2020 Idaho Annual Conservation Report

July 30, 2021

St. Joe River, Idaho

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INTRODUCTION

Snake River, Lewiston, Idaho (left) and Clarkston, Washington (right)

INTRODUCTION

Avista has spent more than four decades developing responsible and cost-effective energy-efficiency programs. This 2020 *Annual Conservation Report* provides a synopsis of those efforts for the company's electric and natural gas customers in the state of Idaho – efforts that are designed not only to provide a least-cost resource, but also to help these customers conserve energy, save money, and live more comfortably – and delivers the results of third-party assessments of Avista's efficiency program portfolio performance.

Recommendations from these assessments, 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.

Customers continued to be the focus of Avista's Energy-Efficiency Program in 2020, though unanticipated impacts of COVID-19 caused the company to look for new avenues to reach them while also maintaining social distancing for the safety of customers, business partners, and employees. While Avista made significant efforts to maintain the program participation of a typical year, overall conservation achievements were affected by lower participation rates in 2020. Nevertheless, the company modified its outreach efforts, took steps to ensure customers stayed connected, and continued on its path of keeping power both affordable and reliable – efforts that are discussed in more detail in this report.

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

Note that the electric and natural gas savings conveyed in this report are provided as gross values based on all program participants.

FIGURE 1 – ELECTRIC AND NATURAL GAS SERVICE AREAS

TARIFF RIDER BALANCES

At the start of 2020, the Idaho electric and natural gas (aggregate) tariff rider balances were underfunded by $4.3 million, due primarily to the high level of conservation achieved during the 2016-17 program years. During 2020, $11.7 million in tariff rider revenue was collected to fund energy efficiency, while $8.9 million was expended to operate energy-efficiency programs. The $2.7 million excess of collections over expenditures contributed to the decrease in the underfunded balance of the tariff riders, resulting in an underfunded balance of $1.6 million by year end.

Table 1 illustrates the 2020 tariff rider activity by fuel type.

TABLE 1 – TARIFF RIDER ACTIVITY

	Electric		Natural Gas		Total	
Beginning Balance (Underfunded)/Overfunded	**$**	**(4,375,287)**	**$**	**78,073**	**$**	**(4,297,214)**
Energy-efficiency funding	$	10,273,434	$	1,382,684	$	11,656,119
Net funding of operations	$	5,898,147	$	1,460,757	$	7,358,905
Energy-efficiency expenditures	$	6,472,333	$	2,482,258	$	8,954,591
Ending Balances (Underfunded)/Overfunded	**$**	**(574,186)**	**$**	**(1,021,500)**	**$**	**(1,595,686)**

IDAHO ACHIEVEMENTS

- ***Electric Conservation:*** 16,710,969 kWh from local programs.
- ***Natural Gas Conservation:*** 352,548 therms from local programs.
- ***NEEA Conservation:*** An additional 3,578,000 kWh were achieved through the NEEA program, resulting in a total of 20,288,969 kWh for Avista's electric program. Moreover, the natural gas NEEA program achieved an additional 5,641 therms, resulting in an overall conservation savings of 358,189. Note that the *Annual Conservation Report* is intended to provide information on Avista's local programs; it will therefore refer to the local achievement of 16,710,969 kWh for electric and 352,548 therms for natural gas.

Program Impacts

COVID-19

COVID-19 created multiple and far-reaching impacts to Avista's customers. While the Energy-Efficiency Program saw a decline in participation, the impact was much more profound within the communities served. Many small businesses suffered financial losses, with more than 100 in the company's service territory closing permanently. Many people lost their jobs. Avista adapted its Energy-Efficiency Program to provide needed support to help customers through this unprecedented event.

COVID-19 Emergency Operating Plan Stages and Response

Early in 2020, Avista operated at the "Monitoring and Precautions" stage 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, the company had moved into the "Preventative" stage, which increased restrictions and limited customer interactions. By the middle of the 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.

Table 2 illustrates the four stages of the COVID-19 EOP.

TABLE 2 – 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.

Program Modifications during COVID-19

Installation Verification: Avista temporarily modified its approach to installation verification. For projects normally requiring on-site verification, the company allowed customers to submit photographs of installations. For some projects, photo submissions were supplemented with live video chats, enabling Avista to virtually walk through the facility and verify equipment installation. This approach met Avista's verification standard while maintaining safe working conditions for employees and customers.

Multifamily Direct Install Pilot: The Multifamily Direct Install (MFDI) program has historically been a high-touch approach to reducing customer energy use. The program uses a direct-installation process for LED lighting, faucet aerators, low-flow showerheads, and other low-cost energy-saving measures. In March, Avista's EOP response restricted staff and contractors from any work done in close proximity with customers; the program was therefore put on hold for the remainder of the year. In its place, the company worked with its implementer to develop a pilot process in which customers could drop off their old equipment, pick up energy-efficient items, and install them. This pilot is discussed in more detail later in the report.

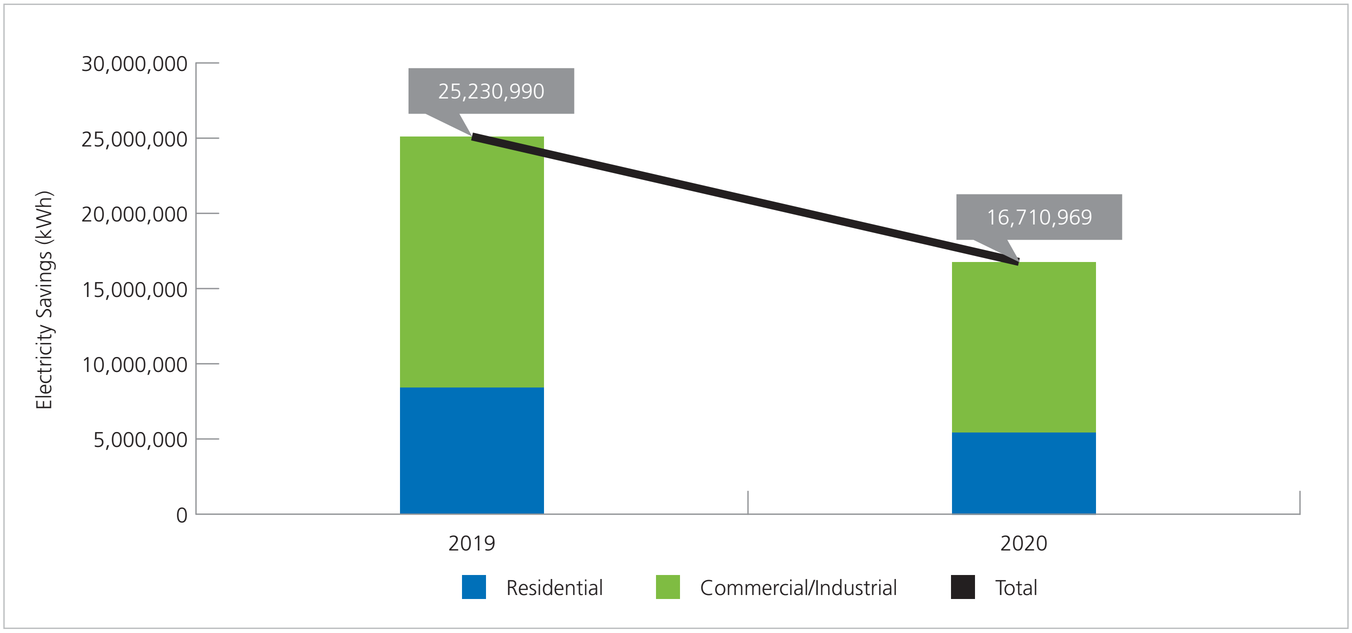
Account Executives: Avista's account executive (AE) team is responsible for maintaining working relationships with commercial/industrial customers. COVID-19 presented challenges for the AE team, because Avista's EOP "Critical" phase significantly limited face-to-face meetings; many business customers had similar restrictions. The impact of these restrictions was significant, because customers regularly report that direct contact and communication with Avista representatives is often their preferred channel to learn about incentives. Impacts ranged from customers closing operations for months, operating under reduced hours and workforce, or closing businesses permanently. Some businesses, however, experienced increased demand for products and services. Avista's commercial/industrial project pipeline became unpredictable as customers re-evaluated funding and scheduling for energy-efficiency projects. In response, the AE team pursued every opportunity to continue to engage with customers while adhering to the restrictions. The team's new Business Concierge program pivoted to pandemic response in the spring of 2020, helping connect business customers to critical resources related to COVID-19.

Customer Outreach: Energy fairs and outreach events were canceled, leaving a significant hole in Avista's ability to connect with 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 *Figure 2*, Avista's energy savings in 2020 were lower than in 2019 (16,710,969 kWh vs. 25,230,990 kWh). The reduction, seen in both residential and commercial/industrial programs, is mainly attributed to COVID-19 and the discontinuation of the Simple Steps, Smart Savings program. Savings acquired through the company's residential program decreased 34 percent between 2019 and 2020, while commercial/industrial programs decreased 33 percent.

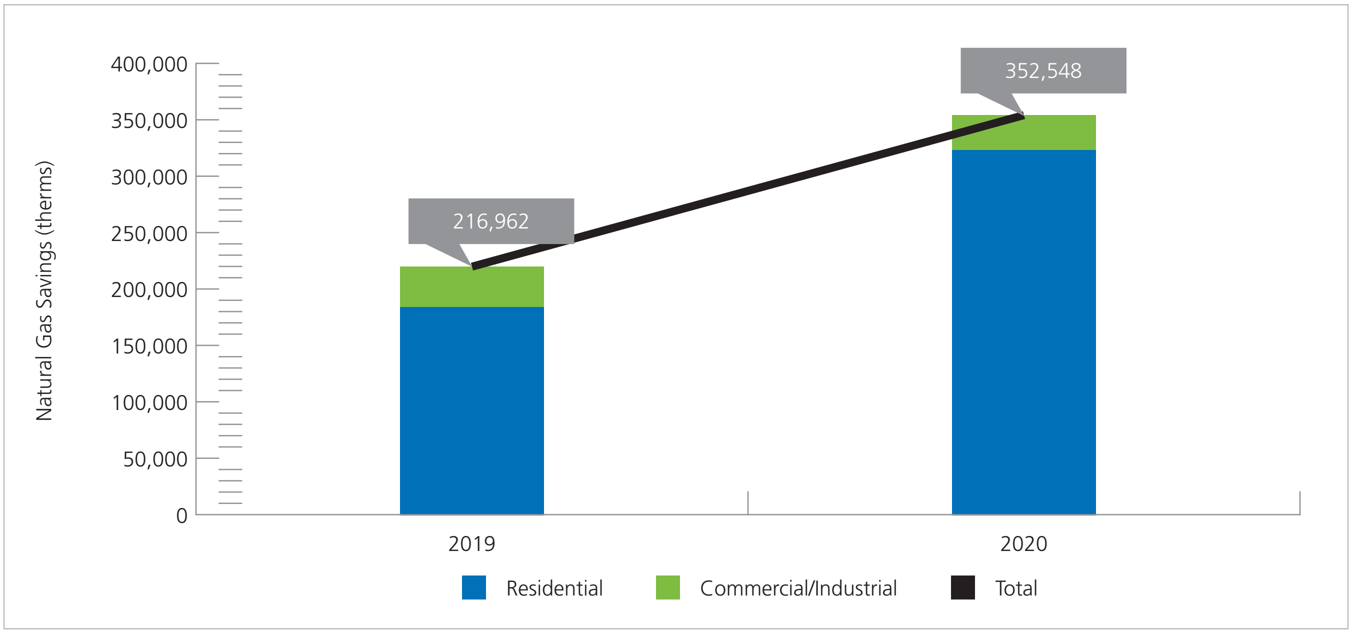
FIGURE 2 – ELECTRIC ENERGY SAVINGS (2019–2020)



Customer Segment	2019	2020
Residential (inclusive of low-income programs)	8,487,490	5,497,847
Commercial/Industrial	16,743,500	11,213,122
Total	**25,230,990**	**16,710,969**

As shown in *Figure 3*, Avista's natural gas portfolio had an increase in savings in 2020 compared to the prior year. Residential programs experienced a savings increase while the commercial/industrial programs saw a modest decrease. Savings acquired through the company's residential programs increased from 183,691 therms in 2019 to 323,044 in 2020, or 176 percent. Much of the change is attributed to a higher participation rate for residential HVAC programs, which include Avista's highest participation measures. Savings acquired through the company's commercial/industrial programs decreased 11 percent from 33,271 therms in 2019 to 29,503 in 2020. Overall natural gas portfolio savings increased by 63 percent.

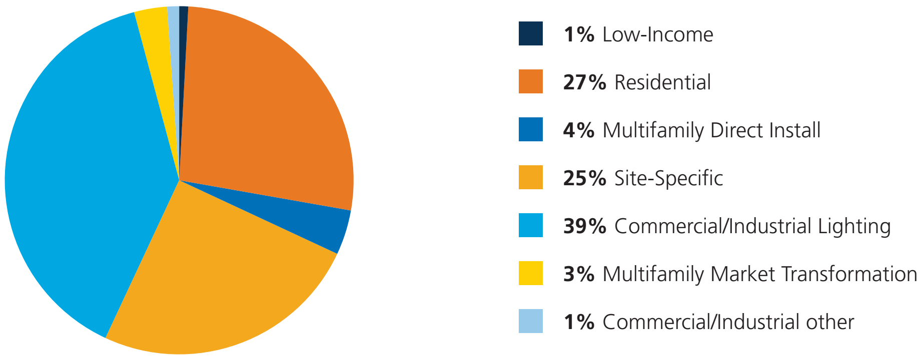
FIGURE 3 – NATURAL GAS ENERGY SAVINGS (2019–2020)



Customer Segment	2019	2020
Residential (inclusive of low-income programs)	183,691	323,044
Commercial/Industrial	33,271	29,503
Total	**216,962**	**352,548**

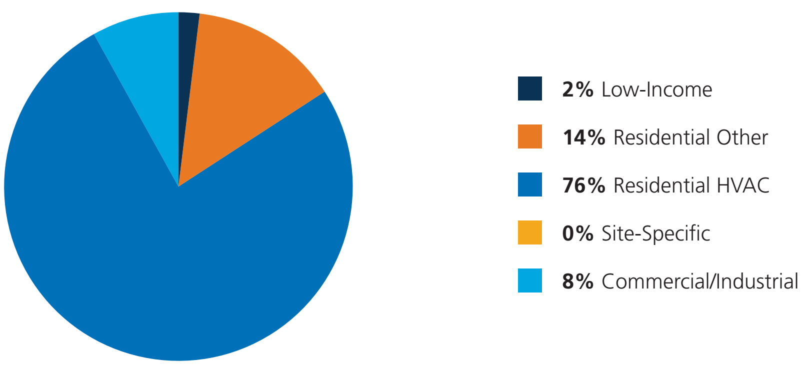
Of Avista's overall electric portfolio in 2020, the commercial/industrial prescriptive lighting and site-specific programs obtained 64 percent of the savings. All other programs combined achieved the remaining 36 percent (see *Figure 4*).

FIGURE 4 – ELECTRIC SAVINGS PORTFOLIO



Of Avista's overall natural gas savings portfolio, residential HVAC programs obtained 76 percent of the savings in 2020. The residential water heater, shell, and commercial/industrial programs combined achieved 24 percent of the overall savings for 2020. (see *Figure 5*).

FIGURE 5 – NATURAL GAS SAVINGS PORTFOLIO



Verified Savings

Avista's targets are set through the *Integrated Resource Plan* (IRP) process. Targets for 2020 were 15,387 MWh and 421,270 therms.

For the 2020 electric target, Avista chose to use the Conservation Potential Assessment (CPA) obtained from its 2017 electric *IRP* as the basis for its Annual Conservation Plan (ACP) savings goals and targets. The company's 2020 conservation acquisition target identified in its *IRP* was 15,387 MWh of qualifying energy efficiency in Idaho.

The 2020 natural gas target of 421,270 therms was identified in the 2018 natural gas *IRP* and was used to establish the targets for each program in the natural gas portfolio.

In 2020, the electric energy-efficiency portfolio achieved first-year annual energy savings of 16,711 MWh and natural gas savings of 352,548 therms. Based on the target established in the electric and natural gas *IRP*s, Avista achieved 109 percent of the electric savings target and 84 percent of the natural gas savings target. *Table 3* shows 2020 savings by fuel and sector.

The Idaho electric portfolio achieved an overall 89 percent realization rate.

TABLE 3 – ENERGY EFFICIENCY SAVINGS BY SECTOR – ELECTRIC

Sector	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Commercial/Industrial	13,194,720	11,213,122	85%
Residential	5,428,913	5,282,547	97%
Low-Income	195,603	215,300	110%
Total	**18,819,236**	**16,710,969**	**89%**

The Idaho natural gas portfolio achieved an overall realization rate of 119 percent as shown in *Table 4*.

TABLE 4 – ENERGY EFFICIENCY SAVINGS BY SECTOR – NATURAL GAS

Sector	Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
Commercial/Industrial	29,315	29,503	101%
Residential	263,167	317,550	121%
Low-Income	5,009	5,495	110%
Total	**297,491**	**352,548**	**119%**

Expenditures

The 2020 *Annual Conservation Plan* provided an expectation for operational planning, with Avista pursuing all cost-effective measures under Tariff Schedules 90 and 190. Since customer incentives are the largest component of expenditures, customer demand can easily affect the funding level of the tariff riders. *Table 5* provides a detailed comparison of budgeted to actual energy-efficiency expenditures by fuel type.

TABLE 5 – ANNUAL CONSERVATION PLAN BUDGET TO ACTUAL EXPENDITURES COMPARISON

	Electric	Natural Gas
Projected 2020 Expenditures		
Incentives budget	$ 4,605,923	$ 2,278,095
Non-incentives and labor	$ 1,828,069	$ 261,606
Market transformation, CPA, EM&V	$ 1,279,500	$ 133,500
Total Budgeted Expenditures	**$ 7,713,492**	**$ 2,673,201**
Actual 2020 Expenditures		
Incentives	$ 3,625,202	$ 2,005,738
Non-incentives and labor	$ 2,049,757	$ 297,365
Market transformation, CPA, EM&V	$ 797,374	$ 179,155
Total Actual Expenditures	**$ 6,472,333**	**$ 2,482,258**
Variance	**$ (1,241,159)**	**$ (190,943)**

Table 6 illustrates the top five programs with the highest impact on the expenditure variance.

TABLE 6 – PROGRAMS WITH HIGHEST IMPACT ON EXPENDITURE VARIANCE

Program	Planned	Actual	Variance	Variance Percentage
Site-Specific	$ 1,682,774	$ 922,158	$ 760,616	45%
Residential Conversions	$ 962,370	$ 340,785	$ 621,585	65%
Low-Income (electric)	$ 246,592	$ 637,629	$ (391,038)	(159)%
Commercial/Industrial Lighting Exterior	$ 647,545	$ 962,080	$ (314,535)	(49)%
Residential Prescriptive (natural gas)	$ 1,737,762	$ 1,426,403	$ 311,359	18%

EVALUATION APPROACH

Because evaluation is a critical component of any successful energy conservation program, Avista employs Evaluation, Measurement and Verification (EM&V) protocols to validate and report verified energy savings related to its energy-efficiency measures and programs. Those protocols represent the 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, are analogous with industry standard terms such as *portfolio evaluation* or *program evaluation*.) Avista also incorporates recommendations to improve program performance, enact changes to programs, and make decisions to phase out programs and measures.

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. 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 tracks those recommendations and uses them as inputs for the annual business planning process.

For 2020, Avista retained two separate firms to conduct impact and process evaluations of electric and natural gas programs in the utility's Idaho program portfolio. Cadmus conducted impact evaluations of the commercial/industrial program portfolio and process evaluations for most programs in the program portfolio; ADM performed impact evaluations of residential and low-income programs. Evaluations took a portfolio-wide evaluation approach to provide a benchmark to compare against future years. 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 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 a number of pilot projects and subcommittee evaluations; portions of the energy-efficiency savings acquired through the latter's regional programs are attributable to Avista's portfolio.

Evaluation Methodology and Activities

The 2020 Idaho electric portfolio impact evaluation took advantage of a variety of methodology approaches. Cadmus evaluated commercial, industrial, and multifamily programs using the following evaluation methods:

TABLE 7 – PROGRAM EVALUATION ACTIVITIES (ELECTRIC PROGRAM EVALUATION ACTIVITIES BY CADMUS)

Sector	Program	Document/Database Review	Verification/Metering Site Visits
Commercial/Industrial	Prescriptive (multiple)	✔	✔
	Site-Specific	✔	✔
Multifamily	Multifamily Direct Install	✔	--
	Supplemental Lighting	✔	--
Fuel Efficiency	Multifamily Market Transformation	✔	--

ADM evaluated programs in the residential electric portfolio with the following methods:

TABLE 8 – ADM IMPACT EVALUATION ACTIVITIES BY PROGRAM AND SECTOR

Sector	Program	Database Review	Survey Verification	Impact Methodology
Residential	Water Heat	✔	✔	RTF UES
	HVAC	✔	✔	RTF UES/Billing analysis with comparison group
	Shell	✔		RTF UES
	Fuel Efficiency	✔	✔	Avista TRM/Billing analysis with comparison group
	ENERGY STAR Homes	✔		RTF UES
	Simple Steps, Smart Savings	✔		RTF UES
Low-Income	Low-Income	✔		Avista TRM

More details about sample design for each sector are included later in this report and in Appendices A and C.

Each evaluator also chose a tailored approach for program evaluation in the gas portfolio. *Table 9* lays out evaluation activities by Cadmus.

TABLE 9 – PROGRAM EVALUATION ACTIVITIES (NATURAL GAS PROGRAM EVALUATION ACTIVITIES BY CADMUS)

Sector	Program	Document/Database Review	Verification/Virtual Site Visit
Commercial/Industrial	Prescriptive (multiple)	✔	✔
	Site-Specific	✔	✔
Fuel Efficiency	Site-Specific (Commercial/Industrial)	✔	--

ADM evaluated the following programs in the residential gas portfolio:

TABLE 10 – ADM IMPACT EVALUATION ACTIVITIES BY PROGRAM AND SECTOR

Sector	Program	Database Review	Survey Verification	Impact Methodology
Residential	Water Heat	✔	✔	Avista TRM
	HVAC	✔	✔	Avista TRM/IPMVP Option A
	Shell	✔		Avista TRM/Billing analysis with comparison group
	Fuel Efficiency	✔	✔	Avista TRM/Billing analysis with comparison group
	ENERGY STAR Homes	✔		Avista TRM
	Simple Steps, Smart Savings	✔		RTF UES
Low-Income	Low-Income	✔		Avista TRM

Cadmus was also contracted in 2020 to conduct process evaluation activities. The process evaluation focused on three fundamental objectives:

- Assess participant and market actor program journeys, including motivation for participation, barriers to participation, and satisfaction.
- Assess Avista and implementer staff experiences, including organizational structure, communication, and program processes.
- Document areas of success, challenges, and changes to the program.

Table 11 outlines the process evaluation activities that were completed in Idaho in 2020:

TABLE 11 – 2020 PROCESS EVALUATIONS FOR IDAHO PROGRAMS

Program
Commercial/Industrial Programs
Site-Specific
Prescriptive [a]
Multifamily Programs
Multifamily Direct Install
Multifamily Market Transformation
Residential
ENERGY STAR Homes
Simple Steps, Smart Savings

a) Includes Lighting, Food Service Equipment, Green Motors Rewind, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and AirGuardian Compressed Air.

Residential HVAC, Water Heat, and Shell/Window programs in Idaho will be evaluated following the 2021 program year.

Process evaluation findings are included in this report for each sector and, where relevant, at the program level under "Customer Satisfaction" headings.

Impact Evaluation Results, Portfolio

As a result of the impact evaluation performed, the following realization rates were achieved in the Idaho program portfolio:

- ***Electric:*** 89 percent realization rate and 16,710,969 kWh in annual verified savings.
- ***Natural Gas:*** 119 percent realization rate and 352,548 therms in annual gross savings.

The evaluators collected Avista's reported savings through database extracts from its customer care and billing (residential) and Infor CRM and iEnergy (commercial/industrial) databases, and from data provided by third-party implementers to determine evaluated savings.

COST-EFFECTIVENESS

Before implementing any new program, Avista conducts analyses to determine whether that program is cost-effective 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), the Participant Cost Test (PCT), and the Ratepayer Impact Test (RIM). For Idaho programs, the UCT is the most important. Avista's cost-effectiveness goal for both the electric and natural gas program portfolios is to have a UCT above 1.00, which indicates that the benefits to the utility exceed the costs of implementing the program. In 2020, the UCT benefit/cost ratios were 2.09 for electric and 1.64 for natural gas.

TABLE 12 – ELECTRIC PORTFOLIO COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 12,280,877	$ 5,886,868	2.09
Total Resource Cost (TRC)	$ 13,576,343	$ 9,852,524	1.38
Participant Cost Test (PCT)	$ 19,406,684	$ 7,712,680	2.52
Ratepayer Impact (RIM)	$ 12,280,877	$ 25,099,813	0.49

TABLE 13 – NATURAL GAS PORTFOLIO COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 3,751,762	$ 2,285,360	1.64
Total Resource Cost (TRC)	$ 4,220,253	$ 4,475,939	0.94
Participant Cost Test (PCT)	$ 5,638,507	$ 4,196,316	1.34
Ratepayer Impact (RIM)	$ 3,751,762	$ 12,999,595	0.29

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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 – and/or that does not meet its parameters – is automatically eligible for treatment through the Site-Specific program, subject to the criteria for participation in that program.

The Prescriptive program path is selected for simple, 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.

- ***1,020 commercial/industrial electric measures in 2020:*** Total savings of 11,213 MWh.
- ***65 commercial/industrial natural gas measures in 2020:*** Total savings of 29,503 therms in 2020.

TABLE 14 – COMMERCIAL/INDUSTRIAL VERIFIED SAVINGS BY PROGRAM

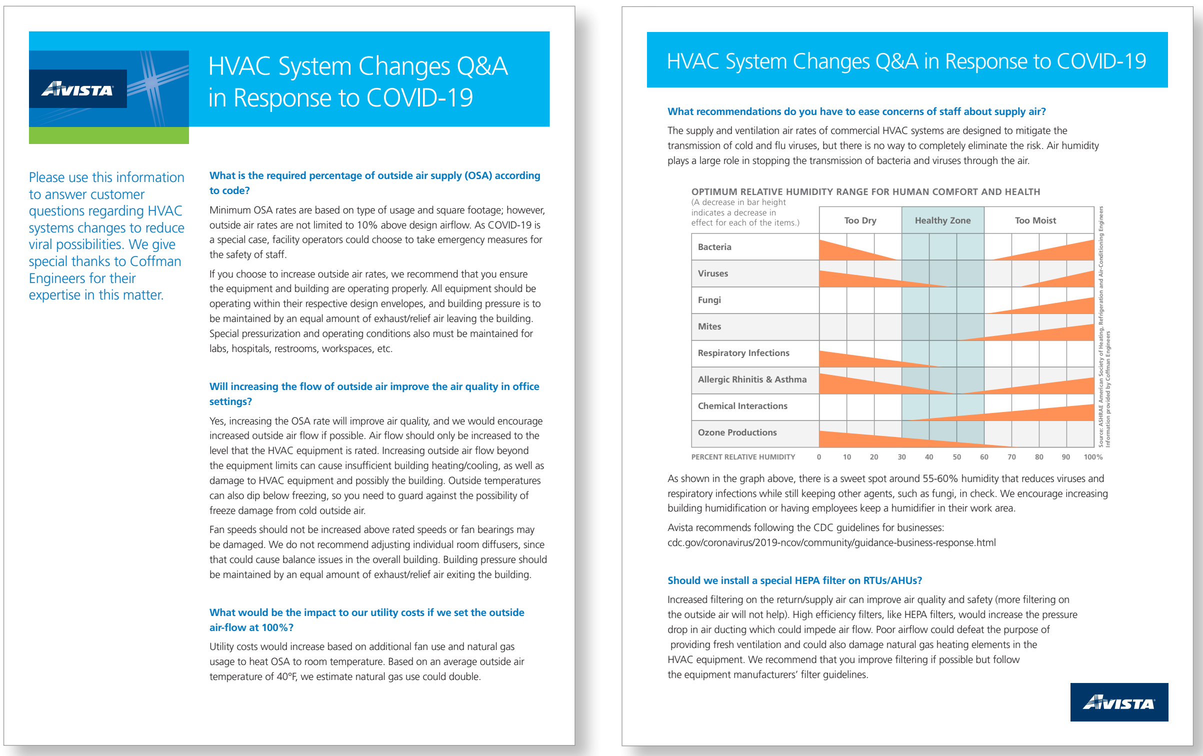
Commercial/Industrial	Program Type	Electric Savings (kWh)	Natural Gas Savings (Therms)
Exterior Lighting	Prescriptive	2,552,295	-
Food Services		13,761	13,597
Green Motors		52,038	-
Grocer		45,938	-
Interior Lighting		3,944,956	-
Shell		1,341	1,821
HVAC		-	13,992
SS Multifamily Market Transformation	Site-Specific	489,597	-
C&I Process		7,575	-
Compressed Air		32,412	-
Other		683,552	-
Shell Windows		4,916	94
Exterior Lighting		571,249	-
Interior Lighting		2,813,492	-
Total Commercial/Industrial		**11,213,122 kWh**	**29,503 therms**

Marketing

To assist commercial customers during the coronavirus pandemic, Avista developed communications materials that included tip sheets – e.g. "HVAC System Changes Q&A" – plus checklists for saving energy when shutting buildings down and when re-entering. To support small businesses, a flyer was created identifying sources of local, state, and federal help available in Idaho. Electronic newsletters containing information on Avista's energy-efficiency programs and related content were also sent to commercial and small business customers. Vendors were mailed updates about program information. New email templates were created for Avista's account executives, providing a customizable tool that could be used to promote various rebate programs to their customers.

Ongoing updates to Avista's website regarding energy-efficiency programs, as well as COVID-19 information, continued throughout the year.

FIGURE 6 – COMMERCIAL/INDUSTRIAL HVAC SYSTEM CHANGES Q&A IN RESPONSE TO COVID-19 FLYER



HVAC System Changes Q&A in Response to COVID-19

Please use this information to answer customer questions regarding HVAC systems changes to reduce viral possibilities. We give special thanks to Coffman Engineers for their expertise in this matter.

What is the required percentage of outside air supply (OSA) according to code?

Minimum OSA rates are based on type of usage and square footage; however, outside air rates are not limited to 10% above design airflow. As COVID-19 is a special case, facility operators could choose to take emergency measures for the safety of staff.

If you choose to increase outside air rates, we recommend that you ensure the equipment and building are operating properly. All equipment should be operating within their respective design envelopes, and building pressure is to be maintained by an equal amount of exhaust/relief air leaving the building. Special pressurization and operating conditions also must be maintained for labs, hospitals, restrooms, workspaces, etc.

Will increasing the flow of outside air improve the air quality in office settings?

Yes, increasing the OSA rate will improve air quality, and we would encourage increased outside air flow if possible. Air flow should only be increased to the level that the HVAC equipment is rated. Increasing outside air flow beyond the equipment limits can cause insufficient building heating/cooling, as well as damage to HVAC equipment and possibly the building. Outside temperatures can also dip below freezing, so you need to guard against the possibility of freeze damage from cold outside air.

Fan speeds should not be increased above rated speeds or fan bearings may be damaged. We do not recommend adjusting individual room diffusers, since that could cause balance issues in the overall building. Building pressure should be maintained by an equal amount of exhaust/relief air exiting the building.

What would be the impact to our utility costs if we set the outside air-flow at 100%?

Utility costs would increase based on additional fan use and natural gas usage to heat OSA to room temperature. Based on an average outside air temperature of 40°F, we estimate natural gas use could double.

HVAC System Changes Q&A in Response to COVID-19

What recommendations do you have to ease concerns of staff about supply air?

The supply and ventilation air rates of commercial HVAC systems are designed to mitigate the transmission of cold and flu viruses, but there is no way to completely eliminate the risk. Air humidity plays a large role in stopping the transmission of bacteria and viruses through the air.

As shown in the graph above, there is a sweet spot around 55-60% humidity that reduces viruses and respiratory infections while still keeping other agents, such as fungi, in check. We encourage increasing building humidification or having employees keep a humidifier in their work area.

Avista recommends following the CDC guidelines for businesses: cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html

Should we install a special HEPA filter on RTUs/AHUs?

Increased filtering on the return/supply air can improve air quality and safety (more filtering on the outside air will not help). High efficiency filters, like HEPA filters, would increase the pressure drop in air ducting which could impede air flow. Poor airflow could defeat the purpose of providing fresh ventilation and could also damage natural gas heating elements in the HVAC equipment. We recommend that you improve filtering if possible but follow the equipment manufacturers' filter guidelines.

FIGURE 7 – COMMERCIAL/INDUSTRIAL BUILDING SHUTDOWN CHECKLIST

AVISTA

Building Shutdown Checklist

GENERAL BEST PRACTICES

- [ ] Review this checklist one week prior to shutdown to ensure all arrangements are made to complete a successful shutdown of each building.
- [ ] Check that all windows and doors to the outside are closed and locked.
- [ ] Cooling Season: Lower and close all blinds to prevent solar heat gain.
- [ ] Heating Season: Open blinds to allow for warming (unless this creates a security issue).*
- [ ] Make a quick walkthrough of your building at the end of the last day of operation to see how you're doing and identify any potential problems. Listen/feel for any equipment that is running.
- [ ] Consolidate building activities during shutdown period and instruct occupants on set-back procedures.

*This is at the building owner's discretion (providing safety allows).

WATER

- [ ] Check all drinking fountains, faucets, showers and toilets for water leaks.
- [ ] Turn off any automatic flushing systems.
- [ ] Check water meters to verify there is not use (movement of the meter) due to water leaks.
- [ ] Turn off all water heaters that will not be needed.
- [ ] If possible, turn off or unplug drinking fountains containing individual refrigeration units.

LIGHTING

- [ ] Check that timers are working and set correctly for exterior lights that will be in operation during the break.
- [ ] Turn off all display-case lighting.
- [ ] Wherever possible, turn off all interior lights except exit/security lighting.
- [ ] Where lighting controls exist, adjust scheduling to be in accordance with new operation schedules.

HVAC

- [ ] Heating Season: Set temperatures to 45-50 degrees in all parts of the building.
- [ ] Cooling Season: Set temperatures to 80-85 degrees in all parts of the building or just shut off AC system.
- [ ] Ensure that all HVAC equipment is set to "auto," not "on." If individual rooms have working HVAC controls, check each room.
- [ ] Adjust your HVAC timers according to required schedules; review building automation system to ensure that schedules are updated for unoccupied period.
- [ ] Ensure that nothing is stacked on supplies or returns.
- [ ] Turn off all automatic and manual exhaust fans.
- [ ] Review the need for building ventilation and shut down all unnecessary ventilation fans.

ELECTRICITY

- [ ] Check to make sure that all unnecessary electrical appliances are turned off and unplugged. This includes copiers, computers, printers, televisions, fax machines, radios, water coolers, sound systems and task lighting.*
- [ ] For schools, check that all electrical appliances in the teachers' lounge are turned off and unplugged.
- [ ] Unplug vending machines (be sure to inform the vendor).
- [ ] Check computer rooms. Turn off and unplug computers, monitors, speakers, projectors and printers.
- [ ] Turn off intercom and conference room systems.

KITCHENS & WORKSHOPS

- [ ] Confirm that all kitchen equipment, both gas and electric, is turned off.
- [ ] Consolidate items from multiple refrigerators into one and clean out, open and unplug others.*
- [ ] Milk coolers not in use should be turned off.*
- [ ] Turn off electric water heaters at circuit box.
- [ ] Turn off any hot water boosters for kitchen dishwashers.
- [ ] Turn off domestic hot water circulating pumps, if feasible.
- [ ] Check to see that all compressors used in facilities or other shops are turned off.

*Send e-mail to appropriate staff requesting they take these steps prior to leaving.

FIGURE 8 – COMMERCIAL/INDUSTRIAL TIPS TO SAVE ENERGY WHEN SHUTTING DOWN COMMERCIAL BUILDINGS FLYER

AVISTA

Save energy when shutting down commercial buildings

Save energy when leaving a building unoccupied. Just follow these simple energy-saving tips from Avista. The larger your facility, the more you can save.

Leaving Lights On

If you are concerned about security, it's smart to leave at least one light on to deter burglars (or to put a few lights on an automatic timer). If you do leave any lights on, just make sure they are all LEDs, which use the least amount of energy. Businesses with a security fence should turn off all their lighting. Just make sure to close and lock your fence.

Unplug Energy-Nabbing Devices

Few people realize it, but electronics and appliances use energy even when they are off. These "parasitic load" devices include printers, scanners, personal entertainment systems, personal computers and other at-the-ready equipment that may be located throughout your offices. Unplugging these devices before you leave will save energy while you're temporarily away.

Curtains and Blinds

Save on heating and cooling by making sure all the windows of your building are closed and locked and that curtains and blinds are shut. This helps heat from coming in during the summer and prevents heat loss in the winter.

Refrigeration

A refrigerator can use up to $80 a year in electricity—even if it's not opened. To save energy, empty the contents of all refrigerators, unplug them, and open the doors (block them so they stay open). The same goes for any miniature refrigerators as well, and be sure to turn off lights in walk-in refrigerators. Also check to see if you have other types of refrigeration systems that can be shut off. You'll save money by pulling the plug on water coolers not being used, as well. If your business uses air compressors, shut them all off if there is not work occurring in the building. Although air compressors may not sound as if they're running, they will come on every time there is a slight drop in pressure. Last but not least, as you turn devices off, put sticky notes on them to remind people that they should be off (and as a reminder for you to turn them back on when you return).

HVAC Systems

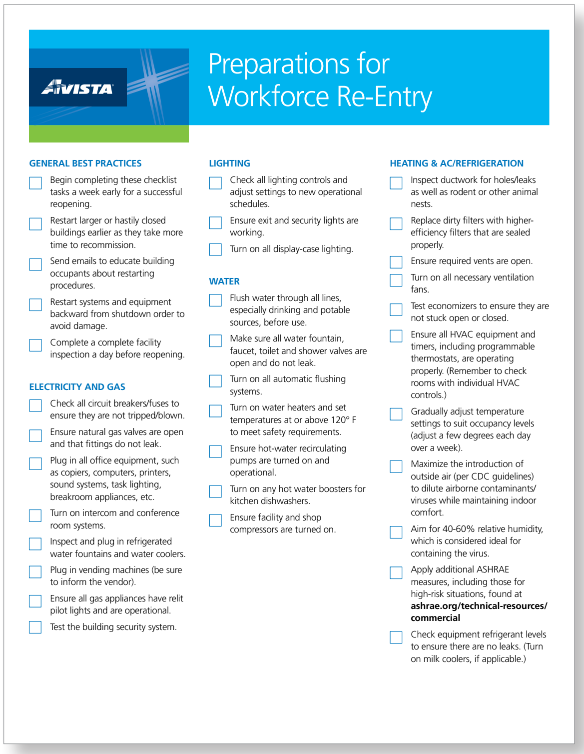
If you must shorten the occupancy hours of your building, also shorten the operating time of your HVAC system and automated lighting systems by changing the programming in your EMS system, programmable thermostats, or manual thermostats. If your building will be unoccupied for several weeks, consider lowering your HVAC heating set point to 45°F. This will create a noticeable drop in HVAC usage and should not pose a problem to the building, as long as you monitor for extended periods of freezing temperatures.

Water Heater

Save electricity or natural gas by turning down your water heater when you leave. A water heater consumes 25% of its energy to keep the tank of water warm—even if hot water is not being used. When lowering the water temperature, set it above 115°F or below 75°F to prevent the growth of Legionella bacteria, which can cause illness.

If you think you'll be away for an extended period, shut off your water heater completely. Make sure your circulation pumps are off, as well.

FIGURE 9 – COMMERCIAL/INDUSTRIAL PREPARATIONS FOR WORKFORCE RE-ENTRY CHECKLIST



AVISTA

Preparations for Workforce Re-Entry

GENERAL BEST PRACTICES

- ☐ Begin completing these checklist tasks a week early for a successful reopening.
- ☐ Restart larger or hastily closed buildings earlier as they take more time to recommission.
- ☐ Send emails to educate building occupants about restarting procedures.
- ☐ Restart systems and equipment backward from shutdown order to avoid damage.
- ☐ Complete a complete facility inspection a day before reopening.

ELECTRICITY AND GAS

- ☐ Check all circuit breakers/fuses to ensure they are not tripped/blown.
- ☐ Ensure natural gas valves are open and that fittings do not leak.
- ☐ Plug in all office equipment, such as copiers, computers, printers, sound systems, task lighting, breakroom appliances, etc.
- ☐ Turn on intercom and conference room systems.
- ☐ Inspect and plug in refrigerated water fountains and water coolers.
- ☐ Plug in vending machines (be sure to inform the vendor).
- ☐ Ensure all gas appliances have relit pilot lights and are operational.
- ☐ Test the building security system.

LIGHTING

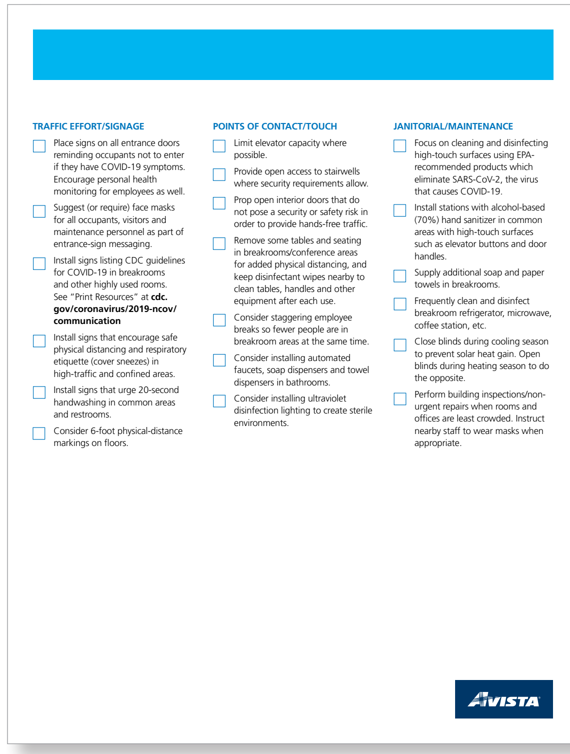
- ☐ Check all lighting controls and adjust settings to new operational schedules.
- ☐ Ensure exit and security lights are working.
- ☐ Turn on all display-case lighting.

WATER

- ☐ Flush water through all lines, especially drinking and potable sources, before use.
- ☐ Make sure all water fountain, faucet, toilet and shower valves are open and do not leak.
- ☐ Turn on all automatic flushing systems.
- ☐ Turn on water heaters and set temperatures at or above 120° F to meet safety requirements.
- ☐ Ensure hot-water recirculating pumps are turned on and operational.
- ☐ Turn on any hot water boosters for kitchen dishwashers.
- ☐ Ensure facility and shop compressors are turned on.

HEATING & AC/REFRIGERATION

- ☐ Inspect ductwork for holes/leaks as well as rodent or other animal nests.
- ☐ Replace dirty filters with higher-efficiency filters that are sealed properly.
- ☐ Ensure required vents are open.
- ☐ Turn on all necessary ventilation fans.
- ☐ Test economizers to ensure they are not stuck open or closed.
- ☐ Ensure all HVAC equipment and timers, including programmable thermostats, are operating properly. (Remember to check rooms with individual HVAC controls.)
- ☐ Gradually adjust temperature settings to suit occupancy levels (adjust a few degrees each day over a week).
- ☐ Maximize the introduction of outside air (per CDC guidelines) to dilute airborne contaminants/viruses while maintaining indoor comfort.
- ☐ Aim for 40-60% relative humidity, which is considered ideal for containing the virus.
- ☐ Apply additional ASHRAE measures, including those for high-risk situations, found at **ashrae.org/technical-resources/commercial**
- ☐ Check equipment refrigerant levels to ensure there are no leaks. (Turn on milk coolers, if applicable.)



TRAFFIC EFFORT/SIGNAGE

- ☐ Place signs on all entrance doors reminding occupants not to enter if they have COVID-19 symptoms. Encourage personal health monitoring for employees as well.
- ☐ Suggest (or require) face masks for all occupants, visitors and maintenance personnel as part of entrance-sign messaging.
- ☐ Install signs listing CDC guidelines for COVID-19 in breakrooms and other highly used rooms. See "Print Resources" at **cdc.gov/coronavirus/2019-ncov/communication**
- ☐ Install signs that encourage safe physical distancing and respiratory etiquette (cover sneezes) in high-traffic and confined areas.
- ☐ Install signs that urge 20-second handwashing in common areas and restrooms.
- ☐ Consider 6-foot physical-distance markings on floors.

POINTS OF CONTACT/TOUCH

- ☐ Limit elevator capacity where possible.
- ☐ Provide open access to stairwells where security requirements allow.
- ☐ Prop open interior doors that do not pose a security or safety risk in order to provide hands-free traffic.
- ☐ Remove some tables and seating in breakrooms/conference areas for added physical distancing, and keep disinfectant wipes nearby to clean tables, handles and other equipment after each use.
- ☐ Consider staggering employee breaks so fewer people are in breakroom areas at the same time.
- ☐ Consider installing automated faucets, soap dispensers and towel dispensers in bathrooms.
- ☐ Consider installing ultraviolet disinfection lighting to create sterile environments.

JANITORIAL/MAINTENANCE

- ☐ Focus on cleaning and disinfecting high-touch surfaces using EPA-recommended products which eliminate SARS-CoV-2, the virus that causes COVID-19.
- ☐ Install stations with alcohol-based (70%) hand sanitizer in common areas with high-touch surfaces such as elevator buttons and door handles.
- ☐ Supply additional soap and paper towels in breakrooms.
- ☐ Frequently clean and disinfect breakroom refrigerator, microwave, coffee station, etc.
- ☐ Close blinds during cooling season to prevent solar heat gain. Open blinds during heating season to do the opposite.
- ☐ Perform building inspections/non-urgent repairs when rooms and offices are least crowded. Instruct nearby staff to wear masks when appropriate.

AVISTA

FIGURE 10 – COMMERCIAL/INDUSTRIAL SUPPORT FOR SMALL BUSINESSES DURING THE COVID-19 CRISIS FLYER

AVISTA

Support for small businesses during the COVID-19 crisis

COVID-19 Small Business Resources for Idaho

Small businesses are the backbone of our country. It's why Avista is dedicated to supporting you in these challenging times. We want to empower small business owners like you by providing advice and services to help, including:

- Making payment arrangements
- Applying security deposits to existing account balances (if applicable)
- Providing references to existing resources in Idaho and the federal programs available from the $2 Trillion Coronavirus Aid, Relief, and Economic Security Act, (CARES Act)

Let our dedicated support team help with your business.

Please call **509-495-4717** or **800-936-6629** (Monday thru Friday, 7:00 a.m. to 5:00 p.m.) or email **businessaccounts@avistacorp.com**

(See additional information on back)

Where to find business relief assistance due to COVID-19

Avista is committed to a strong future for small businesses. Below are some sources of local, state and federal help that may be available to your small business.

Idaho Resources

Avista's COVID-19 Response and Resources:
Energy-saving tips for closing buildings, suggested HVAC system changes, FAQs and more.
myavista.com/safety/covid-19-response

Innovia Foundation:
Two COVID-19 Response and Recovery Funds for community-based organizations working at the frontlines of the outbreak in Eastern Washington and North Idaho.
innovia.org/covid19

Joint Business Service Providers
cdaedc.org/covid19

Idaho Small Business Development Center:
COVID-19 resources for North Idaho.
idahosbdc.org/covid-19-resources

Idaho Community Foundation
Response and Recovery Fund for Idaho, which will provide grants to trusted organizations that support and serve low-income Idahoans.
idahocf.org/covid-19

United Way of North Idaho
Coeur d'Alene Coronavirus Relief Fund
unitedwayofnorthidaho.org/coronavirus-relief-fund

Federal Resources

U.S. Senate Committee on Small Business & Entrepreneurship:
A small business owner's guide to the CARES Act.
sbc.senate.gov/public/index.cfm/guide-to-the-cares-act
home.treasury.gov/policy-issues/cares/assistance-for-small-businesses

SBA COVID-19 Small Business Guidance & Loan Resources:
Long-term, low-interest SBA loans due to COVID-19 for eligible small business owners.
sba.gov/page/coronavirus-covid-19-small-business-guidance-loan-resources

SBA Economic Injury Disaster Loan Program:
Working-capital loans of up to $2 million to help small businesses overcome temporary revenue loss.
disasterloan.sba.gov/ela

Paycheck Protection Program (PPP) information Sheet – Borrowers:
Borrowers information fact sheet.
home.treasury.gov/system/files/136/PPP--Fact-Sheet.pdf

Coronavirus Emergency Loans Guide and Checklist for Small Businesses:
uschamberfoundation.org/reports/coronavirus-emergency-loans-guide-and-checklist-small-businesses-and-nonprofits

Business & Industry Loan Guarantees
Offers loan guarantees to rural businesses.
rd.usda.gov/programs-services/business-industry-loan-guarantees

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. Initiated with an introductory letter followed by a site visit, it was updated in March 2020 to a mail campaign due to the COVID-19 pandemic. The BPP brings awareness of Avista's services to rural small business customers in Idaho and Washington, and includes information on energy audits, budget billing plans, energy-efficiency rebates, and, most recently, information about COVID-19.

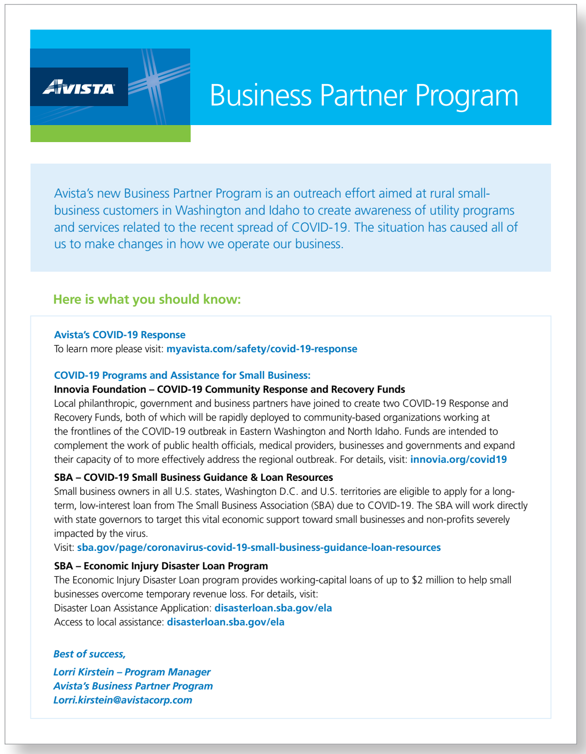
By the end of 2020, the BPP had reached 1,926 small businesses in 15 Idaho rural service territories. Outreach communication included mail, email, phone calls, and some initial site visits. Seven audits were performed, and 53 incandescent lamps were replaced with LEDs for a savings of 6,464 kWh.

In April of 2020, Avista introduced a 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 2020, the program provided cost estimates to eight small business customers in Idaho.

In response to the pandemic, Avista also pivoted its Business Concierge program to focus on COVID-19 resources. Avista customer service representatives contacted more than 2,600 business customers by phone to share information on resources available during the shutdown, including efficiency assistance, flexible repayment options, and information on Avista's shutoff suspension policy. This program helped connect business customers to critical resources, and also helped inform the company's ongoing response to the COVID-19 pandemic.

The outreach forecast for 2021 includes communication with 43 Idaho communities reaching 3,554 small business customers.

FIGURE 11 – COMMERCIAL/INDUSTRIAL BUSINESS PARTNER PROGRAM NEWSLETTER



Business Partner Program

Avista's new Business Partner Program is an outreach effort aimed at rural small-business customers in Washington and Idaho to create awareness of utility programs and services related to the recent spread of COVID-19. The situation has caused all of us to make changes in how we operate our business.

Here is what you should know:

Avista's COVID-19 Response
To learn more please visit: **myavista.com/safety/covid-19-response**

COVID-19 Programs and Assistance for Small Business:
Innovia Foundation – COVID-19 Community Response and Recovery Funds
Local philanthropic, government and business partners have joined to create two COVID-19 Response and Recovery Funds, both of which will be rapidly deployed to community-based organizations working at the frontlines of the COVID-19 outbreak in Eastern Washington and North Idaho. Funds are intended to complement the work of public health officials, medical providers, businesses and governments and expand their capacity of to more effectively address the regional outbreak. For details, visit: **innovia.org/covid19**

SBA – COVID-19 Small Business Guidance & Loan Resources
Small business owners in all U.S. states, Washington D.C. and U.S. territories are eligible to apply for a long-term, low-interest loan from The Small Business Association (SBA) due to COVID-19. The SBA will work directly with state governors to target this vital economic support toward small businesses and non-profits severely impacted by the virus.
Visit: **sba.gov/page/coronavirus-covid-19-small-business-guidance-loan-resources**

SBA – Economic Injury Disaster Loan Program
The Economic Injury Disaster Loan program provides working-capital loans of up to $2 million to help small businesses overcome temporary revenue loss. For details, visit:
Disaster Loan Assistance Application: **disasterloan.sba.gov/ela**
Access to local assistance: **disasterloan.sba.gov/ela**

Best of success,

Lorri Kirstein – Program Manager
Avista's Business Partner Program
Lorri.kirstein@avistacorp.com

Customer Satisfaction

Cadmus conducted process evaluations of the Site-Specific and Prescriptive programs for the 2020 program year. The methodology consisted of interviews with program staff at Avista as well as online surveys with trade allies and program participants.

Interviews with Avista program staff 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
- Market barriers
- Program impact on the market
- Future program changes including redesign

Cadmus completed 81 online surveys in 2020 with commercial/industrial program participants in Idaho and Washington. Cadmus relied on site visits and telephone reminder calls to increase survey participation. The participant survey guides gathered critical insights into participants' program journey, covering the following topics:

- Program awareness
- How respondents learned about the program
- General program participation
- Reasons for participation
- Program benefits
- Program delivery experience
- Overall program satisfaction
- Satisfaction with Avista
- Current energy-efficient behaviors and purchases
- Suggestions for program improvements

Key Findings

The impact of COVID-19 on project scope was minimal, but there may be slight reductions in the number or scope of energy-efficiency projects due to budget or staff constraints. Ten of 13 Site-Specific respondents and 88 percent of Prescriptive participants (n=59) said COVID-19 did not create any obstacles to their 2020 project; most respondents who reported obstacles said the obstacles were minor. Four of 13 Site-Specific respondents and 24 percent of Prescriptive respondents expected reductions to budget or staff availability to support energy-efficiency upgrades in 2021.

Although contractors drive a significant portion of participation, continued Avista outreach and messaging is important to support contractor sales. Eight of 15 Site-Specific participants and 70 percent of Prescriptive participants (n=63) reported first hearing about the Avista program from a contractor, vendor, or retailer. Twelve of 15 Site-Specific participants and 55 percent of Prescriptive participants (n=64) thought the best way to learn about rebates and incentives was through Avista emails or direct mail, or communication from an Avista account representative.

Despite some process issues in 2020, participants are satisfied with the application process and the program overall. Site-Specific satisfaction was lowest for process-related aspects, including submitting the rebate application (75 percent satisfied, n=15) and the time to process the application (87 percent satisfied), but 100 percent of respondents were satisfied with the program overall. Though 14 percent of Prescriptive participants mentioned the application paperwork was burdensome, and 9 percent had some difficulty understanding requirements, 100 percent of participants were satisfied with the program overall, and several respondents mentioned the easy and fast process as an aspect of the program that worked well. Suggestions for process improvements were related to potential enhancements (such as a searchable database of eligible products, or chat feature for application support) rather than suggestions to correct significant problems.

Recommendations

Cadmus offered the following recommendations to improve customer satisfaction for Avista's commercial/industrial programs:

- **Develop tools to help participants sort through options and scope eligible projects more quickly.** For example, although the Avista website currently directs customers to search for eligible lighting on the ENERGY STAR Product Finder database or Design Lights Consortium websites, both of which have advanced search functionality, the search results can be overwhelming. A resource such as an "Energy Efficiency Buying Guide" for specific products could help customers with less technical background navigate their options or evaluate and understand proposals they receive from contractors.
- **If not already doing so, use email blasts, bill inserts, and other promotional tools that are direct from Avista to its customers, and use Avista branding to promote commercial/industrial programs and incentives.** Participants were more likely to want communication directly from Avista than through their contractor or vendor. These marketing efforts will enhance any contractor and vendor marketing or advertising and give sales representatives better credibility, enabling them to make more sales through the program.

Program-specific customer satisfaction recommendations, as well as Avista's plans to improve this customer experience, are described in more detail in the program-by-program summaries (see pages 28-54).

Impact Evaluation

Although some individual project results varied, particularly within the Prescriptive exterior lighting program, the overall commercial/industrial sector performed strongly in 2020 relative to reported savings. Most projects that Cadmus sampled for the evaluation were well-documented and matched findings from the remote project verifications. Savings realization rates were as follows:

- ***Electric:*** Total verified savings of 10,723.5 MWh (excludes fuel conversions) in 2020 with a realization rate of 85 percent.
- ***Natural Gas:*** Total verified savings of 29,503 therms with a combined realization rate of 101 percent.

Performance and Savings Goals

The commercial/industrial sector did not meet the combined Prescriptive and Site-Specific program paths' electric goal of 15,020 MWh, with the programs achieving 71 percent of the overall goal. For natural gas programs, the commercial/industrial sector also fell short of the annual therm savings goal for combined Prescriptive and Site-Specific programs, achieving 29,503 therms (36 percent of the combined Prescriptive and Site-Specific program paths' natural gas savings goal of 82,680 therms).

Impact Evaluation Methodology

As the first step in evaluating electric and natural gas savings for the commercial/industrial sector, Cadmus explored the following documents and data records to gain an understanding of the programs and measures slated for evaluation:

- 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

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

Following this review, Cadmus designed a sample strategy for impact evaluation activities and performed the following evaluation activities in two waves:

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

Sample Design

Cadmus created two sample waves for 2020. Sample 1 included program data from January through June; sample 2 included program data from July through December. As a guideline, Cadmus used the proposed overall 2019 commercial/industrial sample sizes by subprogram in the measurement and verification plan, seeking to complete approximately half of the sample in each wave.

Cadmus initially estimated the total annual population size by reviewing the wave 1 population data and comparing it to 2018-19 population data. Cadmus developed initial sample size targets to achieve 90 percent confidence at ±10 percent precision (90/10) for the estimated annual population for 2020, with a target of 90/20 by program. After receiving the wave 2 population data, Cadmus revised the annual sample size targets for the full year and selected the wave 2 sample to complete the revised target within each program.

Avista advised Cadmus not to evaluate certain programs with low participation and historically consistent realization rates every year. Since the Green Motors program has shown a 100 percent realization rate in every prior evaluation, Cadmus did not evaluate the program in 2020, and does not plan to evaluate it in 2021. Cadmus plans to evaluate the Food Services program only in 2020, and the Energy Smart Grocer and Prescriptive Shell programs only in 2021.

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

Cadmus evaluated all other commercial/industrial programs that had participation in 2020.

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, the team selected the highest-savings applications with certainty. Within programs with a wide variance in savings, the team further stratified non-certainty applications by reported savings magnitude into small and medium strata, each with approximately 50 percent of the total non-certainty program savings. The team assigned random numbers within each stratum to select a random sample of non-certainty sites. In some cases, Cadmus selected additional applications at the same location as a previously selected application to evaluate as a convenience selection if the team could assess both applications in a single virtual visit.

Cadmus encountered some challenges contacting customers to evaluate the wave 1 sample, primarily due to changes in business operations as a result of the COVID-19 pandemic. The team pulled an additional backup sample for the wave 2 sample using random sampling, and recruited participants from the backup sample when participants from the initial random sample were unreachable.

The team pooled results from the randomly selected sites to calculate a realization rate by stratum and applied that realization rate to projects in the population in that stratum. Cadmus applied the project-specific evaluated savings for every project that was in the sample, regardless of whether it was a random, certainty, or convenience selection.

Table 15 summarizes the Idaho commercial/industrial Prescriptive program path evaluation sample. Cadmus sampled 41 Prescriptive applications at 32 unique sites. Of the sampled applications, the team selected five for certainty review based on the scale of savings, selected the 29 randomly, and selected seven additional convenience projects based on location. There was no participation in the AirGuardian, Fleet Heat, and Motor Control programs in 2020.

TABLE 15 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE ELECTRIC EVALUATION SAMPLE

Program Type	Applications Sampled [a]	Sampled Savings (kWh)	Percentage of Reported Savings
Interior Lighting	19	1,589,327	42%
Exterior Lighting	22	947,468	20%
Shell Measure	0	0	N/A
Green Motors	0	0	N/A
Food Service Equipment	2	13,761	100%
AirGuardian	0	0	N/A
Energy Smart Grocer	1	3,060	7%
Commercial/Industrial Prescriptive	**41**	**2,553,616**	**29%**

a) Three applications included measures in the interior lighting and exterior lighting programs, but each measure is only counted once in the total.

Table 16 summarizes the Site-Specific program path's evaluation sample, where Cadmus sampled 12 Site-Specific applications at 12 unique sites overall. Of the sampled applications, the team selected three for certainty review based on the savings scale and selected the remaining nine applications randomly.

TABLE 16 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC ELECTRIC EVALUATION SAMPLE

Program Path	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Site-Specific	12	2,366,694	59%

Table 17 summarizes the Idaho Commercial/Industrial Prescriptive program path natural gas evaluation sample. Overall, Cadmus sampled 14 Prescriptive applications at 14 unique sites, selecting all applications randomly. The team did not select any applications for certainty review.

TABLE 17 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NATURAL GAS EVALUATION SAMPLE

Program Type	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
HVAC	7	3,553	26%
Shell	0	0	0%
Food Service Equipment	7	4,490	33%
Commercial/Industrial Prescriptive	14	8,043	28%

Note: Totals may not sum due to rounding.

Table 18 summarizes the Idaho Commercial/Industrial Site-Specific program path's natural gas evaluation sample. Cadmus sampled one Site-Specific application at one unique site. The team selected the sampled application with certainty as it was the only gas participant in the Site-Specific program.

TABLE 18 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC NATURAL GAS EVALUATION SAMPLE

Program	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
Site-Specific	1	94	100%

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 (IV) reports.

Remote Verification

Cadmus performed virtual site visits and verification calls at 36 unique commercial/industrial locations to assess electric savings for 102 unique Prescriptive and Site-Specific measures (not including fuel efficiency measures) from 44 different applications. To assess natural gas savings, Cadmus performed verifications at 14 unique commercial/industrial locations in Idaho to assess natural gas energy savings for 17 unique Prescriptive and Site-Specific measures (not including fuel efficiency measures). Cadmus evaluated the remaining applications through desk reviews that did not require participant outreach, or through verification calls, which involved a brief discussion by phone or video to confirm key details and any information that was missing in the project documentation. Cadmus typically conducted video calls using the Streem platform that records video and audio. The team conducted some verifications using Microsoft Teams meetings if customers were unable to access Streem or preferred using Teams due to prior familiarity. Cadmus used the project documentation review and on-site findings to adjust the reported savings calculations where necessary.

Recommendations

Cadmus offers the following conclusions and recommendations to improve the commercial/industrial sector's energy savings:

- Avista's new iEnergy system has the capability to automatically calculate more detailed energy savings estimates since it records additional detailed inputs on some prescriptive measures that were not previously tracked in Infor CRM. Some of these inputs are not currently used in the savings calculations.

  Recommendation: Review deemed savings values for prescriptive measures and consider opportunities to take advantage of the additional data now collected in iEnergy to calculate more accurate savings for each participant project. For example, food service 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.

- The iEnergy system introduced variance of up to 2 percent between reported and evaluated savings by rounding intermediate wattage calculation values.

  Recommendation: Review iEnergy calculations to ensure that rounding is only applied on final displayed values and not to any intermediate values.

- Customer uncertainty on where program equipment was installed created challenges for verifying installed quantities and may have contributed to reduced realization rates for projects where verified quantities were less than reported.

  Recommendation: Update all application forms to include space for location notes for each installed measure and encourage contractors installing equipment at very large facilities to include installation location with equipment invoices.

- Variations in the level of detail in Avista IV reports introduced additional complexity in evaluating accurate measure counts, types, and operating parameters.

  Recommendation: Provide more consistent documentation with IV reports. Cadmus recommends that all IV reports include basic information to explicitly state 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.

Avista will consider these recommendations and identify new ways to take advantage of iEnergy to improve the accuracy of calculations. Avista is also planning to overhaul and streamline the installation verification process, which will result in a standardized template for installation verification reports.

Cost-Effectiveness

Tables 19 and *20* show the commercial/industrial sector cost-effectiveness results by fuel type.

TABLE 19 – COMMERCIAL/INDUSTRIAL ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 6,434,778	$ 3,207,038	2.01
Total Resource Cost (TRC)	$ 7,078,256	$ 5,975,711	1.18
Participant Cost Test (PCT)	$ 11,301,365	$ 5,238,461	2.16
Ratepayer Impact (RIM)	$ 6,434,778	$ 12,020,967	0.54

TABLE 20 – COMMERCIAL/INDUSTRIAL NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 181,083	$ 196,443	0.92
Total Resource Cost (TRC)	$ 199,192	$ 370,999	0.54
Participant Cost Test (PCT)	$ 219,873	$ 250,818	0.88
Ratepayer Impact (RIM)	$ 181,083	$ 340,054	0.53

As noted in *Table 20*, the UCT benefit to cost ratio for the commercial/industrial sector was 0.92 in 2020. While Avista always strives to ensure programs are cost-effective, the commercial/industrial natural gas program is very cost-sensitive due to its low participation rates. As compared to 2019, the 2020 program had a decrease in therm savings of approximately 4,000, which was enough to move the program from a 1.04 UCT to a 0.92 UCT.

Program-by-Program Summaries

Commercial/Industrial Site-Specific Program

TABLE 21 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC PROGRAM METRICS

Site-Specific Program Summary – Electric	2020
Participation, Savings, and Costs	
Conservation projects	108
Overall kWh savings	4,113,196
Incentive spend	$ 679,152
Non-incentive utility costs	$ 243,006
Idaho energy-efficiency rider spend	$ 922,158
Site-Specific Program Summary – Natural Gas	**2020**
Participation, Savings, and Costs	
Conservation projects	1
Overall therm savings	94
Incentive spend	$ 282
Non-incentive utility costs	$ 922
Idaho energy-efficiency rider spend	$ 1,204

Description

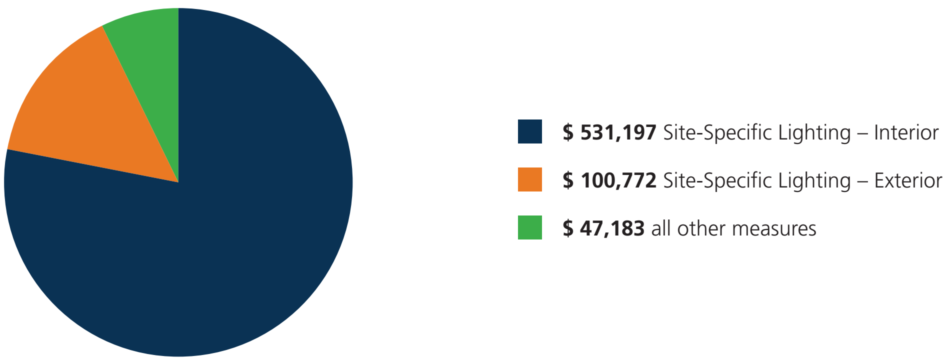
The commercial/industrial energy-efficiency market is delivered through a combination of prescriptive and site-specific offerings. Any measure not offered through a Prescriptive program is automatically eligible for treatment through the Site-Specific program, subject to the criteria for participation in that program. Avista's account executives work with commercial/industrial customers to provide assistance in identifying energy-efficiency opportunities. Customers receive technical assistance in determining potential energy and cost savings as well as identifying and estimating incentives for participation. Site-specific projects include appliances, compressed air, HVAC, industrial process, motors (non-prescriptive), shell, and lighting, with the majority being HVAC, lighting, and shell.

Program Activities

- ***Electric:*** Savings of 4,113,196 kWh, or 25 percent of the overall electric savings. The largest percentage of incentives went to interior lighting projects (68 percent) followed by exterior lighting (14 percent).
- ***Natural Gas:*** Savings of 94 therms in 2020, or 1 percent of the overall natural gas savings. All therm savings in the program came from shell measures.

Incentives by measure are listed in *Figure 12*.

FIGURE 12 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC INCENTIVE DOLLARS BY MEASURE



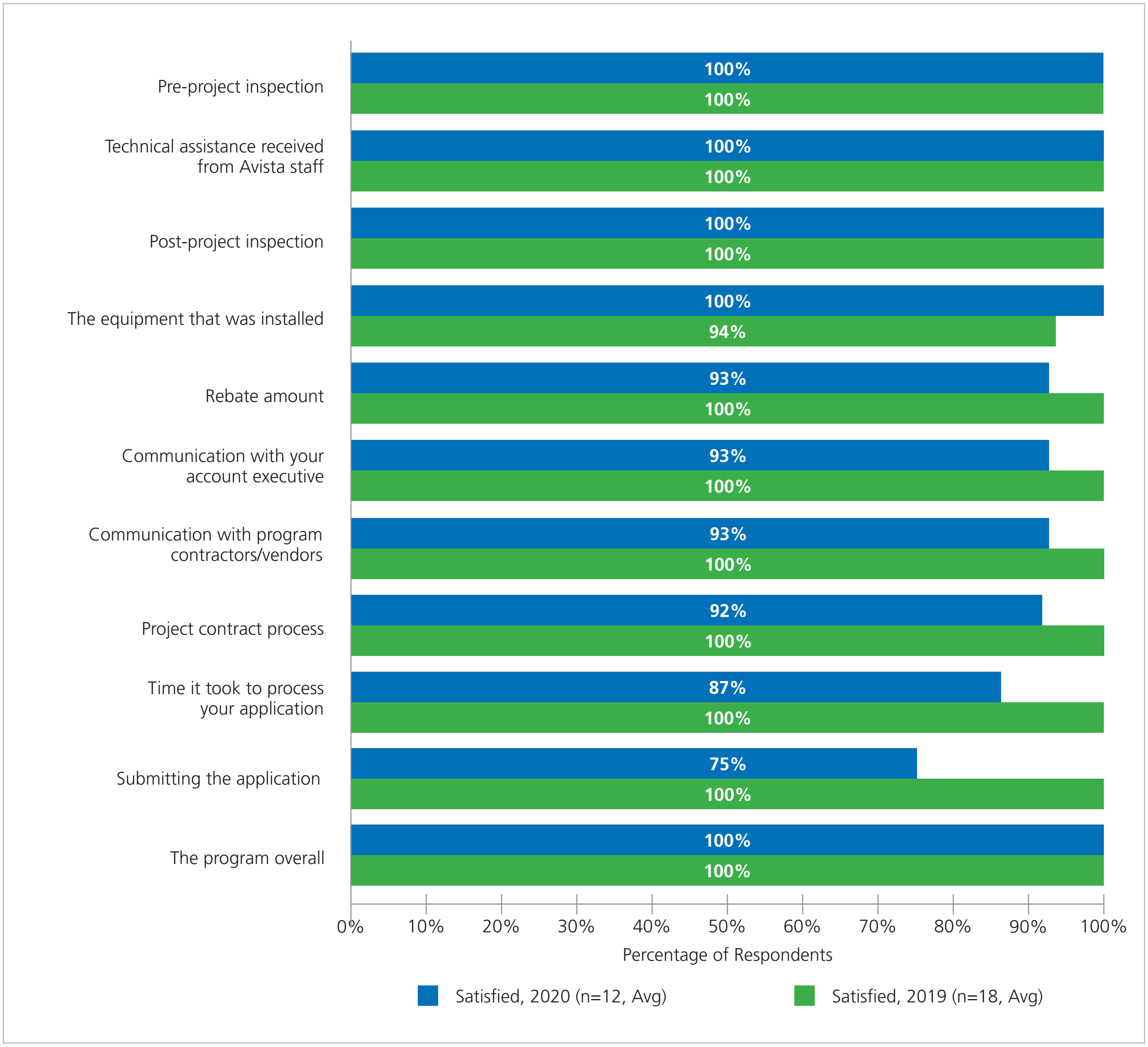
Program Changes

In 2020, Avista did not make any changes to the Site-Specific program. Incentives for any qualifying electric or natural gas energy-saving improvements with a 15-year simple payback or less continue to be offered.

Customer Satisfaction

Cadmus evaluated the Site-Specific program in its 2020 Process Evaluation. *Figure 13* compares the percentage of 2020 respondents rating themselves *very satisfied* or *somewhat satisfied* with different aspects of the Site-Specific program with responses from 2019. While overall satisfaction is very high, respondents were less likely to be satisfied with several components in 2020 than in 2019, in particular with the procedure to submit the application and the time it took to process it. In comments explaining their satisfaction levels, one respondent had difficulty understanding the paperwork, another experienced delays after their Avista representative retired, and a third reported this was their first energy-efficiency project, and they were unsure how to proceed.

FIGURE 13 – COMMERCIAL/INDUSTRIAL RESPONDENT SATISFACTION WITH SITE-SPECIFIC PROGRAM COMPONENTS



Source: 2020 and 2019 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.

As shown in *Table 22*, 10 of 15 2020 respondents reported experiencing program participation challenges. Another respondent reported having no challenges, while four others did not respond. In 2020, the most common challenge reported by participants was just learning about the program. Another two respondents reported internal challenges, related to getting approval to pursue the project and for the up-front capital expense.

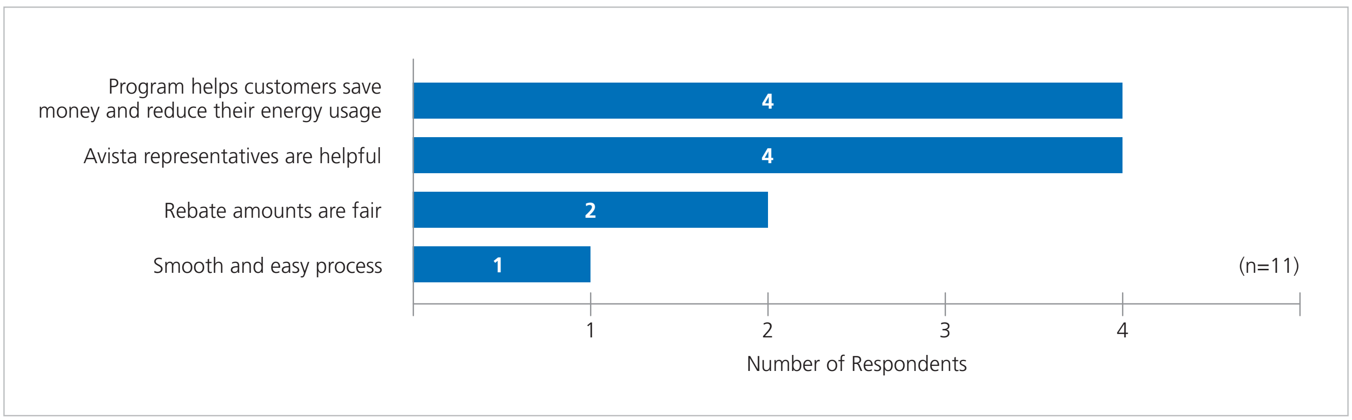
TABLE 22 – COMMERCIAL/INDUSTRIAL 2020 PARTICIPATION CHALLENGES

Challenge	2020 (n=10)
Discovering the program	3
Getting internal interest and approval	2
Finding eligible equipment	1
Understanding what equipment is eligible	1
Slow communication from Avista	1
Delay in receiving the rebate check	1
Finding a contractor willing to work with the program	1

Source: Site-Specific survey question E3: "What do you see as the biggest challenges to participating in Avista's Site-Specific program?"

Despite these issues, 11 respondents identified aspects of the program that they viewed as working well. For example, one Site-Specific participant said, "It is great that Avista is working with business[es] and residents to reduce the electrical demand with new tech." *Figure 14* shows the full breakdown of responses.

FIGURE 14 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC PROGRAM SUCCESSES

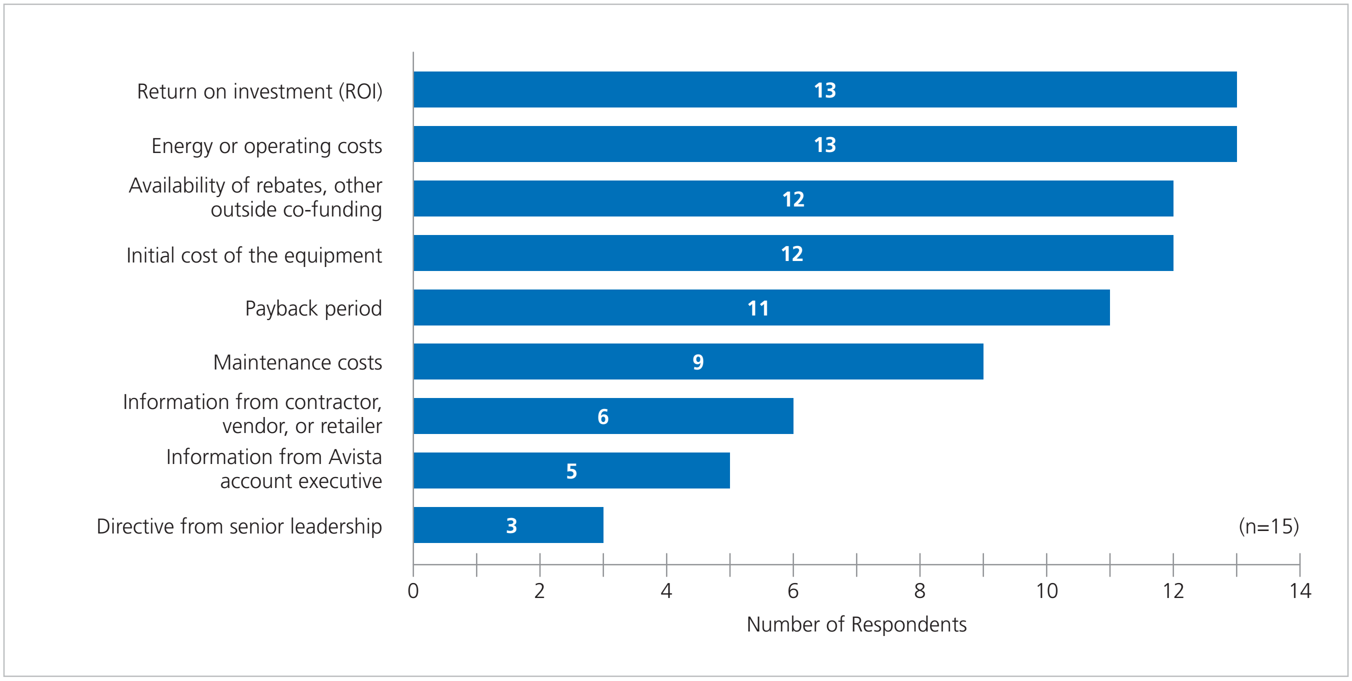


Source: Site-Specific survey question E5: "What would you say is working particularly well with Avista's Site-Specific program?" Multiple responses allowed.

When responding to questions about their motivation to pursue energy-efficiency projects, 12 of 15 respondents said the rebate provided by Avista was *very important* in their decision to complete their project. Another two said it was *somewhat important* and one said the rebate was *not too important* in their decision. All respondents said energy efficiency was *very* or *somewhat important* when making capital upgrades or improvements.

As shown in *Figure 15*, respondents most commonly selected the project's return on investment and energy or operating costs as the most important criteria in their decision to complete their project, followed closely by rebate or outside funding availability. These responses are similar to those from 2019.

FIGURE 15 – COMMERCIAL/INDUSTRIAL 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.

Impact Evaluation

Table 23 shows reported and evaluated electric energy savings for Avista's commercial/industrial Site-Specific program path for the program year. The overall Site-Specific program path had a 103 percent electric realization rate. The table does not include reported and evaluated electric savings for measures in the Multifamily Market Transformation program which, for the purposes of the Cadmus Impact Evaluation Report, were included as a Site-Specific program (see Site-Specific Multifamily).

TABLE 23 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC ELECTRIC IMPACT FINDINGS

Program Path	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Site-Specific	3,993,803	4,113,196	103%

Of 12 evaluated applications, Cadmus identified discrepancies in six, based on virtual site visits and project documentation review. *Table 24* summarizes the reasons for discrepancies between reported and evaluated savings.

TABLE 24 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC EVALUATION SUMMARY OF DISCREPANCIES

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	2	🡅	Cadmus found increased savings for one project that added new lighting controls which had not been accounted for in the reported savings. The lighting controls reduced the installed fixture wattage by dimming the lights throughout the space.
			Cadmus zeroed out negative savings for one line item – which should not have been approved – in which the installed wattage was higher than the existing wattage. This measure did not receive an incentive but was erroneously included in the reported savings.
Motor Control (VFD)	1	🡅	The original analysis for a paper mill wastewater pump variable frequency drive (VFD) project assumed a constant output voltage based on a single spot measurement and a 0.95 power factor from the VFD. Cadmus updated the analysis to estimate the energy use with the VFD with a 0.88 power factor based on the motor specifications and using the metered output voltage via the industrial control system trends, which showed the voltage varied significantly.
Exterior Lighting	1	🡅	Cadmus determined that the HOU for one sign lighting project was higher than reported through interviews with on-site staff. Unlike the prescriptive sign lighting projects, this project did not apply a deemed savings value to determine reported savings.
Compressed Air	1	🡇	Air compressor VFD power data were rounded in the original analysis files. Cadmus did not round any intermediate numbers, which resulted in slightly lower evaluated savings.
Refrigeration	1	🡇	Cadmus found that the original analysis included unrelated equipment in the baseline energy use. The project removed two self-contained freezers that were not replaced with energy-efficient equipment. Cadmus confirmed that the two freezers were removed because the site no longer sold frozen products. Cadmus updated the analysis to exclude unrelated freezer equipment in the baseline energy use calculation, decreasing baseline energy use and decreasing savings.

Table 25 shows reported and evaluated natural gas energy savings for Avista's 2020 commercial/industrial Site-Specific program path. The overall Site-Specific program path natural gas realization rate was 100 percent. The table does not include reported and evaluated natural gas penalties for measures in the fuel efficiency path.

TABLE 25 – COMMERCIAL/INDUSTRIAL SITE-SPECIFIC NATURAL GAS IMPACT FINDINGS

Program	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
Site-Specific	94	94	100%

Recommendations

- The evaluated lighting HOU assumptions for interior and exterior lighting projects did not always align with reported values.

  Recommendation: Review HOU estimates when processing applications and conducting installation verifications. When entering average weekly HOU, confirm how many weeks per year that schedule applies. In particular, Avista should apply additional scrutiny to applications claiming 8,760 hours per year.

- Discrepancies between reported fixture quantities and invoice quantities added complexity and uncertainty in evaluating the Site-Specific lighting program. It is often impractical for Avista staff conducting IV inspections or evaluators conducting verification visits to count every fixture for large lighting projects, necessitating a greater reliance on project documentation.

  Recommendation: Include more detailed documentation for Site-Specific lighting projects. Lighting drawings should be provided whenever possible, and if any other notes, spreadsheets, or other documentation are used to determine eligible quantities, these should be included with the application records. Any difference between invoice quantities and rebated quantities should be clearly explained.

- Avista may rely on spot measurements for values that vary during typical operation. The submitted analysis for a Site-Specific industrial process motor project assumed a fixed output voltage from the VFD based on a single spot measurement, but the plant's industrial control system was capable of recording voltage trend data. Cadmus worked with the customer to add a voltage trend and determined that the VFD voltage output actually varied significantly in daily operation.

  Recommendation: Assume that amperage and voltage output from a VFD may fluctuate significantly. Whenever possible, configure trend data collection for both values. If a voltage trend is unavailable, take multiple spot voltage readings at various VFD speeds or consider installing a temporary power data logger.

Plans for 2021

Avista plans to continue to offer the Site-Specific program in Idaho for both electric and natural gas customers in 2020. Avista will assess the current measurement and verification process and develop a standardized installation verification report. Avista will also employ a process change to more closely assess HOU assumptions in lighting calculations.

Commercial/Industrial Multifamily Natural Gas Market Transformation

TABLE 26 – COMMERCIAL/INDUSTRIAL MULTIFAMILY NATURAL GAS MARKET TRANSFORMATION PROGRAM METRICS

Multifamily Natural Gas Market Transformation Program Summary	2020	
Participation, Savings, and Costs		
Conservation projects		4
Overall kWh savings		489,597
Incentive spend	$	444,000
Non-incentive utility costs	$	48,967
Idaho energy-efficiency rider spend	$	492,967

Description

The Site-Specific program path also includes a market transformation initiative intended to encourage natural gas space and water heating in multifamily residential developments. The focus is on new-construction multifamily residential rental buildings with five or more units. The goal of the program is to address the split incentive issue where developers are focused on low development costs, which can drive low-efficiency heating choices and place a higher cost burden on building tenants. The program intends to create developer confidence in natural gas as a heating option for multifamily construction, while also helping developers and building owners understand the added long-term value of natural gas space and water heating systems. Avista offers program incentives of $3,000 per unit for converting to natural gas by installing standard-efficiency space heat and water heaters.

Program Activities

In 2020, Idaho program performance was consistent with prior years. Four projects with a total of 132 units were constructed. Savings totaled 489,597 kWh and $492,967 in total tariff rider spend. The multifamily market transformation program accounted for approximately 20 percent of fuel efficiency savings in 2020.

Program Marketing

Avista's account executive team focused on creating relationships with regional builders, including one-on-one conversations with contractors and developers. The team also engaged in regular informal check-ins to provide education about offered programs, benefits, savings, and payoffs in installing natural gas – from environmental, comfort, and cost-saving standpoints.

FIGURE 16 – COMMERCIAL/INDUSTRIAL MULTIFAMILY NATURAL GAS INCENTIVE PROGRAM FLYER

Customer Satisfaction

Overall, the Multifamily Natural Gas Market Transformation (MFMT) program was successful in meeting the energy savings goal and achieving high program satisfaction.

- The program surpassed its electric savings goal of 476 MWh per year for 2020.
- Builders have told Avista staff that they appreciate the incentive because it allows them to install natural gas appliances which provides a competitive advantage, since they say natural gas appliances are more attractive and can help increase the value of units.
- The builder who completed a survey said they were *very satisfied* with the program and planned to participate to a greater extent in 2021.

The MFMT program has had success working with HVAC installers to help market the program – though more can be done to increase marketing efforts and participation.

- Avista reported success working with HVAC installers to help promote the program. Staff said this is a beneficial relationship as the HVAC installers are provided with additional work and the program with more participants.
- Avista reported that there used to be a flyer handed out as promotional material for the program, though it is no longer used. Staff also said there is no current way in which they monitor effectiveness of their marketing efforts and do not cross-promote the MFMT program with other Avista programs.

Impact Evaluation

Cadmus followed the same impact evaluation methodology for fuel-efficiency measures as outlined in the *Impact Evaluation Methodology* section on page 23. Two MFMT applications were sampled. Of the sampled applications, the team selected one for certainty review based on the savings scale and selected one randomly.

TABLE 27 – COMMERCIAL/INDUSTRIAL FUEL EFFICIENCY IMPACT FINDINGS

Fuel Efficiency Measure	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Multifamily Market Transformation	528,727	489,597	93%
Total	**528,727**	**489,597**	**93%**

Cadmus identified discrepancies for one high-rise residential tower project that installed a central boiler and chiller system. Avista used the typical deemed savings values for MFMT HVAC measures. Avista developed these savings values through an internal engineering study using building simulation modeling. The savings values are based on the number of apartment units and the rated efficiency of natural gas furnaces replacing electric resistance heaters, and assume a three-story building with a ground, middle, and top floor.

This building had 16 middle floors of residential units, while the ground and top floors did not have residential units. Although this project was eligible per the program criteria, the deemed savings values were not designed to account for this type of installation due to the building layout and because it installed boilers instead of furnaces. Cadmus adjusted the analysis to use the deemed savings value for middle floor units only and to account for additional energy consumption required for the boiler circulation pumps. These adjustments reduced energy savings because the middle-floor units experience less heat loss relative to the ground- and top-floor units, and because pump energy is not required with gas furnace heating.

