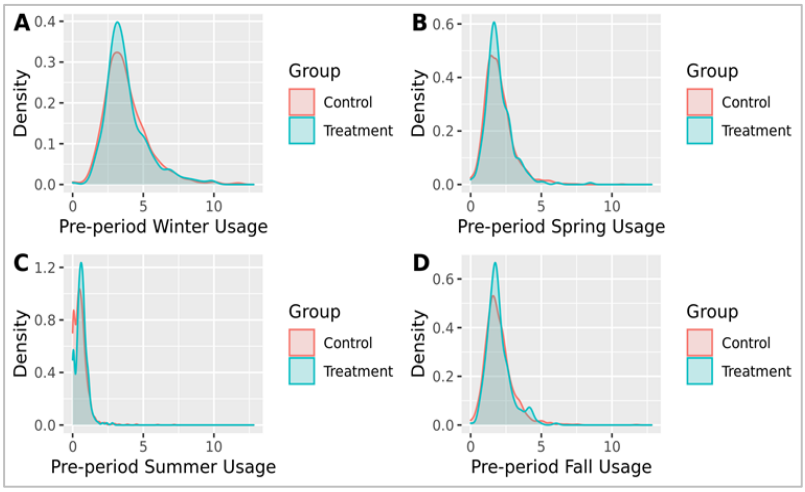


Figure 5-10: Covariate Balance After Matching, Smart Thermostat DIY with Natural Gas Heat



The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

For Natural Gas Furnace and Smart Thermostat DIY With Natural Gas Heat, all tests confirmed that PSM performed well. The t-test displayed no statistically significant differences at the 95% level in average daily consumption between the treatment and control groups for any month in the pre-period.

For Smart Thermostat Paid Install with Natural Gas Heat, the t-test showed statistically significant differences at the 95% level for two summer months. However, the overall pre-period t-test across all

months showed no statistically significant difference between treatment and control groups after matching.

In addition, the chi-squared test returned a p-value well over 0.05 for all measures, indicating that pre-period usage was balanced between the groups. Lastly, the standardized difference test returned values well under the recommended cutoff of 25, further indicating the groups were well matched on all included covariates.

The tables below provide results for the *t*-test on pre-period usage between the treatment and control groups after matching for the HVAC program. A P-Value over 0.05 indicates pre-period usage between treatment and control groups is similar at the 95% confidence level.

Table 5-9: Pre-period Usage T-test for Natural Gas Furnace, HVAC Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.882	3.914	-0.456	0.070	0.649	No
Feb	3.642	3.685	-0.648	0.067	0.517	No
Mar	3.052	3.103	-0.851	0.059	0.395	No
Apr	1.860	1.906	-1.094	0.042	0.274	No
May	1.032	1.089	-1.782	0.032	0.075	No
Jun	0.713	0.749	-1.413	0.026	0.158	No
Jul	0.490	0.502	-0.591	0.021	0.555	No
Aug	0.449	0.460	-0.553	0.020	0.580	No
Sep	0.641	0.647	-0.278	0.021	0.781	No
Oct	1.923	1.969	-1.124	0.042	0.261	No
Nov	3.378	3.427	-0.727	0.068	0.467	No
Dec	3.829	3.881	-0.702	0.074	0.483	No

Table 5-10: Pre-period Usage T-test for Smart Thermostat Paid Install with Natural Gas Heat, HVAC Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.842	3.754	0.753	0.117	0.452	No
Feb	3.630	3.548	0.739	0.111	0.460	No
Mar	3.101	2.962	1.509	0.092	0.132	No
Apr	1.924	1.813	1.608	0.069	0.109	No
May	1.112	1.057	0.953	0.058	0.341	No
Jun	0.795	0.781	0.235	0.059	0.815	No
Jul	0.554	0.541	0.357	0.036	0.722	No
Aug	0.511	0.497	0.383	0.036	0.702	No

Sep	0.705	0.678	0.563	0.048	0.574	No
Oct	1.959	1.845	1.586	0.072	0.114	No
Nov	3.328	3.182	1.414	0.103	0.158	No
Dec	3.762	3.658	0.875	0.119	0.382	No

Table 5-11: Pre-period Usage T-test for Smart Thermostat DIY with Natural gas Heat, HVAC Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.908	3.903	0.044	0.110	0.965	No
Feb	3.735	3.654	0.759	0.106	0.448	No
Mar	3.139	3.080	0.658	0.090	0.511	No
Apr	1.880	1.886	-0.083	0.068	0.934	No
May	1.069	1.093	-0.482	0.050	0.630	No
Jun	0.745	0.786	-1.113	0.037	0.266	No
Jul	0.508	0.578	-2.673	0.026	0.008	Yes
Aug	0.475	0.524	-2.010	0.025	0.045	Yes
Sep	0.668	0.701	-0.941	0.035	0.347	No
Oct	1.943	1.941	0.036	0.063	0.971	No
Nov	3.385	3.330	0.591	0.093	0.555	No
Dec	3.842	3.775	0.657	0.103	0.512	No

Table 5-12 provides customer counts for customers in the final regression model by assigned weather station ID for each measure. In addition, TMY HDD and CDD from the nearest available TMY weather station is provided as well as the weighted HDD/CDD for each measure. The HDD and CDD was weighted by the number of treatment customers assigned to a weather station.

Table 5-12: TMY Weather, HVAC Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
G Natural Gas Furnace	720322	10	727834	6,915	376	6,365	509
	720923	2	727834	6,915	376	6,365	509
	726817	12	727834	6,915	376	6,365	509
	726988	2	726988	4,561	882	6,365	509
	727827	1	727827	5,428	731	6,365	509
	727830	71	727830	5,511	907	6,365	509
	727834	116	727834	6,915	376	6,365	509
	727850	11	727850	6,707	379	6,365	509

	727855	23	727855	7,360	439	6,365	509
	727856	353	727856	6,246	519	6,365	509
	727857	54	727857	6,467	299	6,365	509
	727870	16	727856	6,246	519	6,365	509
	727918	0	726980	4,301	296	6,365	509
G Smart Thermostat Paid Install with Natural Gas Heat	720322	2	727834	6,915	376	6,528	463
	720923	0	727834	6,915	376	6,528	463
	726817	0	727834	6,915	376	6,528	463
	727827	0	727827	5,428	731	6,528	463
	727830	5	727830	5,511	907	6,528	463
	727834	103	727834	6,915	376	6,528	463
	727850	8	727850	6,707	379	6,528	463
	727855	4	727855	7,360	439	6,528	463
	727856	139	727856	6,246	519	6,528	463
	727857	2	727857	6,467	299	6,528	463
	727870	4	727856	6,246	519	6,528	463
G Smart Thermostat DIY with Natural Gas Heat	720322	3	727834	6,915	376	6,388	490
	720923	0	727834	6,915	376	6,388	490
	726817	3	727834	6,915	376	6,388	490
	727827	0	727827	5,428	731	6,388	490
	727830	12	727830	5,511	907	6,388	490
	727834	44	727834	6,915	376	6,388	490
	727850	14	727850	6,707	379	6,388	490
	727855	4	727855	7,360	439	6,388	490
	727856	170	727856	6,246	519	6,388	490
	727857	14	727857	6,467	299	6,388	490
	727870	8	727856	6,246	519	6,388	490

Table 5-13 provides estimated annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the HVAC Program as it provided the highest adjusted R-squared among the regression models. Savings are not statistically significant at the 90% level for Smart Thermostat Paid Install with Natural Gas Heat and DIY Smart Thermostat with Natural Gas Heat.. However, savings are statistically significant for Natural Gas Furnace. The adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-13: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model

G Natural Gas Furnace	671	3,347	16.97	9.82	24.13	0.92	Model 2: PPR
G Smart Thermostat Paid Install with Natural Gas Heat	267	1,335	-7.59	-19.77	4.59	0.91	Model 2: PPR
G Smart Thermostat DIY with Natural Gas Heat	272	1,354	3.12	-7.45	13.68	0.93	Model 2: PPR

The figures below provide monthly TMY savings per customer for the HVAC program.

Figure 5-11: Natural Gas Furnace Monthly Savings, HVAC Program

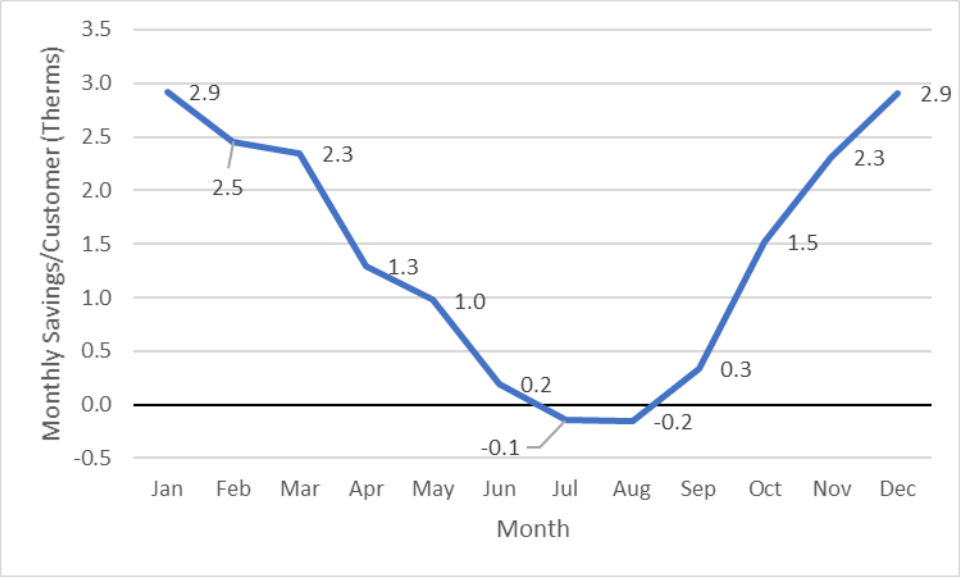


Figure 5-12: Smart Thermostat Paid Install with Natural Gas Heat Monthly Savings, HVAC Program

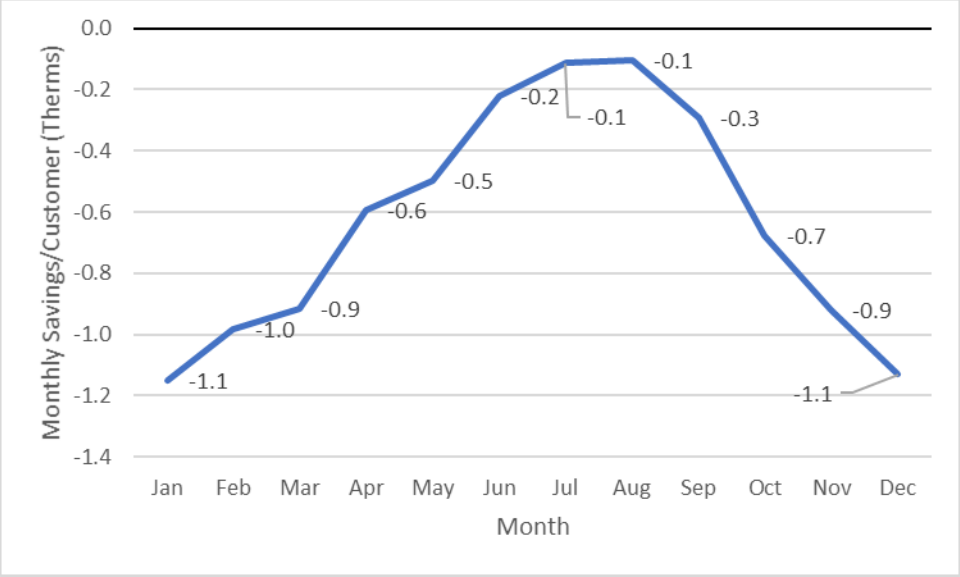
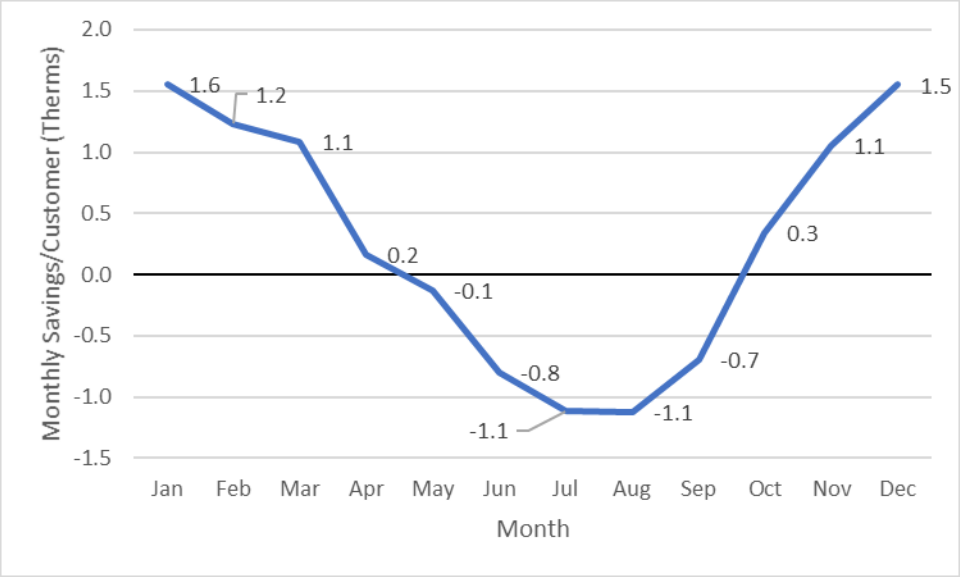


Figure 5-13: Smart Thermostat DIY with Natural Gas Heat Monthly Savings, HVAC Program



5.3 Shell Program

The results of the billing analysis for the Shell program are provided below. Table 5-14 shows customer counts for customers considered for billing analysis (i.e. customer with single-measure installations) and identifies measures that met the requirements for a billing analysis. A billing analysis was completed for measures that had at least 75 customers with single-measure installations. This ensured that measures would have a sufficient sample size after applying PSM data restrictions (e.g. sufficient pre- and post-period data). The billing analysis included participants in both in both Washington and Idaho service territories in order to acquire the maximum number of customers possible.

Table 5-14: Measures Considered for Billing Analysis, Shell Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
G Attic Insulation With Natural Gas Heat	✓	230	✓
G IGU Window Replc With Natural Gas Heat	✓	11	
G Floor Insulation With Natural Gas Heat	✓	9	
G Storm Windows with Natural Gas Heat	✓	4	
G Wall Insulation With Natural Gas Heat	✓	32	
G Window Replc With Natural Gas Heat	✓	1,075	✓

The Evaluators were successful in creating a matched cohort for each of the measures with sufficient participation. Customers were matched on zip code (exact match) and their average pre-period seasonal usage, including summer, fall, winter, and spring for each control and treatment household. The Evaluators were provided a considerable pool of control customers to draw upon, as shown in Table 5-15. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. Also shown in Table 5-15, are the impact of various restrictions on the number of treatment and control customers that were included in

the final regression model. The "Starting Count" displays the beginning number of customers available prior to applying the data restrictions, while the "Ending Count" displays the number of customers after applying data restrictions and final matching.

Table 5-15: Cohort Restrictions, Shell Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
G Attic Insulation With Natural Gas Heat	Starting Count	230	70,444
	Install Date Range: 2021-01-01 to 2021-04-30	62	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	62	70,444
	Treatment Customers Found in Billing Data	62	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	62	70,365
	Restrict to Pre- Post-Period	62	56,911
	Post-Period Date Range Restriction: 2021-05-01 through 2021-12-31	62	56,496
	Require Minimum Post Period: 6 Months	58	39,457
	Incomplete Pre-Period Bills	49	32,092
	Ending Count (Matched by PSM)	49	245
G Window Replc With Natural Gas Heat	Starting Count	1,075	70,444
	Install Date Range: 2021-01-01 to 2021-06-30	514	70,444
	Customers w/ Multiple Accounts for one Premise in Tracking Data	514	70,444
	Treatment Customers Found in Billing Data	501	70,444
	Control Group Usage Outlier (>2X Maximum Avg. Treatment Usage)	501	70,404
	Restrict to Pre- Post-Period	500	56,941
	Post-Period Date Range Restriction: 2021-07-01 through 2021-12-31	500	55,997
	Require Minimum Post Period: 5 Months	478	39,865
	Incomplete Pre-Period Bills	425	31,834
	Ending Count (Matched by PSM)	425	2,107

Figure 5-14 and Figure 5-15 display the density of each variable employed in propensity score matching for the attic insulation measure, before and after conducting matching. In addition, Figure 5-16 and Figure 5-17 display the density of each variable employed in propensity score matching for the window replacement measure, before and after conducting matching.

For the attic insulation measure, the covariate balance shows small differences between the treatment and control groups before and after matching. This is in part due to the small final number of treatment customers for the attic insulation measure (N=49). However, for the window replacement measure, the

covariate distributions prior to matching and after matching are similar, indicating little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-14: Covariate Balance Before Matching, Shell Attic Insulation

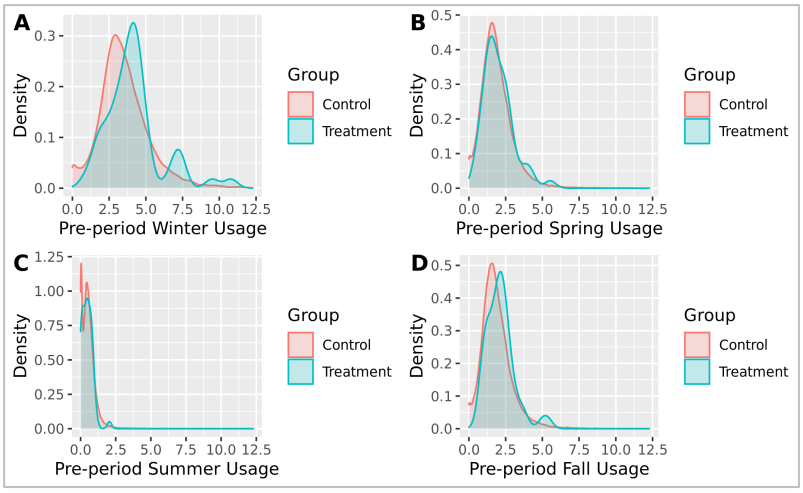


Figure 5-15: Covariate Balance After Matching, Shell Attic Insulation

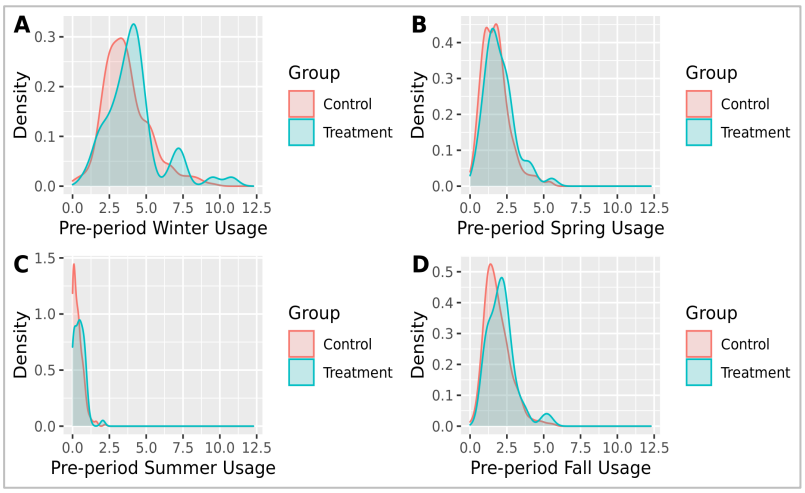


Figure 5-16: Covariate Balance Before Matching, Shell Window Replacement

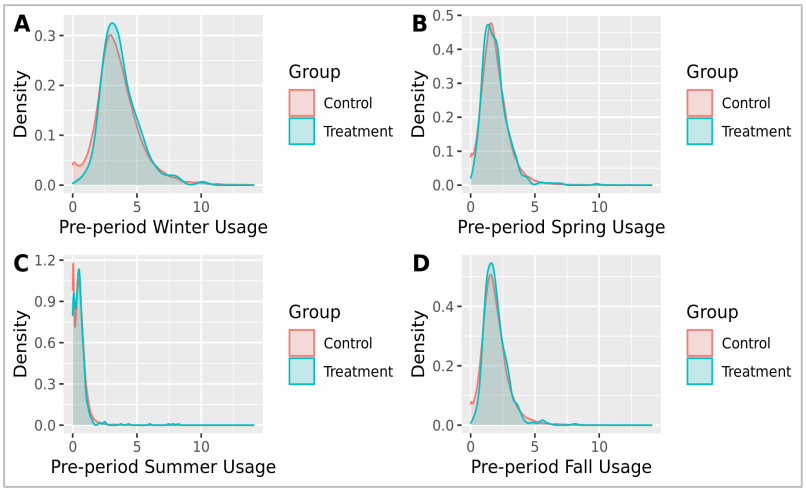
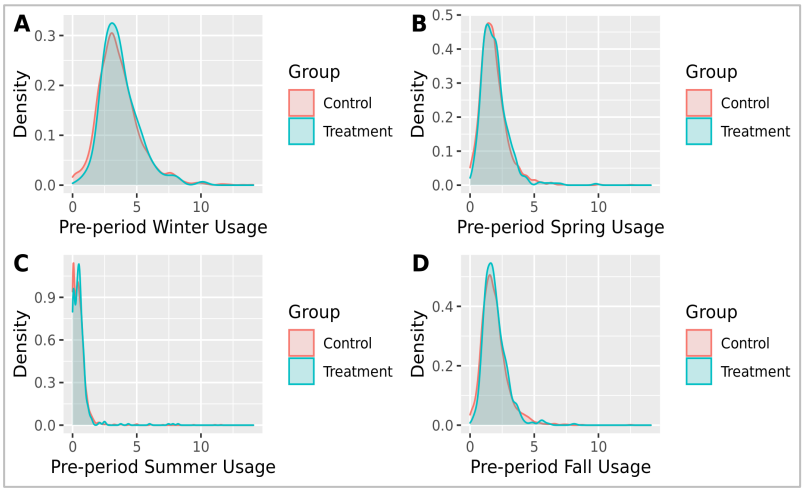


Figure 5-17: Covariate Balance After Matching, Shell Window Replacement



The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month
2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure. The t-test displayed no statistically significant differences at the 95% level in average daily consumption between the treatment and control groups for any month in the pre-period. In addition, the chi-squared test returned a p-value well over 0.05 for all measures, indicating that pre-period usage was balanced between the groups. Lastly, the standardized difference test returned values well under the recommended cutoff of 25, further indicating the groups were well matched on all included covariates.