Recommendations

Cadmus offers the following conclusions and recommendations to improve Avista's MFMT measures:

- Avista's deemed savings values for MFMT HVAC measures are intended for natural gas furnaces and do not accurately estimate savings for central boiler systems because they have additional energy consumption from pumps, experience heat loss in the piping system between the boiler and the conditioned space, and have substantially different equipment sizing, heat transfer properties, and fuel consumption.

  Recommendation: Only use deemed savings in this program for standard forced air gas furnaces that directly heat residential spaces. Analyze eligible projects with any other type of equipment using a site-specific approach, which may require a custom energy model for that particular building.

- Avista's deemed savings values for MFMT HVAC measures overestimate savings for buildings with more than one middle floor, because they assume a three-story building with a ground, middle, and top floor.

  Recommendation: Include a place for MFMT HVAC applications to confirm the number of floors in the building and should apply a weighted average of the deemed savings for ground, middle, and top floors when a building does not have the standard three-story layout.

Cadmus offers the following process improvement recommendations to improve customer satisfaction:

- Develop marketing materials which can be used by HVAC contractors to help promote the MFMT program. Due to the strengthening relationships between program staff and HVAC contractors, promotional materials could be greatly beneficial to provide information about the program in instances where the contractors may encounter potential participants.
- Develop strategies to evaluate the effectiveness of marketing efforts and cross-promotion with other Avista programs. In order to understand if marketing efforts are successful, evaluation standards or goals should be set to better understand what the primary forces are that drive participation to the program. Cross-promotion is also a simple and effective way to increase visibility of the program and garner interest from potential participants.

Plans for 2021

The program will continue in the Idaho service area. Avista will also assess project documentation for this program and determine if process improvements need to be made or if incentive levels need to be adjusted. Avista will also consider an increase in marketing efforts for this program, in alignment with the marketing recommendations offered by Cadmus.

Commercial/Industrial Prescriptive Lighting Programs

TABLE 28 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAMS METRICS

Prescriptive Lighting Program Summary		2020
Participation, Savings, and Costs		
Conservation projects		888
Overall kWh savings		6,497,251
Incentive spend	$	1,207,030
Non-Incentive Utility Costs	$	385,746
Idaho Energy Efficiency Rider spend	$	1,592,776

Description

This program is intended to prompt commercial/industrial 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 is opportunity for lighting improvements in commercial facilities – and, 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

Savings for prescriptive lighting were 6,497,251 kWh, or 58 percent of commercial/industrial electric savings, a substantial increase in savings compared to 2019 and exceeding the goal of 6,078,000 by 7 percent.

As the continued shift toward more prescriptive exterior lighting measures occurred in 2019 and 2020, the four-foot T12/T8 lamp replacement measure fell second to the sign lighting measure as the most popular measure, which also achieved the highest kWh savings in 2020.

As seen in *Figure 17*, lighting throughput was not affected by COVID-19 in 2020. There was a noticeable shift toward exterior lighting projects throughout the year, which may have been a result of social distancing measures. However, apart from June and September, monthly goals were met and annual savings targets were not affected.

FIGURE 17 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM SAVINGS BY MONTH

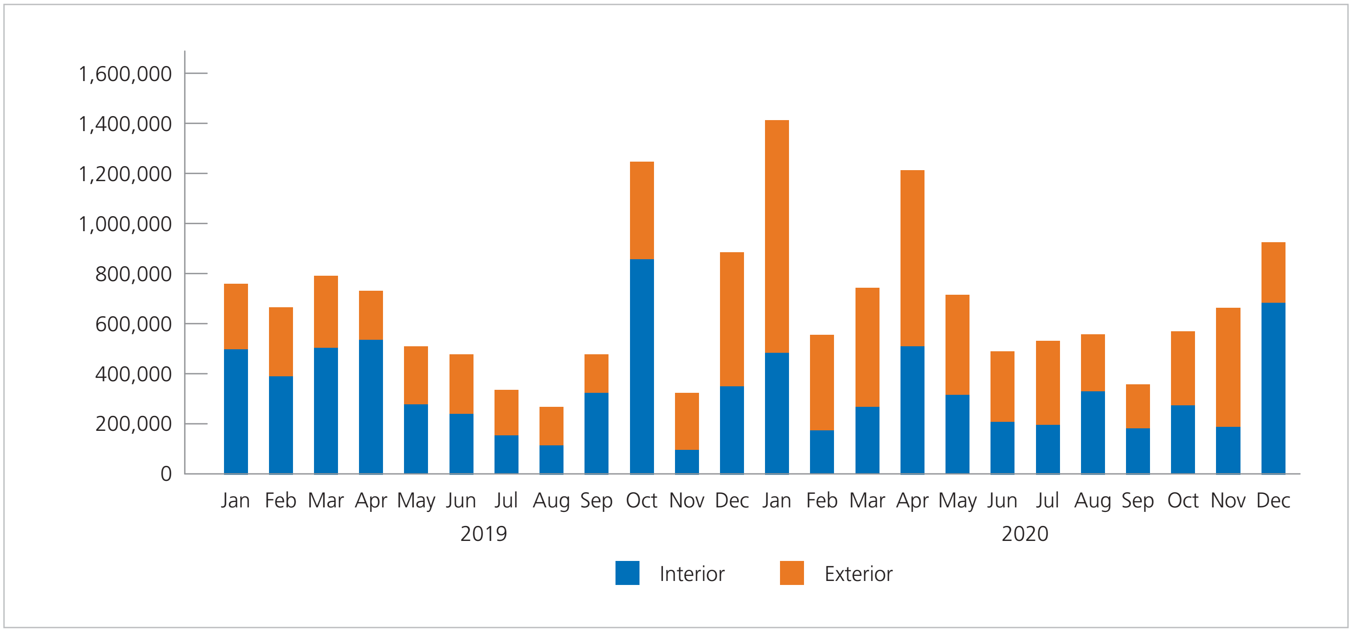


FIGURE 18 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INTERIOR LIGHTING KWH SAVINGS BY MEASURE

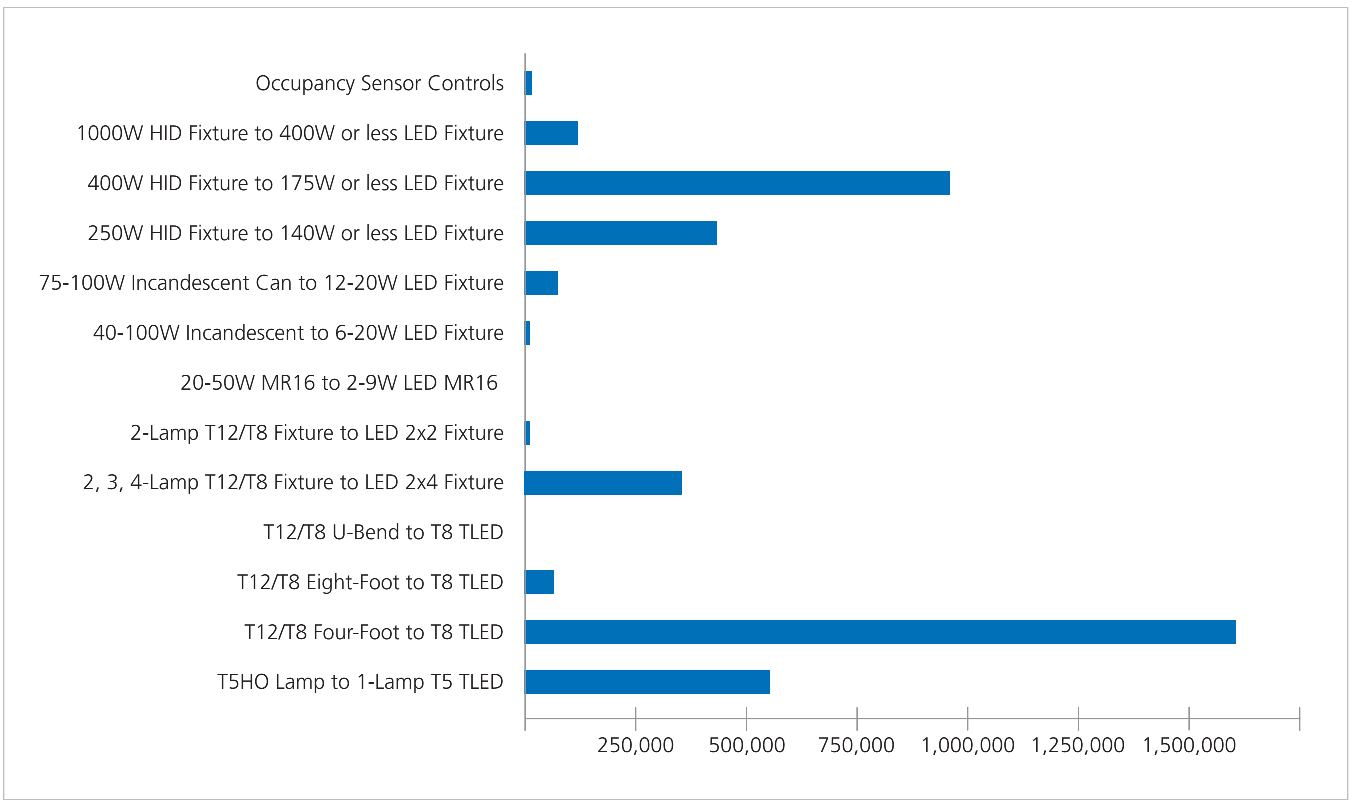
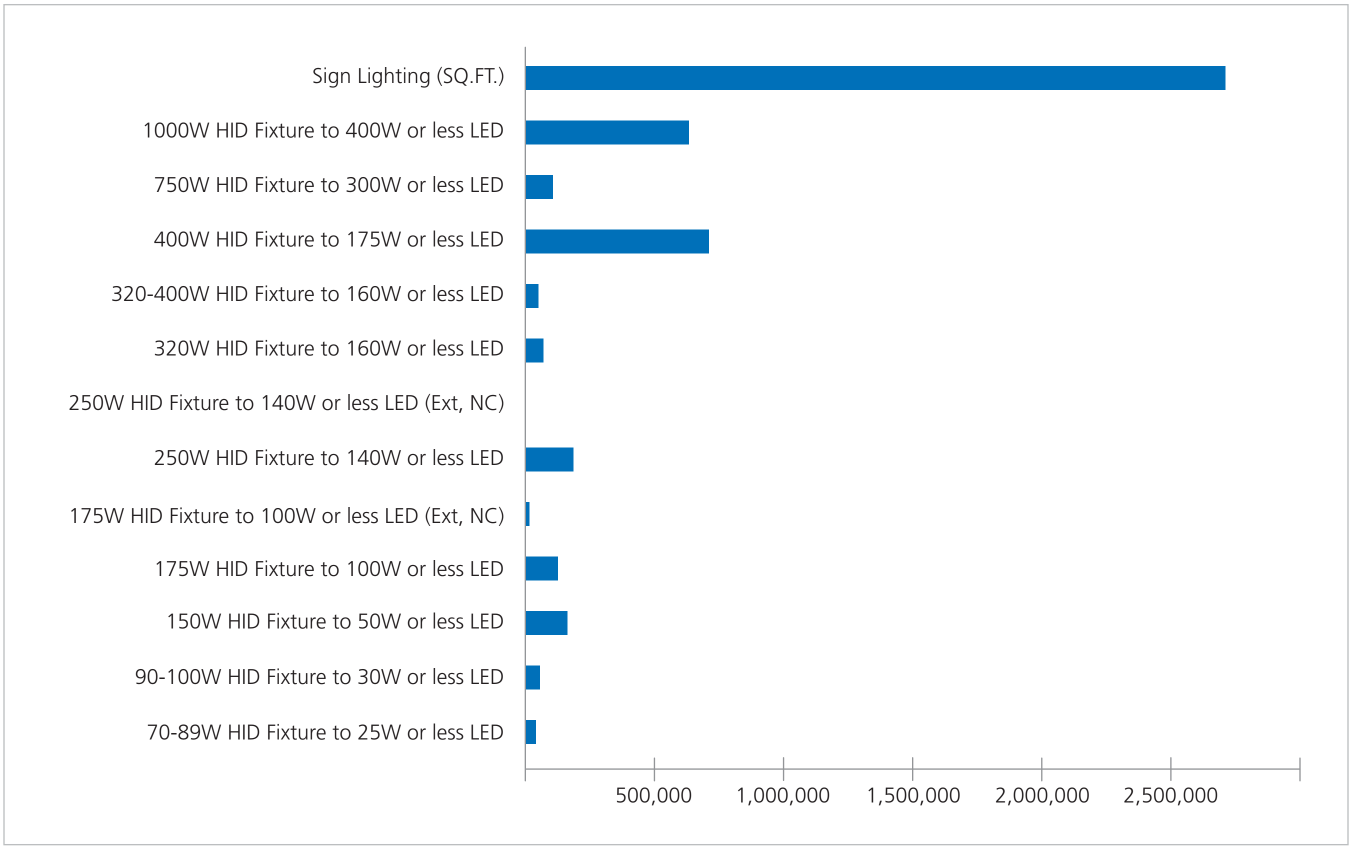


FIGURE 19 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE EXTERIOR LIGHTING KWH SAVINGS BY MEASURE



Program Changes

Avista made the following changes to the program in 2020:

TABLE 29 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM CHANGES

2020 Changes to Commercial Exterior Lighting Rebates	2019	2020	Notes
Exterior Lighting			
Replacement HID Lighting (Pole, Wallpack, or Cano) – Requires at Least 4,288 Hours of Use per Year – Must Be DLC-Rated *Eligible only if ballast and all other existing electrical components are removed.			
70-89W HID fixture to ≤ 25W LED fixture, retrofit kit, or lamp	$ 60	$ 65	Incentive Increase
90-100W HID fixture to ≤ 30W LED fixture, retrofit kit, or lamp	$ 80	$ 85	Incentive Increase
150W HID fixture to ≤ 50W LED fixture, retrofit kit, or lamp	$ 125	$ 130	Incentive Increase
175W HID fixture to ≤ 100W LED fixture, retrofit kit, or lamp	$ 130	$ 130	
250W HID fixture to ≤ 140W LED fixture, retrofit kit, or lamp	$ 140	$ 160	Incentive Increase
320W HID fixture to ≤ 160W LED fixture, retrofit kit, or lamp	$ 180	$ 195	Incentive Increase
400W HID fixture to ≤ 175W LED fixture, retrofit kit, or lamp	$ 255	$ 280	Incentive Increase
750W HID fixture to ≤ 300W LED fixture, retrofit kit, or lamp	$ 450	$ 490	Incentive Increase
1000W HID fixture to ≤ 400W LED fixture, retrofit kit, or lamp	$ 610	$ 610	
New Construction Fixtures HID Lighting – Requires at Least 4,288 Hours of Use per Year – Must Be DLC-Rated			
175W code HID fixture to ≤ 100W LED fixture	$ 130	$ 130	
250W code HID fixture to ≤ 140W LED fixture	$ 140	$ 160	Incentive Increase
320W code HID fixture to ≤ 160W LED fixture	$ 250	$ 195	Incentive Decrease
Sign Lighting Retrofit – Requires at Least 4,288 Hours of Use per Year			
T12 to LED sign lighting	$ 17/SQFT	$ 22/SQFT	Incentive Increase

2020 Changes to Commercial Interior Lighting Rebates	2019	2020	Notes
Interior Lighting			
Fluorescent Tubular Lamps – Must Be DLC-Rated			
T5HO four-foot TLED	$ 15.00	$ 12.50	Incentive Decrease
T8 four-foot TLED	$ 6.50	$ 6.50	
U-bend LED	$ 8.00	$ 10.00	Incentive Increase
T8 eight-foot TLED	$ 13.00	$ 11.50	Incentive Decrease
Fluorescent Fixtures – Must Be DLC-Rated			
2, 3, or 4-Lamp T12/T8 fixture to LED-qualified 2x4 fixture	$ 40.00	$ 28.00	Incentive Decrease
2-Lamp T12/T8 fixture to LED-qualified 2x2 fixture	$ 30.00	$ 20.00	Incentive Decrease
HID Lighting – Must Be DLC-Rated *Eligible only if ballast and all other existing electrical components are removed.			
250W HID fixture to ≤ 140W LED fixture or lamp	$ 155.00	$ 125.00	Incentive Decrease Removed Hourly Requirement
400W HID fixture to ≤ 175W LED fixture or lamp	$ 205.00	$ 185.00	Incentive Decrease Removed Hourly Requirement
1000W HID fixture to ≤ 400W LED fixture or lamp	$ 460.00	$ 270.00	Incentive Decrease Removed Hourly Requirement
Incandescent Replacement Lamps			
6-20W LED lamp	$ 8.00	$ 0.00	Measure Discounted
50-60W LED fixture	$ 55.00	$ 0.00	Measure Discounted
MR16 (GU10 Base) – Must Be ENERGY STAR-Rated			
2-9W MR16 lamp	$ 10.00	$ 5.50	Incentive Decrease
Can Light Kit – Must Be ENERGY STAR-Rated			
12-20W LED fixture retrofit	$ 20.00	$ 20.00	
Controls			
Occupancy sensor controls with built-in relays	$ 40.00	$ 25.00	Incentive Decrease (must control at least 170W)
DLC-qualified LLLC fixture	Site-Specific	$ 35.00	New Measure (must control at least 300W, must be DLC qualified)

Program Marketing

Key to the success of the Prescriptive lighting program is clear communication to lighting supply houses, distributors, electricians, and customers on incentive requirements and forms. The Avista website is also a channel to communicate program requirements and highlight opportunities for customers. In addition, the company's regionally based account executives are an integral component of delivering the prescriptive lighting program to commercial/industrial customers. Any changes to the program typically include advance notice of 90 days to submit under the old requirements and/or incentive levels. This usually includes – at a minimum – direct email communication to trade allies as well as website updates.

Impact Evaluation

The program had a strong realization rate for interior lighting but a relatively low realization rate for exterior lighting. This was due primarily to the sign lighting adjustment, which is described in *Table 30*.

TABLE 30 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE ELECTRIC IMPACT FINDINGS

Program Type	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Interior Lighting	3,816,812	3,944,956	103%
Exterior Lighting	4,742,300	2,552,295	54%

Cadmus notified Avista in January 2021 of systematic savings discrepancies in sign lighting measures within the Prescriptive exterior lighting program. The team observed a significant increase in sign lighting measures in 2020 and found consistently low realization rates on the sign lighting measures evaluated. Avista applied deemed savings of 107.2 kWh per square foot of signage replaced, based on a 2014 internal engineering review that assumed eight-foot T12 high-output fluorescent lamps as the baseline for all sign lighting. Cadmus evaluated sign lighting projects by verifying the quantity, wattages, and HOU for the baseline and installed lamps in each sign by visual confirmation through video or by reviewing invoices and IV report photos. In cases where documentation was insufficient and customers were unable to access the sign, Cadmus estimated lamp quantities and lengths based on the shape and size of the sign. Cadmus calculated savings as the difference in energy use between the actual baseline and installed lighting equipment it verified. In every case, this evaluation methodology resulted in a lower evaluated savings, and Cadmus found an average realization rate of 26 percent across the evaluated sign lighting measures. The team did not find any systematic discrepancies with other exterior lighting measures. The realization rate for non-sign lighting exterior lighting measures was 96 percent.

Of 41 evaluated applications, Cadmus identified discrepancies for 36, based on virtual site visits, verification calls, and project documentation review. *Table 31* summarizes the reasons for discrepancies between reported and evaluated savings.

TABLE 31 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE EVALUATION SUMMARY OF DISCREPANCIES

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	7	↓	Cadmus found that two projects were inaccurately categorized as interior lighting projects rather than exterior. Evaluated savings for these projects were removed from the interior lighting program and added to the exterior.
			Cadmus determined that the HOU for four projects was lower than reported on the applications after interviewing on-site staff.
			Cadmus verified that one project had installed fewer LED lamps than reported. Several linear LED lamps were found in storage and not yet installed in some fixtures throughout the facility, lowering the evaluated savings.
	5	↑	Cadmus determined that the HOU for five projects was higher than reported on the applications after interviewing on-site staff.
Exterior Lighting	17	↓	Cadmus found that the installed fixtures for two projects had a higher wattage than reported on the application.
			Cadmus found one project that was categorized as a new construction measure but involved removing five existing higher-wattage LED wall pack fixtures and installing three LED flood lights in their place. Cadmus adjusted savings to include an estimated baseline wattage for the removed LED wall packs.
			Cadmus evaluated 14 sign lighting projects by calculating the difference in energy use between the baseline and installed lamps, rather than applying a deemed value per square footage of the sign. Cadmus determined the deemed values overestimated savings.
	2	↑	Cadmus found that two projects were inaccurately categorized as interior lighting projects rather than exterior. Evaluated savings for these projects were removed from the interior lighting program and added to the exterior.
	5	↓↑	Cadmus found that some projects had discrepancies due to rounding differences. iEnergy rounds the kilowatt savings to two decimal places in the middle of the calculation, causing a loss of accuracy in the final savings. This correction resulted in a decrease in savings for two projects and an increase for three.

Plans for 2021

In its third year of having more sophisticated measure level detail in iEnergy, Avista has been able to update interior and exterior lighting measures annually to reflect market conditions. The company does not anticipate significant changes to the program in 2021, but will be more flexible in making mid-year changes as needed. Avista has also been able to use the more refined data from the Site-Specific program to add three new measures into the prescriptive offerings. The company plans to dive deeper into networked lighting controls and increase the prescriptive incentive amount for Luminaire Level Lighting Controls (LLLC) to encourage more participation and garner more data.

Avista planned to implement changes to the sign lighting measure effective April 15, 2021, to address these concerns.

Commercial/Industrial Prescriptive Non-Lighting Programs

TABLE 32 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NON-LIGHTING PROGRAM METRICS

Prescriptive Non-Lighting Program Summary – Electric	2020
Participation, Savings, and Costs	
Conservation projects	23
Overall kWh savings	113,078
Incentive spend	$ 17,783
Non-Incentive Utility Costs	$ 4,876
Idaho Energy Efficiency Rider spend	$ 22,659
Prescriptive Non-Lighting Program Summary – Natural Gas	**2020**
Participation, Savings, and Costs	
Conservation projects	64
Overall Therm savings	29,409
Incentive spend	$ 75,981
Non-Incentive Utility Costs	$ 119,258
Idaho Energy Efficiency Rider spend	$ 195,239

Description

Commercial Food Service Equipment Program – The Commercial Food Service Equipment program helps encourage customers to purchase energy-efficient equipment. 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.

Commercial Insulation Program – The Commercial Insulation program is a retrofit program to encourage customers to increase the insulation in an existing building. It addresses three building areas – wall, attic, and roof – and is available to Avista commercial customers who have an annual heating footprint of at least 340 therms or 8,000 kWh. Insulation must be installed by a licensed contractor and meet the eligibility guidelines for existing and new R-values. Customers who meet the requirements must submit rebate paperwork with accompanying insulation certificate and invoice within 90 days of project completion. Incentives are disbursed after receipt of documentation and verification of eligibility.

AirGuardian – The AirGuardian program was developed to offer a prescriptive path for Avista electric customers with a 15 HP or greater rotary screw compressor. It offers a free walk-through audit to identify energy-saving opportunities and the 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. The program is currently delivered by 4Sight Energy Group, LLC. Savings are determined on an individual basis with pre- and post-logging. After logging is complete, a site report is presented with detailed project data and an invoice for kWh savings payment to 4Sight Energy Group, LLC.

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 and verification of eligibility.

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 for the region 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 provides Avista commercial electric customers with a range of retrofit energy savings 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 from display case lighting, motors, controls, strip curtains, or gaskets and apply for an incentive by submitting a rebate form with associated invoicing and providing proof of purchase and installation. Incentives are disbursed after receipt of documentation and verification of eligibility.

Commercial VFD Retrofit – The Commercial HVAC Variable Frequency Drive program is an incentive for Avista commercial electric customers to increase the energy efficiency of their HVAC fan or pump applications with a variable frequency drive. Installing a VFD on an existing unit of equipment enables that equipment to be more energy-efficient. The incentive is calculated at $130 per HP of the motor the VFD is installed on. Post-installation verification is required before payment is 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. Incentive disbursement will be processed after an installation inspection has occurred.

Program Activities

- ***Electric:*** Savings of 113,078 kWh – a decrease of 42 percent compared to 194,978 kWh in 2019. The majority of electric savings came from the Green Motors Rewind program.
- ***Natural Gas:*** Savings of 29,409 therms in 2020, an increase of 13 percent in comparison to 26,120 therms in 2019. Commercial HVAC comprised 55 percent of the program's therm savings, while food service measures accounted for 36 percent.

FIGURE 20 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INCENTIVE DOLLARS BY MEASURE – ELECTRIC

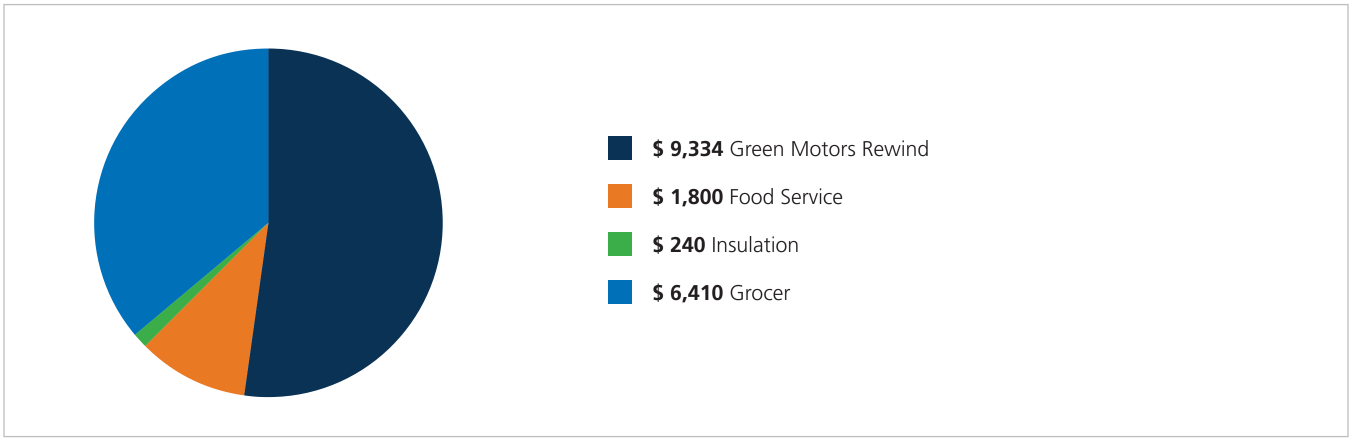
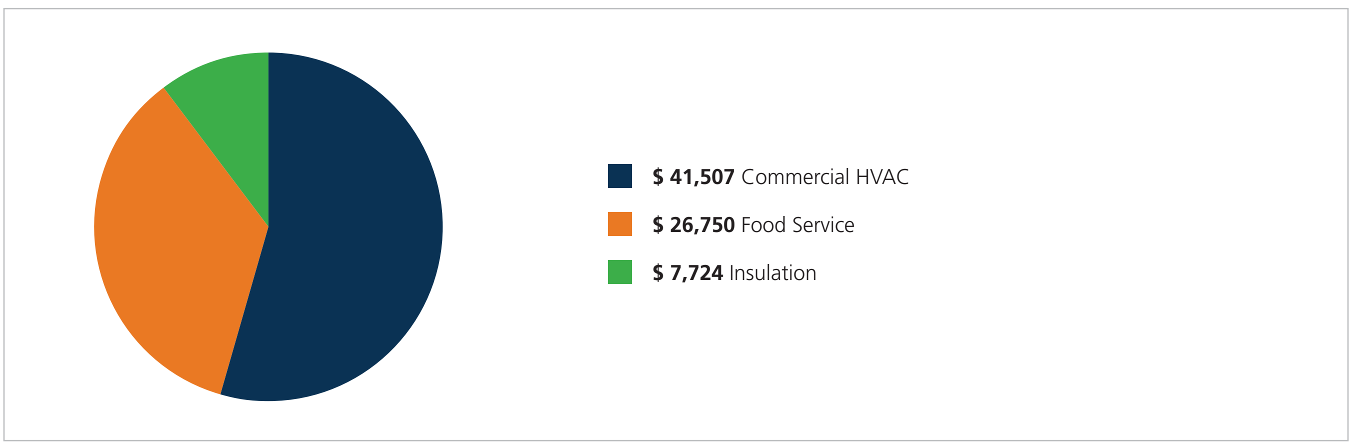


FIGURE 21 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE INCENTIVE DOLLARS BY MEASURE – NATURAL GAS



Program Changes

Several commercial insulation measures were modified from 2019 to 2020. The wall R11 to R18 was decreased to .35 from .40 per square foot. The attic up to R44 was increased from .20 to .50 and R45 or greater from .25 to .60. Roof insulation was increased from .25 to .40 per square foot.

There were no other changes to commercial/industrial non-lighting prescriptive programs in 2020.

TABLE 33 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NON-LIGHTING PROGRAM REBATE CHANGES, INSULATION

Commercial Insulation Program	2019	2020	Notes
Insulation Retrofit			
Less than R11 Attic Insulation to R30-R44 Attic Insulation	0.20	0.50	Incentive Increase
Less than R11 Attic Insulation to R45+ Attic Insulation	0.25	0.60	Incentive Increase
Less than R11 Roof Insulation to R30+ Roof Insulation	0.25	0.40	Incentive Increase
Less than R4 Wall Insulation to R11-R18 Wall Insulation	0.40	0.35	Incentive Decrease

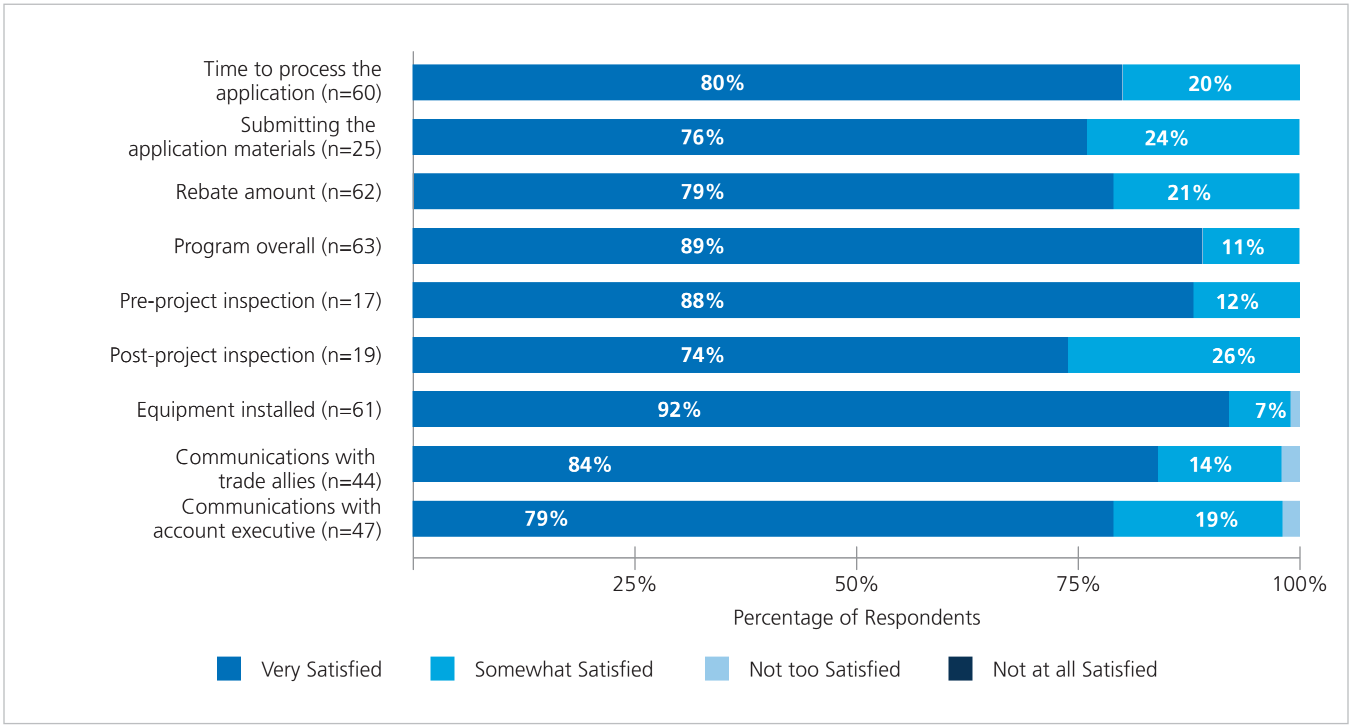
Program Marketing

Avista account executives market this program, which is also featured on the Avista efficiency website and used by trade allies as a marketing tool.

Customer Satisfaction

According to Cadmus' process evaluation, 2020 respondents were nearly all *somewhat satisfied* or *very satisfied* with all aspects of the program, as shown in *Figure 22*. Two respondents reported being *not too satisfied* with aspects of the program. One of these explained that the contractor had been difficult to work with and the process difficult to understand. The other respondent did not provide additional detail on their rating.

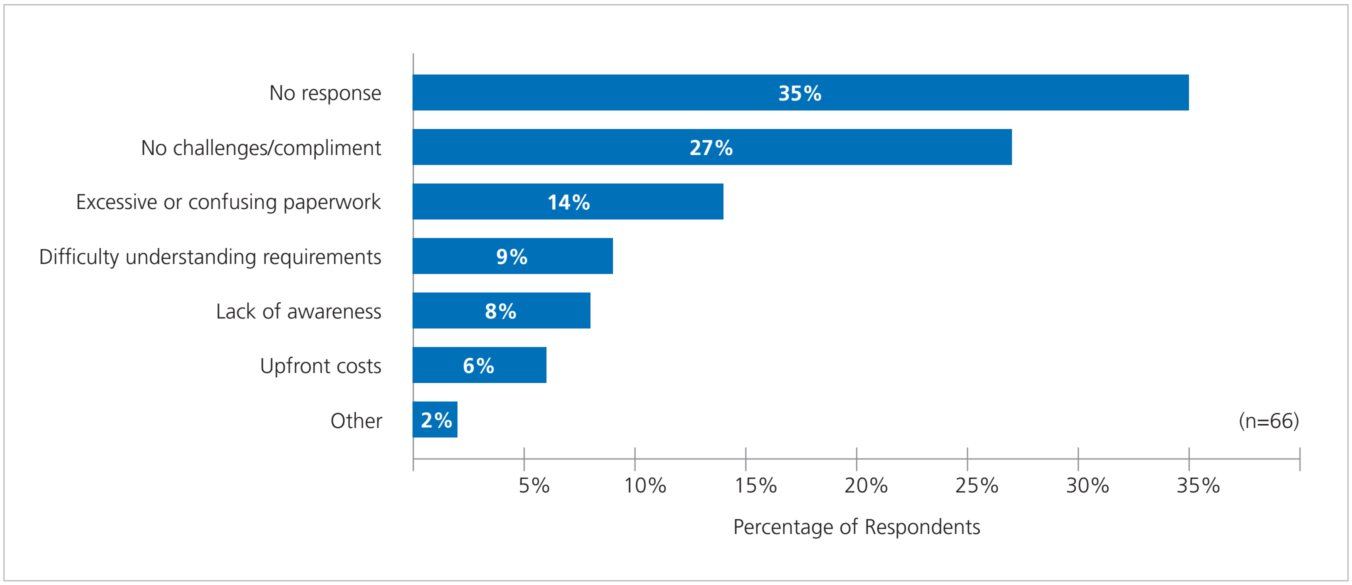
FIGURE 22 – COMMERCIAL/INDUSTRIAL SATISFACTION WITH PRESCRIPTIVE PROGRAM COMPONENTS



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."

When asked what challenges the program presented, 35 percent provided no response and 27 percent took the opportunity to report there were no problems, or to compliment the program. Excessive paperwork was the most common challenge reported, mentioned by 14 percent of respondents.

FIGURE 23 – COMMERCIAL/INDUSTRIAL PARTICIPATION CHALLENGES



Source: Prescriptive survey question H9: "What do so see as the biggest challenges to participating in Avista's [PROGRAM_NAME]?"

Respondents called out several program aspects that they viewed as working well. As shown in *Table 34*, respondents most commonly mentioned the fast or easy application process, followed by the opportunity to save energy and money on utility bills. Several respondents who mentioned the fast process also mentioned good customer support. For example, one respondent stated, "Great customer service and fast rebate turnaround."

TABLE 34 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE PROGRAMS ASPECTS WORKING WELL

Program Aspects	Number of Respondents
Easy/fast process	11
Saving energy and money on utility bills	10
Overall program works well	7
Access to better lighting	5
Good customer service	5
Rebate amount	5
Contractor support	2
Access to quality products	1

Source: Prescriptive survey question H11: "What would you say is working particularly well with Avista's program?" (Multiple responses allowed; n=39)

As shown in *Table 35*, 16 participants provided suggestions for program improvements. The most common suggestion was to provide more information about program requirements, or better customer support. For example, one respondent suggested having a chat function for customer support, instead of just phone and email. Another person requested a searchable database for eligible products.

TABLE 35 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE PROGRAMS IMPROVEMENT SUGGESTIONS

Suggestion	Number of Respondents
More information/better customer support	7
More marketing	5
Bigger rebates	3
Outreach to contractors	1

Source: Prescriptive survey question H10: "What recommendations, if any, would you make to improve the program?" (n=16)

Impact Evaluation

Electric: *Table 36* shows reported and evaluated electric energy savings for Avista's commercial/industrial Prescriptive program path (non-lighting) as well as the realization rates between the evaluated and reported savings for 2020. The overall commercial/industrial Prescriptive program path achieved a 76 percent electric realization rate.

TABLE 36 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE ELECTRIC IMPACT FINDINGS (NON-LIGHTING)

Program Type	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Shell Measure	1,341	1,341	100%
Green Motors	52,038	52,038	100%
Food Service Equipment	13,761	13,761	100%
AirGuardian	0	0	NA
Energy Smart Grocer	45,938	45,938	100%
Commercial/Industrial Prescriptive	113,078	113,078	100%

Natural Gas: *Table 37* shows the reported and evaluated natural gas energy savings for Avista's commercial/industrial Prescriptive program path as well as realization rates between the evaluated and reported savings for 2020. The overall commercial/industrial Prescriptive program path achieved a 101 percent natural gas realization rate.

TABLE 37 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE NATURAL GAS IMPACT FINDINGS

Program Type	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
HVAC	13,803	13,992	101%
Shell	1,821	1,821	100%
Food Service Equipment	13,597	13,597	100%
Commercial/Industrial Prescriptive	29,221	29,409	101%

Of 14 evaluated applications, Cadmus identified discrepancies for one based on the verification and project documentation review. *Table 38* summarizes the reasons for discrepancies between reported and evaluated savings.

TABLE 38 – COMMERCIAL/INDUSTRIAL PRESCRIPTIVE EVALUATION SUMMARY OF DISCREPANCIES

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
HVAC	1	↑	Cadmus found that the installed furnaces for one project were multistage based on the model number and specifications rather than single-stage as reported, which increased the evaluated savings.

Recommendations

Cadmus offered the following recommendations to improve realization rates for prescriptive programs:

- 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 participant project. For example, food service 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.
- Review iEnergy calculations to ensure that rounding is only applied on final displayed values and not to any intermediate values.
- Update all application forms to include space for location notes for each installed measure and encourage contractors installing equipment at very large facilities to include installation location with equipment invoices.

Plans for 2021

Avista is considering increasing incentive levels to encourage more participation in the Commercial/Industrial Insulation and VFD programs. A new measure in the Commercial/Industrial HVAC program for 92 percent AFUE natural gas unit heaters is under consideration. The current AirGuardian program will end in 2021; it will be renamed and relaunched as the Commercial/Industrial Compressed Air Line Isolation program.

Avista will continue to improve and refine calculations in iEnergy for prescriptive rebates in line with Cadmus' recommendations, and will consider updating application forms to capture more accurate location data for installed measures.

Avista will also consider increasing outreach to customers for commercial/industrial programs, and will consider ways to help participants sort through equipment options more efficiently.

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Memorial Bridge, Lewiston, Idaho

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 upstream buy-down of low-cost lighting and water-saving measures, select distribution of low-cost lighting and weatherization materials, direct-installation programs, and a multifaceted, multichannel outreach and customer engagement effort.

Nearly $2.3 million in rebates and direct customer benefits were provided to Idaho residential customers to offset the cost of implementing these energy-efficiency measures in 2020. All programs within the residential sector portfolio combined contributed 5,283 MWh and 317,550 therms to the annual energy savings.

TABLE 39 – RESIDENTIAL SAVINGS BY PROGRAM

Residential Program	Electric Savings (kWh)	Natural Gas Savings (therms)
ENERGY STAR Homes	50,705	401.94
Fuel Efficiency	635,962	0
Multifamily Direct Install	747,227	0
Residential HVAC	508,131	266,939
Residential Water Heat	12,986	37,976
Residential Shell	358,972	12,000
Simple Steps, Smart Savings	2,968,563	233.56
Total Residential	**5,282,546**	**317,550**

To help educate contractors on Avista's new residential rebates, a webinar was conducted – as well as a meeting in Spokane – to present information and provide a forum for questions.

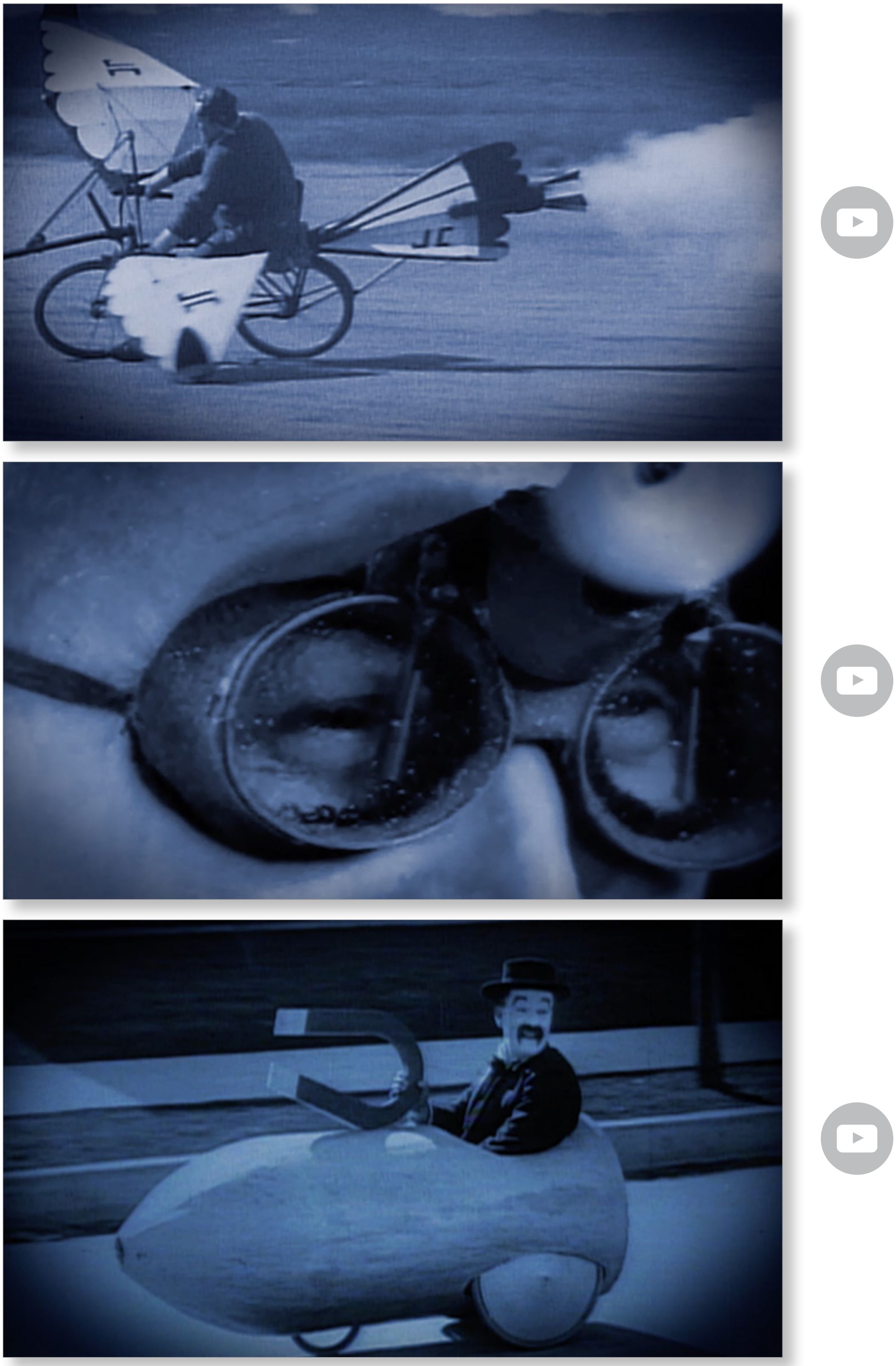
FIGURE 24 – RESIDENTIAL REBATES CONTRACTOR MEETING

Marketing

The spring "Way to Save" advertising campaign included TV, digital, search engine marketing, and social media. It began March 7 and was scheduled to continue through May 3. The campaign was pulled on March 16, however, because the majority of Avista's rebates require professional installation, and many HVAC contractors and vendors were not working due to the stay-at-home order.

Even though the campaign was cut short, it was very effective in driving website traffic while it was running. Average page views on Avista's Idaho rebates page went from 90 per day to 572 per day – an increase of 536 percent.

FIGURE 25 – RESIDENTIAL "WAY TO SAVE" TELEVISION COMMERCIALS



To help customers during the coronavirus pandemic, additional communications were developed that included website updates and energy-efficiency tips for residential customers.

FIGURE 26 – RESIDENTIAL ENERGY SAVINGS TIPS WHILE AT HOME FLYER

AVISTA

Energy-saving tips while at home

To help prevent the spread of COVID-19, government officials have issued a stay-at-home order throughout our region. People working from home—as well as students of all ages in the house—can mean an increase in energy use. You can help take charge of your energy use with these simple home energy-efficiency tips.

Living Spaces

Concerned about the virus in your home? During this time of uncertainty, you can help keep your air cleaner by cracking windows or opening the fresh-air damper on your furnace intake to let in more outside air. Also, continuously run your furnace fan at a low speed and change furnace filters often.

Set your thermostat no higher than 68 degrees. Also lower it an extra five degrees at night unless you have a heat pump.

Keep heat registers free of obstructions. Drapes, furniture and plants can all block air flow.

Close doors to unoccupied rooms if you have zoned heat like baseboards. You'll save space-heating costs. Do not shut off registers or block returns with a forced air system. It will increase fan energy usage and may cause damage to your equipment.

Turn off unnecessary lights. Use sunlight during the daytime if possible. Make sure your exterior lights are off during the day.

Let the sun warm your home. Open your drapes/blinds on south-facing windows to let in sunlight. Close them in rooms that receive no sun to insulate against cold drafts. At night, close coverings to retain heat.

Clean or replace your furnace filters. If you do not have filters on hand, it's still possible to order them for pick-up from local stores. Or, enroll in Avista's Furnace Filter Program to receive reminders, get valuable coupons and have new filters delivered right to your door. Go to **myavista.com/changemyfilter**

Make sure your fireplace is used properly. If you are using another heat source for your home, close off the damper on your fireplace to avoid energy loss up the flue.

Electronics

Turn off TVs and other electronics after use. They may continue to consume power even when appearing off. Also, plug your home electronics into a single power strip so you can switch it off and cut power to all of them at once.

Activate power-saving settings on your game console. Adjusting these settings on your console, and using power strips, can address the phantom loads associated with standby modes. Also, some game consoles use more energy than other dedicated devices to stream HD movies. Check the manufacturer's website for more information.

Energy-saving tips while at home

Kitchen

Set your fridge temperature between 37 and 40 degrees. Keep the freezer section at 5 degrees. Also vacuum exposed coils located on the back or underneath the appliance. Regular cleaning can improve efficiency up to 15% or more.

Set your stand-alone freezer to 0 degrees. A full freezer also retains cold better than an empty one.

Don't put warm foods directly into the refrigerator. Allow hot foods to cool, then refrigerate. Cooked meats, however, should be refrigerated immediately.

Always use a sink stopper or dishpan. Washing or rinsing dishes under running hot water wastes energy.

Run a full dishwasher. If your dishwasher has an automatic energy-savings/cool-dry cycle, use that setting. Otherwise, turn it off after the final rinse and let dishes air dry.

Water Heating

Set your water heater temperature to 120 degrees. That's plenty hot and won't scald. Do not set the water temperature below 115 degrees to prevent Legionnaires' disease.

Take short showers. You'll use less hot water than a bath.

Fix leaky faucets. A small drip can waste a bathtub full of hot water each month.

Laundry

Wash only full loads of clothes. Wash full loads using the proper water levels. Some experts also advise washing clothes in hot water to reduce the chance of virus strands clinging to your clothes (this may increase your energy consumption).

Clean your dryer's lint filter after every load. Clogged filters increase drying time.

Don't overload your dryer. Clothes will take longer to dry.

Humidity Level

Add humidity to your home if it has under 30% relative humidity. Keeping your home's humidity between 40% and 50% will make you feel warmer and reduce the chance of viral spread. If you don't own a device that displays the humidity level inside your home, here are ways to increase humidity indoors as well as how to assess your relative humidity.

How to increase humidity. You can increase humidity indoors using a humidifier. If you don't own one or prefer to save energy, however, you can place water-filled vases on sunny windowsills. The sunshine will slowly evaporate the water, releasing moisture into the air. Hang your clothes to dry inside your home to take advantage of incidental moisture release. A steamy kettle on the stove beats using a microwave.

THE ICE CUBE HUMIDITY TEST

1. Place two or three ice cubes into a glass, add tap water and stir.
2. Wait three to four minutes and then observe the glass.
3. Examine the outside of the glass. If moisture does not form, the air is too dry. If the outside of the glass shows a fog of water vapor, the relative humidity is correct. If water has condensed on the outside of the glass with drops rolling down, the relative humidity is high.

NOTE: Conduct this test in any room where humidity is a concern except the kitchen, as cooking vapors may produce inaccurate results.

FIGURE 27 – RESIDENTIAL ENERGY USE AND SAVINGS GUIDE FOR RESIDENTIAL CUSTOMERS

AVISTA

Energy Use and Savings Guide

For Residential Customers

...pical Energy Use in Your Home

...energy bill for a **typical U.S. single family** home ...ges $2,200 per year. Where does all this money go? ...ost of heating and cooling your home can represent 40% ...% of your total energy bill. The chart to the right shows ...eakdown of energy use by category and starts to give ...sense of where savings can be found. Reducing energy ...mption by just 15% could save you over $300 a year in ... costs.

...Your Energy Budget

...ways a good ...dget starts with ...source needs. ... food, clothing, ...rgy to run your ...our energy usage ...ng that portion ...his booklet, ...saving tips to ...esources.

...as and suggestions ... — and better ...sumption. ...ar with some ...gestions, ... you.

Individual lifestyle and energy use habits, number and age of occupants, as well as the size, design, levels of insulation and heating system in your home, all combine to determine how much energy you will use for heating.

The statistics in this booklet are based on national averages. The wattage or energy usage and efficiencies of your appliances, your own use habits, as well as the size of your family will vary. Keep this in mind when you're reviewing your own energy use.

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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Heating and Cooling

Heating and Cooling Energy Saving Tips

Fireplace dampers should be kept closed when you're not using the fireplace. A chimney can draw off as much as 25% of the heated air in your house if the damper is left open. Safely block off unused fireplaces when possible.

On sunny winter days, open your **draperies** to get full benefit of sun shining through the windows. In summer, close the draperies to help keep out unwanted heat.

Turn down the heat in winter. Keep your **thermostat** at or below 68° F; setting your thermostat three degrees lower in the winter can reduce your bill by about 10%.

When selecting an **air conditioning unit**, both room or central, check its Seasonal Energy Efficiency Ratio (SEER). The SEER indicates a unit's relative energy efficiency. Most units are tagged with this information, or your dealer can help you determine the SEER. The higher the SEER, the better. A SEER of 13 or above is preferred, 18 or above is exceptional.

When selecting a **heat pump**, check its Heating Seasonal Performance Factor (HSPF). The HSPF indicates a heat pump's relative ...

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Heating and Cooling

Energy Saving Checklist

- ☐ **Block drafts.** Check caulking and weather stripping around windows and doors. If you see cracks, light, or feel a draft, make repairs where needed.
- ☐ **Seal leaks.** Ductwork exposed to outside air or in unconditioned spaces should be sealed using mastic paste and wrapped securely with insulation; insulation joints should be sealed with insulation tape.
- ☐ **Check furnace filter.** Check filters at least once a month; clean or replace them when dirty.
- ☐ **Bring in a professional.** A qualified serviceman should check heating and cooling equipment at the beginning of each season to ensure efficient operation.
- ☐ **Use drapes or shades.** Window coverings are one of the easiest ways to help insulate your house. Keep them closed on cold days and open on sunny ones.
- ☐ **Use fans in the summer.** Try using fans in the summer before switching on the air conditioning. Old A/C equipment can be equivalent to using 30 or more fans. If you must use your air conditioner, set it at 78° F; each degree over 78° in the summer will save you approximately 3% on your cooling bill.
- ☐ **Program your thermostat.** Adjust temperature settings according to a preset schedule. This way you can warm up or cool down your rooms when you know you'll be awake or at home. Consider a Wi-Fi enabled smart thermostat that learns your settings.

Reading Your Meter

Electric and natural gas meters are not difficult to read and they ...

Water Heating

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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As businesses opened up in the summer, Avista placed its "Way to Save" digital advertising campaign to help increase awareness of the company's rebates. The advertising included social media, search engine marketing, and online banner ads. It ran June 22-August 31 and proved successful in driving customer engagement. When looking at the weeks prior to the campaign (i.e., May 1-June 21), page views on Avista's Idaho rebates page totaled 2,140. During the campaign and including the two weeks following the advertising (June 22-September 14), page views totaled 29,248 – an increase of 1,267 percent.

FIGURE 28 – RESIDENTIAL "WAY TO SAVE" DIGITAL ADS

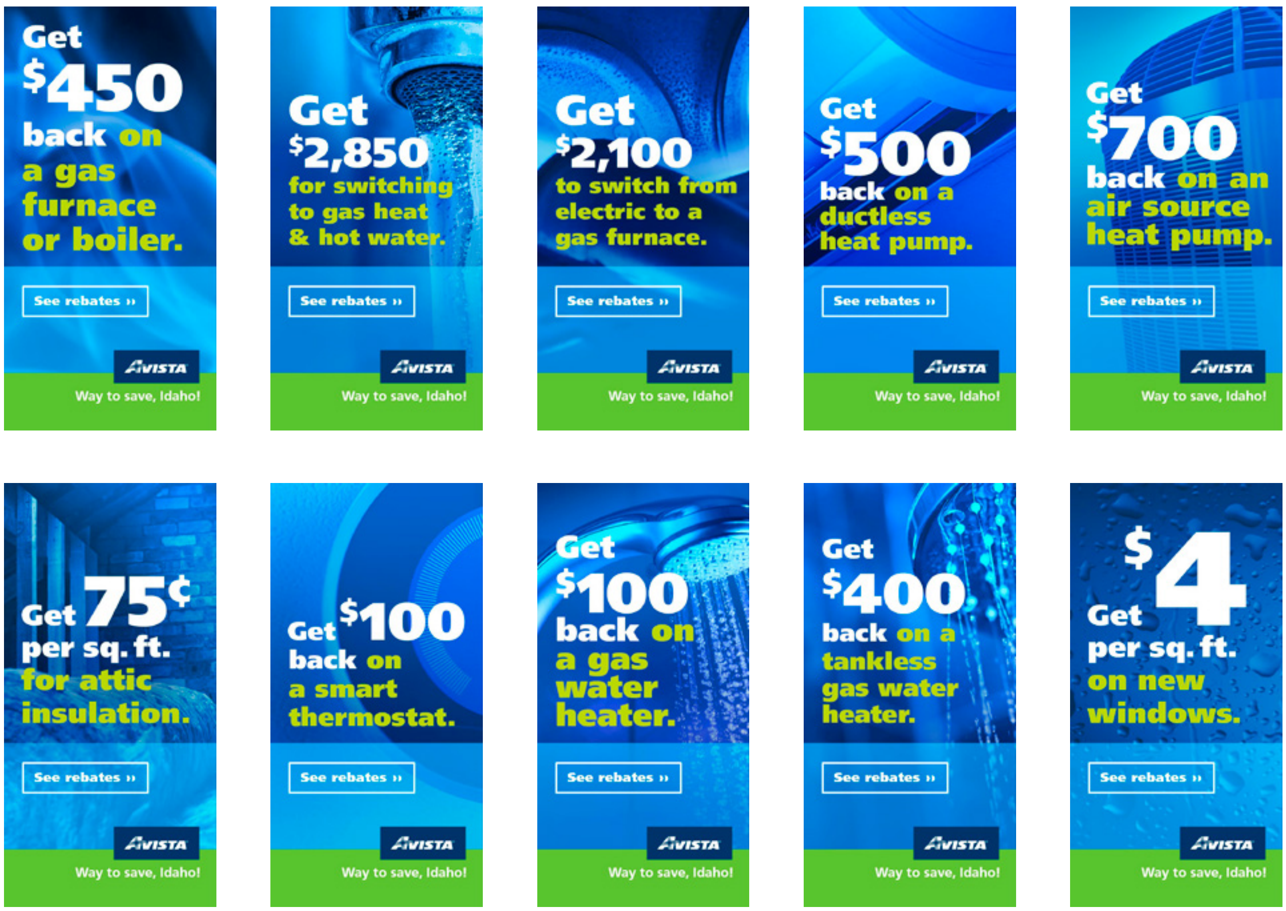
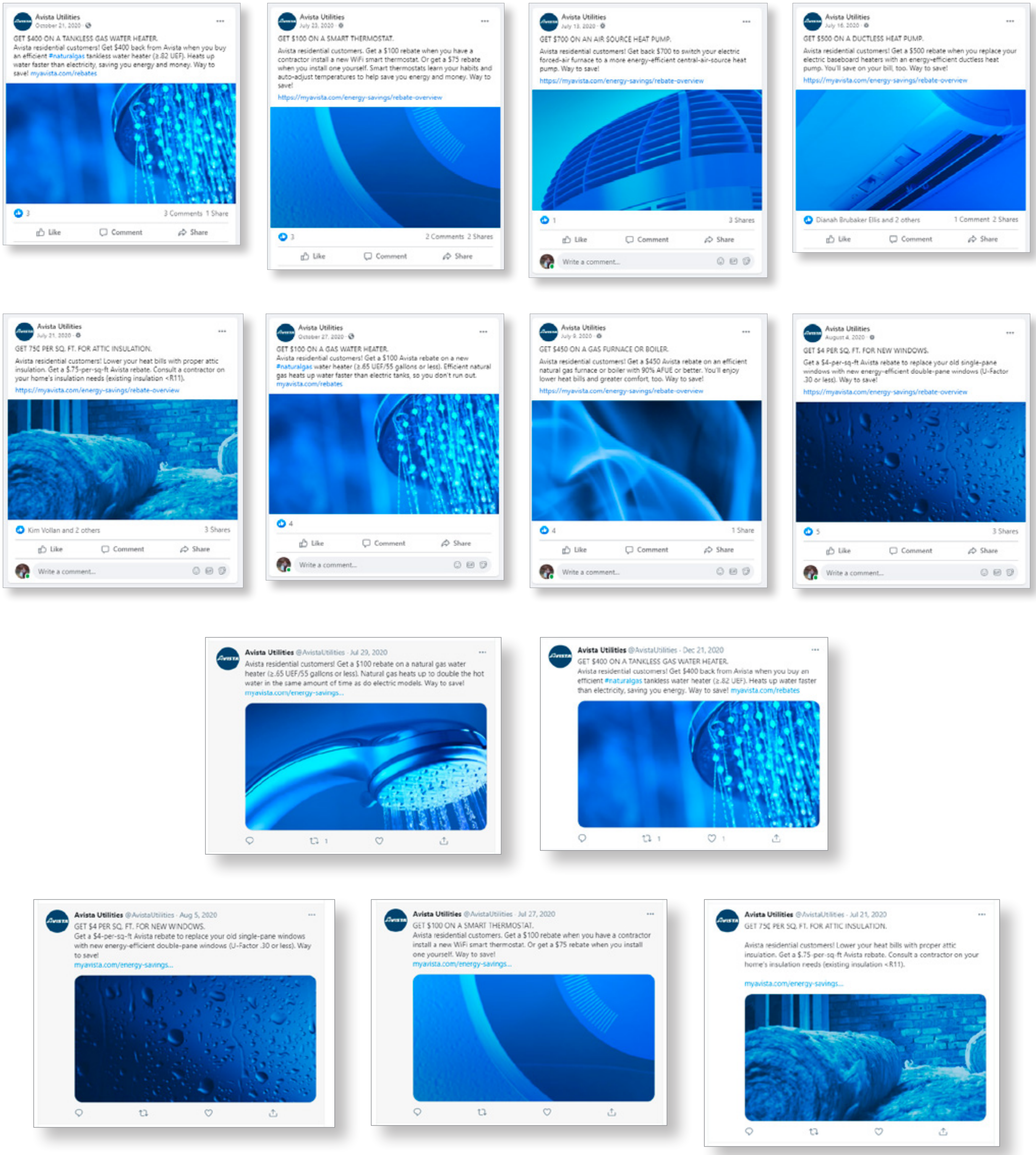


FIGURE 29 – RESIDENTIAL "WAY TO SAVE" SOCIAL MEDIA



As cold weather moved in, Avista's "Smart Winter Giveaway" campaign was implemented to remind customers of energy-saving tips for the heating season. Communication tactics included the *Connections* newsletter, emails, a bill insert, the website, and social media. The campaign proved successful in driving customer engagement, with more than 43,000 entrants.

FIGURE 30 – RESIDENTIAL "SMART WINTER" BROCHURE

Avista Kids

With more children at home due to the pandemic, it was a good time to develop new material to help educate this younger audience about energy efficiency. A complete creative refresh was done to existing materials, with new lessons designed to teach kids how to conserve energy while having fun at the same time. They included pictures to color and activities such as puzzles, word searches, mazes, and fun science experiments – all designed to build energy-saving habits for life. The printable coloring pages and activities content can be found on the website at myavista.com/kids, categorized for ages 4-8 and 9-12. In addition, customers can request a free Kids Activities Kit, which includes a printed version of the activities book along with crayons and pencils. The kit offer is promoted on Avista's website, in the *Connections* newsletter, and through social media channels.

FIGURE 31 – RESIDENTIAL KIDS CAN SAVE ENERGY TOO COLORING AND ACTIVITY BOOK

Impact Evaluation

While some individual programs varied, the residential sector performed strongly overall in 2020. Savings realization rates were as follows:

- ***Electric:*** Total verified savings of 5,282,546 kWh with a realization rate of 97 percent.
- ***Natural Gas:*** Evaluated natural gas savings show a realization rate of 121 percent on savings of 317,550 therms.

Complete impact evaluations for electric and natural gas are included in Appendices A and D.

Performance and Savings Goals

The electric program portfolio achieved 115 percent of the 2020 savings goal, the result of high program participation (134 percent) and a strong overall realization rate for the residential sector.

Lighting measures accounted for 70 percent of the total residential sector savings. The following shows the percentage of residential evaluated savings provided by each program:

- Simple Steps, Smart Savings provided 56 percent, mostly through lighting measures.
- Multifamily Direct Install (MFDI) provided 14 percent, again mostly through lighting measures.
- The residential HVAC program accounted for 10 percent of evaluated savings.
- The Shell and ENERGY STAR Homes programs accounted for a combined 8 percent.

Table 40 shows savings goals assigned to Avista's residential sector programs for 2020, as well as reported savings and the goal portion achieved in 2020. All programs except ENERGY STAR Homes and residential HVAC exceeded savings goals based on reported savings.

TABLE 40 – RESIDENTIAL PROGRAMS REPORTED ELECTRIC SAVINGS

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Simple Steps, Smart Savings	661,531	2,968,563	449%
HVAC	560,367	508,131	91%
Residential Appliances	4,220	0	0%
Shell	252,475	358,972	142%
Fuel Efficiency	1,798,470	635,962	35%
ENERGY STAR Homes	6,630	50,705	765%
Water Heat	16,324	12,986	80%
Multifamily Direct Install	1,288,412	747,227	58%
Residential Total	**4,588,429**	**5,282,546**	**115%**

The natural gas segment of the portfolio achieved 93 percent of the goal for 2020.

The following shows the percentage of residential evaluated savings provided by each program:

- The HVAC program accounted for 84 percent, and was the only program to meet its savings goal.
- The Water Heating program accounted for 12 percent.
- The Shell program accounted for 3.8 percent of residential gas savings.
- Simple Steps, Smart Savings and ENERGY STAR Homes combined accounted for less than 1 percent.

Table 41 shows savings goals assigned to Avista's residential sector programs for 2020, as well as reported savings and percentage of goal achieved in 2020. Note that as part of Avista's planning process, no estimates were made for the Simple Steps, Smart Savings program; thus, no goal was established for the program year.

TABLE 41 – RESIDENTIAL PROGRAMS REPORTED NATURAL GAS SAVINGS

Program	Savings Goals (therms)	Savings Reported (therms)	Percentage of Goal
Simple Steps, Smart Savings	0	234	N/A
HVAC	258,170	266,939	103%
Shell	42,334	12,000	28%
ENERGY STAR Homes	670	402	60%
Water Heat	39,436	37,976	96%
Multifamily Direct Install	236	0	0%
Residential Total	**340,846**	**317,550**	**93%**

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:

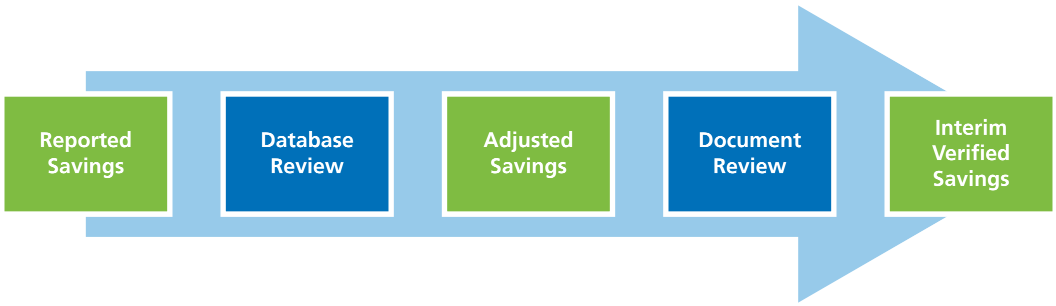
- A *deemed savings* approach involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. These prescriptive savings may also include an adjustment for certain measures, such as lighting, in which site operating hours may differ from RTF 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 percent precision at the 90 percent 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. They 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.

FIGURE 32 – RESIDENTIAL IMPACT PROCESS



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

They analyzed billing data for all electric measure participants in the HVAC and Low-Income programs, and 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.

The evaluators verified a sample of participating households for detailed review of the installed measure documentation and development of verified savings. They verified tracking data by reviewing invoices and surveying a sample of participant customer households. They 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:

FIGURE 33 – EQUATION 2-1 SAMPLE SIZE FOR INFINITE SAMPLE SIZE

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

FIGURE 34 – 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 percent confidence) and $d = 0.10$ (or 10 percent 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,[1] 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 evaluators' methodology for conducting document-based verification and survey-based verification.

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
- HVAC
- Shell
- Fuel Efficiency
- ENERGY STAR Homes
- Simple Steps, Smart Savings
- Low-Income

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, they reported and summarized those differences in the database review sections presented for each program in Sections 3.3 and 4.1 of the electric and natural gas impact evaluations (Appendices C and D).

The evaluators developed a sampling plan that achieves a precision of ±10 percent at 90 percent 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, and ensured representation in each state and fuel type for each measure.

1) Assumption based on 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

Table 42 represents the number of rebates in both Idaho and Washington territories. The evaluators ensured representation of state and fuel type in the sampled rebates for document verification. Please note that number of rebates is not equivalent to number of customers, because some customers receive multiple rebates.

TABLE 42 – RESIDENTIAL DOCUMENT-BASED VERIFICATION SAMPLES AND PRECISION BY PROGRAM

Sector	Program	Gas Population	Sample (with Finite Population Adjustment)*	Precision at 90% CI
Residential	Water Heat	957	65	±9.85%
	HVAC	7,401	69	±9.86%
	Shell	1,337	68	±9.72%
	Fuel Efficiency	N/A	N/A	N/A
	ENERGY STAR Homes	6	6	±0.00%
	Simple Steps, Smart Savings	N/A	N/A	N/A
Low-Income	Low-Income	550	66	±9.50%

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

Survey-Based Verification

The evaluators conducted survey-based verification for the Water Heat and HVAC programs. 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 43* for the Water Heat and HVAC for the Idaho Gas Avista projects. The evaluators developed a sampling plan that achieved a sampling precision of ±4.24 percent at 90 percent statistical confidence for ISR estimates at the measure-level during web-based survey verification.

TABLE 43 – RESIDENTIAL SURVEY-BASED VERIFICATION SAMPLE AND PRECISION BY PROGRAM

Sector	Program	Population	Respondents	Precision at 90% CI
Residential	Water Heat	957	115	±7.20%
	HVAC	7,401	246	±5.16%
	Fuel Efficiency	N/A	N/A	N/A
Total		**8,358**	**361**	**±4.24%**

The evaluators implemented a web-based survey to complete the verification surveys. They supplemented with phone interviews 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 of the residential impact evaluations (Appendices A and C).

Recommendations

ADM offered the following recommendations for Avista's residential programs:

- The evaluators recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the Customer Care & Billing (CC&B) database. The values found in the project documentation should accurately reflect the values represented in the CC&B database.
- A number of rebates were not accompanied by AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The evaluators note that a number of rebate applications did not contain values associated with whether the home is existing or was new construction. 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 cross-referenced the billing data to verify whether customers demonstrated the required heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 therms, as defined in the program requirements. The evaluators found many customers used less than 8,000 kWh or 340 therms annually. In addition, some customers had insufficient pre-period data to determine annual usage. The evaluators recommend Avista verify whether customers meet the requirements prior to completing the rebate.
- The evaluators also recommend collecting information on single-family/multi-family/manufactured in the web rebate form. This allows the evaluators to accurately assign RTF values. The mail-in rebates collect this information; it does not seem to be currently required to complete the rebate, however; many rebates are missing this information.
- 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 that all sources of information reflect the same values as the project documentation.

Cost-Effectiveness

Tables 44 and *45* show the residential sector cost-effectiveness results by fuel type. Note that these values are inclusive of both the prescriptive programs and the multifamily direct install programs.

TABLE 44 – RESIDENTIAL ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 5,573,921	$ 2,133,107	2.61
Total Resource Cost (TRC)	$ 6,131,313	$ 3,271,662	1.87
Participant Cost Test (PCT)	$ 7,417,708	$ 2,019,940	3.67
Ratepayer Impact (RIM)	$ 5,573,921	$ 12,060,227	0.46

Table 7 shows residential cost-effectiveness results for electric.

TABLE 45 – RESIDENTIAL NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 3,502,394	$ 1,426,403	2.46
Total Resource Cost (TRC)	$ 3,852,633	$ 3,466,442	1.11
Participant Cost Test (PCT)	$ 4,821,706	$ 3,422,171	1.41
Ratepayer Impact (RIM)	$ 3,502,394	$ 11,836,441	0.30

Program-by-Program Summaries

Residential HVAC Program

TABLE 46 – RESIDENTIAL HVAC PROGRAM METRICS

HVAC Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		198
Overall kWh savings		508,131
Incentive spend	$	75,613
Non-Incentive Utility Costs	$	59,607
Idaho Energy Efficiency Rider spend	$	135,219
HVAC Program Summary – Natural Gas		**2020**
Participation, Savings, and Costs		
Conservation projects		3,229
Overall Therm savings		266,939
Incentive spend	$	1,028,366
Non-Incentive Utility Costs	$	35,073
Idaho Energy Efficiency Rider spend	$	1,063,439

Description

Through the HVAC program, Avista encourages residential customers to select a high-efficiency solution when making energy upgrades to their homes.

Idaho residential electric customers (Schedule 1) who heat their homes with Avista electricity are eligible for rebates for converting their electric straight-resistance space heating to an air-source heat pump or ductless heat pump system. Customers must demonstrate electricity usage of 8,000 kWh and natural gas usage of less than 340 therms for replacement of electric straight-resistance to air-source heat pumps or ductless heat pumps. Ductless heat pumps are required to demonstrate a 9.0 HSPF or greater.

There was a significant drop in electric conservation projects and savings due to the variable speed motor program being discontinued at the end of 2019 due to it becoming standard equipment on natural gas forced air furnaces. There were also impacts to savings because of the COVID-19 shutdown. The 2020 goal for 300 projected projects to be completed was not met; 199 projects were completed.

Idaho natural gas customers (Schedule 101) who heat their homes with Avista natural gas are eligible for high-efficiency natural gas forced air or wall furnaces or boilers with an energy efficiency of 90 percent AFUE or greater. The supporting documentation required for participation includes copies of project invoices and an Air Conditioning, Heating, and Refrigeration Institute (AHRI) certification. The prescriptive rebate approach issues payment to the customer after the measure has been installed by a licensed contractor.

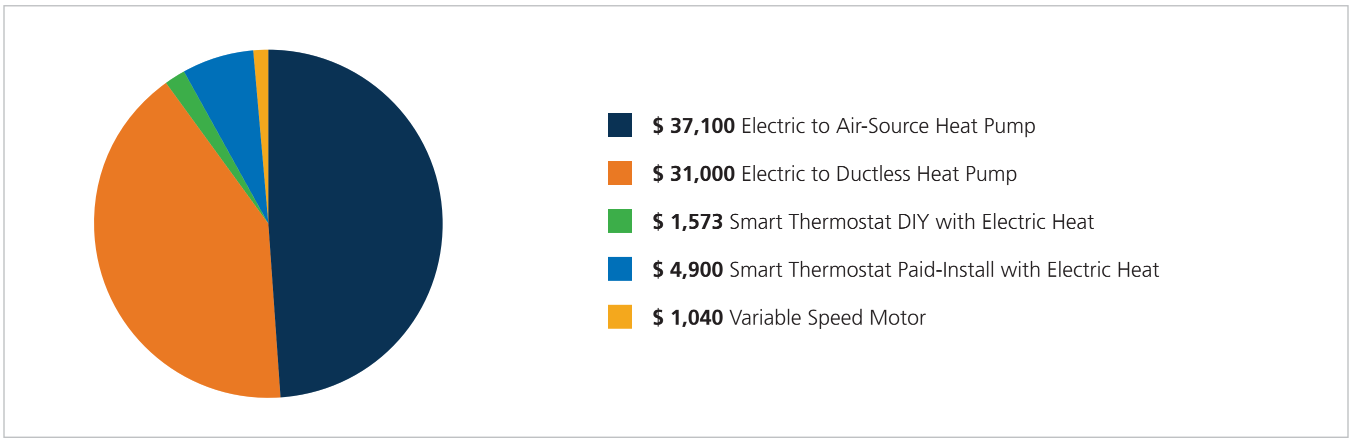
In 2020, the rebate was increased from $300 to $450 to promote replacement of inefficient natural gas heating systems. This increase in incentives motivated many customers to replace their inefficient HVAC systems. Even with the COVID-19 shutdown, furnaces were replaced at the same rate as in 2019. In the 2020 TRM, Avista had to lower the savings for the natural gas furnace measure to 71 therms. The company will continue to encourage installations of high-efficiency natural gas furnaces as well as smart thermostats.

Smart thermostat rebates will continue in 2020. The thermostats can be contractor- or self-installed. The thermostats are required to be connected to the Internet and available to control from a cell phone.

Program Activities

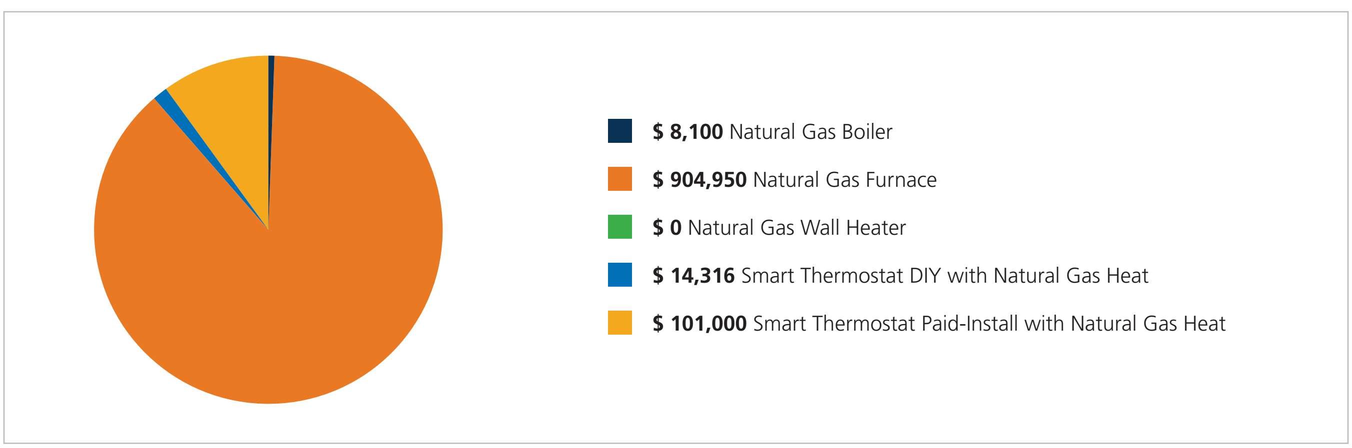
- ***Electric:*** Savings of 508,131 kWh in 2020, 10 percent of the overall savings achieved in Avista's residential portfolio. The program achieved 91 percent of its savings goal of 560,367 kWh.
- ***Natural Gas:*** Savings of 266,939 therms in 2020 – 84 percent of the overall residential savings. The program slightly surpassed its savings goal of 258,170 therms (103 percent of goal).

FIGURE 35 – RESIDENTIAL HVAC INCENTIVE DOLLARS BY MEASURE – ELECTRIC



For the electric HVAC program, electric furnaces to air source heat pumps comprised approximately 46 percent of residential HVAC electric incentives. Ductless heat pumps experienced a rise in use, accounting for almost double the incentives over 2019.

FIGURE 36 – 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 88 percent of Avista's 2020 residential HVAC incentives. Smart thermostats continued to be popular, with 1,269 installed in the Idaho service territory (1,199 for natural gas HVAC systems, 70 for electric HVAC systems).

Energy-efficiency marketing efforts build considerable 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 are utility website promotion, vendor training, retail location visits, and presentations at various customer events throughout the year.

In 2020, Avista program managers kept in regular contact with trade allies via topical, focused email blasts. These blasts notified trade allies of upcoming program changes and deadlines. Avista program managers also held two trade ally engagement events – in person and via webinars – to review program changes, encourage participation, and answer trade ally questions. Trade ally engagement continues to be a core marketing strategy for this program.

The program was included on the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Impact Evaluation

The ADM impact evaluation team found a 101 percent realization rate for the electric HVAC program and a 131 percent realization rate for the natural gas HVAC program in 2020.

The evaluators applied the results of the billing analysis to each electric variable speed motor measure. They reviewed the Avista TRM values along with verified tracking data to estimate net program adjusted savings for measures not evaluated through billing analysis. 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 electric smart thermostat DIY with electric heat realization rate is low because the Avista TRM uses an average of retail and direct installation 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 retail rebates and a higher-than-expected savings for the direct installation rebates for this measure. In addition, the 93.33 percent ISR was applied to the electric smart thermostat with electric heat measure, further decreasing the realization rate for the measure.

The electric to ductless heat pump rebates have high realization rates because the expected savings value used a value differing from the RTF values. The value in the TRM for this measure most likely represents an average of the RTF savings values for a combination of heating zones. The electric variable speed motor program has a high realization rate due to the relatively higher unit-level energy savings from the billing analysis as opposed to the Avista TRM.

Recommendations

ADM offered the following recommendations for Avista's residential HVAC programs, in addition to the overall recommendations for the residential sector listed on page 71:

- The evaluators conducted a billing analysis for the electric variable speed motor measure in the HVAC program. The estimated savings value from the billing analysis was roughly 124 percent of the value reflected in the Avista TRM. The evaluators recommend updating the savings value for this measure in the Avista TRM to reflect observed savings more closely in the territory.
- The natural gas furnace measure in the HVAC has a high realization rate because the billing analysis resulted in a savings value that was 137.45 percent of the value previously used in the Avista TRM. The evaluators recommend adjusting the Avista TRM to reflect the observed savings values from all billing analyses from this impact evaluation.

Program Marketing

The program was included in the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Plans for 2021

Air-source heat pumps will have an energy efficiency requirement of 9.0 HSPF and ductless heat pumps will have a requirement of 10.0 HSPF.

Smart thermostat rebates will be promoted through an increased incentive. Contractor-installed thermostats will increase from $100 to $150. Self-installed thermostats will increase from $75 to $125. In 2021, the new multifamily rebate program will be offering a $20 rebate for line voltage digital and smart thermostats.

Avista will consider updating savings values for the natural gas furnace measure, per ADM's recommendation. The variable speed motor measure will be discontinued from Avista's offerings in 2021, due to energy code changes.

Avista will also examine the rebate process and seek ways to improve accuracy and completeness of submitted information.

Residential Shell Program

TABLE 47 – RESIDENTIAL SHELL PROGRAM METRICS

Shell Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		119
Overall kWh savings		358,972
Incentive spend	$	78,703
Non-Incentive Utility Costs	$	113,867
Idaho Energy Efficiency Rider spend	$	192,570
Shell Program Summary – Natural Gas		**2020**
Participation, Savings, and Costs		
Conservation projects		285
Overall Therm savings		12,000
Incentive spend	$	156,016
Non-Incentive Utility Costs	$	4,148
Idaho Energy Efficiency Rider spend	$	160,163

Description

Through the shell program, Avista encourages residential customers to improve their home's shell or exterior by upgrading insulation, windows, and storm windows. This prescriptive rebate approach issues payment to the customer after the measure has been installed. Energy-efficiency marketing efforts build considerable 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 utility website promotion, vendor training, and presentations at customer events.

Idaho residential electric customers (Schedule 1) who heat their homes with Avista electric are eligible to apply, as are Idaho residential natural gas customers (Schedule 101) who heat their homes with natural gas. Avista will review energy usage as part of the program eligibility requirements. In Idaho, Avista fuel-heated primary residences with electric- heated homes must demonstrate a heating season usage of 8,000 kWh; those with natural gas-heated homes must demonstrate a heating season usage of 340 therms. Windows and insulation are required to be installed by licensed contractors. The rebate is calculated by square feet of windows or insulation.

Windows must have a U-factor rating of 0.30 or lower (encourages .29 or less U-factor). Storm windows (interior/ exterior) must be new, the same size as the existing window, and not be in direct contact with the existing window; exterior window 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.

Avista provides rebates for insulation of attics, walls, and floors that are between conditioned and unconditioned primary living space. Attic rebates require an existing R-value of R-11 or less and brought up R-49 or greater. Wall insulation requires no existing insulation and brought up to R-11 or greater. Floor insulation requires no existing insulation and brought up to R-19 or greater.

Program Activities

- ***Electric:*** Savings of 358,972 kWh in 2020 (7 percent of the overall residential savings), a 223 percent increase over the 160,507 kWh achieved in 2019. The program achieved 142 percent of its goal of 252,475 kWh.
- ***Natural Gas:*** Savings of 12,000 therms in 2020, or 4 percent of the overall residential savings. The program had a 31 percent decrease in savings relative to the of 17,458 therms achieved in 2019, achieving 28 percent of its goal of 42,334 therms.

The savings derived from the Residential Shell program for both natural gas and electric homes are primarily attributed to single-pane window replacements.

Shell program participants have generally been inclined to replace existing windows with regular windows rather than with storm windows.

Impact Evaluation

ADM arrived at a 174 percent realization rate of savings for prescriptive shell rebate measures in electric homes and 59 percent for rebate measures in homes with natural gas.

The realization rate for the electric savings in the Shell program deviates from 100 percent 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 realization rate for gas savings in the Shell program had significant deviation from 100 percent because of low realization rates for two measures: window replacement and attic insulation. Both of these measures had a statistically significant difference between the billing analysis done by ADM and the RTF values the program used to calculate savings.

The evaluators found no duplicate rebates in the project data and therefore did not remove any rebates from verified savings. However, ADM's document review did illuminate some discrepancies for residential shell projects:

- In one instance, square footage quantity in the rebate application did not match the values presented in the project data for attic insulation.
- Two rebates showed R-values that did not align with TRM or RTF values related to the measure.
- For one floor insulation rebate, the new R-value did not match TRM or RTF values.
- In several instances, web-based rebate data indicated electric space heating, but other sources (project data and document verification) indicated natural gas space heating, and vice versa.
- In one instance, R-values for a window were assigned incorrectly. Evaluators reassigned window insulation on this project from an insulation of R0 to R49 to an insulation of R11 to R49.

Recommendations

In addition to the recommendations offered in the overall residential impact evaluation (noted on page 71), ADM offered the following recommendations for the Residential Shell program:

- The evaluators found rebates in which the R-values did not align with TRM or RTF values (R38 and R64). They recommend collecting information in a standardized manner.
- The evaluators recommend collecting information on single/double-pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.
- The evaluators also recommend collecting information on single-family/multi-family/manufactured in the web rebate form. This allows them to accurately assign RTF values. The mail-in rebates collect this information; it does not seem to be required to complete the rebate, however, since many rebates are missing this information.
- The evaluators recommend verifying the household space heating type prior to completing the rebate.

Program Marketing

The program was included in the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Plans for 2021

Avista plans to adjust the U-factor requirement to 0.29 or lower, following the RTF required efficiency revision. In 2021, the new multifamily rebate program will be offering insulation, storm windows, and windows with the same requirements as the residential program but without a usage requirement. Small homes can use this multifamily program as well. There may be changes mid-2021, such as adding measures and adjusting savings and incentives.

Avista will also examine the rebate process and seek ways to improve accuracy and the completeness of submitted information.

Residential Water Heating Program

TABLE 48 – RESIDENTIAL WATER HEATING PROGRAM METRICS

Water Heating Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		10
Overall kWh savings		12,986
Incentive spend	$	2,365
Non-Incentive Utility Costs	$	1,002
Idaho Energy Efficiency Rider spend	$	3,367
Water Heating Program Summary – Natural Gas		**2020**
Participation, Savings, and Costs		
Conservation projects		507
Overall Therm savings		37,976
Incentive spend	$	195,800
Non-Incentive Utility Costs	$	4,982
Idaho Energy Efficiency Rider spend	$	200,782

Description

Idaho electric customers (Schedule 1) who heat their homes with Avista electric or natural gas may be eligible for a rebate for the installation of a high-efficiency electric heat pump water heater (≥1.8 UEF) , natural gas tankless water heater (≥ 0.82 UEF), or natural gas high-efficiency 55-gallon or less water heater (≥0.65 UEF). Efficiencies for space- and water-heating equipment are verified according to the contractor invoice or the Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

Program Activities

- ***Electric:*** Savings were 12,986 kWh in 2020, a 12 percent decrease over the 14,763 kWh of savings achieved in 2019. Savings accounted for less than 1 percent of the residential portfolio.
- ***Natural Gas:*** Overall therm savings were 37,976, an increase of 121 percent over savings of 17,131 therms in 2019. Savings accounted for 12 percent of the residential portfolio and the program achieved 96 percent of its savings goal of 39,436 therms.

Program Changes

There were no program changes for 2020.

Impact Evaluation

ADM arrived at a realization rate of 111 percent for the residential electric water heating program and 100 percent for the natural gas program.

The realization rate for the electric savings in the Water Heat program deviates from 100 percent 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.

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 CC&B web rebate data or mail-in rebate applications.

The evaluators also found that all sampled rebate equipment met or exceeded the measure efficiency requirements for the Water Heat program.

The evaluators did note the following discrepancies:

- In some instances, the CC&B web rebate data does not reflect the same values found in the mail-in rebate applications and/or invoices or AHRI certification documents submitted with the rebate application. For example, 10 of the 111 sampled rebates were not found in the CC&B dataset. A number of the sampled rebates were found to have discrepancies in model numbers between the CC&B data and the mail-in rebate applications and/or invoices.
- Not all rebates were accompanied with AHRI certification.
- The evaluators found one rebate that indicated a quantity of two, but expected savings assigned to the rebate aligned with a quantity of one. The evaluators applied the sampled realization rate to the expected savings value; therefore, the rebate was assigned the savings of one unit of equipment.

Recommendations

- The evaluators recommend that Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database.
- In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The evaluators recommend correcting for instances where quantity is greater than one and savings is equivalent to one measure.

Program Marketing

The program was included in the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Plans for 2021

Avista plans to continue offering water heater rebates in 2021. Avista will also examine the rebate process and seek ways to improve accuracy and the completeness of submitted information.

Residential ENERGY STAR Homes Program

TABLE 49 – RESIDENTIAL ENERGY STAR HOMES PROGRAM METRICS

ENERGY STAR Homes Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		16
Overall kWh savings		50,705
Incentive spend	$	6,500
Non-Incentive Utility Costs	$	7,052
Idaho Energy Efficiency Rider spend	$	13,552
ENERGY STAR Homes Program Summary – Natural Gas		**2020**
Participation, Savings, and Costs		
Conservation projects		3
Overall Therm savings		402
Incentive spend	$	1,950
Non-Incentive Utility Costs	$	69
Idaho Energy Efficiency Rider spend	$	2,019

Description

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. In addition, after the launch of NEEA's regional effort, the manufactured homes industry established manufacturing standards and a labeling program to obtain ENERGY STAR-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 a sustainable, low operating cost, environmentally friendly structure as an alternative to traditional manufactured home construction. In Idaho, Avista offers both electric and natural gas energy-efficiency programs, and, as a result, 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.

Idaho residential electric customers (Schedule 1) with a certified ENERGY STAR home or ENERGY STAR/ECO-rated all-electric manufactured home are eligible. Idaho residential electric customers (Schedule 1) with a NEEM-certified home that has Avista electric and Avista residential natural gas (Schedule 101) for space and water heating are eligible.

A certified ENERGY STAR manufactured home with Avista electric or natural gas only or both Avista electric and natural gas service provides energy savings beyond code requirements for space heating, water heating, shell measures, lighting, and appliances. 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

- ***Electric:*** Savings were 50,705 kWh in 2020, far surpassing the program's goal of 6,630 kwh. Still, the program accounted for 1 percent of the residential electric savings portfolio.
- ***Natural Gas:*** Savings were 402 therms in 2020, with three projects overall (one natural gas, two natural gas and electric combined), less than 1 percent of the residential gas savings portfolio.

The 2020 incentive for ENERGY STAR manufactured homes was $650 per unit for electric only (and natural gas and electric customers). The gas-only customer rebate was $400 in 2020.

Impact Evaluation

Evaluators arrived at a realization rate of 102 percent for the electric ENERGY STAR Homes Program and 100 percent for the natural gas program.

The realization rate for the electric program deviated slightly from 100 percent 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 ENERGY STAR Home – Manufactured Furnace measure category. The overall effect this change had on the measure is an upward adjustment on savings.

The evaluators found no significant or notable discrepancies in the project data and rebate documentation for the rebates in the Idaho electric service territory.

Recommendations

The evaluators note that the realization for the ENERGY STAR Home – Manufactured, Natural 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.

Program Marketing

The program was included in the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Plans for 2021

Avista plans to continue to offer the ENERGY STAR Homes program in 2021. The 2021 incentive for ENERGY STAR manufactured homes will be increased to $1,000 per unit for both electric only and natural gas and electric customers. The gas-only customer rebate will be increased to $600 in 2021. Avista also plans to update the RTF value for ENERGY STAR homes measures in the TRM per ADM's recommendation.

Residential Fuel-Efficiency Program

TABLE 50 – RESIDENTIAL FUEL-EFFICIENCY METRICS

Fuel-Efficiency Program Summary – Fuel Efficiency	2020	
Participation, Savings, and Costs		
Conservation projects		95
Overall kWh savings		635,962
Incentive spend	$	225,600
Non-Incentive Utility Costs	$	115,185
Idaho Energy Efficiency Rider spend	$	340,785

Description

The Fuel-Efficiency program rebate encourages customers to consider converting their resistive electric space and water heating to natural gas. The direct use of natural gas continues to be the most efficient fuel choice when available, and, over time, offers the most economic value in terms of the operating costs of the equipment. Since the early 1990s, Avista has offered a conversion rebate. While natural gas prices have risen slowly in recent years, the cost of infrastructure continues to rise at a faster pace, both for the utility and for customers' installation costs for these conversions. Avista provides incentives for customers switching from electric resistance heat to a natural gas forced air furnace – or a combination conversion rebate for water heater and natural gas furnaces.

The company pays this prescriptive rebate upon the measure installation and receipt of all relevant documentation. Customers' minimum qualifications include using Avista electricity for electric straight-resistance heating or water heating, which is verified by evaluating their energy use. Residential electric customers (Schedule 1) in Idaho who heat their home or water with Avista electricity may be eligible for a rebate for converting to natural gas. The home's electric baseboard or furnace heat consumption must indicate a use of 8,000 kWh or more during the previous heating season (and less than 340 therms).

In 2020, the conversion for electric heat to natural gas forced air or boiler heat was $2,100. The conversion from electric heat to natural gas forced air heat and water heat combination was $2,850.

Program Activities

The Fuel-Efficiency program obtained 635,962 kWh of savings in 2020, which is a decrease of 46 percent from the 1,181,596 kWh achieved in 2019. Savings from this program accounted for 12 percent of the residential electric savings portfolio.

Fifty-nine of 95 customers used the electric furnace to natural gas furnace measure, with the remaining 36 using the combination measure (natural gas furnace and water heat). The decline in savings was due in part to a lower realization rate than in previous years.

Program Changes

TRM values for this program were changed in accordance with Cadmus recommendations.

Impact Evaluation

ADM arrived at a realization rate of 82 percent for the residential Fuel-Efficiency program. Evaluation methods for this program included a database review and document verification, verification surveys, and a billing analysis. The realization rate for the electric savings deviate from 100 percent due to the differences between the applied Avista TRM prescriptive savings value and the billing analysis and true Avista TRM value. The evaluators found one rebate was duplicated in the project data for the electric to natural gas furnace measure. ADM removed this instance from the verified savings for the program. In addition, the 93.33 percent survey in-service rate applied to the combination conversion measure further decreased the realization rate for the measure and program overall.

Recommendations

In addition to the recommendations in the residential programs section on page 71, ADM offered the following recommendations for the Fuel-Efficiency program:

- Evaluators recommend Avista collect efficiency values on the rebate application for conversion measures, not just HVAC measures. Customers can get rebates for a conversion but also not apply for an HVAC rebate (HVAC rebates do ask for the efficiency on the application).
- The evaluators found the CC&B data does not contain manufacturer information. The evaluators recommend this as an input in the CC&B data. The electric to natural gas furnace & water heat measure CC&B data does not detail both the furnace and the water heater model number and manufacturer details. Instead, it contains only the furnace or only the water heater equipment. The evaluators recommend collecting equipment manufacturer, model number, and efficiency for the combination measures.

Program Marketing

Energy-efficiency marketing efforts build considerable 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 and utility website promotion include vendor training, retail location visits, and presentations at various customer events throughout the year.

The program also took advantage of the "Way to Save" advertising campaign to increase awareness and drive program participation. See pages 58-63.

Plans for 2021

There were no changes made for the program in 2021. Avista will consider ADM's recommendations to expand information collected on the rebate form to include efficiency values and manufacturer information.

Residential Simple Steps, Smart Savings Program

TABLE 51 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM METRICS

Simple Steps, Smart Savings Program Summary – Electric	2020	
Participation, Savings, and Costs		
Conservation measures		235,575
Overall kWh savings		2,968,563
Incentive spend	$	214,050
Non-Incentive Utility Costs	$	262,550
Idaho Energy Efficiency Rider spend	$	476,600
Simple Steps, Smart Savings Program Summary – Natural Gas	**2020**	
Participation, Savings, and Costs		
Conservation measures		1,129
Overall Therm savings		234
Incentive spend	$	0
Non-Incentive Utility Costs	$	0
Idaho Energy Efficiency Rider spend	$	0

Description

Avista collaborates with BPA on Simple Steps, Smart Savings, a regional program designed to increase the adoption of energy-efficient residential products. To achieve energy savings, residential consumers are encouraged to purchase and install high-quality LEDs, light fixtures, energy-saving showerheads, and ENERGY STAR appliances. Lighting and showerhead programs are offered only in Idaho.

Simple Steps, Smart Savings continues to provide the region's best opportunity to collectively influence both retail stocking practices and consumer purchasing. There continue to be opportunities for efficient lighting improvements in customer residences, as many residential lighting sockets are still occupied by inefficient bulbs. Incentives also encourage customers to increase efficiency before burn-out of the existing less-efficient lighting. Energy savings claimed are based on BPA deemed savings values.

Program Activities

- ***Electric:*** Savings were 2,968,563 kWh in 2020, far surpassing the program's goal of 661,531 kWh. Savings accounted for 56 percent of all residential electric savings.
- ***Natural Gas:*** Savings were 234 therms in 2020, less than 1 percent of the residential gas savings portfolio.

The key to delivering on the objectives of this program are the incentives to encourage customers' interest and marketing efforts to drive them to using the program. The model used for lighting and showerheads uses manufacturer partnership to buy down costs of products and allow for greater flexibility on how money is used (markdowns and/or marketing).

CLEAResult is contracted by Avista to provide the manufacturer and retail coordination. They are responsible for coordinating program marketing efforts, performing outreach to retailers, ensuring that the proper program tracking is in place, and coordinating all implementation aspects of the program. Big-box retailers, in addition to select regional and national mass-market chains, are the primary recipient of the product and typically offer a variety of the Simple Steps, Smart Savings products at their locations. These products are clearly identified with point-of-purchase tags.

Lighting product savings decreased slightly in 2020 over 2019 as demand for LEDs reached its peak and the program was terminated at the end of Q3. The lowest lumen (250-1049) general purpose LED lamp continued to yield the largest savings for Avista. Savings for showerhead products increased drastically from 2019 while savings for clothes washers was nearly nonexistent.

While the pandemic continued to have a significant impact on the economy and consumer trends, the Simple Steps, Smart Savings lighting and showerhead programs saw a quick rebound in sales at home improvement stores likely because of an uptick in DIY projects while Avista's customers were home. Clothes washers, on the other hand, were affected dramatically as one of the two retail participants closed its doors permanently and the other offered curbside pickup services only throughout most of 2020.

FIGURE 37 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM – LIGHTING KWH SAVINGS

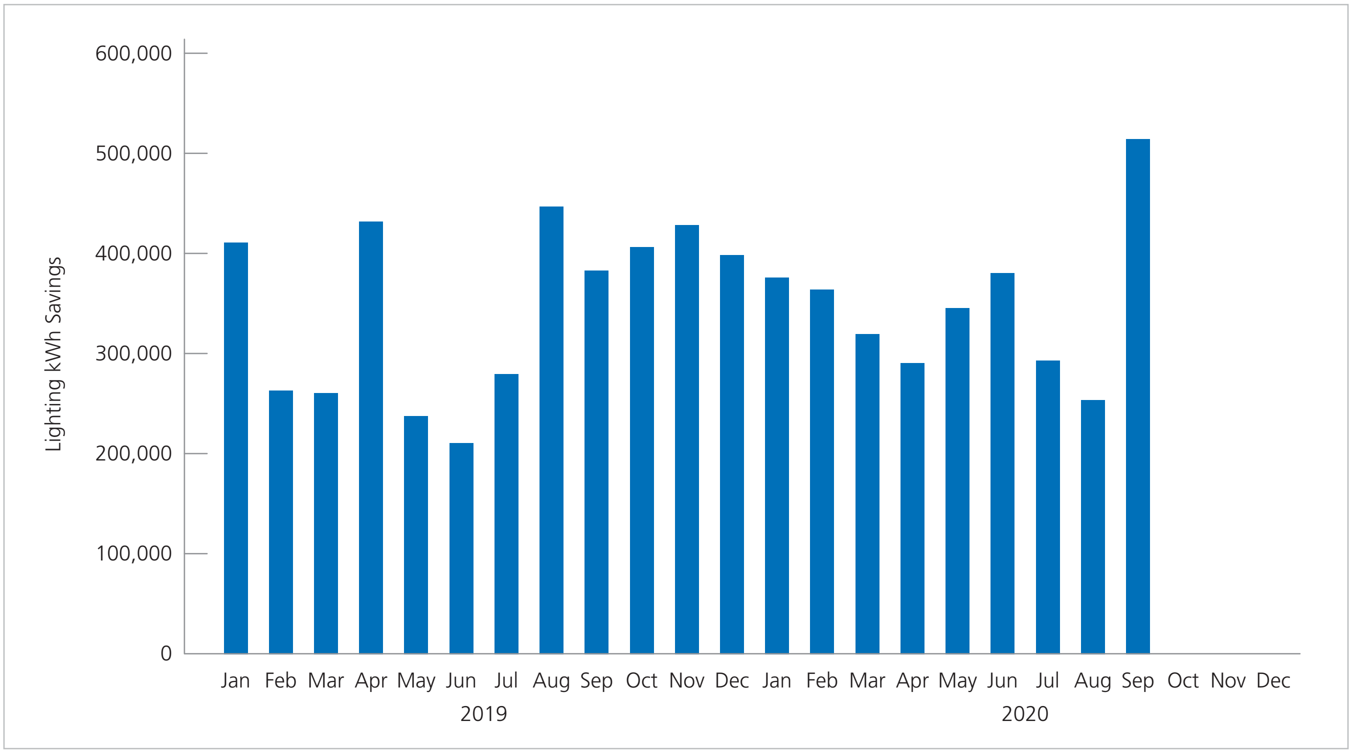


FIGURE 38 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM – SHOWERHEADS SAVINGS

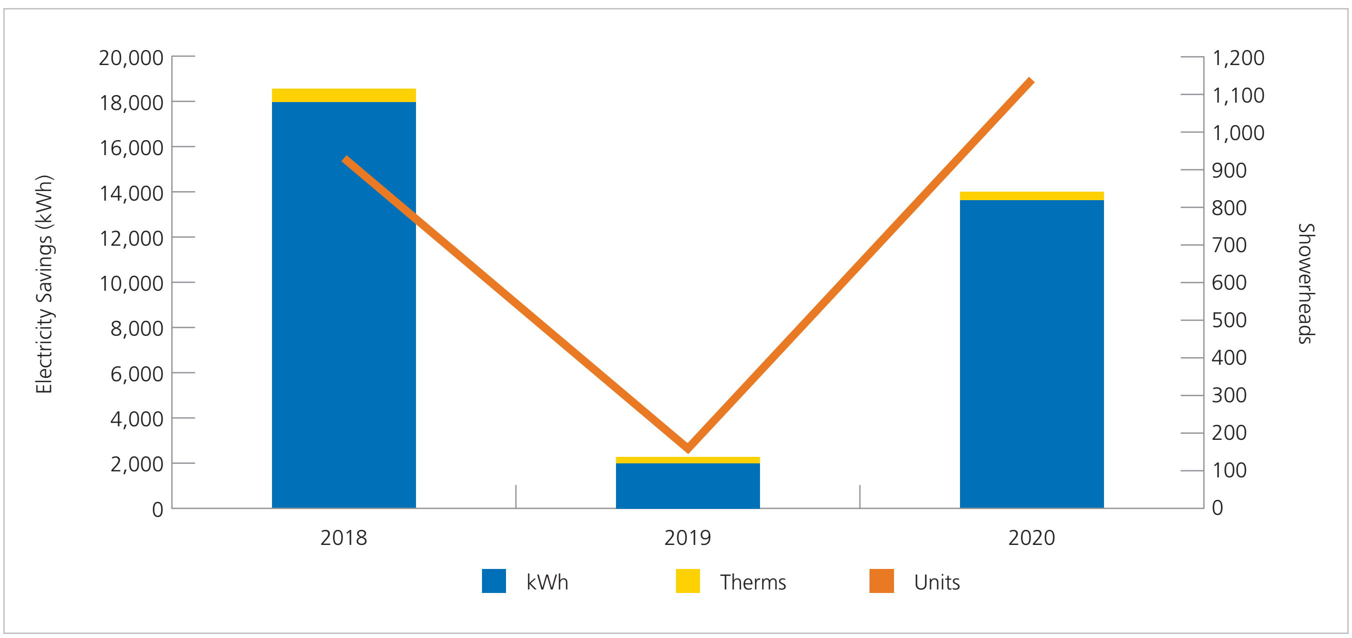
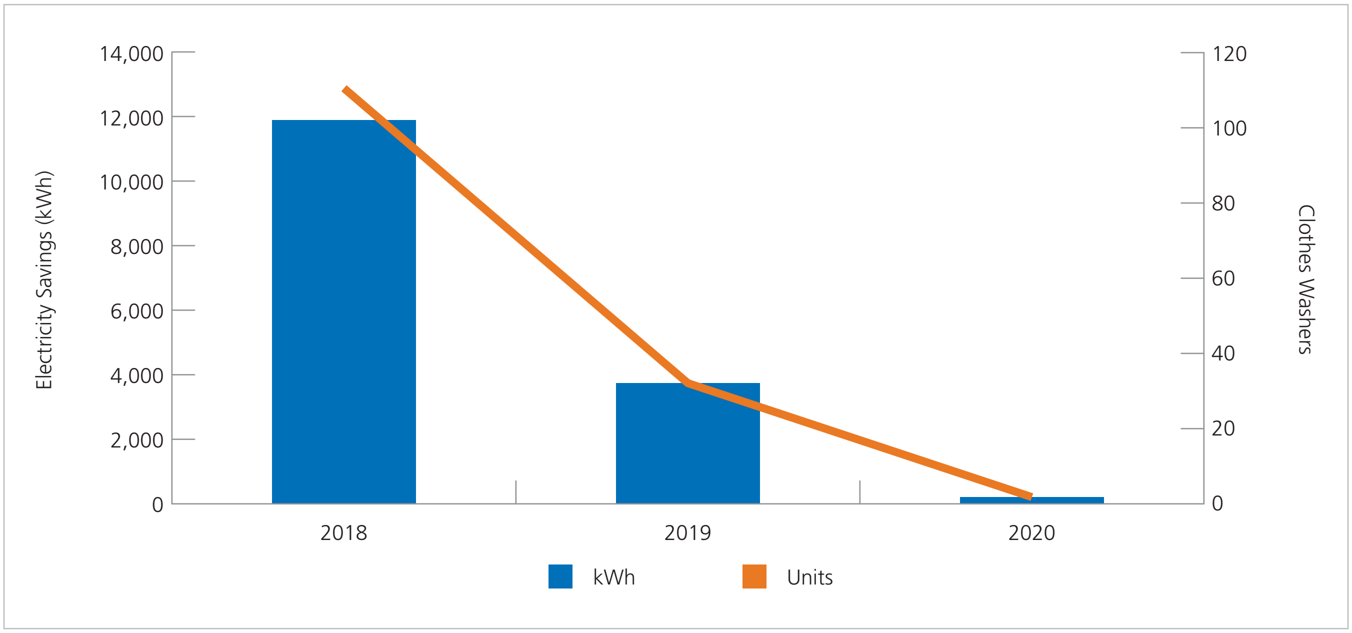


FIGURE 39 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM – CLOTHES WASHERS KWH SAVINGS



Program Changes

Incentives and savings decreased in 2020 for lighting and showerhead products and remained stable for clothes washers.

TABLE 52 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM INCENTIVES CHANGES

Product Category	Incentive Per Unit			
	2020		2020	
LED Bulb	$	0.50-3.00	$	0.50-2.00
LED Fixture	$	0.50-4.00	$	0.50-2.00
Showerhead	$	2.00-6.00	$	2.00
Clothes Washer	$	25.00	$	25.00

Program Marketing

Table 93 is a monthly chart of Simple Steps, Smart Savings program marketing and field activities indicating when the activity was deployed or took place.

TABLE 53 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM MARKETING ACTIVITIES

Deliverable	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Program Activities										
Annual report		✔	✔							
Paid placement			✔							
Shelf survey				✔						
Final program report									✔	✔
Marketing Activities										
Partner promotions					✔	✔	✔	✔	✔	
EFX conference					✔					
Brand awareness	✔	✔	✔	✔						
Retail collateral	✔	✔	✔	✔	✔	✔	✔	✔	✔	
Field Activities										
Lighting events		✔	✔	✔	✔	✔	✔	✔		
Appliance events		✔			✔	✔		✔		
Shelf survey data collection			✔							

Customer Satisfaction

As the Simple Steps, Smart Savings field representatives sunsetted each store toward the end of Q3, they collected comments and feedback from store associates. Those interviewed mentioned that the program worked well in driving customers to LEDs and the customers really appreciated the lighting discounts. The associates also noted they will miss having the program in place as it was beneficial to their overall sales.

The implementer responded to the COVID-19 pandemic thoughtfully, which enabled the program to continue to perform well despite the circumstances until its termination in September 2020. The implementer let retailers permit or deny store visits from implementation field staff, allowed field staff the flexibility to reschedule store visits, and conducted virtual store visits to educate store associates about the program and products (such as LEDs) like it typically would. Avista and the implementer also scaled back marketing and outreach efforts and allowed each retail location to tailor marketing, including point-of-purchase materials provided by the implementer, to their individual needs.

Avista observed unexpectedly low throughput for clothes washers, which the implementer attributed to the challenge it faced when recruiting retail locations to participate. Despite showing a willingness to participate, some retail locations for franchised and individually owned stores like Ace Hardware could not offer program rebates because of a lack of communication/direction from their corporate offices. Thus, fewer retailers offered buy-down for clothes washers, and fewer customers obtained clothes washer rebates. This is useful feedback for Avista as it considers potential midstream appliance programs in the future.

Cadmus' process evaluation found that retailers were generally appreciative of their opportunity to participate in Simple Steps, Smart Savings and saddened to learn of the program's discontinuation. Per the implementer, retailers complimented the program as a "selling tool" and "a good way to get customers looking at more-efficient products."

Impact Evaluation

The Simple Steps, Smart Savings program had a realization rate of 94 percent for electric measures, accounting for 56 percent of residential evaluated savings. The realization rate for gas measures in the program was 100 percent.

Plans for 2021

For 10 years, Simple Steps, Smart Savings has been a source of significant savings for Avista. In 2019 it became clear that the lighting market has transformed drastically over the years in part to retail incentive programs. Where once only inefficient products lined the shelves, energy-efficient products now account for 75 percent of lighting on shelves in the Northwest. As a result of this transformation, the Simple Steps, Smart Savings program was terminated on September 30, 2020 per the following activity schedule:

TABLE 54 – RESIDENTIAL SIMPLE STEPS, SMART SAVINGS PROGRAM PHASE-OUT

	August				September				October			
Program												
Utility communication – program ending + next steps			✔	✔								
Partner communication ≠ program ending + submission deadline				✔	✔							
Final monthly invoices and program reports to utilities and BPA											✔	
Final annual program report to BPA											✔	
Life of program report – 1st draft to BPA					✔							
Life of program report – 2nd draft to BPA									✔			
Life of program report – final to BPA												✔
Final annual NPS reports to BPA												✔
Historical program date and files to BPA										✔	✔	✔
Field												
Store Communication – program ending + remove POP – Tier 3				✔	✔							
Store Communication – program ending + remove POP – Tier 2						✔	✔					
Store Communication – program ending + remove POP – Tier 1								✔				
Marketing												
Website disabled								✔				
Temporary website messaging displayed									✔	✔	✔	✔

Residential Multifamily Direct Install Program and Supplemental Lighting

TABLE 55 – RESIDENTIAL MULTIFAMILY DIRECT INSTALL PROGRAM AND SUPPLEMENTAL LIGHTING PROGRAM METRICS

Multifamily Direct Install Program Summary – Electric		2020
Participation, Savings, and Costs		
Measures installed		16,925
Overall kWh savings		747,227
Incentive spend	$	278,555
Non-Incentive Utility Costs	$	167,397
Idaho Energy Efficiency Rider spend	$	445,952

a) The MFDI has been tracked by total measures installed which include LED lamps, faucet aerators, showerheads, smart strips, pipe wrap, and other measures.

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 in tenant units 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 LED 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 and Avista to ensure the project is cost-effective, after which the project is completed.

Program Activities

- ***Electric:*** Savings were 747,227 kWh in 2020, achieving 58 percent of the program's goal of 1,289,000 kWh. Savings accounted for 58 percent of all residential electric savings.

During 2020, the response to the COVID-19 pandemic caused disruption to the MFDI program's direct-installation design, forcing the third-party implementer to temporarily halt program processes. In late August 2020, supplemental lighting contractors were allowed to complete projects with exterior lighting measures only. The program also experimented with a couple of non-contact or low-contact delivery methods, including a tote drop-off method, in which tote bags including predetermined numbers of lamps, showerheads and aerators, as well as program information, were delivered to residents in multifamily communities. A second method used on-site facility managers that were willing to help tenants install these products. Despite employing these innovative approaches, the MFDI and MFDI supplemental lighting programs did not meet savings goals, with reported savings achieving 55 percent of the savings goal for MFDI programs.

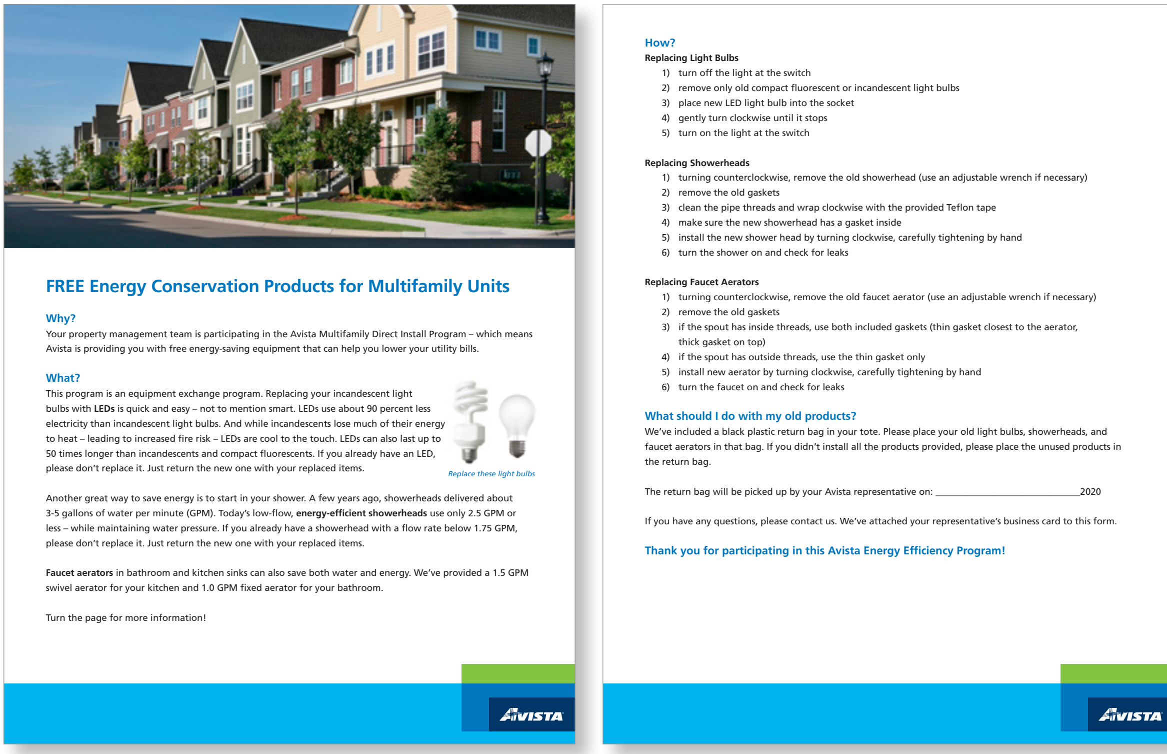
Program Changes

The program did not have any measure changes in 2020.

Program Marketing

This program is marketed by Avista and SBW, and by property managers through word-of-mouth. Avista tries to manage the program pipeline to provide a timely scheduling process.

FIGURE 40 – 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!

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!

Customer Satisfaction

Cadmus evaluated MFDI processes and shared the following findings with Avista:

Collaborative relationships between Avista and the program implementer allowed new delivery methods and future implementation techniques to be conceptualized quickly in response to COVID-19. Open communication between the implementer and property managers ensured the quick dissemination of new implementation information to maintenance staff and tenants allowing the program to continue in 2020 despite challenges due to the pandemic.

- In response to continued COVID-19 restrictions, Avista and implementer staff developed a contactless delivery method.
- Due to low uptake in the first post-COVID-19 implementation phase, Avista and the implementer adjusted the program to increase participation and measure installation by limiting measures and working with property managers.

Property managers were satisfied with the program but suggested some tenants were not satisfied with all the measures included in the program. Additionally, some tenants did not install measures that were difficult to install or for which they did not have appropriate tools.

- Four of five property managers were *very satisfied* with their MFDI program experience overall.
- Two property managers reported tenants were not satisfied with faucet aerators and kitchen aerators due to low water pressure and appearance while three property managers reported tenants were dissatisfied with showerheads due to restricted water flow.
- One property manager reported that tenants participating in Phase 1 were *not at all satisfied* with installation and educational materials provided by Avista.

The reliance of current data tracking on tenants' willingness to return uninstalled or unused equipment, together with low recovery rates, may be a contributing factor to minor inconsistencies in measure-level data.

- The drop-off delivery phases relied heavily on documentation filled out by maintenance staff and tenants detailing the location and type and quantity of both installed and removed measures. The implementer noted during the drop-off phases difficulty in tracking measure installation locations in tenants' units without the presence of a field technician to document measure implementation.

Cadmus made the following recommendations to improve processes and customer satisfaction for the program:

- If the MFDI program continues to request that tenants install measures directly, consider offering an additional incentive such as an entry in a drawing for returning measures that are not installed and for providing information on installed measures and their location.
- If the MFDI program continues to operate using the drop-off delivery method which requires tenants to install measures directly, continue focusing on simple and easy-to-install measures like LEDs. Provide easy-to-follow installation instructions and remind tenants of the benefits of installation in the program materials.

Impact Evaluation

Overall, Cadmus found that the MFDI program is an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units.

TABLE 56 – RESIDENTIAL MULTIFAMILY DIRECT INSTALL PROGRAMS ELECTRIC IMPACT FINDINGS

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Realization Rates
Multifamily Direct Install	510,265	542,451	106%
Multifamily Direct Install Supplemental Lighting	200,474	204,776	102%
MFDI Programs Total	**710,740**	**747,227**	**105%**

The discrepancies between evaluated and reported savings for the MFDI program were a result of reported savings calculations using UES values for non-lighting measures (aerators and showerheads) that were lower than the UES values provided by the most recent RTF workbooks. Specifically, reported savings for showerheads used UES values from Avista's most recent TRM that did not reflect the most recent RTF UES values. The implementer confirmed it used UES values from the most recent TRM to calculate reported savings for showerheads, but not the most recent RTF revision. Cadmus evaluated reported savings using the RTF's most recent 2019 RTF UES value for showerheads. Reported savings for aerators used a conservative weighted average UES value that would allow for some aerators with heat pump water heaters. However, Cadmus determined that the aerator UES value for electric resistance water heater types is more appropriate for the building stock served by the MFDI program. The implementer accepted this recommendation, and Cadmus evaluated savings using the 2019 RTF UES value for aerators with electric resistance water heater types.

Cadmus also identified instances where evaluated realization rates were low for lighting measures because the implementer did not properly account for electric heating interaction effects in common area spaces. In addition, Cadmus found reported savings calculations for lighting measures that did not account for the savings that come from cooling interaction effects in interior spaces. However, the 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 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. Cases with undefined HOU exceeded 100 percent realization since these hours were lower than those documented in the calculation methodology and site data provided. In addition, Cadmus could not verify the interior or exterior lighting HOU for some of these spaces because the assigned identification numbers could not be found in the accompanying audit data.

Recommendations

Cadmus offered the following recommendations for the MFDI program:

- Continue to focus on replacing high-use, low-efficiency lamps where practical to maximize program cost-effectiveness and maintain high savings.
- Use the most current RTF UES values that are appropriate for the MFDI program's building stock to calculate reported savings. Ensure that the TRM provides values and cites sources for all measures. Review the TRM annually and check if updated values are available for any TRM measures using RTF workbooks as a source.
- Ensure methodology documentation and reported savings inputs are accurate and provided for all site data.

Plans for 2021

This program is currently scheduled to run through 2021 and will be run as originally planned as COVID-19 restrictions are lifted. Avista will consider short-term changes to drop-off and tenant installation methods of delivery, but those considerations will depend on the timeline for COVID-19 restrictions being lifted.

For 2021, Avista has updated its TRM to the most recently available RTF at that time. Note that UES values are updated at the beginning of the planning cycle and are locked in for the year.

Residential Home Energy Audit Pilot Program

Description

Taking advantage of previous home energy audit program 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 are located 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 directly 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 items 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.

In early 2020 Avista gained approval from the Energy Efficiency Advisory Group and commission staff for both Idaho and Washington to move the program from pilot to full program status. Modifications to program marketing materials and agreement forms were underway when pandemic restrictions began, effectively suspending the Home Energy Audit program. As a result, no audits were conducted in 2020.

Program Activities

Due to COVID-19 related restrictions, all program activities were suspended and will resume when these restrictions are lifted.

Plans for 2021

As intended for 2020, the Home Energy Audit pilot program will be scaled up and offered across the utility's entire Idaho and Washington service territory. Based on pilot program 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 our community agency partners to serve vulnerable populations with this program offering.

Qualifying customers 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.

LOW-INCOME SECTOR

Clearwater River, Orofino, Idaho

LOW-INCOME SECTOR

Program-by-Program Summaries

Low-Income Program (Including Community Energy Efficiency Program Projects)

TABLE 57 – LOW-INCOME PROGRAM METRICS

Low-Income Program Summary – Electric		2020
Participation, Savings, and Costs		
Conservation projects		146*
Overall kWh savings		215,300
Incentive spend	$	395,025
Non-Incentive Utility Costs	$	241,779
Idaho Energy Efficiency Rider spend	$	637,629
Low-Income Program Summary – Natural Gas		**2020**
Participation, Savings, and Costs		
Conservation projects		149*
Overall Therm savings		5,495
Incentive spend	$	547,343
Non-Incentive Utility Costs	$	115,171
Idaho Energy Efficiency Rider spend	$	662,514

* Many homes served in Idaho last year were dual-fuel and may be counted on both the electric and the natural gas program totals.

Description

Avista works with a Community Action Partnership (CAP) agency to deliver low-income energy-efficiency programs in nine Idaho counties within the company's service territory. The CAP has the infrastructure in place to income-qualify customers and provides access to a variety of funding sources to make energy-efficiency improvements to their homes. The agency serving Avista's Idaho territory receives an annual funding amount of $875,000.

The agency may spend its contract amount at its discretion on either electric or natural gas efficiency measures. Improvements to the home's shell (e.g. insulation, windows) or conversions from electric heat to heat pump or from electric heat to natural gas furnaces require that the home demonstrates a minimum level of annual energy use of either Avista electricity or natural gas for space heating purposes. Within the annual funding allocation is a 15 percent reimbursement for administrative costs. The agency may also choose to use up to 15 percent of its 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 cost-effective and allow for full reimbursement of the installation.

A qualified list of measures allows for partial reimbursement of efficiency improvements that may not be cost-effective from a utility perspective 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 energy efficiency improvement.

Program Activities

For 2020, the program achieved 215,300 kWh of reported electric savings in Idaho.

Table 58 shows Avista savings goals for the low-income sector for 2020, as well as reported savings and goal portions achieved in 2019. The program achieved 5,495 of reported therm savings.

TABLE 58 – LOW-INCOME REPORTED SAVINGS

Program	Savings Goals (kWh)	Reported Savings (kWh)	Percentage of Goal
Low-Income	101,876	195,603	192%
Low-Income – Total	**101,876**	**195,603**	**192%**

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 59*). Avista deemed these measures as cost-effective during the 2020 *Annual Conservation Plan* development.

TABLE 59 – LOW-INCOME PROGRAM APPROVED MEASURE LIST

Electric Measures	Natural Gas Measures
◆ Air infiltration ◆ Doors – ENERGY STAR rated ◆ Duct insulation ◆ Duct sealing ◆ Floor insulation ◆ LED lamps ◆ Refrigerator – ENERGY STAR rated ◆ Wall insulation	◆ Boiler – 96% ◆ Doors – ENERGY STAR rated – .30 U-factor ◆ Furnace (90% AFUE) ◆ Natural gas water heater (0.65 for storage) ◆ Natural gas water heater (.82 tankless) ◆ Windows – ENERGY STAR rated **Fuel Conversion Measures** ◆ Electric to natural gas furnace ◆ Electric to natural gas water heater ◆ Electric to air-source heat pump (8.5 HSPF)

Measures that did not meet the utility cost-effectiveness test are found on the qualified rebate list. The agency is eligible to receive a partial reimbursement for the installation. The reimbursement amount is equal to the avoided cost-energy value of the improvement. This approach focuses the agency toward installing measures that had the greatest cost-effectiveness from the utility's perspective. To allow for additional flexibility, the agency may use the health and safety dollars to fully fund the cost of the measures on the qualified rebate list.

TABLE 60 – LOW-INCOME PROGRAM QUALIFIED REBATE MEASURE LIST

Electric Measures	Natural Gas Measures
◆ Air source heat pump replacement (9.0 HSPF) ◆ Attic insulation ◆ Electric to ductless heat pump (9.0 HSPF) ◆ Heat pump water heater (Tier 2-3 any size) ◆ Windows – ENERGY STAR rated – .30 U-factor	◆ Air infiltration ◆ Attic insulation ◆ Duct insulation ◆ Duct sealing ◆ Floor insulation ◆ Wall insulation

Program Changes

The agency started the year with a funding allocation of $875,000 for energy-efficiency measures; this was a $50,000 increase from the previous year contract as per Order No. 34499 of IPUC Case No. AVU-E-19-04. Other program changes include the yearly update of measures eligible for the approved or qualified rebate lists. This is based on the company's annual business plan process that is completed in Q4 2019. The eligible measures for 2020 are summarized in *Tables 59* and *60*.

While not a change to the program, the COVID-19 pandemic certainly had an effect on homes. When Idaho stay-at-home orders were announced in late March, agencies paused installation of weatherization services until early July 2021. The CAP agency operating in Idaho also serves Avista customers in a small neighboring county in Washington state. For consistency purposes, the same Safe Start protocols that were developed in Washington were also applied to the Idaho service territory. This plan included personal protection and contact tracing initiatives. While it was anticipated that the agency would not be able to spend much of its Avista contract amount due to losing three months of time in the field, it was able to spend the full amount of the Avista contract along with an additional $200,000 to assist with serving a growing list of customers who were heading into the winter with homes in need of weatherization and heating system upgrades. Part of the reason for the quick spend of Avista dollars during the pandemic was the lack of federal dollars that were expected but did not materialize. Utility dollars were the primary funding source available when the agency was able to re-enter customer's homes; the original amount of the Avista contract was fully allocated by September.

Customer Outreach

Customers who participate in the low-income weatherization program are often referred through the agency's energy assistance program. In a usual year, Avista provides a handful of referrals each year from a variety of internal departments including energy efficiency and customer service, as well as Avista's Customer Assistance Referral and Evaluation Services (CARES) program. CARES provides support for disabled, elderly, and low-income customers, or customers experiencing hardships related to employment, health, or finances. In 2020 the company expanded this process to include a hardship referral for customers who contacted Avista's call center and expressed economic distress. The hardship referral includes a customer call transfer along with a daily report of the previous days' referrals to CAP to ensure customers are connected to helpful bill assistance programs and ultimately weatherization opportunities once the agency was able to re-enter customer homes.

Other referrals are a 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 disability, and veterans. Avista reaches this target population through workshops, energy fairs, and mobile and general outreach. Each 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 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.

Avista recognizes several educational strategies as being efficient and effective activities for delivering energy efficiency and conservation outreach:

- Energy conservation workshops for groups of Avista customers where the primary target audience is senior and low-income participants.
- Energy fairs where attendees can receive information about low- and no-cost methods to weatherize their homes through demonstrations and energy-saving products. In addition, fair attendees can learn about bill assistance and watch demonstrations of the online account and energy management tools. Community-based organizations 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.
- Mobile outreach is conducted through the Avista Energy Resource Van, where visitors can learn about effective tips to manage their energy use, bill payment options, and community assistance resources.
- Through general outreach, Avista provides energy management information and resources at events (such as resource fairs) and partnerships that reach the target populations. General outreach also includes outlining bill payment options and assistance resources in senior and low-income publications.

In 2020, to safeguard public and staff health and well-being, Avista suspended outreach activities for several months and used the time to determine how to safely connect with customers to provide energy saving information and resources. For public and staff safety, company-hosted energy fairs and workshops were not conducted in 2020; rather, the outreach team distributed items to local food banks to give out in food boxes and participated in food bank drive-through events. In the fall, kits were provided to North Idaho HeadStart, Meals on Wheels, and Panhandle Health's Senior Companion programs for distribution to their clients. Business reply cards were sent to customers with past due balances to return for a free home energy kit that includes draft-stopping items such as weather stripping and electrical outlet gaskets, as well as LED bulbs. The outreach team conducted and participated in 39 events that included mobile outreach and general outreach (via partnerships and events) that reached 2,147 individuals in Idaho. *Table 61* shows an overview of the different activities.

TABLE 61 – LOW-INCOME OUTREACH EVENT AND LED BULB DISTRIBUTION SUMMARY

Description	Number of Events/ Activities	Contacts	LEDs
Energy fairs	0	0	0
General outreach	38	1,922	8,451
Mobile outreach	1	225	450
Workshops	0	0	0
Total	**39**	**2,147**	**8,901**

In addition to the company's outreach and education activities, Avista partners with CAP for the employment of a full-time conservation education specialist. CAP also uses the funds to enable energy assistance intake specialists in their 10 offices to conduct conservation education activities with clients and in their communities. The conservation specialist conducts activities similar to and in parallel with Avista, and also provides one-on-one education to individuals seeking energy assistance and while weatherization projects are underway. Furthermore, the conservation specialist supports each CAP office's energy staff in their local conservation efforts.

In some situations, the conservation specialist partners with Avista's outreach personnel. These collaborations provide an opportunity for the specialist to learn Avista outreach practices and messaging. During the events where both the company and agency staff are present, the specialist focuses on promoting CAP services and programs. Due to COVID and similar to Avista's outreach program, CAP suspended participation at community events in 2020 and sought to connect with clients through mailed kits, 972 of which were mailed to households who had received energy assistance in the past year. The kits included a deluxe window kit, gasket covers, V-Seal weather stripping, LED bulbs, a nightlight, energy saving tips, and an information sheet about bill/payment options and assistance programs. A business reply card was also included, in which customers could request a Home Energy Use guide and/or a Kids Activity book.

Figure 41 includes snapshots of the business reply card, along with the instruction sheet that was included in home energy kits distributed to customers who responded to the card and through community partners to their clients:

FIGURE 41 – LOW-INCOME HOME ENERGY SAVINGS KIT DIRECT MAIL

FIGURE 42 – LOW-INCOME HOME ENERGY SAVINGS KIT BROCHURE

Program Marketing

Multiple communication channels were used to increase awareness of Avista's energy fairs. Tactics included news releases, direct mail, email, flyers, community calendars, social media, signage, and print advertising.

CAP categorizes their activities in three different approaches: low-, medium-, and high-impact. Low-impact activities are designed to heighten awareness but have the least probability of resulting in behavior change, e.g. brochures or flyers on the wall in the office waiting room. Medium-impact activities help to heighten awareness, are educational in nature, and have a moderate probability of resulting in behavior changes. They include workshops and/or informational booths at community events. Finally, high-impact activities are conducted one-on-one with individuals and have the highest probability of inspiring behavior change. High-impact activities are conducted during energy assistance intake appointments and/or while weatherization projects are underway.

FIGURE 43 – LOW-INCOME ENERGY BILL ASSISTANCE BILL INSERT

FIGURE 44 – LOW-INCOME ENERGY BILL ASSISTANCE FLYER

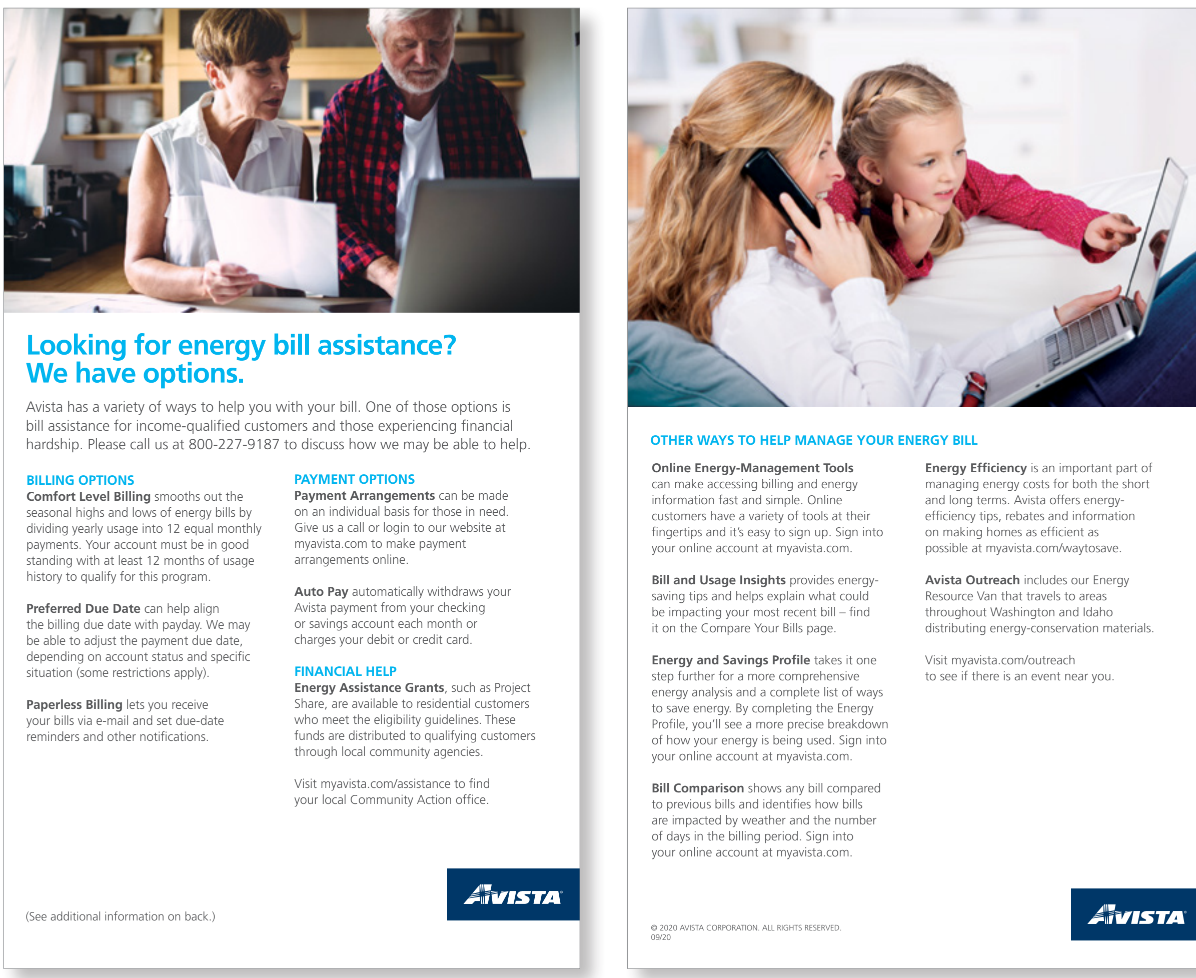


FIGURE 45 – LOW-INCOME ENERGY BILL ASSISTANCE PRINT AD

Impact Evaluation

With a realization rate of 110 percent for both electricity and gas savings, the low-income program achieved savings of 215,300 kWh in 2020 and 5,495 therms in gas savings.

The realization rates for the program deviate from 100 percent due to differences between the Avista TRM values and the appropriately assigned RTF UES values. 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.

TABLE 62 – LOW-INCOME IMPACT FINDINGS – ELECTRIC SAVINGS

Measure	2020 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
Duct sealing	1	689	689	689	100.00%
Ductless heat pump	0	0	0	0	
Air infiltration	18	15,345	15,345	18,018	117.42%
ENERGY STAR doors	9	1,304	1,682	1,682	128.94%
ENERGY STAR refrigerator	1	27	39	39	144.44%
ENERGY STAR windows	12	1,372	1,371	1,661	121.12%
High efficiency air heat pump	1	1,493	2,054	2,054	137.54%
Insulation – attic	5	3,507	3,497	1,825	52.05%
Insulation – duct	2	653	619	653	100.00%
Insulation – floor	9	7,298	8,794	9,563	131.04%
Electric to natural gas furnace and water heater	4	19,660	36,300	36,300	184.64%
Electric to natural gas furnace conversion	13	63,862	59,432	45,448	71.17%
Electric to natural gas H_20 conversion	5	13,004	9,516	7,930	60.98%
Electric to heat pump conversion	15	62,338	87,980	87,980	141.13%
Health and safety	24	0	0	0	-
LED bulbs	27	1,339	1,337	1,458	108.89%
Total	**146**	**195,603**	**228,654**	**215,300**	**110.07%**

TABLE 63 – LOW-INCOME IMPACT FINDINGS – NATURAL GAS SAVINGS

Measure	2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
Air infiltration	18	218.91	220.14	220.14	100.56%
Duct sealing	1	20.17	20.17	20.17	100.00%
ENERGY STAR doors	7	66.96	67.62	67.62	100.99%
ENERGY STAR windows	17	369.48	368.25	376.70	101.95%
High efficiency furnace	49	3,342.84	3,049.76	3,796.64	113.58%
High efficiency water heater 50G	25	174.10	176.28	176.28	101.25%
Insulation – attic	3	370.98	370.98	383.35	103.33%
Insulation – duct	0	0.00	0.00	0.00	
Insulation – floor	4	296.76	296.76	310.18	104.52%
Insulation – wall	2	82.62	82.62	77.11	93.33%
Health and safety	22	0.00	0.00	0.00	
Tankless water heater	1	66.50	66.50	66.50	100.00%
Total	**149**	**5,009.32**	**4,719.08**	**5,494.69**	**109.69%**

Impact Evaluation Methodology

ADM conducted a database review for the Low-Income program by selecting a subset of rebate applications to cross-verify tracking data inputs. Project documentation provided by Avista was reviewed, and billing data was used to check against household-level annual usage in the database.

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, there were inadequate numbers of participants in the Low-Income program 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. A matched cohort for electric measure households was created, with customers 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, and used nearest-neighbor matching with a 5:1 matching ratio. Therefore, each treatment customer was matched to five similar control customers.

Table 64 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 percent 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 64 – LOW-INCOME PROGRAM MEASURE SAVINGS

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (kWh)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
All electric measures	77	364	1,693	1145	2624	0.73	Model 2: PPR

The evaluators applied these regression savings estimates to the program as a whole, by the number of unique households in the program, and found a realization rate of 129.86 percent for all electric measures in the program. Further details of the billing analysis can be found in Appendix A.

ADM provided the following recommendations for Avista's Low-Income program:

- The evaluators note that most deviations from 100 percent realization rate are due to differences between the limited measure category options in Avista's TRM and the more detailed categories for heating zone, cooling zone, heating type, and bulb type present in the RTF. The evaluators recommend that Avista refer to 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 CC&B and the rebate project documentation provided in the data request for document verification. In addition, the unit type, in terms of square footage or number of measures (windows, doors, etc.,) was not documented consistently and therefore savings values were applied inaccurately. The evaluators recommend updating CC&B documentation standards to more accurately reflect values present on the rebate applications.
- The evaluators found discrepancies between the 20 percent annual consumption cap and the claimed energy savings. The evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage and the date range used to calculate the household consumption estimate.

Cost-Effectiveness

Tables 65 and *66* show the low-income sector cost-effectiveness results by fuel type.

TABLE 65 – LOW-INCOME ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 272,178	$ 546,723	0.50
Total Resource Cost (TRC)	$ 366,774	$ 605,151	0.61
Participant Cost Test (PCT)	$ 687,611	$ 454,279	1.51
Ratepayer Impact (RIM)	$ 272,178	$ 1,018,619	0.27

Table 9 shows residential cost-effectiveness results for electric.

TABLE 66 – LOW-INCOME NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 68,285	$ 662,514	0.10
Total Resource Cost (TRC)	$ 168,428	$ 638,498	0.26
Participant Cost Test (PCT)	$ 596,928	$ 523,327	1.14
Ratepayer Impact (RIM)	$ 68,285	$ 823,100	0.08

Plans for 2021

The measures available for full reimbursement will be the same as 2020 and will now include window replacement for electric heated homes. Homes that heat with electricity will receive partial funding for replacement of: existing air source heat pumps with high-efficiency models, converting electric water heaters to natural gas, and the installation of heat pump water heaters. Homes that heat with natural gas continue to receive partial funding for all insulation measures.

As a dual-fuel utility, Avista does not impose requirements to annually serve a set number of electric or natural gas heated homes. The CAP is provided with the flexibility to serve the home of a qualified customer identified during a program year. As mentioned previously, the measures that appear on the approved and qualified list may fluctuate annually based on utility cost-effectiveness tests. The flexibility given to the health, safety, and repair allocation does allow for non-cost-effective measures on the qualified list to be fully funded. The agency has demonstrated the ability to fully spend its utility allocation each year and exceeded that expectation in 2020.

In a separate but related issue, the agency has been awarded $250,000 from the company's Energy Efficiency Assistance Fund (EEAF) that was developed as part of Idaho Settlement Agreement AVU-E-19-4. In conjunction with the EEAF advisory group these funds are distributed for projects that are not typically eligible for traditional energy efficiency funding. The agency will use this amount toward health, safety, and repair work on homes that have not been able to receive energy efficiency services due to extenuating circumstances. The agency will make necessary improvements, which may range from fixing electrical issues to asbestos removal. Once the issue has been resolved, the agency will be able to provide a comprehensive energy efficiency offering using funds from Avista's low- income energy efficiency contract.

As part of Avista's annual business planning, UES measure values will continue to be reviewed and updated; however, when applicable, Avista will continue to use evaluated savings instead of UES values, because evaluated savings are generally more accurate. In addition, Avista will re-evaluate the units used to set program participation goals for the year. Per ADM's recommendations, Avista will also revisit quality control/ accuracy issues in the CC&B tracking system as well as documentation related to the 20 percent savings cap currently used. Lastly, Avista will ensure that the TRM is updated to reflect any UES adjustments.

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Downtown Wallace, Idaho

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 Northwest have cooperatively 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 67 shows the 2020 NEEA actual savings and the associated costs for Idaho. The 2020 electric costs of $651,035 are inclusive of $645,907 paid directly to NEEA and $5,128 for Avista's participation in committees. For natural gas, $137,615 was paid directly to NEEA and an additional $1,593 originated from Avista's participation in committees.

TABLE 67 – ACTUAL SAVINGS AND ASSOCIATED COSTS FOR AVISTA IDAHO

Fuel Type	2020 NEEA Final Reported Energy Savings	2020 Costs (Avista Financials)	Avista Idaho Current Funding Share (2020-2024)
Electric	3,578 MWh (0.41 aMW)	$ 651,035	1.69%
Natural gas	5,641	$ 139,208	3.55%

Electric Energy Savings Share

All the values provided in this report represent the amounts that are allocated to Avista's service territory, which is a combination of site-based energy savings data (where available) or is an allocation of savings based on funding share. Using the funding share allocation approach, the funding share for Avista is split between 30 percent for Avista Idaho and 70 percent for Avista Washington. 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 electric market transformation portfolio calls for the portfolio 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 NEEA delivering cost-effective resources to the company's service territory. Avista believes that NEEA will continue to offer cost-effective electric market transformation in the foreseeable future. Avista will continue to be active in the organizational oversight of NEEA, a critical step in ensuring geographic equity, cost-effectiveness, and resource acquisition.

GLOSSARY OF TERMS

Palouse wheat field, Idaho

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.

AHRI Certificates (Air-Conditioning, Heating and Refrigeration Institute) – a certification widely recognized through the industry as a standard certification for HVAC/ refrigeration efficiency.

Air-Conditioning, Heating, and Refrigeration Institute (AHRI): The trade association representing manufacturers of HVACR and water heating equipment within the global industry.

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 National Standards Institute (ANSI): A source for information on national, regional, and international standards and conformity assessment issues.

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 Avista's conservation offerings, its approach to energy efficiency, and 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 on how efficiently a furnace or boiler uses its fuel.

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, which would have occurred without implementation of the subject 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 the energy efficiency activity takes place.

BPA: Bonneville Power Administration

Building Owners & Managers Association (BOMA): An international federation of U.S. 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 is capable of carrying under specified conditions.

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 Partnership (CAP): 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).

conservation: According to the Northwest Power Act, any reduction in electric power consumption as a result 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, assuming a base of 65 degrees Fahrenheit. 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 based largely 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 of its 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, expressed in cubic feet, therms, BTUs or multiples thereof, for a designated period of time 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 in order 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 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 (for example, space heating), or the type of energy-consuming equipment (for example, 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): Catch-all 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 of time, 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, the HVAC is particularly important in the design of medium to large industrial and office buildings where humidity and temperature must all be closely regulated whilst maintaining safe and healthy conditions within.

High Intensity Discharge (HID) fixture: A fixture that is bright and powerful enough to throw a large number of lumens an extremely long distance; often used in very large spaces such as manufacturing facilities or sports stadiums.

Hours of Use (HOU): an annual estimation of lighting or HVAC equipment operation hours).

Idaho Public Utilities Commission (IPUC): Regulators of investor-owned or privatively owned utilities that provide gas, water, electricity or some telephone services for profit.

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 employees 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.

installation verification (IV) report: A detailed report documenting installed conservation measures on a site-specific project.

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.

Integrated Resource Plan Technical Advisory Committee (IRP TAC): Advisory committee for the IRP process that includes internal and external stakeholders.

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- stands for 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 (IPMVP 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, 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 for 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.

Ratepayer Impact (RIM) Test: An economic test used to compare administrator costs and utility bill reductions to costs of supply side resources.

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.

Strategic Energy Management (SEM): Overall processes implemented in a building or portfolio to manage and continuously improve energy performance.

service territory: The areas in Idaho, Washington, and Oregon served by Avista to provide either gas or electric service (or both).

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, nor 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 as a result 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 as a result of a program's influence.

Technical Reference Manual (TRM): An Avista-prepared resource document that contains Avista's (ex-ante) savings estimates, assumptions, 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 3rd 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.

trade ally: Contractors and service providers who partner with utility efficiency programs to deliver energy efficiency projects, products, and services.

trade ally bid: A bid for an energy-efficiency project, product, or service from a trade ally.

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 a majority 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 3rd party evaluator.

weather normalized: This is an adjustment that is made to actual energy usage, stream-flows, etc., which would have happened if "normal" weather conditions would have taken place.

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

Grangeville, Idaho

APPENDIX A – 2020 IDAHO ELECTRIC IMPACT EVALUATION REPORT – COMMERCIAL/INDUSTRIAL

CADMUS

PY 2020 Idaho Electric Impact Evaluation Report

April 16, 2021

Prepared for:

Avista Corporation
1411 East Mission Avenue
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CADMUS

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Portfolio Executive Summary

For several decades, Avista Corporation (Avista) has administered demand-side management (DSM) programs to reduce the 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 electric DSM Nonresidential and multifamily Residential programs in Idaho. This report presents the electric impact evaluation findings for PY 2020. 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

Cadmus conducted the Idaho portfolio evaluation using the methods and activities shown in Table 1.

Table 1. Electric Program Evaluation Activities

Sector	Program	Document/Database Review	Verification/Metering Site Visits
Nonresidential	Prescriptive (Multiple)	✓	✓
	Site Specific	✓	✓
Multifamily	Multifamily Direct Install	✓	--
	Supplemental Lighting	✓	--
Fuel Efficiency	Multifamily Market Transformation	✓	--

Summary of Impact Evaluation Results

The Nonresidential and Multifamily Idaho electric energy efficiency programs achieved an 86% realization rate and acquired 11,960,349 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) and from data provided by the third-party implementor for the Multifamily Direct Install (MFDI) program.

Despite the COVID-19 pandemic reducing participation in both the Nonresidential and Multifamily sectors, most programs Cadmus evaluated performed strongly relative to reported savings in PY 2020.

Table 2. Reported and Evaluated Energy Efficiency Electric Savings

Sector	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Nonresidential	12,665,993	10,723,525	85%
Multifamily Direct Install	710,740	747,227	105%
Fuel Efficiency	528,727	489,597	93%
Total	**13,905,460**	**11,960,349**	**86%**

Note: totals may not sum due to rounding.

Conclusions and Recommendations

During the PY 202019 evaluation, Cadmus identified several areas for improvement, outlined below by sector.

Nonresidential Conclusions and Recommendations

The Nonresidential sector achieved total evaluated electric energy savings of 10,724 MWh in PY 2020, with a combined realization rate of 85%. The Nonresidential sector did not meet the combined Prescriptive and Site Specific program paths' electric goal of 15,020 MWh, with the program achieving 71% of its goal.

Although some individual project results varied, particularly within the Prescriptive exterior lighting program, the overall Nonresidential sector performed strongly in PY 2020 relative to reported savings. Most projects that Cadmus sampled for the evaluation were well documented and matched findings from the remote project verifications.

Cadmus offers the following conclusions and recommendations to improve the Nonresidential sector's energy savings:

- Avista's new iEnergy system has the capability to automatically calculate more detailed energy savings estimates since it records additional detailed inputs on some prescriptive measures that were not previously tracked in InforCRM. Some of these inputs 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 participant project. For example, food service 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.
- The iEnergy system introduced variance of up to 2% between reported and evaluated savings by rounding intermediate wattage calculation values.
  - **Recommendation:** Review iEnergy calculations to ensure that rounding is only applied on final displayed values and not to any intermediate values.
- Customer uncertainty on where program equipment was installed created challenges for verifying installed quantities and may have contributed to reduced realization rates for projects where verified quantities were less than reported.

    - **Recommendation:** Update all application forms to include space for location notes for each installed measure and encourage contractors installing equipment at very large facilities to include installation location with equipment invoices.
- Variations in the level of detail in Avista installation verification (IV) reports introduced additional complexity in evaluating accurate measure counts, types, and operating parameters.
    - **Recommendation:** Provide more consistent documentation with IV reports. Cadmus recommends that all IV reports include basic information to explicitly state the quantity and type of equipment found. For lighting projects, this would include confirmed fixture types, quantities, installation locations, controls, and estimated hours of use (HOU). For most other equipment, this would include nameplates, model numbers, and quantities.
- The evaluated lighting HOU for interior and exterior lighting projects did not always align with reported values.
    - **Recommendation:** Review HOU estimates when processing applications and conducting installation verifications. When entering average weekly HOU, confirm how many weeks per year that schedule applies. In particular, Avista should apply additional scrutiny to applications claiming 8,760 hours per year.
- Discrepancies between reported fixture quantities and invoice quantities added complexity and uncertainty in evaluating the Site Specific lighting program. It is often impractical for Avista staff conducting IV inspections or evaluators conducting verification visits to count every fixture for large lighting projects, necessitating a greater reliance on project documentation.
    - **Recommendation:** Include more detailed documentation for Site Specific lighting projects. Lighting drawings should be provided whenever possible, and if any other notes, spreadsheets, or other documentation are used to determine eligible quantities, these should be included with the application records. Any difference between invoice quantities and rebated quantities should be clearly explained.
- Avista may rely on spot measurements for values that vary during typical operation. The submitted analysis for a Site Specific industrial process motor project assumed a fixed output voltage from the variable frequency drive (VFD) based on a single spot measurement, but the plant's industrial control system was capable of recording voltage trend data. Cadmus worked with the customer to add a voltage trend and determined that the VFD voltage output actually varied significantly in daily operation.
    - **Recommendation:** Assume that amperage and voltage output from a VFD may fluctuate significantly. Whenever possible, configure trend data collection for both values. If a voltage trend is unavailable, take multiple spot voltage readings at various VFD speeds or consider installing a temporary power data logger.

Multifamily Direct Install Conclusions and Recommendations

Evaluated electricity savings show a 105% realization rate on evaluated savings of 747,227 kWh for MFDI programs, representing 58% of the savings goal for the year.

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

- The MFDI program is an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units.
  - **Recommendation:** Continue to focus on replacing high-use, low-efficiency lamps where practical to maximize program cost-effectiveness and maintain high savings.
- The MFDI program used outdated Regional Technical Forum (RTF) UES values for showerhead measures and RTF UES values for aerator measures that were not appropriate for MFDI's building stock.
  - **Recommendation:** Use the most current RTF UES values that are appropriate for the MFDI program's building stock to calculate reported savings. Ensure that the TRM provides values and cites sources for all measures. Review the TRM annually and check if updated values are available for any TRM measures using RTF workbooks as a source.
- All supplemental lighting program savings calculations had undefined HOU values and some were missing space identifiers in the provided audit data which complicated verification.
  - **Recommendation:** Ensure methodology documentation and reported savings inputs are accurate and provided for all site data.

Fuel Efficiency Conclusions and Recommendations

Multifamily Market Transformation (MFMT) Fuel Efficiency measures achieved evaluated savings of 489,597 kWh, yielding a 93% realization rate, and achieved 103% of the electric energy savings goal of 476,000 kWh.

Cadmus offers the following conclusions and recommendations to improve Avista's Fuel Efficiency measures:

- Avista's deemed savings values for MFMT HVAC measures are intended for natural gas furnaces and do not accurately estimate savings for central boiler systems because they have additional energy consumption from pumps; experience heat loss in the piping system between the boiler and the conditioned space; and have substantially different equipment sizing, heat transfer properties, and fuel consumption.
  - **Recommendation:** Only use deemed savings in this program for standard forced air gas furnaces that directly heat residential spaces. Analyze eligible projects with any other type of equipment using a Site Specific approach, which may require a custom energy model for that particular building.
- Avista's deemed savings values for MFMT HVAC measures overestimate savings for buildings with more than one middle floor, because they assume a three-story building with a ground, middle, and top floor.
  - **Recommendation:** Include a place for MFMT HVAC applications to confirm the number of floors in the building and should apply a weighted average of the deemed savings for

ground, middle, and top floors when a building does not have the standard three-story layout.

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 most programs; the team conducted measurement and verification (M&V) of Prescriptive and Site Specific projects across the full sample.

Program Summary

Avista completed and provided incentives for 1,011 Nonresidential electric measures in Idaho during PY 2020 and reported total electric energy savings of 12,665,993 kWh. Through the Nonresidential sector, Avista offers incentives for high-efficiency equipment and controls through three program paths: Prescriptive, Site Specific, and Multifamily Market Transformation.

The Prescriptive program path applies to smaller, straightforward equipment installations that generally have similar operating characteristics (such as lighting, simple HVAC systems, food service equipment, and VFD). The Site Specific program path applies to more 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).

Multifamily Market Transformation, a Site Specific program, prompts building owners and developers to consider natural gas as the fuel of choice when constructing new multifamily housing. These measures, represented by a combination of electric savings and natural gas penalties, typically involve replacing electric space-heating or water-heating systems with natural gas equipment. See the *Fuel Efficiency Impact Evaluation* section for a discussion of the evaluation methodology and results for the Nonresidential Fuel Efficiency measures.

Program Participation Summary

This section summarizes Nonresidential sector participation and progress toward PY 2020 goals through the Prescriptive and Site Specific program paths.

Nonresidential Prescriptive Program Path

Table 3 shows electric energy savings goals assigned to Avista's Nonresidential Prescriptive program path for PY 2020 as well as reported savings and a comparison between reported savings and goals. Avista's Nonresidential Prescriptive programs reported 128% of their collective savings goal in PY 2020.

Table 3. Nonresidential Prescriptive Electric Savings

Program Name	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Interior Lighting	3,390,000	3,816,812	113%
Exterior Lighting	2,688,000	4,742,300	176%
Shell Measure	18,000	1,341	7%
Green Motors	41,000	52,038	127%
Motor Control (VFD)	76,000	0	0%
Fleet Heat	8,000	0	0%
Food Service Equipment	32,000	13,761	43%
AirGuardian	6,000	0	0%
Energy Smart Grocer	512,000	45,938	9%
Total	**6,771,000**	**8,672,190**	**128%**

Table 4 summarizes actual program participation.

Table 4. Nonresidential Prescriptive Participation by Project

Program Type	Number of Applications	Number of Measures
Interior Lighting	216	333
Exterior Lighting	306	553
Shell Measure	3	4
Green Motors	11	11
Motor Control (VFD)	0	0
Fleet Heat	0	0
Food Service Equipment	2	3
AirGuardian	0	0
Energy Smart Grocer	4	5
Total[a]	**542**	**909**

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

Nonresidential Site Specific Program Path

Table 5 shows electric savings goals assigned to the Site Specific program path in Avista's Nonresidential sector for PY 2020, reported savings, and the percent of goal achieved. The table does not include reported electric savings for the Fuel Efficiency sector, such as those associated with the Multifamily Market Transformation program. The Site Specific program reported 51% of its PY 2020 savings goal, with participation reduced likely due to the COVID-19 pandemic.

Table 5. Nonresidential Site Specific Electric Savings

Program Path	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Site Specific	7,773,000	3,993,803	51%

Table 6 summarizes actual program participation for the Site Specific program.

Table 6. Nonresidential Site Specific Participation by Project

Program	Number of Applications	Number of Measures
Site Specific Lighting	29	95
Site Specific Other	7	7
Total	**36**	**102**

Nonresidential Impact Evaluation Methodology

As the first step in evaluating savings for the Nonresidential sector, Cadmus reviewed the following documents and data records to gain an understanding of the programs and measures slated for evaluation:

- 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. The review provided insight into the sources for unit energy savings (UES) claimed for each measure offered in the programs, 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 for impact evaluation activities and performed the following evaluation activities in two waves:

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

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

Sample Design

Cadmus created two sample waves for PY 2020:

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

Cadmus initially estimated the total annual population size by reviewing the wave 1 population data and comparing it to 2018-2019 population data. Cadmus developed initial sample size targets to achieve 90% confidence at ±10% precision (90/10) for the estimated annual population for 2020, with a target of 90/20 by program. After receiving the wave 2 population data, Cadmus revised the annual sample size targets for the full year and selected the wave 2 sample to complete the revised target within each program.

Avista advised Cadmus not to evaluate certain programs with low participation and historically consistent realization rates every year. Since the Green Motors Program has shown a 100% realization rate in every prior evaluation, Cadmus did not evaluate the program in PY 2020 and does not plan to evaluate the program in PY 2021. Cadmus plans to evaluate the food services program only in PY 2020, and the energy smart grocer and prescriptive shell programs only in PY 2021. Cadmus evaluated all other Nonresidential programs that had participation in PY 2020.

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, the team selected the highest-savings applications with certainty. Within programs with a wide variance in savings, the team further stratified non-certainty applications by reported savings magnitude into small and medium strata, each with approximately 50% of the total non-certainty program savings. The team assigned random numbers within each stratum to select a random sample of non-certainty sites. In some cases, Cadmus selected additional applications at the same location as a previously selected application to evaluate as a convenience selection if the team could assess both applications in a single virtual visit.

Cadmus encountered some challenges contacting customers to evaluate the wave 1 sample, primarily due to changes in business operations as a result of the COVID-19 pandemic. The team pulled an additional backup sample for the wave 2 sample using random sampling and recruited participants from the backup sample when participants from the initial random sample were unreachable.

The team pooled results from the randomly selected sites to calculate a realization rate by stratum and applied that realization rate to projects in the population in that stratum. Cadmus applied the project-specific evaluated savings for every project that was in the sample, regardless of whether it was a random, certainty, or convenience selection.

Table 7 summarizes the Idaho Nonresidential Prescriptive program path evaluation sample. Cadmus sampled 41 Prescriptive applications at 32 unique sites. Of the sampled applications, the team selected five for certainty review based on the scale of savings, selected the 29 randomly, and selected seven additional convenience projects based on location. There was no participation in the AirGuardian, fleet heat, and motor control programs in PY 2020 as shown in Table 4. Table 7 shows the total number of unique application IDs sampled in each program, including three applications containing measures from more than one program.

Table 7. Idaho Nonresidential Prescriptive Electric Evaluation Sample

Program Type	Applications Sampled[a]	Sampled Savings (kWh)	Percentage of Reported Savings
Interior Lighting	19	1,589,327	42%
Exterior Lighting	22	947,468	20%
Shell Measure	0	0	N/A
Green Motors	0	0	N/A
Food Service Equipment	2	13,761	100%
AirGuardian	0	0	N/A
Energy Smart Grocer	1	3,060	7%
Nonresidential Prescriptive	**41**	**2,553,616**	**29%**

[a] Three applications included measures in the interior lighting and exterior lighting programs, but each measure is only counted once in the total.

Table 8 summarizes the Idaho Nonresidential Site Specific program path's evaluation sample, where Cadmus sampled 12 Site Specific applications at 12 unique sites overall. Of the sampled applications, the team selected three for certainty review based on the savings scale and selected the remaining nine applications randomly.

Table 8. Idaho Nonresidential Site Specific Electric Evaluation Sample

Program Path	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Site Specific	12	2,366,694	59%

Document Review

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

Remote Verification

Cadmus performed virtual site visits and verification calls at 36 unique Nonresidential locations and verifications at 36 unique Nonresidential locations to assess electric savings for 102 unique Prescriptive and Site Specific measures (not including Fuel Efficiency measures) from 44 different applications. Cadmus evaluated the remaining nine applications through desk reviews that did not require participant outreach. The team typically conducted virtual site visits using the Streem platform that records video and audio. The visits involved a detailed walkthrough to verify installed equipment types, make and model numbers, operating schedules, and set points, as applicable. The team conducted some virtual visits using Microsoft Teams meetings if customers were unable to access Streem or preferred using Teams due to prior familiarity. Verification calls involved a brief phone or video call to confirm key details and any information missing from the project documentation. Cadmus used the project documentation review and on-site findings to adjust reported savings calculations, where necessary.

Nonresidential Impact Evaluation Findings

This section summarizes electric impact evaluation findings for the Nonresidential Prescriptive and Site Specific program paths in PY 2020.

Prior to this program year, Avista completed a transition from its previous InforCRM system to the new iEnergy system to track Nonresidential energy efficiency applications and measures. Cadmus found that the additional detail provided by the iEnergy system facilitated conducting a detailed and comprehensive evaluation. For example, the iEnergy system reports detailed information about each lighting measure, including existing and installed model number, wattage, quantity, and HOU. This facilitated Cadmus' evaluation and allowed it to partially automate the generation of M&V plans and some analysis tables.

The team did encounter some challenges with inconsistent data in report extracts from iEnergy (i.e., reports with duplicated records) and developed additional quality control processes to identify such issues, working with Avista's technical staff to resolve them. In addition, Cadmus found variation of up to 2% between reported and evaluated savings on Prescriptive lighting projects due to iEnergy rounding an intermediate value in kilowatt units to two decimal places. The level of variance is equivalent to rounding the lighting wattage to the nearest 10 watts. Avista continues to work with the iEnergy vendor to improve the system and integrate feedback.

Cadmus had difficulty verifying exact quantities of installed equipment for some projects at larger facilities where customers often did not know where program equipment was installed or could not recall which equipment was installed during which project if they had completed multiple applications over the course of the year. As such, Cadmus assumed quantities based on invoices in some cases and was not able to definitively verify the installation. This could lead to lower evaluated savings in the future if only a portion of the installed equipment is located during a site visit.

In addition, Cadmus found that the level of detail varied in IV reports. Many IV reports only mentioned that "equipment and quantities were verified," and sometimes the photos only showed the equipment from a distance. One IV report showed photos of lamps submitted under the interior lighting program installed in an exterior location. These issues made it more difficult to determine accurate measure details on various projects.

Nonresidential Prescriptive Programs

Table 9 shows reported and evaluated electric energy savings for Avista's Nonresidential Prescriptive program path as well as the realization rates between the evaluated and reported savings for PY 2020. The overall Nonresidential Prescriptive program path achieved a 76% electric realization rate.

Table 9. Nonresidential Prescriptive Electric Impact Findings

Program Type	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Interior Lighting	3,816,812	3,944,956	103%
Exterior Lighting	4,742,300	2,552,295	54%
Shell Measure	1,341	1,341	100%
Green Motors	52,038	52,038	100%
Food Service Equipment	13,761	13,761	100%
AirGuardian	0	0	N/A
Energy Smart Grocer	45,938	45,938	100%
Nonresidential Prescriptive	**8,672,190**	**6,610,329**	**76%**

Of 41 evaluated applications, Cadmus identified discrepancies for 36, based on virtual site visits, verification calls, and project documentation review. Table 10 summarizes the reasons for discrepancies between reported and evaluated savings.

Table 10. Nonresidential Prescriptive Evaluation Summary of Discrepancies

<table>
<tr><th>Project Type</th><th>Number of Occurrences</th><th>Savings Impact</th><th>Reason(s) for Discrepancy</th></tr>
<tr><td rowspan="2">Interior Lighting</td><td>7</td><td>↓</td><td>Cadmus found that two projects were inaccurately categorized as Interior lighting projects rather than exterior lighting projects. Evaluated savings for these projects were removed from the Interior lighting program and added to the exterior lighting program.
Cadmus determined that the HOU for four projects were lower than reported on the applications after interviewing on-site staff.
Cadmus verified that one project had installed fewer LED lamps than reported. Several linear LED lamps were found in storage and not yet installed in some fixtures throughout the facility, lowering the evaluated savings.</td></tr>
<tr><td>5</td><td>↑</td><td>Cadmus determined that the HOU for five projects were higher than reported on the applications after interviewing on-site staff.</td></tr>
<tr><td rowspan="2">Exterior Lighting</td><td>17</td><td>↓</td><td>Cadmus found that the installed fixtures for two projects had a higher wattage than reported on the application.
Cadmus found one project that was categorized as a new construction measure but involved removing five existing higher wattage LED wall pack fixtures and installing three LED flood lights in their place. Cadmus adjusted savings to include an estimated baseline wattage for the removed LED wall packs.
Cadmus evaluated 14 sign lighting projects by calculating the difference in energy use between the baseline and installed lamps, rather than applying a deemed value per square footage of the sign. Cadmus determined the deemed values overestimated savings.</td></tr>
<tr><td>2</td><td>↑</td><td>Cadmus found that two projects were inaccurately categorized as interior lighting projects rather than exterior lighting projects. Evaluated savings for these projects were removed from the interior lighting program and added to the exterior lighting program.</td></tr>
</table>

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
	5	↓↑	• Cadmus found that some projects had discrepancies due to rounding differences. iEnergy rounds the kilowatt savings to two decimal places in the middle of the calculation, causing a loss of accuracy in the final savings. This correction resulted in a decrease in savings for two projects and an increase in savings for three.

Cadmus found that verified lighting HOU varied from reported HOU in some interior and exterior lighting projects. Several projects reported correct weekly HOU but did not operate the lights every week of the year. Other projects had different weekly or daily operating hours than reported.

Cadmus notified Avista in January 2021 of systematic savings discrepancies in sign lighting measures within the Prescriptive exterior lighting program. The team observed a significant increase in sign lighting measures in PY 2020 and found consistently low realization rates on the sign lighting measures evaluated. Avista applied deemed savings of 107.2 kWh per square foot 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 quantity, wattages, and HOU for the baseline and installed lamps in each sign by visual confirmation through video or by reviewing invoices and IV report photos. In cases where documentation was insufficient and customers were unable to access the sign, Cadmus estimated lamp quantities and lengths based on the shape and size of the sign. Cadmus calculated savings as the difference in energy use between the actual baseline and installed lighting equipment it verified. In every case, this evaluation methodology resulted in a lower evaluated savings, and Cadmus found an average realization rate of 26% across the evaluated sign lighting measures. Avista planned to implement changes to the sign lighting measure effective April 15, 2021, to address these concerns. The team did not find any systematic discrepancies with other exterior lighting measures. The realization rate for non-sign lighting exterior lighting measures was 96%.

Nonresidential Site Specific Program

Table 11 shows reported and evaluated electric energy savings for Avista's Nonresidential sector Site Specific program path for the program year. The overall Site Specific program path had a 103% electric realization rate. The table does not include reported and evaluated electric savings for measures in the Fuel Efficiency path.

Table 11. Nonresidential Site Specific Electric Impact Findings

Program Path	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Site Specific	3,993,803	4,113,196	103%

Of 12 evaluated applications, Cadmus identified discrepancies in six, based on virtual site visits and project documentation review. Table 12 summarizes the reasons for discrepancies between reported and evaluated savings.

Table 12. Nonresidential Site Specific Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	2	↑	• Cadmus found increased savings for one project that added new lighting controls, which had not been accounted for in the reported savings. The lighting controls reduced the installed fixture wattage by dimming the lights throughout the space. • Cadmus zeroed out negative savings for one line item, which should not have been approved, where the installed wattage was higher than the existing wattage. This measure did not receive an incentive but was erroneously included in the reported savings.
Motor Control (VFD)	1	↑	• The original analysis for a paper mill wastewater pump VFD project assumed a constant output voltage based on a single spot measurement and a 0.95 power factor from the variable frequency drive (VFD). Cadmus updated the analysis to estimate the energy use with the VFD with a 0.88 power factor based on the motor specifications and using the metered output voltage via the industrial control system trends, which showed the voltage varied significantly.
Exterior Lighting	1	↑	• Cadmus determined that the HOU for one sign lighting project was higher than reported through interviews with on-site staff. Unlike the prescriptive sign lighting projects, this project did not apply a deemed savings value to determine reported savings.
Compressed Air	1	↓	• Air compressor VFD power data were rounded in the original analysis files. Cadmus did not round any intermediate numbers, which resulted in slightly lower evaluated savings.
Refrigeration	1	↓	• Cadmus found that the original analysis included unrelated equipment in the baseline energy use. The project removed two self-contained freezers that were not replaced with energy-efficient equipment. Cadmus confirmed that the two freezers were removed because the site no longer sold frozen products. Cadmus updated the analysis to exclude unrelated freezer equipment in the baseline energy use calculation, decreasing baseline energy use and decreasing savings.

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. Cadmus also noted that many M&V plans, pre-installation verifications, and IV 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 sector achieved total evaluated electric energy savings of 10,724 MWh in PY 2020, with a combined realization rate of 85%. The Nonresidential sector did not meet the combined Prescriptive and Site Specific program paths' electric goal of 15,020 MWh, with the program achieving 71% of its goal.

Although some individual project results varied, particularly within the Prescriptive exterior lighting program, the overall Nonresidential sector performed strongly in PY 2020 relative to reported savings. Most projects that Cadmus sampled for the evaluation were well documented and matched findings from the remote project verifications.

Cadmus offers the following conclusions and recommendations to improve the Nonresidential sector's energy savings:

- Avista's new iEnergy system has the capability to automatically calculate more detailed energy savings estimates since it records additional detailed inputs on some prescriptive measures that were not previously tracked in InforCRM. Some of these inputs 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 participant project. For example, food service 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.
- The iEnergy system introduced variance of up to 2% between reported and evaluated savings by rounding intermediate wattage calculation values.
  - **Recommendation:** Review iEnergy calculations to ensure that rounding is only applied on final displayed values and not to any intermediate values.
- Customer uncertainty on where program equipment was installed created challenges for verifying installed quantities and may have contributed to reduced realization rates for projects where verified quantities were less than reported.
  - **Recommendation:** Update all application forms to include space for location notes for each installed measure and encourage contractors installing equipment at very large facilities to include installation location with equipment invoices.
- Variations in the level of detail in Avista IV reports introduced additional complexity in evaluating accurate measure counts, types, and operating parameters.
  - **Recommendation:** Provide more consistent documentation with IV reports. Cadmus recommends that all IV reports include basic information to explicitly state 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.
- The evaluated lighting HOU for interior and exterior lighting projects did not always align with reported values.
  - **Recommendation:** Review HOU estimates when processing applications and conducting installation verifications. When entering average weekly HOU, confirm how many weeks per year that schedule applies. In particular, Avista should apply additional scrutiny to applications claiming 8,760 hours per year.

- Discrepancies between reported fixture quantities and invoice quantities added complexity and uncertainty in evaluating the Site Specific lighting program. It is often impractical for Avista staff conducting IV inspections or evaluators conducting verification visits to count every fixture for large lighting projects, necessitating a greater reliance on project documentation.
  - **Recommendation:** Include more detailed documentation for Site Specific lighting projects. Lighting drawings should be provided whenever possible, and if any other notes, spreadsheets, or other documentation are used to determine eligible quantities, these should be included with the application records. Any difference between invoice quantities and rebated quantities should be clearly explained.
- Avista may rely on spot measurements for values that vary during typical operation. The submitted analysis for a Site Specific industrial process motor project assumed a fixed output voltage from the VFD based on a single spot measurement, but the plant's industrial control system was capable of recording voltage trend data. Cadmus worked with the customer to add a voltage trend and determined that the VFD voltage output actually varied significantly in daily operation.
  - **Recommendation:** Assume that amperage and voltage output from a VFD may fluctuate significantly. Whenever possible, configure trend data collection for both values. If a voltage trend is unavailable, take multiple spot voltage readings at various VFD speeds or consider installing a temporary power data logger.

Multifamily Direct Install (MFDI) Impact Evaluation

Cadmus designed the MFDI program's impact evaluation to verify reported program participation and energy savings. Since the 2018-2019 evaluation showed that billing analysis did not provide meaningful evaluation results, Cadmus found that a database review was the most appropriate evaluation approach. The team used data collected and reported in the tracking database, online application forms, and Avista's TRM and RTF values to evaluate savings. This approach provided a reasonable estimate of achieved savings practical for each program, given its delivery method, magnitude of savings, and number of participants.

Program Summary

In PY 2020, Avista completed and provided incentives for 1,001 living units, common areas, or installed lighting fixtures in Idaho and reported total electric energy savings of 710,740 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 savings goals assigned to Avista's MFDI programs for PY 2020, in addition to reported savings. During PY 2020, the response to the COVID-19 pandemic caused disruption to the MFDI program's direct-install design, forcing the third-party implementer to temporarily halt program processes and implement changes that adapt to pandemic restrictions. As a result, the MFDI and MFDI supplemental lighting programs did not meet savings goals, with reported savings achieving 55% of the savings goal for MFDI programs.

Table 13. MFDI Programs Reported Electric Savings

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Multifamily Direct Install	595,000	510,265	86%
Multifamily Direct Install Supplemental Lighting	694,000	200,474	29%
MFDI Programs Total	**1,289,000**	**710,740**	**55%**

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

Table 14. MFDI Programs Participation

Program	Participation Reported
Multifamily Direct Install[a]	767
Multifamily Direct Install Supplemental Lighting[b]	234
MFDI Programs Total	**1,001**

[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 79% of the total MFDI programs' electricity savings. The following shows the percentage of MFDI reported savings provided by each program:

- MFDI lighting measures provided 51% of reported savings.
- MFDI non-lighting measures provided 21% of reported savings.
- MFDI supplemental lighting program provided 28% of reported savings.

Multifamily Direct Install Impact Evaluation Methodology

To determine the MFDI program's evaluated savings for PY 2020, Cadmus employed a database review. For the impact evaluation database review, Cadmus applied UES values provided in the TRM and by the RTF to calculate savings for measures reported in the measure tracking database. Such impact activity may help identify incorrect UES values used to calculate reported savings. For this evaluation, Cadmus applied 2020 Avista TRM values to PY 2020 measures.