Table 5-16 and Figure 5-18 provide results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Shell program. The P-Value is over 0.05 for each month, meaning pre-period usage between treatment and control groups is similar at the 95% confidence level.

Table 5-16: Pre-period Usage T-test for Attic Insulation, Shell Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.785	4.148	-1.097	0.330	0.277	No
Feb	3.503	3.916	-1.349	0.306	0.182	No
Mar	2.850	3.242	-1.539	0.255	0.129	No
Apr	1.648	1.905	-1.621	0.158	0.110	No
May	0.812	0.961	-1.597	0.094	0.115	No
Jun	0.506	0.626	-1.735	0.070	0.087	No
Jul	0.311	0.417	-1.852	0.057	0.069	No
Aug	0.286	0.384	-1.726	0.057	0.089	No
Sep	0.463	0.584	-1.774	0.068	0.081	No
Oct	1.802	2.083	-1.890	0.149	0.063	No
Nov	3.330	3.751	-1.649	0.256	0.104	No
Dec	3.772	4.296	-1.854	0.283	0.068	No

Table 5-17: Pre-period Usage T-test for Window Replacement, Shell Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.727	3.807	-0.905	0.089	0.366	No
Feb	3.486	3.530	-0.529	0.083	0.597	No
Mar	2.876	2.941	-0.904	0.073	0.367	No
Apr	1.722	1.798	-1.373	0.055	0.170	No
May	0.957	1.030	-1.249	0.058	0.212	No
Jun	0.670	0.726	-1.088	0.052	0.277	No
Jul	0.461	0.496	-0.902	0.039	0.367	No
Aug	0.435	0.459	-0.642	0.038	0.521	No
Sep	0.615	0.614	0.043	0.037	0.965	No
Oct	1.836	1.884	-0.930	0.052	0.353	No
Nov	3.250	3.345	-1.236	0.077	0.217	No
Dec	3.685	3.760	-0.918	0.082	0.359	No

Table 5-18 provides customer counts for customers in the final regression model by assigned weather station ID for each measure. In addition, TMY HDD and CDD from the nearest available TMY weather station is provided as well as the weighted HDD/CDD for each measure. The HDD and CDD was weighted by the number of treatment customers assigned to a weather station.

Table 5-18: TMY Weather, Shell Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
G Attic Insulation With Natural Gas Heat	720322	3	727834	6,915	376	6,303	518
	720923	1	727834	6,915	376	6,303	518
	726817	5	727834	6,915	376	6,303	518
	727827	2	727827	5,428	731	6,303	518
	727830	44	727830	5,511	907	6,303	518
	727834	39	727834	6,915	376	6,303	518
	727850	15	727850	6,707	379	6,303	518
	727855	10	727855	7,360	439	6,303	518
	727856	252	727856	6,246	519	6,303	518
	727857	37	727857	6,467	299	6,303	518
	727870	17	727856	6,246	519	6,303	518
G Window Replc With Natural Gas Heat	727827	1	727827	5,428	731	6,266	519
	727830	3	727830	5,511	907	6,266	519
	727834	3	727834	6,915	376	6,266	519
	727850	0	727850	6,707	379	6,266	519
	727855	1	727855	7,360	439	6,266	519
	727856	37	727856	6,246	519	6,266	519
	727857	4	727857	6,467	299	6,266	519
	727870	0	727856	6,246	519	6,266	519

Table 5-19 provides annual savings per customer for the Shell program for each measure and regression model. The PPR model was selected for ex post savings because it provided the best fit for the data (highest adjusted R-squared).

Table 5-19: Measure Savings for All Regression Models, Shell Program

Measure	Model	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared
G Attic Insulation With Natural Gas Heat	Diff-in-diff	49	245	26.21*	-51.23	103.66	0.63
	PPR	49	245	26.35	6.09	46.62	0.93
	Treatment Only (Gross)	49	N/A	111.93	19.97	203.89	0.79
G Window Replc With Natural Gas Heat	Diff-in-diff	425	2,107	23.40*	-8.58	55.38	0.54
	PPR	425	2,107	20.27	10.98	29.56	0.92
	Treatment Only (Gross)	425	N/A	35.41	16.44	54.39	0.83

*Not statistically significant

Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-20: Measure Savings, Shell Program

Measure	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
G Attic Insulation With Natural Gas Heat	49	245	26.35	6.09	46.62	0.93	Model 2: PPR
G Window Replc With Natural Gas Heat	425	2,107	20.27	10.98	29.56	0.92	Model 2: PPR

Figure 5-18 and Figure 5-12 provide monthly TMY savings per customer for the Shell program. As expected for gas weatherization measures, the greatest savings occur during the winter months.

Figure 5-18: Attic Insulation Monthly Savings, Shell Program

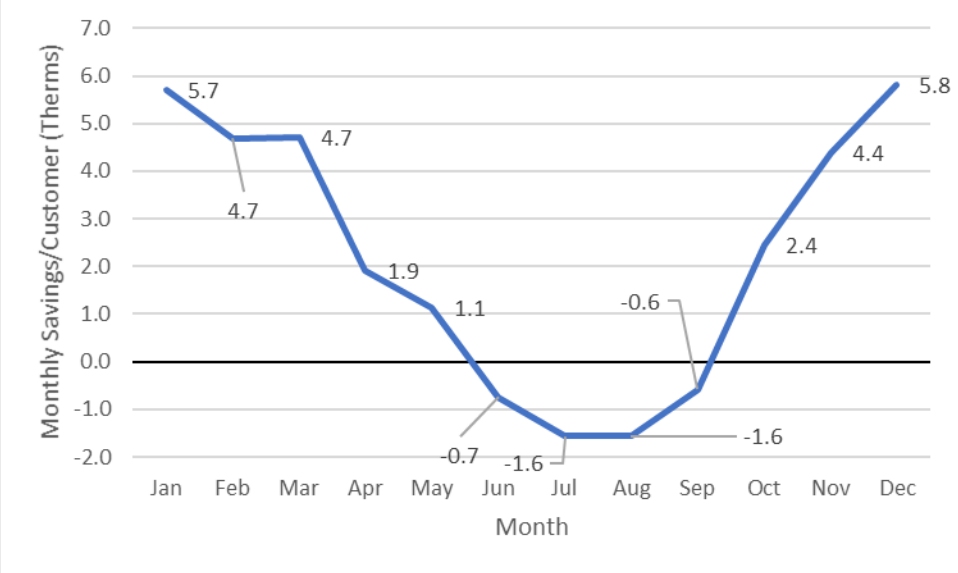
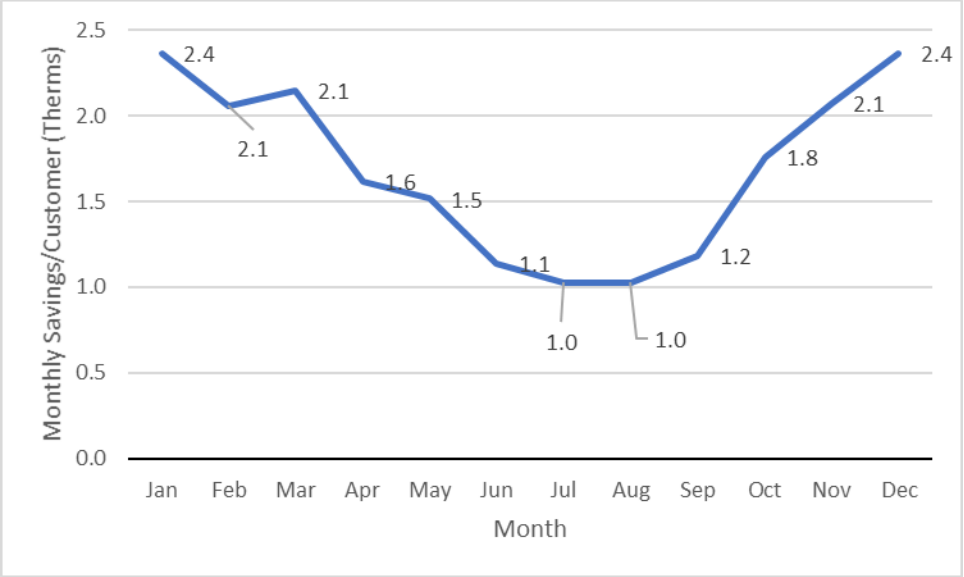


Figure 5-19: Window Replacement Monthly Savings, Shell Program



5.4 Low-Income Program

The Evaluators conducted a whole-home billing analysis for all the natural gas measures combined in order to estimate savings for the average household participating in the program, across all measures. The Evaluators successfully created a matched cohort for the natural gas measure households. Customers were matched on zip code (exact match) and their average pre-period seasonal usage, including summer, fall, winter, and spring for each control and treatment household.

The Evaluators were provided a considerable pool of control customers to draw upon, as shown in Table 5-21. The Evaluators used nearest neighbor matching with a 5 to 1 matching ratio. Therefore, each treatment customer was matched to 5 similar control customers. Also shown in Table 5-21, are the impact of various restrictions on the number of treatment and control customers that were included in the final regression model. The "Starting Count" displays the beginning number of customers available prior to applying the data restrictions, while the "Ending Count" displays the number of customers after applying data restrictions and final matching.

Table 5-21: Cohort Restrictions, Low-Income Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
Whole home natural gas	Starting Count	258	3,274
	Install Date Range: January 1, 2020 to June 30, 2021	100	3,274
	Control Group Usage Outlier (>2X max treatment usage)	100	3,274
	Incomplete Post-Period Bills (<4 months)	94	2867
	Incomplete Pre-Period Bills (<10 months)	67	1995
	Ending Count (Matched by PSM)	67	335

The distributions prior to matching appear to be less similar in summer, with control customers averaging higher usage. However, after matching, the pre-period usage distribution in summer is more similar between the groups. The remaining pre-period seasons (winter, summer, fall), closely overlap before and after matching, indicating little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-20 and Figure 5-21 display the density of each variable employed in propensity score matching for the combined natural gas measures before and after conducting matching.

The distributions prior to matching appear to be less similar in summer, with control customers averaging higher usage. However, after matching, the pre-period usage distribution in summer is more similar between the groups. The remaining pre-period seasons (winter, summer, fall), closely overlap before and after matching, indicating little differences exist on average between the groups prior to matching and validating the initial selection of control customers.

Figure 5-20: Covariate Balance Before Matching, Low Income Gas Measures

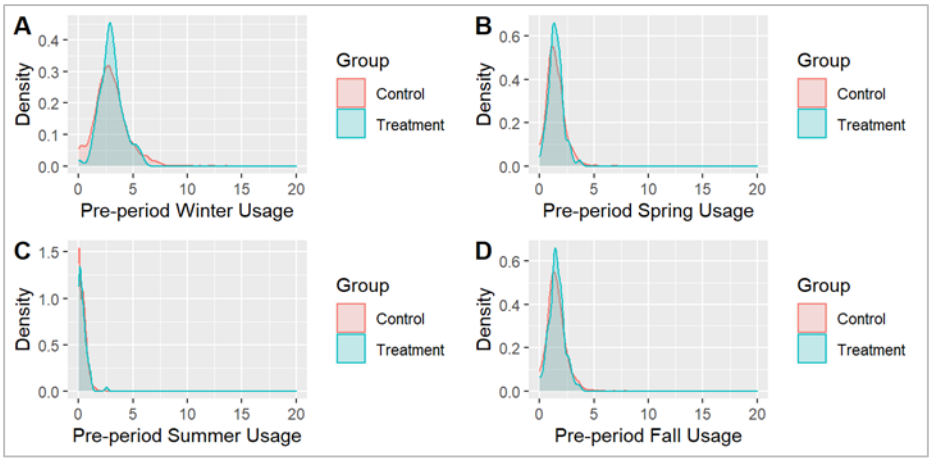
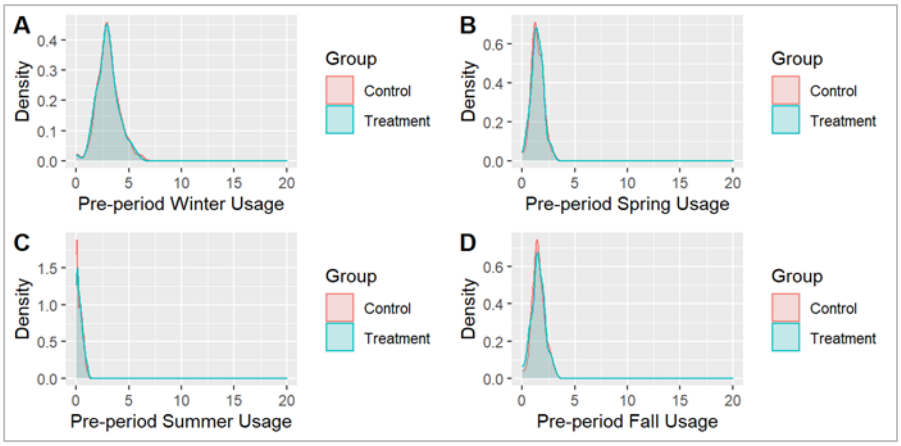


Figure 5-21: Covariate Balance After Matching, Low Income Gas Measures



The Evaluators performed three tests to determine the success of PSM:

1. *t*-test on pre-period usage by month

2. Joint chi-square test to determine if any covariates are imbalanced
3. Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure. The t-test displayed no statistically significant differences at the 95% level in average daily consumption between the treatment and control groups for any month in the pre-period. In addition, the chi-squared test returned a p-value well over 0.05 for all measures, indicating that pre-period usage was balanced between the groups. Lastly, the standardized difference test returned values well under the recommended cutoff of 25, and always falling under 10, further indicating the groups were well matched on all included covariates. Further details on the results of the three tests performed to determine PSM success are available in the Appendix.

Table 5-22 provides customer counts for customers in the final regression model by assigned weather station ID for each measure. In addition, TMY HDD and CDD from the nearest available TMY weather station is provided as well as the weighted HDD/CDD for each measure. The HDD and CDD was weighted by the number of treatment customers assigned to a weather station.

Table 5-22: TMY Weather, Low-Income Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
All Gas Measures	727827	1	727827	5,428	731	6,314	498
	727830	13	727830	5,510	906	6,314	498
	727834	18	727834	6,915	376	6,314	498
	727850	6	727850	6,246	519	6,314	498
	727855	0	727855	7,360	439	6,314	498
	727856	73	727856	6,246	519	6,314	498
	727857	21	727857	6,467	299	6,314	498

Table 5-23 provides annual savings/customer for the Low-Income program the program. Model 2 (PPR) was selected as the final model for the Low Income Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an excellent fit for the data (adjusted R-squared > 0.90).

Table 5-23: Measure Savings for All Regression Models, Low-Income Program

Measure	# of Treatment Customers	# of Control Customers	Annual Savings/Customer	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
All Gas Measures	67	335	.78	0	16.31	0.90	Model 2: PPR

*Not statistically significant

The results of the billing analysis indicate no statistically significant savings were found for the gas measures.

6. Appendix B: Summary of Survey Respondents

This section summarizes additional insights gathered from the simple verification surveys deployed by the Evaluators for the impact evaluation of Avista's Residential and Low-Income Programs.

Survey respondents confirmed installing between one and three measures that were rebated by Avista, displayed in Table 6-1.

Table 6-1: Type and Number of Measures Received by Respondents

Measure Category	Total	Percent (n=305)
One Measure	171	56%
Two Measures	91	30%
Three Measures	34	11%
Four Measures	7	2%
Five Measures	2	1%
HVAC	108	35%
Water Heater	87	29%
Smart Thermostat	127	42%
Clothes Washer	99	32%
Clothes Dryer	66	22%

The Evaluators asked respondents to provide information regarding their home, as displayed in Table 6-2. Similar to ADM's 2020 survey, the majority of respondents noted owning a single-family home between 1,000-3,000 square feet with central air conditioning.

Table 6-2: Survey Respondent Home Characteristics[9]

Question	Response	Percent
Do you rent or your home? (n=300)	Own	98%
	Rent	2%
Which of the following best describe your home? (n=301)	Single-family house detached from any other house	85%
	Single-family house attached to one or more other houses (e.g., duplex, condominium, townhouse)	4%
	Mobile or manufactured home	10%
	Apartment	1%
Does your home have central air conditioning, window air conditioning, or neither? (n=301)	Window air conditioning / a room AC unit	18%
	Central air conditioning	73%
	Neither	8%
	Don't Know	1%
About how many square feet is your home? (n=300)	Less than 1,000 square feet	8%
	1,000-1,999 square feet	48%
	2,000-2,999 square feet	25%
	3,000-3,999 square feet	11%
	4,000 or more square feet	6%
	Don't know	2%
When was your home built? (n=301)	Before 1960	27%
	1960 to 1969	6%
	1970 to 1979	15%
	1980 to 1989	9%
	1990 to 1999	13%
	2000 to 2009	11%
	2010 to 2018	18%
	Don't know	1%

[9] Four contractors or construction companies were not asked these questions.

7. Appendix C: Cost Benefit Analysis Results

The Evaluators estimated the cost-effectiveness for the Avista Residential and Low-Income Programs using evaluated savings results, economic inputs provided by Avista, and incremental costs and non-energy impacts from the RTF. The table below presents the cost-effectiveness results for the PY2021 portfolio.

Table 7-1: Cost-Effectiveness Results

Sector	TRC	UCT	RIM	PCT
Residential	1.93	4.30	0.06	7.39
Low Income	0.48	0.31	0.06	N/A*
Total	**1.65**	**2.83**	**0.06**	**N/A***
***Low Income is offered at no cost to participants; PCT is not calculable.**				

7.1 Approach

The California Standard Practice Model was used as a guideline for the calculations. The cost-effectiveness analysis methods that were used in this analysis are among the set of standard methods used in this industry and include the Utility Cost Test (UCT)[10], Total Resource Cost Test (TRC), Ratepayer Impact Measure Test (RIM), and Participant Cost Test (PCT). All tests weigh monetized benefits against costs. These monetized amounts are presented as NPV evaluated over the lifespan of the measure. The benefits and costs differ for each test based on the perspective of the test. The definitions below are taken from the California Standard Practice Manual.

- The TRC measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.
- The UCT measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.
- The PCT is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.
- The RIM test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation is less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels.

[10] The UCT is also referred to as the Program Administrator Cost Test (PACT).

A common misperception is that there is a single best perspective for evaluation of cost-effectiveness. Each test is useful and accurate, but the results of each test are intended to answer a different set of questions. The questions to be addressed by each cost test are shown in the table below.[11]

Table 7-2: Questions Addressed by the Various Cost Tests

Cost Test	Questions Addressed
Participant Cost Test (PCT)	▪ Is it worth it to the customer to install energy efficiency?
	▪ Is it likely that the customer wants to participate in a utility program that promotes energy efficiency?
Ratepayer Impact Measure (RIM)	▪ What is the impact of the energy efficiency project on the utility's operating margin?
	▪ Would the project require an increase in rates to reach the same operating margin?
Utility Cost Test (UCT)	▪ Do total utility costs increase or decrease?
	▪ What is the change in total customer bills required to keep the utility whole?
Total Resource Cost Test (TRC)	▪ What is the regional benefit of the energy efficiency project (including the net costs and benefits to the utility and its customers)?
	▪ Are all of the benefits greater than all of the costs (regardless of who pays the costs and who receives the benefits)?
	▪ Is more or less money required by the region to pay for energy needs?

Overall, the results of all four cost-effectiveness tests provide a more comprehensive picture than the use of any one test alone. The TRC cost test addresses whether energy efficiency is cost-effective overall. The PCT, UCT, and RIM address whether the selection of measures and design of the program are balanced from the perspective of the participants, utilities, and non-participants. The scope of the benefit and cost components included in each test are summarized in the table below.[12]

Table 7-3: Benefits and Costs Included in Each Cost-Effectiveness Test

Test	Benefits	Costs
PCT (Benefits and costs from the perspective of the customer installing the measure)	▪ Incentive payments ▪ Bill Savings ▪ Applicable tax credits or incentives	▪ Incremental equipment costs ▪ Incremental installation costs

[11] http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf
[12] Ibid.