Multifamily Direct Install Impact Evaluation Results

Cadmus used the results of the database review to evaluate savings for each measure. The analysis 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)	Adjusted Electric Savings (kWh)	Realization Rates
Multifamily Direct Install	510,265	542,451	106%
Multifamily Direct Install Supplemental Lighting	200,474	204,776	102%
MFDI Programs Total	**710,740**	**747,227**	**105%**

The discrepancies between evaluated and reported savings for the MFDI program were a result of reported savings calculations using UES values for non-lighting measures (aerators and showerheads) that were lower than the UES values provided by the most recent RTF workbooks. Specifically, reported savings for showerheads used UES values from Avista's most recent TRM that did not reflect the most recent RTF UES values. The implementer confirmed it used UES values from the most recent TRM to calculate reported savings for showerheads, but not the most recent RTF revision. Cadmus evaluated reported savings using the RTF's most recent 2019 RTF UES value for showerheads. Reported savings for aerators used a conservative weighted average UES value that would allow for some aerators with heat pump water heaters. However, Cadmus determined that the aerator UES value for electric resistance water heater types is more appropriate for the building stock served by the MFDI program. The implementer accepted this recommendation, and Cadmus evaluated savings using the 2019 RTF UES value for aerators with electric resistance water heater types.

Cadmus also identified instances where evaluated realization rates were low for lighting measures because the implementer did not properly account for electric heating interaction effects in common area spaces. In addition, Cadmus found reported savings calculations for lighting measures that did not account for the savings that come from cooling interaction effects in interior spaces. However, the 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. Cases with undefined HOU exceeded 100% realization since these hours were lower than those documented in the calculation methodology and site data provided. In addition, Cadmus could not verify the interior or exterior lighting HOU for some of these spaces because the assigned identification numbers could not be found in the accompanying audit data.

Multifamily Direct Install Conclusions and Recommendations

Evaluated electricity savings show a 105% realization rate on evaluated savings of 747,227 kWh for MFDI programs, representing 58% of the savings goal for the year.

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

- The MFDI program is an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units.
  - **Recommendation:** Continue to focus on replacing high-use, low-efficiency lamps where practical to maximize program cost-effectiveness and maintain high savings.
- The MFDI program used outdated RTF UES values for showerhead measures and RTF UES values for aerator measures that were not appropriate for MFDI's building stock.
  - **Recommendation:** Use the most current RTF UES values that are appropriate for the MFDI program's building stock to calculate reported savings. Ensure that the TRM provides values and cites sources for all measures. Review the TRM annually and check if updated values are available for any TRM measures using RTF workbooks as a source.
- All Supplemental Lighting Program savings calculations had undefined HOU values and some were missing space identifiers in the provided audit data which complicated verification.
  - **Recommendation:** Ensure methodology documentation and reported savings inputs are accurate and provided for all site data.

Fuel Efficiency Impact Evaluation

Cadmus designed the Fuel Efficiency sector impact evaluation to verify reported program participation and energy savings. Evaluation methods included a database review and document review.

Program Summary

Fuel Efficiency measures replace electric space heating or water heating systems with equipment using natural gas. These measures are offered within the Nonresidential Site Specific program path, which includes MFMT measures. From this program, Avista reported electric energy savings of 528,727 kWh for four Fuel Efficiency measures.

Fuel Efficiency measures provide positive electricity savings and negative natural gas savings, reflecting negative avoided costs. Cadmus incorporated these negative avoided costs in the electric cost-effectiveness calculations and reported the negative natural gas consumption impacts in the PY 2020 Idaho Natural Gas Impact Evaluation Report.

Program Participation Summary

This section summarizes Fuel Efficiency sector participation and progress toward PY 2020 goals for the MFMT path.

Table 16 shows savings goals, reported savings, and percentage of goal for the MFMT path. Avista did not set savings goals for the Site Specific Fuel Efficiency measures outside of the MFMT path.

Table 16. Avista Portfolio Fuel Efficiency Reported Electric Savings

Program	Savings Goals (kWh)	Reported Savings (kWh)	Percentage of Goal
Multifamily Market Transformation	476,000	528,727	111%

Table 17 shows Avista's PY 2020 reported participation for the MFMT measures. Avista did not set participation goals for Site Specific Fuel Efficiency measures. There were four MFMT participants in PY 2020.

Table 17. Avista Portfolio Fuel Efficiency Reported Participation

Fuel Efficiency Measure	Participation Reported
Multifamily Market Transformation	4

Fuel Efficiency Impact Evaluation Methodology

The impact methodology for Fuel Efficiency measures is outlined below for the Nonresidential Site Specific program path.

Nonresidential Site Specific Fuel Efficiency Impact Methodology

Cadmus followed the same impact evaluation methodology for Fuel Efficiency measures as outlined in the *Nonresidential Impact Evaluation Methodology* section. Cadmus sampled two MFMT applications. Of the sampled applications, the team selected one for certainty review based on the savings scale and selected one randomly.

Fuel Efficiency Impact Evaluation Results

The following section summarizes findings for the Nonresidential Site Specific program path. All Fuel Efficiency measures provide positive electricity savings and negative natural gas consumption impacts because these measures replace electric space heating or water heating systems with equipment that uses natural gas. Negative natural gas consumption impacts reflect negative avoided costs and are incorporated in the electric cost-effectiveness calculations. The team also report these negative natural gas consumption impacts in the PY 2020 Idaho Natural Gas Impact Evaluation Report.

Nonresidential Fuel Efficiency Impact Findings

Table 18 shows reported and evaluated electric energy savings for Avista's Nonresidential Fuel Efficiency measures, along with realization rates, through PY 2020.

Table 18. Nonresidential Fuel Efficiency Electric Impact Findings

Fuel Efficiency Measure	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Multifamily Market Transformation	528,727	489,597	93%
Total	**528,727**	**489,597**	**93%**

Cadmus identified discrepancies for one high-rise residential tower project that installed a central boiler and chiller system. Avista used the typical deemed savings values for MFMT HVAC measures. Avista developed these savings values through an internal engineering study using building simulation modeling. The savings values are based on the number of apartment units and the rated efficiency of natural gas furnaces replacing electric resistance heaters, and assume a three-story building with a ground, middle, and top floor. This building had 16 middle floors of residential units, while the ground and top floors did not have residential units. Although this project was eligible per the program criteria, the deemed savings values were not designed to account for this type of installation because of the building layout and because it installed boilers instead of furnaces. Cadmus adjusted the analysis to use the deemed savings value for middle floor units only and to account for additional energy consumption required for the boiler circulation pumps. These adjustments reduced energy savings because the middle-floor units experience less heat loss relative to the ground- and top-floor units and because pump energy is not required with gas furnace heating.

Fuel Efficiency Conclusions and Recommendations

MFMT Fuel Efficiency measures achieved evaluated savings of 489,597 kWh, yielding a 93% realization rate, and achieved 103% of the electric energy savings goal of 476,000 kWh.

Cadmus offers the following conclusions and recommendations to improve Avista's Fuel Efficiency measures:

- Avista's deemed savings values for MFMT HVAC measures are intended for natural gas furnaces and do not accurately estimate savings for central boiler systems because they have additional energy consumption from pumps; experience heat loss in the piping system between the boiler and the conditioned space; and have substantially different equipment sizing, heat transfer properties, and fuel consumption.

    - **Recommendation:** Only use deemed savings in this program for standard forced air gas furnaces that directly heat residential spaces. Analyze eligible projects with any other type of equipment using a Site Specific approach, which may require a custom energy model for that particular building.

- Avista's deemed savings values for MFMT HVAC measures overestimate savings for buildings with more than one middle floor, because they assume a three-story building with a ground, middle, and top floor.
    - **Recommendation:** Include a place for MFMT HVAC applications to confirm the number of floors in the building and should apply a weighted average of the deemed savings for ground, middle, and top floors when a building does not have the standard three-story layout.

APPENDIX B – 2020 IDAHO NATURAL GAS EVALUATION REPORT – COMMERCIAL/INDUSTRIAL

CADMUS

PY 2020 Idaho Natural Gas Impact Evaluation Report

April 16, 2020

Prepared for:

Avista Corporation
1411 East Mission Avenue
Spokane, WA 99202

CADMUS

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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 most of these programs have been implemented in house, a few have had external implementers.

Avista contracted with Cadmus to complete process and impact evaluations of its program year (PY) 2020 natural gas DSM Nonresidential and multifamily Residential programs in Idaho. This report presents the natural gas impact evaluation findings. 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

Cadmus used a variety of methods and activities to conduct the Idaho natural gas portfolio evaluation, shown in Table 1.

Table 1. Annual Natural Gas Program Evaluation Activities

Sector	Program	Document/ Database Review	Verification/ Virtual Site Visit
Nonresidential	Prescriptive (Multiple)	✓	✓
	Site Specific	✓	✓
Fuel Efficiency	Site Specific (Nonresidential)	✓	--

Summary of Impact Evaluation Results

Overall, the Idaho portfolio achieved a 101% realization rate on savings from natural gas measures, acquiring 29,503 therms in annual gross savings, as shown in Table 2. Cadmus collected Avista-reported savings through database extracts, drawn from Avista's iEnergy database.

Table 2. PY 2020 Reported and Gross Evaluated Natural Gas Savings

Sector	Reported Savings (therms)	Gross Evaluated Savings (therms)	Realization Rate
Nonresidential	29,315	29,503	101%
Total	**29,315**	**29,503**	**101%**

Conclusions and Recommendations

During the course of the annual evaluation, Cadmus identified the areas addressed below for improvements by sector.

Nonresidential Conclusions and Recommendations

The Nonresidential sector achieved total evaluated natural gas energy savings of 29,503 therms in PY 2020, with a combined realization rate of 101%. The Nonresidential sector did not meet the combined Prescriptive and Site Specific program paths' natural gas savings goal of 82,680 therms, with the program achieving 36% of its goal.

The Nonresidential gas sector performed strongly in PY 2020 relative to reported savings. Most projects that Cadmus sampled for the evaluation were well documented and matched findings from the remote project verifications.

Cadmus offers the following conclusion and recommendation to improve the Nonresidential sector's natural gas savings:

Avista's new iEnergy system has the capability to automatically calculate more detailed energy savings estimates since it records additional detailed inputs on some prescriptive measures that were not previously tracked in InforCRM. Some of these inputs 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 participant project. For example, HVAC furnace measures can use the exact AHRI efficiency rating collected in iEnergy instead of a typical average to automatically calculate more precise savings.

Fuel Efficiency Conclusions and Recommendations

Nonresidential Site Specific and Multifamily Market Transformation (MFMT) Fuel Efficiency measures resulted in evaluated natural gas penalties of 21,948 therms, yielding a 94% realization rate.

Nonresidential Impact Evaluation

Through its Nonresidential program portfolio, Avista promotes purchases of high-efficiency equipment for commercial and industrial utility customers. By providing rebates, Avista partially offsets cost differences between high-efficiency and standard equipment. Cadmus conducted Nonresidential impact evaluation activities to determine evaluated savings for most programs; the team also conducted measurement and verification (M&V) of Prescriptive and Site Specific projects across the full sample.

Program Summary

In PY 2020, Avista completed and provided incentives for 66 Nonresidential natural gas projects in Idaho, reporting total natural gas energy savings of 29,315 therms. Through the Nonresidential sector, Avista offers incentives for high-efficiency equipment and controls through three program paths: Prescriptive, Site Specific, and Fuel Efficiency.

The Prescriptive program path serves 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 path serves more unique projects requiring custom savings calculations and technical assistance from Avista's account executives (such as process equipment, controls, and comprehensive HVAC retrofits).

Multifamily Market Transformation measures involve a combination of electric savings and natural gas penalties. Typically, these measures include replacing electric space-heating or water-heating systems with natural gas equipment. The *Fuel Efficiency Impact Evaluation* section provides a discussion of the evaluation methodology and the results for Multifamily Market Transformation measures.

Program Participation Summary

This section summarizes Nonresidential sector participation and progress toward PY 2020 goals through the Prescriptive and Site Specific program paths.

Nonresidential Prescriptive Programs

Table 3 shows natural gas energy savings goals assigned to Avista's Nonresidential Prescriptive programs for PY 2020 as well as reported savings and a comparison between reported savings and goals. Avista's Nonresidential Prescriptive programs achieved 40% of their collective savings goal in PY 2020. The lower participation is likely due to effects from 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. Nonresidential Prescriptive Natural Gas Savings

Program Type	Savings Goals (therms)	Savings Reported (therms)	Percentage of Goal
HVAC	28,605	13,803	48%
Shell	26,000	1,821	7%
Food Service Equipment	18,075	13,597	75%
Total	**72,680**	**29,221**	**40%**

Table 4 summarizes actual program participation by unique application numbers.

Table 4. Nonresidential Prescriptive Participation by Project

Program Type	Number of Applications	Number of Measures
HVAC	33	40
Shell	4	5
Food Service Equipment	19	20
Total[a]	**56**	**65**

[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 path for Avista's Nonresidential sector for PY 2020, reported savings, and the percent of goal achieved. The Site Specific program achieved 1% of its savings goal, with participation likely reduced due to the effects of the COVID-19 pandemic. The table does not include reported natural gas penalties for the Fuel Efficiency sector, such as those associated with the Multifamily Market Transformation program.

Table 5. Nonresidential Site Specific Natural Gas Savings

Program	Savings Goals (therms)	Savings Reported (therms)	Percentage of Goal
Site Specific	10,000	94	1%

Table 6 summarizes actual program participation for the Site Specific program.

Table 6. Nonresidential Site Specific Participation by Project

Program Type	Number of Applications	Number of Measures
Site Specific Other	1	1
Total	**1**	**1**

Nonresidential Impact Evaluation Methodology

As the first step in evaluating annual savings for the Nonresidential sector, Cadmus explored the following documents and data records to gain an understanding of programs and measures slated for evaluation:

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. The review provided insight into the sources for unit energy savings (UES) claimed for each measure offered in the programs, 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 for impact evaluation activities and performed the following evaluation activities in two waves:

Selected evaluation sample and requested project documentation from Avista

Reviewed project documentation

Prepared virtual site-visit M&V plans

Performed virtual site visits using the Streem platform and collected on-site data (such as trend data, photos, and operating schedules)[1]

Used virtual site-visit findings to calculate evaluated savings by measure

Applied realization rates to total reported savings population to determine overall evaluated savings

Sample Design

Cadmus created two sample waves for PY 2020:

Sample 1 included program data from January 2020 through June 2020.

Sample 2 included program data from July 2020 through December 2020.

Cadmus initially estimated the total annual population size by reviewing the wave 1 population data and comparing it to 2018-2019 population data. The team developed initial sample size targets to achieve 90% confidence at ±10% precision (90/10) for the estimated annual population for 2020, with a target of 90/20 by program. The team pulled the first sample wave to meet one-half of the total target for each program. After receiving the wave 2 population data, Cadmus revised the annual sample size targets and pulled the wave 2 sample to make up the revised target within each program.

Avista advised Cadmus not to evaluate certain prescriptive programs with low participation and historically consistent realization rates every year. Cadmus plans to evaluate the food services and HVAC programs in PY 2020 only, and the shell program in PY 2021 only. Cadmus evaluated all other Nonresidential programs that had participation in PY 2020.

For each activity wave, Cadmus developed a stratified random sample of applications by program path (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 a program, the team selected the highest-savings applications with certainty. For non-certainty applications, Cadmus assigned random numbers and developed a random sample.

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

Cadmus encountered some challenges contacting customers to evaluate the wave 1 sample, primarily due to changes in business operations as a result of the COVID-19 pandemic. The team pulled an additional backup sample for the wave 2 sample using random sampling and recruited participants from the backup sample when participants from the initial random sample were unreachable.

The team pooled results from the randomly selected sites to calculate a realization rate by stratum and applied that realization rate to projects in the population in that stratum. Cadmus applied the project-specific evaluated savings for every project that was in the sample, regardless of whether it was a random, certainty, or convenience selection.

Table 7 summarizes the Idaho Nonresidential Prescriptive program path natural gas evaluation sample. Overall, Cadmus sampled 14 Prescriptive applications at 14 unique sites, selecting all applications randomly. The team did not select any applications for certainty review.

Table 7. Idaho Nonresidential Prescriptive Natural Gas Evaluation Sample

Program Type	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
HVAC	7	3,553	26%
Shell	0	0	0%
Food Service Equipment	7	4,490	33%
Nonresidential Prescriptive	**14**	**8,043**	**28%**

Note: totals may not sum due to rounding.

Table 8 summarizes the Idaho Nonresidential Site Specific program path's natural gas evaluation sample. Cadmus sampled one Site Specific application at one unique site. The team selected the sampled application with certainty as it was the only gas participant in the Site Specific program.

Table 8. Idaho Nonresidential Site Specific Natural Gas Evaluation Sample

Program	Applications Sampled	Sampled Savings (therms)	Percentage of Reported Savings
Site Specific	1	94	100%

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 (IV) reports.

Remote Verification

Cadmus performed verifications at 14 unique Nonresidential locations in Idaho to assess natural gas energy savings for 17 unique Prescriptive and Site Specific measures (not including Fuel Efficiency measures). Cadmus evaluated the remaining application through a desk review that did not require participant outreach. Verification calls involved a brief phone call or video call to confirm key details and any information that was missing in the project documentation. Cadmus typically conducted video calls using the Streem platform that records video and audio. The team conducted some verifications using

Microsoft Teams meetings if customers were unable to access Streem or preferred using Teams due to prior familiarity. Cadmus used the project documentation review and on-site findings to adjust the reported savings calculations where necessary.

Nonresidential Impact Evaluation Findings

This section summarizes the Nonresidential Prescriptive and Site Specific program paths' natural gas impact evaluation results for PY 2020.

Prior to this program year, Avista completed a transition from its previous InforCRM system to the new iEnergy system to track Nonresidential energy efficiency applications and measures. Cadmus found that the additional detail provided by the iEnergy system facilitated conducting a detailed and comprehensive evaluation. For example, the iEnergy system reports detailed information about each HVAC measure, including furnace model number and rated capacity. This facilitated Cadmus' evaluation and allowed it to partially automate the generation of M&V plans and some analysis tables.

The team did encounter some challenges with inconsistent data in report extracts from iEnergy (i.e., reports with duplicated records) and developed additional quality control processes to identify such issues, working with Avista's technical staff to resolve them. Avista continues to work with the iEnergy vendor to improve the system and integrate feedback.

Nonresidential Prescriptive Programs

Table 9 shows the reported and evaluated natural gas energy savings for Avista's Nonresidential Prescriptive program path as well as realization rates between the evaluated and reported savings for PY 2020. The overall Nonresidential Prescriptive program path achieved a 101% natural gas realization rate.

Table 9. Nonresidential Prescriptive Natural Gas Impact Findings

Program Type	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
HVAC	13,803	13,992	101%
Shell	1,821	1,821	100%
Food Service Equipment	13,597	13,597	100%
Nonresidential Prescriptive	**29,221**	**29,409**	**101%**

Of 14 evaluated applications, Cadmus identified discrepancies for one based on the verification and project documentation review. Table 10 summarizes the reasons for discrepancies between reported and evaluated savings.

Table 10. Nonresidential Prescriptive Evaluation Summary of Discrepancies

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
HVAC	1	↑	• Cadmus found that the installed furnaces for one project were multistage based on the model number and specifications rather than single-stage as reported, which increased the evaluated savings.

Nonresidential Site Specific Program

Table 11 shows reported and evaluated natural gas energy savings for Avista's Nonresidential Site Specific program path for the program year. The overall Site Specific program path achieved a 100% natural gas realization rate. The table does not include reported and evaluated natural gas penalties for measures in the Fuel Efficiency path. Cadmus did not identify any discrepancies in the evaluated application.

Table 11. Nonresidential Site Specific Natural Gas Impact Findings

Program	Reported Savings (therms)	Evaluated Savings (therms)	Realization Rate
Site Specific	94	94	100%

Nonresidential Conclusions and Recommendations

The Nonresidential sector achieved total evaluated natural gas energy savings of 29,503 therms in PY 2020, with a combined realization rate of 101%. The Nonresidential sector did not meet the combined Prescriptive and Site Specific program paths' natural gas savings goal of 82,680 therms, with the program achieving 36% of its goal.

The Nonresidential gas sector performed strongly in PY 2020 relative to reported savings. Most projects that Cadmus sampled for the evaluation were well documented and matched findings from the remote project verifications.

Cadmus offers the following conclusion and recommendation to improve the Nonresidential sector's natural gas savings:

Avista's new iEnergy system has the capability to automatically calculate more detailed energy savings estimates since it records additional detailed inputs on some prescriptive measures that were not previously tracked in InforCRM. Some of these inputs 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 participant project. For example, HVAC furnace measures can use the exact AHRI efficiency rating collected in iEnergy instead of a typical average to automatically calculate more precise savings.

Fuel Efficiency Impact Evaluation

Cadmus designed the Fuel Efficiency sector impact evaluation to verify reported program participation and natural gas consumption impacts. Evaluation methods included a database review and document review.

Program Summary

Fuel Efficiency measures replace electric space heating or water heating systems with equipment using natural gas. These measures are offered within the Nonresidential Site Specific program path, which includes MFMT measures. From this program, Avista reported a natural gas energy penalty of 23,338 therms for four Fuel Efficiency measures.

Fuel Efficiency measures provide positive electricity savings and negative natural gas consumption impacts, reflecting negative avoided costs. Cadmus reported the electric energy savings in the PY 2020 Idaho Electric Impact Evaluation Report.

Program Participation Summary

This section summarizes Fuel Efficiency sector impact in PY 2020 for the MFMT path.

Table 12 shows Avista's PY 2020 reported participation for MFMT Fuel Efficiency measures. Avista did not set participation goals for Site Specific Fuel Efficiency measures. There were four MFMT participants in PY 2020.

Table 12. Avista Portfolio Fuel Efficiency Participation

Program	Participation Reported
Multifamily Market Transformation	4

Fuel Efficiency Impact Evaluation Methodology

The impact methodology for Fuel Efficiency measures is outlined below for the Nonresidential Site Specific program path.

Nonresidential Site Specific Fuel Efficiency Impact Methodology

Cadmus followed the same impact evaluation methodology for Fuel Efficiency measures as outlined in the *Nonresidential Impact Evaluation Methodology* section. The team sampled two MFMT applications. Of the sampled applications, the team selected one for certainty review based on the savings scale and selected one randomly.

Fuel Efficiency Impact Evaluation Results

The following section summarizes findings for the Nonresidential Site Specific program path. All Fuel Efficiency measures provide positive electricity savings and negative natural gas consumption impacts because these measures replace electric space-heating or water-heating systems with equipment that uses natural gas. Negative natural gas consumption impacts reflect negative avoided costs and are incorporated in the electric cost-effectiveness calculations. The team also report these positive electric savings in the PY 2020 Idaho Electric Impact Evaluation Report.

Nonresidential Site Specific Fuel Efficiency Impact Findings

Table 13 shows reported and evaluated natural gas penalties for Avista's Nonresidential Fuel Efficiency measures, along with realization rates, through PY 2020.

Table 13. Nonresidential Fuel Efficiency Natural Gas Findings

Fuel Efficiency Measure	Reported Consumption Impacts (therms)	Evaluated Consumption Impacts (therms)	Realization Rate
Multifamily Market Transformation	(23,338)	(21,948)	94%
Total	**(23,338)**	**(21,948)**	**94%**

Cadmus identified discrepancies for one project, where Avista reported higher natural gas consumption for the ground- and top-floor units due to heat loss. Cadmus found that all units were mid floor and removed the ground- and top-floor natural gas consumption impacts. The electric impact evaluation report discusses the causes and solutions for this issue in more detail. This project achieved a realization rate of 92%.

Fuel Efficiency Conclusions and Recommendations

Nonresidential Site Specific and MFMT Fuel Efficiency measures resulted in evaluated natural gas penalties of 21,948 therms, yielding a 94% realization rate.

APPENDIX C – 2020 IDAHO ELECTRIC IMPACT EVALUATION REPORT – RESIDENTIAL AND LOW-INCOME

Evaluation, Measurement and Verification (EM&V) of Avista Idaho Electric PY2020 Residential and Low-Income Energy Efficiency Programs

Prepared for:

Avista Corporation

Delivered on:

June 7, 2021

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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 2020 program year (PY2020) portfolio of programs for Avista Corporation (Avista) in the Idaho 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 PY2020. The Residential portfolio savings amounted to 4,535,320 kWh with a 96.12% realization rate. The Low-Income portfolio savings amounted to 215,300 kWh with a 110.07% 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 2.08 and a UCT value of 3.01. The Low-Income portfolio reflects a TRC value of 0.61 and a UCT value of 0.45, leading to a total Residential and Low-Income TRC of 1.81 and a UCT of 2.33. 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	11,660	12,986	111.37%	$3,366.77
HVAC	503,411	508,131	100.94%	$135,247.55
Shell	206,012	358,972	174.25%	$192,358.60
Fuel Efficiency	780,424	635,962	81.49%	$340,839.76
ENERGY STAR Homes	49,687	50,705	102.05%	$13,555.77
Simple Steps, Smart Savings	3,166,980	2,968,563	93.73%	$476,724.59
Total Res	**4,718,173**	**4,535,320**	**96.12%**	**$1,162,093.04**

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

Program	Expected Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate	Total Costs
Low-Income	195,603	215,300	110.07%	$637,629.48
Total Low-Income	**195,603**	**215,300**	**110.07%**	**$637,629.48**

Table 1-3: Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$5,579,452	$2,681,641	2.08	$5,072,229	$1,687,155	3.01
Low Income	$366,774	$605,151	0.61	$272,178	$546,723	0.50
Total	**$5,946,226**	**$3,286,792**	**1.81**	**$5,344,407**	**$2,233,878**	**2.39**

Table 1-4 summarizes the electric programs offered to residential and low-income customers in the Idaho Avista service territory in PY2020 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/Billing analysis with comparison group
Residential	Shell	✓		RTF UES
Residential	Fuel Efficiency	✓	✓	Avista TRM/Billing Analysis with comparison group
Residential	ENERGY STAR® Homes	✓		RTF UES
Residential	Simple Steps, Smart Savings	✓		RTF UES
Low-Income	Low-Income	✓		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 electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 4,535,320 kWh with a realization rate of 96.12%. 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 2.08 while the UCT value is 3.01. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Residential Portfolio impact evaluation resulted in a realization rate of 96.12% due to slight differences between the Avista TRM categories and the appropriately assigned RTF UES categories for each measure as well as billing analysis results. 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 Idaho 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 Simple Steps, Smart Savings Program, which contributes 65.45% of the expected savings, resulted in a realization rate of 93.73% whereas each of the other programs resulted in a combined 101.00% realization rate. The Shell Program contributed to a 5% decrease in the overall residential sector, which displayed a realization rate of 96.12%.
- The Evaluators conducted a billing analysis to estimate observed, verified savings for the E Variable Speed Motor measure. The Evaluators found the resulting savings to be 513 kWh per year, roughly 124% of the current Avista TRM value for the measure. This savings value was applied to all rebates completed in PY2020.
- The Evaluators also conducted a billing analysis to estimate observed, verified savings for the E Electric to Natural Gas Furnace measure in the Fuel Efficiency Program. The Evaluators found the resulting savings to be 5,068 kWh per year, roughly 72.73% of the current Avista TRM value for the measure. This savings value was applied to all rebates completed in PY2020.
- In the HVAC Program, 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 retail rebates and a higher-than-expected savings for the direct install rebates for this measure.
- The Evaluators note that the RTF version used to evaluate the Simple Steps, Smart Savings Program represents the residential lighting workbook active at the time the Bonneville Power Administration (BPA) planning for this program was established (October 1, 2019). The values present in this version of the RTF workbook do not reflect the current savings values present in the Avista TRM. Therefore, the adjusted savings displayed is significantly lower than the verified savings. This is because the savings for the lighting measures decreased as the baseline efficiencies have been updated and increased.

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 215,300 kWh with a realization rate of 110.07%. 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 0.61 while the UCT value is 0.50. 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 110.07% realization rate. The realization rates for each program deviate from 100% due to differences between the Avista TRM values and the appropriately assigned RTF UES values. 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 130% for all electric measures in the program, which supported the realization rate of 115% from the desk review.
- Some rebates included in the Low-Income Program indicate that savings had been capped at 20% of consumption. The provided project data do not include adequate information to determine when savings values are being appropriately capped. The Evaluators recommend that annual consumption be provided for each measure in the tracking data, if practical, so that evaluation can include verifying that savings are being capped at 20% consumption for application measures.

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 recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. The values found in the project documentation should accurately reflect the values represented in the CC&B database.
- A number of rebates were not accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The realization rate for the electric savings in the Water Heat Program deviate from 100% due to the methodology in which the Avista TRM prescriptive savings value was applied. 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 Tier 4, which the RTF UES assigns a higher savings value. The Evaluators recommend splitting the Avista TRM value for Tier 2, Tier 3, and Tier 4 water heaters into separate values in order to accurately reflect expected savings for the electric water heater measure.

- 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 some of the model numbers for the rebated equipment were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.
- The Evaluators note that a number of rebate applications did not contain values associated with whether the home is existing or was a new construction home. 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 cross-referenced the billing data to verify if customers demonstrated the required heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually. In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.
- The Evaluators conducted a billing analysis for the E Variable Speed Motor measure in the HVAC Program. The estimated savings value from the billing analysis was roughly 124% of the value reflected in the Avista TRM. The Evaluators recommend updating the savings value for this measure in the Avista TRM to reflect observed savings more closely in the territory.
- For the Shell Program, the Evaluators found rebates in which the R-values did not align with TRM or RTF values (R38 and R64). The Evaluators recommend collecting information in a standardized manner.
- The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.
- The Evaluators also recommend collecting information on single-family/multi-family/manufactured in the web rebate form. This allows the Evaluators to accurately assign RTF values. The mail-in rebates collect this information; however, it does not seem to be currently required to complete the rebate. Therefore many rebates are missing this information.
- 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 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.
- The Evaluators recommend the Avista TRM reflect the savings values in effect for the Simple Steps, Smart Savings Program. The Avista TRM currently uses RTF values in effect on November 1, 2019 for the Simple Steps, Smart Savings whereas the expected savings for this program are calculated using the RTF-approved BPA workbook in effect on October 1, 2019.

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 CC&B and the rebate project documentation provided in the data request for document verification. In addition, the unit type, in terms of square footage or number of measures (windows, doors, etc) was not documented consistently and therefore savings values were applied inaccurately. The Evaluators recommend updating CC&B documentation standards to more accurately reflect values present on the rebate applications.
- The Evaluators found discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

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 supplemented with phone 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 Idaho 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:

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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.

- **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 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 2020 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.

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
- Fuel Efficiency Program
- ENERGY STAR® Homes
- Simple Steps, Smart Savings
- Low-Income 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.

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[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

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	127	45	±10.0%
Residential	HVAC	419	62	±9.7%
Residential	Shell	379	63	±9.5%
Residential	Fuel Efficiency	95	41	±9.6
Residential	ENERGY STAR® Homes	44	28	±9.8%
Residential	Simple Steps, Smart Savings	N/A	N/A	N/A
Low-Income	Low-Income	386	65	±9.4%

*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 Idaho Electric Avista projects. The Evaluators developed a sampling plan that achieved a sampling precision of ±5.5% 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	59	32	±9.8%
Residential	HVAC	419	88	±7.9%
Residential	Fuel Efficiency	95	42	±9.5%
Total		**573**	**162**	**±5.5%**

The Evaluators implemented a web-based survey to complete the verification surveys. The Evaluators supplemented with phone interviews 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 2020 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 2020 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, 2018 and December 31, 2020)
5. Typical Meteorological Year (TMY3) data

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

Billing and weather data were obtained for program years 2019 and 2020 and for one year prior to measure install dates (2018).

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 (0.1% of bills).
5. Removed bills missing fuel type/Unit of Measure (UOM) (0.1% of bills).
6. Removed bills missing usage, billing start date, or billing end date (0.17% of bills).
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, 2019 through June 30, 2020) 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

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

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

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

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 PY2020 and perhaps also PY2021 are affected by the stay-at-home orders that had taken effect starting March 2020 in Idaho. 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 PY2020. The following sections summarize findings for each electric impact evaluation in the Residential Portfolio in the Idaho 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	Total Costs
Water Heat	11,660	12,986	111.37%	$3,366.77
HVAC	503,411	508,131	100.94%	$135,247.55
Shell	206,012	358,972	174.25%	$192,358.60
Fuel Efficiency	780,424	635,962	81.49%	$340,839.76
ENERGY STAR Homes	49,687	50,705	102.05%	$13,555.77
Simple Steps, Smart Savings	3,166,980	2,968,563	93.73%	$476,724.59
Total Res	**4,718,173**	**4,535,320**	**96.12%**	**$1,162,093.04**

Table 3-2: Residential Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$5,579,452	$2,681,641	2.08	$5,072,229	$1,687,155	3.01

In PY2020, Avista completed and provided incentives for residential electric measures in Idaho and reported total electric energy savings of 4,535,320 kWh. All programs except the Fuel Efficiency Program and ENERGY STAR® Homes Program exceeded savings goals based on reported savings, leading to an overall achievement of 96.12% of the expected savings for the residential programs. The Evaluators estimated the TRC value for the Residential portfolio is 2.08 while the UCT value is 3.01. Further details of the impact evaluation results by program are provided in the sections following.

3.1 Simple Verification Results

The Evaluators surveyed 261 unique customers that participated in Avista's residential energy efficiency program in February and March 2021 using a mixed mode approach (phone/email). Customers with a valid email were sent the survey via an email invitation. Fifty-three did not have email addresses in program records and were invited to take the survey by the Evaluators' in-house survey administration team. 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 Fuel Efficiency Programs.

Table 3-3: Summary of Survey Response Rate

Population	Respondents
Initial email contact list	959
Invalid email addresses	3
Bounced email	43
Undeliverable email	27
Invalid email (%)	*8%*
Email invitations sent (unique valid)	886
Email completions	208
Email response rate (%)	23%
Initial phone list	190
Phone numbers w/ email addresses	138
Phone numbers w/ no email address	52
Disconnected/wrong number	20
Invalid phone (%)	*11%*
Phone calls (unique valid)	170
Phone completions	54
Phone response rate (%)	32%
Total invites (unique)	938
Total completions	262
Response rate (%)	28%
Initial email contact list	959
Invalid email addresses	3

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 and HVAC 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 6.50% 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	59	32	±9.8%
Residential	HVAC	419	88	±7.9%
Residential	Fuel Efficiency	95	41	±9.5%
Total		**573**	**120**	**±5.5%**

The measure-level ISRs determined from the verification survey for each program in which simple verification was conducted is presented in Table 3-5, Table 3-6, and Table 3-7.

Table 3-5: Water Heat Program ISRs by Measure

Measure	Respondents	ISR
E Heat Pump Water Heater	32	100%

Table 3-6: HVAC Program ISRs by Measure

Measure	Respondents	ISR
E Electric To Air Source Heat Pump	21	100.00%
E Electric to Ductless Heat Pump	21	100.00%
E Smart Thermostat DIY with Electric Heat	15	93.33%
E Smart Thermostat Paid Install with Electric Heat	27	100.00%
E Variable Speed Motor	4	100.00%

Table 3-7: Fuel Efficiency Program ISRs by Measure

Measure	Respondents	ISR
E Electric To Natural Gas Furnace	26	100.00%
E Electric To Natural Gas Furnace & Water Heat	16	93.33%

These ISR values were utilized in the desk reviews for the Water Heat and HVAC 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 60% of respondents said that two or fewer lived at the residence that had the rebated equipment installed.

About two-thirds of respondents (66%) observed that the pandemic had not changed the number of people in their household that worked or went to school remotely.[8] Twenty-two percent of respondents said that more members of their household were attending school remotely or working from home since the COVID-19 pandemic began. Twelve percent of respondents indicated that more members of their household had gone to work or school remotely before the COVID-19 pandemic.

Three-quarters of respondents said that the amount of time they spend at home has increased since the COVID-19 pandemic began. A much smaller portion of respondents indicated that other members of their household were spending more time at home, as displayed in Figure 3-1. About half of respondents indicated that their utility bill had increased, as displayed in Figure 3-2.

[8] n=257

Figure 3-1: Change in amount of time spent at home

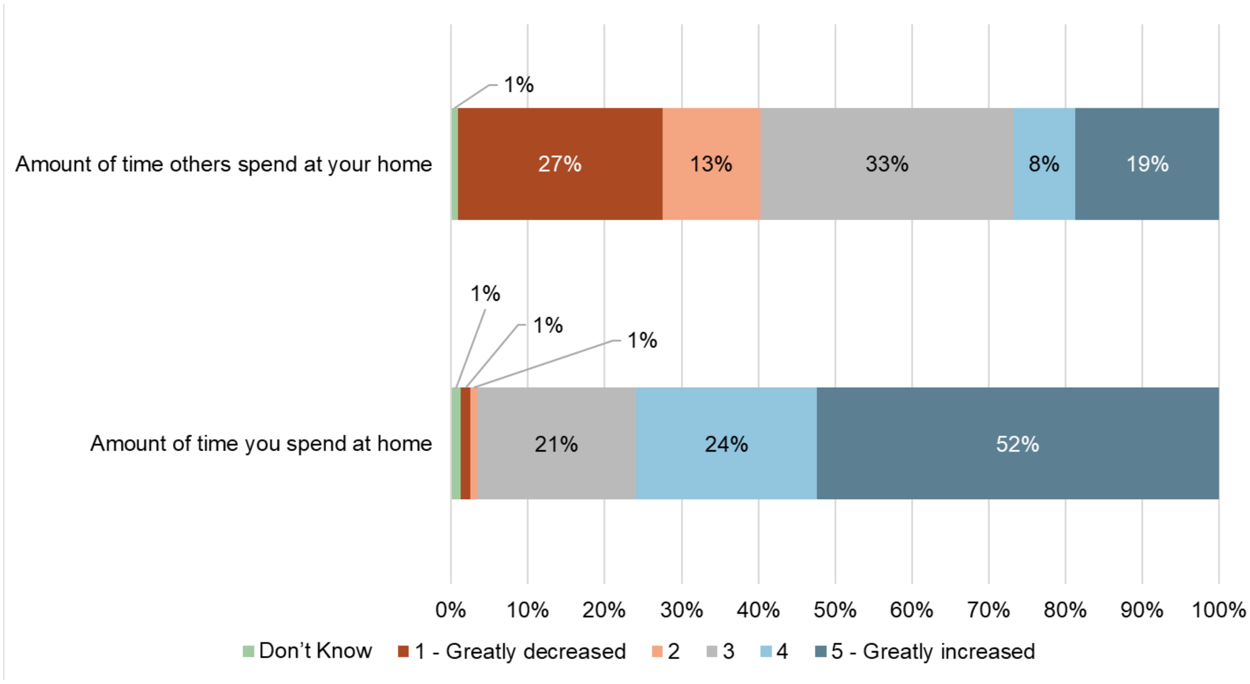
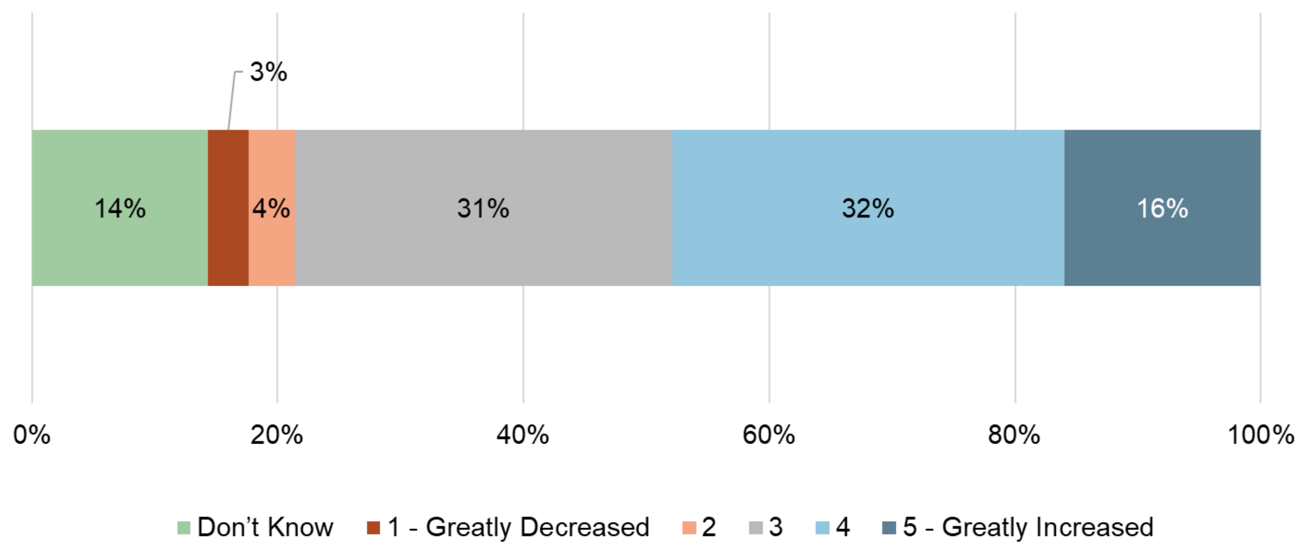


Figure 3-2: Change in electricity bill since COVID19 pandemic began



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
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 3-9 Water Heat Program Verified Electric Savings

Measure	PY2020 Participation	Expected Savings	Adjusted Savings	Verified Savings	Realization Rate
E Heat Pump Water Heater	10	11,660	12,826	12,986	111.37%
Total	**10**	**11,660**	**12,826**	**12,986**	**111.37%**

The Water Heat Program displayed verified savings of 12,986 kWh with a realization rate of 111.37% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-10 Water Heat Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Heat Pump Water Heater	$2,365.00	$1,001.77	$3,366.77
Total	**$2,365.00**	**$1,001.77**	**$3,366.77**

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.

However, the Evaluators note that the CC&B web rebate data does not reflect the same values found in the mail-in rebate applications and/or invoices or AHRI certification documents submitted with the rebate application. The Evaluators recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. For example, ten of the 111 sampled rebates were not found in the CC&B dataset. A number of the sampled rebates were found to have discrepancies in model numbers between the CC&B data and the mail-in rebate applications and/or invoices.

In addition, not all rebates were accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.

The Evaluators found all sampled rebate equipment met or exceeded the measure efficiency requirements for the Water Heat Program. The Evaluators found one rebate which indicated a quantity of two, but expected savings assigned to the rebate aligned with a quantity of one. The Evaluators applied the sampled realization rate to the expected savings value; therefore, the rebate was assigned the savings of one unit of equipment. The Evaluators recommend correcting for instances where quantity is greater than one and savings is equivalent to one measure.

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
E Heat Pump Water Heater	117	32	9.84%*	100%

*Heat Pump Water Heater measure precision calculated at the participant-level, not the project-level, as most participants were builders.

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 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 12,986 kWh with a realization rate of 111.37%, as displayed in Table 3-9.

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 3-8 summarizes the measures offered under this program.

Table 3-12: 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 3-13: HVAC Program Verified Electric Savings

Measure	PY2020 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
E Electric To Air Source Heat Pump	53	301,463	304,997	292,375	96.99%
E Electric to Ductless Heat Pump	62	144,136	145,576	158,685	110.09%
E Smart Thermostat DIY with Electric Heat	21	15,729	15,719	11,237	71.44%
E Smart Thermostat Paid Install with Electric Heat	49	36,701	36,677	39,165	106.71%
E Variable Speed Motor	13	5,382	5,382	6,669	123.92%
Total	**198**	**503,411**	**508,350**	**508,131**	**100.94%**

The HVAC Program displayed verified savings of 508,131 kWh with a realization rate of 100.94% against the expected savings for the program.

Table 3-14: HVAC Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Electric To Air Source Heat Pump	$37,100.00	$32,277.56	$69,377.56
E Electric to Ductless Heat Pump	$31,000.00	$21,149.76	$52,149.76
E Smart Thermostat DIY with Electric Heat	$1,572.61	$1,265.74	$2,838.35
E Smart Thermostat Paid Install with Electric Heat	$4,900.00	$4,411.44	$9,311.44
E Variable Speed Motor	$1,040.00	$502.21	$1,542.21
Total	**$75,612.61**	**$59,606.71**	**$135,219.32**

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. However, the Evaluators note that some of the model numbers were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.

The Evaluators note that not all rebate applications contained existing/new construction field. 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 cross-referenced the billing data to verify if customers that received a rebate for E Electric To Air Source Heat Pump or E Electric To Ductless Heat Pump demonstrate a heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually (not just heating months). In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.

The Evaluators found one E Electric to Air Source Heat Pump rebate was duplicated in the project data after confirming with Avista. The Evaluators removed this instance from the verified savings for the program. The Evaluators found all 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 3-15 displays the ISRs for each of the HVAC measures for Idaho and Washington electric territory combined. The ISRs resulted in 7.90% precision at the 90% confidence interval for the program.

Table 3-15: 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	53	21	7.90%	100.00%
E Electric to Ductless Heat Pump	41	21		100.00%
E Smart Thermostat DIY with Electric Heat	63	15		93.33%
E Smart Thermostat Paid Install with Electric Heat	61	27		100.00%
E Variable Speed Motor	3	4		100.00%

Survey respondents described equipment to be currently functioning, leading to a 100% ISR for all measures except the E Smart Thermostat DIY with Electric Heat. Although less than 100%, the ISR for the E Smart Thermostat DIY with Electric Heat measure still exceeded ISRs of 90%. The Evaluators applied the ISRs listed in Table 3-15 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 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 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 3-16 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 3-16: 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
E Electric To Air Source Heat Pump		N/A	N/A
E Electric to Ductless Heat Pump		N/A	N/A
E Smart Thermostat DIY with Electric Heat		N/A	N/A
E Smart Thermostat Paid Install with Electric Heat		N/A	N/A
E Variable Speed Motor	✓	206	✓

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 3-17.

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. Further details regarding the billing analysis methodology can be found in Appendix A.

Table 3-17 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 statistically significant at the 90% level for E Variable Speed Motor The adjusted R-squared (0.88) shows the model provided an excellent fit for the data.

Table 3-17: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (kWh)	90% Lower CI	90% Upper CI	Relative Precision (90% CI)	Adjusted R-Squared	Model
E Variable Speed Motor	126	630	513	126	900	75.4%	0.88	Model 2: PPR

The Evaluators determined the savings estimate for E Variable Speed Motors in PY2020 to be 513 kWh, which represents a value 124% of that demonstrated in the Avista TRM. The Evaluators applied this value to all rebates in the PY2020 project data.

3.3.2.6 Verified Savings

The HVAC Program in total displays a realization rate of 100.94% with 508,131 kWh verified electric energy savings in the Idaho service territory, as displayed in Table 3-13. 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 applied the results of the billing analysis to each E Variable Speed Motor measure. The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program adjusted savings for measures not evaluated through billing analysis. 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 retail rebates and a higher-than-expected savings for the direct install rebates for this measure. In addition, the 93.33% ISR was applied to the E Smart Thermostat with Electric Heat measure, further decreasing the realization rate for the measure.

The E Electric to Ductless Heat Pump rebates have high realization rates because the expected savings value used a value differing from the RTF values. The value in the TRM for this measure most likely represents an average of the RTF savings values for a combination of heating zones. The E Variable Speed Motor has a high realization rate due to the relatively higher unit-level energy savings from the billing analysis as opposed to the Avista TRM.

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 3-8 summarizes the measures offered under this program.

Table 3-18: 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 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 3-19: Shell Program Verified Electric Savings

Measure	PY2020 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate
E Attic Insulation with Electric Heat	19	44,595	44,728	87,731	196.73%
E Floor Insulation with Electric Heat	4	4,525	5,204	5,185	114.58%
E Storm Window with Electric Heat	1	1,342	1,342	821	61.19%
E Wall Insulation with Electric Heat	8	15,294	13,868	22,667	148.21%

E Window Replc from Double Pane W Electric Heat	1	1,414	1,397	1,143	80.89%
E Window Replc from Single Pane W Electric Heat	86	138,842	136,598	241,425	173.88%
Total	**119**	**206,012**	**203,137**	**358,972**	**174.25%**

The Shell Program displayed verified savings of 358,972 kWh with a realization rate of 174.25% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-20: Shell Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Attic Insulation with Electric Heat	$19,112.25	$27,862.25	$46,974.50
E Floor Insulation with Electric Heat	$3,309.00	$1,646.58	$4,955.58
E Storm Window with Electric Heat	$366.00	$123.21	$489.21
E Wall Insulation with Electric Heat	$5,735.25	$7,198.83	$12,934.08
E Window Replc from Double Pane W Electric Heat	$508.00	$363.10	$871.10
E Window Replc from Single Pane W Electric Heat	$49,672.00	$76,673.10	$126,345.10
Total	**$78,702.50**	**$113,867.08**	**$192,569.58**

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 one instance in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. Two rebates showed R-values that did not align with TRM or RTF values related to the measure (R38 and R64). The Evaluators recommend collecting information in a standardized manner. The Evaluators assumed insulation levels closest to those presented for those two instances.

The Evaluators found the square footage for the floor insulation, wall insulation, and storm windows to be equivalent between the project data and the rebate applications, where available. However, the Evaluators found one floor insulation rebate in which the new R-value did not match TRM or RTF values (R21). The Evaluators recommend collecting this information in a standardized manner in addition to the R-values, detailed above.

The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.

The Evaluators also recommend collecting information on single-family/multi-family/manufactured in the web rebate form. 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 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 verifying the household space heating type prior to completing the rebate.

The Evaluators also note one instance in which the R-values for a window was assigned incorrectly. The Evaluators reassigned this window from an insulation of R0 to R49 to an insulation of R11 to R49.

The Evaluators cross-referenced the billing data to verify if customers demonstrate a heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually (not just heating months). In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.

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 174.25% with 358,972 kWh verified electric energy savings in the Idaho service territory, as displayed in Table 3-19. 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 Fuel Efficiency Program

The Residential Fuel Efficiency Program encourages customers to consider converting their resistive electric space and water heating equipment to natural gas. This program is offered to residential customers in the Idaho service territory. Customers must use Avista electricity for electric straight-resistance heating or water heating in order to qualify for the rebate, which is verified by evaluating their energy use. The home's electric baseboard or furnace heat consumption must indicate at least 8,000 kWh during the previous heating season. Customers receive incentives after installation and after submitting a completed rebate form. Table 3-8 summarizes the measures offered under this program.

Table 3-21: Fuel Efficiency Program Measures

Measure	Description	Impact Analysis Methodology
E Electric to Air Source Heat Pump	Electric central ducted forced air furnace to air source heat pump (9.0 HFSP or greater)	RTF UES
E Electric To Natural Gas Furnace	Electric baseboard or forced air furnace heat to natural gas forced air furnace	Billing Analysis
E Electric To Natural Gas Furnace & Water Heat	Electric to natural gas furnace and water heat combo	Avista TRM

The following table summarizes the verified electric energy savings for the Fuel Efficiency Program impact evaluation.

Table 3-22: Fuel Efficiency Program Verified Electric Savings

Measure	PY2020 Participation	Expected Savings	Adjusted Savings	Verified Savings	Verified Realization Rate
E Electric to Air Source Heat Pump*	0	N/A	N/A	N/A	N/A
E Electric To Natural Gas Furnace	59	422,068	435,656	306,966	72.73%
E Electric To Natural Gas Furnace & Water Heat	36	358,356	352,404	328,996	91.81%
Total	**95**	**780,424**	**780,424**	**635,962**	**81.49%**

*The E Electric to Air Source Heat Pump measure had 0 rebates completed in PY2020

The Fuel Efficiency Program displayed verified savings of 635,962 kWh with a realization rate of 81.49% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-23: Fuel Efficiency Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
E Electric to Air Source Heat Pump*	N/A	N/A	$0.00
E Electric To Natural Gas Furnace	$123,000.00	$55,597.63	$178,597.63
E Electric To Natural Gas Furnace & Water Heat	$102,600.00	$59,587.57	$162,187.57
Total	**$225,600.00**	**$115,185.19**	**$340,785.19**

*The E Electric to Air Source Heat Pump measure had 0 rebates completed in PY2020

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Fuel Efficiency 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 Fuel Efficiency Program.

3.3.4.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the Fuel Efficiency 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 note that some of the model numbers were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.

The Evaluators recommend collecting rebate documentation data in a standardized format. For example, equipment efficiency was entered in either a numeric format, percentage format, or character format. A unified format would allow for more accurate estimation of savings.

The Evaluators found one rebate was duplicated in the project data for the E Electric to Natural Gas Furnace measure. ADM removed this instance from the verified savings for the program.

The Evaluators noted several instances where efficiency in documentation does not match that of the database. Therefore, the Evaluators recommend improving methods for transferring information from paper rebate applications to CC&B database.

Evaluators recommend Avista collect efficiency values on the rebate application for conversion measures, not just HVAC measures. Customers can get rebated for a conversion but also not apply for an HVAC rebate (HVAC rebates do ask for the efficiency on the application)

The Evaluators found the CC&B data does not contain manufacturer information. The Evaluators recommend this as an input in the CC&B data. The E Electric to Natural Gas Furnace & Water Heat measure CC&B data does not detail both the furnace and the water heater model number and manufacturer details. Instead, it contains only the furnace or only the water heater equipment, but not both. The Evaluators recommend collecting both equipment manufacturer, model number, and efficiency for the combination measures.

ADM cross-referenced the billing data to verify if customers that received a rebate demonstrate a heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually (not just heating months). In addition, some customers had insufficient pre-period data to determine annual usage. ADM recommends Avista verify if customers meet the requirements prior to completing the rebate.

3.3.4.3 Verification Surveys

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measure, as described in Section 2.2.2.2. The Evaluators included questions such as:

- 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 in-service rates (ISRs) for the measures offered in the Fuel Efficiency 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 3-11 displays the ISRs for each of the Fuel Efficiency measures for Idaho territory. The ISRs exceeded 10% precision at the 90% confidence interval for the program.

Table 3-24: Fuel Efficiency Verification Survey ISR Results

Measure	Number of Rebates	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
E Electric To Natural Gas Furnace	59	26	9.48%	100.00%
E Electric To Natural Gas Furnace & Water Heat	36	16		93.33%

Survey respondents described equipment to be currently functioning for the E Electric to Natural Gas Furnace measure, leading to a 100% in-service rate. The E Electric To Natural Gas Furnace & Water Heat combination measure displayed an in-service rate of 93.33% due to one of the respondents specifying that they do not know if the equipment is currently installed and working. The Evaluators applied these ISRs to each rebate to quantify verified savings for each measure.

3.3.4.4 Impact Analysis

This section summarizes the verified savings results for the Fuel Efficiency Program. The Evaluators explored billing analyses for measure-level energy savings estimates. In the case participation was low or billing analysis results did not achieve statistical significance, a desk review was conducted. The Evaluators calculated verified savings for the electric measures using the most recent RTF workbook for the Fuel Efficiency measures. The Evaluators calculated verified savings for the gas measures using the active Avista TRM values. 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.

The following sections summarize the results of the billing analysis and the desk review, with a summary of the verified savings for the Fuel Efficiency Program.

3.3.4.5 Billing Analysis

The results of the billing analysis for the Fuel Efficiency 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, Fuel Efficiency Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
E Electric To Natural Gas Furnace	✓	186	✓
E Electric To Natural Gas Furnace & Water Heat	✓	33	

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 3-17.

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. Further details regarding the billing analysis methodology can be found in Appendix A.

Table 3-26 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Fuel Conversion 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.

Table 3-26: Measure Savings, Fuel Efficiency Program

Measure	Treatment Customers	Control Customers	Annual Savings per	90% Lower CI	90% Upper CI	Relative Precision (90% CI)	Adjusted R-Squared	Model

			Customer (kWh)					
E Electric to Natural Gas Furnace	85	421	5,068	4,384	5,7512	0.13	0.73	Model 2: PPR

The Evaluators determined the savings estimate for E Electric to Natural Gas Furnace in PY2020 to be 5,068 kWh, which represents a value 72.73% of that demonstrated in the Avista TRM. The Evaluators applied this value to all rebates in the PY2020 project data.

3.3.4.6 Verified Savings

The HVAC Program in total displays a realization rate of 81.49% with 635,962 kWh verified electric energy savings in the Idaho service territory, as displayed in Table 3-13. 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 billing analysis and true Avista TRM value. In addition, the 93.33% survey in-service rate applied to the combination conversion measure further decreased the realization rate for the measure and program overall.

The Evaluators applied the results of the billing analysis to each E Electric to Natural Gas Furnace measure. The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program adjusted savings for measures not evaluated through billing analysis. In addition, the Evaluators reviewed and applied the current Avista TRM values for the electric measures along with verified tracking data to estimate net program verified savings for this measure.

3.3.5 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 3-8 summarizes the measures offered under this program.

Table 3-27: ENERGY STAR® Homes Program Measures

Measure	Description	Impact Analysis Methodology
E ENERGY STAR Home - Manufactured, Furnace	ENERGY STAR-rated manufactured home with electric furnace	RTF UES
G ENERGY STAR Home - Manufactured, Natural Gas	ENERGY STAR-rated manufactured home with natural gas heating	RTF UES
G 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 3-28: ENERGY STAR® Homes Program Verified Electric Savings

Measure	PY2020 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Verified Realization Rate

E ENERGY STAR Home - Manufactured, Furnace	13	43,095	43,095	50,619	117.46%
G ENERGY STAR Home - Manufactured, Natural Gas	1	0	0	0	-
G ENERGY STAR Home - Manufactured, Gas & Electric	2	6,592	6,630	86	1.30%
Total	**16**	**49,687**	**49,725**	**50,705**	**102.05%**

The ENERGY STAR® Homes Program displayed verified savings of 50,705 kWh with a realization rate of 102.05% 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 by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G ENERGY STAR Home - Manufactured, Gas & Electric*	N/A	N/A	$0.00
E ENERGY STAR Home - Manufactured, Furnace	$6,500.00	$7,052.43	$13,552.43
E ENERGY STAR Home - Manufactured, Gas & Electric	N/A	N/A	$0.00
Total	**$6,500.00**	**$7,052.43**	**$13,552.43**

*The costs associated with this measure are claimed in the Idaho 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.

3.3.5.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the ENERGY STAR® Homes Program.

3.3.5.2 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 significant or notable discrepancies in the project data and rebate documentation for the rebates in the Idaho electric service territory.

3.3.5.3 Verification Surveys

The Evaluators did not conduct verification surveys for the ENERGY STAR® Homes Program.

3.3.5.4 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.

3.3.5.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate adjusted program savings for each of the 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 102.05% with 50,705 kWh verified electric energy savings in the Idaho service territory, as displayed in Table 3-28. 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 an upward 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.

The Evaluators did not conduct a verification survey for the ENERGY STAR® Homes Program and therefore did not adjust verified savings with an ISR.

3.3.6 Simple Steps, Smart Savings Program

The Simple Steps, Smart Savings Program is a midstream lighting and appliance program which encourages consumer to purchase and install high-quality LEDs, light fixtures, energy-efficient showerheads, and energy-efficient clothes washers by marking down retail prices in the Idaho service territory.

This section summarizes the impact results of the evaluation results for the Simple Steps, Smart Savings Program. Table 3-30 summarizes the measures offered under this program.

Table 3-30: Simple Steps, Smart Savings Program Measures

Measure	Description	Impact Analysis Methodology
Lighting	General purpose and specialty bulbs and fixtures	RTF UES
Showerhead	2.0 GPM showerheads	RTF UES
Appliance	High efficiency clothes washers	RTF UES

The following table summarizes the verified electric energy savings for the Simple Steps, Smart Savings Program impact evaluation.

Table 3-31: Simple Steps, Smart Savings Program Verified Electric Savings

Measure	PY2020 Units	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
Lighting	234,446	3,144,312	988,339	2,961,197	94.18%
Showerhead	1,128	22,515	22,515	7,224	32.09%
Appliances	1	153	109	142	93.12%
Total	**235,575**	**3,166,980**	**1,010,962**	**2,968,563**	**93.73%**

The Simple Steps, Smart Savings Program displayed verified savings of 2,968,563 kWh with a realization rate of 93.73% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-32: Simple Steps, Smart Savings Program Costs by Measure

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
Lighting	$210,589.08	$262,105.78	$472,694.87
Showerhead	$3,436.00	$435.06	$3,871.06
Appliances	$25.00	$9.29	$34.29
Total	**$214,050.08**	**$262,550.14**	**$476,600.22**

The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Simple Steps, Smart Savings 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 Simple Steps, Smart Savings Program.

3.3.6.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for Simple Steps, Smart Savings Program. The Evaluators requested the monthly invoices for each month in PY2020 for the Simple Steps, Smart Savings Program from Avista.

The Evaluators collected and reviewed product-level quantity and pricing on each invoice. The Evaluators found no discrepancies between the invoiced amounts and quantities and the project data provided by Avista.

3.3.6.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Simple Steps, Smart Savings Program.

3.3.6.4 Impact Analysis

This section summarizes the verified savings results for the Simple Steps, Smart Savings 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. Final verified savings were estimated using the closest RTF UES lighting category value associated with each measure. Simple Steps, Smart Savings Program displayed 93.73% realization with 2,968,563 kWh saved, as displayed in Table 3-31.

The Evaluators note that the RTF version used to evaluate this program represents the residential lighting workbook active at the time the Bonneville Power Administration (BPA) planning for this program was established (October 1, 2019). The values present in this version of the RTF workbook do not reflect the current savings values present in the Avista TRM. Therefore, the adjusted savings displayed is significantly lower than the verified savings. This is because the savings for the lighting measures decreased as the baseline efficiencies have been updated and increased.

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 4,535,320 kWh with a realization rate of 96.12%. 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 2.08 while the UCT value is 3.01. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Residential Portfolio impact evaluation resulted in a realization rate of 96.12% due to slight differences between the Avista TRM categories and the appropriately assigned RTF UES categories for each measure as well as billing analysis results. 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 Idaho 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 Simple Steps, Smart Savings Program, which contributes 65.45% of the expected savings, resulted in a realization rate of 93.73% whereas each of the other programs resulted in a combined 101.00% realization rate. The Shell Program contributed to a 5% decrease in the overall residential sector, which displayed a realization rate of 96.12%.
- The Evaluators conducted a billing analysis to estimate observed, verified savings for the E Variable Speed Motor measure. The Evaluators found the resulting savings to be 513 kWh per year, roughly 124% of the current Avista TRM value for the measure. This savings value was applied to all rebates completed in PY2020.
- The Evaluators also conducted a billing analysis to estimate observed, verified savings for the E Electric to Natural Gas Furnace measure in the Fuel Efficiency Program. The Evaluators found the resulting savings to be 5,068 kWh per year, roughly 72.73% of the current Avista TRM value for the measure. This savings value was applied to all rebates completed in PY2020.
- In the HVAC Program, 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 retail rebates and a higher-than-expected savings for the direct install rebates for this measure.
- The Evaluators note that the RTF version used to evaluate the Simple Steps, Smart Savings Program represents the residential lighting workbook active at the time the Bonneville Power Administration (BPA) planning for this program was established (October 1, 2019). The values present in this version of the RTF workbook do not reflect the current savings values present in the Avista TRM. Therefore, the adjusted savings displayed is significantly lower than the verified savings. This is because the savings for the lighting measures decreased as the baseline efficiencies have been updated and increased.

3.4.2 Recommendations

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

- The Evaluators recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. The values found in the project documentation should accurately reflect the values represented in the CC&B database.
- A number of rebates were not accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The realization rate for the electric savings in the Water Heat Program deviate from 100% due to the methodology in which the Avista TRM prescriptive savings value was applied. 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 Tier 4, which the RTF UES assigns a higher savings value. The Evaluators

recommend splitting the Avista TRM value for Tier 2, Tier 3, and Tier 4 water heaters into separate values in order to accurately reflect expected savings for the electric water heater measure.

- 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 some of the model numbers for the rebated equipment were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.
- The Evaluators note that a number of rebate applications did not contain values associated with whether the home is existing or was a new construction home. 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 cross-referenced the billing data to verify if customers demonstrated the required heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually. In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.
- The Evaluators conducted a billing analysis for the E Variable Speed Motor measure in the HVAC Program. The estimated savings value from the billing analysis was roughly 124% of the value reflected in the Avista TRM. The Evaluators recommend updating the savings value for this measure in the Avista TRM to reflect observed savings more closely in the territory.
- For the Shell Program, the Evaluators found rebates in which the R-values did not align with TRM or RTF values (R38 and R64). The Evaluators recommend collecting information in a standardized manner.
- The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.
- The Evaluators also recommend collecting information on single-family/multi-family/manufactured in the web rebate form. This allows the Evaluators to accurately assign RTF values. The mail-in rebates collect this information; however, it does not seem to be currently required to complete the rebate. Therefore many rebates are missing this information.
- 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 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.
- The Evaluators recommend the Avista TRM reflect the savings values in effect for the Simple Steps, Smart Savings Program. The Avista TRM currently uses RTF values in effect on November 1, 2019 for the Simple Steps, Smart Savings whereas the expected savings for this program are calculated using the RTF-approved BPA workbook in effect on October 1, 2019.

4. Low-Income Impact Evaluation Results

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Idaho 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 PY2020. The following sections summarize findings for each electric impact evaluation in the Low-Income Portfolio in the Idaho 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	Total Costs
Low-Income	195,603	215,300	110.07%	$637,629.48
Total Low-Income	**195,603**	**215,300**	**110.07%**	**$637,629.48**

Table 4-2: Low-Income Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Low Income	$366,774	$605,151	0.61	$272,178	$546,723	0.50

In PY2020, Avista completed and provided incentives for low-income electric measures in Idaho and achieved total electric energy savings of 215,300 kWh. The Low-Income Program exceeded savings expectations based on reported savings. The Low-Income sector had achieved 110.07% of the savings expectations. The Evaluators estimated the TRC value for the Low-Income portfolio is 0.61 while the UCT value is 0.50. 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 Idaho 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. 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	PY2020 Participation	Expected Savings (kWh)	Adjusted Savings (kWh)	Verified Savings (kWh)	Realization Rate
E Duct Sealing	1	689	689	689	100.00%
E Ductless Heat Pump	0	0	0	0	
E Air Infiltration	18	15,345	15,345	18,018	117.42%
E Energy Star Doors	9	1,304	1,682	1,682	128.94%

E Energy Star Refrigerator	1	27	39	39	144.44%
E Energy Star Windows	12	1,372	1,371	1,661	121.12%
E HE Air Heat Pump	1	1,493	2,054	2,054	137.54%
E INS - Attic	5	3,507	3,497	1,825	52.05%
E INS - Duct	2	653	619	653	100.00%
E INS - Floor	9	7,298	8,794	9,563	131.04%
E to G Furnace and Water Heater	4	19,660	36,300	36,300	184.64%
E To G Furnace Conversion	13	63,862	59,432	45,448	71.17%
E To G H20 Conversion	5	13,004	9,516	7,930	60.98%
E To Heat Pump Conversion	15	62,338	87,980	87,980	141.13%
Health And Safety	24	0	0	0	-
LED Bulbs	27	1,339	1,337	1,458	108.89%
Total	**146**	**195,603**	**228,654**	**215,300**	**110.07%**

The Low-Income Program displayed verified savings of 215,300 kWh with a realization rate of 110.07% 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 Duct Sealing	$517.80	$832.81	$1,350.61
E Ductless Heat Pump	N/A	N/A	$0.00
E Air Infiltration	$21,705.21	$16,350.71	$38,055.92
E Energy Star Doors	$11,435.67	$3,801.49	$15,237.16
E Energy Star Refrigerator	$749.00	$32.94	$781.94
E Energy Star Windows	$3,919.34	$4,250.72	$8,170.06
E HE Air Heat Pump	$1,885.18	$1,826.43	$3,711.61
E INS - Attic	$4,289.63	$4,670.17	$8,959.80
E INS - Duct	$1,110.19	$1,669.51	$2,779.70
E INS - Floor	$12,489.19	$24,468.92	$36,958.11
E to G Furnace and Water Heater	$38,426.38	$43,876.60	$82,302.98
E To G Furnace Conversion	$76,367.48	$54,933.99	$131,301.47
E To G H20 Conversion	$10,442.31	$5,773.23	$16,215.54
E To Heat Pump Conversion	$152,547.26	$78,251.43	$230,798.69
Health And Safety	$59,415.41	$0.00	$59,415.41
LED Bulbs	$550.78	$1,039.72	$1,590.50
Total	**$395,850.83**	**$241,778.65**	**$637,629.48**

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.

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 CC&B and the rebate project documentation provided in the data request for document verification. The Evaluators, updated quantity based on project documentation.

The Evaluators note that some project data account numbers do not match the account numbers referenced in the project documentation. In addition, the Evaluators found conflicting information in the project documentation on a number of homes' heating type. The Evaluators recommend confirming and documenting all rebate applications for completed and accurate heating type details.

The Evaluators also note that project documentation contains additional equipment included in some invoices. These additional equipment contribute to the total project cost. The Evaluators identified and removed three duplicated rebates. These rebates seem to have been duplicated due to rebate administration corrections.

The Evaluators also utilized the delivered billing data to check the household-level annual usage. The Low-Income Program requires a 20% annual energy usage cap on claimed energy savings. The Evaluators found some discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

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. Table 4-6 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 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, as displayed in Table 4-6 and therefore the Evaluators were unable to estimate measure-level savings through billing analysis.

Table 4-6: Measures Considered for Billing Analysis, Low-Income Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis*
Electric to air source heat pump	✓	24	
Electric to ductless heat pump	✓	9	
Air source heat pump	✓	1	
ENERGY STAR® door	✓	0	
ENERGY STAR® refrigerator	✓	8	
ENERGY STAR® window	✓	0	
Air Infiltration	✓	0	
Duct sealing	✓	0	
Attic Insulation	✓	2	
Duct insulation	✓	0	
Wall insulation	✓	0	
Floor insulation	✓	4	
LED lighting	✓	20	

*No measures had sufficient participation of isolated measures

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 4-7 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 excellent fit for the data (adjusted R-squared > 0.90).

Table 4-7: 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	77	364	1,693	1145	2624	0.73	Model 2: PPR

The Evaluators applied these regression savings estimates to the program as a whole, by the number of unique households in the program and found a realization rate of 129.86% 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 110.07% with 215,300 kWh verified electric energy savings in the Idaho service territory, as displayed in Table 4-4. The billing analysis supports this estimate, with the billing analysis estimating a 129.86% realization. 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.

4.2 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 electric programs:

- The Evaluators found the Residential portfolio to demonstrate a total of 215,300 kWh with a realization rate of 110.07%. 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 0.61 while the UCT value is 0.50. 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 110.07% realization rate. The realization rates for each program deviate from 100% due to differences between the Avista TRM values and the appropriately assigned RTF UES values. 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 130% for all electric measures in the program, which supported the realization rate of 115% from the desk review.
- Some rebates included in the Low-Income Program indicate that savings had been capped at 20% of consumption. The provided project data do not include adequate information to determine

when savings values are being appropriately capped. The Evaluators recommend that annual consumption be provided for each measure in the tracking data, if practical, so that evaluation can include verifying that savings are being capped at 20% consumption for application measures.

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 CC&B and the rebate project documentation provided in the data request for document verification. In addition, the unit type, in terms of square footage or number of measures (windows, doors, etc) was not documented consistently and therefore savings values were applied inaccurately. The Evaluators recommend updating CC&B documentation standards to more accurately reflect values present on the rebate applications.
- The Evaluators found discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

5. Appendix A: Billing Analysis Results

This appendix provides additional details on the billing analyses conducted for each program.

5.1 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. 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 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 PY2019 and PY2020 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2020 participants.

Table 5-1: 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
E Electric To Air Source Heat Pump		N/A	N/A
E Electric to Ductless Heat Pump		N/A	N/A
E Smart Thermostat DIY with Electric Heat		N/A	N/A
E Smart Thermostat Paid Install with Electric Heat		N/A	N/A
E Variable Speed Motor	✓	206	✓

The Evaluators were provided a considerable pool of control customers to draw upon, 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 5-2, 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, HVAC Program

Measure	Data Restriction	Treatment Customers	Control Customers

E Variable Speed Motor	Starting Count	206	132,725
	Install Date Range: 2019-01-01 to 2020-06-30	206	132,725
	Control Group Usage Outlier (>2X max treatment usage)	206	132,675
	Incomplete Post-Period Bills (<24 months)	147	78,645
	Incomplete Pre-Period Bills	126	72,062
	Ending Count (Matched by PSM)	126	630

Figure 5-1 and Figure 5-2 display the density of each variable employed in propensity score matching for the E Variable Speed Motor measure, 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 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, Electric Variable Speed Motor

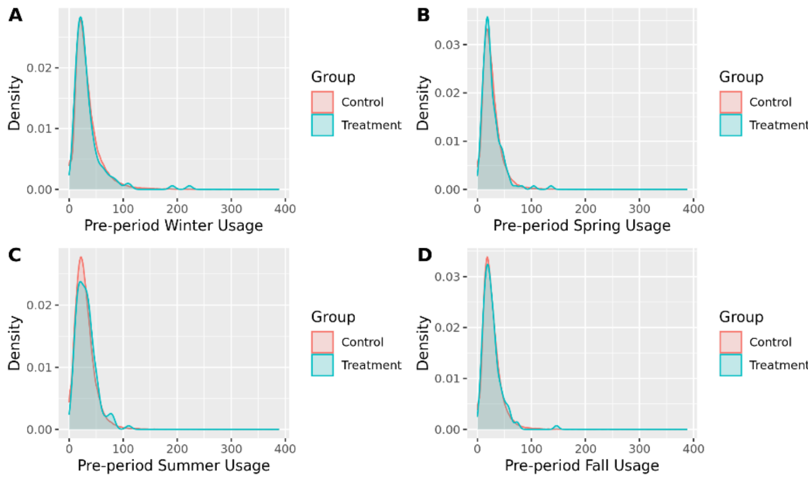
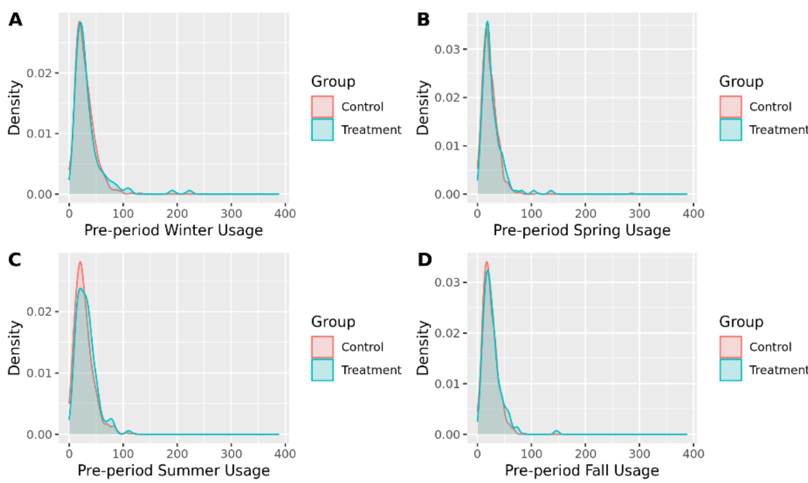


Figure 5-2: Covariate Balance After Matching, Electric Variable Speed Motor



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 the measure. *T*-tests of monthly pre period usage can yield a statistically significant difference 40% of the time for one to two months out of 12. Thus, the Evaluators set a tolerance band allowing two months out of 12 to vary in pre-period usage at the 95% confidence level. All groups passed this threshold. 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, typically falling under 10, further indicating the groups were well matched on all included covariates.

Table 5-3 provides results for the *t*-test on pre-period usage between the treatment and control groups after matching for the HVAC program. The Evaluators placed a threshold of two rejects for each measure as there is a 40% likelihood that one or two months may show statistical variance due to chance. The variable speed motor measure did not exceed this threshold.

Table 5-3: Pre-period Usage T-test for Electric Variable Speed Motor, HVAC Program

Month	Average Daily Usage (kWh), Control	Average Daily Usage (kWh), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	29.52	35.01	-1.57	3.49	0.118	No
Feb	28.54	32.01	-1.27	2.74	0.206	No
Mar	25.57	29.30	-1.65	2.25	0.101	No
Apr	22.68	25.32	-1.51	1.75	0.133	No
May	22.25	24.29	-1.30	1.57	0.195	No
Jun	24.46	26.32	-1.06	1.76	0.289	No
Jul	30.72	35.06	-2.04	2.13	0.043	Yes
Aug	28.76	32.84	-2.19	1.86	0.030	Yes
Sep	23.53	24.68	-0.57	2.01	0.566	No
Oct	22.95	25.43	-1.35	1.84	0.177	No
Nov	27.34	30.29	-1.28	2.30	0.201	No
Dec	30.83	34.59	-1.32	2.84	0.187	No

Table 5-4 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 5-4: TMY Weather, HVAC Program

Measure	USAF Station ID	Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
E Variable Speed Motor	720322	1	727834	6,915	376	6,527	475
E Variable Speed Motor	726817	1	727834	6,915	376	6,527	475
E Variable Speed Motor	727827	1	727827	5,428	731	6,527	475
E Variable Speed Motor	727830	5	727830	5,511	907	6,527	475
E Variable Speed Motor	727834	43	727834	6,915	376	6,527	475
E Variable Speed Motor	727850	3	727850	6,707	379	6,527	475
E Variable Speed Motor	727855	5	727855	7,360	439	6,527	475
E Variable Speed Motor	727856	57	727856	6,246	519	6,527	475

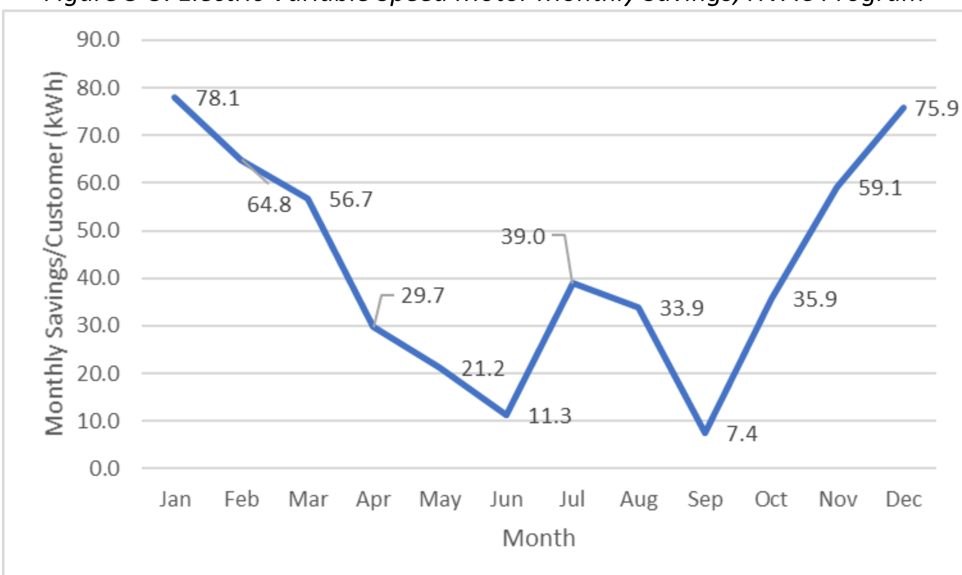
Table 3-17 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the HVAC Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for E Variable Speed Motor The adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-5: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual kWh Savings per Customer	90% Lower CI	90% Upper CI	Relative Precision (90% CI)	Adjusted R-Squared	Model
E Variable Speed Motor	126	630	513	126	900	75.4%	0.88	Model 2: PPR

Figure 5-3 provides the monthly verified savings per customer for the variable speed motor measure.

Figure 5-3: Electric Variable Speed Motor Monthly Savings, HVAC Program



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 5-6 provides annual savings/customer for the HVAC program for each measure 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. However, the Evaluators were unable to estimate a statistically significant value.

Table 5-6: Measure Savings for All Regression Models, HVAC Program

Measure	Model	Treatment Customers	Control Customers	Annual Savings per Customer (kWh)	90% Lower CI	90% Upper CI	Relative Precision (90% CI)	Adjusted R-Squared
E Variable Speed Motor	Diff-in-diff	126	630	687*	-821	2,195	220%	0.02
E Variable Speed Motor	PPR	126	630	513	126	900	75%	0.88
E Variable Speed Motor	Treatment Only (Gross)	126	N/A	256*	-316	829	223%	0.76

*Not statistically significant

5.2 Fuel Efficiency Program

The results of the billing analysis for the Fuel Conversion program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2. 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 Fuel Efficiency 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 PY2020 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2020 participants.

Table 5-7: Measures Considered for Billing Analysis, Fuel Efficiency Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
E Electric To Natural Gas Furnace	✓	186	✓
E Electric To Natural Gas Furnace & Water Heat	✓	33	

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 5-8. 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, Fuel Efficiency Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
E Electric To Natural Gas Furnace	Starting Count	186	132,725
E Electric To Natural Gas Furnace	Install Date Range: January 1, 2019 to June 30, 2020	162	132,725
E Electric To Natural Gas Furnace	Control Group Usage Comparable to Treatment Group	158	132,654
E Electric To Natural Gas Furnace	Incomplete Post-Period Bills (<4 months)	132	89,361
E Electric To Natural Gas Furnace	Incomplete Pre-Period Bills (<10 months)	85	69,413
E Electric To Natural Gas Furnace	Restrict to Controls w/ Probable Electric Resistance[9]	85	10,412
E Electric To Natural Gas Furnace	Ending Count (Matched by PSM)	85	421

Figure 5-4 and Figure 5-5 display the density of each variable employed in propensity score matching for the E Electric to Natural Gas Furnace measure, before and after conducting matching.

The distributions prior to matching appear to be less similar, with control customers averaging lower usage. However, after matching, the pre-period usage distribution is more similar between the groups. The pre-period usage in the winter before and after matching averages a more spread distribution for the treatment group, however, the average usage between groups appears the same after matching (verified with *t*-test on pre-usage).

[9] The Evaluators restricted to controls with pre-period winter usage higher than the 85th percentile (i.e. top 15%) as these customers are more likely to have electric resistance heating.

Figure 5-4: Covariate Balance Before Matching, E Electric to Natural Gas Furnace

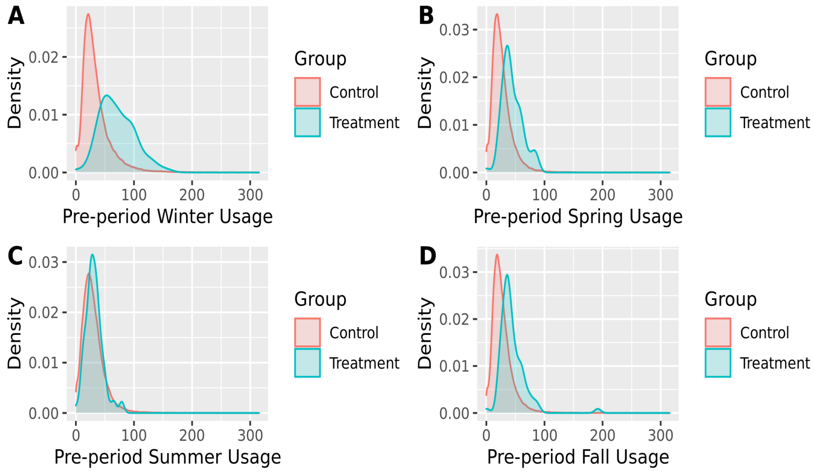
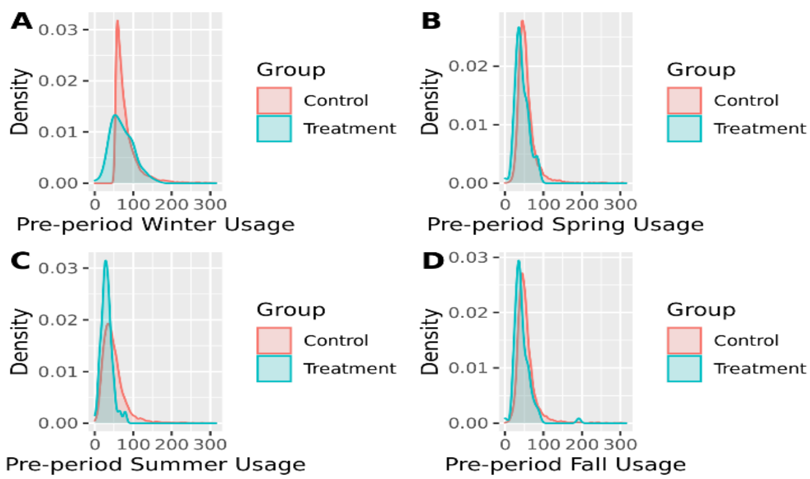


Figure 5-5: Covariate Balance After Matching, E Electric to Natural Gas Furnace



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 the 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.

Table 5-9 provides the results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Fuel Efficiency 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 5-9: Pre-period Usage T-test for Electric to Gas Furnace, Fuel Conversion Program

Month	Average Daily Usage (kWh), Control	Average Daily Usage (kWh), Treatment	T Stat	Std Error	P-Value	Reject Null?
Jan	72.502	69.978	0.699	3.613	0.486	No
Feb	69.808	67.655	0.611	3.522	0.542	No
Mar	59.063	60.098	-0.344	3.006	0.731	No
Apr	43.331	43.494	-0.077	2.133	0.939	No
May	30.497	29.155	0.915	1.466	0.362	No
Jun	29.164	27.861	0.802	1.624	0.423	No
Jul	34.092	33.291	0.364	2.198	0.716	No
Aug	33.202	32.844	0.175	2.050	0.862	No
Sep	30.944	30.174	0.435	1.766	0.664	No
Oct	41.417	41.816	-0.156	2.567	0.877	No
Nov	59.142	60.794	-0.389	4.246	0.698	No
Dec	69.305	69.601	-0.072	4.086	0.942	No

Table 5-10 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 5-10: TMY Weather, Fuel Efficiency Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
E Electric to Natural Gas Furnace	720322	3	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	726817	3	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	727827	4	727827	5,428	731	6,333	517
E Electric to Natural Gas Furnace	727830	7	727830	5,511	907	6,333	517
E Electric to Natural Gas Furnace	727834	13	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	727855	2	727855	7,360	439	6,333	517
E Electric to Natural Gas Furnace	727856	47	727856	6,246	519	6,333	517
E Electric to Natural Gas Furnace	727857	4	727857	6,467	299	6,333	517
E Electric to Natural Gas Furnace	727870	2	727856	6,246	519	6,333	517

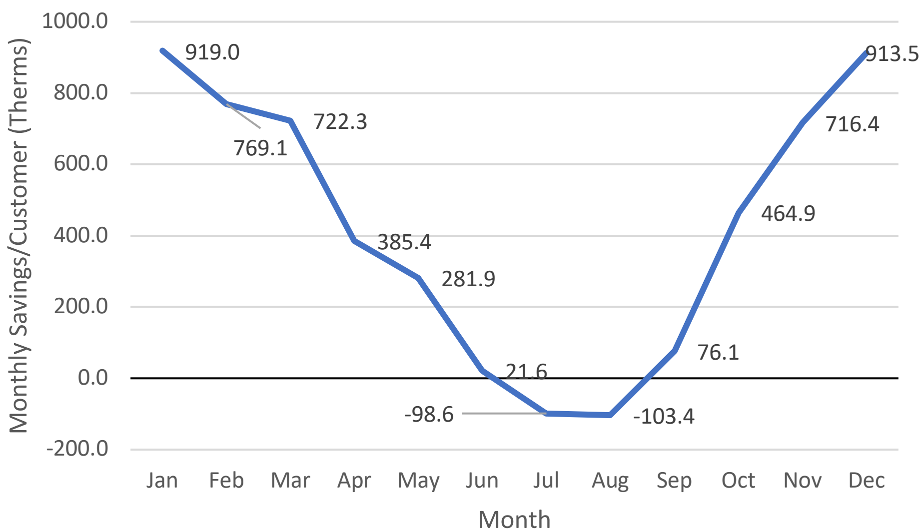
Table 5-11 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Fuel Efficiency Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-11: Measure Savings, Fuel Efficiency Program

Measure	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (kWh)	90% Lower CI	90% Upper CI	90% Relative Precision	Adjusted R-Squared	Model
E Electric to Natural Gas Furnace	85	421	5,068	4,384	5,7512	0.13	0.73	Model 2: PPR

Figure 5-6 provides monthly TMY savings per customer for the Fuel Conversion program. As expected, the greatest savings occur during the winter months.

Figure 5-6: E Electric to Gas Furnace Monthly Savings, Fuel Conversion Program



The Evaluators found the E Electric To Natural Gas Furnace measure to display 5,068 kWh savings per year. This estimate was statistically significant at the 90% confidence interval with precision of 13%. The Evaluators estimate the Therms penalty for this measure with the following equation:

Equation 5-1: Furnace Conversion Heating Load

$$Heating\ Load = \frac{Annual\ kWh\ Savings * COP_{Electric} * \frac{3{,}412\ kWh}{BTU}}{\frac{100{,}000\ Therms}{BTU}}$$

Equation 5-2 Furnace Conversion Therms Penalty

$$Therms\ Penalty = \frac{Heating\ Load}{0.80\ Base\ AFUE}$$

Where,

- $Heating\ Load$ = The number of full load hours required for heating the home per year
- $Annual\ kWh\ Savings$ = measure saving result from linear regression (5,068 kWh/year)
- $COP_{Electric}$ = Coefficient of performance (equal to 1, assuming electric resistance baseline)

The Therms penalty for the E Electric to Natural Gas Furnace measure is 216.15 Therms. This penalty is applied in the Idaho Gas Impact Evaluation Report.

Due to the insufficient isolated measure participation for the E Electric To Natural Gas Furnace & Water Heater measure, the Evaluators assigned savings for this measure using the Avista TRM value of 9,789 kWh and -565 Therms savings per year.

Evaluators also conducted a treatment-only regression model for each of the measures described above. This analysis was completed at the request of Avista in order to help with program planning. Table 5-12 provides annual savings/customer for the Fuel Conversion 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). The treatment-only model represents estimated gross savings for this measure at 5,430 Therms saved per year.

Table 5-12: Measure Savings for All Regression Models, Fuel Efficiency Program

Measure	Model	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (kWh)	90% Lower CI	90% Upper CI	90% Relative Precision	Adjusted R-Squared
Electric to Natural Gas Furnace	Diff-in-diff	85	421	5,267.69	3,572.27	6,963.10	0.32	0.26
Electric to Natural Gas Furnace	PPR	85	421	5,068.03	4,384.25	5,751.80	0.13	0.73
Electric to Natural Gas Furnace	Treatment Only (Gross)	85	N/A	5,430.42	4,625.74	6,235.10	0.15	0.70

5.3 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 5-13. 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 5-13, 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 5-13: Cohort Restrictions, Low-Income Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
Whole home electric	Starting Count	147	2,632
	Install Date Range: January 1, 2019 to June 30, 2020	90	2,632
	Control Group Usage Outlier (>2X max treatment usage)	90	2,630
	Incomplete Post-Period Bills (<4 months)	83	2,172
	Incomplete Pre-Period Bills (<10 months)	77	1,932
	Ending Count (Matched by PSM)	77	364

Figure 5-7 and Figure 5-8 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 5-7: Covariate Balance Before Matching, Low-Income Electric Measures

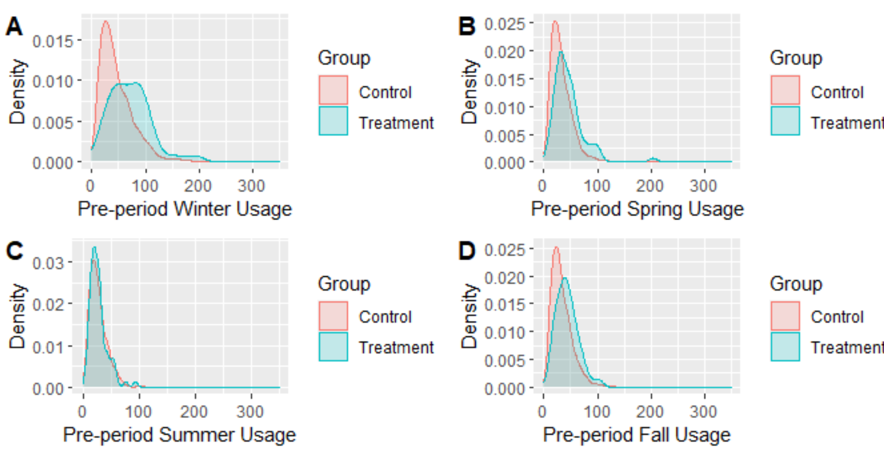
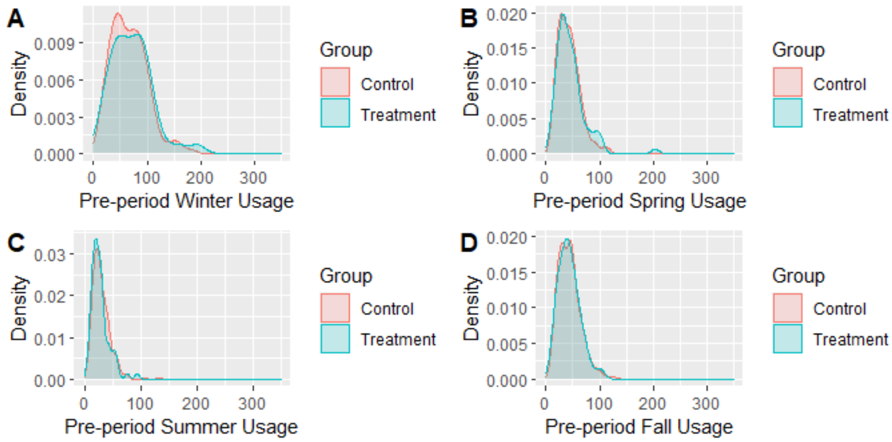


Figure 5-8: Covariate Balance After Matching, Low-Income Electric Measures



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 5-14 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 5-14: 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	69.94	70.41	-0.130	3.608	0.897	No
Feb	53.51	56.83	-1.235	2.687	0.217	No
Mar	63.85	66.38	-0.778	3.255	0.437	No
Apr	40.20	43.70	-1.692	2.068	0.091	No
May	35.14	37.91	-1.529	1.814	0.127	No
Jun	22.69	24.73	-1.337	1.523	0.182	No
Jul	22.56	24.08	-0.990	1.528	0.322	No
Aug	28.73	28.07	0.228	2.869	0.819	No

Sep	22.87	25.08	-1.383	1.597	0.167	No
Oct	24.97	28.61	-2.192	1.661	0.029	No
Nov	52.77	57.49	-1.637	2.884	0.102	No
Dec	60.34	64.69	-1.355	3.206	0.176	No

Table 5-15 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 5-15: 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	9	727827	5,428	731	6,171	550
All Electric Measures	727830	18	727830	5,510	906	6,171	550
All Electric Measures	727834	4	727834	6,915	376	6,171	550
All Electric Measures	727850	3	727850	6,246	519	6,171	550
All Electric Measures	727855	3	727855	7,360	439	6,171	550
All Electric Measures	727856	94	727856	6,246	519	6,171	550
All Electric Measures	727857	16	727857	6,467	299	6,171	550

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 5-16 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 1,404 kWh per year.

Table 5-16: 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	77	364	2,097*	0	4,340	0.34
All Electric Measures	PPR	77	364	1,693	1,146	2,624	0.73
All Electric Measures	Treatment Only (Gross)	555	64	1,404	0	4,049	0.69

*Not statistically significant

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	161	61%
Two Measures	69	26%
Three Measures	32	12%
HVAC	140	53%
Water Heater	138	53%
Smart Thermostat	113	43%
Variable Speed Motors	4	2%

The Evaluators asked respondents to provide information regarding their home, as displayed in Table 6-2. Most 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[10]

Question	Response	Percent (n=258)
Do you rent or your home?	Own	97%
	Rent	3%
Which of the following best describe your home?	Single-family house detached from any other house	89%
	Single-family house attached to one or more other houses (e.g., duplex, condominium, townhouse)	4%
	Mobile or manufactured home	6%
	Apartment with 2 or 3 units	1%
	Garage/outbuilding	1%
	Don't Know	1%
Does your home have central air conditioning, window air conditioning, or neither?	Window air conditioning / a room AC unit	12%
	Central air conditioning	73%
	Neither	14%
	Don't Know	1%
About how many square feet is your home?	Less than 1,000 square feet	6%
	1,000-1,999 square feet	38%
	2,000-2,999 square feet	35%
	3,000-3,999 square feet	14%
	4,000 or more square feet	6%
	Don't know	1%
When was your home built?	Before 1960	21%
	1960 to 1969	5%
	1970 to 1979	17%
	1980 to 1989	12%
	1990 to 1999	12%
	2000 to 2009	16%
	2010 to 2018	15%
	Don't know	1%

[10] 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 PY2020 portfolio.

Table 7-1: Cost-effectiveness Results

Program	TRC	UCT	RIM	PCT	TRC Net Benefits
Residential	2.08	3.01	0.47	3.96	$2,897,811
Low Income	0.61	0.50	0.27	N/A*	($238,377)
Total	**1.81**	**2.39**	**0.45**	**N/A***	**$2,659,434**
***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)[11], 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

[11] The UCT is also referred to as the Program Administrator Cost Test (PACT).

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.

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.[12]

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.[13]

[12] http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf
[13] Ibid.

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
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	2.08	3.01	0.47	3.96
Low Income	0.61	0.50	0.27	N/A*
Total	**1.81**	**2.39**	**0.45**	**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	$5,579,452	$5,072,229	$5,072,229	$6,330,037
Low Income	$366,774	$272,178	$272,178	$687,611
Total	**$5,946,226**	**$5,344,407**	**$5,344,407**	**$7,017,649**

Table 7-6: Cost-Effectiveness Costs by Sector

Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs
Residential	$2,681,641	$1,687,155	$10,805,160	$1,597,316
Low Income	$605,151	$546,723	$1,018,619	$454,279
Total	**$3,286,792**	**$2,233,878**	**$11,823,780**	**$2,051,595**

Table 7-7: Cost-Effectiveness Net Benefits by Sector

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits
Residential	$2,897,811	$3,385,074	($5,732,931)	$4,732,722
Low Income	($238,377)	($274,545)	($746,441)	$233,332
Total	**$2,659,434**	**$3,110,529**	**($6,479,373)**	**$4,966,054**

APPENDIX D – 2020 IDAHO NATURAL GAS EVALUATION REPORT – RESIDENTIAL AND LOW-INCOME

Evaluation, Measurement and Verification (EM&V) of Avista Idaho Gas PY2020 Residential and Low-Income Energy Efficiency Programs

Prepared for:

Avista Corporation

Delivered on:

June 7, 2021

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List of Tables

1. Executive Summary

This report is a summary of the Residential and Low-Income Gas Evaluation, Measurement, and Verification (EM&V) effort of the 2020 program year (PY2020) portfolio of programs for Avista Corporation (Avista) in the Idaho 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 PY2020. The Residential portfolio savings amounted to 317,549.63 Therms with a 120.66% realization rate. The Low-Income portfolio savings amounted to 5,494.69 Therms with a 109.69% realization rate. The Evaluators summarize the Residential portfolio verified savings in Table 1-1and the Low-Income portfolio verified savings in Table 1-2 below.

The Residential portfolio reflects a TRC value of 1.11 and a UCT value of 2.46. The Low-Income portfolio reflects a TRC value of 0.27 and a UCT value of 0.10, leading to a total Residential and Low-Income TRC of 0.89 and a UCT of 1.66. 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	38,131.80	37,975.80	99.59%	$200,782.21
HVAC	204,211.46	266,938.58	130.72%	$1,063,438.94
Shell	20,121.75	11,999.75	59.64%	$160,163.25
Fuel Efficiency[1]	0.00	0.00	-	
ENERGY STAR Homes	402.00	401.94	99.99%	$2,018.87
Simple Steps, Smart Savings[2]	299.69	233.56	77.93%	$0.03
Total Res	**263,166.70**	**317,549.63**	**120.66%**	**$1,426,403.31**

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

Program	Expected Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate	Total Costs
Low-Income[3]	5,009.32	5,494.69	109.69%	$662,513.76
Total Low-Income	**5,009.32**	**5,494.69**	**109.69%**	**$662,513.76**

[1] The Fuel Efficiency Program displayed a verified Therms penalty of 32,378.27 Therms due to fuel conversion measures. For the purposes of this report, this penalty is not included in the overall metrics of natural gas-saving energy efficiency measures.

[2] The Simple Steps, Smart Savings Program displayed a verified Therms penalty of 22,604.26 Therms due to lighting measures.

[3] The Low-Income Program displayed a verified Therms penalty of 3,759.50 Therms due to fuel conversion measures.

Table 1-3: Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$3,852,633	$3,466,442	1.11	$3,502,394	$1,426,403	2.46
Low Income	$168,428	$638,498	0.26	$68,285	$662,514	0.10
Total	**$4,021,822**	**$4,105,041**	**0.98**	**$3,570,679**	**$2,089,019**	**1.71**

Table 1-4 summarizes the gas programs offered to residential and low-income customers in the Idaho Avista service territory in PY2020 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/Billing analysis with comparison group
Residential	Fuel Efficiency	✓	✓	Avista TRM/Billing analysis with comparison group
Residential	ENERGY STAR® Homes	✓		Avista TRM
Residential	Simple Steps, Smart Savings	✓		RTF UES
Low-Income	Low-Income	✓		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 317,549.63 Therms with a realization rate of 120.66%. 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 1.11 while the UCT value is 2.46. Further details on cost-effectiveness methodology can be found in Appendix C.
- The Residential Portfolio impact evaluation resulted in a realization rate of 120.66% due to slight differences between the applied Avista TRM values and the most active Avista TRM value 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 78% of the expected savings, resulted in a realization rate of 130.72% whereas each of the other programs resulted in a combined 74% realization rate. The Shell Program contributed to a 35% increase in the overall residential sector, which displayed a realization rate of 120.66%.
- The Evaluators conducted verification surveys via web survey and phone calls to collect information from customers who participated in the Water Heat and HVAC Programs. A total of 261 unique customers were surveyed between February and March 2021. 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 99.59%. This program deviated from 100% realization because two rebates were duplicates. Therefore, the Evaluators removed these rebates from savings, lowering the realization rate for the program.
- 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 lacked sufficient participation to estimate savings and the G Tankless Gas Water Heater measure 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.
- The HVAC Program in total displays a realization rate of 130.72% with 266,938.58 Therms verified natural gas savings in the Idaho service territory. The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to the differences between the applied Avista TRM prescriptive savings value and the updated Avista TRM or updated RTF UES value. The smart thermostat measures' realization rates are low because an outdated Avista TRM value was applied to the project data to calculate expected savings. The furnace measure has a high realization rate because the billing analysis resulted in a savings value that was 137% of the value previously used in the Avista TRM.
- 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 PY2020 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 2021.
- The Shell Program displayed verified savings of 11,999.75 Therms with a realization rate of 59.64% 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 differences between the billing analysis results and the Avista TRM prescriptive savings values as well as outdated Avista TRM values being applied in the expected savings calculations.

- For the Shell Program, the Evaluators conducted a billing analysis for two measures that had sufficient participation. The Evaluators found the G Attic Insulation With Natural Gas Heat measure to display a statistically significant verified savings value of 55.56 Therms per year. In addition, the Evaluators found statistically significant savings of 36.78 Therms per year for the G Window Replacement with Natural Gas Heat measure. The Evaluators used these savings estimates towards calculating verified savings for the program.
- Final verified savings for the Simple Steps, Smart Savings Program were estimated using the RTF UES values associated with each measure. Simple Steps, Smart Savings Program displayed 77.93% realization with 233.56 Therms saved. The discrepancy between expected and verified Therms for the measures in this program are due to the differences between the BPA values assigned and the appropriately applied RTF values the Evaluators assigned.

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 5,494.69 Therms with a realization rate of 109.69%. The Low-Income Portfolio impact evaluation resulted in 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 0.26 while the UCT value is 0.10. 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. The Evaluators found a realization rate of 139% for all natural gas measures in the program, which supported the realization rate of 110% from the desk review.
- 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.

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 recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. The values found in the project documentation should accurately reflect the values represented in the CC&B database.
- A number of rebates were not accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The Evaluators note that some of the model numbers for the rebated equipment were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.
- The Evaluators cross-referenced the billing data to verify if customers demonstrated the required heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually. In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.
- For the Shell Program, the Evaluators found rebates in which the R-values did not align with TRM or RTF values (R38 and R64). The Evaluators recommend collecting information in a standardized manner.
- The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.
- 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 natural gas furnace measure in the HVAC has a high realization rate because the billing analysis resulted in a savings value that was 137.45% of the value previously used in the Avista TRM. The Evaluators recommend adjusting the Avista TRM to reflect the observed savings values from all billing analyses from this impact evaluation.
- The Evaluators recommend adjusting expected savings calculations in the Simple Steps, Smart Savings Program to include Therms penalty for the measures offered, in order to more accurately reflect the approved RTF savings values.

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 is due to the change in square footage or number of units verified in the project documentation. 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 CC&B and the rebate project documentation provided in the data request for document verification. In addition, the unit type, in terms of square footage or number of measures (windows, doors, etc) was not documented consistently and therefore savings values were applied inaccurately. The Evaluators recommend updating CC&B documentation standards to more accurately reflect values present on the rebate applications.

- The Evaluators found discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

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)[4] and the Uniform Methods Project (UMP)[5]:

- Simple verification (web-based surveys supplemented with phone 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 Idaho 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)[6]
- 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[7]
- International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization (EVO) with sponsorship by the U.S. Department of Energy (DOE)[8]

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:

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[4] https://www.nrel.gov/docs/fy02osti/31505.pdf

[5] https://www.nrel.gov/docs/fy18osti/70472.pdf

[6] https://rtf.nwcouncil.org/measures

[7] 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.

[8] Core Concepts: International Measurement and Verification Protocol. EVO 100000 – 1:2016, October 2016.

- **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 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 2020 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[9], 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.

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
- Fuel Efficiency Program
- ENERGY STAR® Homes Program
- Simple Steps, Smart Savings Program
- Low-Income 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.

[9] 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

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	957	65	±9.85%
Residential	HVAC	7,401	69	±9.86%
Residential	Shell	1,337	68	±9.72%
Residential	Fuel Efficiency	N/A	N/A	N/A
Residential	ENERGY STAR® Homes	6	6	±0.00%
Residential	Simple Steps, Smart Savings	N/A	N/A	N/A
Low-Income	Low-Income	550	66	±9.50%

*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 Idaho Gas Avista projects. The Evaluators developed a sampling plan that achieved a sampling precision of ±4.24% 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	957	115	±7.20%
Residential	HVAC	7,401	246	±5.16%
Residential	Fuel Efficiency	N/A	N/A	N/A
Total		**8,358**	**361**	**±4.24%**

The Evaluators implemented a web-based survey to complete the verification surveys. The Evaluators supplemented with phone interviews 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 2020 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 2020 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)[10]
- 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, 2018 and December 31, 2020)

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

5. Typical Meteorological Year (TMY3) data

Billing and weather data were obtained for program years 2019 and 2020 and for one year prior to measure install dates (2018).

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 (0.1% of bills).
5. Removed bills missing fuel type/Unit of Measure (UOM) (0.1% of bills).
6. Removed bills missing usage, billing start date, or billing end date (0.17% of bills).
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, 2019 through June 30, 2020) 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

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

Where,

- i = the ith 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

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

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

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

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 PY2020 and perhaps also PY2021 are affected by the stay-at-home orders that had taken effect starting March 2020 in Idaho. 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 PY2020. The following sections summarize findings for each natural gas impact evaluation in the Residential Portfolio in the Idaho 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	Total Costs
Water Heat	38,131.80	37,975.80	99.59%	$200,782.21
HVAC	204,211.46	266,938.58	130.72%	$1,063,438.94
Shell	20,121.75	11,999.75	59.64%	$160,163.25
Fuel Efficiency	0.00	0.00	-	-
ENERGY STAR Homes	402.00	401.94	99.99%	$2,018.87
Simple Steps, Smart Savings	299.69	233.56	77.93%	$0.03
Total Res	**263,166.70**	**317,549.63**	**120.66%**	**$1,426,403.31**

Table 3-2: Residential Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Residential	$3,852,633	$3,466,442	1.11	$3,502,394	$1,426,403	2.46

In PY2020, Avista completed and provided incentives for residential natural gas measures in Idaho and reported total natural gas savings of 317,549.63 Therms. All programs except the Water Heat Program and the Shell Program met savings goals based on reported savings, leading to an overall achievement of 120.66% of the expected savings for the residential programs. The Evaluators estimated the TRC value for the Low-Income portfolio is 1.11 while the UCT value is 2.46. Further details of the impact evaluation results by program are provided in the sections following.

3.1 Simple Verification Results

The Evaluators surveyed 261 unique customers that participated in Avista's residential energy efficiency program in February and March 2021 using a mixed mode approach (phone/email). Customers with a valid email were sent the survey via an email invitation. Fifty-three did not have email addresses in program records and were invited to take the survey by the Evaluators' in-house survey administration team. 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 Fuel Efficiency Programs.

Table 3-3: Summary of Survey Response Rate

Population	Respondents
Initial email contact list	959
Invalid email addresses	3
Bounced email	43
Undeliverable email	27
Invalid email (%)	*8%*
Email invitations sent (unique valid)	886
Email completions	208
Email response rate (%)	23%
Initial phone list	190
Phone numbers w/ email addresses	138
Phone numbers w/ no email address	52
Disconnected/wrong number	20
Invalid phone (%)	*11%*
Phone calls (unique valid)	170
Phone completions	54
Phone response rate (%)	32%
Total invites (unique)	938
Total completions	262
Response rate (%)	28%
Initial email contact list	959
Invalid email addresses	3

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 and HVAC Programs. The Fuel Efficiency program was surveyed for the electric measures; the sample is provided in the Idaho Electric Impact Evaluation report and does not contribute to the precision for the Idaho Gas impacts. 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 ±4.24% 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	957	115	±7.20%
Residential	HVAC	7,401	246	±5.16%
Residential	Fuel Efficiency	N/A	N/A	N/A
Total		**8,358**	**361**	**±4.24%**

The measure-level ISRs determined from the verification survey for each program in which simple verification was conducted is presented in Table 3-5 and Table 3-6.

Table 3-5: Water Heat Program ISRs by Measure

Measure	Respondents	ISR
G 50 Gallon Natural Gas Water Heater	11	100%
G Tankless Water Heater	102	100%

Table 3-6: HVAC Program ISRs by Measure

Measure	Respondents	ISR
G Natural Gas Boiler	4	100.00%
G Natural Gas Furnace	92	98.86%
G Natural Gas Wall Heater	2	100.00%
G Smart Thermostat DIY with Natural Gas Heat	20	100.00%
G Smart Thermostat Paid Install with Natural Gas Heat	52	94.12%

These ISR values were utilized in the desk reviews for the Water Heat and HVAC 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 60% of respondents said that two or fewer lived at the residence that had the rebated equipment installed.

About two-thirds of respondents (66%) observed that the pandemic had not changed the number of people in their household that worked or went to school remotely.[11] Twenty-two percent of respondents said that more members of their household were attending school remotely or working from home since the COVID-19 pandemic began. Twelve percent of respondents indicated that more members of their household had gone to work or school remotely before the COVID-19 pandemic.

Three-quarters of respondents said that the amount of time they spend at home has increased since the COVID-19 pandemic began. A much smaller portion of respondents indicated that other members of their household were spending more time at home, as displayed in Figure 3-1. About half of respondents indicated that their utility bill had increased, as displayed in Figure 3-2.

[11] n=257

Figure 3-1: Change in amount of time spent at home

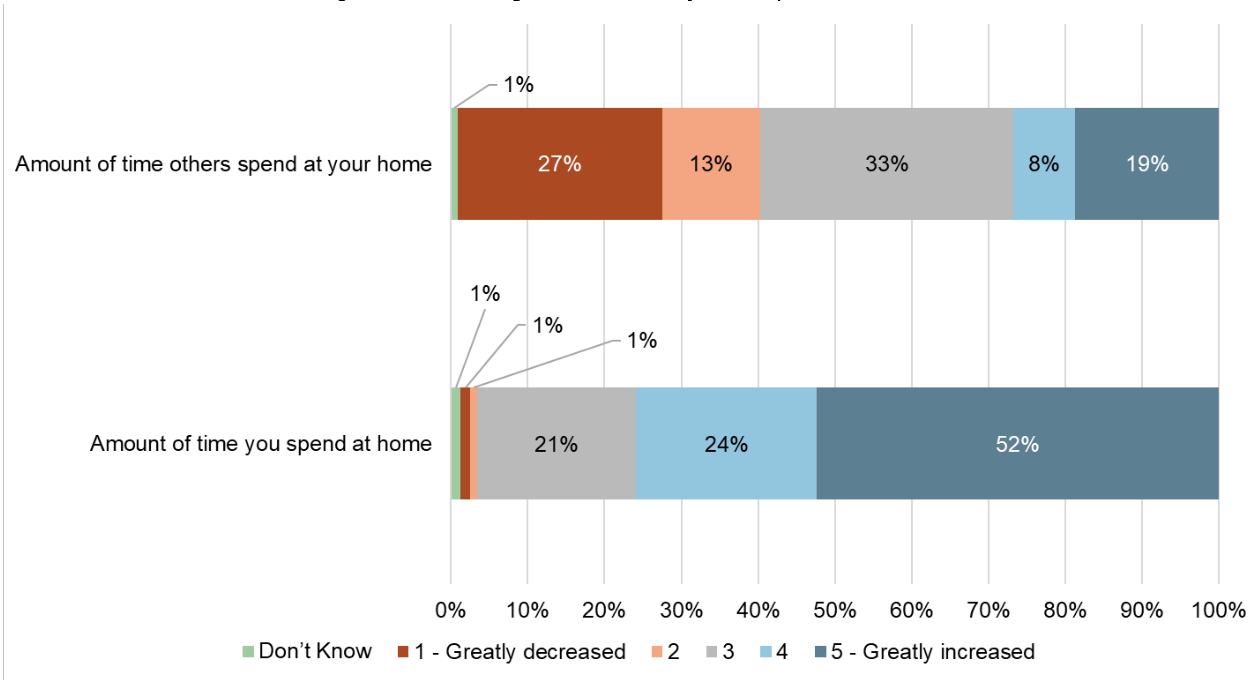
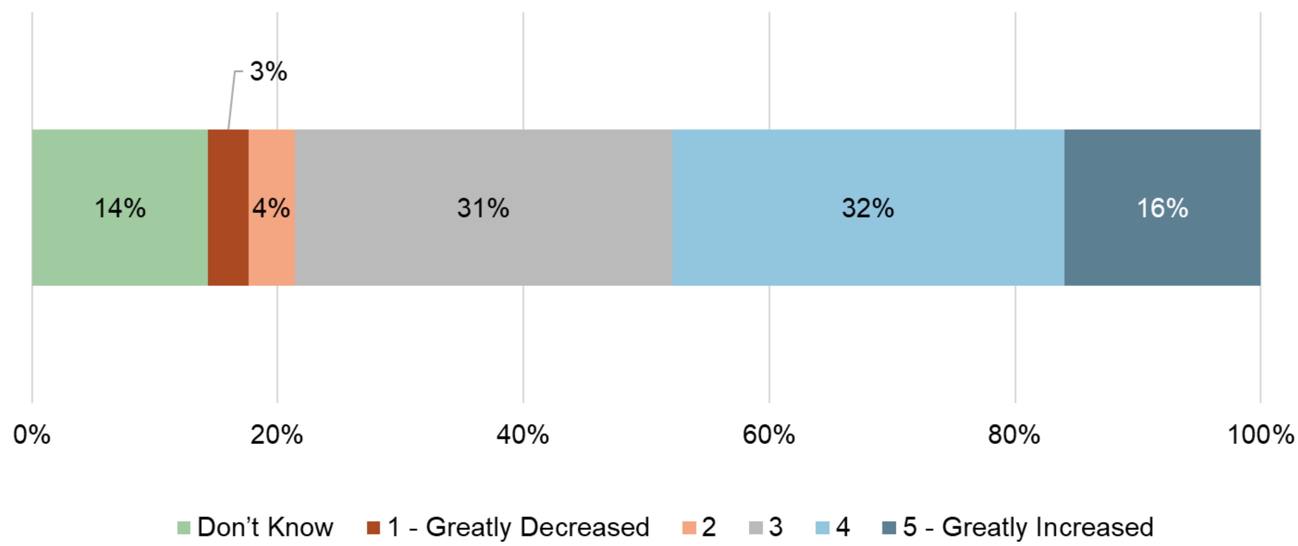


Figure 3-2: Change in natural gas bill since COVID19 pandemic began



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 3-7 summarizes the measures offered under this program.

Table 3-7: 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 3-8: Water Heat Program Verified Natural Gas Savings

Measure	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G 50 Gallon Natural Gas Water Heater	22	457.80	457.80	457.80	100.00%
G Tankless Water Heater	485	37,674.00	37,674.00	37,518.00	99.59%
Total	**507**	**38,131.80**	**38,131.80**	**37,975.80**	**99.59%**

The Water Heat Program displayed verified savings of 37,975.80 Therms with a realization rate of 99.59% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs from the program.

Table 3-9: Water Heat Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G 50 Gallon Natural Gas Water Heater	$2,200.00	$42.51	$2,242.51
G Tankless Water Heater	$193,600.00	$4,939.70	$198,539.70
Total	**$195,800.00**	**$4,982.21**	**$200,782.21**

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.

However, the Evaluators note that the CC&B web rebate data does not reflect the same values found in the mail-in rebate applications and/or invoices or AHRI certification documents submitted with the rebate application. The Evaluators recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. For example, ten of the 111 sampled rebates were not found in the CC&B dataset. A number of the sampled rebates were found to have discrepancies in model numbers between the CC&B data and the mail-in rebate applications and/or invoices.

In addition, not all rebates were accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.

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 3-10 displays the ISRs for each of the Water Heat measures for Idaho and Washington territory combined.

Table 3-10: 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	119	11	7.20%*	100%
G Tankless Water Heater	838	104		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 Evaluators explored a billing analysis for the natural gas water heater measures within this program. However, the G 50 Gallon Natural gas Water Heater lacked sufficient participation to estimate savings and the G Tankless Gas Water Heater measure 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. 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 37,975.80 Therms with a realization rate of 99.59%, as displayed in Table 3-8.

The realization rate for the natural gas savings in the Water Heat Program deviate from 100% for the G Tankless Gas Water Heat measure because two rebates were duplicated. Therefore, the Evaluators removed these rebates from savings, lowering the realization rate for the program.

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 3-7 summarizes the measures offered under this program.

Table 3-11: 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 3-12: HVAC Program Verified Natural Gas Savings

Measure	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Natural Gas Boiler	18	1,854.00	1,836.00	1,836.00	99.03%
G Natural Gas Furnace	2,012	170,502.60	142,497.00	234,361.24	137.45%
G Natural Gas Wall Heater	0	0.00	0.00	0.00	-
G Smart Thermostat DIY with Natural Gas Heat	190	5,077.18	5,160.82	5,110.38	100.65%
G Smart Thermostat Paid Install with Natural Gas Heat	1,009	26,777.68	27,263.18	25,630.97	95.72%
Total	**3,229**	**204,211.46**	**176,757.00**	**266,938.58**	**130.72%**

The HVAC Program displayed verified savings of 226,938.58 Therms with a realization rate of 130.72% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-13: HVAC Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Natural Gas Boiler	$8,100.00	$241.23	$8,341.23
G Natural Gas Furnace	$904,950.00	$30,792.49	$935,742.49
G Natural Gas Wall Heater	$0.00	$0.00	$0.00
G Smart Thermostat DIY with Natural Gas Heat	$14,316.14	$671.45	$14,987.59
G Smart Thermostat Paid Install with Natural Gas Heat	$101,000.00	$3,367.63	$104,367.63
Total	**$1,028,366.14**	**$35,072.80**	**$1,063,438.94**

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. However, the Evaluators note that some of the model numbers were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.

The Evaluators note that not all rebate applications contained existing/new construction field. 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 cross-referenced the billing data to verify if customers that received a rebate for E Natural Gas To Air Source Heat Pump or E Natural Gas To Ductless Heat Pump demonstrate a heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually (not just heating months). In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.

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 3-14 displays the ISRs for each of the HVAC measures for Idaho and Washington natural gas territory combined. The ISRs resulted in 5.16% precision at the 90% confidence interval for the program.

Table 3-14: HVAC Verification Survey ISR Results

Measure	Number of Rebates*	Number of Survey Completes	Precision at 90% Confidence	In-Service Rate
G Natural Gas Boiler	40	4	5.16%	100.00%
G Natural Gas Furnace	4,531	166		98.86%
G Natural Gas Wall Heater	1	1		100.00%
G Smart Thermostat DIY with Natural Gas Heat	765	20		100.00%
G Smart Thermostat Paid Install with Natural Gas Heat	2,064	55		94.12%

*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 Paid Install with Natural Gas Heat. Although less than 100%, the ISR for the referenced two measures measure still exceeded ISRs of 90%.

The Evaluators applied the ISRs listed in Table 3-14 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 3-15 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 customers considered for billing analysis include customers in both Washington and Idaho service territories as well as program years 2019 and 2020 in order to gather the maximum number of customers possible for precise savings estimates.

Table 3-15: 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	✓	38	
G Natural Gas Furnace	✓	4,531	
G Natural Gas Wall Heater	✓	0	
G Smart Thermostat DIY with Natural Gas Heat	✓	1,053	✓
G Smart Thermostat Paid Install with Natural Gas Heat	✓	362	✓

*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 3-16.

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 3-16 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 statistically significant at the 90% level for the DIY smart thermostat measure. However, the paid install smart thermostat displayed negative savings that were not statistically significant.

Table 3-16: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
Smart Thermostat DIY with Natural Gas Heat	128	637	16.14	3.91	28.38	0.91	Model 2: PPR
Smart Thermostat Paid Install with Natural Gas Heat	90	450	-34.80	-50.06	-19.54	0.91	Model 2: PPR

Because the results from these two billing analyses for smart thermostats are contradicting and/or inconclusive, the Evaluators elected to utilize Avista TRM values to estimate verified savings for these measures. The findings from the PY2020 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.

Retrofit Isolation Results

A retrofit isolation approach was used to estimate savings for Natural Gas Furnaces. Although this measure was initially considered as part of the scope of the billing data regression analysis, the Evaluators could not isolate statistically significant savings via a regression approach. Because the retrofit isolation approach relies on extracting baseload usage estimates from June, July, and August billing data, the sample was restricted to customers who had a full 12 months of post-installation data prior to February of 2020. This was to prevent a potential comparison of higher baseload to lower seasonal load just as an artifact of increased occupation due to COVID-19 restrictions.

Table 3-17 presents the total number of customers and the number of sampled customers.

Table 3-17: Customer Counts for Natural Gas Furnaces, HVAC Program

Measure	Data Restriction	# of Treatment Customers
G Natural Gas Furnace	Starting Count	2,065
	12 Months of Post Data prior to 2020-02-01	74

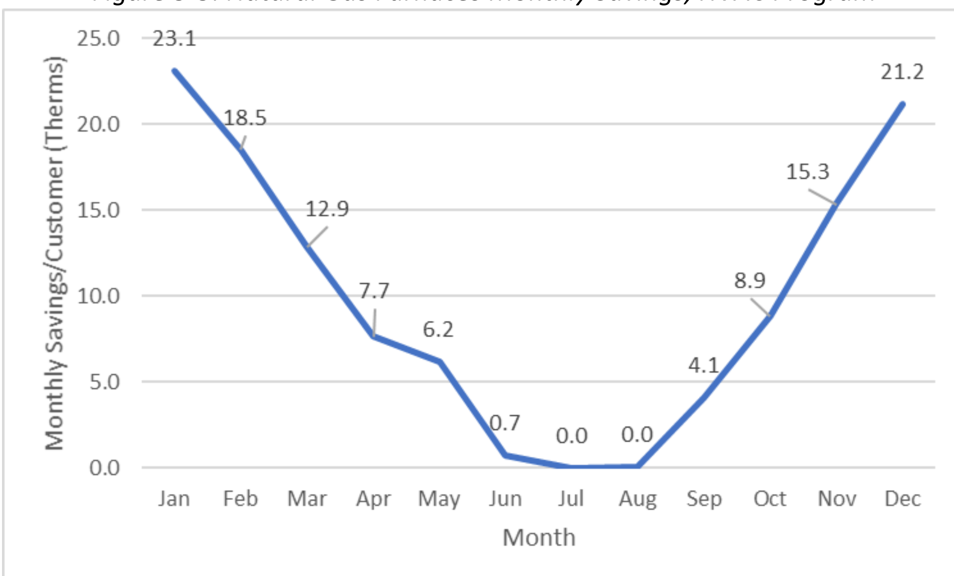
Table 3-18 provides annual savings for Natural Gas Furnaces. The Evaluators estimate the G Natural Gas Furnace measure to display an annual savings of 118.70 Therms. This verified value was applied to all associated rebates in the Idaho gas service territory.

Table 3-18: 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	74	118.70	116.26	121.14	2.1%

Figure 3-3 provides monthly weather-normalized savings for natural gas furnaces.

Figure 3-3: Natural Gas Furnaces Monthly Savings, HVAC Program



The savings for the natural gas furnace range between 15 and 23 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 130.72% with 266,938.58 Therms verified natural gas savings in the Idaho service territory, as displayed in Table 3-12. The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to the differences between the applied Avista TRM prescriptive savings value and the updated Avista TRM or updated RTF UES value.

The Evaluators applied the results of the retrofit isolation results to each of the G Natural Gas Furnace measures. The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate net program adjusted savings for measures not evaluated through billing analysis. In addition, the Evaluators reviewed and applied the current Avista TRM values for the natural gas measures along with verified tracking data to estimate net program verified savings for this measure.

The smart thermostat measures' realization rates are low because an outdated Avista TRM value was applied to the project data to calculate expected savings. The Evaluators assigned the appropriate, active Avista TRM value for each smart thermostat measure.

The G Natural Gas Furnace measure has a high realization rate because the billing analysis resulted in a savings value that was 137% of the value previously used in the Avista TRM. The Evaluators recommend adjusting the Avista TRM to reflect the observed savings value from this impact evaluation.

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 3-7 summarizes the measures offered under this program.

Table 3-19: Shell Program Measures

Measure	Description	Impact Analysis Methodology
G Attic Insulation With Natural Gas Heat	Attic insulation for homes heated with natural gas	Billing analysis with counterfactual group
G Floor Insulation With Natural Gas Heat	Floor insulation 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	Billing analysis with counterfactual group

The following table summarizes the adjusted and verified natural gas savings for the Shell Program impact evaluation.

Table 3-20: Shell Program Verified Natural Gas Savings

Measure	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Attic Insulation With Natural Gas Heat	35	5,633.10	5,633.10	1,944.60	34.52%
G Floor Insulation With Natural Gas Heat	10	749.34	749.34	749.34	100.00%
G Wall Insulation With Natural Gas Heat	11	883.19	780.84	883.19	100.00%

G Window Replc With Natural Gas Heat	229	12,856.12	8,328.28	8,422.62	65.51%
Total	**285**	**20,121.75**	**15,491.56**	**11,999.75**	**59.64%**

The Shell Program displayed verified savings of 11,999.75 Therms with a realization rate of 59.64% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-21: Shell Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Attic Insulation With Natural Gas Heat	$28,029.20	$672.12	$28,701.32
G Floor Insulation With Natural Gas Heat	$9,366.75	$259.00	$9,625.75
G Wall Insulation With Natural Gas Heat	$9,462.75	$305.26	$9,768.01
G Window Replc With Natural Gas Heat	$109,157.00	$2,911.16	$112,068.16
Total	**$156,015.70**	**$4,147.55**	**$160,163.25**

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 one instance in which square footage quantity in the rebate application does not match the values presented in the project data attic insulation. Two rebates showed R-values that did not align with TRM or RTF values related to the measure (R38 and R64). The Evaluators recommend collecting information in a standardized manner. The Evaluators assumed insulation levels closest to those presented for those two instances.

The Evaluators found the square footage for the floor insulation, wall insulation, and storm windows to be equivalent between the project data and the rebate applications, where available. However, the Evaluators found one floor insulation rebate in which the new R-value did not match TRM or RTF values (R21). The Evaluators recommend collecting this information in a standardized manner in addition to the R-values, detailed above.

The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows.

The Evaluators also 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 note several instances in which the web-based rebate data indicates the household has electric heating, but all other sources (project data and document verification) indicate natural gas space heating, and vice versa. The Evaluators recommend verifying the household space heating type prior to completing the rebate.

The Evaluators also note one instance in which the R-values for a window was assigned incorrectly. The Evaluators reassigned this window from an insulation of R0 to R49 to an insulation of R11 to R49.

The Evaluators cross-referenced the billing data to verify if customers demonstrate a heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually (not just heating months). In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.

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. 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 3-15 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 customers considered for billing analysis include customers in both Washington and Idaho service territories as well as program years 2019 and 2020 in order to gather the maximum number of customers possible for precise savings estimates.

Table 3-22: 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 Attic Insulation With Natural Gas Heat	✓	291	✓
G Floor Insulation With Natural Gas Heat	✓	8	
G Storm Windows with Natural Gas Heat	✓	9	
G Wall Insulation With Natural Gas Heat	✓	24	
G Window Replc With Natural Gas Heat	✓	1,309	✓

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 3-16.

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 3-16 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 3-23: 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 Attic Insulation With Natural Gas Heat	109	545	55.56	38.06	73.06	0.94	Model 2: PPR
G Window Replc With Natural Gas Heat	181	902	36.78	26.64	46.91	0.91	Model 2: PPR

The Evaluators found the G Attic Insulation With Natural Gas Heat measure to display a statistically significant verified savings value of 55.56 Therms per year. In addition, the Evaluators found statistically significant savings of 36.78 Therms per year for the G Window Replacement with Natural Gas Heat measure. The Evaluators used these savings estimates towards calculating verified savings for the program. 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 59.64% with 11,999.75 Therms verified natural gas savings in the Idaho service territory, as displayed in Table 3-20. The realization rate for the natural gas savings in the Shell Program deviate from 100% due to the differences between the billing analysis results and the Avista TRM prescriptive savings values as well as outdated Avista TRM values being applied in the expected savings calculations.

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 Fuel Efficiency Program

The Residential Fuel Efficiency Program encourages customers to consider converting their resistive electric space and water heating equipment to natural gas. This program is offered to residential customers in the Idaho service territory. Customers must use Avista electricity for electric straight-resistance heating or water heating in order to qualify for the rebate, which is verified by evaluating their energy use. The home's electric baseboard or furnace heat consumption must indicate at least 8,000 kWh during the previous heating season. Customers receive incentives after installation and after submitting a completed rebate form. Table 3-7 summarizes the measures offered under this program.

Table 3-24: Fuel Efficiency Program Measures

Measure	Description	Impact Analysis Methodology
E Electric to Air Source Heat Pump	Electric central ducted forced air furnace to air source heat pump (9.0 HFSP or greater)	RTF UES
E Electric To Natural Gas Furnace	Electric baseboard or forced air furnace heat to natural gas forced air furnace	Billing Analysis
E Electric To Natural Gas Furnace & Water Heat	Electric to natural gas furnace and water heat combo	Avista TRM

The following table summarizes the verified electric energy savings for the Fuel Efficiency Program impact evaluation. The program does not contain any natural gas saving measures; however, the program includes a Therms penalty due to converting electric equipment to natural gas equipment. The verified Therms penalty is 32,378.27 Therms and represents a 78.59% realization rate against the expected Therms penalty amount of 46,831.00 Therms. The following table displays the Therms penalty by measure.

Table 3-25: Fuel Efficiency Program Verified Natural Gas Penalty

Measure	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
E Electric to Air Source Heat Pump*	0	N/A	N/A	N/A	N/A
E Electric To Natural Gas Furnace	59	-22,445.00	-26,491.00	-13,419.29	59.79%
E Electric To Natural Gas Furnace & Water Heat	36	-18,756.00	-20,340.00	-18,958.98	101.08%
Total	**95**	**-41,201.00**	**-46,831.00**	**-32,378.27**	**78.59%**

*The E Electric to Air Source Heat Pump measure had 0 rebates completed in PY2020

The Therms penalties represented in the table above are not aggregated in the Residential portfolio impact evaluation and are summarized here for planning purposes. The costs associated with this program are claimed in the Idaho Electric Impact Evaluation Report. The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for the Fuel Efficiency Program in Idaho Electric Impact Evaluation Report for PY2020.

3.3.5 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 3-7 summarizes the measures offered under this program.

Table 3-26: ENERGY STAR® Homes Program Measures

Measure	Description	Impact Analysis Methodology
G Energy Star Home - Manufactured, Natural Gas	ENERGY STAR-rated manufactured home with natural gas furnace	RTF UES
G Energy Star Home - Manufactured, Gas & Electric	ENERGY STAR-rated manufactured home with natural gas and electric	RTF UES

The following table summarizes the verified natural gas savings for the ENERGY STAR® Homes Program impact evaluation.

Table 3-27: ENERGY STAR® Homes Program Verified Natural Gas Savings

Measure	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Energy Star Home - Manufactured, Natural Gas	1	134.00	133.98	133.98	99.99%
G Energy Star Home - Manufactured, Gas & Electric	2	268.00	0.00	267.96	99.99%
Total	**3**	**402.00**	**133.98**	**401.94**	**99.99%**

The ENERGY STAR® Homes Program displayed verified savings of 401.94 Therms with a realization rate of 99.99% against the expected savings for the program. The following table summarizes the incentive and non-incentive costs associated with the program.

Table 3-28: ENERGY STAR® Homes Program Costs

Measure	Incentive Costs	Non-Incentive Costs	Total Costs
G Energy Star Home - Manufactured, Natural Gas	$650.00	$22.96	$672.96
G Energy Star Home - Manufactured, Gas & Electric	$1,300.00	$45.92	$1,345.92
Total	**$1,950.00**	**$68.87**	**$2,018.87**

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.

3.3.5.1 Database Review & Verification

The following sections describe the Evaluator's database review and document verification findings for the ENERGY STAR® Homes Program.

3.3.5.2 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 one duplicate rebate in the project data. The Evaluators confirmed this instance with Avista and removed the rebate from verified savings.

3.3.5.3 Verification Surveys

The Evaluators did not conduct verification surveys for the ENERGY STAR® Homes Program.

3.3.5.4 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.

3.3.5.5 Verified Savings

The Evaluators reviewed the Avista TRM values along with verified tracking data to estimate adjusted program savings for each of the 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 99.99% with 401.94 Therms verified natural gas energy savings in the Idaho service territory, as displayed in Table 3-27. The realization rate for the natural gas savings in the ENERGY STAR® Homes Program deviate from 100% due to rounding of the expected savings using the Avista TRM. The Evaluators included savings up to the hundredth Therms from the RTF, which led to the 99.99% realization rate.

The Evaluators note that 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 did not impact the two three rebates included in the Idaho Gas territory, but did affect the realization rates of rebates in Washington.

The Evaluators did not conduct a verification survey for the ENERGY STAR® Homes Program and therefore did not adjust verified savings with an ISR.

3.3.6 Simple Steps, Smart Savings Program

The Simple Steps, Smart Savings Program is a midstream lighting and appliance program which encourages consumer to purchase and install high-quality LEDs, light fixtures, energy-efficient showerheads, and energy-efficient clothes washers by marking down retail prices in the Idaho service territory. The Simple Steps, Smart Savings Program was implemented in Idaho during the month of January 2020 and therefore reflect a small percentage of savings for the residential natural gas savings.

This section summarizes the impact results of the evaluation results for the Simple Steps, Smart Savings Program. Table 3-29 summarizes the measures offered under this program.

Table 3-29: Simple Steps, Smart Savings Program Measures

Measure	Description	Impact Analysis Methodology
Lighting	General purpose and specialty bulbs and fixtures	RTF UES
Showerhead	2.0 GPM showerheads	RTF UES
Appliance	High efficiency clothes washers	RTF UES

The following table summarizes the verified natural gas savings for the Simple Steps, Smart Savings Program impact evaluation.

Table 3-30: Simple Steps, Smart Savings Program Verified Natural Gas Savings

Measure	PY2020 Units	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
Lighting[12]	234,446	0.00	0.00	0.00	-
Showerhead	1,128	299.69	0.00	231.50	77.25%
Appliances	1	0.00	0.00	2.06	-
Total	**235,575**	**299.69**	**0.00**	**233.56**	**77.93%**

The Simple Steps, Smart Savings Program displayed verified savings of 233.56 Therms with a realization rate of 77.93% against the expected savings for the program. The costs associated with this program are entirely claimed in the Idaho Electric Impact Evaluation Report. The Evaluators summarize the program-specific and measure-specific impact analysis activities, results, conclusions, and recommendations for Simple Steps, Smart Savings 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 Simple Steps, Smart Savings Program.

[12] The lighting measures in the Simple Steps, Smart Savings program included a verified Therms penalty of 22,604.26 Therms. However, this penalty is not included in the Idaho Gas Residential Impact Evaluation impacts.

3.3.6.2 Database Review & Document Verification

Before conducting the impact analysis, the Evaluators conducted a database review for Simple Steps, Smart Savings Program. The Evaluators requested the monthly invoices for each month in PY2020 for the Simple Steps, Smart Savings Program from Avista.

The Evaluators collected and reviewed product-level quantity and pricing on each invoice. The Evaluators found no discrepancies between the invoiced amounts and quantities and the project data provided by Avista.

3.3.6.3 Verification Surveys

The Evaluators did not conduct verification surveys for the Simple Steps, Smart Savings Program.

3.3.6.4 Impact Analysis

This section summarizes the verified savings results for the Simple Steps, Smart Savings Program. The Evaluators calculated verified savings for this program's measures using the RTF UES values in effect before October 1, 2019.

The Evaluators note that the RTF version used to evaluate this program represents the residential lighting workbook active at the time the Bonneville Power Administration (BPA) planning for this program was established (October 1, 2019).

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. Final verified savings were estimated using the RTF UES values associated with each measure. Simple Steps, Smart Savings Program displayed 77.93% realization with 233.56 Therms saved, as displayed in Table 3-30.

The Simple Steps, Smart Savings Program did not have any Therms penalty expectations because the Avista TRM does not include a Therms penalty for the measures provided in the program. However, the RTF UES includes a Therms penalty, which the Evaluators applied to the project data. This Therms penalty does not contribute to the program's natural gas savings impacts.

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 317,549.63 Therms with a realization rate of 120.66%. 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

1.11 while the UCT value is 2.46. Further details on cost-effectiveness methodology can be found in Appendix C.

- The Residential Portfolio impact evaluation resulted in a realization rate of 120.66% due to slight differences between the applied Avista TRM values and the most active Avista TRM value 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 78% of the expected savings, resulted in a realization rate of 130.72% whereas each of the other programs resulted in a combined 74% realization rate. The Shell Program contributed to a 35% increase in the overall residential sector, which displayed a realization rate of 120.66%.
- The Evaluators conducted verification surveys via web survey and phone calls to collect information from customers who participated in the Water Heat and HVAC Programs. A total of 261 unique customers were surveyed between February and March 2021. 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 99.59%. This program deviated from 100% realization because two rebates were duplicates. Therefore, the Evaluators removed these rebates from savings, lowering the realization rate for the program.
- 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 lacked sufficient participation to estimate savings and the G Tankless Gas Water Heater measure 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.
- The HVAC Program in total displays a realization rate of 130.72% with 266,938.58 Therms verified natural gas savings in the Idaho service territory. The realization rate for the natural gas savings in the HVAC Program deviate from 100% due to the differences between the applied Avista TRM prescriptive savings value and the updated Avista TRM or updated RTF UES value. The smart thermostat measures' realization rates are low because an outdated Avista TRM value was applied to the project data to calculate expected savings. The furnace measure has a high realization rate because the billing analysis resulted in a savings value that was 137% of the value previously used in the Avista TRM.
- 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 PY2020 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 2021.
- The Shell Program displayed verified savings of 11,999.75 Therms with a realization rate of 59.64% 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 differences between the billing analysis results and the Avista TRM prescriptive savings values as well as outdated Avista TRM values being applied in the expected savings calculations.

- For the Shell Program, the Evaluators conducted a billing analysis for two measures that had sufficient participation. The Evaluators found the G Attic Insulation With Natural Gas Heat measure to display a statistically significant verified savings value of 55.56 Therms per year. In addition, the Evaluators found statistically significant savings of 36.78 Therms per year for the G Window Replacement with Natural Gas Heat measure. The Evaluators used these savings estimates towards calculating verified savings for the program.
- Final verified savings for the Simple Steps, Smart Savings Program were estimated using the RTF UES values associated with each measure. Simple Steps, Smart Savings Program displayed 77.93% realization with 233.56 Therms saved. The discrepancy between expected and verified Therms for the measures in this program are due to the differences between the BPA values assigned and the appropriately applied RTF values the Evaluators assigned.

3.4.2 Recommendations

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

- The Evaluators recommend Avista work to improve methods for collecting mail-in rebate application information to reconcile the CC&B database. The values found in the project documentation should accurately reflect the values represented in the CC&B database.
- A number of rebates were not accompanied with AHRI certification. In order to acquire accurate equipment efficiencies and tank sizes, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the model number found in the AHRI certification.
- The Evaluators note that some of the model numbers for the rebated equipment were incomplete and the Evaluators were unable to identify a single AHRI certification that matched the description in the rebate application. In order to acquire accurate equipment efficiencies, AHRI certifications are recommended to be required and submitted with the rebate application, with an invoice that matches the manufacturer and model number found in the AHRI certification.
- The Evaluators cross-referenced the billing data to verify if customers demonstrated the required heating season electricity usage of 8,000 kWh and natural gas usage of less than 340 Therms, as defined in the program requirements. The Evaluators found many customers used less than 8,000 kWh or 340 Therms annually. In addition, some customers had insufficient pre-period data to determine annual usage. The Evaluators recommend Avista verify if customers meet the requirements prior to completing the rebate.
- For the Shell Program, the Evaluators found rebates in which the R-values did not align with TRM or RTF values (R38 and R64). The Evaluators recommend collecting information in a standardized manner.
- The Evaluators recommend collecting information on single/double pane windows of the baseline windows and class of the efficient windows in order to correctly assign RTF UES values.

- 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 natural gas furnace measure in the HVAC has a high realization rate because the billing analysis resulted in a savings value that was 137.45% of the value previously used in the Avista TRM. The Evaluators recommend adjusting the Avista TRM to reflect the observed savings values from all billing analyses from this impact evaluation.
- The Evaluators recommend adjusting expected savings calculations in the Simple Steps, Smart Savings Program to include Therms penalty for the measures offered, in order to more accurately reflect the approved RTF savings values.

4. Low-Income Impact Evaluation Results

The Low-Income Program delivers energy efficiency measures to low-income residential customers in its Idaho 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 PY2020. The following sections summarize findings for each natural gas impact evaluation in the Low-Income Portfolio in the Idaho 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)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
Low-Income	5,009.32	4,719.08	5,494.69	109.69%
Total	**5,009.32**	**4,719.08**	**5,494.69**	**109.69%**

Table 4-2: Low-Income Portfolio Cost-Effectiveness Summary

Sector	TRC			UCT		
	Benefits	Costs	B/C Ratio	Benefits	Costs	B/C Ratio
Low Income	$168,428	$638,498	0.26	$68,285	$662,514	0.10

In PY2020, Avista completed and provided incentives for low-income gas measures in Idaho and achieved total natural gas savings of 5,494.69 Therms. The Low-Income Program exceeded savings expectations based on reported savings with an achieved realization rate of 109.69%. The Evaluators estimated the TRC value for the Low-Income portfolio is 0.26 while the UCT value is 0.10. 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 Idaho 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. 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	PY2020 Participation	Expected Savings (Therms)	Adjusted Savings (Therms)	Verified Savings (Therms)	Verified Realization Rate
G Air Infiltration	18	218.91	220.14	220.14	100.56%
G Duct Sealing	1	20.17	20.17	20.17	100.00%
G Energy Star Doors	7	66.96	67.62	67.62	100.99%
G Energy Star Windows	17	369.48	368.25	376.70	101.95%
G HE Furnace	49	3,342.84	3,049.76	3,796.64	113.58%
G HE WH 50G	25	174.10	176.28	176.28	101.25%
G INS - Attic	3	370.98	370.98	383.35	103.33%
G INS - Duct	0	0.00	0.00	0.00	
G INS - Floor	4	296.76	296.76	310.18	104.52%
G INS - Wall	2	82.62	82.62	77.11	93.33%
Health and Safety	22	0.00	0.00	0.00	
G Tankless Water Heater	1	66.50	66.50	66.50	100.00%
Total	**149**	**5,009.32**	**4,719.08**	**5,494.69**	**109.69%**

The Low-Income Program displayed verified savings of 5,494.69 Therms with a realization rate of 109.69% 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	$1,454.03	$1,211.01	$2,665.04
G Duct Sealing	$173.61	$156.99	$330.60
G Energy Star Doors	$5,511.00	$1,200.91	$6,711.91
G Energy Star Windows	$50,625.76	$7,713.02	$58,338.78
G HE Furnace	$281,070.11	$23,737.30	$304,807.41
G HE WH 50G	$104,110.27	$816.18	$104,926.45

G INS - Attic	$5,361.75	$7,849.05	$13,210.80
G INS - Duct	$0.00	$0.00	$0.00
G INS - Floor	$4,609.56	$6,350.88	$10,960.44
G INS - Wall	$1,142.91	$1,578.88	$2,721.79
Health and Safety	$89,410.19	$64,039.16	$153,449.35
G Tankless Water Heater	$3,873.60	$517.59	$4,391.19
Total	**$547,342.79**	**$115,170.97**	**$662,513.76**

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.

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 CC&B and the rebate project documentation provided in the data request for document verification. The Evaluators, updated quantity based on project documentation.

The Evaluators note that some project data account numbers do not match the account numbers referenced in the project documentation. In addition, the Evaluators found conflicting information in the project documentation on a number of homes' heating type. The Evaluators recommend confirming and documenting all rebate applications for completed and accurate heating type details.

The Evaluators also note that project documentation contains additional equipment included in some invoices. These additional equipment contribute to the total project cost. The Evaluators identified and removed three duplicated rebates. These rebates seem to have been duplicated due to rebate administration corrections.

The Evaluators also utilized the delivered billing data to check the household-level annual usage. The Low-Income Program requires a 20% annual energy usage cap on claimed energy savings. The Evaluators found some discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

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. Table 4-6 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 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, as displayed in Table 4-6 and therefore the Evaluators were unable to estimate measure-level savings through billing analysis. The customers considered for billing analysis include customers in both Washington and Idaho service territories as well as program years 2019 and 2020 in order to gather the maximum number of customers possible for precise savings estimates.

Table 4-6: Measures Considered for Billing Analysis, Low-Income Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis*
G Air Infiltration	✓	0	
G Duct Sealing	✓	0	
G Energy Star Doors	✓	0	
G Energy Star Windows	✓	6	
G HE Furnace	✓	27	
G HE WH 50G	✓	0	
G INS – Attic	✓	0	
G INS – Duct	✓	0	
G INS – Floor	✓	0	
G INS – Wall	✓	0	
Health And Safety	✓	0	
G Tankless Water Heater	✓	2	

*No measures had sufficient participation of isolated measures

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 4-7 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 excellent fit for the data.

Table 4-7: 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)	79	369	54.53	26.33	83.1	0.91	Model 2: PPR

The Evaluators applied these regression savings estimates to the program as a whole, by the number of unique households in the program and found a realization rate of 139.64% for all natural gas 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 109.69% with 5,494.69 Therms verified natural gas savings in the Idaho service territory, as displayed in Table 4-4. The billing analysis supports this estimate, with the billing analysis estimating a 139.64% realization. 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.

4.2 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 natural gas programs:

- The Evaluators found the Low-Income portfolio to demonstrate a total of 5,494.69 Therms with a realization rate of 109.69%. The Low-Income Portfolio impact evaluation resulted in 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 0.26 while the UCT value

is 0.10. 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. The Evaluators found a realization rate of 139% for all natural gas measures in the program, which supported the realization rate of 110% from the desk review.
- 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.

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 is due to the change in square footage or number of units verified in the project documentation. 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 CC&B and the rebate project documentation provided in the data request for document verification. In addition, the unit type, in terms of square footage or number of measures (windows, doors, etc) was not documented consistently and therefore savings values were applied inaccurately. The Evaluators recommend updating CC&B documentation standards to more accurately reflect values present on the rebate applications.
- The Evaluators found discrepancies between the 20% annual consumption cap and the claimed energy savings. The Evaluators recommend checking each project against billing data prior to reporting energy savings for the project, as well as documenting each household's usage as well as the date range used to calculate the household consumption estimate.

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 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 PY2019 and PY2020 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2020 participants.

Table 5-1: 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 50 Gallon Natural Gas Water Heater	✓	23	
G Tankless Gas Water Heater	✓	285	✓

The Evaluators were provided a considerable pool of control customers to draw upon, as shown in Table 5-2. However, the G 50 Gallon Natural Gas Water Heater measure had insufficient participation to conduct a billing analysis. The Evaluators moved forward with billing analysis for the G Tankless Gas Water Heater.

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 5-7, 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, HVAC Program

Measure	Data Restriction	Treatment Customers	Control Customers
	Starting Count	231	42,191

G Tankless Gas Water Heater	Install Date Range: 2019-01-01 to 2020-06-30	134	42,191
	Control Group Usage Outlier (>2X max treatment usage)	134	42,186
	Incomplete Post-Period Bills (<24 months)	106	28,196
	Incomplete Pre-Period Bills	99	25,523
	Ending Count (Matched by PSM)	99	495

Figure 5-1 and Figure 5-2 display the density of each variable employed in propensity score matching for the G Tankless 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 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, Tankless Gas Water Heater

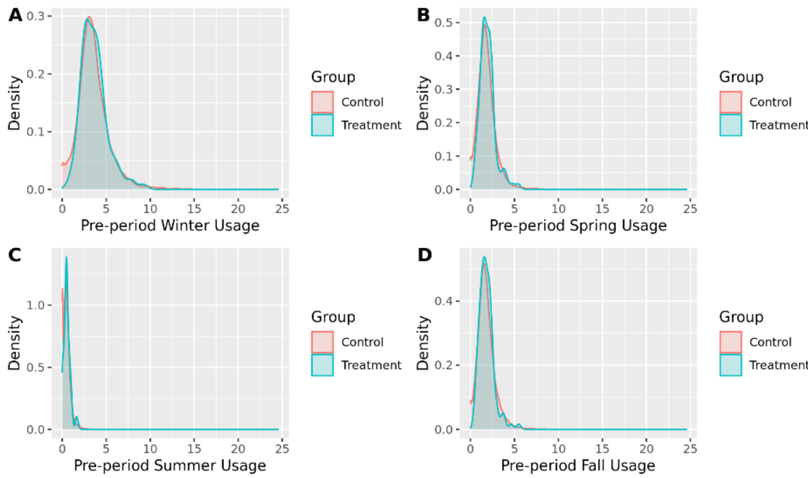
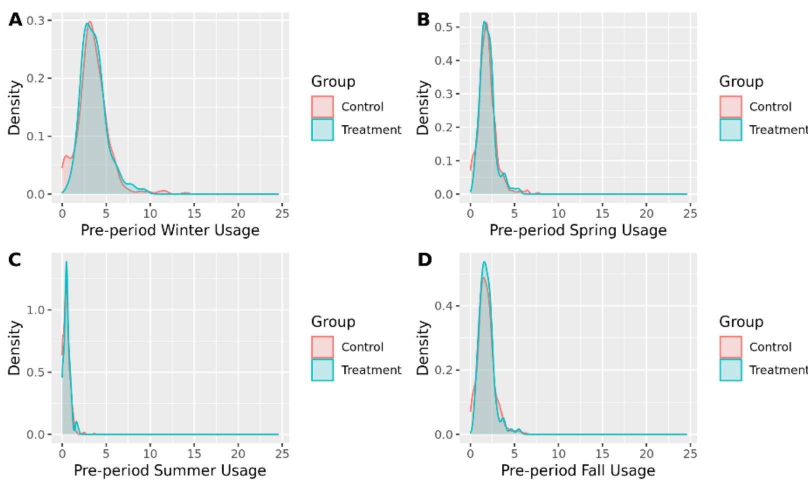


Figure 5-2: Covariate Balance After Matching, Tankless Gas Water Heater



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 the measure. *T*-tests of monthly pre period usage can yield a statistically significant difference 40% of the time for one to two months out of 12. Thus, the Evaluators set a tolerance band allowing two months out of 12 to vary in pre-period usage at the 95% confidence level. All groups passed this threshold. 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, typically falling under 10, further indicating the groups were well matched on all included covariates.

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, HVAC Program

Measure	USAF Station ID	Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
G Tankless Gas Water Heater	720322	6	727834	6,915	376	6,859	398
G Tankless Gas Water Heater	726817	3	727834	6,915	376	6,859	398
G Tankless Gas Water Heater	727830	4	727830	5,511	907	6,859	398
G Tankless Gas Water Heater	727834	86	727834	6,915	376	6,859	398

Table 5-4 provides annual savings per customer for the HVAC 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 G Tankless Gas Water Heater.

Table 5-4: Measure Savings for All Regression Models, HVAC Program

Measure	Model	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Relative Precision (90% CI)	Adjusted R-Squared
G Tankless Gas Water Heater	Diff-in-diff	99	495	16.71	-38.11	71.54	328%	0.50
G Tankless Gas Water Heater	PPR	99	495	-0.76	-19.34	17.81	2439%	0.88
G Tankless Gas Water Heater	Treatment Only (Gross)	99	N/A	-18.51	-56.35	19.32	204%	0.75

*Not statistically significant

Table 5-5 provides results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Water Heat program. The Evaluators placed a threshold of two rejects for each measure as there is a 40% likelihood that one or two months may show statistical variance due to chance. The variable speed motor measure did not exceed this threshold.

Table 5-5: Pre-period Usage T-test for Tankless Gas Water Heater, Water Heater Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.808	3.893	-0.355	0.241	0.723	No
Feb	3.740	3.948	-0.861	0.242	0.390	No
Mar	3.023	3.217	-0.977	0.198	0.330	No
Apr	1.840	1.920	-0.685	0.117	0.494	No
May	0.776	0.767	0.156	0.059	0.876	No

Jun	0.608	0.570	0.662	0.057	0.508	No
Jul	0.521	0.529	-0.099	0.076	0.921	No
Aug	0.553	0.622	-0.493	0.140	0.623	No
Sep	0.903	0.909	-0.065	0.095	0.948	No
Oct	1.810	1.818	-0.060	0.126	0.952	No
Nov	3.127	3.186	-0.307	0.193	0.759	No
Dec	3.731	3.773	-0.188	0.222	0.851	No

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. Table 5-6 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 PY2019 and PY2020 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2020 participants.

Table 5-6: 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	✓	18	
G Natural Gas Furnace	✓	2,958	✓
G Natural Gas Wall Heater	✓	0	
G Smart Thermostat DIY with Natural Gas Heat	✓	347	✓
G Smart Thermostat Paid Install with Natural Gas Heat	✓	571	✓

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 5-7. 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 5-7, 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 5-7: Cohort Restrictions, HVAC Program

Measure	Data Restriction	Treatment Customers	Control Customers
Smart Thermostat DIY with Natural Gas Heat	Starting Count	347	42,191
	Install Date Range: 2019-01-01 to 2020-06-30	233	42,191
	Control Group Usage Outlier (>2X max treatment usage)	232	42,186
	Incomplete Post-Period Bills (<24 months)	152	28,173
	Incomplete Pre-Period Bills	128	25,505
	Ending Count (Matched by PSM)	128	637
Smart Thermostat Paid Install with Natural Gas Heat	Starting Count	571	42,191
	Install Date Range: 2019-01-01 to 2020-06-30	299	42,191
	Control Group Usage Outlier (>2X max treatment usage)	298	42,186
	Incomplete Post-Period Bills (<24 months)	121	28,158
	Incomplete Pre-Period Bills	90	25,490
	Ending Count (Matched by PSM)	90	450

Figure 5-3 and Figure 5-4 display the density of each variable employed in propensity score matching for the DIY installed smart thermostat with natural gas heat measure, before and after matching. Additionally, Figure 5-5 and Figure 5-6 display the density of each variable employed in propensity score matching for the professionally installed smart thermostat with natural gas heat measure, before and after 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 5-3: Covariate Balance Before Matching, Smart Thermostat DIY with Natural Gas Heat

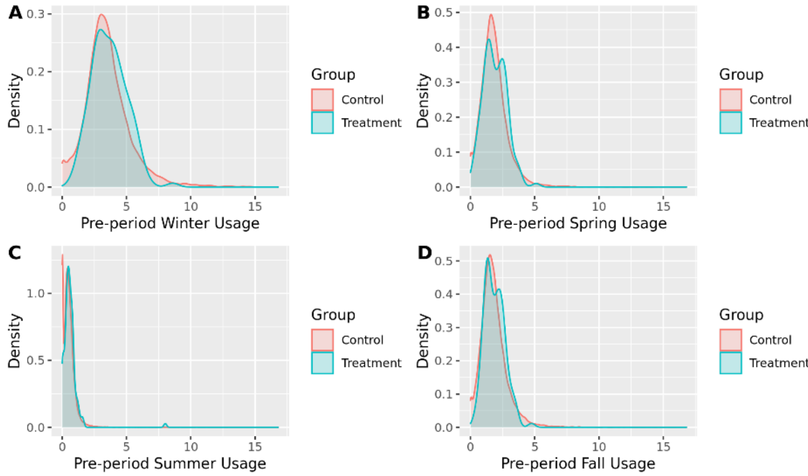


Figure 5-4: Covariate Balance After Matching, Smart Thermostat DIY with Natural Gas Heat

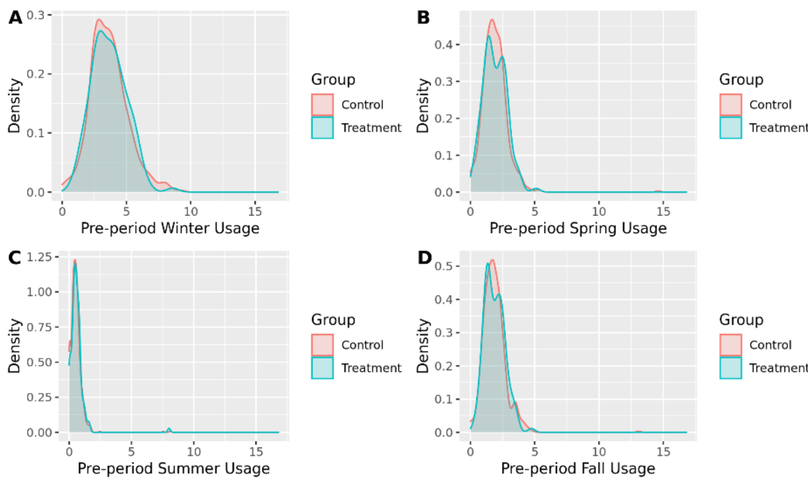


Figure 5-5: Covariate Balance Before Matching, Smart Thermostat Paid Install with Natural Gas Heat

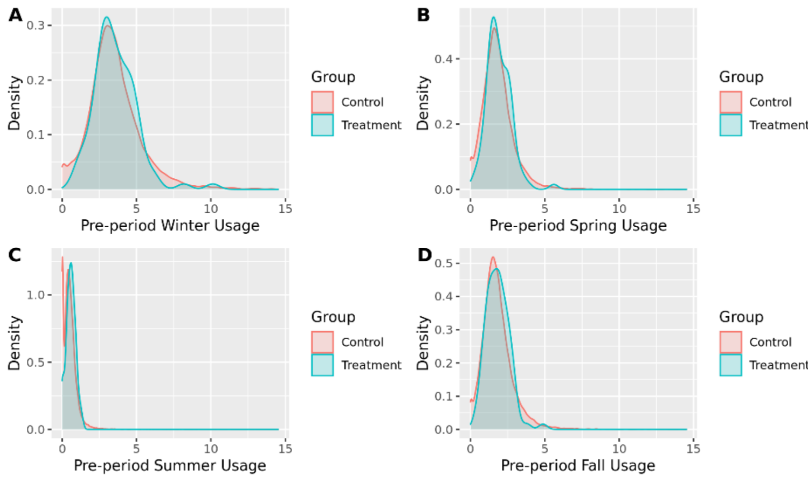
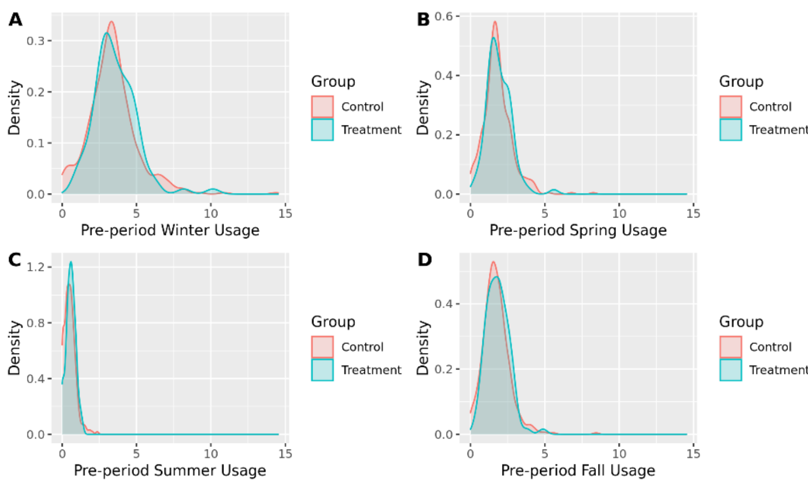


Figure 5-6: Covariate Balance After Matching, Smart Thermostat Paid Install with Natural Gas Heat



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

All tests confirmed that PSM performed well for each measure. T-tests of monthly pre period usage can yield a statistically significant difference 40% of the time for one to two months out of 12. Thus, the Evaluators set a tolerance band allowing two months out of 12 to vary in pre-period usage at the 95% confidence level. All groups passed this threshold. 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, typically 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 5-8 and Table 5-9 provide results for the *t*-test on pre-period usage between the treatment and control groups after matching for the HVAC program. The Evaluators placed a threshold of two rejects for each measure as there is a 40% likelihood that one or two months may show statistical variance due to chance. All three measures do not exceed this threshold.

Table 5-8: 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	3.522	3.587	-0.476	0.137	0.635	No
Feb	3.433	3.487	-0.394	0.137	0.694	No
Mar	2.758	2.826	-0.564	0.121	0.574	No
Apr	1.682	1.733	-0.577	0.088	0.564	No
May	0.682	0.703	-0.375	0.056	0.708	No
Jun	0.501	0.519	-0.380	0.050	0.704	No
Jul	0.414	0.414	0.002	0.045	0.999	No
Aug	0.421	0.410	0.257	0.043	0.798	No
Sep	0.741	0.789	-0.685	0.070	0.494	No
Oct	1.628	1.701	-0.858	0.085	0.392	No
Nov	2.820	2.879	-0.520	0.113	0.603	No
Dec	3.495	3.514	-0.152	0.128	0.880	No

Table 5-9: 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	3.435	3.529	-0.514	0.182	0.608	No
Feb	3.474	3.634	-0.871	0.184	0.385	No
Mar	2.883	3.032	-0.951	0.156	0.343	No
Apr	1.825	1.889	-0.645	0.099	0.520	No
May	0.800	0.856	-1.113	0.050	0.267	No
Jun	0.596	0.658	-1.472	0.042	0.143	No
Jul	0.487	0.561	-2.000	0.037	0.047	Yes
Aug	0.487	0.542	-1.517	0.036	0.131	No
Sep	0.825	0.873	-0.963	0.050	0.337	No
Oct	1.643	1.727	-0.934	0.090	0.352	No
Nov	2.733	2.894	-1.121	0.143	0.264	No
Dec	3.274	3.505	-1.328	0.174	0.187	No

Table 5-10 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 5-10: TMY Weather, HVAC Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
Smart Thermostat DIY with Natural Gas Heat	720322	7	727834	6,915	376	6,564	509
Smart Thermostat DIY with Natural Gas Heat	720923	1	727834	6,915	376	6,564	509
Smart Thermostat DIY with Natural Gas Heat	726817	3	727834	6,915	376	6,564	509
Smart Thermostat DIY with Natural Gas Heat	727830	32	727830	5,511	907	6,564	509
Smart Thermostat DIY with Natural Gas Heat	727834	85	727834	6,915	376	6,564	509
Smart Thermostat Paid Install with Natural Gas Heat	720322	2	727834	6,915	376	6,822	412
Smart Thermostat Paid Install with Natural Gas Heat	727830	6	727830	5,511	907	6,822	412
Smart Thermostat Paid Install with Natural Gas Heat	727834	82	727834	6,915	376	6,822	412

Table 5-11 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 statistically significant at the 90% level for the DIY Smart Thermostat with Natural Gas Heat. However, savings for Smart Thermostat Paid Install with Natural Gas Heat statistically significant and negative, as shown in the table and figures below. The adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-11: Measure Savings, HVAC Program

Measure	Treatment Customers	Control Customers	Annual Savings per Customer (Therms)	90% Lower CI	90% Upper CI	Adjusted R-Squared	Model
Smart Thermostat DIY with Natural Gas Heat	128	637	16.14	3.91	28.38	0.91	Model 2: PPR

Smart Thermostat Paid Install with Natural Gas Heat	90	450	-34.80	-50.06	-19.54	0.91	Model 2: PPR

Figure 5-7 and Figure 5-8 provide monthly TMY savings per customer for the HVAC program.

Figure 5-7: Smart Thermostat DIY with Natural Gas Heat Monthly Savings, HVAC Program

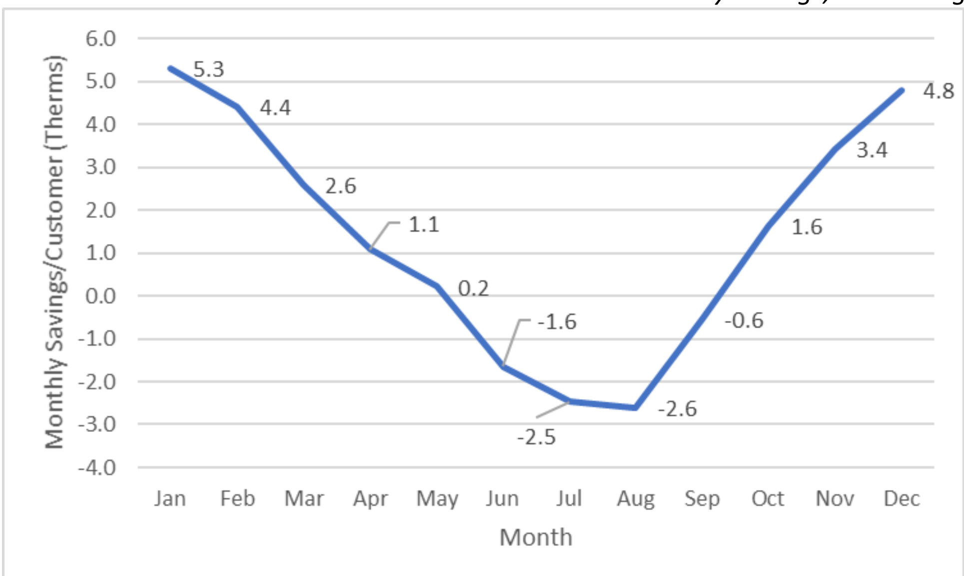
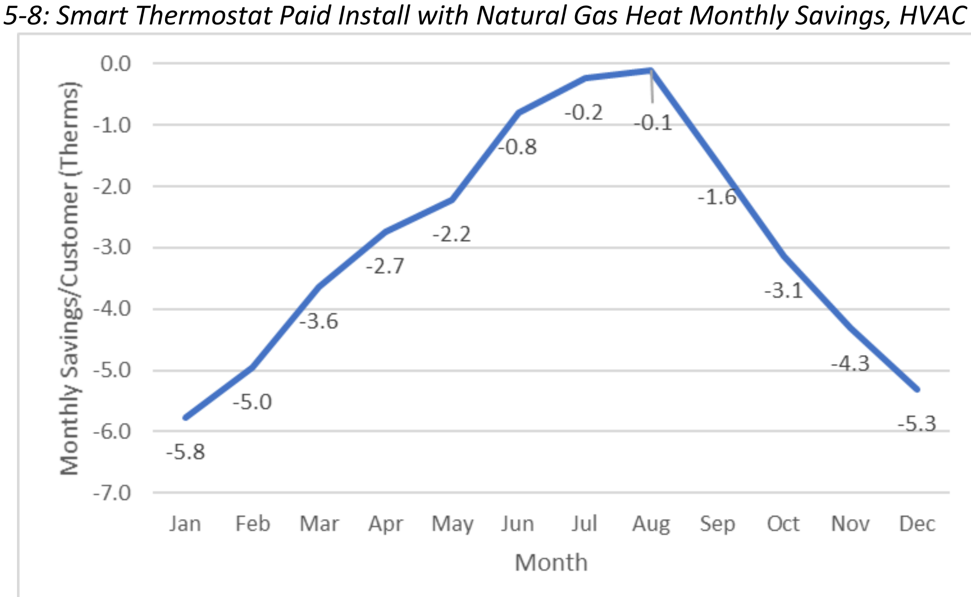


Figure 5-8: Smart Thermostat Paid Install with Natural Gas Heat Monthly Savings, HVAC Program



The Evaluators note that the negative savings for DIY and Paid Smart Thermostats are not typical. This may be attributable to increased household occupation during the post-treatment period due to COVID-19 pandemic restrictions. Additionally, Smart Thermostats may be subject to a snapback effect in which energy usage increases due to the replacement of faulty or ineffective equipment. Therefore, the Evaluators elected to use TRM values for verified savings for the smart thermostat measures in the Idaho Gas impact evaluation for PY2020. The Evaluators will re-evaluate the smart thermostat measures in PY2021.

5.3 Shell Program

The results of the billing analysis for the Shell program are provided below. Table 5-12 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).

Table 5-12: Measures Considered for Billing Analysis, Shell Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Single-Measure Installations	Sufficient Participation for Billing Analysis
G Attic Insulation With Natural Gas Heat	✓	336[13]	✓
G Floor Insulation With Natural Gas Heat	✓	6	
G Storm Windows with Natural Gas Heat	✓	1	
G Wall Insulation With Natural Gas Heat	✓	4	
G Window Replc With Natural Gas Heat	✓	370	✓

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 5-13. 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 5-13, 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 5-13: Cohort Restrictions, Shell Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers

[13] This estimate includes 291 customers from WA with attic insulation; ID on its own had an insufficient number of attic installations for a billing analysis (45 customers).