Test	Benefits	Costs
UCT (Perspective of utility, government agency, or third party implementing the program	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Utility/program administrator incentive costs
TRC (Benefits and costs from the perspective of all utility customers in the utility service territory)	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution ▪ Additional resource savings ▪ Monetized non-energy benefits	▪ Program overhead costs ▪ Program installation costs ▪ Incremental measure costs
RIM (Impact of efficiency measure on non-participating ratepayers overall)	▪ Energy-related costs avoided by the utility ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution	▪ Program overhead costs ▪ Lost revenue due to reduced energy bills ▪ Utility/program administrator installation costs

7.2 Non-Energy Benefits

Non-energy Benefits (NEBs) were sourced from the most updated RTF workbooks. NEBs included wood fuel credits, increased comfort, and reductions in PM 2.5 emissions.

- Residential measures with NEBs included air source heat pumps, ductless heat pumps, windows, and insulation measures.
- Low Income NEBs included the NEBs described for Residential as well as a dollar-for-dollar benefit adder for health and safety spending.

7.3 Economic Inputs for Cost Effectiveness Analysis

The Evaluators used the economic inputs provided by Avista for the cost benefit analysis. Avista provided the Evaluators with avoided costs on the following basis:

- Hourly avoided commodity costs
- Modifications for the Clean Premium
- Avoided capacity costs
- Avoided transmission
- 10% Conservation Adder

- Line losses
- Discount rate (after tax Weighted Average Cost of Capital)

The values were aggregated to provide a single benefit multiplier on a Therms basis for every hour of the year (8,760). Savings by measure were then parsed out to the following load shapes provided by Avista:

- Residential Space Heating
- Residential Air Conditioning
- Residential Lighting
- Residential Refrigeration
- Residential Water Heating
- Residential Dishwasher
- Residential Washer/Dryer
- Residential Furnace Fan
- Residential Miscellaneous

The Evaluators in addition created a Residential Heat Pump load shape by weighting the relative magnitude of cooling versus heating savings from a heat pump and assigning these to weight the Residential Space Heating and Residential Air Conditioning load shapes.

7.4 Results

The tables below outline the results for each test, for both the programs and the portfolio as a whole. Summations may differ by $1 due to rounding.

Table 7-4: Cost-Effectiveness Results by Sector

Sector	TRC	UCT	RIM	PCT
Residential	1.93	4.30	0.06	7.39
Low Income	0.48	0.31	0.06	N/A*
Total	**1.65**	**2.83**	**0.06**	**N/A***
***Low Income is offered at no cost to participants; PCT is not calculable.**				

Table 7-5: Cost-Effectiveness Benefits by Sector

Program	TRC Benefits	UCT Benefits	RIM Benefits	PCT Benefits
Residential	$13,328,625	$12,116,794	$12,116,794	$49,978,337
Low Income	$784,655	$504,110	$504,110	$2,465,638
Total	**$14,113,281**	**$12,620,904**	**$12,620,904**	**$52,443,976**

Table 7-6: Cost-Effectiveness Costs by Sector

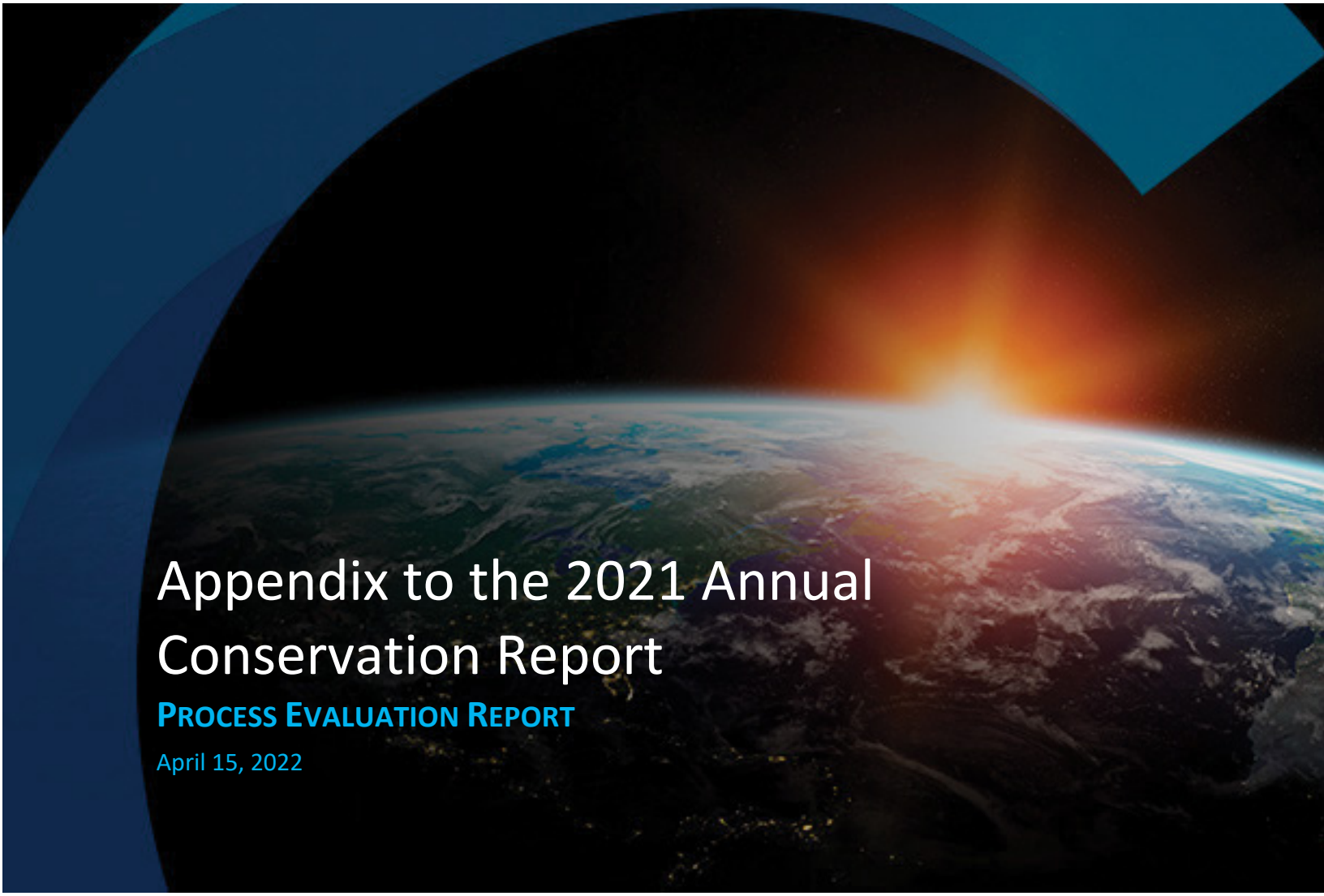
Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs
Residential	$6,903,476	$2,816,408	$187,086,157	$6,762,782
Low Income	$1,640,456	$1,640,456	$8,480,412	$1,157,076
Total	**$8,543,932**	**$4,456,864**	**$195,566,568**	**$7,919,858**

Table 7-7: Cost-Effectiveness Net Benefits by Sector

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits
Residential	$6,425,149	$9,300,386	($174,969,363)	$43,215,555
Low Income	($855,801)	($1,136,346)	($7,976,301)	$1,308,562
Total	**$5,569,349**	**$8,164,040**	**($182,945,664)**	**$44,524,118**

APPENDIX E –

CADMUS



Appendix to the 2021 Annual Conservation Report

PROCESS EVALUATION REPORT

April 15, 2022

Prepared for:

Avista

1411 E. Mission Avenue

Spokane, WA 99202

CADMUS

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Figures

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Executive Summary

As part of the Avista 2021 demand-side management portfolio evaluation, Cadmus conducted process evaluation activities for program year (PY) 2021. The process evaluation focused on three fundamental objectives:

- Assess participant and market actor program journey, including motivation for participation, barriers to participation, and satisfaction
- Assess Avista staff experiences, including program changes, impact of the COVID-19 pandemic, and program processes
- Document areas of success, challenges, and changes to the program

This report describes Cadmus' data collection and process methods, presents analysis results, summarizes findings, draws conclusions, and recommends possible improvements for the nonresidential, low-income, and residential programs listed in Table 1.

Table 1. PY 2021 Process Evaluations

Program[a]	Idaho	Washington
Nonresidential Programs		
Site Specific	✓	✓
Prescriptive[b]	✓	✓
Low-Income		
Low-Income	✓	✓
Low-Income Fuel Efficiency	✓	
Community Energy Efficiency Program		✓
Residential		
HVAC	✓	✓
Water Heat	✓	✓
Shell and Windows	✓	✓
Fuel Switching	✓	

[a] Cadmus completed all evaluation activities for the Multifamily Direct Install, Multifamily Market Transformation, and ENERGY STAR® Homes programs in 2020. Refer to the PY 2020 report for these findings.

[b] Includes the Lighting, Food Service Equipment, Green Motors, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and Compressed Air programs.

Summary of Milestones and Deliverables

Cadmus conducted the evaluation by reviewing documents, surveying participants, and interviewing program and implementation staff and contractors. Table 2 lists the completed process evaluation activities.

Table 2. PY 2021 Completed Milestones and Deliverables

Milestones and Deliverables	Completed
Document and Database Review	✓
Avista and Implementer Interviews	✓
Participant Surveys	✓
Trade Ally Interviews	
Contractors	✓
Community Action Program Agency Representatives	✓

Key Conclusions

Nonresidential

- **Overall, respondent satisfaction with the PY 2021 Site Specific and Prescriptive programs was high.**
  - Overall, 91% of Site Specific respondents and 98% of Prescriptive program respondents said they were *very* or *somewhat satisfied* with the program.
  - While most Site Specific respondents reported increased satisfaction across most categories in PY 2021, satisfaction with the technical assistance received from Avista staff decreased slightly from 100% in PY 2020 to 86% in PY 2021.
  - While satisfaction with all aspects of the Prescriptive programs remained high, some respondents expressed dissatisfaction with completing and submitting the rebate application, communication with trade allies and their account executive, and information about program requirements.
- **PY 2021 Site Specific and Prescriptive respondents' top motivations to participate aligned with their top benefits from the program.**
  - Site Specific respondents were motivated to participate in the program to save energy (nine of 11), to save money (nine of 11), and to receive the rebate (eight of 11).
  - Site Specific respondents said that saving money on their utility bills was the main benefit of participation for their company (eight of 11), followed by using less energy (seven of 11) and improved aesthetics (seven of 11). Although receiving the rebate was not one of the top three benefits, a majority of respondents named it as a benefit (six of 11).
  - Prescriptive respondents most frequently cited saving energy (63%; n=56), receiving the rebate (59%; n=56), and reducing energy (57%; n=56) as reasons for participating in the programs.
  - They similarly cited these three items as benefits: saving energy (76%; n=54), reducing energy (61%; n=54), and receiving the rebate (59%; n=54). While not one of the top three benefits, prescriptive respondents also cited improved aesthetics as a top benefit (56%; n=54).
- **In PY 2021, the relationship between Site Specific respondents and vendors/contractors worked well for different aspects of the program.**

  - All Site Specific respondents were especially satisfied with their vendors and contractors, specifically with their communication with program contractors. Five of 11 respondents said that their contractor, vendor, or retailer was involved in the design of the project and took the lead in preparing their application.

- **Respondents in all nonresidential programs continued to report a lack of knowledge as a challenge to participation.**
  - Most Site Specific respondents (eight of 11) said their lack of knowledge about the program was a challenge and three recommended increasing communication about the program to participants.
  - Most Prescriptive respondents said their lack of awareness about the program was the biggest challenge to participation (42%, n=24). Some respondents (nine of 18) said that more information about the program requirements would improve the Prescriptive program.
- **In PY 2021, Site Specific and Prescriptive respondents said the programs were easy to participate in and provided other aspects of the program that worked well, such as energy savings, receiving the rebate, and communication.**
  - Site Specific survey respondents said the Avista engineering and utility account executives were helpful (two responses), the program was easy to participate in and worked out well (two responses), and that they appreciated the rebates (one response).
  - Seven of 33 Prescriptive program participants said the program had an easy/fast process and six of 33 said savings received due to improvements worked especially well.
- **While most respondents stated they did not experience any impacts due to the continued COVID-19 pandemic, a small number of respondents said that timing delays continued to persist in PY 2021.**
  - Most of the Site Specific respondents said that there were no COVID-19 impacts to their project (six of 10), while those who experienced challenges said their project timeline was impacted due to delays (three of 10) and one respondent said the project scope was impacted.
  - A majority of the Prescriptive respondents (78%, n=51) reported no impact on their projects. Among those who did report COVID impacts, respondents most frequently mentioned time labor/supply chain problems (eight responses) and time delays (one response) as roadblocks.

Low-Income

- **CAP agencies and participating customers were highly satisfied with the Low-Income program.**
  - Avista and all six CAP agencies interviewed emphasized positive, well-established relationships that were communicative and collaborative. Despite facing challenges with participation, some CAP agencies noted that Avista was working with them to market the program and increase outreach in an effort to bring in potential customers.

  - All four CAP agencies that had participated reported that customers generally provided positive feedback. These agencies said that customers were typically happy with the equipment they received through the program and appreciative of the work provided.
- **The COVID-19 pandemic impacted program implementation and participation.**
  - Both Avista and CAP agencies reported that COVID-19 impacted the program in PY 2021. After Avista temporarily suspended the program in PY 2020 to establish health and safety protocols, participation was slow to rebound in some areas. While some CAP agencies had returned to steady work, others (especially newer agencies) have struggled to reach customers. Other customer bases, such as elderly clients and clients with health vulnerabilities, were still difficult to serve at the time of the interviews.
  - Program marketing also suffered as a result of the pandemic. Certain in-person events that were previously used to market the program were cancelled, which made particular groups of clients more difficult to reach.

Residential

- **Survey respondents and contractors are highly satisfied with most aspects of the program.**
  - All survey respondents were *very* or *somewhat satisfied* (90% *very satisfied* and 10% *somewhat satisfied*) with the program overall, with over 99% of respondents satisfied with interactions with Avista staff and 99% satisfied with their overall experience with Avista.
  - All contractors were *very* or *somewhat satisfied* with the program overall. They said that the rebate application process was simple, straightforward, and user-friendly.
- **While contractors said the rebate application was simple and straightforward to complete, some survey respondents suggested simplifying the application as a way to improve the program.**
  - All of the contractors who said they have completed the application for their customers did not find the rebate application process difficult (nine of nine) and rated their satisfaction with the rebate application process as a 4.7 on a 5-point scale where 1 means *not at all satisfied* and 5 means *very satisfied* (n=10). As a program improvement, two contractors suggested Avista create an application status tracker in the portal.
  - Most survey respondents who provided improvement suggestions said the program should increase advertising to increase awareness among residential customers (16 of 29) or simplify the rebate application as a program improvement (six of 29).
- **Contractors said the program rebate influenced their decision to recommend equipment to their customers and influenced their customers decisions to purchase and install new energy-efficient equipment.**
  - The majority of the contractors said that their participation in the Avista rebate programs was the defining reason that influenced their customers to receive energy-efficient equipment. They rated the programs influence on their decision to recommend equipment as a 4.7 on a scale from 1 to 5, where 1 is *not influential* and 5 is *very influential*.

  - They rated how influential the program was on their customers decision to purchase new equipment as a 4.9, on a 1 to 5 scale, where 1 meant *not at all influential* and 5 meant *very influential*.
  - Additionally, a majority of survey respondents said the most important reason they decided to purchase and install energy efficiency equipment was because of information from their retailer or installer (70%; n=134).
- **While most residential customers learned about the programs from their contractor, installer or trade ally, they prefer to learn about the program though emails and bill inserts from Avista.**
  - Respondents in both states most frequently learned about Avista programs through contractors, installers, or trade allies (39% in Washington and 42% in Idaho).
  - Most respondents preferred to learn about the programs from Avista's emails (31% in Washington and 37% in Idaho) or bill inserts (29% in Washington and 27% in Idaho). A smaller portion of the respondents preferred learning about the program from contractors, installers, and trade allies (13% of Washington respondents and 14% of Idaho respondents) .
- **Saving money or energy are the key drivers of motivation to participate in the program according to survey respondents.**
  - Respondents participated in Avista's programs primarily to save money (80% of Washington respondents and 69% of Idaho respondents) and save energy (63% of Washington respondents and 55% of Idaho respondents).
- **The COVID-19 pandemic continued to impact customer participation, but Avista pivoted throughout the year to find ways to address customer challenges related to the pandemic.**
  - Some of pandemic-related issues impacted project completion but Avista was lenient with project completion schedules to account for these challenges. Additionally, costs of equipment increased due to supply-chain issues, but Avista was able to increase some incentives to help customers alleviate this challenge.

Recommendations

Nonresidential

Nonresidential Recommendation 1: Consider developing and using customer testimonials in targeted outreach to customers who have not historically participated in programs. The testimonials from satisfied participants could focus on the ease of participating in the programs and the benefits of participation, such as reduced energy use, bill savings, and receiving the rebate. The marketing could also provide information to prospective participants on potential energy savings for businesses with similar profiles.

Nonresidential Recommendation 2: Continue to look for ways to provide contractor and installer training, educational resources about program requirements, and application completion tips to remove roadblocks or communication issues between Avista and participants.

Low-Income

Low-Income Recommendation 1: Increase and adjust program marketing efforts to target hard-to-reach members of the income-eligible community. As more in-person events are offered, market the program to increase potential customer participation. Along with in-person events, offer virtual marketing opportunities to reach more vulnerable customers, such as the elderly or those with health vulnerabilities, who may not be able to attend in-person events. Work with community groups in rural areas to help identify customer bases and strategize marketing efforts to inform them of the program.

Low-Income Recommendation 2: Continue to work with newer CAP agencies to help increase customer participation. Providing support in more rural areas where these new CAP agencies are working will be essential to helping them gain customers. Understanding the needs of people within their territories can also help inform targeted marketing offerings or ways to promote the program.

Residential

Residential Recommendation 1: Continue to use emails and bill inserts as the primary forms of program outreach to advertise Avista's residential programs and incentives. In outreach materials, consider using messaging focused on program benefits: energy savings, lower maintenance costs, and increased home comfort.

Residential Recommendation 2: Consult with contractors and identify tips for completing the rebate application that could be shared with customers who complete their own application. These tips could highlight the technical aspects of submitting the application, the steps involved in the application process, and the amount of detail needed for an application so that it can be approved quickly. Additionally, continue to encourage contractors and installers to complete the rebate application for customers to eliminate the confusion some customers feel when they fill out and submit the application themselves.

***Residential Recommendation 3*:** If not already available or planned for development, consider adding a way to track rebate status to the online portal so that contractors and customers can track the status of their applications and follow-up with Avista if anything seems incorrect.

Introduction

In program year (PY) 2021, Avista provided rebates and services to its nonresidential and residential electric and natural gas customers throughout its Washington and Idaho service territories. Through the PY 2021 portfolio process evaluation, Cadmus sought to identify and document each program's successes and challenges by reviewing program materials, conducting interviews with program and implementation staff and trade allies, and conducting surveys with nonresidential and residential program participants.

Program Descriptions

Table 3 provides a summary of programs included in Avista's PY 2021 demand-side management portfolio's evaluation.

Table 3. PY 2021 Evaluated Program Descriptions

Program	Measure(s)	Implementer	Program Summary
Nonresidential			
Site Specific	Custom measure(s)	Avista	Customers design energy efficiency projects with documented energy savings and a minimum 10-year measure life for a technical review and possible rebates.
Prescriptive	Lighting, HVAC, variable frequency drives, food service equipment, grocer, shell	Avista	Customers identify potential energy efficiency projects, submit paperwork, and receive Prescriptive rebates for projects.
Fleet Heat[a]	Smart block heating system	Avista	Electric customers receive a smart block heating system to install on vehicles. The device controls the water temperature in the block and the air temperature outside the block.
Green Motors	Repair/rewind of motors	The Green Motors Practices Group	Electric customers who receive a green motor rewind at a participating service receive a rebate. The rebate applies to 15 hp to 5,000 hp industrial motors.
Compressed Air[a]	Compressed air leak reduction device	Avista	Following a compressed air audit, electric customers receive direct installation of a compressed air leak reduction device.
Low-Income			
Low-Income and Low-Income Fuel Efficiency	HVAC, insulation, water heaters, windows, appliances	Community Action Program (CAP) Agencies	Customers qualify through income level and receive reimbursement for cost of work completed on their home. CAP agencies install measures in homes based on their approved measure list.
Community Energy Efficiency Program (CEEP)	Multifamily housing energy efficiency improvements, removal of alternative heating sources, small business education	Avista and CAP Agencies	Three focus areas that aim to improve the efficiency and education of targeted customer groups through home improvements and education efforts.

Program	Measure(s)	Implementer	Program Summary
Residential			
HVAC	Space heat and smart thermostats	Avista	Customers complete energy efficiency projects, submit paperwork, and receive Prescriptive rebates for projects.
Water Heat	Water heat		
Shell and Windows	Wall, floor, and attic insulation; standard and storm windows		
Fuel Efficiency	Space and water heat and smart thermostats (offered only in Idaho)		

[a] Cadmus planned to evaluate the Fleet Heat and Compressed Air programs, but there were no participants in PY 2021.

Methodology

This section describes the interview and survey methodology.