G Attic Insulation With Natural Gas Heat	Starting Count	336	116,739
	Install Date Range: January 1, 2019 to June 30, 2020	189	116,739
	Control Group Usage Outlier (>2X max treatment usage)	189	116,732
	Incomplete Post-Period Bills (<24 months)	133	79,804
	Incomplete Pre-Period Bills (<10 months)	109	73,096
	Ending Count (Matched by PSM)	109	545
G Window Replc With Natural Gas Heat	Starting Count	370	42,191
	Install Date Range: January 1, 2019 to June 30, 2020	241	42,191
	Control Group Usage Outlier (>2X max treatment usage)	240	42,186
	Incomplete Post-Period Bills (<24 months)	204	28,174
	Incomplete Pre-Period Bills (<10 months)	181	25,506
	Ending Count (Matched by PSM)	181	902

Figure 5-9 and Figure 5-10 display the density of each variable employed in propensity score matching for the attic insulation measure, before and after conducting matching. In addition, Figure 5-11 and Figure 5-12 display the density of each variable employed in propensity score matching for the window replacement measure, 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 5-9: Covariate Balance Before Matching, Shell Attic Insulation

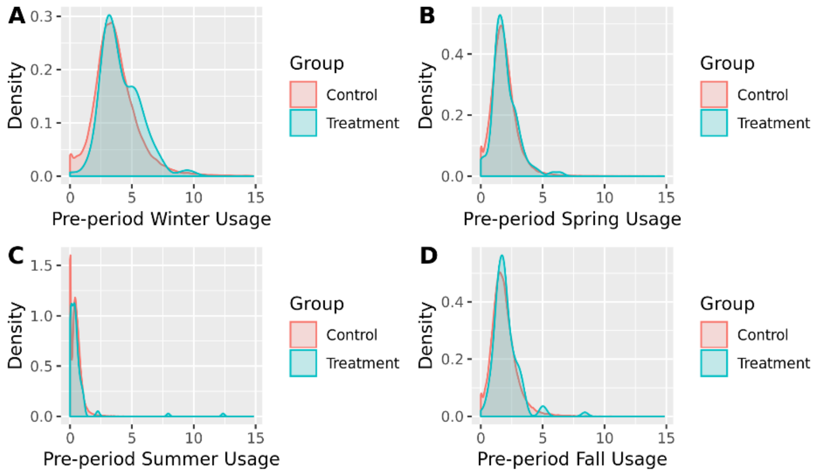


Figure 5-10: Covariate Balance After Matching, Shell Attic Insulation

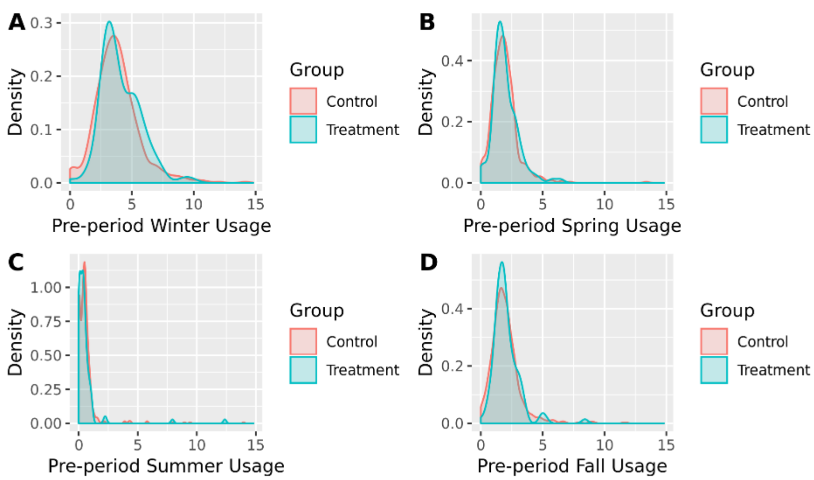


Figure 5-11: Covariate Balance Before Matching, Shell Window Replacement

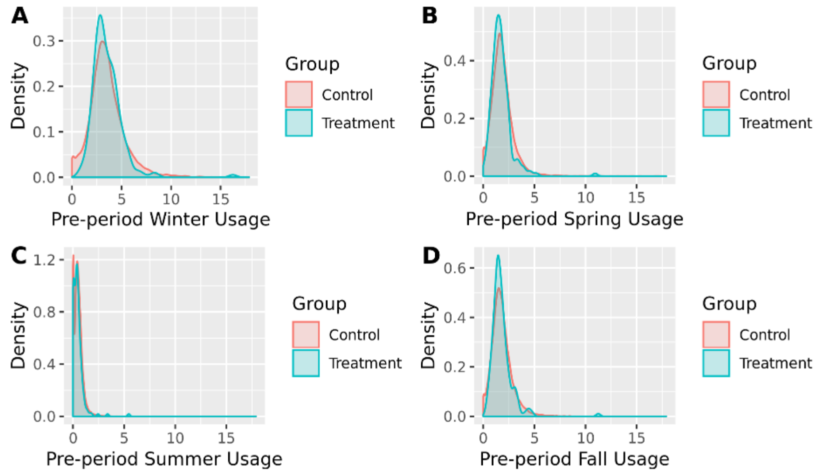
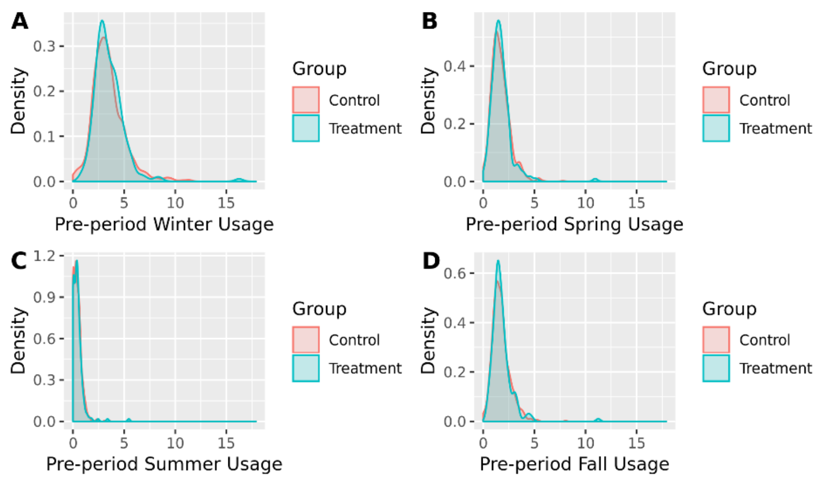


Figure 5-12: Covariate Balance After Matching, Shell Window Replacement



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, 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 5-14 and Figure 5-13 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 5-14: 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	4.156	4.113	0.198	0.214	0.843	No
Feb	4.064	4.083	-0.087	0.212	0.931	No
Mar	3.214	3.347	-0.761	0.175	0.447	No
Apr	1.946	1.988	-0.353	0.119	0.724	No
May	0.849	0.805	0.439	0.099	0.662	No
Jun	0.699	0.640	0.416	0.140	0.678	No
Jul	0.574	0.508	0.511	0.129	0.610	No
Aug	0.577	0.595	-0.101	0.171	0.920	No
Sep	0.902	0.912	-0.063	0.148	0.950	No
Oct	1.883	1.849	0.294	0.116	0.769	No
Nov	3.320	3.333	-0.074	0.180	0.941	No
Dec	3.969	4.166	-0.934	0.211	0.351	No

Table 5-15: 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	3.522	3.587	-0.476	0.137	0.635	No
Feb	3.433	3.487	-0.394	0.137	0.694	No
Mar	2.758	2.826	-0.564	0.121	0.574	No
Apr	1.682	1.733	-0.577	0.088	0.564	No
May	0.682	0.703	-0.375	0.056	0.708	No
Jun	0.501	0.519	-0.380	0.050	0.704	No
Jul	0.414	0.414	0.002	0.045	0.999	No
Aug	0.421	0.410	0.257	0.043	0.798	No
Sep	0.741	0.789	-0.685	0.070	0.494	No
Oct	1.628	1.701	-0.858	0.085	0.392	No
Nov	2.820	2.879	-0.520	0.113	0.603	No
Dec	3.495	3.514	-0.152	0.128	0.880	No

Table 5-16 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 5-16: 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	727830	5	727830	5,511	907	6,312	518
G Attic Insulation With Natural Gas Heat	727834	7	727834	6,915	376	6,312	518
G Attic Insulation With Natural Gas Heat	727850	0	727850	6,707	379	6,312	518
G Attic Insulation With Natural Gas Heat	727855	5	727855	7,360	439	6,312	518
G Attic Insulation With Natural Gas Heat	727856	88	727856	6,246	519	6,312	518
G Attic Insulation With Natural Gas Heat	727857	3	727857	6,467	299	6,312	518
G Attic Insulation With Natural Gas Heat	727870	1	727856	6,246	519	6,312	518
G Window Replc With Natural Gas Heat	720322	4	727834	6,915	376	6,186	652
G Window Replc With Natural Gas Heat	720923	1	727834	6,915	376	6,186	652
G Window Replc With Natural Gas Heat	726817	18	727834	6,915	376	6,186	652
G Window Replc With Natural Gas Heat	727830	94	727830	5,511	907	6,186	652

Table 5-17 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 5-17: 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	109	545	44.82*	-42.58	132.23	0.30
G Attic Insulation With Natural Gas Heat	PPR	109	545	55.56	38.06	73.06	0.94
G Attic Insulation With Natural Gas Heat	Treatment Only (Gross)	109	N/A	50.05	18.00	82.11	0.81
G Window Replc With Natural Gas Heat	Diff-in-diff	181	902	34.30	0.04	68.56	0.55
G Window Replc With Natural Gas Heat	PPR	181	902	36.78	26.64	46.91	0.91
G Window Replc With Natural Gas Heat	Treatment Only (Gross)	181	N/A	11.28*	-5.75	28.31	0.86

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 5-18: 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	109	545	55.56	38.06	73.06	0.94	Model 2: PPR
G Window Replc With Natural Gas Heat	181	902	36.78	26.64	46.91	0.91	Model 2: PPR

Figure 5-13 and Figure 5-7 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 5-13: Attic Insulation Monthly Savings, Shell Program

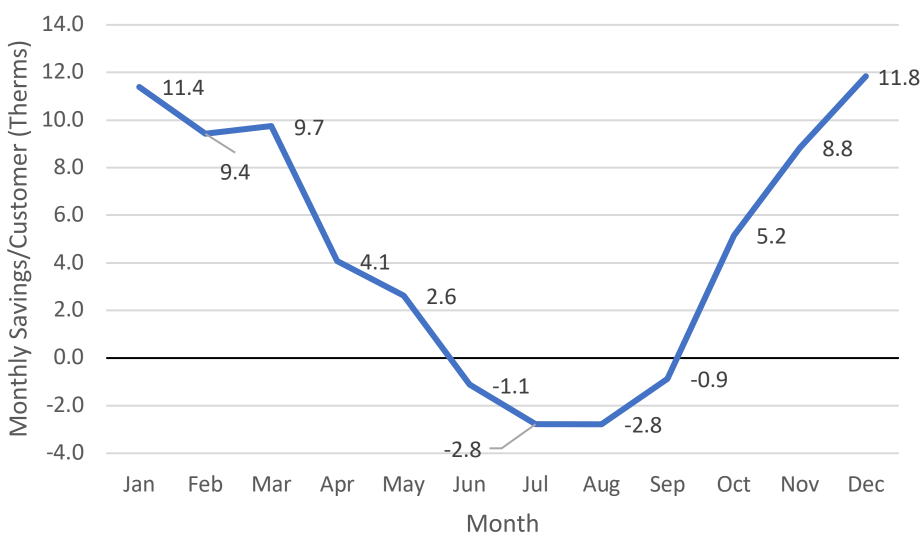
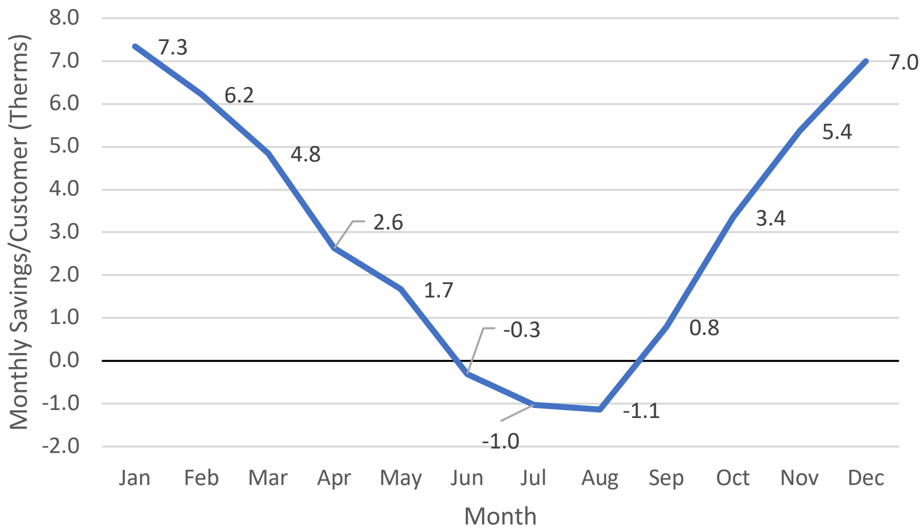


Figure 5-14: Window Replacement Monthly Savings, Shell Program



5.4 Fuel Efficiency Program

The results of the billing analysis for the Fuel Conversion program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.3.2. Table 5-19 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 Fuel Efficiency 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 PY2020 in order to acquire the maximum number of customers possible. However, results from billing analyses are only extrapolated to PY2020 participants.

Table 5-19: Measures Considered for Billing Analysis, Fuel Efficiency Program

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
E Electric To Natural Gas Furnace	✓	186	✓
E Electric To Natural Gas Furnace & Water Heat	✓	33	

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 5-20. 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 5-20, 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 5-20: Cohort Restrictions, Fuel Efficiency Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
E Electric To Natural Gas Furnace	Starting Count	186	132,725
E Electric To Natural Gas Furnace	Install Date Range: January 1, 2019 to June 30, 2020	162	132,725
E Electric To Natural Gas Furnace	Control Group Usage Comparable to Treatment Group	158	132,654
E Electric To Natural Gas Furnace	Incomplete Post-Period Bills (<4 months)	132	89,361
E Electric To Natural Gas Furnace	Incomplete Pre-Period Bills (<10 months)	85	69,413
E Electric To Natural Gas Furnace	Restrict to Controls w/ Probable Electric Resistance[14]	85	10,412
E Electric To Natural Gas Furnace	Ending Count (Matched by PSM)	85	421

Figure 5-15 and Figure 5-16 display the density of each variable employed in propensity score matching for the E Electric to Natural Gas Furnace measure, before and after conducting matching.

The distributions prior to matching appear to be less similar, with control customers averaging lower usage. However, after matching, the pre-period usage distribution is more similar between the groups. The pre-period usage in the winter before and after matching averages a more spread distribution for the treatment group, however, the average usage between groups appears the same after matching (verified with *t*-test on pre-usage).

[14] The Evaluators restricted to controls with pre-period winter usage higher than the 85th percentile (i.e. top 15%) as these customers are more likely to have electric resistance heating.

Figure 5-15: Covariate Balance Before Matching, E Electric to Natural Gas Furnace

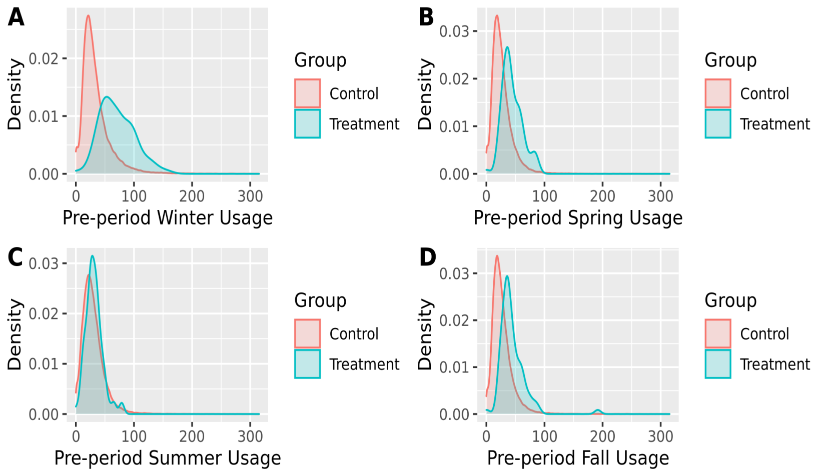
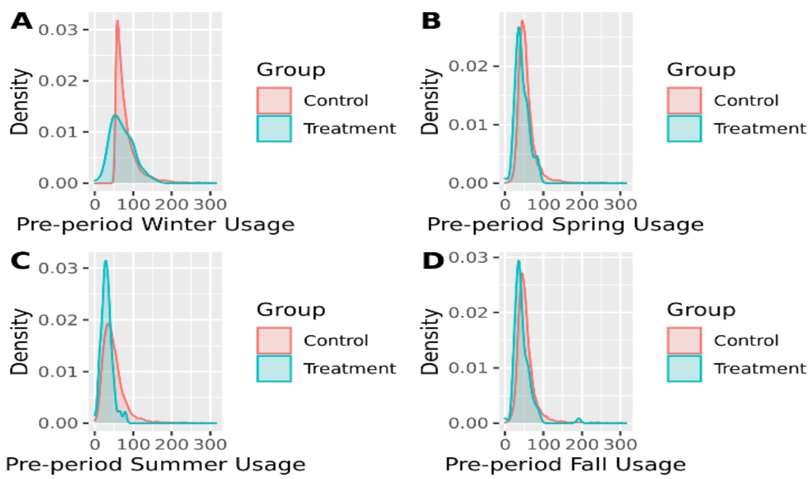


Figure 5-16: Covariate Balance After Matching, E Electric to Natural Gas Furnace



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 the 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.

Table 5-21 provides the results for the *t*-test on pre-period usage between the treatment and control groups after matching for the Fuel Efficiency 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 5-21: Pre-period Usage T-test for Electric to Gas Furnace, Fuel Conversion Program

Month	Average Daily Usage (kWh), Control	Average Daily Usage (kWh), Treatment	T Stat	Std Error	P-Value	Reject Null?
Jan	72.502	69.978	0.699	3.613	0.486	No
Feb	69.808	67.655	0.611	3.522	0.542	No
Mar	59.063	60.098	-0.344	3.006	0.731	No
Apr	43.331	43.494	-0.077	2.133	0.939	No
May	30.497	29.155	0.915	1.466	0.362	No
Jun	29.164	27.861	0.802	1.624	0.423	No
Jul	34.092	33.291	0.364	2.198	0.716	No
Aug	33.202	32.844	0.175	2.050	0.862	No
Sep	30.944	30.174	0.435	1.766	0.664	No
Oct	41.417	41.816	-0.156	2.567	0.877	No
Nov	59.142	60.794	-0.389	4.246	0.698	No
Dec	69.305	69.601	-0.072	4.086	0.942	No

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, Fuel Efficiency Program

Measure	USAF Station ID	# of Treatment Customers	TMY USAF ID	TMY HDD	TMY CDD	Weighted TMY HDD	Weighted TMY CDD
E Electric to Natural Gas Furnace	720322	3	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	726817	3	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	727827	4	727827	5,428	731	6,333	517
E Electric to Natural Gas Furnace	727830	7	727830	5,511	907	6,333	517
E Electric to Natural Gas Furnace	727834	13	727834	6,915	376	6,333	517
E Electric to Natural Gas Furnace	727855	2	727855	7,360	439	6,333	517
E Electric to Natural Gas Furnace	727856	47	727856	6,246	519	6,333	517
E Electric to Natural Gas Furnace	727857	4	727857	6,467	299	6,333	517
E Electric to Natural Gas Furnace	727870	2	727856	6,246	519	6,333	517

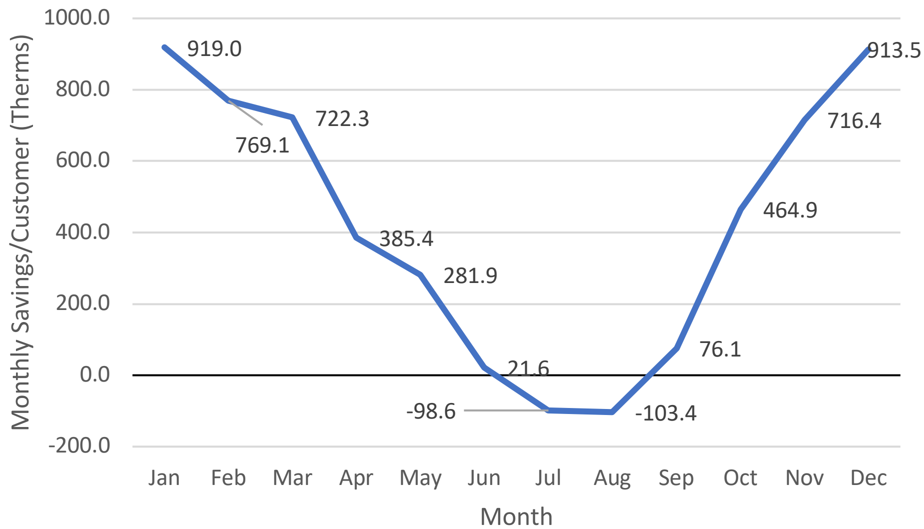
Table 5-23 provides annual savings per customer for each measure. Model 2 (PPR) was selected as the final model for the Fuel Efficiency Program as it provided the highest adjusted R-squared among the regression models. Savings are statistically significant at the 90% level for all measures and the adjusted R-squared shows the model provided an excellent fit for the data.

Table 5-23: Measure Savings, Fuel Efficiency Program

Measure	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (kWh)	90% Lower CI	90% Upper CI	90% Relative Precision	Adjusted R-Squared	Model
E Electric to Natural Gas Furnace	85	421	5,068	4,384	5,7512	0.13	0.73	Model 2: PPR

Figure 5-17 provides monthly TMY savings per customer for the Fuel Conversion program. As expected, the greatest savings occur during the winter months.

Figure 5-17: E Electric to Gas Furnace Monthly Savings, Fuel Conversion Program



The Evaluators found the E Electric To Natural Gas Furnace measure to display 5,068 kWh savings per year. This estimate was statistically significant at the 90% confidence interval with precision of 13%. The Evaluators estimate the Therms penalty for this measure with the following equation:

Equation 5-1: Furnace Conversion Heating Load

$$Heating\ Load = \frac{Annual\ kWh\ Savings * COP_{Electric} * \frac{3{,}412\ kWh}{BTU}}{\frac{100{,}000\ Therms}{BTU}}$$

Equation 5-2 Furnace Conversion Therms Penalty

$$Therms\ Penalty = \frac{Heating\ Load}{0.80\ Base\ AFUE}$$

Where,

- $Heating\ Load$ = The number of full load hours required for heating the home per year
- $Annual\ kWh\ Savings$ = measure saving result from linear regression (5,068 kWh/year)
- $COP_{Electric}$ = Coefficient of performance (equal to 1, assuming electric resistance baseline)

The Therms penalty for the E Electric to Natural Gas Furnace measure is 216.15 Therms. This penalty is applied in the Idaho Gas Impact Evaluation Report.

Due to the insufficient isolated measure participation for the E Electric To Natural Gas Furnace & Water Heater measure, the Evaluators assigned savings for this measure using the Avista TRM value of 9,789 kWh and -565 Therms savings per year.

Evaluators also conducted a treatment-only regression model for each of the measures described above. This analysis was completed at the request of Avista in order to help with program planning. Table 5-24 provides annual savings/customer for the Fuel Conversion 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). The treatment-only model represents estimated gross savings for this measure at 5,430 Therms saved per year.

Table 5-24: Measure Savings for All Regression Models, Fuel Efficiency Program

Measure	Model	# of Treatment Customers	# of Control Customers	Annual Savings/Customer (kWh)	90% Lower CI	90% Upper CI	90% Relative Precision	Adjusted R-Squared
Electric to Natural Gas Furnace	Diff-in-diff	85	421	5,267.69	3,572.27	6,963.10	0.32	0.26
Electric to Natural Gas Furnace	PPR	85	421	5,068.03	4,384.25	5,751.80	0.13	0.73
Electric to Natural Gas Furnace	Treatment Only (Gross)	85	N/A	5,430.42	4,625.74	6,235.10	0.15	0.70

5.5 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 5-25. 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 5-25, 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 5-25: Cohort Restrictions, Low-Income Program

Measure	Data Restriction	# of Treatment Customers	# of Control Customers
Whole home natural gas	Starting Count	146	1,252
	Install Date Range: January 1, 2019 to June 30, 2020	89	1,252

	Control Group Usage Outlier (>2X max treatment usage)	89	1,252
	Incomplete Post-Period Bills (<4 months)	82	1058
	Incomplete Pre-Period Bills (<10 months)	79	970
	Ending Count (Matched by PSM)	79	369

Figure 5-18 and Figure 5-19 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 5-18: Covariate Balance Before Matching, Low Income Gas Measures

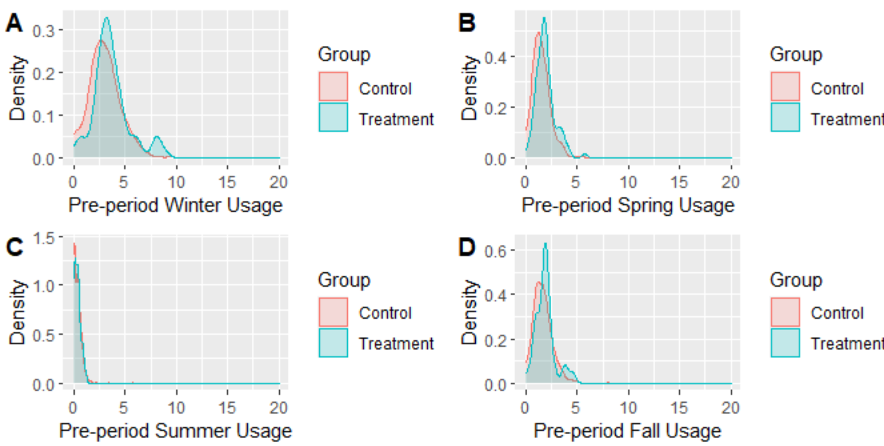
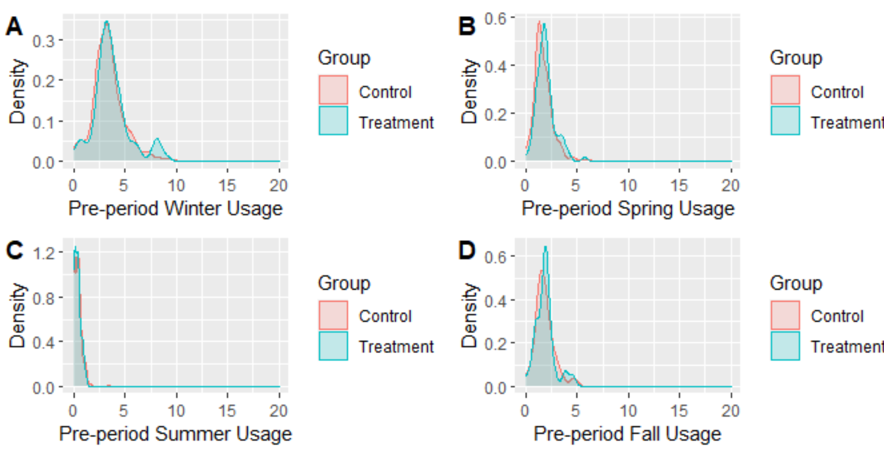


Figure 5-19: Covariate Balance After Matching, Low Income Gas Measures



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 were under 10 (well under the recommended cutoff of 25), further indicating the groups were well matched on all included covariates.

Table 5-26 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 5-26: 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 Natural Gas Measures	727827	2	727827	5,428	731	6,300	501
All Natural Gas Measures	727830	5	727830	5,510	906	6,300	501
All Natural Gas Measures	727834	7	727834	6,915	376	6,300	501
All Natural Gas Measures	727850	2	727850	6,246	519	6,300	501
All Natural Gas Measures	727855	2	727855	7,360	439	6,300	501
All Natural Gas Measures	727856	49	727856	6,246	519	6,300	501
All Natural Gas Measures	727857	12	727857	6,467	299	6,300	501

Table 5-27 provides annual savings/customer for the Low-Income 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 5-27: Measure 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 Natural Gas Measures	Diff-in-diff	79	485	16.00*	0	84.41	0.61
All Natural Gas Measures	PPR	79	485	54.53	26.33	83.1	0.91

All Natural Gas Measures	Treatment Only (Gross)	79	485	46.22	0	128.56	0.81

*Not statistically significant

The Evaluators estimate each household in the Low-Income Program saved an average of 54.53 Therms per year. The treatment-only model displays an average household savings of 46.22 Therms per year. This estimate represents a gross savings estimate for the program rather than a net savings estimate.

Table 5-28 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 5-28: Pre-period Usage T-test for Natural Gas Measures, Low-Income Program

Month	Average Daily Usage (Therms), Control	Average Daily Usage (Therms), Treatment	T Statistic	Std Error	P-Value	Reject Null?
Jan	3.55	3.52	0.166	0.189	0.868	No
Feb	2.69	2.68	0.101	0.135	0.920	No
Mar	3.30	3.26	0.300	0.153	0.765	No
Apr	1.80	1.80	-0.021	0.083	0.983	No
May	1.40	1.38	0.302	0.080	0.763	No
Jun	0.58	0.60	-0.543	0.043	0.588	No
Jul	0.10	0.11	-0.127	0.045	0.899	No
Aug	0.05	0.04	0.153	0.044	0.879	No
Sep	0.14	0.16	-0.373	0.050	0.710	No
Oct	0.75	0.78	-0.511	0.063	0.609	No
Nov	2.65	2.69	-0.283	0.120	0.777	No
Dec	3.14	3.07	0.464	0.152	0.643	No

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	161	61%
Two Measures	69	26%
Three Measures	32	12%
HVAC	140	53%
Water Heater	138	53%
Smart Thermostat	113	43%
Variable Speed Motors	4	2%

The Evaluators asked respondents to provide information regarding their home, as displayed in Table 6-2. Most 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[15]

Question	Response	Percent (n=258)
Do you rent or your home?	Own	97%
	Rent	3%
Which of the following best describe your home?	Single-family house detached from any other house	89%
	Single-family house attached to one or more other houses (e.g., duplex, condominium, townhouse)	4%
	Mobile or manufactured home	6%
	Apartment with 2 or 3 units	1%
	Garage/outbuilding	1%
	Don't Know	1%
Does your home have central air conditioning, window air conditioning, or neither?	Window air conditioning / a room AC unit	12%
	Central air conditioning	73%
	Neither	14%
	Don't Know	1%
About how many square feet is your home?	Less than 1,000 square feet	6%
	1,000-1,999 square feet	38%
	2,000-2,999 square feet	35%
	3,000-3,999 square feet	14%
	4,000 or more square feet	6%
	Don't know	1%
When was your home built?	Before 1960	21%
	1960 to 1969	5%
	1970 to 1979	17%
	1980 to 1989	12%
	1990 to 1999	12%
	2000 to 2009	16%
	2010 to 2018	15%
	Don't know	1%

[15] 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 PY2020 portfolio.

Table 7-1: Cost-effectiveness Results

Program	TRC	UCT	RIM	PCT	TRC Net Benefits
Residential	1.11	2.46	0.30	1.41	$386,191
Low Income	0.26	0.10	0.08	N/A*	($470,010)
Total	**0.98**	**1.71**	**0.28**	**N/A***	**($83,220)**
***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)[16], 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

[16] The UCT is also referred to as the Program Administrator Cost Test (PACT).

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.

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.[17]

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.[18]

[17] http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf

[18] Ibid.

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
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	1.11	2.46	0.30	1.41
Low Income	0.27	0.10	0.08	N/A*
Total	**0.98**	**1.71**	**0.28**	**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	$3,852,633	$3,502,394	$3,502,394	$4,821,706
Low Income	$168,428	$68,285	$68,285	$596,928
Total	**$4,021,061**	**$3,570,679**	**$3,570,679**	**$5,418,635**

Table 7-6: Cost-Effectiveness Costs by Sector

Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs
Residential	$3,466,442	$1,426,403	$11,836,441	$3,422,171
Low Income	$638,498	$662,514	$823,100	$523,327
Total	**$4,105,041**	**$2,089,019**	**$12,659,643**	**$3,945,498**

Table 7-7: Cost-Effectiveness Net Benefits by Sector

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits
Residential	$386,191	$2,075,991	($8,334,047)	$1,399,536
Low Income	($469,310)	($594,229)	($754,815)	$73,601
Total	**($83,220)**	**$1,481,660**	**($9,088,964)**	**$1,473,137**

APPENDIX E – 2020 PROCESS EVALUATION REPORT

CADMUS

Appendix to the 2020 Annual Conservation Report

Process Evaluation Report

April 16, 2021

Prepared for:

Avista

1411 E. Mission Avenue

Spokane, WA 99202

CADMUS

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Executive Summary

As part of the Avista 2020 demand-side management (DSM) portfolio evaluation, Cadmus conducted process evaluation activities for program year (PY) 2020. 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 and implementer staff experiences, including organizational structure, communication, 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, Multifamily, and Residential programs listed in Table 1.

Table 1. PY 2020 Process Evaluations

Program	Idaho	Washington
Nonresidential Programs		
Site Specific	✓	✓
Prescriptive [a]	✓	✓
Multifamily Programs		
Multifamily Direct Install (MFDI)	✓	✓
Multifamily Market Transformation (MFMT)	✓	
Residential		
ENERGY STAR® Homes	✓	✓
Simple Steps, Smart Savings	✓	
HVAC		✓
Water Heat		✓
Shell and Windows		✓

[a] Includes Lighting, Food Service Equipment, Green Motors Rewind, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and AirGuardian Compressed Air.

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 2020 Completed Milestones and Deliverables

Milestones and Deliverables	Completed
Document and Database Review	✓
Avista and Implementer Interviews	✓
Participant Surveys	✓
Trade Ally Interviews	
Multifamily Property Managers	✓
Builders	✓

Key Conclusions

Nonresidential

- **The impact of COVID-19 on project scope was minimal, but going forward there may be slight reductions in the number or scope of energy efficiency projects due to budget or staff constraints.**
  - Ten of 13 Site Specific respondents and 88% (n=59) of Prescriptive participants said COVID-19 did not create any obstacles to their 2020 project; most respondents who reported obstacles said the obstacles were minor.
  - Four of 13 Site Specific respondents and 24% of Prescriptive respondents expected reductions to budget or staff availability to support energy efficiency upgrades in PY 2021.
- **Although contractors drive a significant portion of participation, continued Avista outreach and messaging is important to support contractor sales.**
  - Eight of 15 Site Specific participants and 70% (n=63) of Prescriptive participants reported first hearing about the Avista program from a contractor, vendor, or retailer.
  - Twelve of 15 Site Specific participants and 55% (n=64) of Prescriptive participants thought the best way to learn about rebates and incentives was through Avista emails or direct mail, or communication from an Avista account representative.
- **Despite some process issues in PY 2020, participants are satisfied with the application process and the program overall.**
  - Site Specific satisfaction was lowest for process-related aspects, including submitting the rebate application (75% satisfied, n=15) and the time to process the application (87% satisfied), but 100% of respondents were satisfied with the program overall.
  - Though 14% of Prescriptive participants mentioned the application paperwork was burdensome, and 9% had some difficulty understanding requirements, 100% of participants were satisfied with the program overall, and several respondents mentioned the easy and fast process as an aspect of the program that worked well. Suggestions for process improvements were related to potential enhancements (such as a searchable database of eligible products, or chat feature for application support) rather than suggestions to correct significant problems.

Multifamily

- **MFDI: Collaborative relationships between Avista and the program implementer allowed new delivery methods and future implementation techniques to be conceptualized quickly in response to COVID-19. Open communication between the implementer and property managers ensured the quick dissemination of new implementation information to maintenance staff and tenants allowing the program to continue in PY 2020 despite challenges due to the pandemic.**
  - In response to continued COVID-19 restrictions, Avista and implementer staff developed a contactless delivery method.
  - Due to low uptake in the first post-COVID-19 implementation phase, Avista and the implementer adjusted the program to increase participation and measure installation by limiting measures and working with property managers.
- **MFDI: Property managers were satisfied with the program but suggested some tenants were not satisfied with all the measures included in the program. Additionally, some tenants did not install measures that were difficult to install or for which they did not have appropriate tools.**
  - Four of five property managers (4 of 5) were *very satisfied* with their MFDI program experience overall.
  - Two property managers reported tenants were not satisfied with faucet aerators and kitchen aerators due to low water pressure and appearance while three property managers reported tenants were dissatisfied with showerheads due to restricted water flow.
  - One property manager reported that tenants' participating in Phase 1 were *not at all satisfied* with installation and educational materials provided by Avista.
- **MFDI: The reliance of current data tracking on tenants' willingness to return uninstalled or unused equipment, together with low recovery rates, may be a contributing factor to minor inconsistencies in measure-level data.**
  - The drop-off delivery phases relied heavily on documentation filled out by maintenance staff and tenants detailing the location and type and quantity of both installed and removed measures. The implementer noted during the drop-off phases difficulty in tracking measure installation locations in tenants' units without the presence of a field technician to document measure implementation.
- **MFMT: Overall, the MFMT program was successful meeting the energy savings goal and achieving high program satisfaction.**
  - The program surpassed its electric savings goal of 476 MWh per year for PY 2020.
  - Builders have told Avista staff that they appreciate the incentive because it allows them to install natural gas appliances which provides a competitive advantage, since they say natural gas appliances are more attractive and can help increase the value of units.
  - The builder who completed a survey said they were *very satisfied* with the program and planned to participate to a greater extent in 2021.

- **The MFMT program has had success working with HVAC installers to help market the program, though more can be done to increase marketing efforts and participation, as a result.**
  - Avista reported success working with HVAC installers to help promote the program. Staff said this is a beneficial relationship as the HVAC installers are provided with additional work and the program with more participants.
  - Avista reported that there used to be a flyer handed out as promotional material for the program, though it is no longer used. Staff also said there is no current way in which they monitor effectiveness of their marketing efforts and do not cross-promote the MFMT program with other Avista programs.

Residential

- **Like some utility energy efficiency programs, the ENERGY STAR Homes program was negatively affected by the COVID-19 pandemic.**
  - Avista achieved its target number of rebates for electric and electric/natural gas homes in Idaho but otherwise fell short of other state-specific, fuel-specific, and overall goals. The pandemic forced local manufactured homes dealers to close down, slowed the ENERGY STAR certification process for newly constructed manufactured homes, and, as was seen nationally, likely increased income insecurity among Avista's target customer base.
- **Contractors remain an important way to learn about the Residential programs but survey respondents also indicated an increased interest in learning about the programs through email from Avista.**
  - The share of respondents who learned about Avista's program through contractors increased from 38% in PY 2019 to 52% in PY 2020. Additionally, 15% of PY 2020 respondents said that contractors would be the best way for Avista to inform them about energy efficiency, compared to 9% in PY 2019.
  - The most common way PY 2020 respondents would like for Avista to inform them about energy efficiency is through email from Avista (37%). This percentage increased from 10% in PY 2019 respondents, indicating more interest in this method of communication.
- **Saving money or energy are key drivers of motivation to participate in the program.**
  - Eighty-eight percent of PY 2020 respondents said that saving money or saving energy motivated them to participate, and 96% of respondents listed energy savings, rebates, or lower operating costs as a benefit of participating in the program.
- **Participants remain highly satisfied with most aspects of the program.**
  - More than 99% of respondents were *very satisfied* or *somewhat satisfied* with their interactions with Avista staff and the program overall, as well as with the time it took to receive the rebate, the application process, and their new energy-saving equipment.
- **Information from equipment retailers or installers heavily influenced respondents' decision to participate.**

- Ninety-six percent of respondents rated this information as *very important* or *somewhat important*, compared to information about the equipment from friends and relatives, which 67% of respondents rated as *very important* or *somewhat important.*

Third-Party Implementer

- **The implementer responded to the COVID-19 pandemic thoughtfully, which enabled the program to continue to perform well despite the circumstances until its termination in September 2020.**
  - The implementer let retailers permit or deny store visits from implementation field staff, allowed field staff the flexibility to reschedule store visits, and conducted virtual store visits to educate store associates about the program and products (such as LEDs) like it typically would. Avista and the implementer also scaled back marketing and outreach efforts and allowed each retail location to tailor marketing, including point-of-purchase materials provided by the implementer, to their individual needs.
- **Avista and the implementer faced uncertainty with the repeal of the Energy Independence and Security Act, which led to the Simple Steps, Smart Savings program being implemented differently in Washington.**
  - The implementer offered rebates for clothes washers in Washington and for LEDs, showerheads, and clothes washers in Idaho. Avista did not set goals for clothes washers in Washington or for LEDs in Idaho.
- **Avista observed unexpectedly low throughput for clothes washers, which the implementer attributed to the challenge it faced when recruiting retail locations to participate.**
  - Despite showing a willingness to participate, some retail locations for franchised and individually owned stores like Ace Hardware could not offer program rebates because of a lack of communication/direction from their corporate offices. Thus, fewer retailers offered buy-downs for clothes washers, and fewer customers obtained clothes washer rebates.

Recommendations

Nonresidential

Nonresidential Recommendation 1: Develop tools to help participants sort through options and scope eligible projects more quickly. For example, although the Avista website currently directs customers to search for eligible lighting on the ENERGY STAR Product Finder database or DesignLights Consortium websites, both of which have advanced search functionality, the search results can be overwhelming. A resource such as an “Energy Efficiency Buying Guide” for specific products could help customers with less technical background navigate their options or evaluate and understand proposals they receive from contractors.

Nonresidential Recommendation 2: If not already doing so, use email blasts, bill inserts, and other promotional tools that are direct from Avista to its customers, and use Avista branding to promote Nonresidential programs and incentives. Participants were more likely to want communication directly from Avista than through their contractor or vendor. These marketing efforts will enhance any contractor and vendor marketing or advertising, and give sales representatives better credibility, enabling them to make more sales through the program.

Multifamily

MFDI Recommendation 1: If the MFDI program continues to request tenants install measures directly, consider offering an additional incentive such as an entry in a drawing for returning measures that are not installed and for providing information on installed measures and their location.

MFDI Recommendation 2: If the MFDI program continues to operate using the drop-off delivery method which requires tenants to install measures directly, continue focusing on simple and easy-to-install measures like LEDs. Provide easy to follow installation instructions and remind tenants of the benefits of installation in the program materials.

MFMT Recommendation 1: Develop marketing materials which can be used by HVAC contractors to help promote the MFMT program. Due to the strengthening relationships between program staff and HVAC contractors, promotional materials could be greatly beneficial to provide information about the program in instances where the contractors may encounter potential participants.

MFMT Recommendation 2: Develop strategies to evaluate the effectiveness of marketing efforts and cross-promotion with other Avista programs. In order to understand if marketing efforts are successful, evaluation standards or goals should be set to better understand what the primary forces are that drive participation to the program. Cross-promotion is also a simple and effective way to increase visibility of the program and garner interest from potential participants.

Residential

Residential Recommendation 1: If not already doing so, use email blasts, bill inserts, and other promotional tools that are direct from Avista to customers, with Avista branding, to promote Residential programs and incentives. Although most participants learned about the programs from their contractor, they were more likely to want communication directly from Avista than through their contractor or vendor. These marketing efforts will enhance any contractor and vendor marketing or advertising, and give them better credibility, enabling them to make more sales through the program.

Residential Recommendation 2: Focus program outreach on home comfort to encourage participants since this was mentioned as a motivating factor for participation.

Third-Party Implementer

Because Simple Steps, Smart Savings discontinued in PY 2020, Cadmus does not have any recommendations to make for the program.

Introduction

In program year (PY) 2020, Avista provided rebates and services to its Nonresidential and Residential electric and natural gas customers throughout its Washington and Idaho service territories. The PY 2020 portfolio process evaluation 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 2020 demand-side management (DSM) portfolio's evaluation.

Table 3. PY 2020 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 (VFDs), food service equipment, grocer, and 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. HOTSTART can provide Installation help.
Green Motor Rewind	Repair/rewind of motors	The Green Motors Practices Group (CMPG)	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.
AirGuardian [a]	Compressed air leak reduction device	Sight Energy Group	Following a compressed air audit, electric customers receive direct installation of a compressed air leak reduction device.
Multifamily			
Multifamily Direct Install (MFDI)	Lighting, water-saving measures, smart power strips, VendingMisers	SBW Consulting	Direct installation of energy-saving measures, on-site audits to identify opportunities and interest in existing Avista programs, and follow-up- visits to install supplemental lighting measures.
Multifamily Market Transformation (MFMT)	Natural gas space and water heat	Avista	New multifamily development receives incentives to install natural gas space and water heating.

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		
ENERGY STAR Homes	New ENERGY STAR manufactured homes		Home dealers promote and sell ENERGY STAR-certified manufactured homes to customers.
Residential Third-Party Implementer Programs			
Simple Steps, Smart Savings	LEDs, LED fixtures, showerheads, clothes washers	CLEAResult	Midstream program markdowns are offered for certain products in retail stores; CLEAResult receives monthly sales data and provides program support through retailer visits.

[a] Cadmus planned to evaluate the Fleet Heat and AirGuardian programs, but there were no participants in 2020.

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
- Market barriers
- Program impacts on the market
- Future program changes, including redesigns

Table 4. PY 2020 Stakeholder Interviews

Program	Avista Staff	Implementer Staff
Nonresidential Programs		
Site Specific	✓	N/A
Prescriptive [a]	–	N/A
Multifamily Programs		
Multifamily Direct Install	✓	✓
Multifamily Market Transformation	✓	N/A
Residential Programs		
ENERGY STAR® Homes	✓	N/A
HVAC	–	
Water Heat	–	
Shell and Windows	–	
Simple Steps, Smart Savings	✓	✓

[a] Includes Lighting, Food Service Equipment, Green Motors Rewind, Commercial HVAC, Insulation, HVAC Motor Controls, Grocer, Fleet Heat, and AirGuardian Compressed Air.

Market Actor Ally Interviews

In PY 2020, Cadmus conducted telephone interviews with various market actors to assess levels of program awareness, experiences, successes, and challenges. Avista provided contact lists for each audience. Table 5 lists the program, audience, number of records provided by Avista, interview target, and number of interviews. Cadmus was unable to meet the MFDI target despite multiple attempts to contact every record and unable to meet the MFMT target due to a lower than expected population size.

Table 5. PY 2020 Trade Ally Interviews

Program	Audience	Number of Records	Target	Number of Interviews
Multifamily Direct Install	Participating Property managers	11	10	5
Multifamily Market Transformation	Participating multifamily home builders	3	5	1

Participant Surveys

Cadmus completed 119 online surveys in PY 2020 with Residential program participants in Washington and 81 online surveys in PY 2020 with Nonresidential program participants in Washington and Idaho. Cadmus relied on site visits and telephone reminder calls to increase Nonresidential survey participation. The participant survey guides gathered critical insights into participants' program journey, covering the following topics:

- Program awareness
- How respondents learned about the program
- General program participation
- Reasons for participation
- Program benefits
- Program delivery experience
- Overall program satisfaction
- Satisfaction with Avista
- Current energy-efficient behaviors and purchases
- Suggestions for program improvements

Residential Sampling

To prepare the participant contact list for the Residential survey, Cadmus removed duplicate records, records with incorrect or missing email addresses, and records selected by the Residential impact evaluator for impact analysis activities. After preparing the list, Cadmus randomly selected a sufficient number of records proportionate to participation in each of the programs to include in the sample frame. Cadmus sent an email invitation to participants included in the sample frame, followed by a reminder email. Overall, Cadmus collected 119 responses for process evaluation purposes, as shown in Table 6.

Table 6. Residential Participant Survey Sample Frame, Target, and Completes by Program

Program	Total		
	Sample Frame [a]	Target	Complete
HVAC	906	70	64
Shell and Windows	388		48
Water Heating	106		7
Total	**1,400**	**70**	**119**

[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. Cadmus sent an email invitation to a census of all participants in each program, followed by two reminder emails. To increase the number of survey responses, the field engineers urged participants to complete the survey during virtual site visits if they had not yet done so. Additionally, because of low initial participation in the Site Specific survey, Cadmus made one telephone attempt to Site Specific participants to increase participation.

As shown in Table 7, Nonresidential participants completed 81 surveys in PY 2020.

Table 7. Nonresidential Participant Survey Sample Frame, Target, and Completes by Program

Program	PY 2020 Total		
	Sample Frame [a]	Target	Completes
Nonresidential Site Specific			
Electric	64	All eligible	**14**
Gas	5		**1**
Dual	4		-
Nonresidential Prescriptive			
Lighting	750	30 to 40	**63**
Food Service Equipment	8	AMAP (between 10 and 20)	**1**
Green Motors Rewind	8		**1**
Commercial HVAC	7		-
Insulation	5		**1**
HVAC Motor Controls	1		-
Grocer	1		-
Fleet Heat	0		-
AirGuardian	0		-
Total	**853**		**81**

[a] Sample frame refers to the records available for surveys after removing duplicate records, records with only installer contact information, 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 program offers incentives for specific measures and services.

Nonresidential Site Specific Findings

This section describes the findings from 15 surveys completed with PY 2020 Site Specific participants. Where meaningful, Cadmus compares PY 2019 results to PY 2020.

Program Changes

In PY 2020, Avista made one change to the Site Specific program, transitioning to the iEnergy data tracking system. Avista now inputs all project level details, savings, payments, and sales after project approval in both iEnergy and InfoCRM. Avista plans to use iEnergy as the primary analysis and storage tool for all Site Specific projects moving forward and plans to transition to iEnergy fully by the end of 2021.

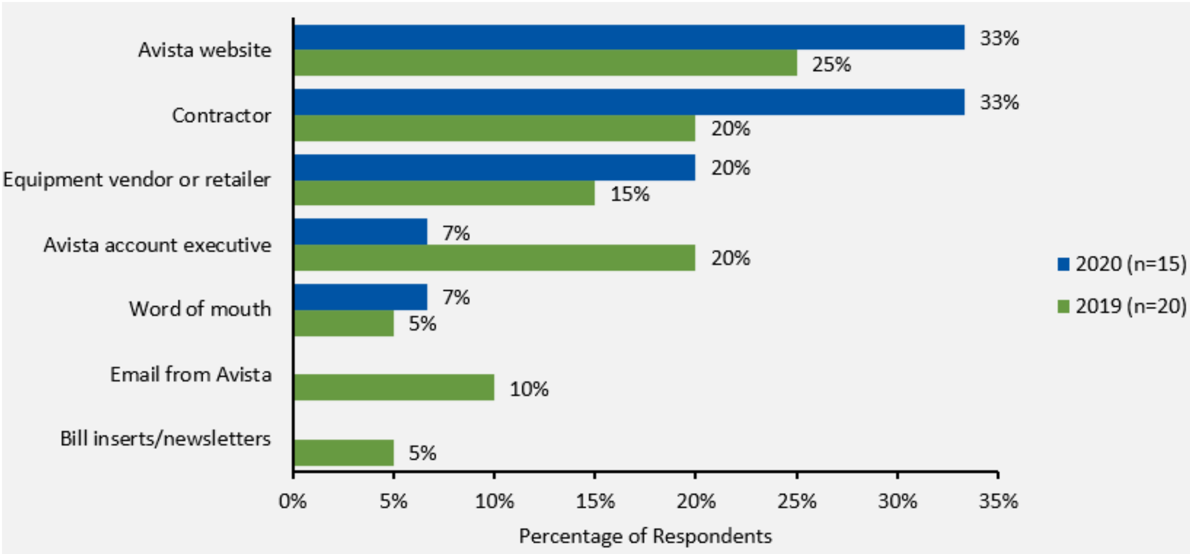
In addition to this program change, Avista specifically started targeting small businesses in rural service territories where Avista programs are less active. Avista targets rural customers through direct mail communication and informs them about the availability of energy efficiency and billing assistance services, along with other Avista resources.

The program manager did not report problems or issues in implementing the Site Specific program, other than customers were more focused on the financial viability of their businesses, due to COVID-19, instead of energy efficiency.

Customer Awareness

The PY 2020 Site Specific survey indicated that the majority of participants (10 of 14) had previously participated in an Avista energy efficiency program, which is consistent with PY 2019 results. As shown in Figure 1, survey respondents first learned about the Site Specific program through a variety of sources. The Avista website and contractors were both mentioned by 33% of PY 2020 respondents, followed by equipment vendors or retailers. PY 2020 respondents were less likely to mention contact with an Avista representative, word of mouth, or Avista direct marketing through emails or direct mail than PY 2019 respondents.

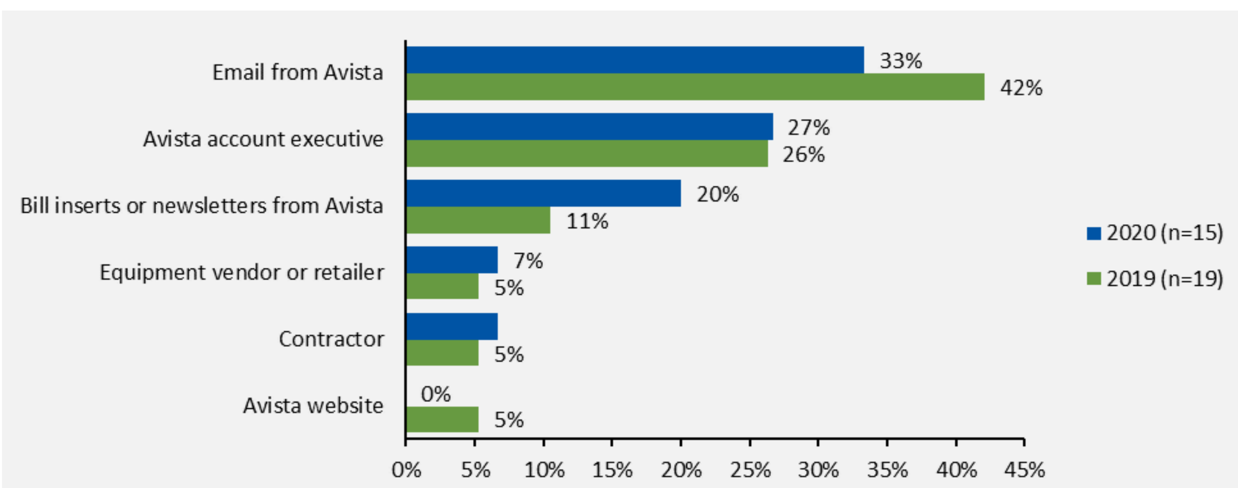
Figure 1. How Participants First Learned of Program



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 2020 respondents were most likely to select email, followed by their account executive. This is notably different from the actual channel through which they learned about the program, as discussed above. As shown in Figure 2, responses in PY 2020 closely matched responses in PY 2019.

Figure 2. How Participants Prefer to Learn of Programs and Offers

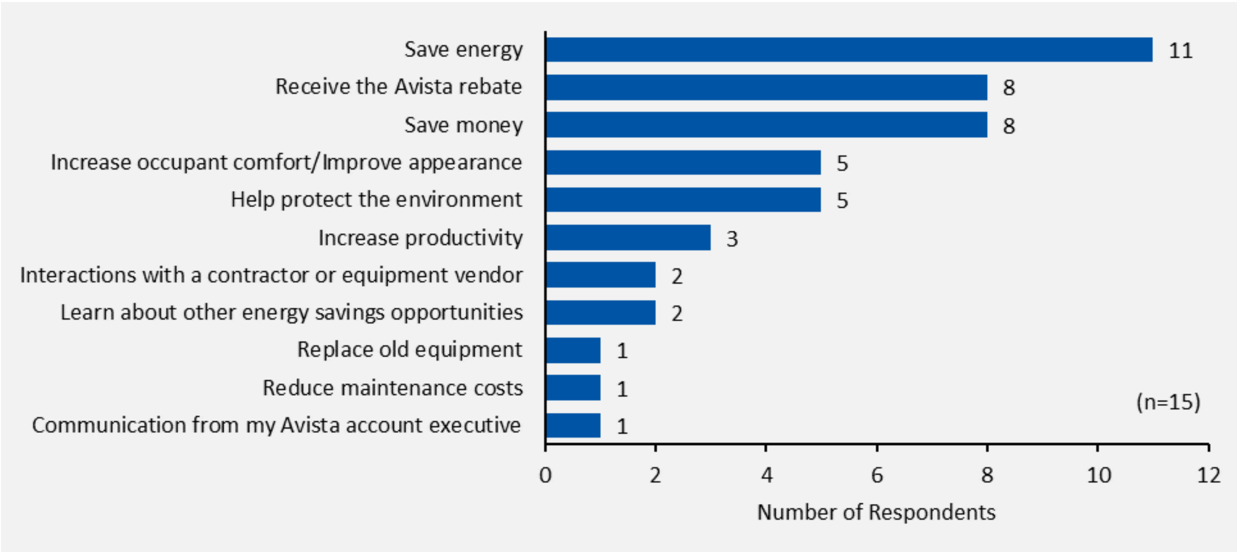


Source: Site Specific survey questions C3: "What is the best way for Avista to inform commercial customers like you about their rebates and incentives for energy efficiency improvements?"

Participation Motivations and Benefits

Figure 3 shows the distribution of motivations identified by PY 2020 Site Specific survey respondents. Participants were primarily driven by economic motivations including saving energy, taking advantage of the Avista rebate, and saving money on utility bills. Increasing occupant comfort or improving the appearance of a space and helping the environment were also frequently mentioned.

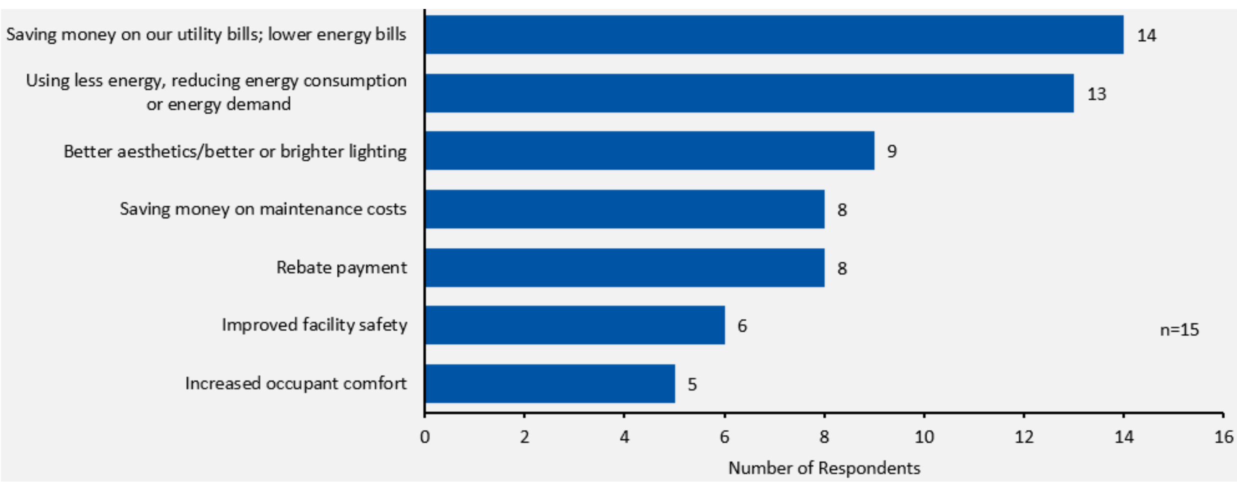
Figure 3. Site Specific Participant Motivation



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 of respondents cited using less energy and saving money on utility bills as benefits, over half of respondents noted better aesthetics from improved lighting, reduced maintenance costs, and the rebate payment.

Figure 4. Site Specific Participation Benefits



Source: Site Specific survey question C5: "What would you say are the main benefits your company has experienced as a result of participation?" Multiple responses allowed.

Customer Experience

Program Delivery

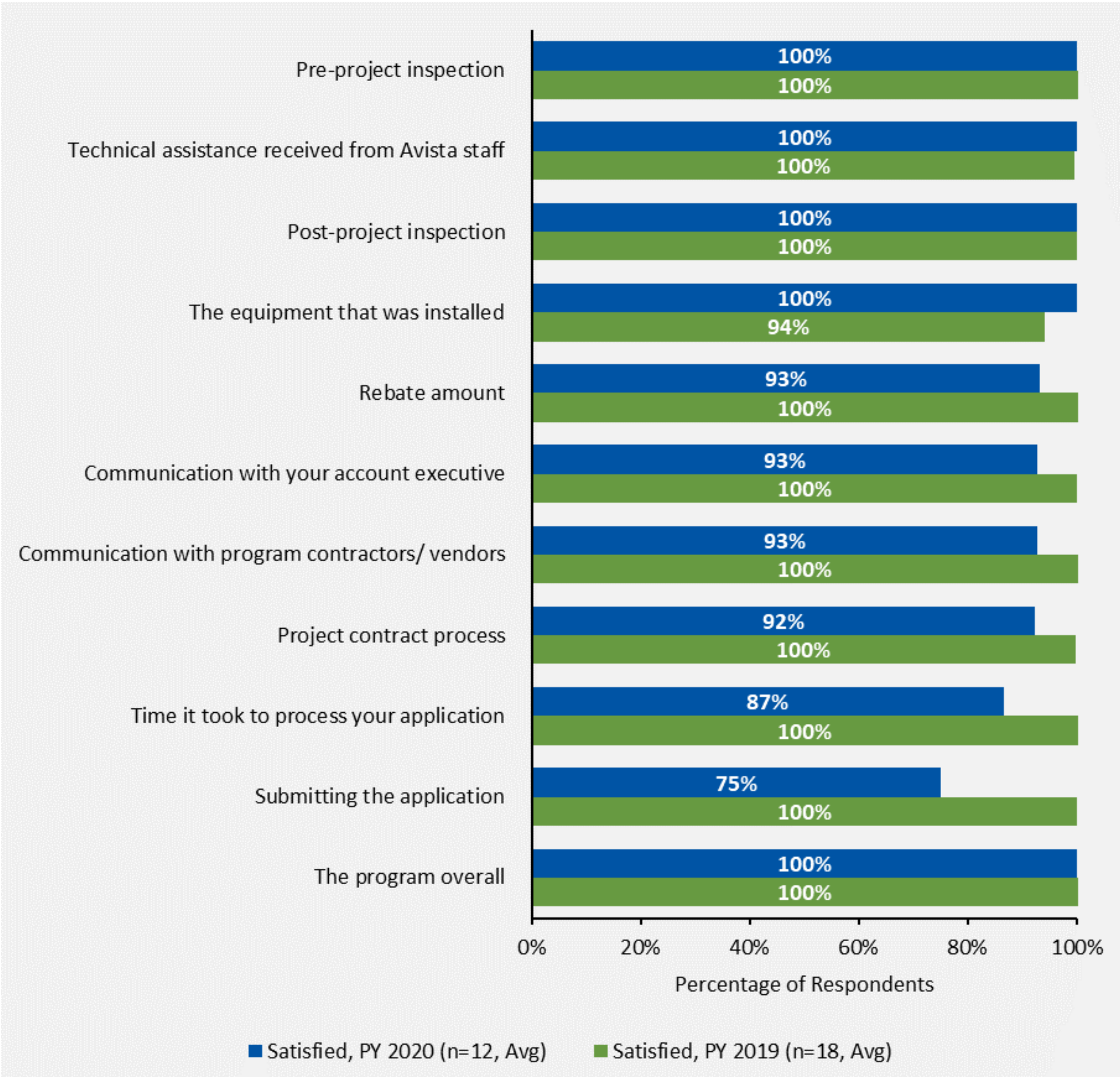
Most PY 2020 respondents (12 of 15) reported their contractor, vendor, or retailer was involved in the design or implementation of their project. Six of those respondents reported their Avista account executive was also involved. Two-thirds of those respondents (8 of 12) said the contractor, vendor, or retailer also took the lead in preparing the application, and three of those respondents received a discount from the contractor rather than receive the rebate directly.

Of the three 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 respondents said they completed the projects on their own.

Program Satisfaction

Figure 5 compares the percentage of PY 2020 respondents rating themselves *very satisfied* or *somewhat satisfied* with different aspects of the Site Specific program with responses from PY 2019. Respondents were less likely to be satisfied with several components in PY 2020 than in PY 2019, in particular with the process to submit the application and the time it took to process it. In comments explaining their satisfaction levels, one respondent had difficulty understanding the paperwork, another experienced delays after their Avista representative retired, and a third reported this was their first energy efficiency project, and they were unsure how to proceed.

Figure 5. Respondents Satisfied with Site Specific Program Components



Source: PY 2020 and 2019 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, 10 of 15 PY 2020 respondents reported experiencing program participation challenges. Another respondent reported having no challenges, while four others did not respond. In PY 2020, the most common challenge reported by participants was just learning about the program. Another two respondents reported internal challenges, related to getting approval to pursue the project and for the upfront capital expense.

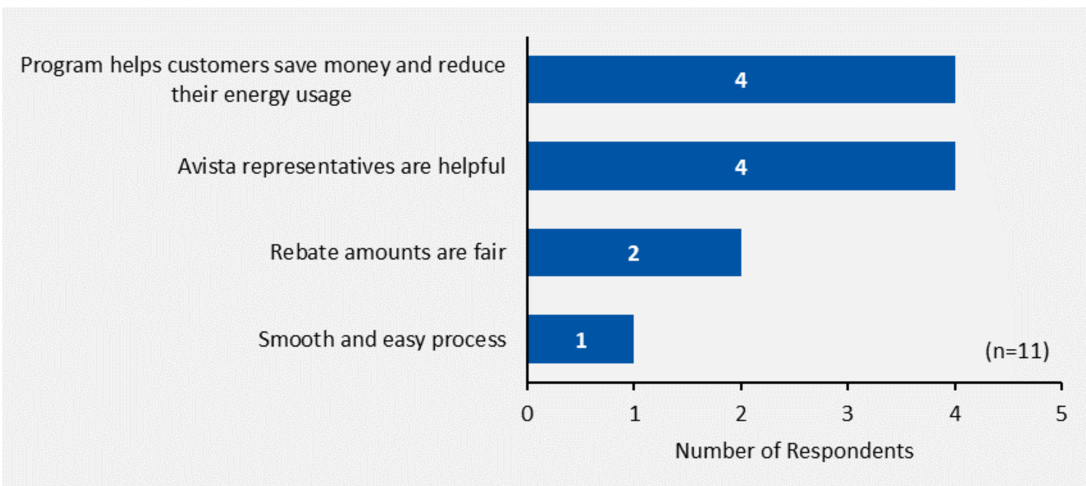
Table 8. PY 2020 Participation Challenges

Challenge	PY 2020 (n=10)
Discovering the program	3
Getting internal interest and approval	2
Finding eligible equipment	1
Understanding what equipment is eligible	1
Slow communication from Avista	1
Delay in receiving the rebate check	1
Finding a contractor willing to work with the program	1

Source: Site Specific survey question E3: "What do so see as the biggest challenges to participating in Avista's Site Specific program?"

Despite these issues, 11 PY 2020 respondents identified aspects of the program that they viewed as working well. For example, one PY 2020 Site Specific participant said, "It is great that Avista is working with business[es] and residents to reduce the electrical demand with new tech." Figure 6 shows the full break down of responses.

Figure 6. Site Specific Program Successes



Source: Site Specific survey question E5: "What would you say is working particularly well with Avista's Site Specific program?" Multiple responses allowed.

While seven PY 2020 respondents indicated they could not think of ways to improve the program, four survey respondents provided recommendations:

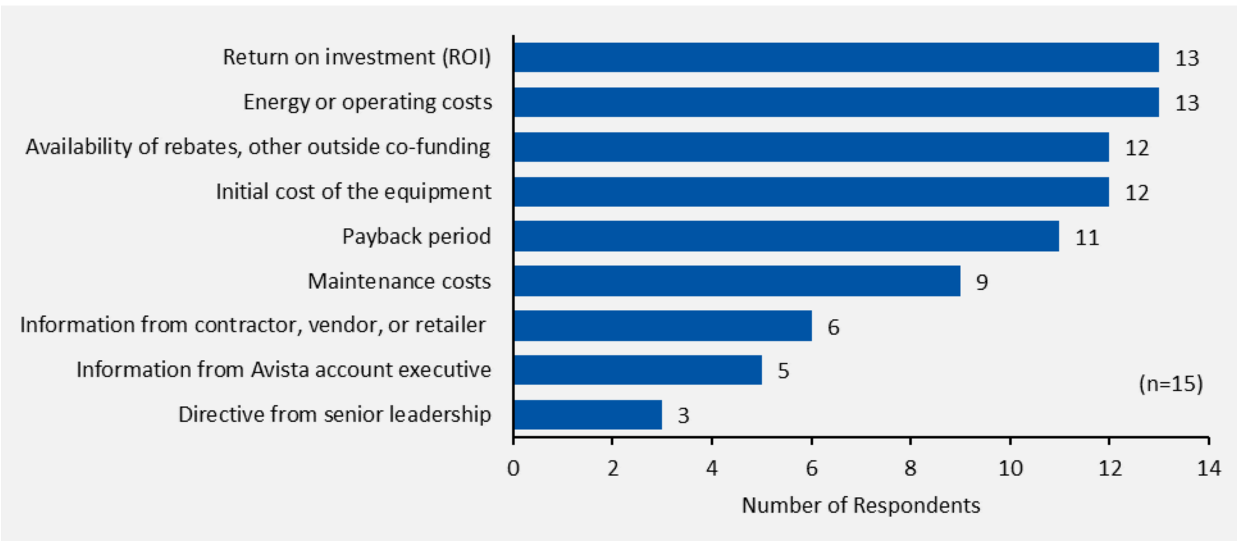
- Quicker response and interim check-ins from Avista (2 respondents)
- Increase awareness (1 respondent)
- More information about process provided upon initiating a project, including information about factors that might cause delays (1 respondent)
- Simplify the approval process (1 respondent)

Energy Efficiency Attitudes and Behaviors

Twelve of 15 PY 2020 respondents said the rebate provided by Avista was *very important* in their decision to complete their project. Another two said it was *somewhat important* and one said the rebate was *not too important* in their decision. All respondents said energy efficiency was *very* or *somewhat important* when making capital upgrades or improvements.

As shown in Figure 7, respondents most commonly selected the project's return on investment and energy or operating costs as the most important criteria in their decision to complete their project, followed closely by rebate or outside funding availability. These responses are similar to those from PY 2019.

Figure 7. 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, four PY 2020 respondents purchased energy-efficient equipment, and two adopted new energy-efficient protocols. Three respondents who mentioned purchasing new equipment had invested in lighting upgrades, and one had purchased a new ventilation system. One respondent with new protocols had changed their refrigeration setpoints, and the second had adopted a checklist for turning off equipment.

In PY 2020, participants faced potential obstacles related to COVID-19 shut-downs. However, 10 respondents said there were no impacts to their project from the pandemic. One respondent said their project scope was impacted because it was difficult to get supplies. Two respondents said their project timeline was impacted, but the delays were minor. Going forward, nine respondents thought the COVID-19 economic impacts would not affect their organization's interest in or ability to complete other energy efficiency projects, but three respondents thought there would be less budget available and one respondent thought there would be less staff time available for such projects.

Survey Respondent Profile

The majority of PY 2020 Site Specific survey respondents (13 of 15) owned their facilities, while two leased. Employee numbers at each facility ranged from six to 330, with an average of 80 per facility (n=11). Eleven of 15 facilities used gas for heating, and four used electricity. The PY 2020 sample included a range of sectors, including industrial, commercial, public, and nonprofits.

Nonresidential Prescriptive Findings

This section describes findings from 65 online surveys completed with Prescriptive participants for PY 2020. Because 63 of the 65 respondents installed lighting projects, the results primarily represent lighting participants rather than non-lighting participants. Because the PY 2020 sample did not reflect the same mix of lighting and non-lighting as the PY 2019 survey, Cadmus did not compare PY 2020 results to prior years.

Program Changes

As shown in Table 9, Avista made several changes to the lighting program in PY 2020; the PY 2020 Avista Washington Annual Conservation Plan, Appendix A, page 12, compares the PY 2019 and PY 2020 Prescriptive lighting rebates.

Table 9. Prescriptive Lighting Rebate Changes

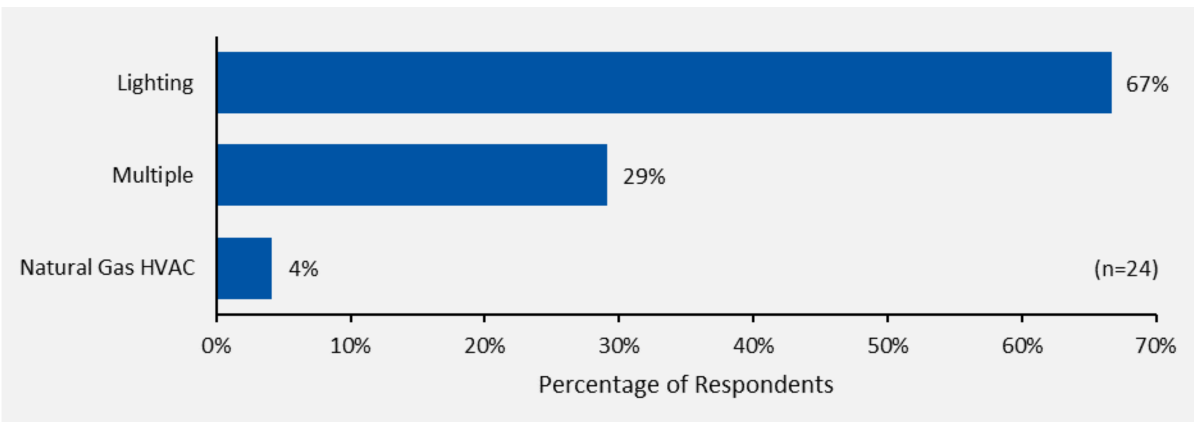
Change	PY19	PY20
Fluorescent Tubular Lamps		
T5HO four-foot TLED	$15	$12.50
T8 four-foot TLED	$6.50	$6.50
U-bend LED	$8	$10.00
T8 eight-foot TLED	$13	$11.50
Fluorescent Fixtures		
2, 3, or 4-lamp T12/T8 fixture to LED qualified 2x4 fixture	$40	$45
2-lamp T12/T8 fixture to LED qualified 2x2 fixture	$30	$20
250-watt HID fixture to ≤140-watt LED fixture or lamp	$155	$125
1,000-watt HID fixture to ≤400-watt LED fixture or lamp	$205	$185
1,000-watt HID fixture to ≤400-watt LED fixture or lamp	$460	$270
2-watt to 9-watt MR16 lamp	$10	$5.50
Occupancy sensors with built-in relays	$40	$25
70-watt to 89-watt HID fixture to ≤25-watt LED fixture, retrofit kit, or lamp	$60	$65
90-watt to 100-watt HID fixture to ≤30-watt LED fixture, retrofit kit, or lamp	$80	$85
150-watt HID fixture to ≤50-watt LED fixture, retrofit kit, or lamp	$125	$130
175-watt HID fixture to ≤100-watt LED fixture, retrofit kit, or lamp	$130	$130
250-watt HID fixture to ≤140-watt LED fixture, retrofit kit, or lamp	$140	$160
320-watt HID fixture to ≤160-watt LED fixture, retrofit kit, or lamp	$180	$195
400-watt HID fixture to ≤175-watt LED fixture, retrofit kit, or lamp	$255	$280
750-watt HID fixture to ≤300-watt LED fixture, retrofit kit, or lamp	$450	$490
1,000-watt HID fixture to ≤400-watt LED fixture, retrofit kit, or lamp	$610	$610
175-watt code HID fixture to ≤100-watt LED fixture	$130	$130
250-watt code HID fixture to ≤140-watt LED fixture	$140	$160
320-watt and 400-watt code HID fixture to ≤160-watt LED fixture	$250	$195

Change	PY19	PY20
T12 to LED sign lighting	$17/sq ft	$22/sq ft
LLLC Fixture	-	$35

Customer Awareness

Just over one-half of PY 2020 survey respondents (50%, n=60) previously participated in an Avista business energy efficiency program, for a previous participation rate about equal to the PY 2019 program year (56%, n=75). Of the 31 respondents who participated previously, 24 provided details about programs in which they participated. As shown in Figure 8, most reported installing lighting, with five respondents reporting they participated multiple times in previous years, and one respondent reporting having previously upgraded a furnace.

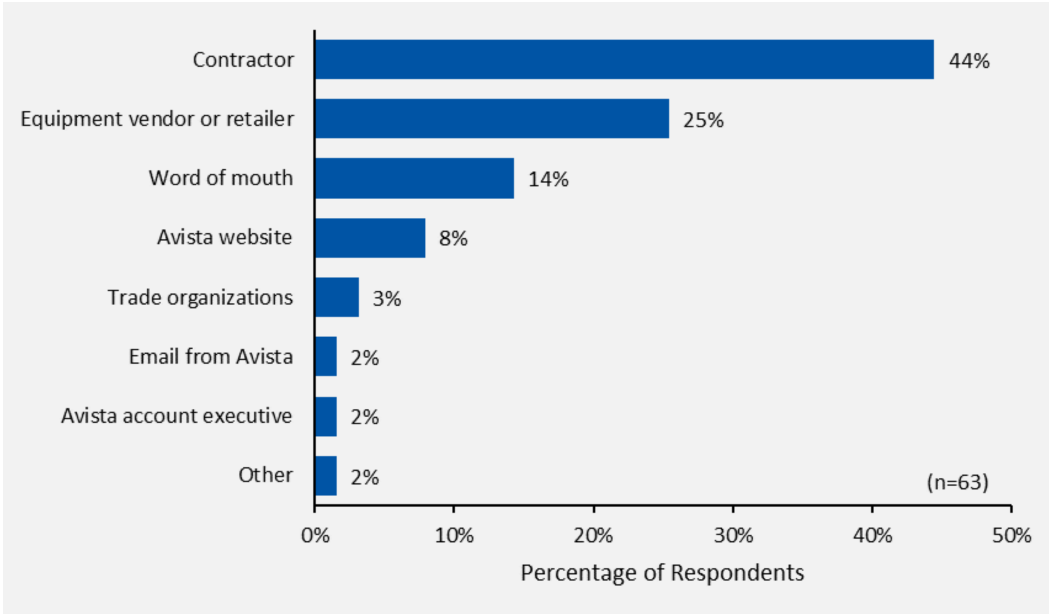
Figure 8. Equipment Installed by Previous Avista Program Participants



Source: Prescriptive survey question C1.2: "What other Avista Nonresidential energy efficiency programs has your business participated in?"

In PY 2020, respondents were most likely to say they first learned about the program from a contractor (44%, n=63), followed by a vendor or retailer (25%). Figure 9 shows the frequency that each information channel was mentioned.

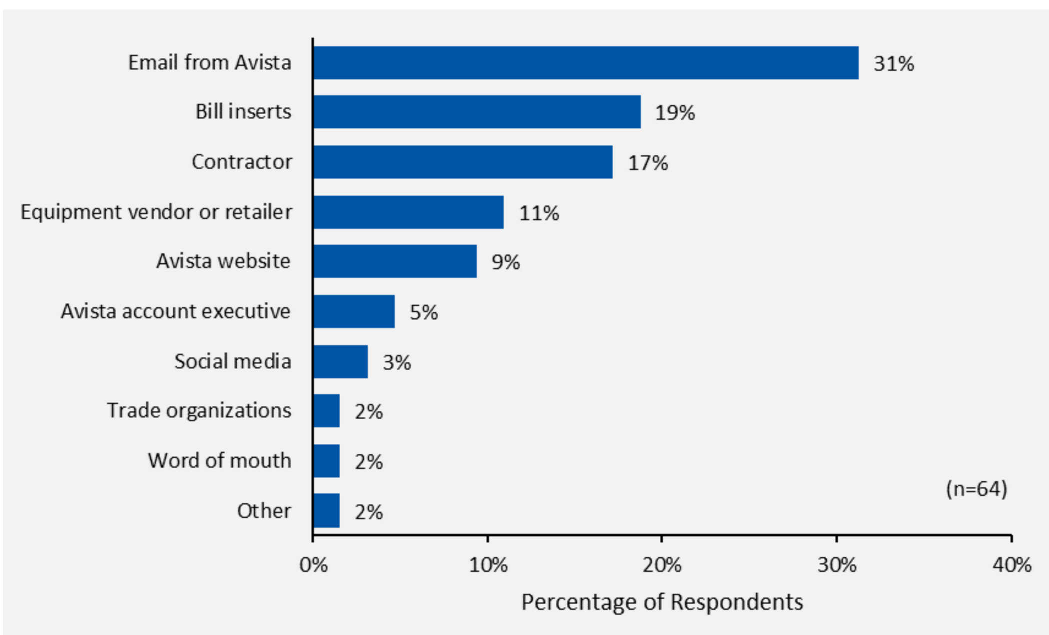
Figure 9. How Participants First Learned of Program



Source: Prescriptive survey questions C2: "How did you first hear about the program?"
Percentages may not total 100% due to rounding.

Respondents most commonly said that the best way for Avista to inform them of rebate programs was by an email from Avista (31%) or through a bill insert (19%). Figure 10 shows the distribution of preferred methods across all respondents in PY 2020.

Figure 10. How Participants Preferred to Learn of Programs and Offers

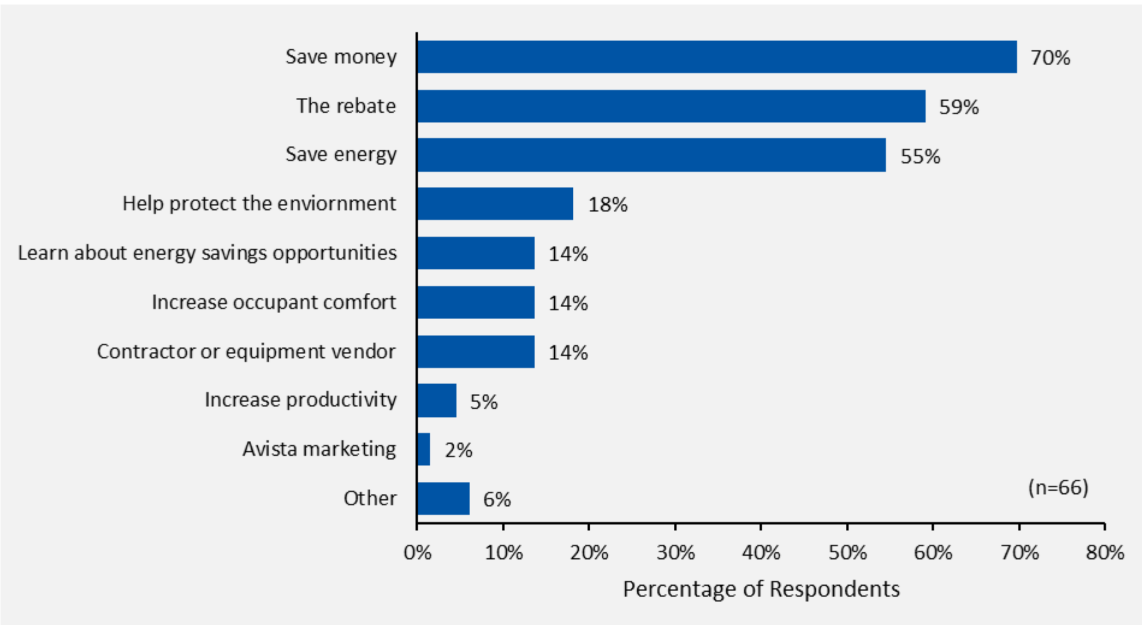


Source: Prescriptive survey question C3: "What is the best way for Avista to inform commercial customers like you about their rebates and incentives for energy efficiency improvements?"

Participation Motivations and Benefits

In PY 2020, respondents most commonly reported saving money and taking advantage of the rebate as participation motivations, followed closely by saving energy. This is similar to the PY 2019 result, except that receiving the rebate was not a survey choice in PY 2019. As shown in Figure 11, PY 2020 respondents identified several other motivations, but were less likely than PY 2019 respondents to mention wanting to increase occupant comfort, or that they were responding to a contractor or vendor recommendation. This difference is likely attributable to the lower percentage of non-lighting projects in the sample.

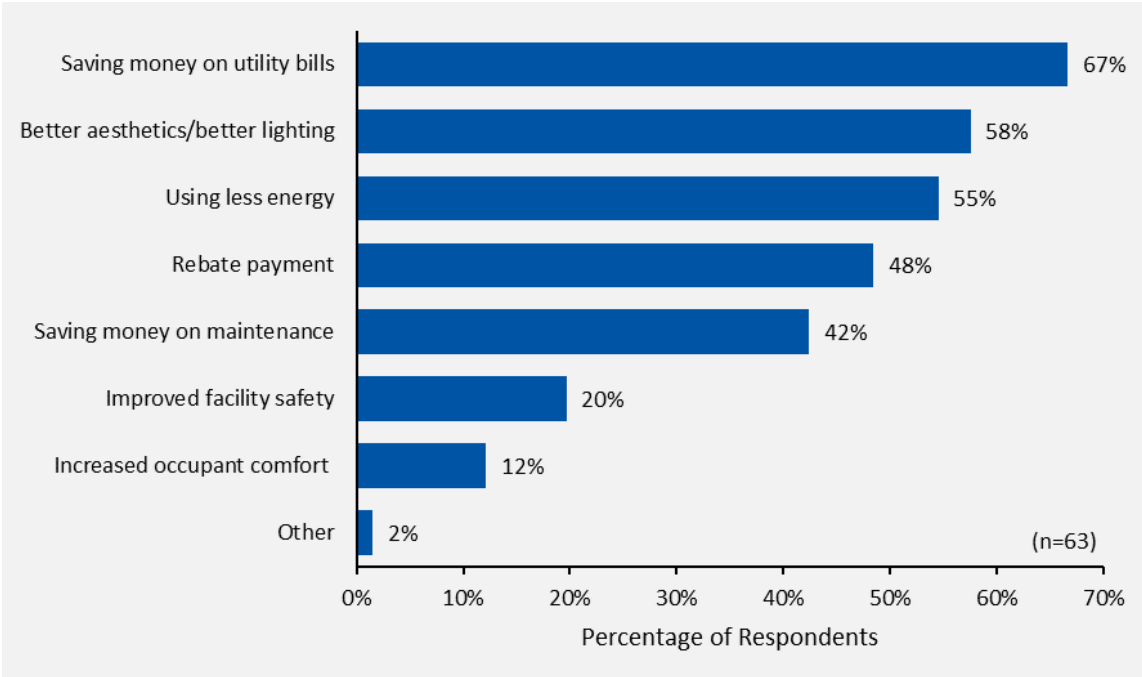
Figure 11. Prescriptive Participant Motivation



Source: Prescriptive survey question C4: "What motivated you to participate in the program?"
Multiple responses accepted.

As shown in Figure 12, PY 2020 participants' main reported benefits somewhat reflected their motivations, with saving money on utility bills being the most commonly mentioned benefit (67%, n=63), and using less energy being the third most common benefit (55%). However, while receiving the rebate was a commonly reported motivation, it was mentioned as a benefit less frequently than better aesthetics.

Figure 12. Prescriptive Participation Benefits



Source: Prescriptive survey question C5: "What would you say are the main benefits your company has experienced as a result of participation?" Multiple responses accepted.

Customer Experience

Program Delivery

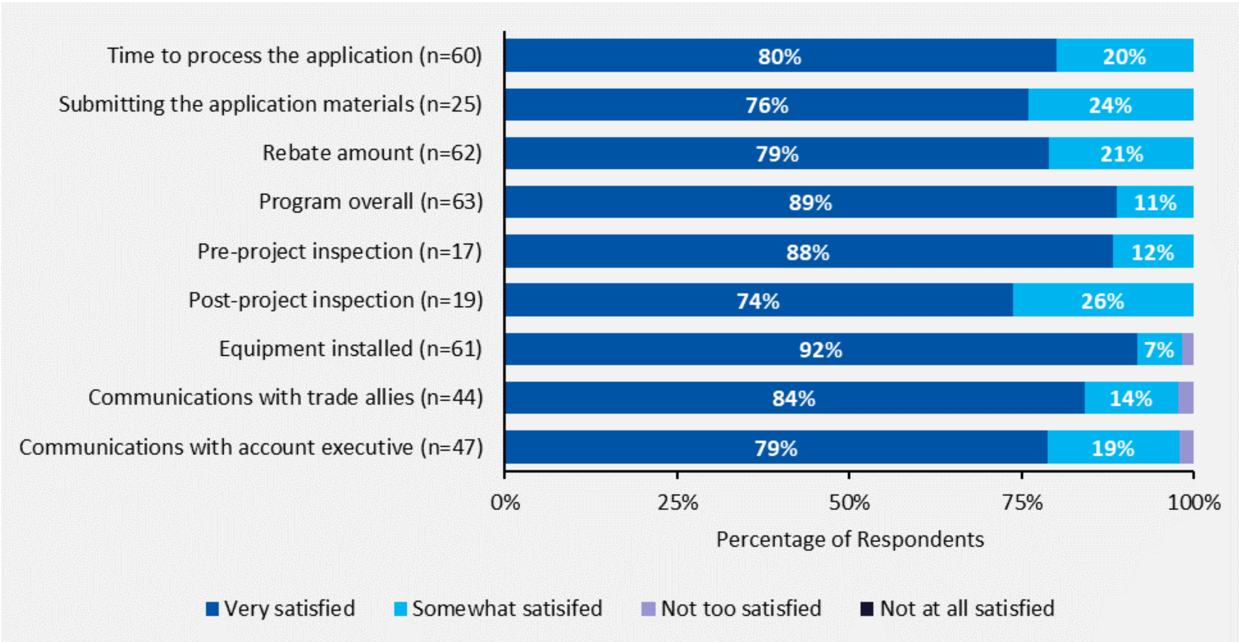
Although the majority of PY 2020 respondents reported a contractor or vendor (71%, n=66) or an Avista account executive (14%) was involved in a project's design or implementation, half of respondents (50%) took the lead on their own applications. These results are similar to PY 2019.

Most PY 2020 respondents (79%; n=47) also received their rebate checks directly, rather than as instant discounts from a contractor or vendor. Of nine PY 2020 respondents who did receive an instant discount, three said they chose the instant discount because it was easier for them, allowing them to complete projects with less cash outlay or to process less paperwork. Three other respondents chose the instant discount to reduce the amount they had to cover upfront. Another respondent wanted to avoid being responsible for any errors on the application and the last respondent wanted to reward the contractor for providing good service.

Program Satisfaction

PY 2020 respondents were nearly all *somewhat satisfied* or *very satisfied* with all aspects of the Avista program, as shown in Figure 13. Two respondents reported being *not too satisfied* with aspects of the program. One of these explained that the contractor had been difficult to work with and the process difficult to understand. The other respondent did not provide additional detail on their rating.

Figure 13. Satisfaction with Prescriptive Program Components

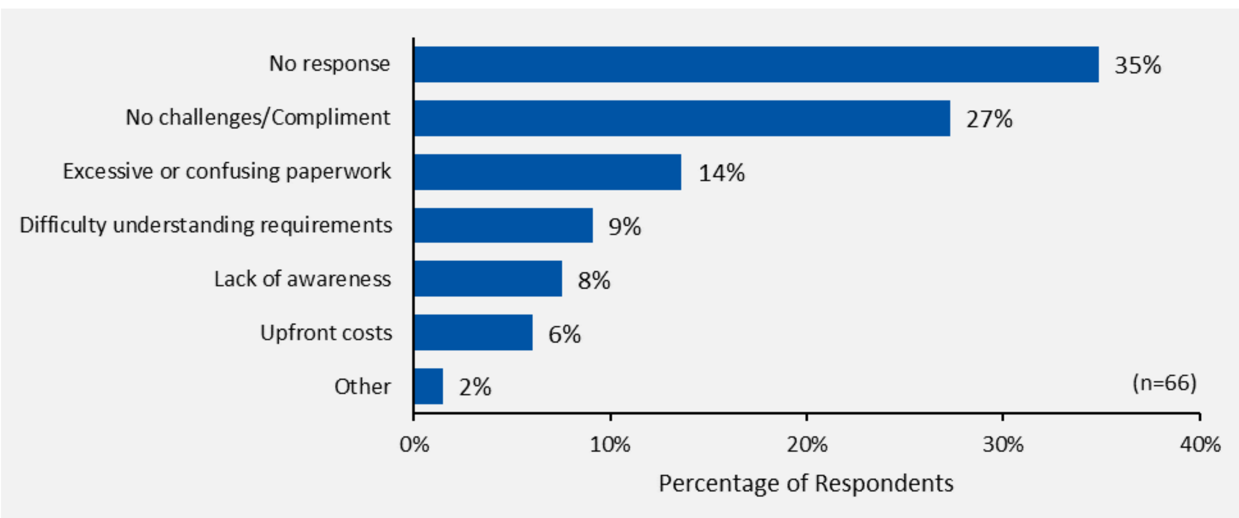


Source: Prescriptive survey questions H1: "In terms of the [PROGRAM], how satisfied were you with the following aspects? Please think about each item individually as you select your answer."

Program Challenges and Successes

When asked what challenges the program presented, 35% provided no response and 27% took the opportunity to report there were no problems, or to compliment the program. Excessive paperwork was the most common challenge reported, mentioned by 14% of respondents.

Figure 14. Participation Challenges



Source: Prescriptive survey question H9: "What do so see as the biggest challenges to participating in Avista's [PROGRAM_NAME]?"

Respondents called out several program aspects that they viewed as working well. As shown in Table 10, respondents most commonly mentioned the fast or easy application process, followed by the opportunity to save energy and money on utility bills. Several respondents who mentioned the fast process also mentioned good customer support. For example, one respondent stated, “Great customer service and fast rebate turn around.”

Table 10. Aspects of Avista Prescriptive Programs Working Well

Program Aspects	Number of Respondents
Easy/fast process	11
Saving energy and money on utility bills	10
Overall program works well	7
Access to better lighting	5
Good customer service	5
Rebate amount	5
Contractor support	2
Access to quality products	1

Source: Prescriptive survey question H11: “What would you say is working particularly well with Avista’s program?” (Multiple responses allowed; n=39)

As shown in Table 11, 16 participants provided suggestions for program improvements. The most common suggestion was to provide more information about program requirements, or better customer support. For example, one respondent suggested having a chat function for customer support, instead of just phone and email. Another person requested a searchable database for eligible products.