Program Administrator and Implementer Interviews

Cadmus conducted telephone interviews with the program staff and third-party implementers listed in Table 4. Interviews focused on the following program topics:

- Program roles and responsibilities
- Program goals and objectives
- Program design and implementation
- Data tracking
- Program participation
- Marketing and outreach
- Program successes
- Program impacts on the market

Table 4. PY 2021 Stakeholder Interviews

Program	Avista Staff	Implementer Staff
Nonresidential Programs		
Site Specific	–	N/A
Prescriptive[a]	✓	-
Low-Income		
Low-Income and Fuel Efficiency	✓	✓
CEEP	✓	N/A
Residential Programs		
HVAC	✓	N/A
Water Heat	✓	
Shell and Windows	✓	
Fuel Efficiency	✓	

[a] Includes Lighting, Food Service Equipment, Green Motors Rewind, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and Compressed Air.

CAP Agency Interviews

In September 2021, Cadmus conducted interviews with six CAP agencies participating in the Low-Income program to assess experiences, successes, and challenges. Avista provided the contact list for the

interviews. Table 5 lists the program, audience, number of records provided by Avista, interview target, and number of interviews.

Table 5. PY 2021 Trade Ally Interviews

Program	Audience	Number of Records	Target	Number of Interviews
Low-Income Program	Participating CAP Agencies	8	5	6

Residential Contractor Interviews

Cadmus conducted 10 interviews with contractors who serve residential customers (five serving customers in Idaho and five serving customers in Washington). Avista provided a list of 927 contractors to Cadmus. We selected a random sample of 64 contractors from the list and averaged four attempts to contact each contractor in the sample.

The telephone interviews focused on these program topics:

- Program awareness and motivation
- Program benefits
- Program delivery experience, including marketing and fulfilling rebates
- Effects of program on success of business
- Interaction with Avista staff
- Perception of customer experience, including awareness and satisfaction
- Successes and challenges
- Feedback and recommendations

Participant Surveys

In PY 2021, Cadmus completed 150 online surveys with residential participants in Idaho and Washington and 67 online surveys with nonresidential program participants in both states. Cadmus completed telephone reminder calls to increase Site Specific survey participation. The participant survey guides gathered critical insights into participants' program journey, covering the following topics:

- Program awareness
- General program participation
- Reasons for participation
- Program benefits
- Program delivery experience
- Overall program satisfaction
- Satisfaction with Avista
- Suggestions for program improvements

Residential Sampling

To prepare the participant contact list for the residential survey, Cadmus removed duplicate records and records with incorrect or missing email addresses. After preparing the list, we randomly selected a sufficient number of records proportionate to participation in each of the programs to include in the sample frame. We sent an email invitation to participants included in the sample frame, followed by a reminder email. Overall, we collected 150 responses for process evaluation purposes, as shown in Table 6.

Table 6. Residential Participant Survey Sample Frame, Target, and Completes by Program

Program	Idaho and Washington Total		
	Sample Frame[a]	Target	Completed Surveys
Space Heating	1,990	80	73
Shell and Windows	744		50
Water Heating	351		20
Fuel Switching	71		7
Total	**3,156**	**80**	**150**

[a] Sample frame refers to the records selected for the survey contact list.

Nonresidential Sampling

To prepare the contact lists for each nonresidential survey, Cadmus removed duplicate records and records with incorrect or missing email addresses. We sent an email invitation to a census of all participants with email addresses in each program, followed by two reminder emails. Additionally, because of low initial participation in the Site Specific survey, we made a telephone attempt to Site Specific participants to increase participation. As shown in Table 7, nonresidential participants completed 67 surveys in PY 2021.

Table 7. Nonresidential Participant Survey Sample Frame, Target, and Completes by Program

Program	PY 2021 Total		
	Sample Frame[a]	Target	Completed Surveys
Nonresidential Site Specific			
Electric	67	All eligible	**8**
Gas	2		**1**
Dual	4		**2**
Nonresidential Prescriptive			
Lighting	793	30 to 40	**50**
Food Service Equipment	4	As many as possible	**2**
Green Motors Rewind	-		**-**
Commercial HVAC	12		**3**
Insulation	4		**-**
HVAC Motor Controls	3		**1**
Grocer	1		**-**
Fleet Heat	-		**-**
Compressed Air	-		**-**
Total	**890**		**67**

[a] Sample frame refers to the records available for surveys after removing duplicate records, records with only installer contact information, records without email addresses, and records with incomplete or bad contact information.

Nonresidential Programs

This section focuses on two nonresidential programs: Site Specific and Prescriptive. The Site Specific program provides incentives to customers who install custom energy efficiency projects, while the Prescriptive programs[1] offer incentives for specific measures and services.

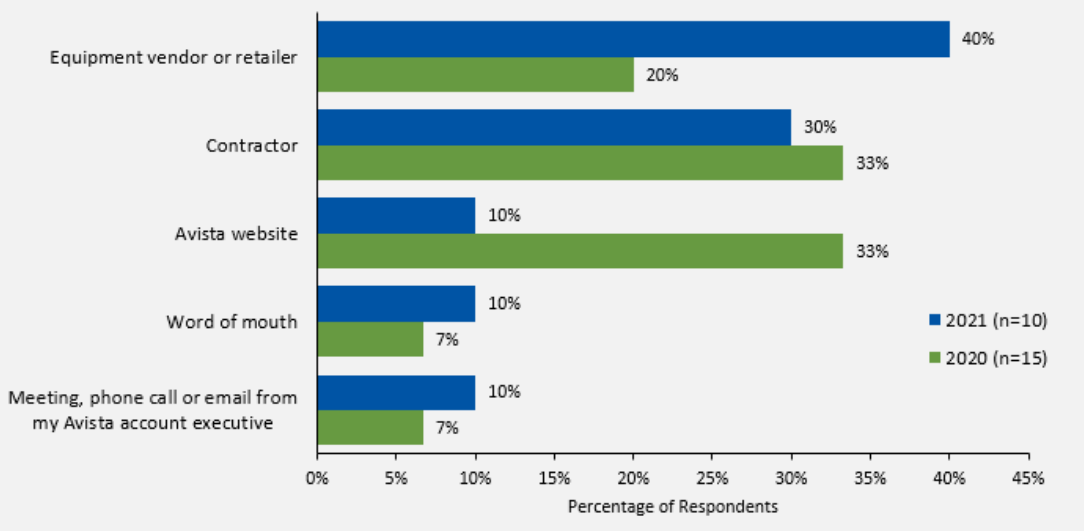
Nonresidential Site Specific Findings

This section describes the findings from 11 surveys completed with PY 2021 Site Specific participants. Where meaningful, Cadmus compared PY 2020 results to PY 2021.

Customer Awareness

The majority of the PY 2021 Site Specific survey respondents (seven of 101) had previously participated in an Avista energy efficiency program, which is consistent with PY 2020 results. As shown in Figure 1, survey respondents first learned about the Site Specific program through a variety of sources. Equipment vendors or retailers were the most common sources (40%), followed by contractors (30%). PY 2021 respondents were more likely to mention equipment vendor or retailer compared to the PY 2020 respondents but were less likely to mention contractors and the Avista website compared to PY 2020 respondents.

Figure 1. How Participants First Learned of Program



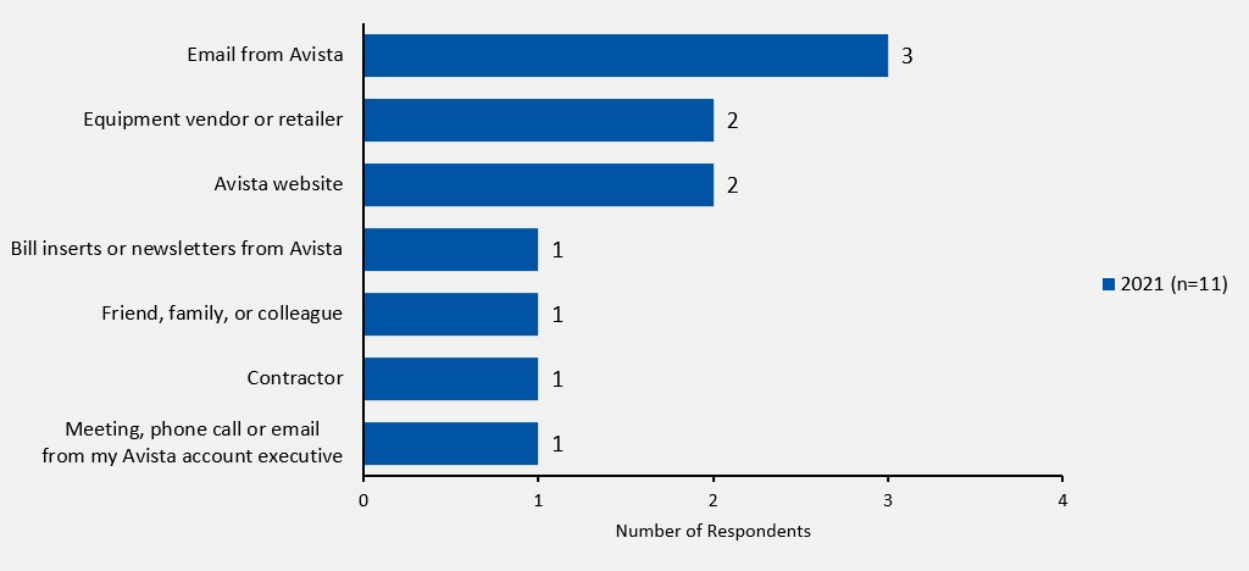
Source: Site Specific survey questions C2: "How did you first hear about the Site Specific program?"

When asked how they preferred to learn of rebates and incentives, PY 2021 respondents were most likely to select email (three respondents), followed by their equipment vendor or retailer and the Avista

[1] Prescriptive includes Lighting, Food Service Equipment, Green Motors Rewind, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and Compressed Air.

website (two respondents each). This is slightly different from the actual channel through which they learned about the program, as discussed above.

Figure 2. How Participants Prefer to Learn of Programs and Offers

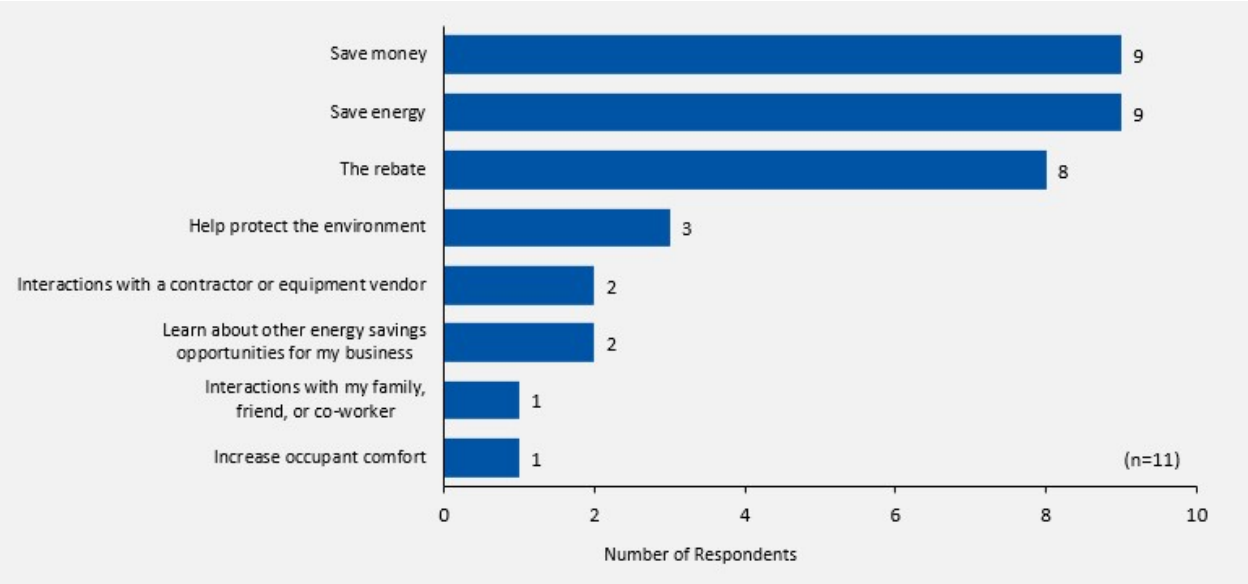


Source: Site Specific survey questions C3: "What is the best way for Avista to inform commercial customers like you about their rebates and incentives for energy efficiency improvements?"

Participation Motivations and Benefits

Figure 3 shows the distribution of motivations reported by PY 2021 Site Specific survey respondents. Respondents were primarily driven by economic motivations, including saving money (nine respondents), saving energy (nine respondents), and utilizing the Avista rebate (eight respondents).

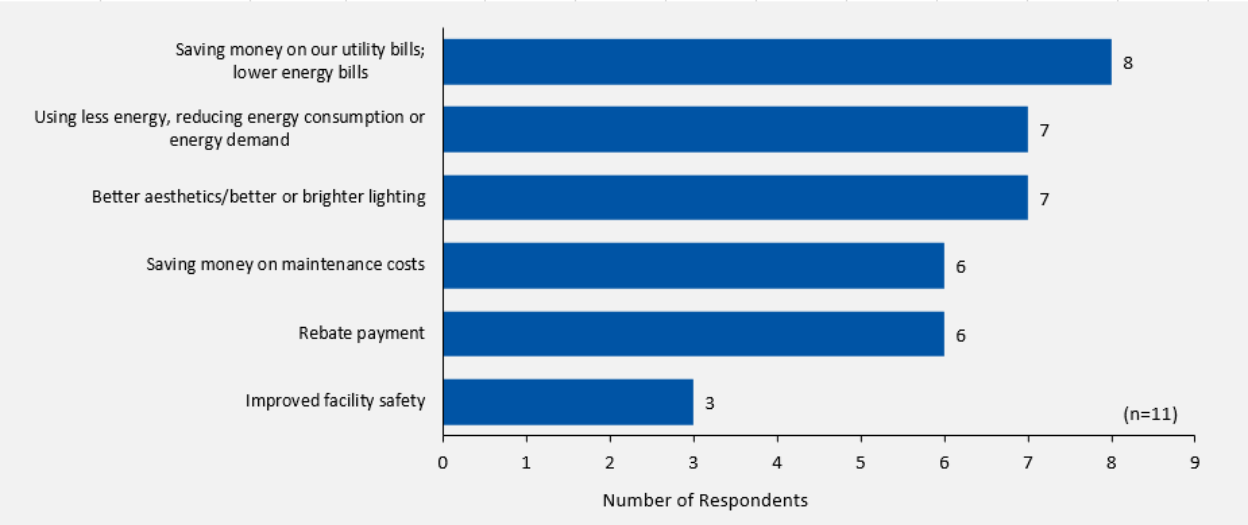
Figure 3. Site Specific Participant Motivation



Source: Site Specific survey question C4: "What motivated you to participate in the Site Specific Program?" Multiple responses allowed.

Respondents' perceived benefits aligned closely with their motivations, as shown in Figure 4. The majority (eight respondents) cited saving money on utility bills, followed by using less energy as benefits (seven respondents) and better aesthetics from improved lighting (seven respondents).

Figure 4. Site Specific Participation Benefits



Source: Site Specific survey question C6: "What would you say are the main benefits your company has experienced as a result of participating in the Avista Site-Specific Program?" Multiple responses allowed.

Customer Experience

Program Delivery

Most PY 2021 respondents (five of 11) reported their contractor, vendor, or retailer was involved in the design or implementation of their project, four said their Avista account executive was involved, and two completed the project with internal resources. Over half of the respondents (five of 9) said the contractor, vendor, or retailer took the lead in preparing the application, three respondents completed the application themselves, and one said their Avista account executive took the lead in completing their application. Three respondents said the contractor, vendor, or retailer provided a discount on the cost of their project and most received a check from Avista directly (six of 9).

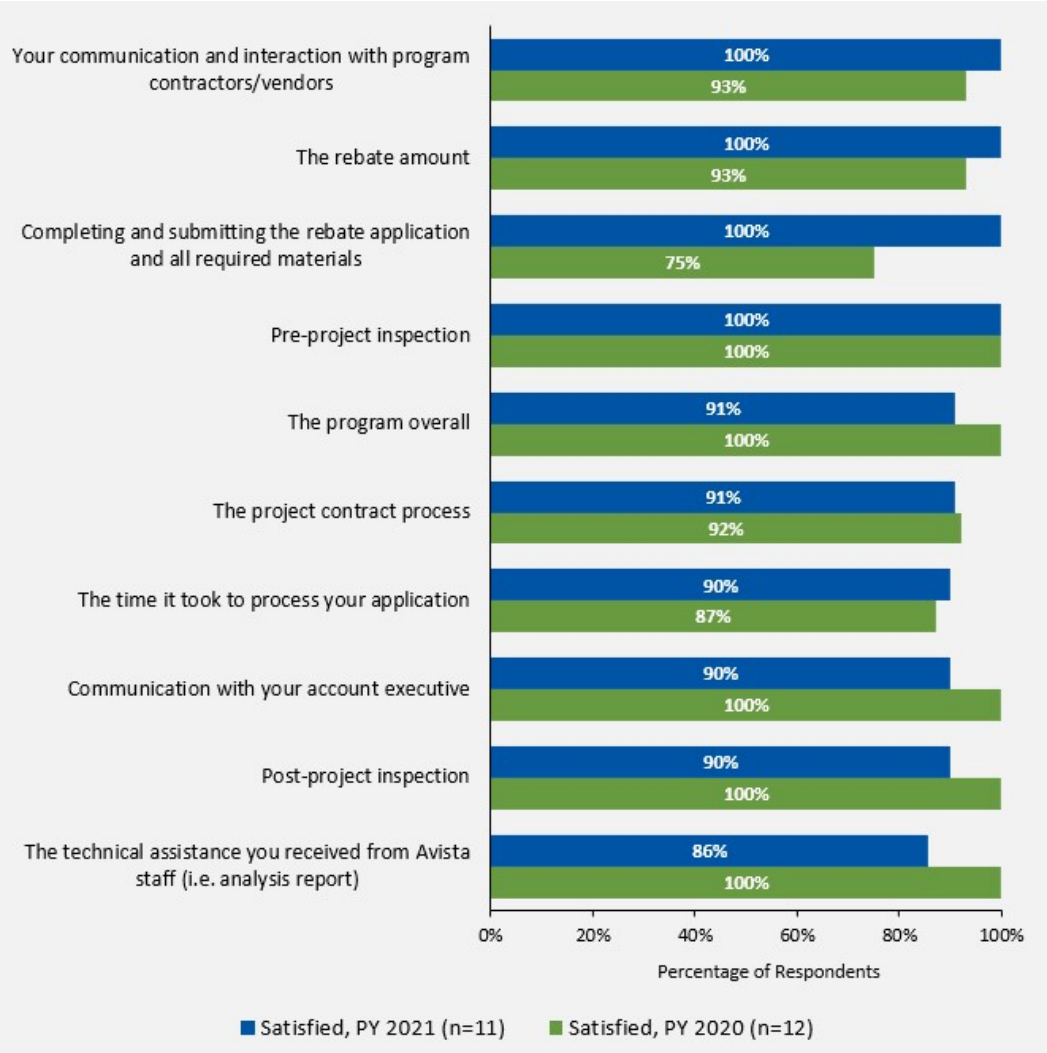
Of the three respondents who did not mention a contractor helping implement their project, one said their Avista account representative was involved in the design of the project, and two said they completed the projects on their own.

Program Satisfaction

Figure 5 shows the percentage of PY 2021 respondents and PY 2020 respondents who rated each program component as *very* or *somewhat satisfied*. Ten of the 11 respondents were *very* or *somewhat satisfied* with the overall program.

Respondents were more likely to be satisfied with several components in PY 2021 than in PY 2020: communication with vendors (100% in PY 2021 vs 93% in PY 2020), the rebate amount (100% in PY 2021 vs 93% in PY 2020), and completing the rebate application/materials (100% in PY 2021 vs 75% in PY 2020). Respondents were less satisfied in PY 2021 than in PY 2020 with the technical assistance they received, their post-project inspection and their communication with their Avista account representative.

Figure 5. Respondents Satisfied with Site Specific Program Components



Source: PY 2021 and 2020 Site Specific survey question E1: "In terms of the Site Specific program, how satisfied were you with the following aspects? Please think about each item individually as you select your answer." Showing only respondents that indicated they were *very satisfied* or *somewhat satisfied*.

Program Challenges and Successes

As shown in Table 8, eight of 11 respondents provided feedback about their program participation challenges. The most common challenge reported by respondents was their lack of knowledge about the program (four respondents), which is consistent with PY 2020. Two respondents reported that coordinating internal resources and external contractors were challenges for them.

Table 8. PY 2021 Participation Challenges

Challenge	PY 2021 (n=8)
Knowledge of the programs, costs and/or the rebates	4
Coordinating internal resources and external contractors	2
COVID-19 restrictions	1
Coordinating with Avista	1

Source: Site Specific survey question E4: "What do you so see as the biggest challenges to participating in Avista's Site-Specific Program for your company or other companies like yours (n=8)?"

On the other hand, PY 2021 respondents commented on many aspects of the program that worked well:

- "The Avista energy efficiency program engineering and utility account executive teams were very helpful."
- "Communication from Avista account executive."
- "It was relatively easy and fast to participate in, so that was appreciated."
- "[The] rebates are a great incentive."
- "Keep doing what you're doing. It worked out well."