Table 11. Suggestions to Improve Avista Prescriptive Programs

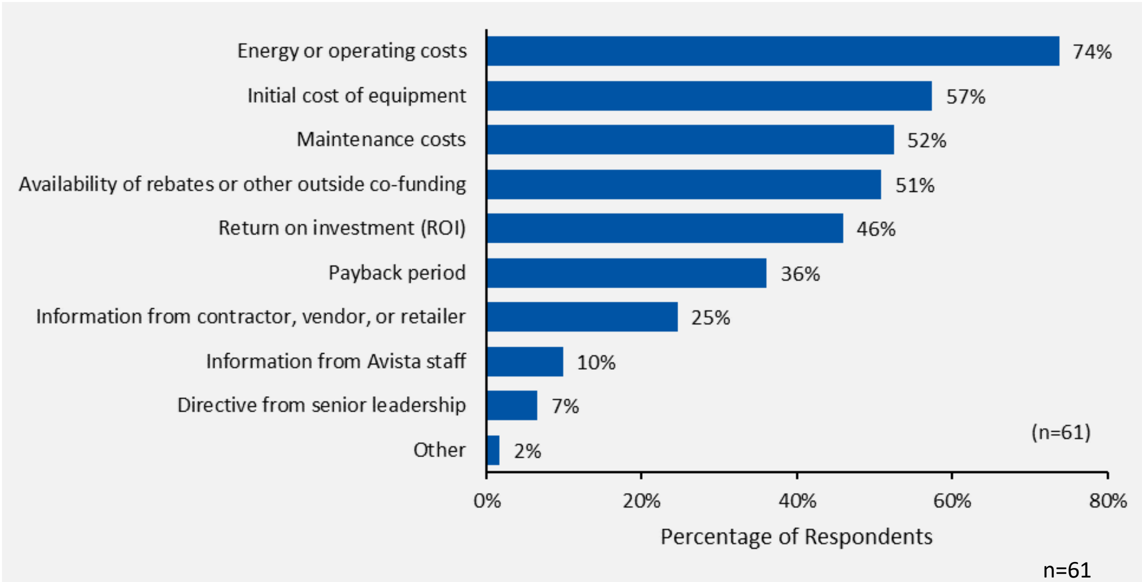
Suggestion	Number of Respondents
More information/better customer support	7
More marketing	5
Bigger rebates	3
Outreach to contractors	1

Source: Prescriptive survey question H10: “What recommendations, if any, would you make to improve the program?” (n=16)

Energy Efficiency Attitudes and Behaviors

All PY 2020 respondents (100%, n=63) considered energy efficiency either *somewhat* or *very important* to their organization when making capital upgrades or improvements. As shown in Figure 15, respondents cited energy or operating costs (74%) as the most important criteria in their decisions to undertake energy efficiency improvements, followed by initial cost of equipment (57%) and maintenance costs (52%).

Figure 15. 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, 88% (n=59) reported there was no impact, while 8% said the pandemic impacted the project timeline, and 3% said both the timeline and the scope were impacted. Those who reported impacts described them as due to the following factors (some respondents mentioned multiple factors):

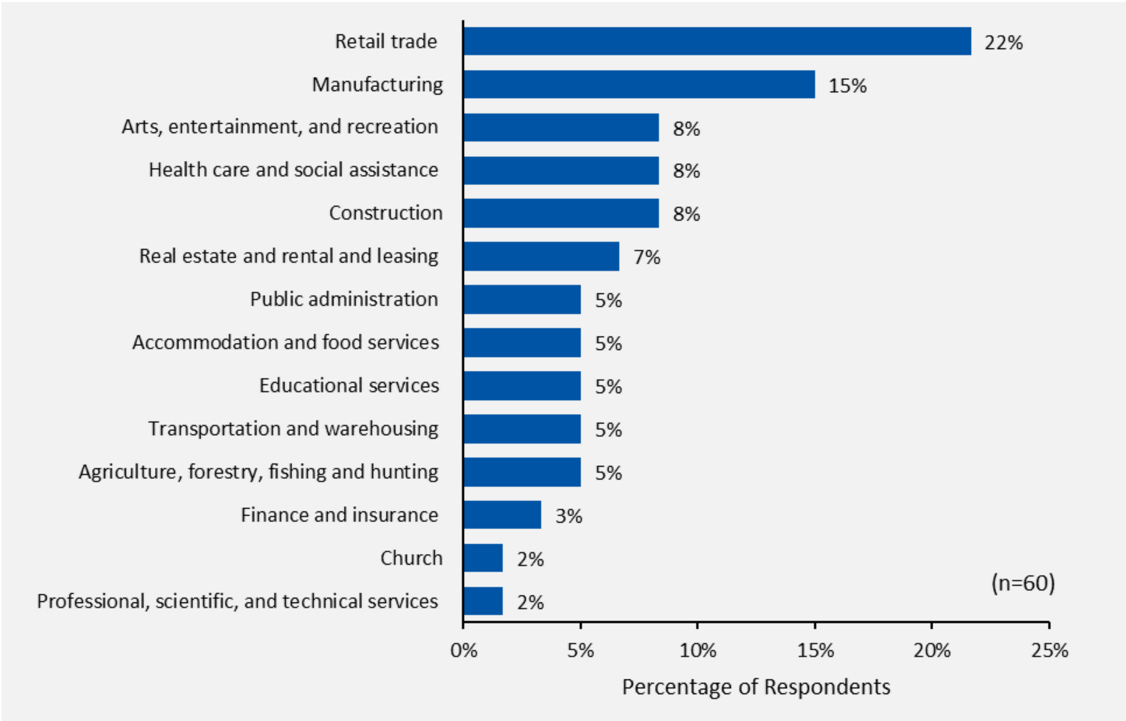
- Suspension of operations/shutdown (3 respondents)
- Shortage of materials (2 respondents)
- Additional safety requirements for contractors (1 respondent)
- Employees staying home due to illness (1 respondent)
- Short delay receiving the rebate (1 respondent)

When asked how their interest in energy efficiency projects will be impacted by COVID-19 going forward, 64% (n=55) said they expected no change relative to before the pandemic. The second most common response was that respondents expected to have less budget available to pay for projects (24%). However, 11% expected their organization to have more interest in cost-cutting projects such as energy efficiency upgrades.

Survey Respondent Profiles

Most PY 2020 survey respondents reported natural gas as their primary heating fuel (69%; n=54); 76% owned their facilities. Most respondents did not provide their facilities' square footage, but of the 28 who did respond, sizes ranged from 2,000 to 200,000 square feet, with an average of 25,500 square feet (n=28). The number of people employed at the project site ranged from 0 to 200, with an average of 28 employees (n=44). Figure 16 shows respondents' organization types. Retail trade, followed by manufacturing were the most common types.

Figure 16. PY 2020 Prescriptive Survey Sample Organization Types



Source: Prescriptive survey question J1: "What is the primary industry of your organization?"

Nonresidential Conclusions and Recommendations

Conclusions and recommendations for the Nonresidential programs are presented in this section.

Nonresidential Conclusions

- **The impact of COVID-19 on project scope was minimal, but going forward there may be slight reductions in the number or scope of energy efficiency projects due to budget or staff constraints.**
  - Ten of 13 Site Specific respondents and 88% (n=59) of Prescriptive participants said COVID-19 did not create any obstacles to their 2020 project; most respondents who reported obstacles said the obstacles were minor.
  - Four of 13 Site Specific respondents and 24% of Prescriptive respondents expected reductions to budget or staff availability to support energy efficiency upgrades in PY 2021.
- **Although contractors drive a significant portion of participation, continued Avista outreach and messaging is important to support contractor sales.**
  - Eight of 15 Site Specific participants and 70% (n=63) of Prescriptive participants reported first hearing about the Avista program from a contractor, vendor, or retailer.

    - Twelve of 15 Site Specific participants and 55% (n=64) of Prescriptive participants thought the best way to learn about rebates and incentives was through Avista emails or direct mail, or communication from an Avista account representative.

- **Despite some process issues in PY 2020, participants are satisfied with the application process and the program overall.**
    - Site Specific satisfaction was lowest for process-related aspects, including submitting the rebate application (75% satisfied, n=15) and the time to process the application (87% satisfied), but 100% of respondents were satisfied with the program overall.
    - Though 14% of Prescriptive participants mentioned the application paperwork was burdensome, and 9% had some difficulty understanding requirements, 100% of participants were satisfied with the program overall, and several respondents mentioned the easy and fast process as an aspect of the program that worked well. Suggestions for process improvements were related to potential enhancements (such as a searchable database of eligible products, or chat feature for application support) rather than suggestions to correct significant problems.

Nonresidential Recommendations

Nonresidential Recommendation 1: Develop tools to help participants sort through options and scope eligible projects more quickly. For example, although the Avista website currently directs customers to search for eligible lighting on the ENERGY STAR Product Finder database or DesignLights Consortium websites, both of which have advanced search functionality, the search results can be overwhelming. A resource such as an “Energy Efficiency Buying Guide” for specific products could help customers with less technical background navigate their options or evaluate and understand proposals they receive from contractors.

Nonresidential Recommendation 2: If not already doing so, use email blasts, bill inserts, and other promotional tools that are direct from Avista to its customers, and use Avista branding to promote Nonresidential programs and incentives. Participants were more likely to want communication directly from Avista than through their contractor or vendor. These marketing efforts will enhance any contractor and vendor marketing or advertising, and give sales representatives better credibility, enabling them to make more sales through the program.

Multifamily Programs

This section focuses on two Multifamily programs: Multifamily Direct Install (MFDI) and Multifamily Market Transformation (MFMT). The MFDI program provides energy efficiency measures through a direct-install phase and an optional supplemental phase; however, due to the COVID-19 pandemic, Avista adjusted the program to a contactless delivery method midway through the year. The MFMT program provides incentives for natural gas space and water heating equipment in new multifamily developments.

Multifamily Direct Install Program Findings

The MFDI program typically consists of a direct-install phase that includes energy efficiency measures, such as faucet aerators, kitchen aerators, LEDs, Tier I smart power strips, and VendingMisers.[1] However, due to COVID-19, Avista changed the delivery mechanism midyear to a contactless model which is addressed in the next section.

An optional supplemental lighting phase typically follows, in which SBW Consulting offers lighting upgrades in facilities' common areas. Various lighting contractors perform an audit and provide SBW with the best lighting retrofit options.

Cadmus conducted stakeholder interviews with Avista program and implementation staff, in addition to five phone interviews with multifamily property managers who participated in the program in PY 2020.

Stakeholder Interviews

In January 2021, Cadmus interviewed Avista and program implementation staff about the MFDI program. Consistent with previous years, the program implementer, SBW, is responsible for recruiting and treating multifamily units and due to a robust participant pipeline no additional marketing was needed in 2020. The implementer said that, due to COVID-19 and the temporary suspension of the program, multiple properties were unable to participate. Irrespective of the pandemic and program suspension, the implementer noted participation interest from qualifying properties was high.

Program Implementation

Direct Install. As a result of the COVID-19 shutdown, Avista temporarily suspended the program in mid-March, as implementation staff were barred from entering tenant units. The program remained in a sustained critical phase through July 2020. In response to continued COVID-19 restrictions, Avista and implementer staff developed two drop-off pilot concepts. The rest of the report refers to the drop-off pilot concepts as Phase 1 and Phase 2.

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1 Devices that can be installed on beverage vending machines that use a motion sensor to determine when the machine should be powered on and off. The device measures ambient room temperatures every few hours to determine how much power to utilize.

Phase 1 targeted smaller multifamily properties in Avista's service territories. SBW provided property managers with drop-off kits that included LEDs, faucet aerators, kitchen aerators, showerheads, installation instructions and notices, a return equipment bag, and additional documentation explaining the program. SBW instructed property staff to leave drop-off kits outside of tenants' units and ask tenants to install the measures themselves. Avista and the implementer reported low uptake and difficulty recovering unused or uninstalled measures.

Phase 2 was a hybrid model that targeted three additional facilities. Avista provided property managers with drop-off kits that included LEDs, faucet aerators, kitchen aerators, installation instructions and notices, and documentation explaining the program. Property managers could install measures in tenants' units using facility staff or instruct tenants to install the drop-off kit measures themselves. The implementer reported greater uptake during Phase 2 and attributed this to better communication with facility staff. Avista changed program documentation in drop-off kits to emphasize *item exchange*, which led to an increase in recovery of unused or uninstalled measures.

Supplemental Lighting. In addition to the direct-install phases, Avista and the implementer offered a supplemental lighting phase, during which installers, hired by the implementer, revisited multifamily properties to install additional common area lighting for property managers expressing interest. Eligibility requirements included the following: the property must be an Avista electric customer, lighting must be 24/7, and supplemental lighting must be deemed cost-effective. Pre-COVID-19, while completing the direct install of measures, the implementer identified and reviewed opportunities for common area lighting with Avista and participating properties, all subject to Avista's approval. If approved by Avista, a subcontractor later returned to the property to install the lighting.

In response to COVID-19, Avista temporarily suspended the supplemental lighting phase. Avista completed eligible projects with supplemental exterior lighting and did not pursue any mixed interior and exterior supplemental lighting projects. Avista modified eligibility for the supplemental lighting phase to only include exterior common area lighting projects in 2021.

Communication. Throughout PY 2020, Avista and the implementer met monthly to discuss program progress, address program issues, and conceptualize new delivery methods in response to COVID-19. Avista noted there was an open line of communication with the implementer and both called impromptu meetings as necessary. The implementer expressed gratitude for Avista's flexibility during the pandemic and noted a strong sense of partnership.

Data tracking. The drop-off phases posed an issue for Avista and implementer staff, as implementer staff were no longer able to verify where or if measures were installed. Avista and the implementer relied on tenants to return unused or uninstalled measures to track installation. Avista reported high variability across participating properties in terms of returned measures. The implementer reported difficulty in collecting detailed measure level data and suggested low measure return rates exacerbated this issue.

Tenant installation. Avista mentioned that some tenants participating in Phase 1 and Phase 2 of the drop-off pilot were unable to, or did not have the necessary equipment to, properly install measures.

Aerators and showerheads saw the lowest uptake in PY 2020 and Avista attributed this to lack of installation knowledge and necessary tools. Due to COVID-19 restrictions, implementer staff were unable to conduct quality control checks to determine whether measures were installed correctly.

Future Plans. Avista and the implementer are considering an exchange-based delivery system for PY 2021. The exchange pilot model encourages participating tenants to return uninstalled or unused equipment and allows the implementer to track measure-level details with greater accuracy. The exchange pilot will offer LEDs only, and implementer staff will pre-audit the property to gauge compatible offerings. A facility manager or SBW staff member will be on site with an assortment of lighting products and ask tenants to remove outdated bulbs from their units and deliver them to the exchange. Upon exchange, tenants will receive LEDs compatible with their pre-existing fixtures. The process allows for social distancing, proof of exchange, enhanced data tracking, and enables staff to give tenants installation and educational guidance.

In PY 2021, showerheads will no longer be offered through the program. Avista is planning to suspend the offering of faucet and kitchen aerators in PY 2021, but will consider re-integrating these measures into the program if the pre-COVID-19 delivery model is reinstated.

Participant Interviews

In February and March of 2021, Cadmus interviewed five multifamily property managers who participated in the MFDI program to understand their awareness of and satisfaction with the program, identify the program's challenges and successes, and assess its influence on other energy-saving behaviors. The five property managers had not participated in the program in the past and attributed this to lack of awareness. Of the five property managers who participated, two were through the initial direct install phase, one was through Phase 1, and two were through Phase 2. Participating multifamily residences could have the following measures installed:

- Faucet aerators
- LEDs (indoor)
- Kitchen aerators
- Showerheads

Consistent with PY 2019, the implementer no longer offered the following in PY 2020: water heater temperature assessments, water heater blanket installs, water heater pipe wrap installs, shower valves with automatic temperature shut-offs, or smart plugs. Avista reported VendingMisers and smart power strips were offered where possible in the initial direct install phase pre-COVID-19, but both measures were not included in Phase 1 or Phase 2.

Awareness and Motivation

Two property managers said they learned about the program from the implementer, two learned about the program through fliers mailed by Avista, and one heard of the program through word of mouth.

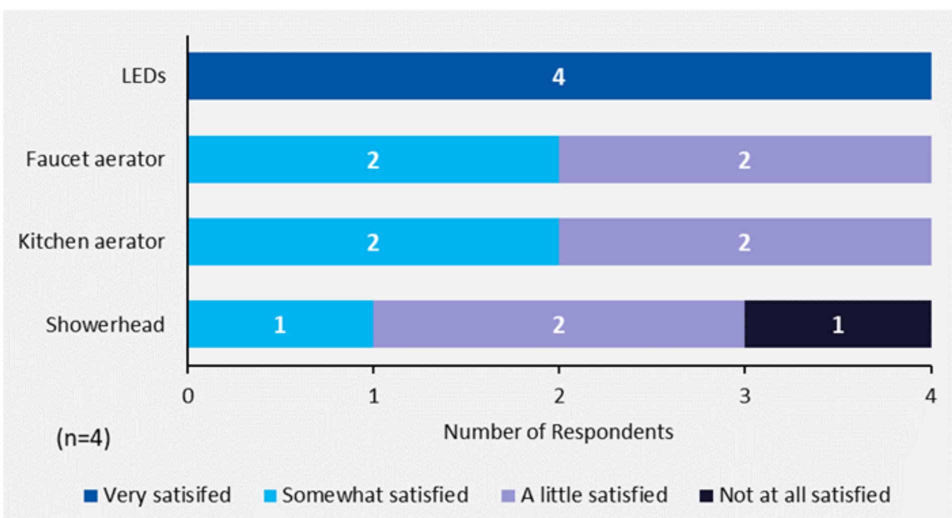
With regards to energy savings, three property managers said Avista or the implementer usually informed them of ways to save in their buildings, one property manager said he uses past experiences to inform them of ways to save energy, and the remaining property manager reported hearing little about energy-saving opportunities as a result of being recently hired. These results were similar to PY 2019 findings.

Measure Satisfaction

In terms of tenant satisfaction, all property managers reported that their tenants were *very satisfied* with the LEDs, as shown in Figure 17. One property manager reported not receiving tenant feedback about satisfaction with installed measures. Tenant satisfaction with LEDs was consistent across the 2019 and 2020 program years. Unlike PY 2019, when most tenants were *very satisfied* with program measures, in PY 2020, multiple tenants expressed dissatisfaction with the faucet aerators, kitchen aerators, and showerheads.

Two property managers reported tenants were *a little satisfied* with faucet aerators and kitchen aerators due to low water pressure and the aesthetically displeasing appearance. Three property managers reported tenants were dissatisfied with showerheads due to restricted water flow, of which two were *a little satisfied* and one was *not at all satisfied*. One property manager suggested that tenants with no obligation to pay their water bill were uninterested in installing aerators or showerheads, and instead preferred installing LEDs.

Figure 17. Satisfaction with Program Measures, PY 2020



Source: MFDI Program Participant Interview, Question C1:
"In your perspective (given your interactions with them), are your tenants very satisfied, somewhat satisfied, a little satisfied, or not at all satisfied with their new…?"

Of the four PY 2020 property managers who participated in the supplemental lighting phase, all were *very satisfied* with the new outdoor lighting. When asked about tenant feedback, three did not report tenant issues or complaints. One reported that tenants provided positive feedback, such as being able to see clearly at night.

Program Delivery

Cadmus asked property managers whether implementer staff, maintenance staff, or tenants installed program measures. Two property managers who participated in the program pre-COVID-19 reported SBW staff installed energy efficiency measures while being accompanied by maintenance staff. In addition, two property managers reported maintenance staff installed measures. Both property managers who participated in Phase 2 were *very satisfied* with the instructional materials provided by SBW and reported no issues during the installation process. The property manager who participated in Phase 1 reported tenants were uninterested in the program and *not at all satisfied* with the installation instructions and educational material. This property manager said, “Because they’re renters, many of the tenants didn’t care as much to install the measures. The educational materials and installation instructions didn’t provide enough information to show tenants how these measures will save them money and energy. I talked with one of the tenants at C*** Apartments, and he commented on how he didn’t look through the bag that Avista provided. He left the drop-off kit in the closet.”

All three property managers who participated in either Phase 1 or 2 were *very satisfied* with the unused or uninstalled equipment pick-up process.

Program Satisfaction

Consistent with PY 2019, most property managers (4 of 5) were *very satisfied* with their MFDI program experience overall. One property manager was *a little satisfied* with the additional time that resulted from tenant installation and suggested changing program delivery to maintenance staff installation only.

Four property managers who received supplemental lighting addressed questions about their satisfaction with this program phase. All supplemental lighting participants reported being *very satisfied* with the contractors’ professionalism, the time required to complete the installations, the quality of outdoor lighting, and the scheduling process.

Participation Barriers

As in previous years, property managers did not report any barriers to program participation in the direct install portion of the program.

In PY 2020, one property manager was unaware of the supplemental lighting phase and expressed interest in pursuing a common area lighting retrofit. The property manager reported the implementer reached out to the property’s improvement manager, who never relayed the information, and recommended enhanced communication. This was consistent with PY 2019 feedback.

Program Influence

Cadmus asked property managers if they took energy-saving actions after participating in the MFDI program, and, if so, how important the program was in influencing that behavior. Two property managers installed additional energy-saving items. One of these property managers reported that the program was *somewhat important* in influencing this decision while the other property manager would have installed the measures anyway and considered the program's influence *not at all important*.[2] Four respondents were *very likely* to seek out energy efficiency measures, while one said they were *somewhat likely* to do so.[3]

Multifamily Market Transformation Program Findings

The MFMT program provides incentives for natural gas space and water heating equipment in new multifamily developments in Idaho. Builders are eligible to receive incentives of up to $3,000 per unit to pay for the incremental cost of installing natural gas heat and/or water heat in new multifamily developments of five or more units per building. Water heating applications can either be individual natural gas hot water heaters in each unit or a central natural gas hot water system. Participants are required to sign a contract prior to construction and complete their project within two years. Cadmus conducted interviews with Avista staff and home builders as part of the MFMT program evaluation in PY 2020.

Avista Staff Interview

Program Changes

Avista discontinued the Washington portion of the program at the end of PY 2019 and reported that all Washington projects were required to finish by the end of the year. Avista also reported that the incentive for installing equipment through the program decreased from $3,500 to $3,000 at the beginning of PY 2020. If a project was contracted before the start of PY 2020, participants could receive $3,500 if they completed and verified their installation within two years. Avista does not expect significant changes for PY 2021.

Program Goals and Delivery

The program set and achieved an electric savings goal of 476 MWh per year for PY 2020. Avista tracks certain targets related to the number of projects completed through the program, current year-to-date pace, and kWh savings. Avista did not see a large impact from COVID-19 on program delivery aside from initial challenges with conducting final inspections on projects near the beginning of the pandemic. Avista also noted that program participants were in a slower time of the year when these challenges arose, so it did not create any long-term challenges for the program.

Aside from processing the rebate, Avista takes the role of confirming and verifying installations of equipment in new developments. While participants have up to two years after signing their contract to install their equipment, Avista confirmed the incentive is typically paid to the participant within a week of the verification. Avista also said that data tracking is different for the MFMT program than other Avista programs because the data are considered Site Specific and therefore project tracking is more

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[2] Using the following scale: *not at all important*, *a little important*, *somewhat important*, *very important*.

[3] Using the following scale: *not at all likely*, *a little likely*, *somewhat likely*, *very likely*.

customized. Avista did not track any new data in PY 2020 that were not already being tracked and indicated the current data tracking and reporting systems and processes meet their needs.

Marketing and Outreach

The program is marketed primarily by Avista interacting directly with multifamily developers and builders—a strategy that Avista indicated has succeeded. Avista also lists the incentive for the program on their website. While the program previously had an informational flyer which could be distributed, staff noted this is no longer in use. Avista said there are currently no efforts to increase customer participation in hard-to-reach areas, but did note that a “gas growth team” was recently established in Idaho and that increasing participation in hard-to-reach areas may be a goal of the initiative.

Avista said that staff currently does not have a good way to monitor or assess marketing and outreach efforts for their effectiveness, but noted that the marketing department tracks activity on their website. Staff also indicated there are no current cross-promotional efforts for the MFMT program with other Avista programs. They emphasized that they have had success marketing the program through HVAC installers and would recommend targeting them more to enhance program marketing. While these HVAC installers do not act officially as trade allies for the program, some can promote the program if they have a good understanding and relationship with the program. Avista did not report any effects from COVID-19 related shutdowns on the program marketing efforts.

Stakeholder and Customer Experience

Avista reported good relationships with other groups involved in working with the MFMT program. These groups include builders, developers, HVAC installers, and development CPCs. Avista noted a good level of communication between groups, which allows program efforts to be handled relatively easily.

Avista faces two main barriers to participation among builders in the area. The first is that some regulations in Washington affect builders who operate there and in Idaho as well and that they need to limit their inventory of developments with natural gas appliances as a result. The second barrier is the price point of equipment compared to the incentive they offer. Avista said that the current incentive level, $3,000 per unit, continued to generate interest but explained if the incentive decreases further, some builders said the incentive will not offset the cost because installation is too expensive. To combat these barriers, Avista continues to work with builders and developers to bring natural gas into their developments in Idaho, despite the Washington regulations and plans to keep incentives at their current level.

Avista reported positive feedback from customers regarding their participation in the program. Staff noted that builders appreciate the incentive that allows them to install these natural gas appliances. They also said that the appliances can add value to the developments, especially in times when there is more competition for multifamily living spaces, as the natural gas appliances are more attractive and can help increase the value of units.

Home Builder Interviews

Cadmus interviewed one home builder who participated in the program in 2020 to assess their reasons for and obstacles to participation as well as measuring their overall satisfaction and experience with the program. Cadmus attempted to interview two other participating home builders but were unsuccessful after multiple attempts.

Program Experience

The participating home builder reported learning about Avista's MFMT program from family members who had previously worked for Avista and had connections to program staff. This builder said their main motivation for participating in the program was to help offset costs of heating in their buildings. They noted they were originally planning to install electric cadet heaters, but the incentive from the program made natural gas heaters more affordable and allowed them to provide a better product to their customers. This home builder claimed it was *very easy*[4] to qualify a new building for the incentive offered by the program.

When asked about their relationship with Avista, the home builder said it was "fantastic" and added "Avista is above and beyond the most flexible company to work with in our local area." This builder did not report experiencing any barriers to participation but noted there are occasional obstacles with other service providers for their buildings, though Avista has been able to assist them in those instances. The builder said they were *very satisfied*[5] with the MFMT program overall and planned to participate to a greater extent in 2021 as they have additional projects planned and will use the program.

Program Impact

The home builder was also asked what kind of impact the program has had on their operations. This builder reported that the program has greatly influenced the way they build multifamily housing because they primarily install natural gas heaters rather than electric cadet heaters. They also said the incentive is what makes this possible and would not complete any natural gas space heating projects without the incentive due to the associated costs. The home builder said in the projects they have completed through the program; they have only installed natural gas space heating and have not installed natural gas water heating. They said this was because the venting system in these buildings would have to be re-designed in order to install natural gas water heating. Although, they would have liked to install natural gas water heating they felt it was not worth the effort. The home builder did not report any effects on their participation in the program due to COVID-19 related shutdowns and/or stay-at-home orders. This builder also noted that the program has had a positive effect on their business because they are able to provide a different product than other companies in their area. They also said it is more attractive to their tenants because the natural gas appliances help keep utility costs lower than if it were electric heating.

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[4] Using the following scale: *not at all easy*, *not too easy*, *somewhat easy*, *very easy*.

[5] Using the following scale: *not at all satisfied*, *a little satisfied*, *somewhat satisfied*, *very satisfied*.

Builder Profile

Cadmus interviewed the owner of a home building company who said they primarily do field work and ensure the installations go as planned, with respect to the MFMT program. They said their company has been building multifamily housing in Idaho for 6 years and first participated in the program in 2019. They indicated they did not build any multifamily housing in Avista's service territory that did not participate in the program in 2020.

Multifamily Conclusions and Recommendations

Conclusions and recommendations for the Multifamily programs are presented in this section.

Multifamily Conclusions

- **MFDI: Collaborative relationships between Avista and the program implementer allowed new delivery methods and future implementation techniques to be conceptualized quickly in response to COVID-19. Open communication between the implementer and property managers ensured the quick dissemination of new implementation information to maintenance staff and tenants allowing the program to continue in PY 2020 despite challenges due to the pandemic.**
  - In response to continued COVID-19 restrictions, Avista and implementer staff developed a contactless delivery method.
  - Due to low uptake in the first post-COVID-19 implementation phase, Avista and the implementer adjusted the program to increase participation and measure installation by limiting measures and working with property managers.
- **MFDI: Property managers were satisfied with the program but suggested some tenants were not satisfied with all the measures included in the program. Additionally, some tenants did not install measures that were difficult to install or for which they did not have appropriate tools.**
  - Four of five property managers (4 of 5) were *very satisfied* with their MFDI program experience overall.
  - Two property managers reported tenants were not satisfied with faucet aerators and kitchen aerators due to low water pressure and appearance while three property managers reported tenants were dissatisfied with showerheads due to restricted water flow.
  - One property manager reported that tenants' participating in Phase 1 were *not at all satisfied* with installation and educational materials provided by Avista.
- **MFDI: The reliance of current data tracking on tenants' willingness to return uninstalled or unused equipment, together with low recovery rates, may be a contributing factor to minor inconsistencies in measure-level data.**
  - The drop-off delivery phases relied heavily on documentation filled out by maintenance staff and tenants detailing the location and type and quantity of both installed and removed measures. The implementer noted during the drop-off phases difficulty in tracking measure

installation locations in tenants' units without the presence of a field technician to document measure implementation.

- **MFMT: Overall, the MFMT program was successful meeting the energy savings goal and achieving high program satisfaction.**
    - The program surpassed its electric savings goal of 476 MWh per year for PY 2020.
    - Builders have told Avista staff that they appreciate the incentive because it allows them to install natural gas appliances which provides a competitive advantage, since they say natural gas appliances are more attractive and can help increase the value of units.
    - The builder who completed a survey said they were *very satisfied* with the program and planned to participate to a greater extent in 2021.

- **The MFMT program has had success working with HVAC installers to help market the program, though more can be done to increase marketing efforts and participation, as a result.**
    - Avista reported success working with HVAC installers to help promote the program. Staff said this is a beneficial relationship as the HVAC installers are provided with additional work and the program with more participants.
    - Avista reported that there used to be a flyer handed out as promotional material for the program, though it is no longer used. Staff also said there is no current way in which they monitor effectiveness of their marketing efforts and do not cross-promote the MFMT program with other Avista programs.

Multifamily Recommendations

MFDI Recommendation 1: If the MFDI program continues to request tenants install measures directly, consider offering an additional incentive such as an entry in a drawing for returning measures that are not installed and for providing information on installed measures and their location.

MFDI Recommendation 2: If the MFDI program continues to operate using the drop-off delivery method which requires tenants to install measures directly, continue focusing on simple and easy-to-install measures like LEDs. Provide easy to follow installation instructions and remind tenants of the benefits of installation in the program materials.

MFMT Recommendation 1: Develop marketing materials which can be used by HVAC contractors to help promote the MFMT program. Due to the strengthening relationships between program staff and HVAC contractors, promotional materials could be greatly beneficial to provide information about the program in instances where the contractors may encounter potential participants.

MFMT Recommendation 2: Develop strategies to evaluate the effectiveness of marketing efforts and cross-promotion with other Avista programs. In order to understand if marketing efforts are successful, evaluation standards or goals should be set to better understand what the primary forces are that drive participation to the program. Cross-promotion is also a simple and effective way to increase visibility of the program and garner interest from potential participants.

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. The ENERGY STAR Homes program provides rebates to customers who purchase newly constructed manufactured homes that are ENERGY STAR-certified.

Residential Program Findings

For the PY 2020 process evaluation, Cadmus completed interviews with the Avista program manager for the ENERGY STAR Homes program and conducted online surveys with Space Heat, Water Heat, Shell, and Windows program participants.

Cadmus completed online surveys with 119 customers who participated in the Space Heat, Water Heat, Shell, and Windows programs in PY 2020. Respondents who participated in the Shell or Windows programs are reported together. The following sections present results and detail the findings.

ENERGY STAR Homes

Avista's program manager for the ENERGY STAR Homes program said the PY 2020 program operated similarly to how it operated in previous years. Participants purchase new homes from manufactured home dealers who ensure the new homes are ENERGY STAR-certified. The dealer provides a name certificate to the customer, who submits it to Avista with required program paperwork as proof of participation. Avista approves the paperwork and processes rebates shortly thereafter. Avista typically develops marketing campaigns to promote the program but relies primarily on dealers to drive participation by directly informing customers of the program at point of purchase.

Changes to ENERGY STAR Homes program include increased rebates for natural gas homes from $400 to $600, which Avista said has received "very positive" feedback from home dealers. Like most utility energy efficiency programs, the ENERGY STAR Homes program was affected by the COVID-19 pandemic. The pandemic forced some local businesses that sold manufactured homes to close permanently and inhibited the certification of new homes that, at the time, were in the process of becoming ENERGY STAR-certified. Additionally, a marketing campaign that Avista planned to launch the week the shutdown occurred in March 2020 was tabled, and the pandemic limited Avista's partnership with Northwest Energy Efficiency Alliance (NEEA), which in past years had helped market the program.

Primarily because of the pandemic, the ENERGY STAR Homes program came close to, but ultimately fell short of, achieving its participation and savings goals. Table 12 shows the target and achieved numbers of homes rebated in each state.

Table 12. PY 2020 Target and Achieved New Homes – ENERGY STAR Homes

State	Fuel Type	Target	Achieved
Washington	Natural Gas	5	3
	Electric or Electric/Natural Gas	50	30
Idaho	Natural Gas	5	3
	Electric or Electric/Natural Gas	2	13
Total		**62**	**49**

Avista speculated that, generally, investment in manufactured homes was dampened because customers who typically purchase manufactured homes may have experienced income insecurity induced by the pandemic.

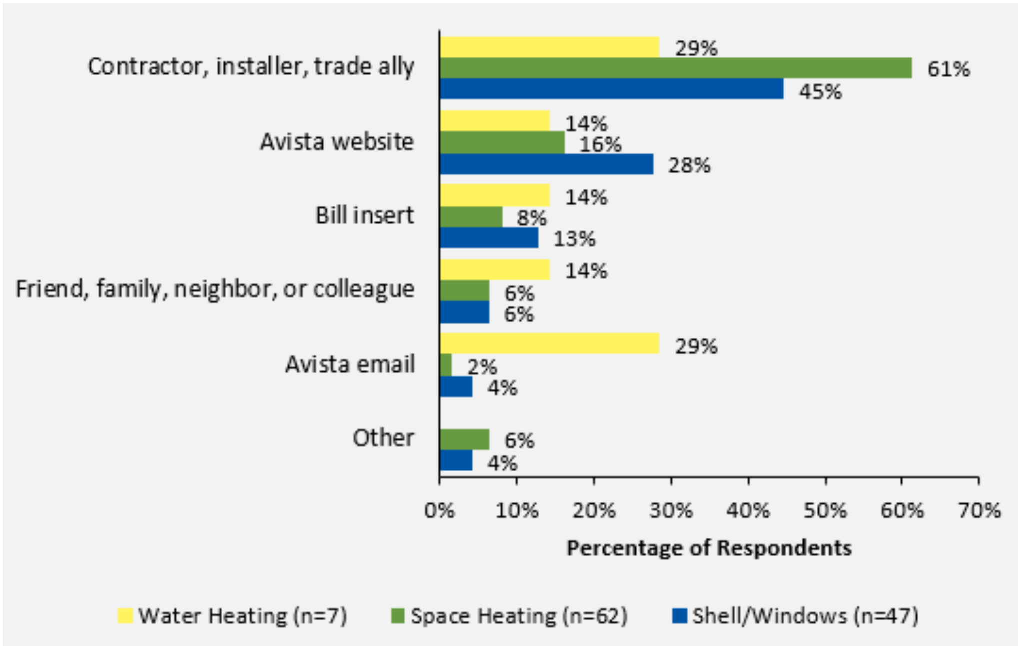
In terms of planning for PY 2021 and beyond, Avista plans to increase rebates for electric-only and combination electric/natural gas homes, continue evaluating its outreach partnership with NEEA, and explore partnerships directly with local manufactured home builders (in addition to partnerships with manufactured home dealers).

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 2020, respondents most commonly learned about Avista programs through contractors (52%), followed by Avista's website (21%) and bill inserts (9%). The share of customers who learned about programs primarily through contractors increased from PY 2019 (38%). Otherwise, respondents learned more frequently about the program through Avista's website (21% in PY 2020 compared to 19% in PY 2019), while respondents learned about the program less frequently through word of mouth (6% in PY 2020 compared to 26% in PY 2019). Figure 18 shows program-specific results.

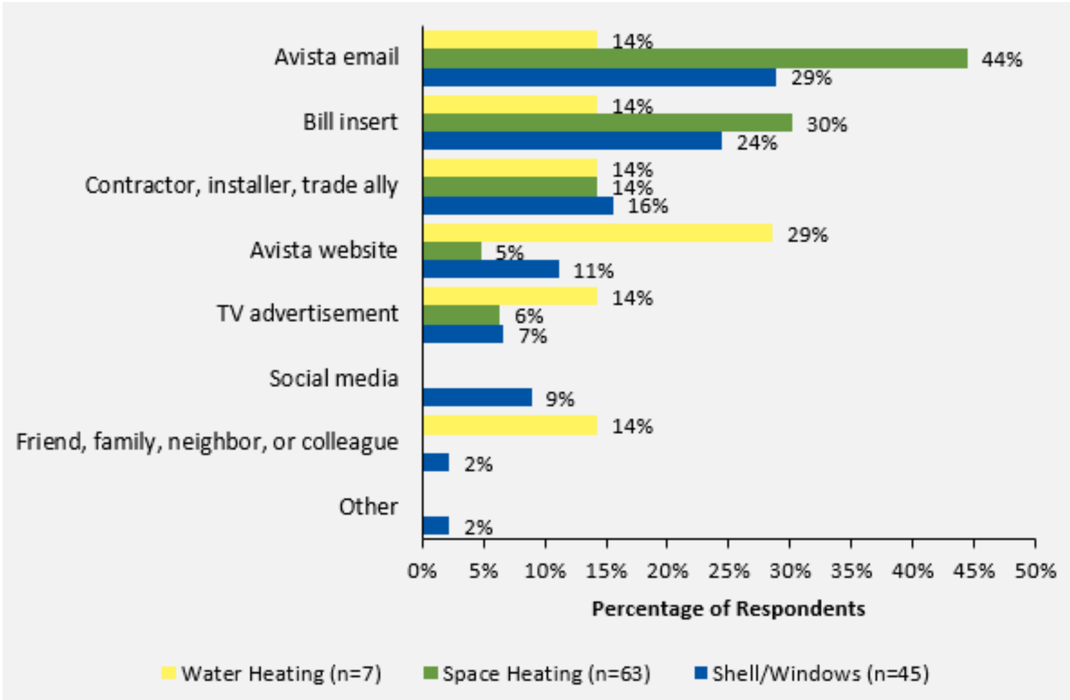
Figure 18. Awareness of Avista Energy Efficiency Programming



Source: Residential Programs Participant Survey, Question D1: "How did you first hear about Avista's Energy Efficiency Rebate program?"

Cadmus also asked respondents how they preferred to learn about Avista's energy efficiency programs. Though most PY 2020 respondents preferred Avista's emails (37%), they also cited bill inserts (27%) as an effective method for spreading information. A small portion of PY 2020 respondents preferred contractors (15%) or Avista's website (9%). From PY 2019 to PY 2020, Avista emails saw the greatest increase as an information source (from 10% to 37%), while bill inserts experienced the biggest decrease (from 43% to 27%). Figure 19 shows program-specific results.

Figure 19. Preferred Method to Learn About Programming

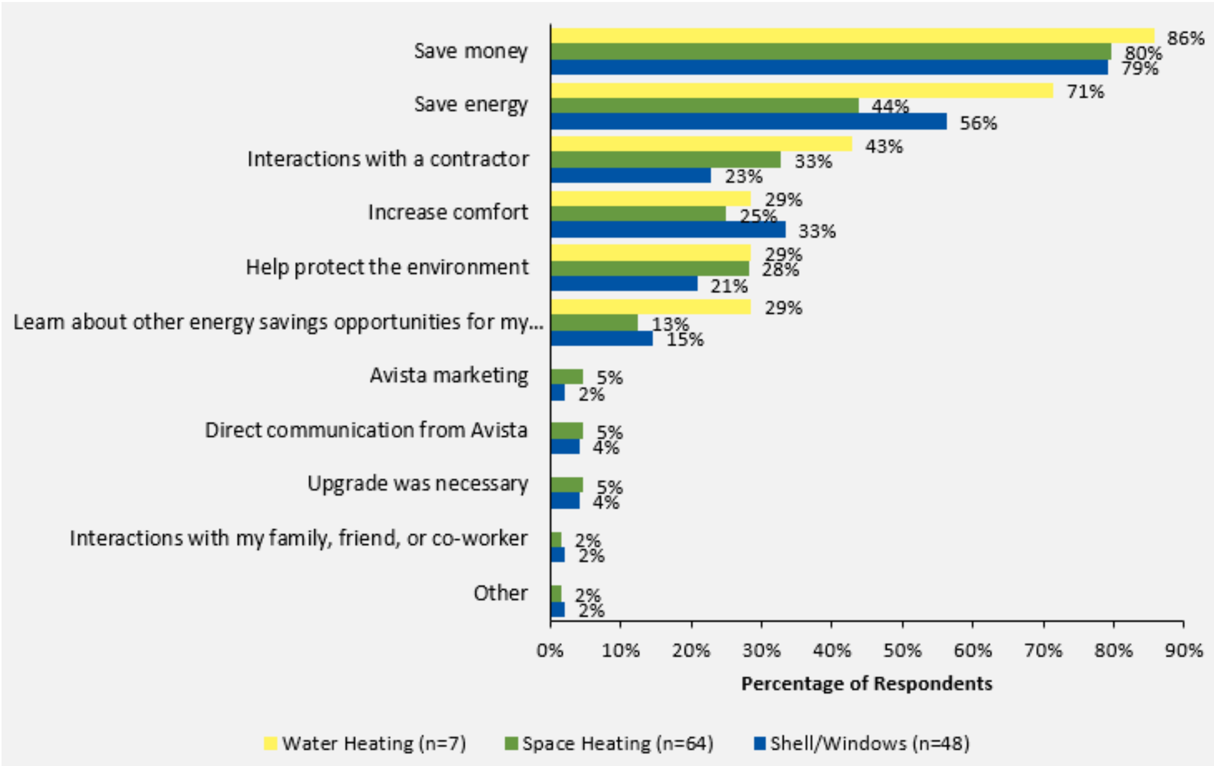


Source: Residential Programs Participant Survey, Question D2: "What is the best way for Avista to inform Residential customers like you about their energy efficiency improvement rebates?"

Motivation and Program Benefits

In PY 2020, respondents participated in Avista's programs primarily to save money (80%), save energy (50%), and/or increase their homes' comfort (33%). From PY 2019 to PY 2020, saving money provided the largest motivation increase (from 25% to 80%), followed by saving energy (from 22% to 50%). Necessary upgrades realized the largest decrease in motivation (from 31% to 4%). Figure 20 shows program-specific results.

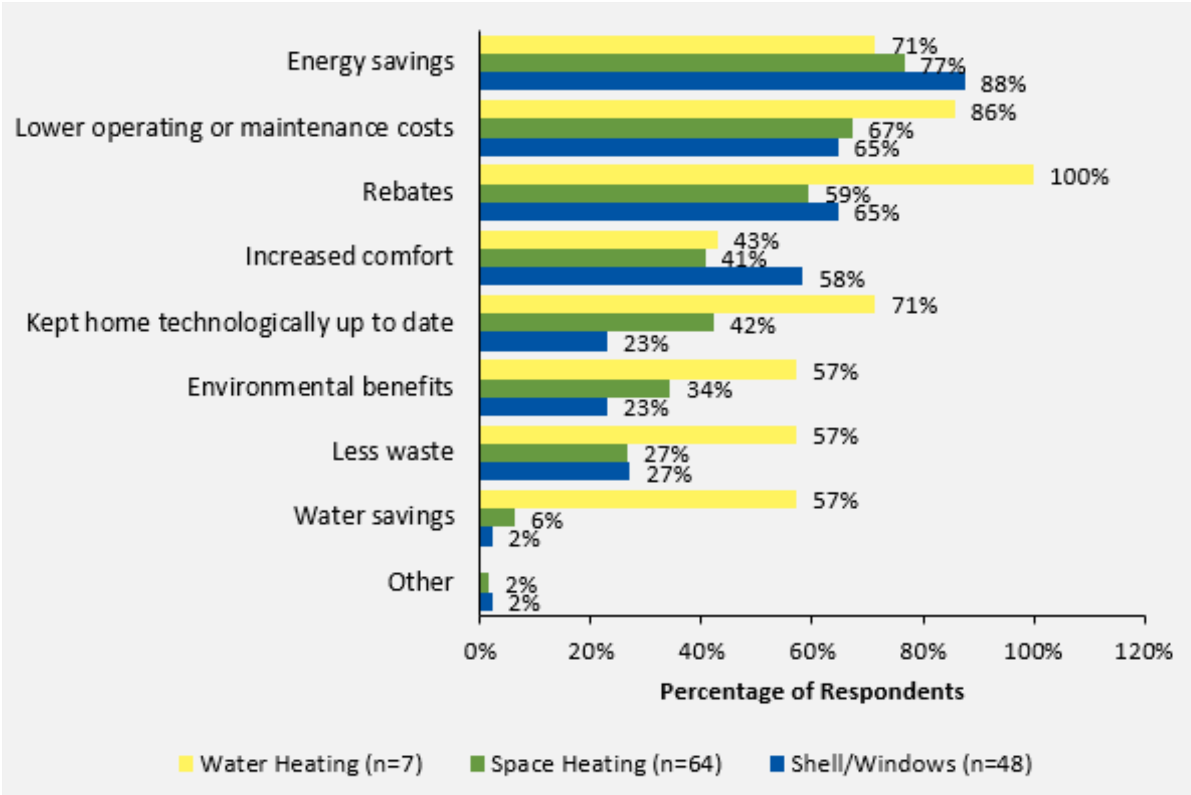
Figure 20. Motivation to Participate in Residential Programs



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 2020, most cited energy savings (81%), lower operating and maintenance costs (67%), rebates (64%), and increased comfort (48%). Though some respondents preferred to keep up with technological trends and to produce less waste and better environmental outcomes, the largest increase in perceived application benefits from PY 2019 to PY 2020 occurred for energy savings (from 34% to 81%). Figure 21 shows program-specific results.

Figure 21. Benefits of Participation in Residential Programs



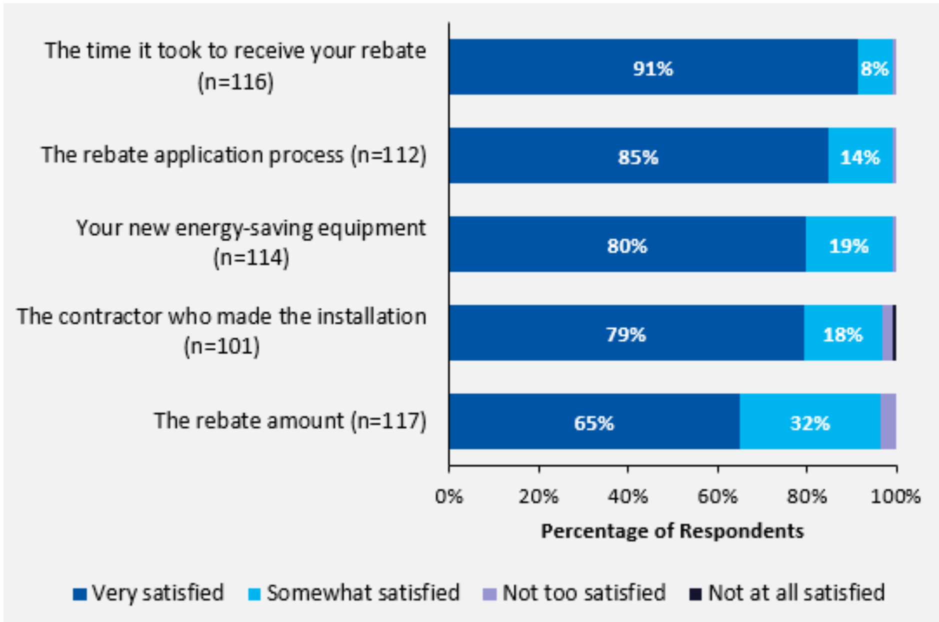
Source: Residential Programs Participant Survey, Question D4. "What benefits come to mind when thinking about your participation in Avista's Energy Efficiency Rebate program?" Multiple responses allowed.

Program Satisfaction

Cadmus asked survey respondents to indicate their satisfaction levels with various program elements associated with their rebate, new equipment, and installing contractor. Respondents' satisfaction levels with the PY 2020 program ranged from 97% to 100%[6] with the five elements shown in Figure 22. Respondents were least often *very satisfied* with the rebate amount. Lower satisfaction with rebates—as customers self-reported via the survey—occurs commonly among Prescriptive rebate programs; hence, Cadmus does not find this result unusual. From PY 2019 to PY 2020, the time it took to receive the rebate increased the most in *very satisfied* responses (from 76% to 91%). Conversely, satisfaction with the energy-saving equipment decreased the most in *very satisfied* responses (from 89% to 80%).

[6] The combination of *very satisfied* and *somewhat satisfied* responses.

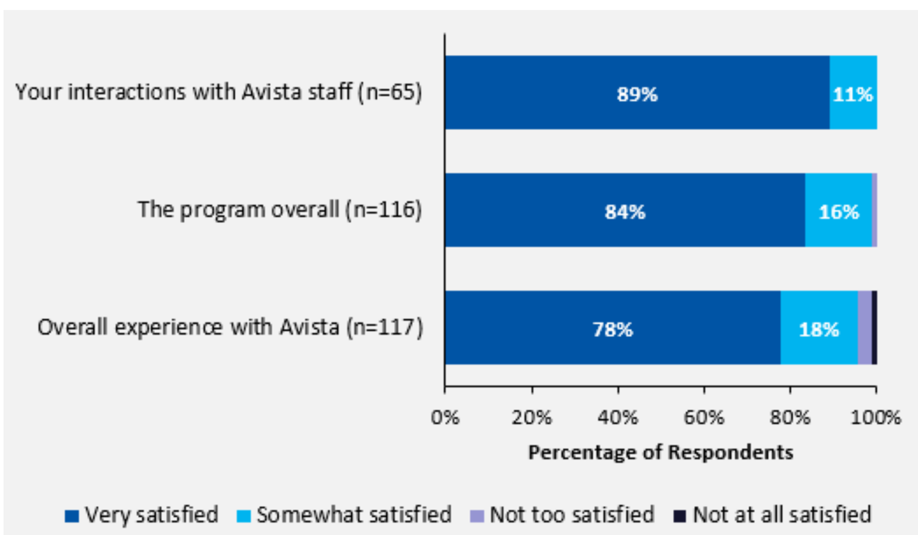
Figure 22. Satisfaction with Residential Program Elements



Source: Residential Programs Participant Survey, Question E1: "How would you rate your overall experience with..."

Respondents satisfaction levels with the PY 2020 program ranged from 96% to 100%[7] with the three elements shown in Figure 23.

Figure 23. Satisfaction with Avista and Residential Programs Overall



Source: Residential Programs Participant Survey, Questions E1, E4: "How would you rate your overall experience with..."

[7] The combination of *very satisfied* and *somewhat satisfied* responses.

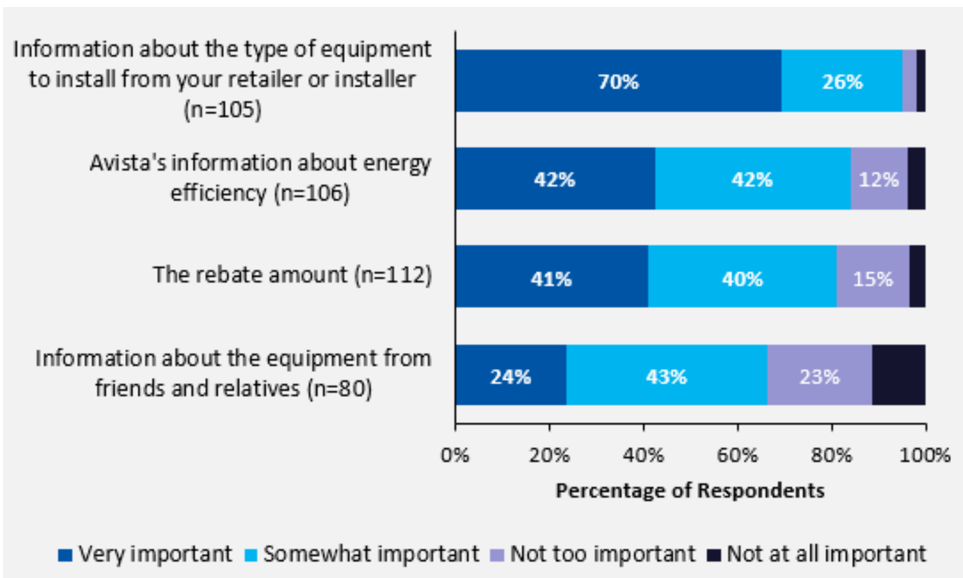
After asking respondents about their satisfaction with the PY 2020 programs and their elements, Cadmus solicited respondents' recommendations and feedback regarding possible program improvements. Nineteen percent of respondents (23 of 119) provided feedback, consisting mostly of the following recommendations:

- Increase advertising (9 of 23)
- Simplify rebate applications (4 of 23)
- Increase rebate amounts (2 of 23)

Decision Influencers

Cadmus asked respondents to rate the importance of several items on their decision to purchase and install the equipment. Respondents rated information about the equipment from retailers and installers as *very important* the most (70%), followed by Avista's information about energy efficiency (42%) and the rebate amount (41%). Respondents' reported importance of all four items is shown in Figure 28.

Figure 28. 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 [MEASURE]."

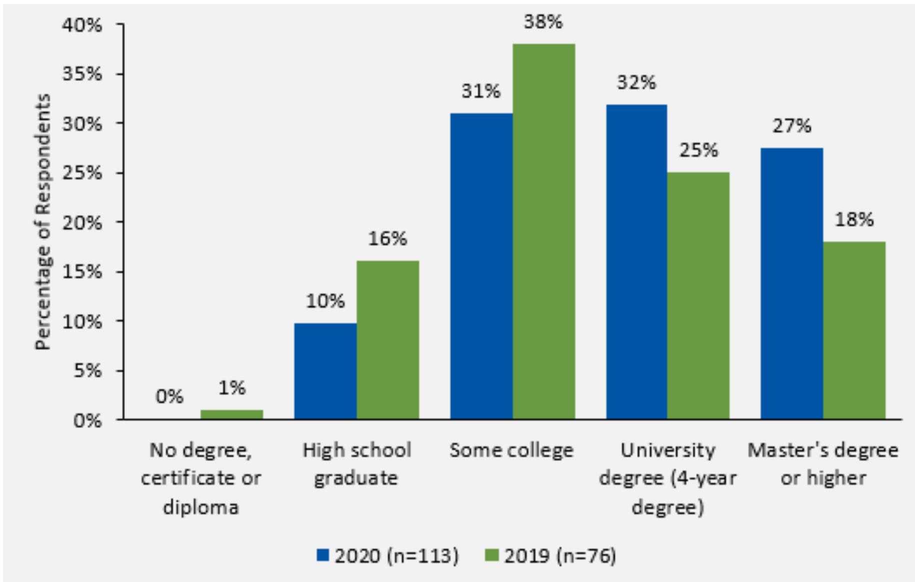
Cadmus asked respondents if anything else was *very important* in their decision to purchase and install the equipment. Forty-six percent of respondents (49 of 119) provided an answer, consisting mostly of the following reasons:

- Equipment needed to be replaced (17 of 49)
- Increased comfort (11 of 49)
- Desired to be more energy efficient (7 of 49)

Survey Respondent Profile

As shown in Figure 24, most survey respondents in PY 2020 had a two-year, four-year, or master's degree (90%), results were consistent with PY 2019.

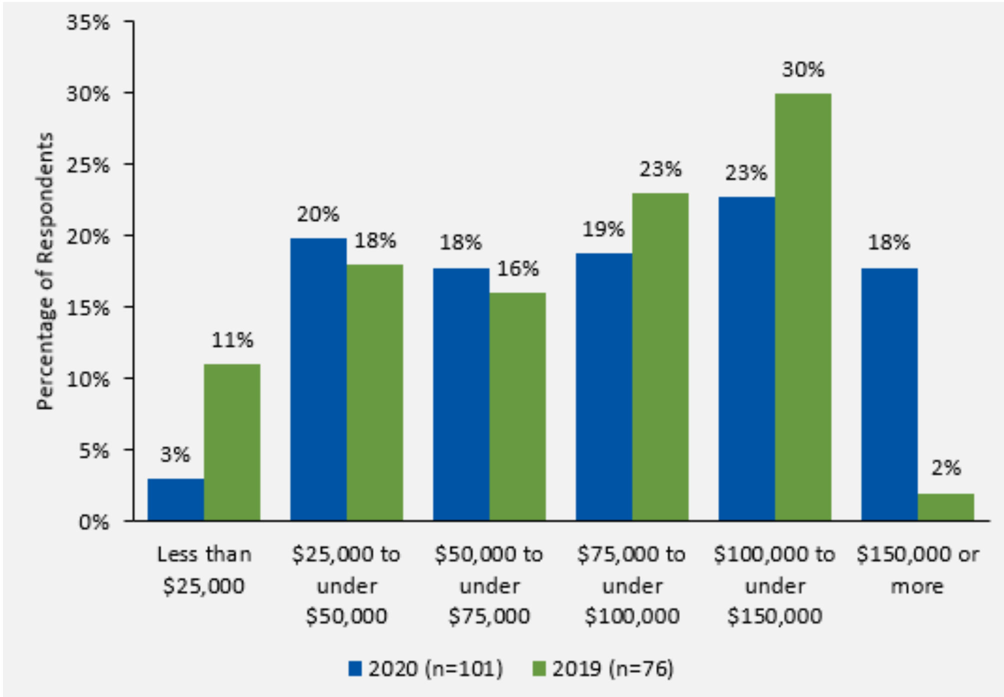
Figure 24. Residential Program Participant Education by Program Year



Source: Residential Programs Participant Survey, Question G1: "What is the highest level of education that you have completed?"

In PY 2020, 77% of respondents earned at least $50,000 annually, as shown in Figure 25.

Figure 25. Residential Program Participant Income Ranges by Program Year



Source: Residential Programs Participant Survey, Question G5: "Select the category that applies to your total household income for the year 2019."

In PY 2020, survey respondents reported an average household size of roughly 2.6 residents (n=111). Over 98% of respondents owned their homes (n=119).

Residential Conclusions and Recommendations

Conclusions and recommendations for the Residential programs are presented in this section.

Residential Conclusions

- **Like some utility energy efficiency programs, the ENERGY STAR Homes program was negatively affected by the COVID-19 pandemic.**
  - Avista achieved its target number of rebates for electric and electric/natural gas homes in Idaho but otherwise fell short of other state-specific, fuel-specific, and overall goals. The pandemic forced local manufactured homes dealers to close down, slowed the ENERGY STAR certification process for newly constructed manufactured homes, and, as was seen nationally, likely increased income insecurity among Avista's target customer base.
- **Contractors remain an important way to learn about the Residential programs but survey respondents also indicated an increased interest in learning about the programs through email from Avista.**
  - The share of respondents who learned about Avista's program through contractors increased from 38% in PY 2019 to 52% in PY 2020. Additionally, 15% of PY 2020 respondents

said that contractors would be the best way for Avista to inform them about energy efficiency, compared to 9% in PY 2019.

- The most common way PY 2020 respondents would like for Avista to inform them about energy efficiency is through email from Avista (37%). This percentage increased from 10% in PY 2019 respondents, indicating more interest in this method of communication.

- **Saving money or energy are key drivers of motivation to participate in the program.**
  - Eighty-eight percent of PY 2020 respondents said that saving money or saving energy motivated them to participate, and 96% of respondents listed energy savings, rebates, or lower operating costs as a benefit of participating in the program.
- **Participants remain highly satisfied with most aspects of the program.**
  - More than 99% of respondents were *very satisfied* or *somewhat satisfied* with their interactions with Avista staff and the program overall, as well as with the time it took to receive the rebate, the application process, and their new energy-saving equipment.
- **Information from equipment retailers or installers heavily influenced respondents' decision to participate.**
  - Ninety-six percent of respondents rated this information as *very important* or *somewhat important*, compared to information about the equipment from friends and relatives, which 67% of respondents rated as *very important* or *somewhat important.*

Residential Recommendations

Residential Recommendation 1: If not already doing so, use email blasts, bill inserts, and other promotional tools that are direct from Avista to customers, with Avista branding, to promote Residential programs and incentives. Although most participants learned about the programs from their contractor, they were more likely to want communication directly from Avista than through their contractor or vendor. These marketing efforts will enhance any contractor and vendor marketing or advertising, and give them better credibility, enabling them to make more sales through the program.

Residential Recommendation 2: Focus program outreach on home comfort to encourage participants since this was mentioned as a motivating factor for participation.

Third-Party Implementer Program

Simple Steps, Smart Savings is a midstream program that provides markdowns on specific items (such as LEDs, LED fixtures, showerheads, and clothes washers) through participating retailers. Avista administers the program and CLEAResult implements it. As part of the implementation process, CLEAResult gathers all sales data from participating retailers, occasionally sends program staff to visit each retailer, and provides marketing materials as well as any other relevant program information.

Third-Party Program Findings

For the process evaluation of Simple Steps, Smart Savings, Cadmus conducted stakeholder interviews with Avista and implementer staff.

Program Changes

Avista confirmed that most of Washington's Simple Steps, Smart Savings program terminated at the end of PY 2019, except for rebates for clothes washers. Idaho's Simple Steps, Smart Savings program operated in PY 2020 as it did in PY 2019, offering rebates on LED lamps and fixtures, showerheads, and clothes washers until the program's sunset in September 2020. Rebates did not change from PY 2019 levels.

In PY 2019, Avista considered implementing new data tracking software for the program. Avista used the software for other programs in its portfolio but did not move the Simple Steps, Smart Savings program onto the software because PY 2020 would be its last year in operation. The existing data tracking processes met Avista's needs.

Marketing and Outreach

As with past years, the implementer's field team provided marketing materials to participating retailers; Avista allows retail locations to choose if and how to use those materials in their stores. In response to the COVID-19 pandemic, the implementer provided marketing materials and conducted store visits based on both the preferences of the retail location and of its field staff. The implementer respected the individual wishes of every participating retail location; for example, some did not want any non-customers to enter for safety of their employees and customers. In those instances, the implementer did not conduct visits. Similarly, if an implementation field staff felt uncomfortable entering a store that appeared too crowded, the field staff could choose to not enter and revisit later.

Avista typically supplements point-of-purchase materials with marketing of its own materials but chose not to do so in PY 2020 in the wake of the pandemic. The implementer also scaled back online marketing in response to both the pandemic and the end of Energy Independence and Security Act (EISA) regulations.

Customer and Retailer Experiences

Because Simple Steps, Smart Savings is a third-party midstream program, Avista and the implementer cannot directly collect customer feedback or gauge satisfaction, which has always been a limitation for it and similar program models. However, feedback from retailers and the implementer suggests customers are satisfied with the program.

In past years, the implementer's field team would visit retail locations to educate customers and store associates, answer their lighting questions, and help them find the correct LED products for their needs. For health and safety reasons, implementation field staff stopped visiting stores to educate customers and store associates. Per the implementer, this left the burden of customer education on the retailers themselves; however, store associates often relied on product education as much as customers did. To overcome this barrier, the implementer arranged recurring virtual appointments between field staff and store associates to explain the program and answer any general or product-specific questions that store associates had. The implementer said its pandemic protocols, and especially its virtual visits, "worked really well." Despite the pandemic, the implementer observed sustained interest from customers in LEDs. Both Avista and the implementer speculated this could be attributed to people spending much more time at home than they normally would.

Ultimately, retailers were appreciative of their opportunity to participate in Simple Steps, Smart Savings and saddened to learn of the program's discontinuation. Per the implementer, retailers complimented the program as a "selling tool" and "a good way to get customers looking at more-efficient products."

Challenges and Successes

In addition to challenges caused by the COVID-19 pandemic described above, Avista and the implementer indicated three other challenges for the Simple Steps, Smart Savings program:

- **Goals:** When Avista set goals for PY 2020, it expected Idaho program activity to include only showerheads and clothes washers and Washington program activity to have ceased completely. Instead, Avista continued to offer rebates for LED lamps and fixtures in Idaho and for clothes washers in Washington. Accordingly, Avista did not have goals set for LEDs or clothes washers in their respective states.

  The implementer described the market as "fluid" and said, because of this fluidity, the goal of the program is to generate as much energy savings as possible using open-ended budgets. In response to the pandemic, the implementer did scale back savings program-wide in anticipation of declining activity. However, the implementer observed sustained interest in LEDs.
- **Retailer participation:** The implementer said some retail locations—especially franchises and individually owned stores such as Ace Hardware—wanted to participate in the program but could not because of unclear communication or direction from the retailer's corporate office. This resulted in unexpectedly low retailer participation.
- **EISA uncertainty:** The implementer said, for LED products, it was difficult to navigate the repeal of EISA. Because the Simple Steps, Smart Savings program is designed to be a turnkey program, the implementer faced challenges in adapting the program to the unique lighting guidelines developed by each state in response to EISA's repeal. Avista and the implementer discontinued the program in Washington largely because of the state's adoption of stricter guidelines than the federal guidelines originally imposed by EISA, a decision that rendered lighting savings in

Washington nearly obsolete. The repeal of EISA was a challenge for PY2020 that Avista and the implementer anticipated in PY 2019.

The implementer continues to maintain good relationships with utility partners, manufacturers, and retailers, and utilities find the program easy to sponsor, with current reporting systems making the program easy to maintain.

Third-Party Program Conclusions and Recommendations

Conclusions for the Simple Steps, Smart Savings program are presented in this section.

Conclusions

- **The implementer responded to the COVID-19 pandemic thoughtfully, which enabled the program to continue to perform well despite the circumstances until its termination in September 2020.**
  - The implementer let retailers permit or deny store visits from implementation field staff, allowed field staff the flexibility to reschedule store visits, and conducted virtual store visits to educate store associates about the program and products (such as LEDs) like it typically would. Avista and the implementer also scaled back marketing and outreach efforts and allowed each retail location to tailor marketing, including point-of-purchase materials provided by the implementer, to their individual needs.
- **Avista and the implementer faced uncertainty with the repeal of EISA, which led to the Simple Steps, Smart Savings program being implemented differently in Washington.**
  - The implementer offered rebates for clothes washers in Washington and for LEDs, showerheads, and clothes washers in Idaho. Avista did not set goals for clothes washers in Washington or for LEDs in Idaho.
- **Avista observed unexpectedly low throughput for clothes washers, which the implementer attributed to the challenge it faced when recruiting retail locations to participate.**
  - Despite showing a willingness to participate, some retail locations for franchised and individually owned stores like Ace Hardware could not offer program rebates because of a lack of communication/direction from their corporate offices. Thus, fewer retailers offered buy-downs for clothes washers, and fewer customers obtained clothes washer rebates.

Recommendations

Because Simple Steps, Smart Savings discontinued in PY 2020, Cadmus does not have any recommendations to make for the program.

Low-Income Program

Cadmus did not complete any process evaluation activities in PY 2020 for the Low-Income program. Cadmus will conduct a process evaluation for both Idaho and Washington for PY 2021 as indicated in the evaluation plan.

APPENDIX F – 2020 EXPENDITURES BY PROGRAM

	Electric				Natural Gas			
Program	Participants		Evaluated Savings (kWh)	Utility Cost	Participants		Evaluated Savings (Therms)	Utility Cost
Low-Income								
Weatherization	56	Homes	34,091	$ 111,511	52	Sq ft/Units	1,455	$ 94,939
Fuel Conversions	22	Units	89,678	$ 229,820	-	Units	0	$ 0
HVAC	16	Units	90,034	$ 234,510	49	Units	3,797	$ 304,807
Water Heat	0	Units	0	$ 0	26	Units	243	$ 109,318
Outreach/Giveaways	27	Events	1,458	$ 1,590	-	NA	0	$ 0
Health and Safety	24	HHS	0	$ 59,415	22	HHS	0	$ 153,449
ENERGY STAR Refrigerator	1	Units	39	$ 782	-	Units	0	$ 0
Low-Income Total			**215,300**	**$ 637,629**			**5,495**	**$ 662,514**
Residential								
ENERGY STAR Homes	16	Homes	50,705	$ 13,552	3	Homes	402	$ 2,019
Fuel Conversions	95	Units	635,962	$ 340,785	-	Units	0	$ 0
HVAC	198	Furnace, Tstat	508,131	$ 135,219	3,229	Furnace, Tstat	266,939	$ 1,063,439
Water Heat	10	Units	12,986	$ 3,367	507	Units	37,976	$ 200,782
Multifamily Direct Install	16,925	Units (Measures)	747,227	$ 445,952	-	Units (Measures)	0	$ 0
Shell	119	Windows, Insulation	358,972	$ 192,570	285	Windows, Insulation	12,000	$ 160,163
Simple Steps, Smart Savings	235,575	LEDs, Washers, Showerheads	2,968,563	$ 476,600	235,575	Showerheads	234	$ 0
Residential Total			**5,282,546**	**$ 1,608,046**			**317,550**	**$ 1,426,403**
Commercial/Industrial								
Site-Specific	108	Projects	4,113,196	$ 922,158	1	Projects	94	$ 1,204
Compressed Air	0	Units	0	$ 0	-	NA	0	$ 0
Grocer	5	Projects	45,938	$ 8,157	-	Projects	0	$ 0
Food Services	3	Projects	13,761	$ 2,309	20	Projects	13,597	$ 72,721
Green Motors	11	Motor Rewinds	52,038	$ 11,747	-	NA	0	$ 0
HVAC	0	Units	0	$ 0	40	Units	13,992	$ 104,126
Shell	4	Projects	1,341	$ 448	4	Projects	1,821	$ 18,391
Multifamily Market Transformation	4	Units (multifamily)	489,597	$ 492,967	-	Units (multifamily)	0	$ 0
Exterior Lighting	557	Projects	2,552,295	$ 962,080	-	NA	0	$ 0
Interior Lighting	331	Projects	3,944,956	$ 630,696	-	NA	0	$ 0
Motor Control HVAC	0	Projects	0	$ 0	-	Projects	0	$ 0
Commercial/Industrial Total			**11,213,122**	**$ 3,030,561**			**29,503**	**$ 196,443**
Energy Efficiency Total			**16,710,968**	**$ 5,276,236**			**352,548**	**$ 2,285,36**

Appendix F includes programmatic costs that are directly related to or allocated to specific programs, including costs for incentives as well as non-incentive utility costs. These costs exclude market transformation, Idaho research costs, pilot programs, EM&V/CPA, and labor that is not associated with a specific program.

APPENDIX G – 2020 PROGRAM ACTIVITY

Program	Electric	Natural Gas	Total
Low-Income			
Low-Income	$ 211,199	$ 457,933	$ 669,132
Health and Safety	$ 59,415	$ 89,410	$ 148,826
Low-Income Fuel Conversions	$ 125,236	$ 0	$ 125,236
Residential			
ENERGY STAR Homes	$ 6,500	$ 1,950	$ 8,450
HVAC	$ 75,613	$ 1,028,366	$ 1,103,979
Multifamily Direct Install	$ 278,555	$ 0	$ 278,555
Fuel Efficiency	$ 225,600	$ 0	$ 225,600
Shell	$ 78,703	$ 156,016	$ 234,718
Simple Steps, Smart Savings	$ 214,050	$ 0	$ 214,050
Water Heater	$ 2,365	$ 195,800	$ 198,165
Commercial/Industrial			
Site-Specific	$ 679,152	$ 282	$ 679,434
Compressed Air	$ 0	$ 0	$ 0
Grocer	$ 6,410	$ 0	$ 6,410
Food Services	$ 1,800	$ 26,750	$ 28,550
Green Motors	$ 9,334	$ 0	$ 9,334
Multifamily Market Transformation	$ 444,000	$ 0	$ 444,000
HVAC	$ 0	$ 41,507	$ 41,507
Shell	$ 240	$ 7,724	$ 7,964
Exterior Lighting	$ 815,360	$ 0	$ 815,360
Interior Lighting	$ 391,670	$ 0	$ 391,670
Motor Control HVAC	$ 0	$ 0	$ 0
Energy Efficiency Total	**$ 3,625,202**	**$ 2,005,738**	**$ 5,630,940**
Market Transformation			
Market Transformation	$ 655,310	$ 139,208	$ 794,518
Market Transformation Total	**$ 655,310**	**$ 139,208**	**$ 794,518**
Other Programs and Activities			
General Implementation	$ 1,762,346	$ 296,315	$ 2,058,661
Idaho Research and Development	$ 254,121	$ 0	$ 254,121
Pilot Programs	$ 33,290	$ 1,050	$ 34,340
EM&V/CPA	$ 142,064	$ 39,947	$ 182,011
Other Programs and Activities	**$ 2,191,821**	**$ 337,312**	**$ 2,529,133**
Grand Total	**$ 6,472,333**	**$ 2,482,258**	**$ 8,954,591**

Appendix G is inclusive of all costs booked to the Company's Energy Efficiency Tariff Rider. Costs included in Low-Income, Residential and Commercial/Industrial represent incentive costs paid to customers. Costs in Market Transformation and Other Programs and Activities represent other non-incentive utility costs.

APPENDIX H – 2020 IDAHO COST-EFFECTIVENESS TABLES

Idaho Cost-Effectiveness Summary

Table 1 shows the overall cost-effectiveness results in Idaho.

TABLE 1 – 2020 IDAHO COST-EFFECTIVENESS SUMMARY

Benefit Cost Ratios	Portfolio	
	Electric	Gas
Utility Cost Test (UCT)	2.09	1.64
Total Resource Cost (TRC)	1.38	0.94
Participant Cost Test (PCT)	2.52	1.34
Ratepayer Impact (RIM)	0.49	0.29

Idaho Portfolio Cost-Effectiveness Results

Table 2 and *Table 3* shows the portfolio level cost-effectiveness results in Idaho by fuel type.

TABLE 2 – IDAHO ELECTRIC PORTFOLIO COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 12,280,877	$ 5,886,868	2.09
Total Resource Cost (TRC)	$ 13,576,343	$ 9,852,524	1.38
Participant Cost Test (PCT)	$ 19,406,684	$ 7,712,680	2.52
Ratepayer Impact (RIM)	$ 12,280,877	$ 25,099,813	0.49

TABLE 3 – IDAHO NATURAL GAS PORTFOLIO COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 3,751,762	$ 2,285,360	1.64
Total Resource Cost (TRC)	$ 4,220,253	$ 4,475,939	0.94
Participant Cost Test (PCT)	$ 5,638,507	$ 4,196,316	1.34
Ratepayer Impact (RIM)	$ 3,751,762	$ 12,999,595	0.29

Idaho Commercial/Industrial Cost-Effectiveness Results

Table 4 and *Table 5* show commercial/industrial cost-effectiveness results in Idaho by fuel type.

TABLE 4 – IDAHO COMMERCIAL/INDUSTRIAL ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 6,434,778	$ 3,207,038	2.01
Total Resource Cost (TRC)	$ 7,078,256	$ 5,975,711	1.18
Participant Cost Test (PCT)	$ 11,301,365	$ 5,238,461	2.16
Ratepayer Impact (RIM)	$ 6,434,778	$ 12,020,967	0.54

TABLE 5 – IDAHO COMMERCIAL/INDUSTRIAL NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 181,083	$ 196,443	0.92
Total Resource Cost (TRC)	$ 199,192	$ 370,999	0.54
Participant Cost Test (PCT)	$ 219,873	$ 250,818	0.88
Ratepayer Impact (RIM)	$ 181,083	$ 340,054	0.53

Idaho Residential Cost-Effectiveness Results

Table 6 shows residential cost-effectiveness results for electric.

TABLE 6 – IDAHO RESIDENTIAL ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 5,573,921	$ 2,133,107	2.61
Total Resource Cost (TRC)	$ 6,131,313	$ 3,271,662	1.87
Participant Cost Test (PCT)	$ 7,417,708	$ 2,019,940	3.67
Ratepayer Impact (RIM)	$ 5,573,921	$ 12,060,227	0.46

Table 7 shows residential cost-effectiveness results for natural gas.

TABLE 7 – IDAHO RESIDENTIAL NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 3,502,394	$ 1,426,403	2.46
Total Resource Cost (TRC)	$ 3,852,633	$ 3,466,442	1.11
Participant Cost Test (PCT)	$ 4,821,706	$ 3,422,171	1.41
Ratepayer Impact (RIM)	$ 3,502,394	$ 11,836,441	0.30

Idaho Low-Income Cost-Effectiveness Results

Table 8 shows residential cost-effectiveness results for low-income electric.

TABLE 8 – IDAHO LOW-INCOME ELECTRIC COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 272,178	$ 546,723	0.50
Total Resource Cost (TRC)	$ 366,774	$ 605,151	0.61
Participant Cost Test (PCT)	$ 687,611	$ 454,279	1.51
Ratepayer Impact (RIM)	$ 272,178	$ 1,018,619	0.27

Table 9 shows residential cost-effectiveness results for low-income natural gas.

TABLE 9 – IDAHO LOW-INCOME NATURAL GAS COST-EFFECTIVENESS RESULTS

Cost-Effectiveness Test	Benefits	Costs	Benefit/Cost Ratio
Utility Cost Test (UCT)	$ 68,285	$ 662,514	0.10
Total Resource Cost (TRC)	$ 168,428	$ 638,498	0.26
Participant Cost Test (PCT)	$ 596,928	$ 523,327	1.14
Ratepayer Impact (RIM)	$ 68,285	$ 823,100	0.08

APPENDIX I – 2020 UES MEASURE LIST

Measure Name	UOM	Measure Life	Customer Incremental Cost	Annual kWh Savings	Annual Therm Savings
Commercial/Industrial – Electric – AirGuardian					
AirGuardian	Unit	10	$ 1,440.00	6,000.00	
Commercial/Industrial – Electric – Prescriptive Exterior Lighting					
100 watt fixture	Unit	12	$ 187.81	681.18	
100 watt NC fixture	Unit	12	$ 337.08	737.88	
140 watt fixture	Unit	12	$ 241.04	910.42	
140 watt NC fixture	Unit	12	$ 357.88	817.83	
160 watt fixture	Unit	12	$ 475.43	1,142.86	
160 watt NC fixture	Unit	12	$ 417.80	984.07	
175 watt fixture	Unit	12	$ 401.58	1,415.50	
25 watt fixture	Unit	12	$ 147.03	329.18	
30 watt fixture	Unit	12	$ 211.38	439.27	
300 watt fixture	Unit	12	$ 794.82	2,468.82	
400 watt fixture	Unit	12	$ 876.04	3,493.04	
50 watt fixture	Unit	12	$ 225.11	675.00	
Sign lighting	Unit	10	$ 31.78	107.20	
Commercial/Industrial – Electric – Food Services					
0.81 to 1.00 GPM electric pre-rinse sprayer	Unit	4	$ 71.63	570.00	
10 or larger pan electric steamer	Unit	7	$ 4,287.00	29,954.00	
3 pan electric steamer	Unit	7	$ 1,036.90	9,066.00	
4 pan electric steamer	Unit	7	$ 2,489.00	12,123.00	
5 pan electric steamer	Unit	7	$ 3,111.00	15,013.00	
6 pan electric steamer	Unit	7	$ 1,020.02	17,906.00	
Efficient combination oven (>= 16 pan and <= 20 pan) electric	Unit	7	$ 493.08	5,528.00	
Efficient combination oven (>= 6 pan and <= 15 pan) electric	Unit	7	$ 878.40	5,107.00	
Efficient electric convection oven full size	Unit	8	$ 161.04	977.00	
Efficient hot food holding cabinet, 1/2 size	Unit	10	$ 280.59	1,607.00	
Efficient hot food holding cabinet, double size	Unit	10	$ 2,520.75	5,238.00	
Efficient hot food holding cabinet, full size	Unit	10	$ 597.41	2,860.00	
Electric fryer (large vat size)	Unit	6	$ 255.62	1,660.00	
Fleet heat	Unit	12	$ 520.50	8,000.00	
High temp electric hot water dishwasher	Unit	12	$ 2,297.00	4,110.00	

Low temp electric hot water dishwasher	Unit	12	$	2,297.00	3,801.00
Standard efficiency appliance to ENERGY STAR ice maker, air cooled, ice making head, 200 to 399 lbs./day capacity	Unit	10	$	185.00	592.00
Standard efficiency appliance to ENERGY STAR ice maker, air cooled, ice making head, 400 to 599 lbs./day capacity	Unit	10	$	204.00	804.00
Standard efficiency appliance to ENERGY STAR ice maker, air cooled, ice making head, 600 to 799 lbs./day capacity	Unit	10	$	220.00	1,000.00
Standard efficiency appliance to ENERGY STAR ice maker, air cooled, ice making head, 800 to 999 lbs./day capacity	Unit	10	$	240.00	173.00
Standard efficiency appliance to ENERGY STAR ice maker, air cooled, ice making head, under 200 lbs./day capacity	Unit	10	$	317.67	940.00
Standard efficiency appliance to high-efficiency electric griddle, 70% efficient or better	Unit	12	$	1,000.00	1,636.00
Commercial/Industrial – Electric – Green Motors					
100 HP industrial	Unit	8	$	374.61	1,723.00
1000 HP industrial	Unit	8	$	1,946.32	16,682.00
125 HP industrial	Unit	8	$	373.40	1,990.00
1250 HP industrial	Unit	9	$	2,325.02	17,812.00
15 HP industrial	Unit	7	$	125.07	525.00
150 HP industrial	Unit	8	$	415.93	2,366.00
1500 HP industrial	Unit	9	$	2,663.37	21,329.00
1750 HP industrial	Unit	9	$	3,039.84	24,779.00
20 HP industrial	Unit	7	$	139.54	703.00
200 HP industrial	Unit	8	$	500.72	3,138.00
2000 HP industrial	Unit	9	$	3,409.96	28,201.00
2250 HP industrial	Unit	9	$	3,714.88	31,527.00
25 HP industrial	Unit	8	$	159.43	893.00
250 HP industrial	Unit	8	$	643.55	3,799.00
2500 HP industrial	Unit	9	$	4,064.37	34,957.00
30 HP industrial	Unit	8	$	175.10	962.00
300 HP industrial	Unit	8	$	650.50	4,535.00
3000 HP industrial	Unit	9	$	4,752.00	41,686.00
350 HP industrial	Unit	8	$	681.80	5,287.00
3500 HP industrial	Unit	9	$	5,251.18	48,532.00
40 HP industrial	Unit	8	$	213.98	1,121.00
400 HP industrial	Unit	8	$	761.51	5,994.00
4000 HP industrial	Unit	9	$	5,862.69	55,466.00
450 HP industrial	Unit	8	$	832.39	6,732.00
4500 HP industrial	Unit	9	$	6,318.17	62,269.00

50 HP industrial	Unit	8	$	236.88	1,206.00
500 HP industrial	Unit	8	$	899.26	7,491.00
5000 HP industrial	Unit	9	$	6,744.35	69,044.00
60 HP industrial	Unit	8	$	279.38	1,269.00
600 HP industrial	Unit	8	$	1,353.31	10,137.00
700 HP industrial	Unit	8	$	1,476.45	11,777.00
75 HP industrial	Unit	8	$	301.98	1,305.00
800 HP industrial	Unit	8	$	1,638.17	13,431.00
900 HP industrial	Unit	8	$	1,806.00	15,077.00
Commercial/Industrial – Electric – Grocer					
Add doors to open medium temp cases	Unit	20	$	385.00	533.00
Anti-sweat heater controls – low temp	Unit	12	$	47.90	305.00
Anti-sweat heater controls – medium temp	Unit	12	$	47.90	217.00
Evap motors: shaded pole to ECM in display case	Unit	15	$	94.38	685.00
Evap motors: shaded pole to ECM in walk-in – greater than 23 watts	Unit	15	$	275.73	1,355.00
Evap motors: shaded pole to ECM in walk-in – less than 23 watts	Unit	15	$	275.73	583.00
Evaporator fan ECM motor controller – walk-In – low temp – >23 watt – 3 or more motors/controller	Unit	15	$	154.55	253.00
Evaporator fan ECM motor controller – walk-In – low temp – ≤23 watt – 7 or more motors/controller	Unit	15	$	59.32	119.00
Floating head pressure control w/ VFD – air cooled	Unit	15	$	200.00	915.00
Floating head pressure for single compressor systems, LT condensing unit	Unit	15	$	306.99	855.00
Floating head pressure for single compressor systems, LT remote condenser	Unit	15	$	163.25	685.00
Floating head pressure for single compressor systems, MT remote condenser	Unit	15	$	214.50	473.00
Gaskets for low temp reach-in glass doors	Unit	4	$	111.12	243.00
Gaskets for medium temp reach-in glass doors	Unit	4	$	89.95	248.00
Gaskets for walk-in cooler – main	Unit	4	$	84.66	204.00
Gaskets for walk-in freezer – main door	Unit	4	$	125.93	347.00
LT case: 2 T12 to 1 high power LED inside lamp	Unit	7	$	22.93	223.00
LT case: 2 T8 to 1 high power LED inside lamp	Unit	7	$	22.93	142.00
LT case: T12 to LP LED inside lamp	Unit	7	$	14.18	104.00
LT case: T8 to LP LED inside lamp	Unit	7	$	14.18	63.00
MT case: 2 T12 to 1 high power LED inside lamp	Unit	7	$	22.93	183.00
MT case: 2 T12 to 1 high power LED outside lamp	Unit	7	$	22.93	156.00
MT case: 2 T8 to 1 high power LED inside lamp	Unit	7	$	22.93	116.00

MT case: 2 T8 to 1 high power LED outside lamp	Unit	7	$	22.93	99.00	
MT case: T12 to LP LED inside lamp	Unit	7	$	14.18	85.00	
MT case: T8 to LED inside lamp	Unit	7	$	14.18	52.00	
On-demand commercial overwrapper	Unit	10	$	306.77	1,588.00	
Strip curtains for convenience store walk-in freezers	Unit	2	$	10.14	31.00	
Strip curtains for restaurant walk-in freezers	Unit	2	$	10.14	129.00	
Strip curtains for supermarket walk-in coolers	Unit	2	$	10.14	123.00	
Strip curtains for supermarket walk-in freezers	Unit	2	$	10.14	535.00	
T12 to LP LED outside lamp	Unit	7	$	14.18	73.00	
T8 to LP LED outside lamp	Unit	7	$	14.18	44.00	
Commercial/Industrial – Electric – Prescriptive Interior Lighting						
12-20 watt LED fixture retrofit	Unit	12	$	30.51	159.87	(1.98)
140 watt fixture/lamp – interior	Unit	12	$	182.46	627.23	(7.79)
175 watt fixture/lamp – interior	Unit	12	$	268.43	1,015.33	(12.60)
2-9 watt MR16	Unit	12	$	7.92	57.20	(0.71)
2x2 fixtures	Unit	12	$	100.57	106.15	(1.32)
2x4 fixtures	Unit	12	$	112.01	139.83	(1.74)
400 watt fixture/lamp – interior	Unit	12	$	389.22	2,723.66	(33.81)
8’ T8 TLED	Unit	12	$	23.39	57.84	(0.72)
LLLC fixture	Unit	20	$	75.00	187.20	(2.32)
occupancy sensors	Unit	20	$	91.27	127.92	(1.59)
T5HO TLED	Unit	12	$	18.13	105.40	(1.31)
T8 TLED	Unit	12	$	12.41	48.38	(0.60)
U-Bend	Unit	12	$	23.69	52.09	(0.65)
Commercial/Industrial – Electric – MFMT						
Multifamily NG Market Transformation (per unit)	Unit	20	$	6,000.00	5,874.00	(258.00)
Commercial/Industrial – Electric – Prescriptive Shell						
Less than R11 attic insulation (E/E) to R30-R44 attic insulation	Sq Ft	22	$	0.76	1.02	
Less than R11 attic insulation (E/E) to R45+ attic insulation	Sq Ft	22	$	0.86	1.39	
Less than R11 roof insulation (E/E) to R30+ roof insulation	Sq Ft	22	$	0.62	1.36	
Less than R4 wall insulation (E/E) to R11-R18 wall insulation	Sq Ft	22	$	0.61	2.82	
Less than R4 wall insulation (E/E) to R19+ wall Insulation	Sq Ft	22	$	0.65	4.11	
Commercial/Industrial – Electric – Variable Frequency Drives						
Prescriptive VFDs – HVAC cooling pump	Unit	16	$	200.00	1,091.00	
Prescriptive VFDs – HVAC fan	Unit	16	$	200.00	1,022.00	
Prescriptive VFDS – HVAC heating pump or combo	Unit	16	$	200.00	1,756.00	

Commercial/Industrial – Natural Gas – Food Services						
0.81 to 1 GPM gas pre-rinse sprayer	Unit	4	$	108.42		16.81
10 or larger pan gas steamer	Unit	9	$	4,287.16		3,043.24
3 pan gas steamer	Unit	9	$	1,867.00		586.22
4 pan gas steamer	Unit	9	$	2,489.00		779.91
5 pan gas steamer	Unit	9	$	3,111.00		973.63
6 pan gas steamer	Unit	9	$	3,733.00		1,167.36
Efficient combination oven (>= 16 pan and <= 20 pan) gas	Unit	10	$	5,717.00		500.00
Efficient combination oven (>= 6 pan and <= 15 pan) gas	Unit	10	$	5,717.00		403.00
Efficient convection oven full size	Unit	10	$	5,717.00		450.00
ENERGY STAR 50% efficiency gas fryer	Unit	12	$	2,500.00		505.00
Gas rack oven	Unit	8	$	4,933.00		1,034.00
H.E. gas convection oven, 40% efficiency or better	Unit	12	$	700.00		323.00
H.E. gas griddle, 40% efficiency or better	Unit	12	$	491.00		88.00
High temp gas hot water dishwasher	Unit	12	$	2,297.00		102.82
Low temp gas hot water dishwasher	Unit	12	$	2,297.00		140.10
Commercial/Industrial – Natural Gas – HVAC						
Gas boiler <300 kBtu .85-.89 AFUE	KBTU	16	$	12.31		1.77
Gas boiler <300 kBtu .90+ AFUE	KBTU	16	$	14.77		2.87
Multi-stage furnace <225 kBtu .90-.95 AFUE	KBTU	16	$	8.61		3.67
Multi-stage furnace <225 kBtu .95+ AFUE	KBTU	16	$	10.76		4.22
Single-stage furnace <225 kBtu .90-.95 AFUE	KBTU	16	$	6.66		2.87
Single-stage furnace <225 kBtu .95+ AFUE	KBTU	16	$	8.61		3.67
Commercial/Industrial – Natural Gas – Shell						
Less than R11 attic insulation (E/G) to R30-R44 attic insulation	Sq Ft	22	$	0.76		0.09
Less than R11 attic insulation (E/G) to R45+ attic insulation	Sq Ft	22	$	0.86		0.13
Less than R11 roof insulation (E/G) to R30+ roof insulation	Sq Ft	22	$	0.62		0.12
Less than R4 wall insulation (E/G) to R11-R18 wall insulation	Sq Ft	22	$	0.61		0.24
Less than R4 wall insulation (E/G) to R19+ wall Insulation	Sq Ft	22	$	0.65		0.36
Residential – Electric – Fuel Conversion						
Natural gas furnace	Unit	20	$	3,031.98	7,384.00	(449.00)
Natural gas furnace + water heater	Unit	20	$	4,416.43	9,789.00	(565.00)
Residential – Electric – MFDI						
Multifamily Direct Install	Unit	12	$	769,391	$1,288,412	

Residential – Electric – Prescriptive						
Attic insulation less than R11 to R49	Sq Ft	45	$	1.17	1.75	
Ductless heat pump (displace zonal)	Unit	15	$	3,553.36	2,348.00	
E ESTAR HOME – MANUF, ELEC/DF	Unit	25	$	2,400.94	3,315.00	
ELEC resistance to ASHP	Unit	18	$	4,359.21	5,865.33	
ElEC storm windows	Sq Ft	20	$	9.90	12.25	
ELEC windows --> <0.30 U	Sq Ft	45	$	22.32	11.13	
ELEC windows --> <0.30 U	Sq Ft	45	$	22.32	11.00	
Floor insulation R0->=R19+	Sq Ft	45	$	1.41	1.00	
Front load washer	Unit	14	$	61.54	143.00	
Heat pump water heater (any size ave tier 2/3)	Unit	13	$	629.17	1,166.00	
Vented ENERGY STAR clothing dryer	Unit	23	$	20.44	68.00	
Wall insulation R0->=R11+	Sq Ft	45	$	1.54	2.00	
Web Tstat Elec Cont	Unit	15	$	294.25	748.50	
Web Tstat Elec DIY	Unit	15	$	240.35	748.50	
Residential – Electric – Simple Steps						
Clothing washer	Unit	11	$	55.00	108.58	
LED – decorative ceiling flush mount fixture – 2000-7999 lumens	Unit	20	$	7.80	25.00	
LED – exterior porch light fixture – 2000-7999 Lumens	Unit	20	$	1.48	37.00	
LED – general purpose and dimmable – 1050-1489 lumens	Unit	13	$	3.32	5.00	
LED – general purpose and dimmable – 1490-2600 lumens	Unit	13	$	2.67	6.00	
LED – general purpose and dimmable – 250-1049 lumens	Unit	13	$	0.55	1.00	
LED – globe – 250-1049 lumens	Unit	13	$	1.04	6.00	
LED – reflectors and outdoor – 1050-1489 lumens	Unit	13	$	0.69	6.00	
LED – reflectors and outdoor – 1490-2600 lumens	Unit	13	$	5.44	59.00	
LED – reflectors and outdoor – 250-1049 lumens	Unit	13	$	0.50	10.00	
LED – track light fixture – 2000-7999 Lumens	Unit	20	$	8.20	63.50	
LED – bathroom vanity – 2000-7999 Lumens	Unit	13	$	5.15	17.50	
LED – MR Bi-Pin base – 250-499 Lumens	Unit	12	$	0.88	4.00	
LED – MR Bi-Pin base – 500-999 Lumens	Unit	12	$	0.88	8.00	
LED – recessed retrofit – 500-1999 Lumens	Unit	20	$	0.56	18.50	
Showerhead 2.0 GPM	Unit	10	$	0.37	19.96	
Residential – Natural Gas – Prescriptive						
ENERGY STAR home – gas only	Unit	25	$	2,117.00		133.98
Attic insulation	Sq Ft	45	$	1.30		0.15
Floor insulation	Sq Ft	45	$	1.31		0.06

HE water heaters (<= 55)(.65 or greater)	Unit	15	$	315.85		21.80
Wall insulation	Sq Ft	45	$	1.38		0.07
Web Tstat gas cont	Unit	15	$	294.25		26.00
Web Tstat gas DIY	Unit	15	$	240.35		26.00
Windows dual pane <0.30 U-value	Sq Ft	45	$	22.58		0.37
Windows single pane <0.30 U-value	Sq Ft	45	$	22.32		0.37
High efficiency wall furnace (AFUE 90%)	Unit	20	$	2,000.00		103.00
Natural gas boiler 96% AFUE	Unit	20	$	2,855.00		112.40
Natural gas furnace 90%	Unit	20	$	823.10		103.00
Natural gas furnace 90%	Unit	20	$	823.10		71.00
Storm windows	Sq Ft	20	$	9.90		0.42
Low-Income – Electric						
Duct sealing	Unit	20	$	394.00	689.00	-
Ductless heat pump (displace Zonal)	Unit	15	$	4,103.00	2,348.00	-
Ductless heat pump w FAF	Unit	15	$	4,103.00	3,902.55	-
Air infiltration	Sq Ft	15	$	0.73	1.00	-
ENERGY STAR rated doors	Unit	40	$	608.53	186.86	-
ENERGY STAR refrigerator	Unit	20	$	100.23	39.00	-
HE AIR HPUMP	Unit	15	$	4,055.53	2,053.50	-
INS – ceiling/attic	Sq Ft	45	$	1.81	0.46	-
INS – DUCT	Sq Ft	45	$	2.83	2.61	-
INS – floor	Sq Ft	45	$	2.93	1.23	-
INS – wall	Sq Ft	45	$	2.03	1.48	-
E TO G combo	Unit	20	$	9,613.00	9,075.00	(402.00)
E TO G furnace conversion	Unit	20	$	2,950.00	3,496.00	(133.00)
E TO G H2O conversion	Unit	15	$	1,518.00	1,586.00	(84.50)
Elec Res --> heat pump	Unit	15	$	4,055.53	5,865.33	-
HHS	Unit	1	$	1.00	1.00	1.00
Outreach LEDs	Unit	13	$	1.10	9.00	-
Tier 2-3 any size HPWH	Unit	13	$	697.39	587.33	-
Windows	Sq Ft	45	$	8.55	1.64	-
Low-Income – Natural Gas						
INS – DUCT	Sq Ft	45	$	8.01		0.07
INS – floor	Sq Ft	45	$	4.48		0.07

APPENDIX J – 2020-2021 EVALUATION WORK PLANS

Work Plan: Evaluation, Measurement and Verification (EM&V) of Avista's 2020-2021 Energy Efficiency Programs

Prepared for:

Avista Corporation

Delivered on:

January 7, 2020

Prepared by:

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1. Technical Evaluation Plan

This Evaluation, Measurement, and Verification (EM&V) Plan details the methods by which ADM Associates, Inc. (ADM) and Cadeo will complete the impact evaluation of Avista Utility's (Avista) 2020 Programs as-specified in ADM's response to the Request for Proposals (RFP) for evaluating Avista Utility's ("Avista") 2020-2021 residential and residential low-income (collectively, "residential") energy efficiency programs in Idaho and Washington.