Four of the 11 survey respondents provided suggestions about improving the program, which primarily fell into categories listed below:

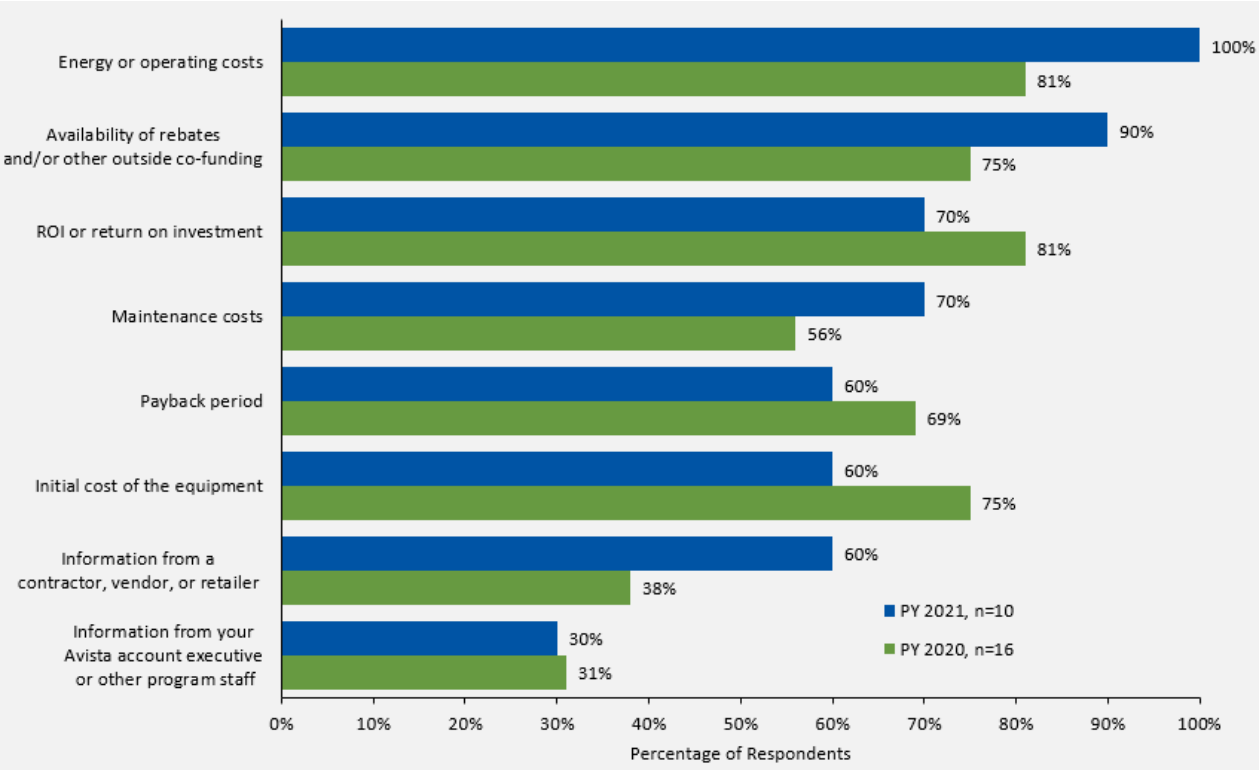
- Increase communication about programs (three respondents)
- Increase rebate amounts (one respondent)

Energy Efficiency Attitudes and Behaviors

Eight of 11 PY 2021 respondents said the rebate provided by Avista was *very important* in their decision to complete their project. Another three said it was *somewhat important*. When making capital upgrades, eight respondents said energy efficiency was *very important*, two said it was *somewhat important* and only one said it was *not too important*.

As shown in Figure 6, respondents most frequently selected energy or operating costs as the most important criteria for making energy efficiency improvements (100%). This was followed closely by the rebate or the availability of outside funding (90%).

Figure 6. Important Criteria for Making Energy Efficiency Improvements



Source: Site Specific survey question F5: "Which of the following criteria are important in deciding whether your company makes energy efficiency improvements?" Multiple responses allowed.

Since participating in the Site Specific program, three PY 2021 respondents purchased energy-efficient equipment, and one adopted new energy-efficient protocols and purchased new equipment. Three respondents who mentioned purchasing new equipment had invested in lighting upgrades. One had purchased compressor upgrades and one upgraded to digital programmable thermostats.

COVID-19 Impacts

In PY 2021, respondents faced potential obstacles related to the COVID-19 pandemic. However, six respondents said there were no impacts to their project from the pandemic. Most respondents (three of 10) who experienced challenges related to COVID-19, experienced issues with delays. These respondents mentioned general delays and delays on receiving equipment. One respondent said their project scope was impacted because it was difficult to get supplies and one respondent said both their project scope and timeline were affected.

Looking forward, two respondents thought the COVID-19 impacts would not affect their organization's interest in or ability to complete other energy efficiency projects. However, two respondents thought there would be less budget available, and two respondents thought there would be more interest in cost-cutting projects like efficiency. One respondent noted that their organization's interest would not be impacted unless there were new guidelines and policies mandated.

Survey Respondent Profile

The majority of PY 2021 Site Specific survey respondents (nine of 11) owned their facilities. Seven of the 11 facilities used gas for heating, and three used electricity. The PY 2021 sample included a range of sectors, including wholesale, retail trade, real estate, education, agriculture, arts, and emergency services.

Nonresidential Prescriptive Findings

This section describes findings from 56 online surveys completed with Prescriptive participants in PY 2021. Because 50 of the 56 respondents installed lighting projects, the results primarily represent lighting participants rather than non-lighting participants. Where meaningful, Cadmus compared PY 2020 results to PY 2021.

Program Delivery

This section provides an overview of program delivery and the impact of COVID-19 in PY 2021:

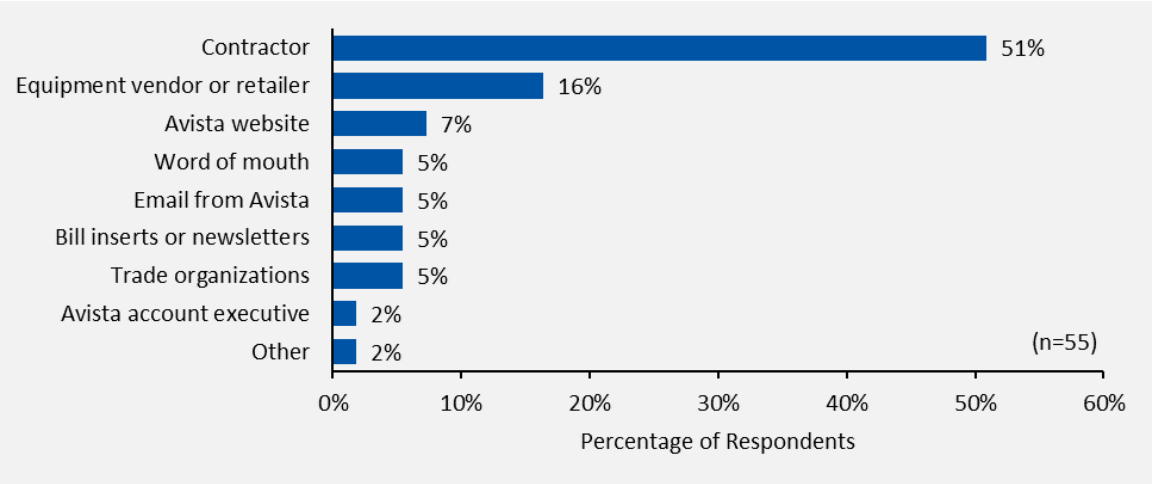
- **Program Changes.** Avista increased incentives for lighting measures in July 2021.
- **Program Participation.** Participation in programs was lower due to COVID-19. Additionally, interest in the Fleet Heat program was lower because there was a mild winter, so customers were less concerned with the potential benefits of this program.
- **Marketing and Outreach.** Most customers learned about the HVAC, variable frequency drives, shell, and grocer measures through their account executive or through the website. Food service equipment participants typically learned about the program through equipment retailers. Customers who installed lighting measures typically learned about the program from their electrician or lighting vendor.
- **Data Tracking.** iENERGY is used to track program data and allows program managers to capture all important data fields. This system has improved reporting capabilities compared to previous systems. Some lighting and food services vendors are able to enter rebate information directly into the system which will continue to increase efficiencies.
- **COVID-19 Impact.** Program goals were not met due to the impacts of COVID-19. This included businesses being unable to complete projects, supply chain issues regarding equipment materials, decreases in installer availability, and general labor shortages.
- **Successes.** Communication with customers was positive and they continued to thank Avista for offering the programs and providing incentives to encourage energy efficiency. Vendor and trade allies continued to successfully support the programs.

Customer Awareness

Just over one-third of PY 2021 survey respondents (34%, n=56) previously participated in an Avista business energy efficiency program, a decrease from PY 2020 (50%, n=60). Of the 19 respondents who participated previously, 15 provided details about programs in which they participated. Most reported installing lighting (87%, n=15), with one respondent reporting they participated multiple projects in previous years and another reporting having previously upgraded a furnace.

Most respondents said they first learned about the program from a contractor (51%, n=55), followed by a vendor or retailer (16%). The top two results are consistent with PY 2020 results.[2] Figure 7 shows the frequency that each information channel was mentioned.

Figure 7. How Participants First Learned of Program



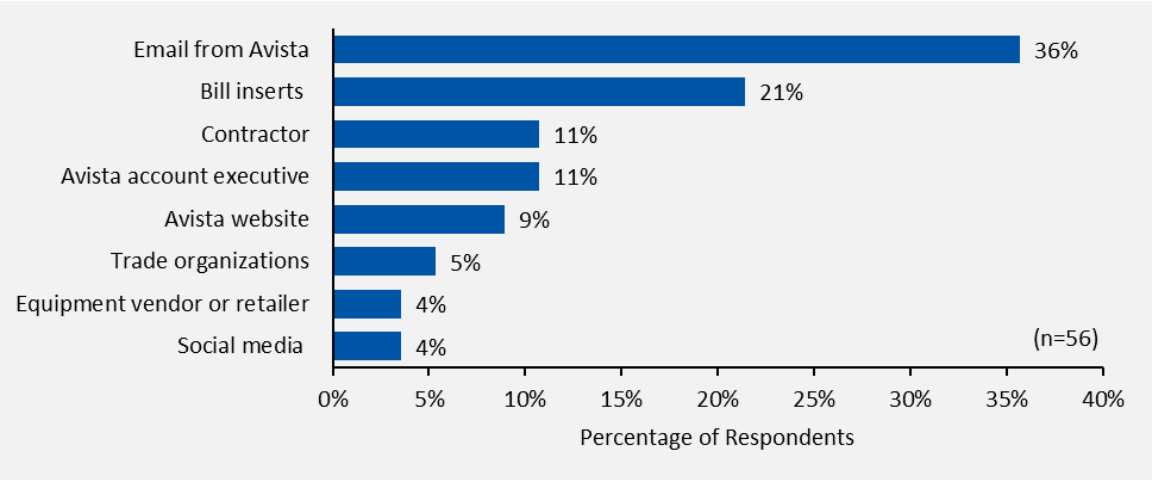
Source: Prescriptive survey questions C2: "How did you first hear about the program?"
Percentages may not total 100% due to rounding.

Respondents most frequently said that the best way for Avista to inform them of rebate programs was by an email from Avista (36%, n=56) or through a bill insert (21%). These were also the top responses in PY 2020. [3] Figure 8 shows the distribution of preferred methods across all respondents in PY 2021.

[2] In PY 2020, most respondents selected contractors (44%, n=63), followed by equipment vendor or retailer (25%).

[3] In PY 2020, most respondents said an email from Avista (31%, n=64), followed by bill inserts (19%).

Figure 8. How Participants Preferred to Learn of Programs and Offers

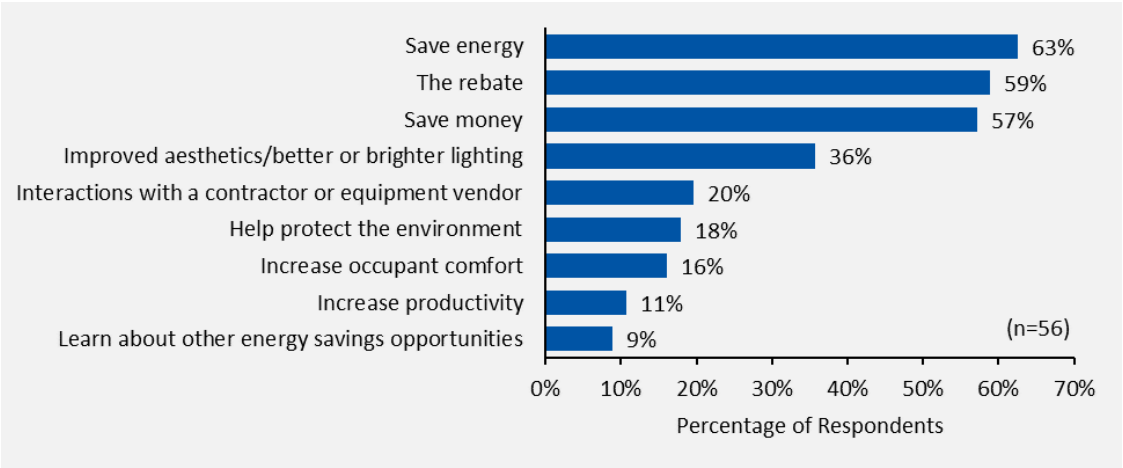


Source: Prescriptive survey question C3: "What is the best way for Avista to inform business customers like you about their rebates and incentives for energy efficiency improvements?" Percentages may not total 100% due to rounding.

Participation Motivations and Benefits

In PY 2021, most respondents said saving energy (63%, n=56) and utilizing the rebate (59%) motivated them to participate in the program, followed closely by saving money (57%). These top three results are similar to the PY 2020 result.[4] As shown in Figure 9, in PY 2021, many respondents said they were motivated by improved aesthetics and better lighting (36%), which was not reported in the PY 2020.

Figure 9. Prescriptive Participant Motivation

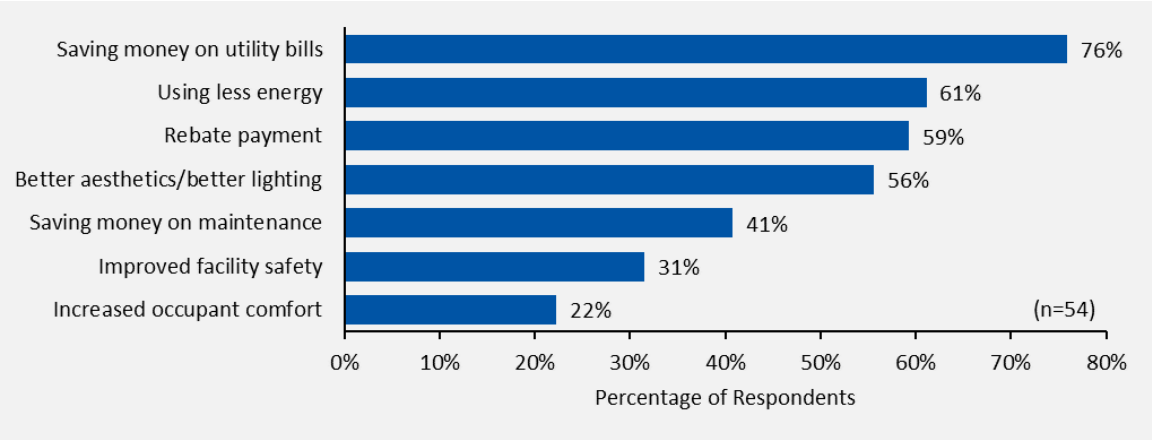


Source: Prescriptive survey question C4: "What motivated you to participate in the program?" Multiple responses accepted.

[4] PY 2020 respondents (n=66) top three motivations for participating were saving money (70%), receiving the rebate (59%), and saving energy (55%).

As shown in Figure 10, PY 2021 respondents' top program benefits align with their motivations to participate, with most respondents reporting that saving money on utility bills was the primary benefit of participation (76%, n=54). This was followed by reducing energy consumption (61%) and receiving the rebate (59%). The top three benefits reported in PY 2021 are consistent with PY 2020 results.

Figure 10. Prescriptive Participation Benefits



Source: Prescriptive survey question C6: "What would you say are the main benefits your company has experienced as a result of participation in Avista's program?" Multiple responses accepted.

Customer Experience

Program Delivery

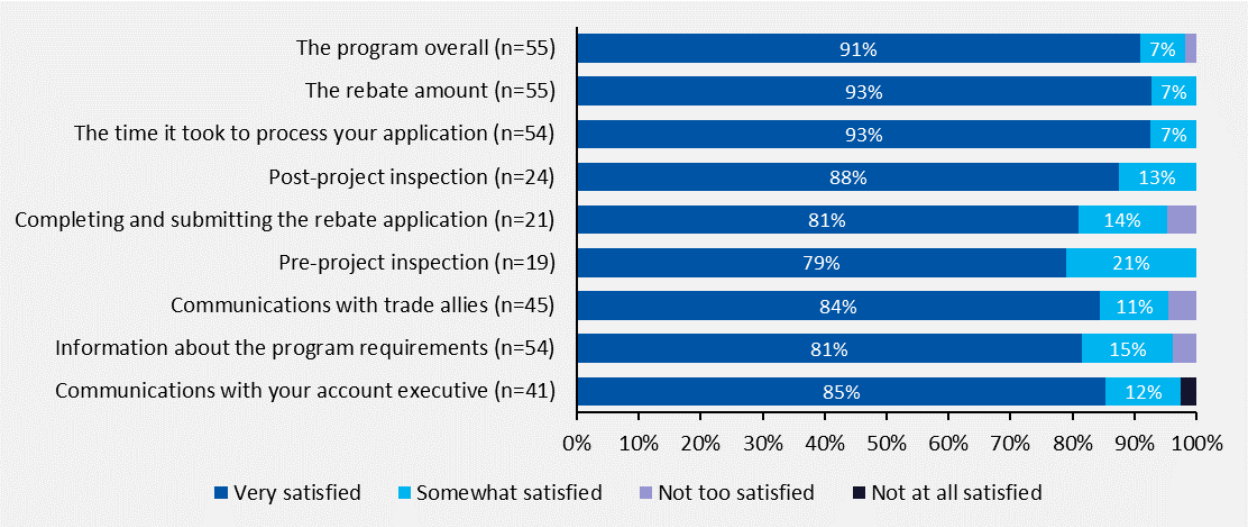
Although the majority of PY 2021 respondents reported a contractor or vendor (85%, n=54) or an Avista account executive (15%) was involved in a project's design or implementation, nearly half of respondents (45%) took the lead on their own applications. These results are similar to PY 2020.

Most PY 2021 respondents (80%; n=44) also received their rebate checks directly, rather than as instant discounts from a contractor or vendor. Of nine PY 2021 respondents who did receive an instant discount, seven of them explained why they chose to receive an instant discount. Two said they chose the instant discount because it was easier for them due to less cash outlay and the process being simple. Two other respondents chose the instant discount as the contractor had set it up as such and they had no problem with it. One respondent reported less wait time, while another respondent was happy with the contractor services from past experience. The last respondent reported not having an option.

Program Satisfaction

PY 2021 respondents were nearly all *somewhat* or *very satisfied* with all aspects of the Avista program, as shown Figure 11. One respondent was *not too satisfied* with the overall program citing challenges in filling out the forms due to lack of instructions from the contractor. None of the other respondents who were *not too* or *not at all satisfied* provided specific reasons for being less satisfied.

Figure 11. Satisfaction with Prescriptive Program Components

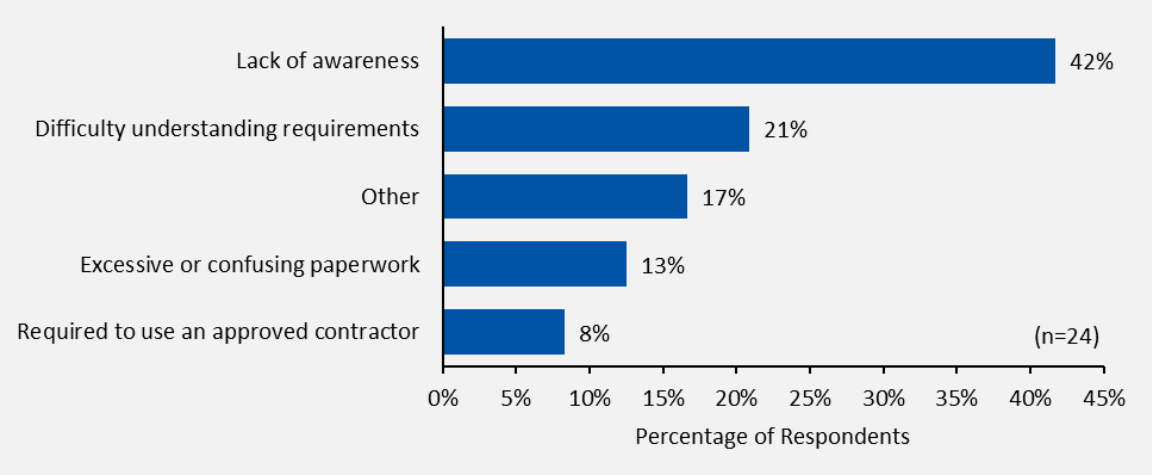


Source: Prescriptive survey questions H1: "In terms of the program, how satisfied were you with the following aspects? Please think about each item individually as you select your answer."

Program Challenges and Successes

When asked what challenges the program presented, 39% of respondents (n=56) provided no response and 18% reported there were no problems or complimented the program. As shown in Figure 12, respondents most frequently cited lack of awareness as their biggest challenge to participation (42%, n=24) followed by difficulty understanding the lighting requirements and rebate form. Two respondents had issues using an approved contractor, for example one respondent mentioned they did not want to use an approved contractor, but would have liked to complete the work themselves. Responses in the "other" category include difficulty disposing of old lighting, internal company challenges such as budget and labor, differing lighting preferences, and finding the decision-maker.

Figure 12. Participation Challenges



Source: Prescriptive survey question H10: "What do so see as the biggest challenges to participating in Avista's program for your company or other companies like yours?" Percentage may not sum to 100% due to rounding.

PY 2021 respondents provided feedback about what worked well in Avista's Prescriptive programs. As shown in Table 9, respondents most commonly mentioned the fast or easy application process (seven respondents, followed by the opportunity to save energy and money on utility bills (six respondents).

Table 9. Aspects of the Prescriptive Programs that Worked Well

Program Aspects	Number of Respondents
Easy/fast process	7
Saving energy and money on utility bills	6
Overall program works well	5
Good customer service	5
Rebate amount	4
Contractor support	3
Program duration	2
Access to better lighting	1

Source: Prescriptive survey question H12: "What would you say is working particularly well with Avista's program?" (n=33)

As shown in Table 10, 18 respondents made suggestions for improvements to the Prescriptive programs. Respondents most frequently suggested providing more information about the program requirements (nine respondents).

Table 10. Suggestions to Improve Avista Prescriptive Programs

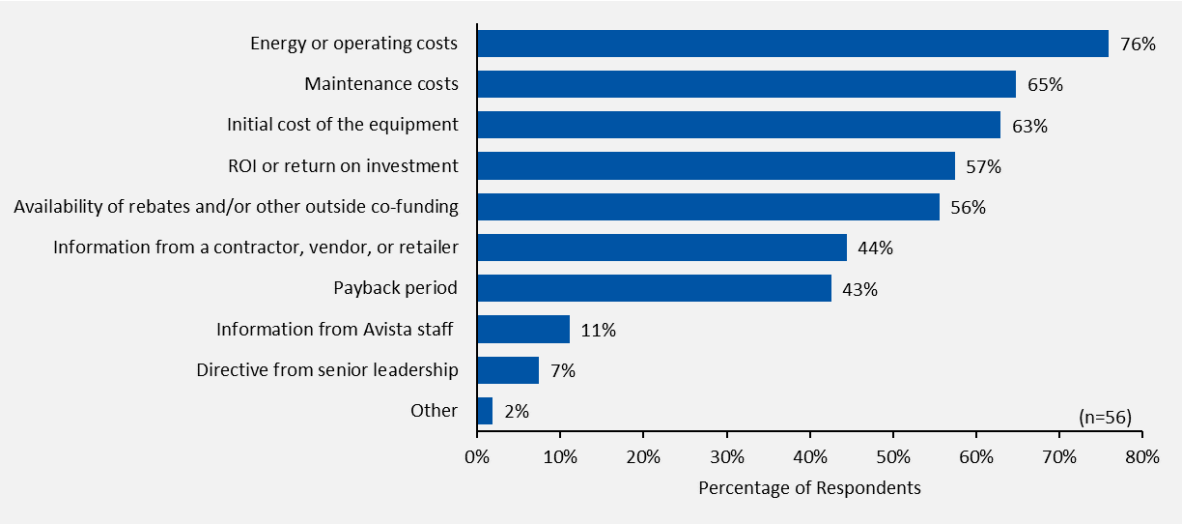
Suggestion	Number of Respondents
More information about program requirements	9
More marketing to customers	3
Expansion of prescriptive list to include motion sensors and other lighting options	2
Vendor motivation	1
More time to submit rebate application	1
Bigger rebates	1
List of available contractors	1

Source: Prescriptive survey question H11: "What recommendations, if any, would you make to improve the program?" (n=18)

Energy Efficiency Attitudes and Behaviors

A majority of the PY 2021 respondents (98%, n=55) considered energy efficiency either *somewhat* or *very important* to their organization when making capital upgrades or improvements. As shown in Figure 13, respondents cited energy or operating costs (76%, n=56) as the most important criteria in their decision to undertake energy efficiency improvements, followed by maintenance costs (65%) and initial cost of equipment (63%).

Figure 13. Important Criteria for Making Energy Efficiency Improvements



Source: Prescriptive survey question I4: "Which of the following criteria are important in deciding whether your company makes energy efficiency improvements?" Multiple responses allowed.

The survey asked respondents how the COVID-19 pandemic affected their project. The majority of respondents (78%, n=51) reported there was no impact, while 16% said the pandemic impacted the project timeline, and 6% said it impacted both the timeline and the scope. One respondent mentioned that COVID-19 impacted the project positively as they could complete the project faster. Those who reported negative impacts described the following factors:

- Supply chain problems (six responses)
- Labor shortages (two responses)
- Delay in project (one responses)

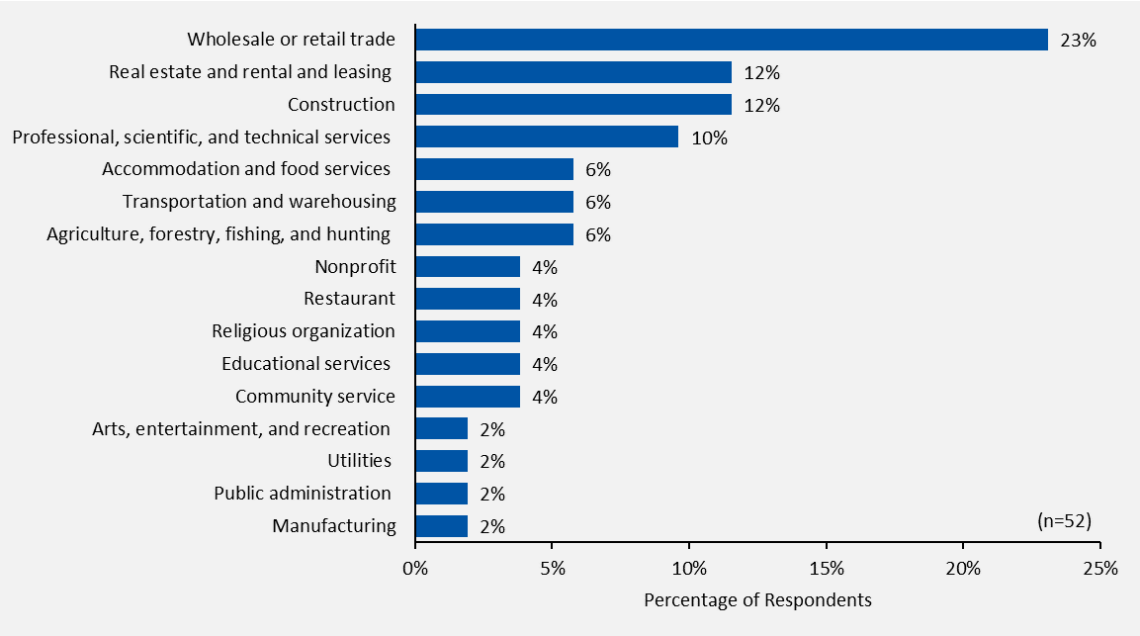
Survey Respondent Profile

The PY 2021 participant survey collected firmographic information about Prescriptive program survey respondents. The majority of the survey respondents had the following characteristics:

- Natural gas as their primary heating fuel (64%; n=50)
- Owned their own facilities (81%; n=52)
- Fewer than 100 employees (95%; n=34)

Figure 14 shows respondents' organization types. Respondents were most frequently from the wholesale or retail trade industry (23%, n=52), followed by real estate and rental and leasing (12%) and construction (12%).

Figure 14. PY 2021 Prescriptive Survey Organization Types



Source: Prescriptive survey question J1: "What is the primary industry of your organization?" Note: May not sum to 100% due to rounding.

Nonresidential Conclusions and Recommendations

This section includes Cadmus' conclusions and recommendations for Avista's nonresidential Site Specific and Prescriptive programs based on the evaluation findings.

Nonresidential Conclusions

- **Overall, respondent satisfaction with the PY 2021 Site Specific and Prescriptive programs was high.**
  - Overall, 91% of Site Specific respondents and 98% of Prescriptive program respondents said they were *very* or *somewhat satisfied* with the program.
  - While most Site Specific respondents reported increased satisfaction across most categories in PY 2021, satisfaction with the technical assistance received from Avista staff decreased slightly from 100% in PY 2020 to 86% in PY 2021.
  - While satisfaction with all aspects of the Prescriptive programs remained high, some respondents expressed dissatisfaction with completing and submitting the rebate application, communication with trade allies and their account executive, and information about program requirements.
- **PY 2021 Site Specific and Prescriptive respondents' top motivations to participate aligned with their top benefits from the program.**
  - Site Specific respondents were motivated to participate in the program to save energy (nine of 11), to save money (nine of 11), and to receive the rebate (eight of 11).

  - Site Specific respondents said that saving money on their utility bills was the main benefit of participation for their company (eight of 11), followed by using less energy (seven of 11) and improved aesthetics (seven of 11). Although receiving the rebate was not one of the top three benefits, a majority of respondents named it as a benefit (six of 11).
  - Prescriptive respondents most frequently cited saving energy (63%; n=56), receiving the rebate (59%; n=56), and reducing energy (57%; n=56) as reasons for participating in the programs.
  - They similarly cited these three items as benefits: saving energy (76%; n=54), reducing energy (61%; n=54), and receiving the rebate (59%; n=54). While not one of the top three benefits, prescriptive respondents also cited improved aesthetics as a top benefit (56%; n=54).
- **In PY 2021, the relationship between Site Specific respondents and vendors/contractors worked well for different aspects of the program.**
  - All Site Specific respondents were especially satisfied with their vendors and contractors, specifically with their communication with program contractors. Five of 11 respondents said that their contractor, vendor, or retailer was involved in the design of the project and took the lead in preparing their application.
- **Respondents in all nonresidential programs continued to report a lack of knowledge as a challenge to participation.**
  - Most Site Specific respondents (eight of 11) said their lack of knowledge about the program was a challenge and three recommended increasing communication about the program to participants.
  - Most Prescriptive respondents said their lack of awareness about the program was the biggest challenge to participation (42%, n=24). Some respondents (nine of 18) said that more information about the program requirements would improve the Prescriptive program.
- **In PY 2021, Site Specific and Prescriptive respondents said the programs were easy to participate in and provided other aspects of the program that worked well, such as energy savings, receiving the rebate, and communication.**
  - Site Specific survey respondents said the Avista engineering and utility account executives were helpful (two responses), the program was easy to participate in and worked out well (two responses), and that they appreciated the rebates (one response).
  - Seven of 33 Prescriptive program participants said the program had an easy/fast process and six of 33 said savings received due to improvements worked especially well.
- **While most respondents stated they did not experience any impacts due to the continued COVID-19 pandemic, a small number of respondents said that timing delays continued to persist in PY 2021.**
  - Most of the Site Specific respondents said that there were no COVID-19 impacts to their project (six of 10), while those who experienced challenges said their project timeline was

impacted due to delays (three of 10) and one respondent said the project scope was impacted.

- A majority of the Prescriptive respondents (78%, n=51) reported no impact on their projects. Among those who did report COVID impacts, respondents most frequently mentioned time labor/supply chain problems (eight responses) and time delays (one response) as roadblocks.

Nonresidential Recommendations

Nonresidential Recommendation 1: Consider developing and using customer testimonials in targeted outreach to customers who have not historically participated in programs. The testimonials from satisfied participants could focus on the ease of participating in the programs and the benefits of participation, such as reduced energy use, bill savings, and receiving the rebate. The marketing could also provide information to prospective participants on potential energy savings for businesses with similar profiles.

Nonresidential Recommendation 2: Continue to look for ways to provide contractor and installer training, educational resources about program requirements, and application completion tips to remove roadblocks or communication issues between Avista and participants.

Low-Income Programs

The Low-Income program consists of Community Action Program (CAP) agencies providing qualified customers with energy efficiency measures, drawn from an Approved Measures List, at no cost. Avista receives a set funding portion for each state and reimburses CAPs for the measures' cost.

Low-Income Program Findings

For its process evaluation of the Low-Income program, Cadmus conducted stakeholder interviews with Avista staff and with CAP agencies participating in PY 2021.

Stakeholder Interview

In August 2021, Cadmus interviewed Avista staff about its Low-Income program, and they confirmed that, in Washington and Idaho, Avista provided funding to CAP agencies, which ultimately became responsible for qualifying potential customers based on their income.

Successes

Avista staff reported two successes for the PY 2021 Low-Income program:

- **CAP agency relationships:** Avista staff noted an overall positive relationship with CAP agencies. They emphasized that they appreciated their partnership with these agencies and how they serve an integral role in operating the program.
- **Data tracking:** Program data are tracked through the Customer Care and Billing system, which Avista staff said meets the needs of its staff.

Challenges

Avista staff reported a few challenges with the program in PY 2021:

- **Savings and participation goals:** Avista staff reported the program was likely to fall short of savings and participation goals for the year and this was largely due to the COVID-19 pandemic. CAP agencies were still not administering the program to seniors, people with health conditions, or any other customers who may be more vulnerable, which comprised a large portion of their typical base.
- **New CAP agencies:** Avista staff said there were two CAP agencies that were relatively new to the program in 2021. While staff noted that they had good relationships with these agencies, they had struggled to find any customers in their territory due to a small overall customer base.
- **Marketing:** Avista staff reported they had not introduced any new channels for marketing the program, largely due to COVID-19. They noted that marketing is often done through in-person outreach at energy fairs, food banks, and workshops for seniors, all of which were impacted. Staff also said that they put together a post card campaign and email blast to customers with information about the program and the CAP agencies but had not received much response from the effort.

CAP Agency Interviews

In September 2021, Cadmus conducted interviews with six CAP agencies participating in the Low-Income program. Two of the agencies were relatively new to the program and therefore had not completed any projects with Avista funding as of the time of their interviews.

To qualify their clients by income, all of the CAP agencies said they used the Department of Commerce low-income standard to income-qualify new clients.

In terms of prioritizing customers that qualify, the CAP agencies identified certain priority groups, such as elderly clients, clients with small children, Native Americans, clients with high energy usage, and clients with disabilities.

Avista provides funding to the CAP agencies on a calendar-year basis. All six agencies said the schedule of funding by Avista works well for them and how they need to treat their clients' homes. All six agencies also reported that the current level of funding is sufficient to meet their needs, although three noted some caveats. One agency reported that since COVID-19 interrupted participation, it is hard to truly know if the current level of funding is sufficient and added they could potentially add more staff to take on more work if funding increased. Similarly, another agency reported that the current level of funding is sufficient for what they can handle right now, but they could take on more work if they hired additional employees and received more funding. Another agency said the level of funding had fluctuated over time, which makes it difficult to plan their needs for future years.

The CAP agencies have a mix of in-house teams that complete project work and external contractors they work with to complete more specialized work. Three of the agencies reported they had sufficient contractor support, two agencies had not begun work yet, and one agency struggled with contractor availability. This agency had their own crews for some work, but contracts out tasks related to furnaces, heaters, and electrical work. They said there were some issues with availability when construction work started picking back up following shut downs from COVID-19. One CAP agency suggested that Avista promote workshops for crew-based workers coming out of school so there are more trained workers available.

Successes

CAP agencies reported three major successes for the Low-Income program:

- **Relationship with Avista:** All six CAP agencies emphasized a positive relationship with Avista. All CAP agencies also noted the Avista was good at communicating with them about the program and providing them with the proper amount of support to operate in the program.
- **Positive customer feedback:** Four of the CAP agencies reported that they receive mostly positive customer feedback from the work they do through the program. Some agencies noted occasional complaints, but said these are pretty rare. Two CAP agencies were relatively new and had not had any participation in PY 2021 at the time of the interview, so they were unable to provide feedback.

- **Reliable data tracking systems:** Five CAP agencies reported the current data tracking systems in place were meeting their needs for administering the program.

Challenges

CAP agencies mentioned several challenges with the Low-Income program:

- **Program implementation during the COVID-19 pandemic:** All six CAP agencies reported impacts on program participation due to COVID-19. Program participation was initially suspended in PY 2020, while the CAP agencies worked to establish health and safety protocols, and five agencies noted that engagement was slow to return in PY 2021 as a result.
- **Marketing:** Three CAP agencies serving Washington customers reported challenges with customer engagement and marketing efforts. One agency said they noticed fewer clients requesting help in PY 2021 and that they were looking at new ways to market the program and be proactive in engaging with customers. Two other agencies had not completed any projects in PY 2021 at the time of the interview, but said that Avista was working with them to market the program. However, they still faced struggles with recruiting clients to the program.
- **Additional barriers:** Four CAP agencies noted additional barriers for program implementation and customer participation. One agency noted an issue with finding contractors (electricians particularly) to perform work. Two other agencies noted issues with trying to engage with certain members of their communities. One agency serving Washington customers said their county has a higher concentration of Hispanic clients who they have struggled to engage with, while another agency serving Washington customers said their county has clients from the Marshall Islands and they have been unable to find a translator to help communicate with them. One CAP agency serving Idaho customers reported issues with untreatable homes due to things like a damaged roof or sewer line.

Community Energy Efficiency Program Findings

The Community Energy Efficiency program (CEEP) is also implemented by CAP agencies, though the program only operates in Washington. Funding for the program comes from the Washington capital budget for energy efficiency improvements in identified areas that do not tend to benefit from traditional energy efficiency programs. These are typically areas with low- to moderate-income customers, small businesses, multifamily residences, and alternative fuel homes.

For its process evaluation of CEEP, Cadmus conducted a stakeholder interview with Avista staff.

Stakeholder Interview

In August 2021, Cadmus interviewed Avista about CEEP, and Avista staff thought they would have a chance to spend out the funding for the program based on the current level of participation. The funding for the CY 2021 program was set to expire in May of 2021, but an extension was granted through the end of the year due to COVID-19 and its impact on the work. Avista staff stated the current program has three focus areas: (1) energy efficiency improvements to multifamily properties, (2) removal of alternative heating sources (e.g., wood, oil) in favor of heat pumps and weatherization

upgrades, and (3) a small business efficiency effort. The small business effort was combined with a business partner program to target small rural towns and provide them with comprehensive information about the utility to educate and raise awareness of energy efficiency and identify potential projects. Avista staff clarified that CAP agencies only implement the first two focus areas of the program, but that the third focus area operates independently through the partner program, which can use CEEP funding for any projects identified.

Avista staff also reported that while they identified some potential opportunities for program participation, the CAP agencies were the primary way they identified participants. They also noted that they were unable to conduct a large marketing effort for the program due to limited funds.

Staff said they were thinking of shifting the focus from multifamily residences to the removal of wood stoves (which they received some funding from a local clean air agency to help with) and possibly expanding weatherization efforts.

Low-Income Conclusions and Recommendations

This section includes Cadmus' conclusions and recommendations for Avista's Low-Income program based on the evaluation findings.

Low-Income Conclusions

- **CAP agencies and participating customers were highly satisfied with the Low-Income program.**
  - Avista and all six CAP agencies interviewed emphasized positive, well-established relationships that were communicative and collaborative. Despite facing challenges with participation, some CAP agencies noted that Avista was working with them to market the program and increase outreach in an effort to bring in potential customers.
  - All four CAP agencies that had participated reported that customers generally provided positive feedback. These agencies said that customers were typically happy with the equipment they received through the program and appreciative of the work provided.
- **The COVID-19 pandemic impacted program implementation and participation.**
  - Both Avista and CAP agencies reported that COVID-19 impacted the program in PY 2021. After Avista temporarily suspended the program in PY 2020 to establish health and safety protocols, participation was slow to rebound in some areas. While some CAP agencies had returned to steady work, others (especially newer agencies) have struggled to reach customers. Other customer bases, such as elderly clients and clients with health vulnerabilities, were still difficult to serve at the time of the interviews.
  - Program marketing also suffered as a result of the pandemic. Certain in-person events that were previously used to market the program were cancelled, which made particular groups of clients more difficult to reach.

Low-Income Recommendations

Low-Income Recommendation 1: Increase and adjust program marketing efforts to target hard-to-reach members of the income-eligible community. As more in-person events are offered, market the program to increase potential customer participation. Along with in-person events, offer virtual marketing opportunities to reach more vulnerable customers, such as the elderly or those with health vulnerabilities, who may not be able to attend in-person events. Work with community groups in rural areas to help identify customer bases and strategize marketing efforts to inform them of the program.

Low-Income Recommendation 2: Continue to work with newer CAP agencies to help increase customer participation. Providing support in more rural areas where these new CAP agencies are working will be essential to helping them gain customers. Understanding the needs of people within their territories can also help inform targeted marketing offerings or ways to promote the program.

Residential Programs

The Space Heat, Water Heat, Shell, and Windows programs provide residential households with Prescriptive rebates for installing space heat, water heat, smart thermostats, storm and standard windows, and natural gas space and water heat.

Residential Program Findings

For the PY 2021 process evaluation, Cadmus completed interviews with the Avista program manager and conducted 150 online surveys with Space Heat, Water Heat, Shell, Windows, and Fuel Switching program participants. The following sections present results and detail the findings.

The survey sample sizes noted in this report may vary by survey question because respondents could skip questions if they chose not to answer; therefore, not all respondents provided answers to every question. Cadmus included all survey responses.

Program Delivery

This section provides an overview of program delivery and the impact of COVID-19 in PY 2021:

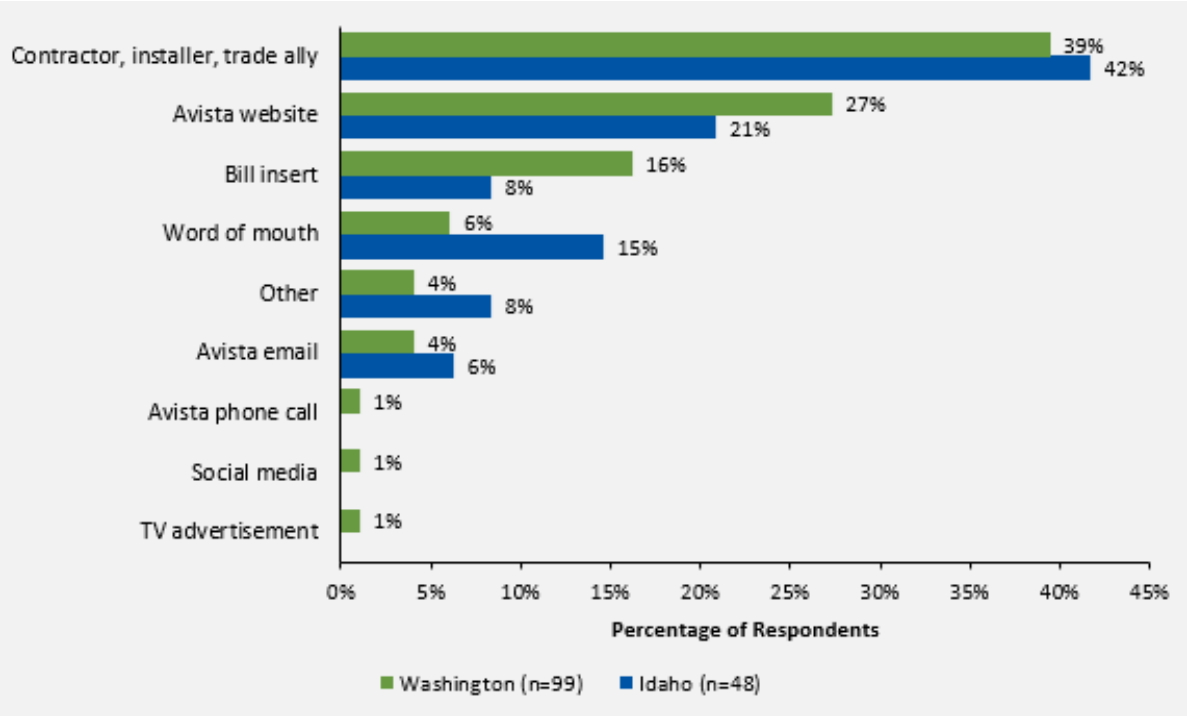
- **Rebate submission.** Customers continued to participate through two avenues of rebate submission: directly by the customer or landlord or through trade allies, such as contractors.
- **Equipment and incentive levels.** Avista increased the rebate amounts on a few equipment categories and added a few new equipment types to the list of eligible equipment.
- **Marketing and outreach.** In PY 2021, the program continued to run the "Ways to Save" advertising campaign and continued to reach out to customers through email blasts. Avista updated the website as needed when program offerings changed.
- **COVID-19 impact.** The pandemic was the main challenge in PY 2021. Not all program goals were met because of the impact of pandemic-specific issues, such as quarantine periods, contractor staffing issues, and customers being less likely to allow contractors in their home. Some of these issues impacted project completion but Avista was lenient with project completion schedules to account for timeline challenges. Additionally, the cost of equipment continued to increase due to supply chain issues caused by the pandemic. This increased equipment cost was a challenge for customers, but Avista was able to increase some incentives in response to this customer challenge.

Space Heat, Water Heat, Shell, and Windows Customer Survey Results

Customer Awareness

Cadmus asked survey respondents where they learned about the program in which they participated. In PY 2021, respondents in both states most frequently said they learned about Avista programs through contractors, installers, or trade allies (39% in Washington and 42% in Idaho). This was followed by the Avista website in both states (27% in Washington and 21% in Idaho), bill inserts in Washington (16%), and word of mouth in Idaho (15%). Figure 15 shows state-specific results.

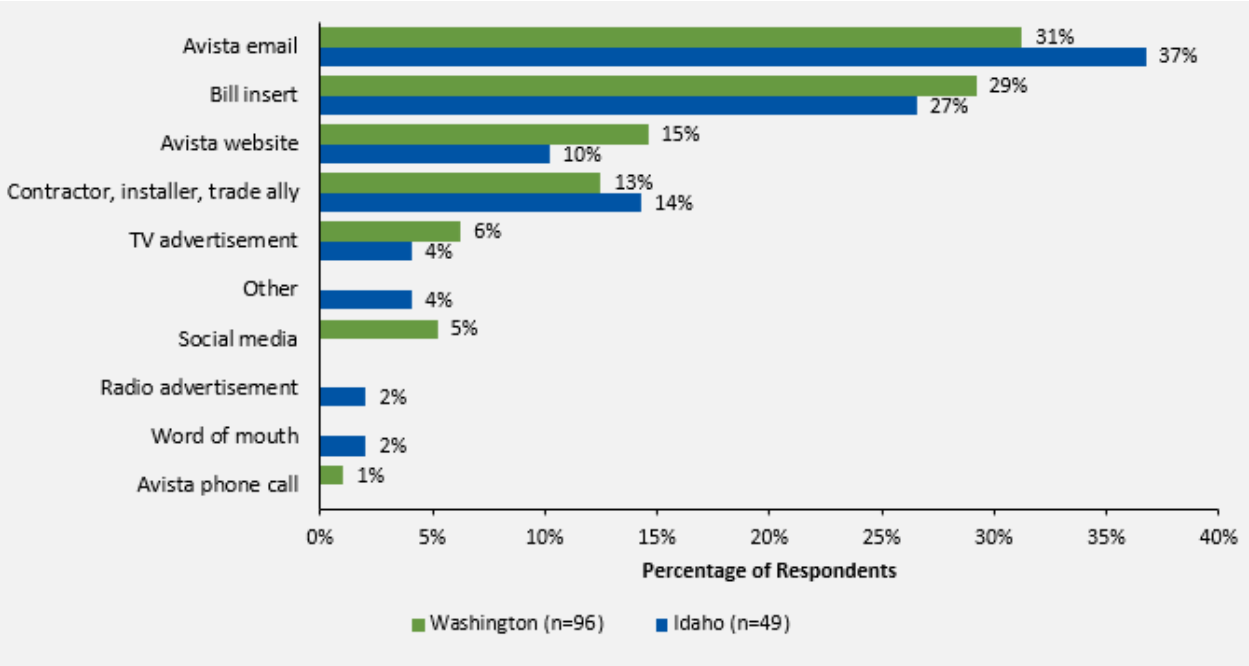
Figure 15. Awareness of Avista Energy Efficiency Programming



Source: Residential Programs Participant Survey, Question D1: "How did you first hear about Avista's Energy Efficiency Rebate program?" Percentages may not add up to 100% due to rounding.

Cadmus also asked respondents how they preferred to learn about Avista's energy efficiency programs. Most PY 2021 respondents in both states preferred Avista's emails or bill inserts (31% in Washington and 37% in Idaho). These preferred methods were consistent with those chosen in PY 2020. Figure 16 shows all state-specific results.

Figure 16. Preferred Method to Learn About Programming

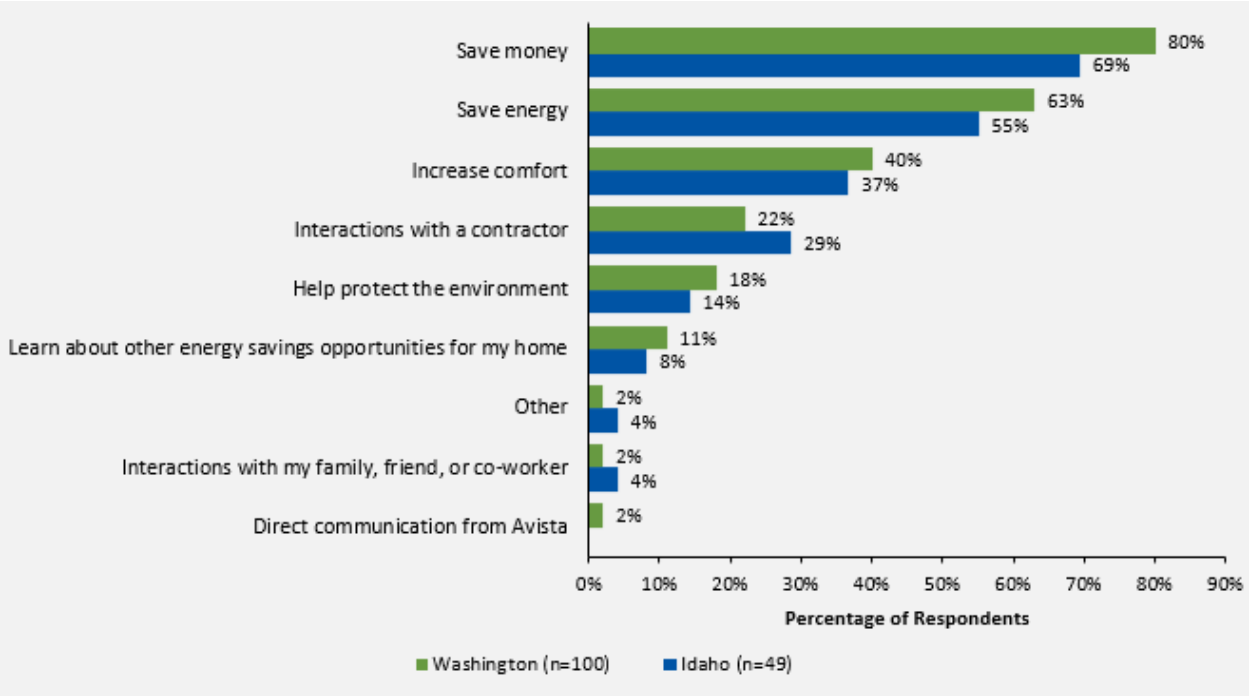


Source: Residential Programs Participant Survey, Question D2: "What is the best way for Avista to inform Residential customers like you about their energy efficiency improvement rebates?"

Motivation and Program Benefits

In PY 2021, respondents participated in Avista's programs primarily to save money (80% in Washington and 69% in Idaho), save energy (63% in Washington and 55% in Idaho), and/ or increase their homes comfort (40% in Washington and 37% in Idaho). Figure 17 shows all state-specific results.

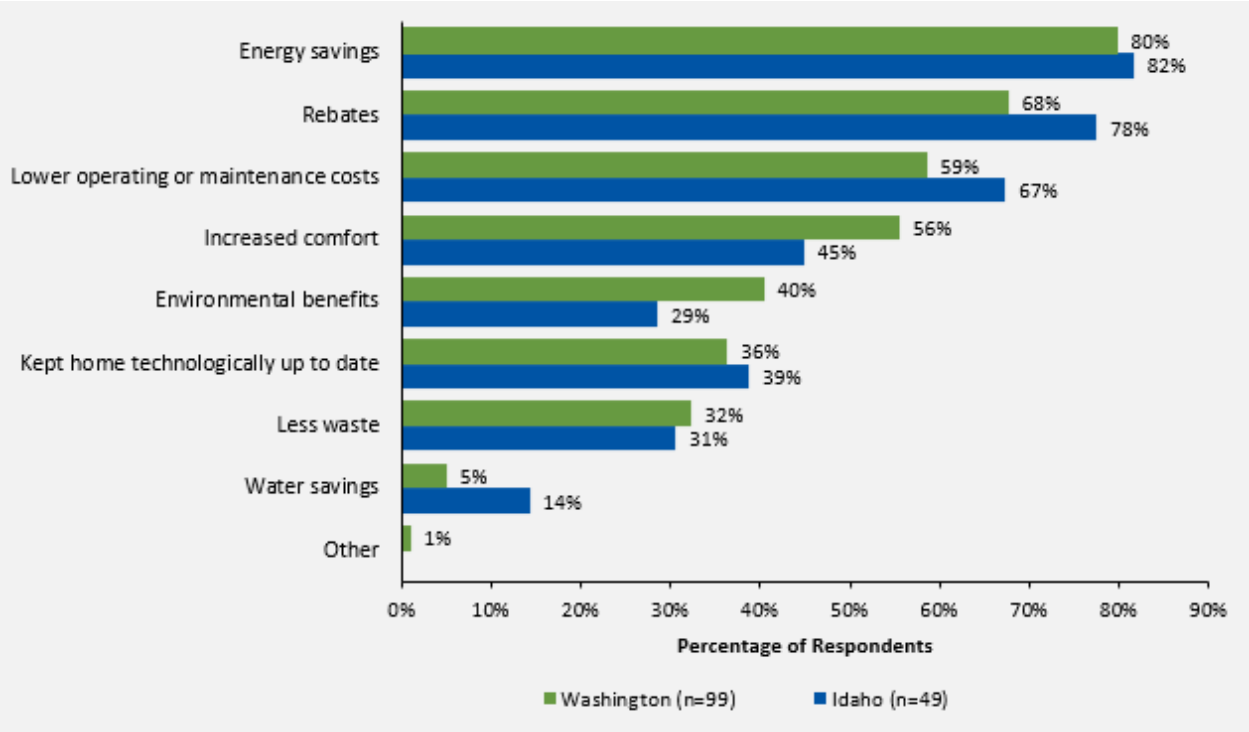
Figure 17. Motivations to Participate in Residential Programs



Source: Residential Programs Participant Survey, Question D3: "What motivated you to participate in Avista's Energy Efficiency Rebate program?" Multiple responses allowed.

Cadmus asked respondents a multiple-response question about benefits they associated with Avista's residential programs. In PY 2021, most respondents cited energy savings (80% in Washington and 82% in Idaho), rebates (68% in Washington and 78% in Idaho), and lower operating or maintenance costs (59% in Washington and 67% in Idaho). While some respondents did note the importance of environmental benefits and less waste, these were not the top responses in either state. Figure 18 shows all state-specific results.

Figure 18. Benefits of Participation in Residential Programs

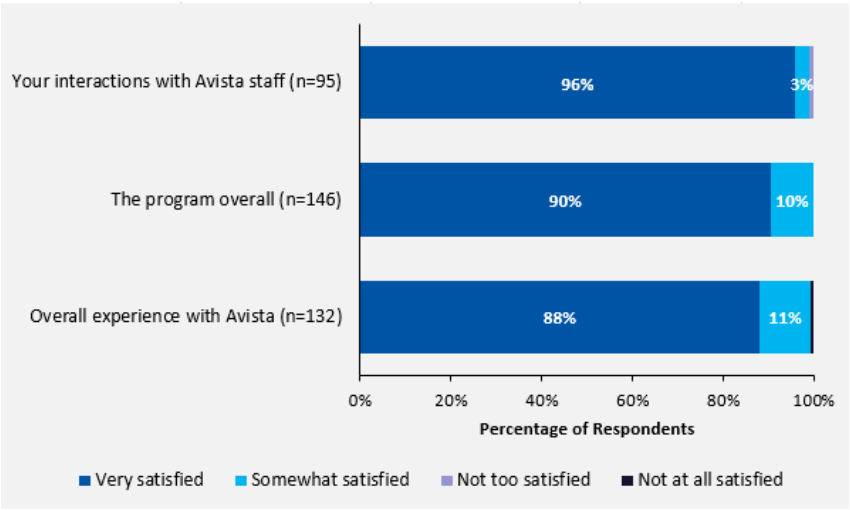


Source: Residential Programs Participant Survey, Question D4. "What benefits come to mind when thinking about your participation in Avista's Energy Efficiency Rebate program?" Multiple responses allowed.

Program Satisfaction

Cadmus asked survey respondents to indicate their satisfaction levels with various program elements associated with their rebate, new equipment, and installing contractor. In PY 2021, all respondents in both states who answered the question said they were *very* or *somewhat* satisfied with the program overall, as shown in Figure 19.

Figure 19. Satisfaction with Avista and Residential Programs Overall

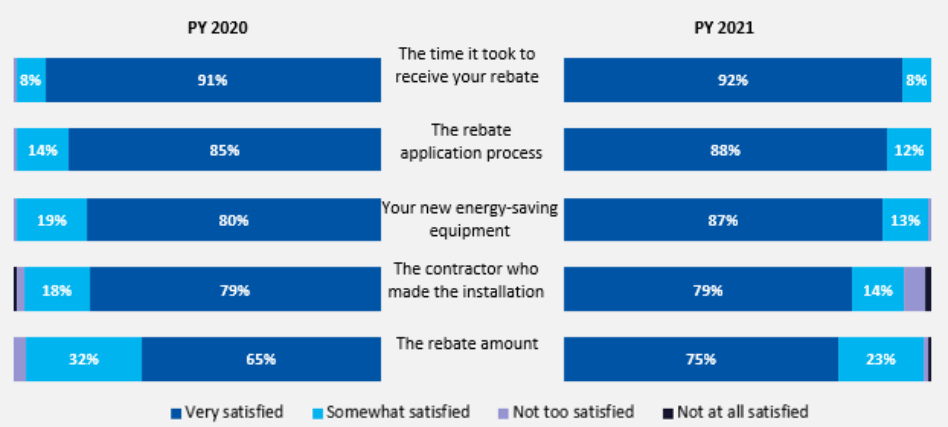


Source: Residential Programs Participant Survey, Questions E1, E4: "How would you rate your overall experience with..."

Figure 20 shows satisfaction with various program components. Respondents were most satisfied with the time it took to receive the rebate (100% said *very* or *somewhat satisfied*; n=141).

The proportion of *very satisfied* ratings increased for four of the components from PY 2020 to PY 2021, while one of them stayed the same, as shown in Figure 20. While satisfaction with rebate amounts still had the lowest *very satisfied* rating of all five elements, the percentage of *very satisfied* responses increased by 10% from 65% in PY 2020 (n=117) to 75% (n=143) in PY 2021.

Figure 20. Satisfaction with Residential Program Elements



Source: Residential Programs Participant Survey, Question E1: "How would you rate your overall experience with..." (PY 2020 n's=101 to 117 and PY 2021 n's=121 to 150)

After asking respondents about their satisfaction with the PY 2021 program and program components, the survey asked respondents' recommendations and feedback regarding possible program improvements. Nineteen percent of respondents (29 of 150) provided feedback, the top two responses—increase awareness/advertising (16 responses) and simplify rebate applications (six responses)—were consistent with PY 2020. This was followed by increase rebate options (three responses), a change from increase the rebate amount in PY 2020. Figure 21 highlights respondents' recommendations and feedback in these program components.

Figure 21. Respondent Feedback and Recommendations for Program and Program Components

Increase awareness/ advertising (16 of 29)

"For us it was a win/win. Communicating how that can be true using examples (smart thermostats) in an email or monthly letter might edge customers closer to a decision. How much one could save in dollars and it's environmental impact, for example."

Simplify rebate applications (6 of 29)

"The request for invoice should be waived when other proof of purchase items are supplied. I tried to get an invoice from the installer but they wouldn't supply me one. The Avista rep was able to get it thankfully."

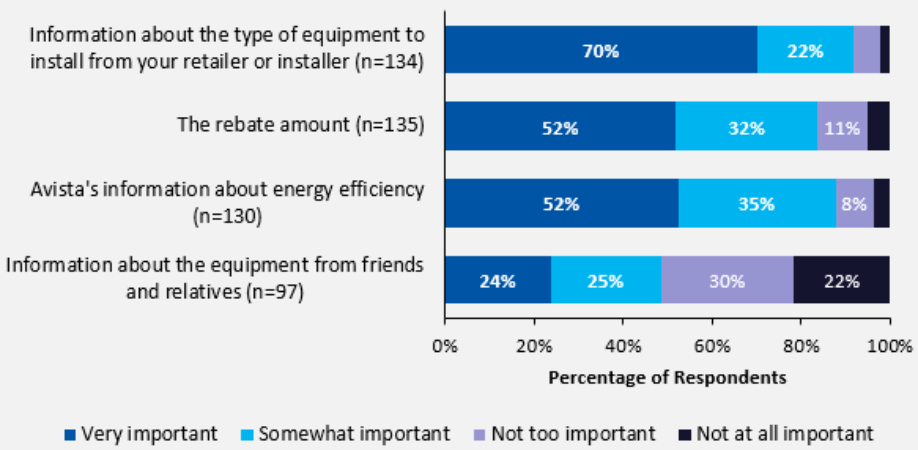
Increase rebate equipment options (3 of 29)

"I would like to see the return of the home insulation program. I did this many years ago and I think my house would benefit from this again."

Decision Influencers

Cadmus asked respondents to rate the importance of several items on their decision to purchase and install the equipment (Figure 22). The majority of respondents rated information about the equipment from retailers and installers as *very important* (70%; n=134), followed by both the rebate amount (52%; n=135) and Avista's information about energy efficiency (52%; n=130).

Figure 22. Influences on Program Participation

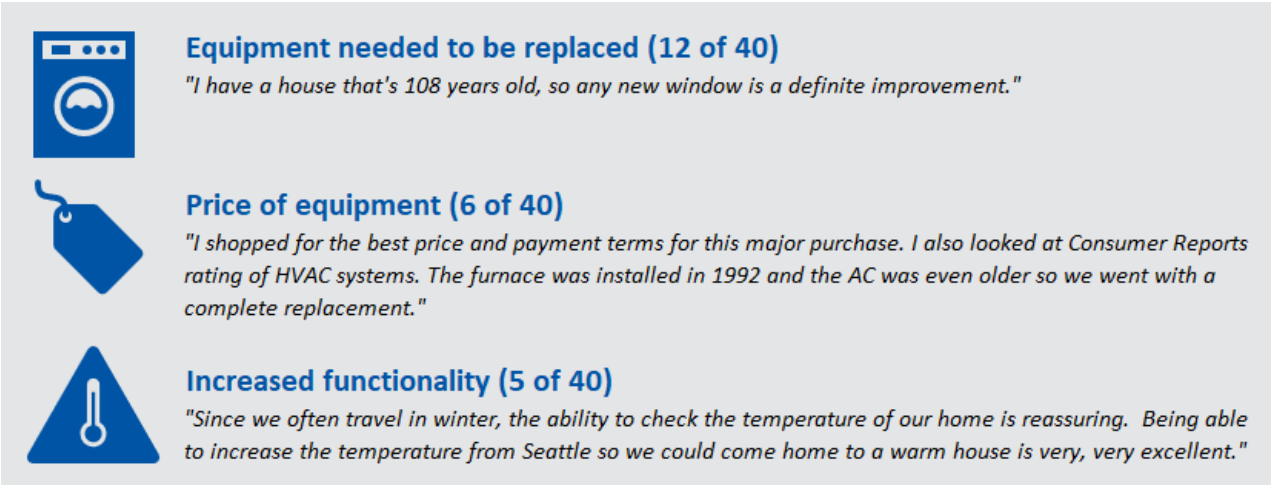


Source: Residential Programs Participant Survey, Question F1: "Please rate the following items on how important each item was on your decision to purchase and install the equipment?"

Cadmus asked respondents if anything else was *very important* in their decision to purchase and install the equipment. Twenty seven percent of respondents (40 of 150) provided an answer that primarily fell

into three categories: equipment needed to be replaced, price of equipment, and increased functionality. Figure 23 provides verbatim feedback from respondents in each category.

Figure 23. Respondent Feedback for Additional Drivers of Equipment Purchases



Survey Respondent Profile

The PY 2021 participant survey collected demographic information about residential survey respondents. The majority of the survey respondents had the following characteristics:

- Had an average household size of 2.3 residents (n=130)
- Owned their homes (99%; n=143)
- Had completed some college or had a four-year university degree (66%; n=140)
- Earned at least $50,000 per year (72%; n=107)

Contractor Interview Findings

In January 2022, Cadmus interviewed 10 contractors, five from Idaho and five from Washington, to collect information about their awareness of and motivation to participate in Avista's residential rebate programs as well as their standard business practices, experiences with the program, and perceptions of customers' experiences with the program.

Program Awareness

Table 11 shows which residential programs contractors said they have participated in.

Table 11. Contractor Program Participation

Residential Programs	Reponses (n=10)
All Programs (unspecified)	2
Most programs (unspecified)	2
Insulation	2
Water heating	1
Fuel switching	1
Appliances	1
Smart thermostats	1
Don't know	1
Source: Interview question B1:, "Which Avista programs have you participated in?" Multiple responses accepted.	

The contractors were also asked about their customers' awareness of the Avista residential rebate programs. Four of the contractors said customers are aware of Avista but were not aware they offered rebate programs while two of the contractors said that their customers had a high level of understanding about the offered programs. The other four did not know whether their customers were aware of Avista or the rebate program offerings.

Motivation to Participate

Eight contractors participated in the residential programs so they could help their customers afford higher efficiency equipment because they would receive a rebate. One contractor said that the programs work well for them and that is why they participate in the program. Another contractor said that by participating in the program, it allows their company to be more competitive among others.

Program Benefits

A majority of contractors said the program benefitted their customers by allowing them to upgrade to more efficient equipment that provided greater comfort and electric bill savings (seven of 10). Two contractors said the program made the difference of whether customers could make such upgrades. One contractor mentioned that customers who participate in the programs, overall, lower their energy bills.

Rebate Application Process

Seven contractors said they typically help their customers complete their rebate forms. Three contractors said they provide their customers with an instant discount on their invoice. All of the contractors who said they have completed the application for their customers did not find the rebate application process difficult (nine of nine).

Table 12 shows the different ways the contractors offered to redeem rebates.

Table 12. Rebate Options

Rebate Type	Description	Count (n=10)
Direct discount	The contractor subtracted the rebate amount up front and invoiced the customer for remaining costs, and the contractor then kept the rebate.	4
Contractor-delivered rebate	The contractor invoiced the customer for the full project cost, received the rebate from Avista, and passed the amount of the rebate along to the customer after the work was completed.	6
Utility-delivered rebate	The contractor invoiced the customer for the full project cost, and Avista delivered the rebate directly to the customer.	0

Source: Interview question D1:, **"**Do you typically help customers complete their rebate forms (and charge the normal price of equipment and installation), or do you provide an instant discount up front and receive the rebate directly through Avista afterward?"

Contractor Experience

Cadmus spoke to contractors about their satisfaction with various program elements and how much the program influenced their businesses' success.

Satisfaction

Contractors rated all program elements shown in Table 13 with high satisfaction marks, ranging from 4.3 to 4.8 on a scale of 1 to 5, where 1 meant *not at all satisfied* and 5 meant *very satisfied*.

Table 13. Satisfaction Ratings by Program Element

Program Element	Average (n=10)
Overall program	**4.8**
Rebate application process	4.7
Rebate levels	4.6
Interaction with Avista	4.5
Equipment covered by rebates	4.3

Source: Interview question D4:, **"**On a scale from 1 to 5, where 1 means *not at all satisfied* and 5 means *very satisfied*, how satisfied are you with…?"

Additional details related to contractors' ratings for each program element above include the following:

- **Rebate application**: All contractors said the application process was simple, straightforward, and user-friendly.
- **Rebate levels**: Contractors were generally satisfied with the rebate levels, although those who did not give a 5 rating (three of 10) said that the rebate amounts could be higher to provide further benefits to customers.
- **Equipment**: Half of the contractors (five of 10) suggested other types of high-efficiency equipment (such as air conditioners, water heaters, and side-arm heat exchangers for boilers and furnaces) that could benefit customers.

Program Influence

Most of the contractors (seven of 10) stated that Avista's rebate program *highly influenced* their decision to recommend its equipment. Six contractors said the program enabled them to sell more higher-efficiency equipment. Two contractors stated that Avista's residential programs did not affect the type of work that their companies perform. No contractors reported negative impacts on their businesses due to participating in the residential programs.

With regard to perceived customer experience, contractors rated the programs' importance on their customers' decisions to purchase high-efficiency equipment on a 5-point scale, where 1 meant *not at all important* and 5 meant *very important*. The overall rating for program importance was 4.9.

> "Participating in Avista's programs can be the deciding factor on whether or not our customers can get the energy-efficient upgrades."
>
> - Contractor

Awareness

Half of the contractors (five of 10) estimated that, on average, 50% of customers already knew about the program when they contacted them and were highly knowledgeable of the program requirements and benefits. Roughly 85% of all customers who contacted the contractors, qualified for a rebate through Avista's residential rebate program.

COVID-19 Impacts

In PY 2021, two contractors in Washington observed sales of energy equipment increase during COVID-19. The contractors explained that the increase in sales was probably because more people were spending time at home and were more aware of the amount of energy their households consumed. Three contractors stated that their customers experienced scheduling issues when trying to find installers. One contractor explained that this issue could be due to the uncertainty of the pandemic or because visits had to be rescheduled due to positive COVID-19 tests. One contractor experienced a delay in receiving equipment. However, none of the contractors said they observed changes in the quality or quantity of the products, nor did they have any issues finding installers. In PY 2021, contractors indicated that most of their work was done via virtual meetings with customers.

Feedback and Recommendations

Four of the contractors stated that they could not think of any recommendations or of any aspect where the program could be improved while two praised Avista's easy and straightforward application process.

> "The programs work well for us."
>
> - Contractor

Six of the contractors provided the following recommendations to improve the contractor and customer experiences:

- Increase rebate amounts (two respondents)
- Provide contractors and customers with an application status tracker in the portal (two respondents)

- Provide contractors with marketing tools (one respondent)
- Provide contractors with a list of certified installers (one respondent)

Residential Conclusions and Recommendations

This section includes Cadmus' conclusions and recommendations for Avista's residential programs based on the evaluation findings.

Residential Conclusions

- **Survey respondents and contractors are highly satisfied with most aspects of the program.**
  - All survey respondents were *very* or *somewhat satisfied* (90% *very satisfied* and 10% *somewhat satisfied*) with the program overall, with over 99% of respondents satisfied with interactions with Avista staff and 99% satisfied with their overall experience with Avista.
  - All contractors were *very* or *somewhat satisfied* with the program overall. They said that the rebate application process was simple, straightforward, and user-friendly.
- **While contractors said the rebate application was simple and straightforward to complete, some survey respondents suggested simplifying the application as a way to improve the program.**
  - All of the contractors who said they have completed the application for their customers did not find the rebate application process difficult (nine of nine) and rated their satisfaction with the rebate application process as a 4.7 on a 5-point scale where 1 means *not at all satisfied* and 5 means *very satisfied* (n=10). As a program improvement, two contractors suggested Avista create an application status tracker in the portal.
  - Most survey respondents who provided improvement suggestions said the program should increase advertising to increase awareness among residential customers (16 of 29) or simplify the rebate application as a program improvement (six of 29).
- **Contractors said the program rebate influenced their decision to recommend equipment to their customers and influenced their customers decisions to purchase and install new energy-efficient equipment.**
  - The majority of the contractors said that their participation in the Avista rebate programs was the defining reason that influenced their customers to receive energy-efficient equipment. They rated the programs influence on their decision to recommend equipment as a 4.7 on a scale from 1 to 5, where 1 is *not influential* and 5 is *very influential*.
  - They rated how influential the program was on their customers decision to purchase new equipment as a 4.9, on a 1 to 5 scale, where 1 meant *not at all influential* and 5 meant *very influential*.
  - Additionally, a majority of survey respondents said the most important reason they decided to purchase and install energy efficiency equipment was because of information from their retailer or installer (70%; n=134).

- **While most residential customers learned about the programs from their contractor, installer or trade ally, they prefer to learn about the program though emails and bill inserts from Avista.**
  - Respondents in both states most frequently learned about Avista programs through contractors, installers, or trade allies (39% in Washington and 42% in Idaho).
  - Most respondents preferred to learn about the programs from Avista's emails (31% in Washington and 37% in Idaho) or bill inserts (29% in Washington and 27% in Idaho). A smaller portion of the respondents preferred learning about the program from contractors, installers, and trade allies (13% of Washington respondents and 14% of Idaho respondents) .
- **Saving money or energy are the key drivers of motivation to participate in the program according to survey respondents.**
  - Respondents participated in Avista's programs primarily to save money (80% of Washington respondents and 69% of Idaho respondents) and save energy (63% of Washington respondents and 55% of Idaho respondents).
- **The COVID-19 pandemic continued to impact customer participation, but Avista pivoted throughout the year to find ways to address customer challenges related to the pandemic.**
  - Some of pandemic-related issues impacted project completion but Avista was lenient with project completion schedules to account for these challenges. Additionally, costs of equipment increased due to supply-chain issues, but Avista was able to increase some incentives to help customers alleviate this challenge.

Residential Recommendations

Residential Recommendation 1: Continue to use emails and bill inserts as the primary forms of program outreach to advertise Avista's residential programs and incentives. In outreach materials, consider using messaging focused on program benefits: energy savings, lower maintenance costs, and increased home comfort.

Residential Recommendation 2: Consult with contractors and identify tips for completing the rebate application that could be shared with customers who complete their own application. These tips could highlight the technical aspects of submitting the application, the steps involved in the application process, and the amount of detail needed for an application so that it can be approved quickly. Additionally, continue to encourage contractors and installers to complete the rebate application for customers to eliminate the confusion some customers feel when they fill out and submit the application themselves.

***Residential Recommendation 3*:** If not already available or planned for development, consider adding a way to track rebate status to the online portal so that contractors and customers can track the status of their applications and follow-up with Avista if anything seems incorrect.

APPENDIX F – 2021 COST-EFFECTIVENESS TABLES

Electric

Electric Portfolio

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 24,332,473	$ 18,179,009	1.34
Utility Cost Test (UCT)	$ 21,713,095	$ 10,527,569	2.06
Participant Cost Test (PCT)	$ 38,137,362	$ 14,873,620	2.56
Ratepayer Impact (RIM)	$ 21,713,095	$ 45,789,342	0.47

Electric Portfolio (without Low-Income)

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 23,218,700	$ 16,436,333	1.41
Utility Cost Test (UCT)	$ 21,067,239	$ 8,784,893	2.40
Participant Cost Test (PCT)	$ 36,396,949	$ 13,577,876	2.68
Ratepayer Impact (RIM)	$ 21,067,239	$ 42,878,597	0.49

Residential (Prescriptive and MFDI)

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 3,645,271	$ 3,358,020	1.09
Utility Cost Test (UCT)	$ 3,273,212	$ 1,834,075	1.78
Participant Cost Test (PCT)	$ 2,659,027	$ 1,926,716	1.38
Ratepayer Impact (RIM)	$ 3,273,212	$ 7,713,522	0.42

Commercial/Industrial

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 19,573,429	$ 13,078,313	1.5
Utility Cost Test (UCT)	$ 17,794,027	$ 6,950,818	2.56
Participant Cost Test (PCT)	$ 33,737,922	$ 11,651,160	2.9
Ratepayer Impact (RIM)	$ 17,794,027	$ 35,165,075	0.51

Multifamily Direct Install

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 179,852	$ 422,877	0.43
Utility Cost Test (UCT)	$ 163,502	$ 265,647	0.62
Participant Cost Test (PCT)	$ 240,266	$ 166,084	1.45
Ratepayer Impact (RIM)	$ 163,502	$ 497,059	0.33

Residential

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 3,465,419	$ 2,935,143	1.18
Utility Cost Test (UCT)	$ 3,109,710	$ 1,568,428	1.98
Participant Cost Test (PCT)	$ 2,418,761	$ 1,760,632	1.37
Ratepayer Impact (RIM)	$ 3,109,710	$ 7,216,463	0.43

Low-Income

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 1,113,773	$ 1,742,676	0.64
Utility Cost Test (UCT)	$ 645,856	$ 1,742,676	0.37
Participant Cost Test (PCT)	$ 1,740,413	$ 1,295,744	1.34
Ratepayer Impact (RIM)	$ 645,856	$ 2,910,745	0.22

Natural Gas

Natural Gas Portfolio

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 15,653,542	$ 9,340,020	1.68
Utility Cost Test (UCT)	$ 14,021,143	$ 4,862,834	2.88
Participant Cost Test (PCT)	$ 54,164,242	$ 8,463,283	6.40
Ratepayer Impact (RIM)	$ 14,021,143	$ 197,539,500	0.07

Natural Gas Portfolio (without Low-Income)

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 14,868,887	$ 7,699,564	1.93
Utility Cost Test (UCT)	$ 13,517,033	$ 3,222,378	4.19
Participant Cost Test (PCT)	$ 51,698,604	$ 7,306,207	7.08
Ratepayer Impact (RIM)	$ 13,517,033	$ 189,059,088	0.07

Residential (Prescriptive and MFDI)

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 13,328,625	$ 6,903,947	1.93
Utility Cost Test (UCT)	$ 12,116,794	$ 2,816,879	4.30
Participant Cost Test (PCT)	$ 49,978,337	$ 6,762,782	7.39
Ratepayer Impact (RIM)	$ 12,116,794	$ 187,086,628	0.06

Commercial/Industrial

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 1,540,262	$ 795,617	1.94
Utility Cost Test (UCT)	$ 1,400,239	$ 405,499	3.45
Participant Cost Test (PCT)	$ 1,720,267	$ 543,425	3.17
Ratepayer Impact (RIM)	$ 1,400,239	$ 1,972,460	0.71

Multifamily Direct Install

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 0	$ 471	0
Utility Cost Test (UCT)	$ 0	$ 471	0
Participant Cost Test (PCT)	$ 0	$ 0	0
Ratepayer Impact (RIM)	$ 0	$ 471	0

Residential

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 13,328,625	$ 6,903,476	1.93
Utility Cost Test (UCT)	$ 12,116,794	$ 2,816,408	4.30
Participant Cost Test (PCT)	$ 49,978,337	$ 6,762,782	7.39
Ratepayer Impact (RIM)	$ 12,116,794	$ 187,086,157	0.06

Low-Income

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Total Resource Cost (TRC)	$ 784,655	$ 1,640,456	0.48
Utility Cost Test (UCT)	$ 504,110	$ 1,640,456	0.31
Participant Cost Test (PCT)	$ 2,465,638	$ 1,157,076	2.13
Ratepayer Impact (RIM)	$ 504,110	$ 8,480,412	0.06

APPENDIX G – 2021 EXPENDITURES BY PROGRAM

Energy Efficiency Program	Electric	Natural Gas	Total
Energy Efficiency			
Low-Income			
Low-Income	$ 920,555	$ 1,157,076	$ 2,077,631
Residential			
ENERGY STAR Homes	$ 31,000	$ 3,000	$ 34,000
HVAC	$ 170,994	$ 1,663,352	$ 1,834,345
Multifamily Direct Install	$ 8,854	$ 0	$ 8,854
Shell	$ 133,292	$ 745,372	$ 878,665
Multifamily Weatherization	$ 28,265	$ 19,598	$ 47,862
Appliances	$ 11,820	$ 7,300	$ 19,120
Water Heater	$ 17,845	$ 222,300	$ 240,145
Commercial/Industrial			
Site-Specific	$ 2,695,514	$ 53,535	$ 2,749,049
Compressed Air	$ 0	$ 0	$ 0
Grocer	$ 3,268	$ 0	$ 3,268
Food Services	$ 12,810	$ 45,900	$ 58,710
Green Motors	$ 3,346	$ 0	$ 3,346
HVAC	$ 45,305	$ 34,400	$ 79,705
Shell	$ 377	$ 19,472	$ 19,849
Exterior Lighting	$ 1,372,192	$ 0	$ 1,372,192
Interior Lighting	$ 1,390,853	$ 0	$ 1,390,853
Energy Efficiency Total	**$ 6,846,289**	**$ 3,971,305**	**$ 10,817,594**
Market Transformation			
Northwest Energy Efficiency Alliance	$ 1,301,204	$ 367,208	$ 1,668,412
Brio Eastside Market Transformation	$ 203,543	$ 0	$ 203,543
Market Transformation Total	**$ 1,504,746**	**$ 367,208**	**$ 1,871,955**
Other Programs and Activities			
General Implementation	$ 930,559	$ 25,158	$ 955,717
Labor Costs	$ 1,916,662	$ 336,747	$ 2,253,409
Marketing Costs	$ 560,265	$ 64,832	$ 625,097
Third Party Implementation	$ 439,745	$ 454,697	$ 894,442
Pilot Programs	$ 175,869	$ 48,741	$ 224,610
EM&V/CPA	$ 300,295	$ 73,913	$ 374,208
CEEP Funds (inclusive of PY reimb)	$ (115,883)	$ 93,982	$ (21,900)
Other Programs and Activities Total	**$ 4,207,513**	**$ 1,098,070**	**$ 5,305,583**
Grand Total	**$ 12,558,548**	**$ 5,436,583**	**$ 17,995,131**

APPENDIX H – 2021 ENERGY EFFICIENCY ACTIVITY BY PROGRAM

Energy Efficiency Program	Participants		Evaluated Savings (kWh)	Participants		Evaluated Savings (Therms)
Low-Income						
Weatherization	210	Homes	114,783	333	Homes	8,256
HVAC	40	Units	125,883	54	Units	3,286
Water Heat	0	Units	0	22	Units	913
Outreach/Giveaways	20	Events	228	-	NA	0
Health and Safety	70	HHS	0	117	HHS	0
ENERGY STAR Refrigerator	1	Units	39 -	Units	0	
CEEP	17	Units	65,533	-	Units	0
Low-Income Total			**306,466**			**12,455**
Residential						
ENERGY STAR Homes	34	Homes	90,133	34	Homes	438
HVAC	409	Furnace, Thermostat	535,629	5,476	Furnace, Thermostat	306,026
Water Heat	83	Units	103,798	668	Units	43,696
Multifamily Direct Install	1,162	Units (Measures)	218,057	-	Units (Measures)	0
Shell	256	Windows, Insulation	390,726	1,345	Windows, Insulation	76,639
Appliances	327	Washer/Dryer	30,506	185	Washer/Dryer	721
Multifamily Weatherization	68	Units (Measures)	199,562	46	Units (Measures)	2,912
Residential Total			**1,568,411**			**430,433**
Commercial/Industrial						
Site Specific	451	Projects	12,733,816	7	Projects	290,463
Compressed Air	-	Units	-	-	NA	-
Grocer	6	Projects	43,292	-	Projects	-
Food Services	13	Projects	75,664	40	Projects	23,289
Green Motors	6	Motor Rewinds	18,905	-	NA	-
HVAC	24	Units	219,848	31	Units	10,692
Shell	8	Projects	2,188	10	Projects	3,151
Exterior Lighting	781	Projects	6,075,343	-	NA	-
Interior Lighting	785	Projects	9,574,219	-	NA	-
Commercial/Industrial Total			**28,743,276**			**327,595**
Energy Efficiency Total			**30,618,153**			**770,483**

Columbia National Wildlife Refuge, Othello, Washington