1.1 Summary of Avista's Residential and Low-Income Portfolio

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

Table 1-1: Impact Evaluation Activities by Program

Program	Database Review	Survey Verification	Impact Methodology
Water Heat	✓	✓	Billing analysis with comparison group
HVAC	✓	✓	Billing analysis with comparison group
Shell	✓	✓	Billing analysis with comparison group
ENERGY STAR Homes	✓	✓	Simulation modeling/Billing analysis with comparison group
Residential Small Home & Multifamily Weatherization*	✓		RTF UES/ Billing analysis with comparison group
Residential Fuel Efficiency Program	✓		Billing analysis with comparison group
Low-Income	✓		Billing analysis with comparison group
CEEP	✓		RTF UES/Billing analysis with comparison group

*This program was not deployed for the 2020 program year. Evaluation of this program will commence in 2021.

1.2 Evaluation Approach

ADM will perform an impact evaluation on each of the programs. ADM will use the following approaches to calculate energy impact defined by the International Performance Measurement and Verification Protocols (IPMVP) and the Uniform Methods Project (UMP):

- Simple verification (web-based survey)
- Deemed savings and/or Engineering Algorithms (IPMVP Options A & B)
- Whole building billing analysis (IPMVP Option C)
- Simulation modeling (IPMVP Option D)

ADM will complete and report the results of the above impact tasks for each the electric impacts and the natural gas impacts for each state separately.

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, we will also review 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)
- 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[1]
- International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization (EVO) with sponsorship by the U.S. Department of Energy (DOE)[2]

We will keep our data collection instruments, calculation spreadsheets, and monitored/survey data available at the request of Avista. Any component of the data collection or analysis will be made available at request. All communications (including data transfer) will be consistently performed with constant communication and data sharing protocols.

1.2.1 Impact Evaluation Approach

This section presents our general cross-cutting approach to accomplishing the scope of work outlined in the Request for Proposal (RFP) for impact evaluation of Avista's Residential and Low-Income programs listed in Table 1-1. The Evaluators start by presenting our general evaluation approach. This chapter is organized by general task due to several overlap across programs. Section 1.3 describes the Evaluators' program-specific impact evaluation methods in further detail.

ADM outlines our 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. There will be no on-site verification or equipment monitoring.

Our general approach for this evaluation considers the cyclical feedback loop among program design, implementation, and impact evaluation. Our activities during the evaluation will 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 2020 and 2021 program years. ADM will provide the following services and objectives as deliverables to Avista for this evaluation, as specified in the RFP:

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[1] 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.

[2] Core Concepts: International Measurement and Verification Protocol. EVO 100000 – 1:2016, October 2016.

1. Independently verify, measure and document energy savings impacts from each of Avista's electric and natural gas energy efficiency Programs, or for Program categories representing consolidated small-scale offerings from January 1, 2020 through December 31, 2021;
2. Analytically substantiate the measurement of those savings;
3. Calculate the cost effectiveness of the Portfolio and component Programs using the Total Resource Cost Test (TRC), Utility Cost Test (UCT), Participant Cost Test (PCT), Ratepayer Impact Measure Test (RIM), and, potentially, the Resource Values Test (RVT) tests;
4. Identify Program improvements, if any; and
5. Identify possible future Programs.

In addition to the above services, we have identified the following deliverables to Avista for this evaluation:

- Two (2) separate and independent evaluation reports, one for Idaho and one for Washington, of Avista's Residential Natural Gas Impact Evaluation for each program year
- Two (2) separate and independent evaluation reports, one for Idaho and one for Washington, of Avista's Residential Electric Impact Evaluation for each program year
- An independent estimate of kWh and Therm savings for 2020 and 2021 through thorough and proper evaluation of program impacts with statistical precision and confidence at a minimum of 10%/90% for each state and fuel type
- Presentation of evaluation findings to Avista's Spokane offices or other regional locations, as required, along with additional stakeholders, as necessary
- Updates to Avista's Technical Reference Manual (TRM), annually, based on Avista's evaluation findings and secondary information
- All supporting workpapers for calculations, tables, graphs, and other documents as necessary
- State-specific reports on any project where realization rate is expected to be less than 90% as well as a complete listing of all projects where any material adjustments were made
- Summary of any deviations from historical methodology for calculating cost-effectiveness in the final report in addition to a presentation of deviations to the Advisory Group.

ADM will deliver the 2020 program year results by April 15, 2021, and the 2021 program year results by April 15, 2022. We approach evaluation with the frame of mind that the final report should not contain information that has not already been communicated with Avista. This is achieved through the following:

- **Transparency of Evaluation Effort.** In our evaluations, we will keep our data collection instruments, models, calculation spreadsheets, programming scripts, and monitored data/survey data available at the request of Avista. All components of the data collection or analysis will be made available in their native format with all formulas intact, informing Avista as to how the calculation of energy savings is performed and allowing for independent review of ADM's efforts.
- **Regular Updates on Impact Findings.** ADM approaches the evaluation effort with the frame of mind that Avista should know the realized savings of the program prior to delivery of evaluation reporting. This will be accomplished through regular updating of all involved parties as to the

findings of the impact evaluation effort. This allows for real-time feedback regarding the performance of varying measures or participant classes, feeding into a process of continuous program improvement. This also allows for Avista to conduct an independent review or quality check of ADM's analysis, if desired. ADM's analysis will be kept transparent throughout the evaluation effort.

This document contains the approach for the evaluation of Avista's 2020 and 2021 program year. It is ADM's intention to formalize this workplan in collaboration with Avista; This is a collaborative effort with Avista to ensure Idaho Public Utilities Commission (PUC) and Washington Utilities and Transportation Commission (WUTC) receives accurate and reliable program findings and that Avista receives meaningful insights to continue energy efficiency efforts and improve program results. ADM will provide comprehensive documentation and transparency for all evaluation tasks and will provide ongoing technical reviews and guidance throughout the evaluation cycle.

ADM will employ the following approach to complete impact evaluation activities for the programs. ADM defines three 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 require an adjustment for certain measures, such as lighting measures in which site operating hours may differ from RTF values. ADM will work with Avista to identify these instances and develop a method for calculated an adjusted value. This approach aligns with the IPMVP Option A and B.
- A *Billing Analysis* approach involves estimating energy savings by applying a linear regression to measured participant energy consumption utility meter billing data. Billing analyses may also include billing data from nonparticipant customers. This approach does not require on-site data collection for model calibration. However, a sample of customers or sites may be selected and surveyed to confirm that the energy conservation measures were installed and are still operating. This approach aligns with the IPMVP Option C.
- A *Simulation Model Analysis* approach involves a whole building simulation using the program REM/Rate and a User Defined Reference Home (UDRH) to compare the efficient home and the baseline home. The UDRH is designed as an exact replica of each program participating home in terms of size, structure, and climate zone. This approach aligns with the IPMVP Option D. ADM will apply appropriate net-to-gross (NTG) values to estimate net impacts.

ADM will accomplish the following quantitative goals as part of the impact evaluation:

- Verify savings with 10% precision at the 90% confidence level by program year;
- 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.

1.2.2 Database Review

At the outset of the evaluation, ADM will review the databases to ensure that each program tracking database conforms to industry standards and adequately tracks key data required for evaluation. ADM will additionally review program materials – such as program theory and logic models to identify potential issues and key barriers to end-use behavior changes that could be influenced by efforts by each program.

Measure-level gross savings will be evaluated primarily by reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied using the Avista TRM. The ADM team will then aggregate and cross-check program and measure totals. The ADM team will calculate verified gross program savings by summing deemed kWh and Therm savings per project.

The ADM team will clearly identify, clarify, and substantiate any variations in the savings calculations we uncover. We will integrate all findings into the final evaluation report. In addition to reporting the total gross realization rates, we will also quantify the associated impact each adjustment had on the overall program savings.

1.2.3 Simple Verification Methods

ADM will verify a sample of participating households for detailed review of the installed measure documentation and development of verified savings. Proposed sample sizes for documentation review is detailed in Table 1-2 in the section below. ADM will work with Avista to adjust the sampling plan once program tracking data has been delivered and participation rates are finalized.

ADM will also verify tracking data by reviewing invoices and surveying a sample of participant customer households. We will coordinate as needed with Avista's process evaluation contractor in conducting participant surveys. Proposed sample sizes for documentation review are detailed in Table 1-3 in the section below. The following sections describe ADM's general methodology for conducting document-based verification and survey-based verification.

1.2.3.1 Documentation-Based Verification

ADM will first screen each rebate household to ensure the customer who received a measure did not also receive another measure that disqualifies that customer from participating in either program, such as the ENERGY STAR Homes rebate in combination with an HVAC rebate. Tracking data will be reviewed to verify each measure satisfies all program efficiency requirements.

ADM will also request rebate documentation for a subset of participating customers. These documents will include invoices, rebate applications, and additional materials required for accepting rebate applications for each of the following programs:

- Water Heat Program
- HVAC Program
- Shell Program
- ENERGY STAR Homes Program

This sample of documents will be used to cross-verify tracking data inputs. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report under each program.

ADM will develop a sampling plan that achieves a sampling precision of ±10% with 90% statistical confidence – or "90/10 precision" – to estimate the percentage of projects for which the claimed savings are verified or require some adjustment. ADM will use the following equations to estimate sample size requirements for each program and fuel type. If the population of participants is small, ADM will use the finite population size equation. Otherwise, ADM will use the infinite population size equation.

Equation 1-1 Sample Size for Infinite Sample Size

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

Equation 1-2 Sample Size for Finite Population Size

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

Where,

n = Sample size

Z = Z-value

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. The most conservative value of *CV* is 0.5, as that results in the largest sample size. Specifically, it yields a sample size of 68 for an infinite population. In cases in which the participant population is small enough that Equation 1-2 produces a smaller sample size, we will use that sample size.

Based on the above considerations, ADM proposes the following sample sizes for the above programs' document review (Table 1-2). The representative participant sample will be adjusted for each of the programs in Washington and Idaho, by fuel type.

Table 1-2: Sample Design for Document Review for Washington and Idaho Combined

Program	Fuel	Population	Sample (With Finite Population Adjustment)[1]
Water Heat	Electric	127	45
	Natural Gas	957	64
HVAC	Electric	419	59
	Natural Gas	7,401	68
Shell	Electric	379	58
	Natural Gas	1,337	65
ENERGY STAR Homes	Electric	44	27
	Natural Gas	6	6
Residential Small Home & MF Weatherization	Electric	NA	NA
	Natural Gas	NA	NA
Residential Fuel Efficiency Program	Electric	95	40
Low-Income	Electric	364	58
	Natural Gas	550	61
CEEP	Electric	21	17
	Natural Gas	0	0

*Residential and Low-Income combined

[1]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 above values represent our preliminary sample design. ADM will work with Avista to adjust these sample sizes once program tracking data has been delivered for the program year in evaluation. ADM understands that representation of participants in each state in Avista's service territory is critical. Therefore, ADM will ensure the samples for document review includes participants in both Washington and Idaho in addition to representation of each the electric and natural gas fuel types.

1.2.3.2 Survey-Based Verification

The primary purpose of conducting a verification survey would be to confirm that the measure was installed and is still currently operational and whether the measure was early retirement or replace-on-burnout. Units found to be inoperative prior to replacement could be re-classifies as replace-on-burnout. This would aid in providing more accurate estimation of annual savings by replacement type.

ADM proposes to conduct survey-based verification for the Water Heat Program and the HVAC Program. The evaluation of these programs would benefit from additional information from the participating customer on baseline equipment and home heating and cooling type. Survey responses for these programs may be used to confirm assumptions made during the impact analysis via billing regression. ADM concluded that it is unlikely a survey would provide additional insight or adjustments to the Shell

Program or ENERGY STAR Homes Program; therefore, these programs are not included in the survey-based verification effort.

If there is reason to believe, however, that the misclassification of measures is rare, then the likely value of collecting such information must be weighed against the effort and cost of surveying customers. This is especially a concern, given that the process evaluation contactor may be fielding a survey of the same customer population at the same time or nearly the same time. One possible approach is for the process evaluation contractor to include a question about the operability of the old equipment at the time the new measure was purchased.

Therefore, we suggest holding off making a final decision on fielding a survey until ADM has been able to confer with the process evaluation contractor. Should the decision be made to proceed with a verification survey, ADM will also ask the participant questions about additional details of the installed unit, such as sizing of furnace, model number, number of light bulbs installed, etc.

ADM proposes the sample sizes shown in Table 1-3 for the Water Heat and HVAC document review. The representative participant sample will be adjusted for each of the programs in Washington and Idaho, by fuel type. ADM will develop a sampling plan that achieves a sampling precision of ±10% with 90% statistical confidence – or “90/10 precision” – for net realized savings estimates at the measure category level for all significant measures during web-based survey verification.

Table 1-3: Sample Design for Verification Survey for Washington and Idaho Combined

Program	Fuel	Survey Verification Goal
Water Heat	Electric	45
	Natural Gas	64
HVAC	Electric	59
	Natural Gas	68
Fuel Efficiency	Electric	40

The above values represent our preliminary sample design. ADM will work with Avista to adjust these sample sizes during the kickoff meeting and the formation of Avista’s Electric and Natural Gas Residential EM&V Plan for Idaho and Washington.

ADM will develop the web-based verification guide for review and comment by Avista staff prior to deploying these verification surveys. ADM will employ our in-house survey research center to support all survey-based data collection efforts. In cases where the web-based survey response does not meet sampling target, ADM will use our in-house survey research center to reach out to customers via phone call.

ADM will develop a sampling plan that achieves 90/10 precision at the measure category level for all significant measures during web-based survey verification. The selected sample participants will be offered a $10 gift card incentive to participate in the verification survey. In the case the targeted number of web-based survey completes is not reached, ADM will supplement with phone interviews to reach the 90/10 precision goal.

These surveys will be designed to ensure that best practices and lessons learned from individual programs are then shared and incorporated across the entire program portfolio. In order to facilitate evaluation among and between programs, customer surveys will contain a standard set of questions to be addressed across all Avista programs.

The findings from these activities will serve to:

- Verify measure was installed
- Verify measure is functional
- Gather pre-retrofit equipment information
- Gather retrofit equipment information

1.2.4 Impact Evaluation Methods

ADM will employ the following approach to complete impact evaluation activities for the programs. ADM defines three major approaches to determining net savings for Avista's programs:

- Deemed Savings
- Billing Analysis
- Simulation Model Analysis

ADM will also estimate gross savings for all measures that require billing analyses for planning purposes at the request of Avista.

In the following sections, we summarize the general guidelines and activities ADM will follow to conduct each of the above analyses.

1.2.4.1 Deemed Savings

This section summarizes the deemed savings analysis method ADM will employ for the evaluation of a subset of measures for each program. ADM will complete the validation for specific measures across each program using the RTF unit energy savings (UES) values, where available. The goal is to ensure that the proper measure unit savings were recorded and used in the calculation of Avista's ex-ante measure savings. ADM will request and use the RTF document version Avista employed during calculation of ex-ante measure savings. The ADM team will document any cases where we recommend values differing 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, ADM will verify the quantity and quality of installations and apply the RTF's UES to determine verified savings. If we find any projects that do not use the RTF values, we will complete additional investigation and review of measures with custom savings inputs through engineering algorithms. ADM understands that for measures using RTF UES, no NTG adjustments are necessary.

ADM will verify the following home specifications, as required by the RTF:

- Verify heating system type
- Verify heating and cooling zone

ADM will review program application documents for a sample of incented measures to verify the tracking data accurately represents the program documents. ADM will ensure the home installed measures that meet or exceed program efficiency standards.

1.2.4.2 Billing Analysis

This section summarizes the general billing analysis methods ADM will employ for the evaluation of a subset of measures for each program. For further details on the specific model specifications to be explored for each measure, see Section 1.3.

For the purposes of this summary, 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 conduct a linear regression billing analysis for energy efficiency measures, ADM requires billing data for a control group to compare against treatment households via quasi-experimental methods. The evaluation team will request billing data for nonparticipant customers to serve as the control group. This method assumes Avista is able to provide consumption data for a group of similar non-participating customers in the service area.

ADM will attempt to create a statistically similar control group using propensity score matching (PSM), a method that allows the evaluators to find the most similar nonparticipant customer households based on a range of independent variables. ADM has extensive experience conducting propensity score matching for residential program billing analyses of similar measures and is familiar with the implications and uncertainties involved in this type of analysis. ADM will use available datasets to ensure the control households are similar to the treatment homes, using variables such household square footage, household heating type, household occupancy date, household zip code, and any other information available for the nonparticipant customers specific to the program. For example, to create a sufficient counterfactual group for the Low-Income Program, ADM will request flags for income eligibility across nonparticipant customers.

Further information on the selection of customers for a counterfactual control group is detailed below, as well as potential risks and implications. If a sufficient control group can be constructed, ADM will compare participant billing data to the control billing data, as detailed in IPMVP Option C. ADM will fit a regression model to estimate weather-dependent daily consumption differences between participating customer households and nonparticipating customer households. ADM will include independent variables such as Heating Degree Days for weather controls, square footage, and other household characteristics where applicable to improve model confidence. We will tailor our regression model specifications to each program and measure. ADM will explore the following regression models:

- Fixed effect Difference-in-Difference (D-n-D) regression model (recommended in UMP protocols)
- Random effects post-program regression model (recommended in UMP protocols)

Further details on model specifications can be found below. It is important to note that because whole household consumption is used, the savings value includes the positive or negative effects of any non-measure changes made in the household. This option is used to determine the collective savings of all measures applied to the program-participating household by the energy meter. Therefore, ADM will attempt to isolate households that have installed only the measure in evaluation. For example, in evaluating the furnace measure in billing analyses, ADM will exclude households that have also installed an incented water heater in order to effectively isolate the effects of the furnace retrofit.

The period of billing data should cover the same timeframe for both groups. To evaluate the 2020 and 2021 program years, ADM will request billing data ranging from at least one year prior to measure intervention (i.e. date measure was installed, or date household was built) through the most recent date available from each household.

The following lists the data requirements for billing analysis:

1. Monthly billing data for program participants (treatment)
2. Monthly billing data for a group of non-program participants (control)
3. Household-level data provided by Avista and public sources relevant to program requirements and targeted customers

The following steps will be taken to prepare data:

1. Gather billing data for homes that participated in the program.
2. Exclude participant homes that also participated in the other programs, if either program disqualifies the combination of any other rebate or participation.
3. Gather billing data for similar customers that did not participate in the program in evaluation
4. Create a matched control group using non-participant billing and customer and/or household characteristic data.
5. Exclude homes missing sufficient billing data.
6. Exclude bills with consumption indicated to be outliers.

ADM will report parameters necessary to portray model accuracy and significance such as coefficient p-values, adjusted *R*-squared values, and household-level and program-level kWh and Therm savings at the 90% confidence intervals for each state. Program-year savings estimates at the monthly- and annual-level will also be reported for each state and fuel type.

One major caveat of this method is that we must be able to gather a sufficiently large sample of control households that are statistically similar to the treatment households. If the nonparticipant homes are statistically different from the participant homes in the pre-treatment period, this analytical approach will not provide meaningful results and ADM will therefore validate savings via RTF or Avista TRM engineering algorithms as well as additional literature review.

Billing analysis with a valid counterfactual group can provide reliable net impact estimates at the measure-level and program-level. However, the success of a billing analysis depends on the availability of several key factors:

- A sufficient number of customers have installed the measure to isolate measure-level savings;
- A sufficient number of similar nonparticipant customers can be identified and used towards propensity score matching to create a valid counterfactual group for the measure;
- Install dates for the measure display sufficient variability; and

- Historical billing data is available for at least one year prior to customer install dates.

ADM will also conduct an additional billing analysis for these measures to estimate gross savings. This analysis is very similar to the net estimate methodology, but it will not require the use of a counterfactual control group.

ADM provides further detail on the implications of each of the components listed above.

Comparison Group

To estimate reliable net impacts through billing analysis, a similar counterfactual group must be selected. 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. ADM proposes to construct a comparison group of nonparticipants who are similar to participants and reflect the counterfactual condition. ADM aims to achieve this by selecting customers from one of the two following options:

- Future program participants or
- Nonparticipants selected through propensity score matching (PSM)

For the prior case, ADM would isolate customers that participated later in the program year as the control group to compare against customers that participated earlier in the program year (the treatment group). ADM will then verify that the treatment and control groups display similar pre-period average daily consumption through *t*-testing and run a linear regression model to estimate the measure effect on consumption in the post-period.

In the latter case, ADM will use propensity-scoring matching (PSM) to match nonparticipants to similar participants using pre-period data, test the validity of the matches with *t*-testing, and run a linear regression to estimate the measure effect. 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.

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. ADM will create 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 will allow ADM to select from a large group of similar households that have not installed an incented measure. With this information, ADM will attempt to create a statistically valid matched control group via seasonal pre-period usage. After matching, ADM will conduct a *t*-test for each month in the pre-period to help determine the success of PSM.

After creating a PSM control group, ADM will carry out linear regression modeling on the treatment and matched control group.

For measures that are active during the heating season only, such as the air source heat pump or furnace, ADM will include heating degree days in the model specification. For measures that are active during the heating season and cooling season, such as water heaters and thermostats, ADM will include heating degree days and cooling degree days in the model specification.

In addition, ADM will test and select the optimal temperature base for heating degree days and cooling degree days based on model *R*-squared values. ADM will select a value between 60- and 80-degrees Fahrenheit that displays the optimal model *R*-squared value. The selected base temperature therefore maximizes the total variation the model is able to explain.

Fixed Effects Difference-in-Difference Regression Model

To calculate the impacts of each measure, ADM will apply a linear fixed effects regression using participant and nonparticipant 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 1-3: Fixed Effects Difference-in-Difference (D-n-D) Model Specification

$$\begin{aligned} ADC_{it} = \alpha_0 &+ \beta_1(Post)_{it} + \beta_2(Post \times Treatment)_{it} + \beta_3(HDD)_{it} + \beta_4(CDD)_{it} \\ &+ \beta_5(Post \times HDD)_{it} + \beta_6(Post \times CDD)_{it} + \beta_7(Post \times HDD \times Treatment)_{it} \\ &+ \beta_8(Post \times CDD \times Treatment)_{it} + \beta_9(Customer\ Dummy)_i + \varepsilon_{it} \end{aligned}$$

Where,

ADC_{it} = Estimated average daily consumption (dependent variable) in home *i* during period *t*

$Post_{it}$ = 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*

$Customer\ Dummy_i$= A dummy variable indicating customer-specific identifier at home *i*

ε_{it} = Customer-level random error

α_0= The model intercept for home *i*

β_{1-9} = 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 will then be estimated by extrapolating the β_7 and β_8 coefficients with Typical Meteorological Year (TMY) HDD and CDD data or actual weather displayed in the program year, gathered from NOAA. Note that the Treatment term is dropped from the model specification due to fixed effects. This term is not included because it would be collinear with the customer-specific dummy variable.

This option is used to determine the collective savings of all measures applied to the program-participating household by the energy meter. It is important to note that because whole household consumption is used, the savings value includes the positive or negative effects of any non-measure changes made in the household.

Random Effects Post-Program Regression Model

ADM will also explore the post-program regression model with random effects to estimate net program savings. 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 1-4 Post-Program Regression (PPR) Model Specification

$$\begin{aligned}
ADC_{it} = {} & \alpha_0 + \beta_1(Treatment)_i \\
& + \beta_2\ (PreUsage)_i \\
& + \beta_3\ (PreUsageSummer)_i \\
& + \beta_4(PreUsageWinter)_i \\
& + \beta_5(Month)_t \\
& + \beta_6(Month \times PreUsage)_{it} \\
& + \beta_7(Month \times PreUsageSummer)_{it} \\
& + \beta_8(Month \times PreUsageWinter)_{it} \\
& + \varepsilon_{it}
\end{aligned}$$

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

$Treatment_i$ = Dummy variable indicating whether household *i* was in the treatment or control group

$Month_t$ = Dummy variable indicating month-year 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 pre-treatment billing reads

$PreUsageWinter_i$ = Average daily usage in the winter months across household *i*'s available pre-treatment billing reads

ε_{it} = Customer-level random error

α_0= The model intercept for home *i*

β_{1-8} = 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.

In this specification, savings are calculated by:

Equation 1-5 Monthly Savings Estimate

$$Savings = \sum Treatment\ Coeff \times Number\ of\ recipients\ in\ month\ i \\ \times Number\ of\ days\ in\ month\ i$$

Gross Billing Analysis

The sections above detail ADM's methodology for estimating net energy savings for each measure. The results of the above methodology report net savings due to the inclusion of the counterfactual comparison group. However, for planning purposes, it would also be useful to estimate gross savings for each measure. To estimate gross savings, ADM will employ similar regression models, but only with the participant customer billing data. This analysis will not include any control group billing data and will only model energy reductions between the pre-period and post-period for the measure participants.

To calculate the impacts of each measure, ADM will apply a 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 1-6: Treatment-Only Fixed Effects Weather Model Specification

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

ADM also will explore the monthly regression model rather than degree days to estimate gross program savings.

Equation 1-7 Treatment-Only Fixed Effects Monthly Model Specification

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

ADM will test and select the optimal regression model and temperature base for heating degree days and cooling degree days based on model *R*-squared values.

The results of the treatment-only regression models will be gross savings estimates. The gross savings estimates will be 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 PY2020 and perhaps also PY2021 will be affected by the stay-at-home orders that had taken effect starting March 2020 in Idaho and Washington. The stay-at-home orders most likely will affect the post-period household usage. Because there is insufficient post-period data before the shelter-in-place orders, ADM is 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.

1.2.4.3 Simulation Model Analysis

ADM provides the following method for deriving savings from the ENERGY STAR Homes Program. This method involves a whole building simulation (IPMVP Option D) in addition to a billing analysis with a counterfactual control group.

The simulation analysis results in gross savings estimates whereas a billing analysis with a control group results in net savings estimates. Therefore, ADM will use a simulation analysis with a net-to-gross (NTG) savings adjustment or a billing analysis with a counterfactual control group.

This approach involves the comparison of participating homes with a User Defined Reference Home (UDRH). The methodology detailed in this section is supported by the IPMVP Option D as a whole building simulation using calibrations. ADM will use the simulation models to compare a sample of participating homes with a User Defined Reference Home (UDRH), an agreed upon set of efficiency standards built to represent the baseline residential home in the region. The UDRH is defined in more detail in the following subsection.

ADM will use the program REM/Rate to complete whole building simulation modeling efforts. The UDRH feature in REM/Rate allows energy consumption to be calculated using energy efficiency input values for both the efficient home and the baseline home. The UDRH will be designed as an exact replica of each program participating home in terms of size, structure, and climate zone. However, instead of using the actual HERS-rated efficiency values, we use the energy codes defined in the UDRH. ADM will gather energy characteristics for the efficient, rated home by requesting HERS datafiles from the certified HERS-raters or by gathering information from the HERS certificates required by the program and provided by Avista.

To calculate the gross savings for a given home, first, the as-built home is verified using building characteristics found in supporting documentation. Once the efficient home is modeled, the energy model calculates the unadjusted gross savings by subtracting the energy use of the as-built home from the energy use of its UDRH baseline home. This method provides a reliable and supported means of verifying gross residential new construction home savings.

Energy savings will be calculated per-home with the following calculation:

Equation 1-8: Whole Building Model Energy Savings

$$Energy\ Savings = Consumption_{UDRH} - Consumption_{ENERGY\ STAR}$$

Where,

$Consumption_{UDRH}$ = Simulated energy consumption values from REMRate for a household under the UDRH efficient code standards

$Consumption_{ENERGY\ STAR}$ = Simulated energy consumption from REM/Rate for a household built referencing the HERS certification values

ADM defines the UDRH used to evaluate simulated savings in the following section.

User Defined Reference Home (UDRH)

The UDRH represents a home built to meet the state of Idaho's and Washington's current minimum energy efficiency code requirements. Idaho uses the residential 2015 International Energy Conservation Code (IECC) with amendments[3] for newly constructed residential homes until January 1, 2021. Starting in 2021, Idaho will use the residential 2018 IECC with Idaho amendments. ADM will use the residential 2015 IECC with Idaho-specific amendments efficiency values to create the UDRH when evaluating homes built in Idaho during the 2020 program year and the 2018 IECC with Idaho-specific amendments when evaluating homes built in Idaho during the 2021 program year. This comparison will provide an accurate simulation of a newly constructed minimum efficient code residential home to compare against efficiency, program-participating homes. For homes built in Avista's territory in Washington state lines, ADM will create a UDRH based on Washington residential building codes, which are modeled after International Residential Code (IRC) 2015.

Realization rates from the home-level analyses can be used to provide strategic guidance for program improvement. We will examine realization rates for commonalities among home builders or HERS raters and inform Avista if any program partner demonstrates a statistically significant increased likelihood of association with low realization rates. We will then review the home results in further detail to identify a root-cause (errors in model input, construction practice, equipment sizing, etc.)

1.2.5 Net-To-Gross

The Northwest RTF UES measures do not require NTG adjustments. 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).

However, the simulation model analysis presented for the ENERGY STAR Homes Program results in gross savings estimates.

1.2.6 Cost-Effectiveness Tests

ADM will calculate each program's cost-effectiveness, avoided energy costs, and implementation costs. ADM will use our ADM-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, ADM will determine the economic performance with the following cost-effectiveness tests:

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[3] https://www.energycodes.gov/adoption/states/idaho

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

1.2.7 Non-Energy Benefits

ADM will use 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. ADM understands the RTF provides NEB values for electric measures, but not natural gas measures.

In addition to the residential NEBs, ADM will apply the end-use non-energy benefit and health and human safety non-energy benefit to the Low-Income Program. ADM understands that the two major non-energy benefits referenced above are uniquely applicable to the Low-Income Program. ADM will apply those benefits to the program impacts as well as additional non-energy benefits associated with individual measures included in the program.

ADM will incorporate additional NEBs to the impact evaluation, as applicable and under guidance from Avista.

1.3 Program-Level EM&V Approaches

ADM presents a summary of the program-specific impact evaluation work procedures. ADM will work with Avista to adjust program-specific impact and sampling plans as additional information is received about program participation, program restrictions, measure offerings, and available data.

1.3.1 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 1-4 summarizes the measures offered under this program.

Table 1-4: Water Heat Program Measures

Measure	Impact Analysis Methodology
Electric Water Heater (0.94 EF or higher)	Billing Analysis
Natural Gas Water Heater (0.60 EF or higher)	Billing Analysis
Natural Gas Tankless Water Heater (0.82 EF or higher)	Billing Analysis

ADM summarizes the program-specific and measure-specific impact analysis activities and requirements for the Water Heat Program in the section below.

1.3.1.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the Water Heat Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

In addition, ADM will randomly select a subset of participant customers to survey for simple verification of installed measure, displayed in Table 1-3. ADM will include 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?
- What is the efficiency and sizing of the newly installed water heater?

These questions will help ADM verify that the measure was documented accurately and that data collection activities are progressing smoothly for the program. In addition, in the event that billing analysis is infeasible, this simple verification will help ADM more accurately estimate measure-level impacts using engineering algorithms.

1.3.1.2 Impact Analysis

ADM will conduct a billing analysis regression using with a counterfactual group selected via propensity score matching on each of the water heater measures in the Water Heat Program. ADM will isolate each unique measure and verify the participant did not also participate in other programs; therefore, ADM will be able to isolate the measure effects using the customer's consumption billing data.

ADM will attempt to create a valid quasi-experimental control group using nonparticipant customer data and available household characteristics. ADM will work with Avista to identify household characteristics the Water Heat Program targets in order to identify nonparticipant customers similar to program participants. ADM will then explore the linear regressions summarized in Section 1.2.4.2 with controls for HDD and CDD to estimate weather-related impacts from each measure. ADM will summarize the measure-level impacts by extrapolating regression coefficients with TMY data or actual weather data.

1.3.1.3 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of measure install
- Filled rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if available

1.3.1.4 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis, ADM will review RTF values and Avista TRM methods along with verified tracking data to estimate net program savings.

1.3.2 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 1-5 summarizes the measures offered under this program.

Table 1-5: HVAC Program Measures

Measure	Impact Analysis Methodology
Variable speed motor	Billing Analysis
Electric to air source heat pump	Billing Analysis
High efficiency natural gas furnace	Billing Analysis
High efficiency natural gas boiler	Billing Analysis
Smart thermostat	RTF UES

ADM summarizes the program-specific and measure-specific impact analysis activities and requirements for the HVAC Program in the section below.

1.3.2.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the HVAC Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

In addition, ADM will randomly select a subset of participant customers to survey for simple verification of installed measure, displayed in Table 1-3. ADM will include 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?

These questions will help ADM verify that the measure was documented accurately and that data collection activities are progressing smoothly for the program. The verification for smart thermostats will allow ADM to calculate measure-level savings more accurately. In addition, in the event that billing analysis is infeasible, this simple verification will help ADM more accurately estimate measure-level impacts for the other measures using engineering algorithms.

1.3.2.2 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if necessary

1.3.2.3 Impact Analysis

ADM will conduct billing analysis regression using with a counterfactual group selected via propensity score matching on the HVAC measures in the HVAC Program listed in Table 1-5. The smart thermostat measure will be estimated using RTF UES values. ADM will apply the RTF UES values to the types and quantities of each connected thermostat, after applying adjustments from verification surveys, if found.

In order to estimate daily impacts of each measure, ADM will isolate the customers that received an isolated measure. For example, to evaluate the air source heat pump measure, ADM will select only customers that have retrofitted their air source heat pump and have not installed any additional program measures during the same program year. ADM will connect these isolated customers to billing data, provided by Avista as well as historical weather data collected from NOAA. ADM will conduct billing cleaning and estimate fixed-effects panel regression models referenced in Section 1.2.4.2 with heating season and cooling season controls to estimate the relationship between the energy consumption and weather during the pre- and post-periods, for electric or gas, as applicable to the measure.

1.3.2.4 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis, ADM will review RTF UES values and Avista TRM methods along with verified tracking data to estimate net program savings.

1.3.3 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 1-6 summarizes the measures offered under this program.

Table 1-6: Shell Program Measures

Measure	Impact Analysis Methodology
Attic insulation	RTF UES
Wall insulation	RTF UES
Floor insulation	RTF UES
Window insulation	RTF UES
Low-E Storm Windows	RTF UES
Manufactured home duct sealing	Billing Analysis

ADM will attempt to isolate the duct sealing measure in order to isolate the performance of the duct improvement measure.

1.3.3.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the Shell Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

In addition, ADM will randomly select a subset of participant customers to survey for simple verification of installed measure, displayed in Table 1-3. ADM will include questions such as:

- When did the weatherization measures get installed?
- What type of fuel is used to heat your home?
- Does your home have central air conditioning, window, or neither?
- How long did the contractors take to complete the work?

These questions will help ADM verify that the measure was documented accurately and that data collection activities are progressing smoothly for the program. The verification of heating and cooling type will allow ADM to calculate measure-level savings more accurately based on RTF value. In addition, in the event that billing analysis is infeasible, this simple verification will help ADM more accurately estimate measure-level impacts for the other measures using engineering algorithms.

1.3.3.2 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if necessary

1.3.3.3 Impact Analysis

ADM will conduct billing analysis regression using with a counterfactual group selected via propensity score matching on the duct sealing measure in the Shell Program listed in Table 1-6. The remaining measures will be estimated using RTF UES values. ADM will apply the RTF UES values to the types and quantities of each measure, after applying adjustments from database review and verification surveys, if necessary.

In order to estimate daily impacts of each measure, ADM will isolate the customers that received an isolated measure. For example, to evaluate the duct sealing measure, ADM will select only customers that have installed the duct sealing measure and have not installed any additional program measures during the same program year. ADM will connect these isolated customers to billing data, provided by Avista as well as historical weather data collected from NOAA. ADM will conduct billing cleaning and estimate fixed-effects panel regression models referenced in Section 1.2.4.2 with heating season and cooling season controls to estimate the relationship between the energy consumption and weather during the pre- and post-periods, for electric or gas, as applicable to the duct sealing measure.

1.3.3.4 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis for duct sealing, ADM will review RTF UES values and Avista TRM methods along with verified tracking data to estimate net program savings.

1.3.4 Residential Fuel Efficiency Program

The Residential Fuel Efficiency Program encourages customers to consider converting their resistive electric space and water heating equipment to natural gas. This program is offered to residential customers in the Idaho service territory. Customers must use Avista electricity for electric straight-resistance heating or water heating in order to qualify for the rebate, which is verified by evaluating their energy use. The home's electric baseboard or furnace heat consumption must indicate at least 8,000 kWh during the previous heating season. Customers receive incentives after installation and after submitting a completed rebate form. Table 1-4 summarizes the measures offered under this program.

Table 1-7: Residential Fuel Efficiency Program Measures

Measure	Impact Analysis Methodology
Electric central ducted forced air furnace to air source heat pump (9.0 HFSP or greater)	Billing Analysis
Electric baseboard or forced air furnace heat to natural gas forced air furnace	Billing Analysis
Electric to natural gas furnace and water heat combo	Billing Analysis

ADM summarizes the program-specific and measure-specific impact analysis activities and requirements for the Residential Fuel Efficiency Program in the section below.

1.3.4.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the Residential Fuel Efficiency Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

There will be no verification surveys for this program.

1.3.4.2 Impact Analysis

ADM will conduct a billing analysis regression using with a counterfactual group selected via propensity score matching on each of the water heater measures in the Residential Fuel Efficiency Program. ADM will isolate each unique measure and verify the participant did not also participate in other programs; therefore, ADM will be able to isolate the measure effects using the customer’s consumption billing data.

ADM will attempt to create a valid quasi-experimental control group using nonparticipant customer data and available household characteristics. ADM will work with Avista to identify household characteristics the Residential Fuel Efficiency Program targets in order to identify nonparticipant customers similar to program participants. ADM will then explore the linear regressions summarized in Section 1.2.4.2 with controls for HDD and CDD to estimate weather-related impacts from each measure. ADM will summarize the measure-level impacts by extrapolating regression coefficients with TMY data or actual weather data.

1.3.4.3 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of measure install
- Filled rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if available

1.3.4.4 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis, ADM will review RTF values and Avista TRM methods along with verified tracking data to estimate net program savings.

1.3.5 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 1-8 summarizes the measures offered under this program.

Table 1-8: HVAC Program Measures

Measure	Impact Analysis Methodology
ENERGY STAR ECO-rated home	Simulation Model Analysis
ENERGY STAR-rated manufactured home	RTF UES

ADM will verify a sample of participating homes for detailed review of the home's documentation and development of a simulation model. ADM will work with Avista to make adjustments to the sampling plan summarized in Table 1-3 and create an approved sampling plan and stratification method for the measure before submitting a data request.

1.3.5.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the ENERGY STAR Homes Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report. ADM will also ensure that ENERGY STAR Homes Program participants did not also participate in another Avista program, as this would be deemed as a disqualification for the ENERGY STAR Homes Program. In the case that a customer did participate in another program, ADM will remove the rebate from claiming any savings.

In addition, ADM will randomly select a subset of participant customers to survey for simple verification of installed measure, displayed in Table 1-3. ADM will include questions such as:

- When did you purchase and move into the household?
- What type of fuel is used to heat your home?
- Does your home have central air conditioning, window, or neither?
- What appliances were present in your home during move-in?

These questions will help ADM verify that the HERS rater documented accurately and that data collection activities are progressing smoothly for the program and adjust simulation model components accordingly.

1.3.5.2 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Rebate application forms and certifications
- A sample of REM/Rate project files from HERS raters
- Monthly billed consumption data for participating customers

- Monthly billed consumption data for non-participating customers
- Program builder contact information

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if necessary

1.3.5.3 Impact Analysis

ADM will calculate verified energy savings for the ENERGY STAR Homes Program using a whole building simulation (IPMVP Option D) to estimate gross savings. In addition, ADM will explore the option for an additional billing analysis with a counterfactual control group to estimate net savings.

1.3.6 Residential Small Home & Multifamily Weatherization Program

The Residential Small Home & Multifamily Weatherization Program provides Avista multifamily residential customers with weatherization improvementsto improve home energy efficiency. Table 1-9 summarizes the measures offered under this program.

Table 1-9: Residential Small Home & Multifamily Weatherization Program Measures

Measure	Impact Analysis Methodology
Air infiltration	Billing Analysis
Attic insulation	RTF UES
Duct insulation	Billing Analysis
Duct sealing	Billing Analysis
Floor insulation	RTF UES
Wall insulation	RTF UES
Window replacements and upgrades	RTF UES
Door retrofit	RTF UES
Low-E storm windows	RTF UES

This program was not in effect for the 2020 program year but will be offered to residential customers in Avista's service territory in the 2021 program year. Therefore, ADM will not evaluate this program as part of the 2020 impact evaluation report. ADM will complete the following impact tasks for the 2021 program year evaluation.

1.3.6.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the Residential Small Home & Multifamily Weatherization Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

There will be no verification surveys for this program.

1.3.6.2 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Rebate application forms and applicable invoices

1.3.6.3 Impact Analysis

ADM will measure net savings for each measure in the program using RTF UES values. ADM will apply the RTF UES values to the types and quantities of each measure, after applying adjustments from data review, if deviations found between invoices and tracking data.

1.3.6.4 Technical Comments

ADM provides no technical comments for this program's evaluation.

1.3.7 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 1-10 summarizes the measures offered under this program.

Table 1-10: Low-Income Program Measures

Measure	Impact Analysis Methodology
Air Infiltration	Billing analysis
Air source heat pump	
Attic insulation	
Duct insulation	
Duct sealing	
Electric to air source heat pump	
Electric to natural gas water heater and or furnace (ID Only)	
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	

Database Review & Verification

Before conducting the impact analysis, ADM and Cadeo will conduct a database review for the Low-Income Program. ADM and Cadeo will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2 (above). If ADM and Cadeo finds any deviations between the tracking data and application values, we will note and summarize these differences to Avista through periodic updates and the final report. There will be no verification surveys for this program.

1.3.7.1 Required Data

ADM and Cadeo will request the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Program materials
- Rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers
- Identifiers, if available, for low- to moderate-income households in both participant and nonparticipant customers in the Avista Washington territory
- Stakeholder contact information, such as CAP agencies

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if necessary

1.3.7.2 Impact Analysis

In order to estimate daily impacts of each measure, ADM will identify the customers that participated in the Low-Income program. ADM will connect these identified participants to billing data, provided by Avista as well as historical weather data collected from NOAA. ADM will conduct billing cleaning and estimate fixed-effects panel regression models referenced in Section 1.2.4.2 with heating season and cooling season controls to estimate the relationship between the energy consumption and weather during the pre- and post-periods, for electric or gas, as applicable to the measure. The team will explore the Difference-in-Difference (D-in-D) regression and Post-Program Regression (PPR) billing analysis model to estimate verified energy savings for a subset of measures.

Our approach uses either a control group made up of "future" participants from the same program (i.e., those that received measures in late 2020 and/or early 2021 for the 2020 analysis period, and those that received measures in late 2021 and/or early 2022 for the 2021 analysis period) or a control group matched via quasi-experimental methods. A control group will account for the impact of various macroeconomic factors and other influences on pre- and post-program energy consumption that are unrelated to the installation of program measures. These include economic effects, the movement of people in and out of dwelling units, fluctuations in per-unit energy costs, or, for example, shelter-in-place orders for COVID19.

The quasi-experimental method goes beyond random sampling of treatment and comparison groups and instead uses a nearest-neighbor algorithm via propensity score matching to match each participant (treatment group) customer with a specific best-match from a pool of future participants (control group) based on pre-program energy usage. This approach identifies the future participant whose energy consumption pattern over the most recent 12 pre-participation months was most similar to that of the participant.

1.3.7.3 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis, ADM and Cadeo will review RTF UES values and Avista TRM methods along with verified tracking data to estimate net program savings. It is likely that insufficient instances of isolated measure installs can be identified. In this case, ADM and Cadeo will attempt to conduct a billing analysis for the combined measures.

Unlike other programs the Avista portfolio, the responsibility of evaluating the Low-Income Program will primarily be that of Cadeo. Specifically, Cadeo will perform the database review, billing analysis and reporting portions of the Low-Income Program evaluation using the framework described above.

1.3.8 Community Energy Efficiency Program

Avista partners with the Community Energy Efficiency Program (CEEP) and community action agencies in Washington to identify hard-to-reach markets such as rental properties, homes with alternative heat (wood, oil, propane), and households that are considered low to moderate income for potential energy efficiency improvements. In addition, CEEP provides energy efficiency improvements for small businesses in rural communities. Avista matches the CEEP contribution to share the cost of the improvements. Table 1-11 and Table 1-12 summarizes the measures offered under this program.

Table 1-11: Multi-family CEEP Program Measures

Measure	Impact Analysis Methodology
Electric ductless heat pump	Billing analysis with comparison group
Line voltage control thermostats	Billing analysis with comparison group
Air infiltration	Billing Analysis
Attic insulation	RTF UES
Duct insulation	Billing Analysis
Duct sealing	Billing Analysis
Floor insulation	RTF UES
Wall insulation	RTF UES
Lighting	RTF UES

Table 1-12: Income-Qualified Single-family CEEP Program Measures

Measure	Impact Analysis Methodology
Alternative heat to ductless heat pump	Billing analysis with comparison group
Alternative heat to air source heat pump	Billing analysis with comparison group

CEEP also funds some of the weatherization measures in the Low-Income Program as well as the Small Business Initiative Program.

1.3.8.1 Database Review & Verification

Before conducting the impact analysis, ADM will conduct a database review for the CEEP Program. ADM will select a subset of rebate applications to cross-verify tracking data inputs, summarized in Table 1-2. If ADM finds any deviations between the tracking data and application values, ADM will note and summarize these differences to Avista through periodic updates and the final report.

There will be no verification surveys for this program.

1.3.8.2 Required Data

ADM requires the following data to complete the analysis for this program:

- Program tracking data, including customer identifiers, address, and date of rebate
- Rebate application forms and applicable invoices
- Monthly billed consumption data for participating customers
- Monthly billed consumption data for non-participating customers

- Identifiers for low- to moderate-income households in both participant and nonparticipant customers in the Avista Washington territory

In addition, ADM will gather the following datasets to complete the analysis:

- Historical NOAA weather data
- Typical Meteorological Year weather data
- Publicly available household characteristics from county assessor data, if necessary

ADM will review delivered tracking data for inconsistencies

1.3.8.3 Impact Analysis

ADM will conduct a billing analysis regression using with a counterfactual group selected via propensity score matching on the heat pump and thermostat measures in the CEEP Program, as displayed in Table 1-11. All other measure savings for the program will be estimated using RTF UES values. ADM will apply the RTF UES values to the types and quantities of each measure, after applying adjustments from database review, if necessary.

In order to estimate daily impacts of each measure, ADM will isolate the customers that received an isolated measure. For example, to evaluate the heat pump measure, ADM will select only customers that have installed the heat pump and have not installed any additional program measures during the same program year. ADM will connect these isolated customers to billing data, provided by Avista as well as historical weather data collected from NOAA. ADM will conduct billing cleaning and estimate fixed-effects panel regression models referenced in Section 1.2.4.2 with heating season controls for the heat pump and heating season and cooling season controls for thermostat to estimate the relationship between the energy consumption and weather during the pre- and post-periods, for electric or gas, as applicable to the measure.

1.3.8.4 Technical Comments

In the event that the required data is not available or sufficient to conduct a billing regression analysis, ADM will review RTF UES values and Avista TRM methods along with verified tracking data to estimate net program savings. There is a possibility that insufficient instances of isolated measure installs can be identified. In this case, ADM will attempt to conduct a billing analysis for both the heat pump and thermostat, combined. This will give a reliable estimate of both measures, but not individual measure savings.

1.4 Management Plan & Schedule

This section presents information on the ADM team's project management structure and the organization of the project team.

1.4.1 Team Members

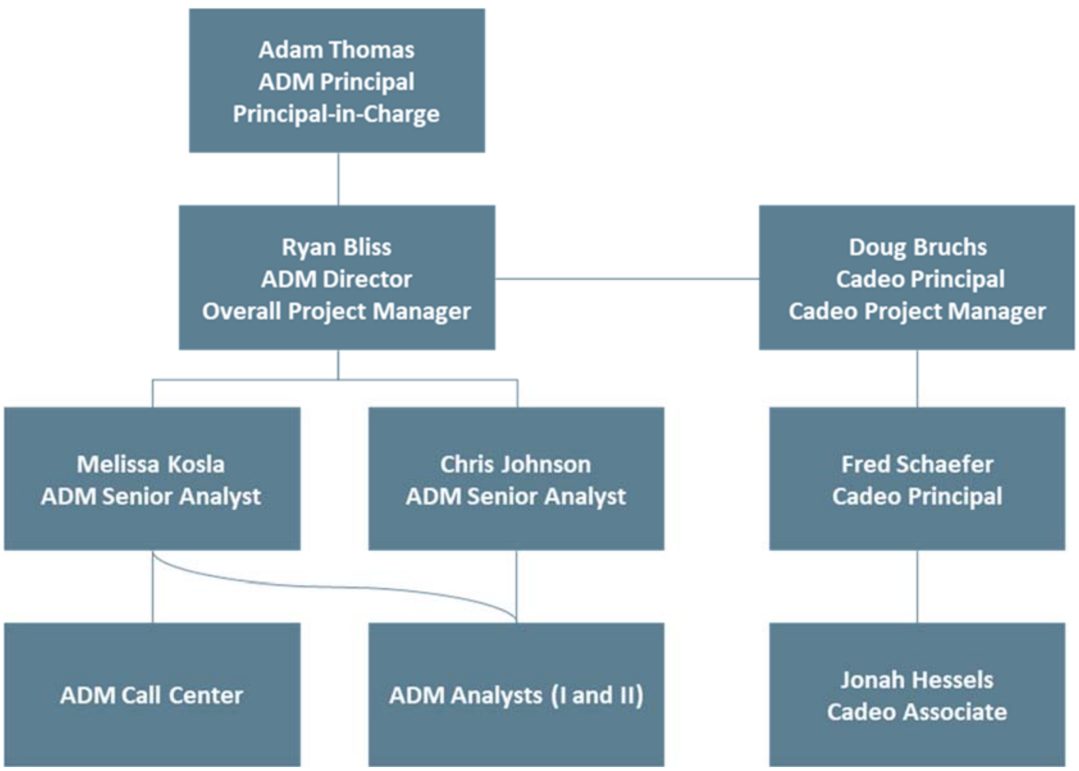
Table 1-13 summarizes the key program staff for the EM&V of Avista's programs.

Table 1-13: Project Team Members

Team Member	Role
Adam Thomas, PMP	Principal-in-charge
Ryan Bliss	Overall Project Manager
Doug Bruchs	Cadeo Project Manager
Melissa Kosla	Impact evaluation lead
Chris Johnson	Impact evaluation lead
Fred Schaefer	Cadeo Principal
Jonah Hessels	Cadeo Associate
Analyst II Staff	Supporting impact analysis
Analyst I Staff	Supporting impact analysis
Admin Staff	Call center support –surveys

Figure 1-1 shows our project organization.

Figure 1-1: Project Organization



1.4.2 Schedule

Table 1-14 presents our expected schedule for the evaluation of program year 2020. A similar project schedule will be developed for program year 2021 evaluation tasks.

Table 1-14: Schedule

Time Period	Time Period
Kickoff meeting	November 23, 2020
Submit data request	December 4, 2020
Submit evaluation plan	December 18, 2020
Avista fulfills data request	December 18, 2020
Submit participant survey instruments	December 23, 2020
Develop sampling plan	December 23, 2020
Survey data collection	January 15, 2021 – February 26, 2021
Submit billing data request	January 8, 2021
Avista fulfills billing data request	January 15, 2021
Conduct impact analysis	January 15, 2021 – February 26, 2021
Perform cost-effectiveness analysis	February 26, 2021 – March 5, 2021
Submit draft version of PY2020 final report	March 12, 2021
Submit revised version of PY2020 final report	April 9, 2021

In addition to the schedule above, ADM will meet and participate with advisory groups, subcommittees, and others as needed, in addition to presenting annual results at Avista's convenience.

CADMUS

Avista Corporation

2020-2021 Evaluation Work Plan

October 15, 2020

Prepared for:

Avista Corporation

1411 East Mission Avenue

Spokane, WA 99252

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Figures

Tables

Introduction and Goals

Avista Corporation contracted with Cadmus to evaluate its Nonresidential program portfolio for program year (PY) 2020 and PY 2021. For this engagement, the Nonresidential evaluation also includes the Multifamily Direct Install program. Cadmus will also conduct a process evaluation of Avista's entire portfolio, including Nonresidential, Residential, and Low Income programs.

The primary goals for the evaluation are these:

- Independently verify, measure, and document energy savings impacts from each electric and natural gas energy efficiency program or from program categories representing consolidated small-scale program offerings, from January 1, 2020, through December 31, 2021
- Analytically substantiate the measurement of those savings
- Calculate the cost-effectiveness of the portfolio and component programs
- Identify any program improvements
- Identify possible future programs

This evaluation work plan reflects Cadmus' understanding of the programs as described in Avista's 2020 Annual Conservation Plans as well as at the project kickoff. The work plan may change in response to program modifications or at Avista's request during PY 2020 and PY 2021. Cadmus will relay to Avista all modifications to evaluation approaches prior to proceeding.

Presently, this document offers proven methods to conduct full impact and process evaluations for Avista's Nonresidential portfolio and the Multifamily Direct Install program, as well as process evaluations for Avista's Residential and Low-Income portfolio of programs.

The following chapter summarizes the overall evaluation effort and includes an introduction to project staff, overview of the budget, and list of deliverables. Subsequent chapters present the evaluation methodologies for the impact and process evaluations, cost-effectiveness calculations, and Cadmus' quality assurance and quality control (QA/QC) processes.

Evaluation Work Plan Overview

Cadmus' highly skilled evaluators have considerable knowledge from many years of evaluating Avista's portfolio of programs and can rely on resources such as Cadmus' inventory of data monitoring equipment and Portfolio Pro+. The team has experience conducting virtual site visits, even before the limiting effects from Covid-19, and its proactive approach to project management will ensure the evaluation objectives are achieved in the most cost-effective manner. The following sections introduce the evaluation team and present the budget, timeline, and communication activities.

Evaluation Team

Cadmus' evaluation team is organized as shown in Figure 1 and features key personnel who have previous experience with Avista's evaluations.

Figure 1. Cadmus Evaluation Team Organizational Chart

Table 1 presents the projected staffing hours by state and includes current Cadmus titles and billing rates.

Table 1. Cadmus Staffing Plan

Staff	FY2021 Title	FY2021 Billing Rate	Projected Hours	
			Washington	Idaho
Jeffrey Cropp	Principal II	$310	195	132
Jerica Stacey	Associate I	$180	343	326
Nathan Hinkle	Associate II	$190	287	203
Kristie Rupper	Associate III	$205	67	64
Max Blasdel	Analyst	$125	113	60
Romio Mikhael	Associate III	$205	63	50
Evan Talan	Sr. Analyst II	$165	215	174
Brandon Kirlin	Analyst II	$135	192	181
Ian Nimmo	Engineering Tech III	$135	73	71
Aaron Huston	Engineering Tech II	$115	16	12
Nora Twichell	Engineering Tech II	$115	107	99
Mitt Jones	Sr. Associate II	$250	12	29
Kean Amidi-Abraham	Research Analyst	$115	120	108
Brian Hedman	Principal II	$310	10	10
Maggie Buffum	Associate I	$180	31	31
Taylor La Prairie	Analyst I	$125	84	52
Amanda McLeod	Analyst II	$135	116	76
Alex Chamberlain	Sr. Analyst I	$155	68	55
Alexander Opipari	Research Analyst	$115	179	160
Leslie Anderson	Technical Editor	$125	42	40

Budget

Avista awarded Cadmus $413,211.25 for the PY 2020-2021 Washington evaluation and $336,252.50 for the Idaho evaluation. This budget includes $33,169 in travel and other direct costs for site visits.

Timeline and Reporting

The overall timeline presented in Table 2 broadly depicts progress for each of the work tasks. The work plans for each program cluster include their own specific evaluation timelines. Deliverables associated with work tasks are specified after the table.

Table 2. PY 2020 and PY 2021 Task and Deliverable Schedule

Task	PY 2020		PY 2021				PY 2022	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Kickoff Meeting								
Work Plan								
Project Management								
Advisory Group Meetings, as needed								
Verification Surveys								
On-Site or Virtual M&V and Analysis								
Cost-Effectiveness Analysis								
Document and Database Review								
Avista and Implementer Interviews								
Participant Surveys and Interviews								
Market Actor Interviews								
Electric Impact Memos								
Natural Gas Impact Memos								
Process Memo and Report								
Cost-Effectiveness Memos								

Deliverables

Impact evaluation activities

Process evaluation activities

Cadmus will provide the following deliverables by the dates listed:

- April 9, 2021
  - PY 2020 Washington Nonresidential electric impact evaluation memorandum
  - PY 2020 Washington Nonresidential natural gas impact evaluation memorandum
  - PY 2020 Washington Nonresidential electric and natural gas cost-effectiveness analysis
- April 16, 2021
  - PY 2020 Idaho Nonresidential electric impact evaluation memorandum
  - PY 2020 Idaho Nonresidential natural gas impact evaluation memorandums
  - PY 2020 Idaho Nonresidential electric and natural gas cost-effectiveness analysis
  - PY 2020 Washington and Idaho (combined) process evaluation memorandum
- April 8, 2022
  - PY 2020 – 2021 Washington Nonresidential electric impact evaluation memorandum
  - PY 2020 – 2021 Washington Nonresidential natural gas impact evaluation memorandum
  - PY 2020 – 2021 Washington Nonresidential electric and natural gas cost-effectiveness analysis

- April 15, 2022
  - PY 2021 Idaho Nonresidential electric impact evaluation memorandum
  - PY 2021 Idaho Nonresidential natural gas impact evaluation memorandum
  - PY 2021 Idaho Nonresidential electric and natural gas cost-effectiveness analysis
  - PY 2020 – 2021 Washington and Idaho (combined) process evaluation memorandum

Prior to delivery of each memorandum, Cadmus will prepare a comprehensive outline for Avista's review and approval. The memorandums will describe data collection and process methods, present results of the analysis and summarize findings, draw conclusions, and provide meaningful recommendations. Data collection instruments used for the process evaluation will be included as appendices to the final report. Cadmus will submit all supporting workpapers for the calculations, tables, graphs, and other illustrations contained in the deliverables.

Cadmus will also prepare *ad hoc* reports to document problems, urgent issues, and resolutions as they arise.

Communication

Avista expects multiple communication and reporting activities to be performed as part of this evaluation effort. Cadmus will design its project communications based on the following:

- The Avista DSM Planning and Analytics team serves as the lead contact for all evaluation aspects (impact and process) and, for contract purposes, is the client. Ryan Finesilver of the DSM Planning and Analytics team will serve as the contract manager and primary contact for the Cadmus team.
- The Avista DSM Planning and Analytics team will work with the Cadmus team to facilitate incorporation of Avista's implementation team's input into the final product. Avista may encourage the implementation team to actively participate in the evaluations, seeking to deliver the best product possible, consistent with the evaluation's independent character.
- An Avista DSM Planning and Analytics team member may be present (in person, by phone, or copied on e-mails) during any interactions between the Cadmus team and Avista's DSM implementation team.

Cadmus will hold biweekly conference calls with the Avista DSM Planning and Analytics team. These calls will provide updates about the project's status and issues. *Ad hoc* calls may be required to address specific project issues and activities. Cadmus anticipates attending and occasionally facilitating in-person, telephone, or web-based meetings in addition to regular and *ad hoc* project meetings and a final close-out meeting.

Throughout the evaluation process, Cadmus will remain engaged with Avista's regional stakeholders, participating as requested in DSM Advisory Group and Technical Committee meetings. Cadmus will provide the following support to Avista through these meetings:

- Present evaluation plans

- Present interim or final results on energy savings, realization rates, and cost-effectiveness
- Act as a technical resource to explain details of the evaluation methodologies and the rationale behind the methods employed for Avista
- Explore opportunities for new or expanded techniques to evaluate programs or inform program design

Impact Evaluation

Cadmus will apply the methods described below to develop findings that will determine the impacts of Avista's Nonresidential programs and guide the development of current and future programs.

Overview of Nonresidential Impact Evaluation Methods

Cadmus' analyses will use standard engineering approaches such as those defined by the International Performance Measurement and Verification Protocols (IPMVP) and the Uniform Methods Project (UMP). Cadmus will employ the following primary methods:

- Simple verification (desk review, phone, online, remote walk-through, or on-site)
- Energy calculation models
- Metering (IPMVP A and B)
- Whole building billing analysis (IPMVP Option C)
- Simulation modeling (IPMVP Option D)

Table 3 lists the impact evaluation data collection and analysis activities by program. Cadmus will conduct the online, phone, remote, and on-site measurement and verification activities in two waves in both 2020 and 2021 to obtain a reasonable sample from each program year.

Table 3. PY 2020–2021 Natural Gas and Electric Impact Evaluation Activities

Sector	Program	Database/ Document Review	Remote Verification/ Site Visit	Metering	Billing Analysis	Simulation Modeling
Multifamily	Multifamily Direct Install	✓				
	Multifamily Market Transformation – Fuel Efficiency (Idaho)	✓	✓			
Nonresidential	Site Specific	✓	✓	✓	✓	✓
	Interior Lighting	✓	✓			
	Exterior Lighting	✓	✓			
	Prescriptive Shell	✓	✓		✓	
	Green Motors	✓	✓			
	Motor Control HVAC (VFD)	✓	✓			
	HVAC	✓	✓		✓	
	Fleet Heat	✓	✓			
	Food Services	✓	✓			
	Compressed Air	✓	✓	✓		
	Grocer	✓	✓			

Simple Verification

Cadmus will verify some prescriptive measures (particularly those with relatively small reported savings) on site, via remote video walkthrough, by phone, by reviewing submitted documentation, or through an on-line questionnaire to confirm that measures are installed in the reported quantity and operating in a manner consistent with deemed-savings assumptions. Cadmus will also verify recorded nameplate efficiency data against manufacturer's specifications. Cadmus will accept reported savings without further investigation if it can confirm that these details match the assumptions used for unit energy savings in the Regional Technical Forum (RTF) or Avista technical reference manual (TRM). Cadmus will adjust the savings for any inconsistencies based on equipment and operating parameters found at the site.

Engineering Calculation Models

For some Nonresidential Site Specific measures, Avista uses spreadsheets to calculate the estimated energy savings for a variety of measures based on relevant inputs, such as quantity, fixture wattage, square footage, efficiency value, HVAC system details, and location details. For each spreadsheet, Cadmus will review input requirements and outputs to determine if the approach is reasonable. We will discuss any concerns about the approach with Avista's implementation team and explain why we think a different method may yield more accurate results. Where applicable, we will update calculations using on-site verification data, energy management system (EMS) trend data, spot measurements, and metering data.

Metering Analysis (IPMVP Options A and B)

To estimate the relevant operational parameters needed to inform engineering calculation models, Cadmus may perform data logging for a period of days, weeks, or months. During the site visits, we will confirm relevant information such as installation of the efficient equipment, set points, sequence of operations, operating schedules, and ambient conditions. We will also estimate the baseline energy performance, according to program documentation, on-site conditions, facility interviews, and relevant energy code requirements.

After downloading, we will clean meter data, checking key fields for missing data, correcting bad data, and removing sites with insufficient data. We will flag anomalies and send them to a senior engineer who will determine if the data should be used, corrected, or excluded from the analysis. Next, we will analyze the key variables in the metering data using spreadsheet tools or Python. We will use the resulting information to calculate savings (as input variables in an engineering model) or for comparison to consumption estimates.

Whole Building Analysis (IPMVP Option C)

Cadmus can use monthly billing or interval data to conduct regression analyses for nonresidential retrofit projects, particularly in the Site Specific and HVAC-related prescriptive programs (for example, HVAC and Shell). This analysis method is particularly useful for accurately assessing the energy savings from comprehensive retrofit projects, especially those involving custom HVAC or controls measures.

Using the pre- and post-modeling approach, Cadmus will develop retrofit-savings estimates for the sampled sites, accounting for cooling degree days (CDDs) and heating degree days (HDDs). We will match the participant-consumption data to the nearest weather station by zip code. We will then calculate the building balance-point temperature by correlating monthly energy use with monthly average temperature.

Cadmus will use the balance-point temperature to calculate the CDDs and HDDs then match these to the monthly billing data. We will use the resulting regression estimates to extrapolate average energy savings based on normalized weather conditions. (For this calculation, we will use typical meteorological year [TMY], 15-year normal weather averages from 1991–2005, obtained from the National Oceanic and Atmospheric Administration.)

For each project, Cadmus will model average daily consumption in kilowatt hours (kWh) and/or therms as a function of base load, HDDs and CDDs, and, where appropriate, daily production. For the evaluated sites, we will estimate two demand models—one for the pre-period and one for the post-period. We typically choose this methodology over a single standard-treatment-effects model to account for structural changes in demand that can occur with retrofits, such as changes in occupancy or usage patterns. We will then estimate the annual consumption based these values.

Simulation Model Analysis (IPMVP Option D)

Cadmus may review and verify the savings calculated from simulation models if this methodology is applied on projects. Our simulation approach, which is based on *in situ* observations and measurements, is calibrated to the best available energy-use indices. It entails the use of well-developed, sophisticated building-simulation tools, such as DOE-2, and follows methods described in the U.S. Department of Energy M&V Guideline and ASHRAE Guideline 14.[1,2]

We will obtain the existing as-built and baseline models, utility billing data, and any available documentation for each simulated measure project in the sample. Step one will be to conduct a side-by-side comparison of the existing baseline and as-built models. Because different versions of the same software (mainly eQuest and EnergyPlus) can return conflicting results, we will open models only in the software-build version in which they were developed.

Our goal for the site visit will be to gather all data necessary to improve and calibrate the model. Using our on-site data collection form and following our facility operator interview guide, we will verify all necessary assumptions and obtain any available EMS data needed to further inform the calibration process.

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1 U.S. Department of Energy. *M&V Guidelines: Measurement and Verification for Performance-Based Contracts (Version 4.0).* Available online at: http://energy.gov/sites/prod/files/2016/01/f28/mv_guide_4_0.pdf

2 ASHRAE. *Measurement of Energy, Demand, and Water Savings.* Atlanta, GA. 2014.

Following the site visit, Cadmus will update the model with the verified values and actual meteorological year (AMY) weather data for the appropriate location and time period then test statistical calibration, comparing model results with utility and metered data. In accordance with ASHRAE Guideline 14, we will target a monthly accuracy within a mean bias error (MBE) of ±5% and a coefficient of variation root mean square error (CVRMSE) of ±15%. We will make logical improvements, based on engineering judgment where anomalies are identified. In our analysis, we will account for fluctuations, such as those from initial building commissioning or first-year occupancy changes.

Once the adjusted as-built model has achieved the accuracy requirements, the remaining steps are straightforward. We will replace the AMY data used for calibration purposes with typical meteorological year (TMY) data. To develop the baseline model, we will back out the conservation measures based on incentive documentation, changes between existing models documented during the initial comparison, and any measure stipulations, such as code requirements. Unless instructed otherwise by Avista, we will calculate measure savings in the same order and manner suggested by the existing models and documentation (that is, first measure in, last measure out, and so on). We will determine savings by comparing results from the calibrated typical year as-built and baseline models.

Impact Sampling Plan

Cadmus' approach to developing impact evaluation sampling plans is consistent with the methods described in the UMP. Specifically, we will include these guidelines in our approach:

- **Determine confidence and precision requirements for key metrics.** Our team will use key metrics to support our gross and net energy estimates for each program. For programs with more complex or comprehensive offerings, we typically expect variation between customers to be larger than for programs with fewer variables or more streamlined installations. We will rely on our experience evaluating Avista's programs to estimate the homogeneity or heterogeneity of the population of participants and rely on coefficients of variance calculated from the previous round of evaluation to inform the variability in the expected sample population. When possible, we will design a sample for each program so that we can estimate the overall portfolio energy savings with 90% confidence and ±10% precision for each fuel type within each state.
- **Develop the sample design.** We will apply a sample design that primarily features stratified random sampling. The optimal design depends on the homogeneity or heterogeneity of the population of participants within each program as well as any targeted research we plan to perform (that is, if we are particularly interested in evaluating savings for a particular measure or collection of measures, we will stratify accordingly to ensure ample sample sizes from that population). We may select very large projects with certainty, when their expected savings are expected to differ substantially from the rest of the population. We will select at minimum the number of projects in each program as necessary to calculate confidence and precision within the program, even if participation or savings are low.

- **Calculate sample sizes.** We will calculate sample sizes based on the confidence and precision requirements, expected variation, sample design, and population size for each program. Sample sizes will be sufficient to estimate gross savings for each program and the portfolio as a whole.

For Nonresidential programs and Multifamily Market Transformation, Cadmus proposes a stratified sample design, with strata defined based on fuel type (electric and natural gas) and project savings. For each program and fuel type, we will stratify the sample into large- or small-savings projects and conduct verification on a simple random sample of the projects within each stratum. We will include dual fuel projects in the natural gas stratum for sampling purposes but will include electric savings from dual fuel measures with the electric stratum. We will evaluate the electric savings as a certainty selection for any dual fuel projects selected for random sampling. For the Multifamily Direct Install program, Cadmus will apply a simple random sample to select projects.

We will determine sample sizes for each program and fuel type separately in Washington and Idaho. Data we obtain during site visits will inform our calculation of realization rates used to estimate population savings for each program and fuel type. We will report these results and the corresponding state-specific program savings results.

After receiving program population data from Avista for January to September 2020 we determined sample sizes according to the most recent evaluation results, actual participant and project population sizes, additional stratification variables, and/or alternative sampling approaches (for example, probability proportional to size), with portfolio-level target confidence of 90% and precision of 10%. If possible, we will apply a finite correction to sample sizes to decrease the sample sizes. Table 4 shows the sample design for Washington and Idaho combined.

Table 4. Sample Design for Verification Surveys and Site Visits for Washington and Idaho Combined

Program	Fuel Type	Confidence	Precision	Washington		Idaho	
				Expected Population Size*	Sample Size	Expected Population Size*	Sample Size
Site Specific	Electric	80	20	184	34	64	30
	Natural Gas	80	20	32	6	7	4
Grocer	Electric	90	20	13	2	12	2
Interior Lighting	Electric	90	20	1084	17	516	20
Exterior Lighting	Electric	90	20	1304	17	712	20
Green Motors	Electric	90	20	16	8	16	0
Compressed Air	Electric	90	20	2	1	1	1
Fleet Heat	Electric	90	20	1	1	0	0
Motor Control HVAC (VFD)	Electric	90	20	4	7	3	1
HVAC	Natural Gas	90	20	80	10	80	6
Prescriptive Shell	Electric	90	20	16	3	1	1
	Natural Gas	90	20	16	4	4	2
Food Services	Electric	90	20	28	5	8	2
	Natural Gas	90	20	56	9	52	4
Multifamily Market Transformation	Fuel Efficiency	90	20	N/A	N/A	7	3
Total Nonresidential Site Visits/Verification Surveys				**2836**	**124**	**1483**	**96**

*** Expected population size is extrapolated from 2020 Q1-Q2 participation and 2018-2019 participation. Dual fuel measures are counted as gas for population size and sampling purposes.**

Impact Evaluation Activities by Program

Cadmus will conduct the verification activities in four waves—fall 2020, January 2021, summer 2021, and January 2021—using desk reviews, remote or physical site visits, and phone surveys to collect baseline data, operations data, and other information to inform the energy savings analyses. The following sections describe each Avista program and the proposed impact evaluation activities.

Multifamily Direct Install Program

Avista provides free gas and electric direct-install measures to multifamily residences (of five units or more) and common areas in its service territory though the Multifamily Direct Install program. Cadmus will conduct document reviews on the census of projects installed through this program to assess the quality of program tracking data (noting missing, duplicate, and out-of-range values) and will verify that values of key metrics are within expected limits.

We will provide Avista with *ex post* savings values by measure and will also calculate the program's cost-effectiveness.

Nonresidential Site Specific Program

The Nonresidential Site Specific program provides flexible opportunities to achieve energy savings for measures that do not fit a prescriptive path. In the past, these projects have been for compressed air, custom lighting, process improvement, and complex HVAC measures, among others. Multifamily Market Transformation projects for Idaho are also included in this program.

Cadmus will calculate participants' gross reductions in electricity and natural gas consumption using data collected through desk reviews, remote or on-site visits, customer billing histories (as needed), and engineering models and calculations, for the projects selected by the sample. The number of site visits will depend on actual enrollment and sample-size calculations, based on expected variability and the desired confidence and precision of evaluated savings. During the site visits, we will verify measure installations, collect baseline and equipment data, and identify addressable enrollment or installation issues.

We will analyze gross program impacts using data collected from site visits and from tracking data. We will verify reported *ex ante* savings by recalculating energy savings using Excel spreadsheet analysis tools, site-specific data, and standard engineering analysis methods. Data may include savings calculations, manufacturers' specification sheets, and commissioning reports. We may also conduct regression analyses, as needed, for measures such as comprehensive HVAC controls, whose savings impact cannot readily be evaluated through other means. Information collected during our site visits will determine if the sample projects reasonably address the measure's operating parameters and accurately reflect operating conditions.

Because we will not inspect all participant sites, we need a mechanism to extrapolate the difference between *ex ante* and *ex post* savings to the population. To resolve this, we will apply a correction factor based on the realization rates to *ex ante* savings to calculate evaluated *ex post* gross savings. We will document the reasons and impacts on savings of all adjustments and will review these with Avista's implementation team during a presentation before committing results to the draft reports.

Nonresidential Prescriptive Programs

Avista implements these ten prescriptive programs that provide incentives directly to customers for a variety of measures supported by unit energy savings in the RTF or Avista's TRM:

- Compressed Air
- Fleet Heat
- Food Services
- Green Motors
- Grocer
- HVAC
- Lighting Interior
- Lighting Exterior
- Prescriptive Shell
- Variable Frequency Drives

Cadmus will first work with Avista to prioritize and review prescriptive measures in the TRM to identify those with the most variance based on previous impact evaluation results. These measures may benefit from primary data collection and analysis during the 2020-2021 impact evaluation. This review requires in-depth knowledge and understanding about the specifics of each measure to ensure that the baseline and savings calculations reflect the best possible *ex ante* values for the region. Cadmus and Avista engineers will coordinate to ensure consistency in inputs and calculations and to ensure that the TRM uses the most up-to-date sources for Avista's engineering calculations. We may recommend measures to examine, as necessary, including references, algorithms, and inputs.

Cadmus will design a sample for verification activities to include all prescriptive programs, with primary emphasis on those that contribute the most savings or represent the highest level of uncertainty. We will apply sampling weights accordingly as part of the correction factor.

We will conduct desk reviews, remote, or on-site inspections during the initial round of impact data collection to confirm that Avista's quality-assurance processes have been maintained. This is particularly relevant for any new programs or programs with updated processes. If we find a high correlation between the *ex ante* and *ex post* results in our initial inspections, we may increase our reliance on less-intrusive data collection methods including desk reviews and phone interviews with participants.

We will review project documents, verify assumptions, adjust reported calculations, and compute *ex post* savings using Excel spreadsheet analysis tools or by approving installation rates for RTF measures with well-defined unit energy savings. We will derive baseline data from virtual/on-site visits, customer interviews, and Avista's program data. We will calculate *ex post* savings using submitted documentation, site visit data, and standard engineering analysis practices. We will also calculate a realization rate based on sampled sites and will apply this rate to the project population to estimate program total *ex post* savings.

In the Prescriptive program, as with the Site Specific program, we will document all reasons and impacts on savings for adjustments and will review these with Avista's implementation team before committing the results to the draft reports.

Remote Verification Strategy

The COVID-19 pandemic has resulted in significant and rapid changes to facility operations and caused uncertainty about future operations. This has complicated impact evaluation and especially affected on-site project verification site visits. Cadmus has developed a virtual and contactless approach that prioritizes customer comfort, preference, privacy concerns and operational policies, and is designed to minimize the burden on the customer throughout the data collection and inspection process.

Our virtual verification process involves using a web-based audio and video connection to simulate in-person customer interactions with a project-specific site contact. To verify savings, our evaluation staff may use a combination of:

- Existing submitted project documentation, including project application files, invoices, specification sheets, calculation models, and Installation Verification reports provided by Avista or available in the iEnergy web software

- Virtual site visit observations, for example a video recording, interview with the site contact, and photos taken during a virtual project tour
- Additional information provided by the site contact, for example additional trend data from the equipment, control system, or meter, more detailed photos or videos of equipment operation, or other documentation requested during the virtual site visit

Cadmus has conducted over 100 virtual site visits for 12 clients throughout the country across a wide variety of project types, and over the next 12 months we expect to have completed over 1,000 virtual site visits across the country. Our process has been designed for the long haul and we plan to keep the virtual/contactless option as a part of our evaluation offerings moving forward. In addition to the safety benefits related to the COVID-19 pandemic, our virtual site visit process saves travel costs, and allows for more flexible scheduling, particularly for geographically remote sites in rural regions of Avista's service territory.

We will review each project selected for verification to ascertain whether it is appropriate for remote verification and what level of remote verification is required to sufficiently verify the measures.

- Desk review: Lower-complexity projects which can be verified through a review of existing complete documentation.
- Desk review with interview: Projects with nearly complete documentation requiring additional photos, invoices, spec sheets, or other simple documentation. Projects with complete documentation where assumptions need to be reviewed or discussed. Interview may be conducted via email, phone call, or web video conference.
- Virtual site visit: Projects that have large savings, higher complexity, or incomplete documentation. Remote verification and interview will be conducted via video walkthrough of the project with a site contact involved in the implementation or operation of the system.
- Physical site visit: Projects that are too complex for remote verification, require on-site data collection or meter installation, projects with a large number of measures or large quantity of equipment, or where safety concerns, participant availability, or time required on site make a virtual site visit impractical or unsafe.

To be eligible for remote verification, a project must meet criteria for participant safety, data security and privacy, suitability of measures to remote verification, and site contact knowledge, availability, and technology limitations. Cadmus will provide a detailed virtual site visit protocol to Avista, and will notify the Avista account executive assigned to each project prior to initiating recruitment for remote or on-site verification. Physical site visits may be postponed until travel to the region is safe and prudent. We will review all in-person site visit plans with Avista prior to scheduling travel and will adhere to all COVID safety procedures provided by Cadmus, Avista, and the participant.

Real-Time Evaluation and Measurement

Cadmus may coordinate with Avista's implementation team to identify projects with both relatively large expected energy savings and relatively high uncertainty (for example, demand control ventilation and multi-stage compressed air retrofit). In comparison, projects such as large lighting retrofits may not require real-time EM&V because the savings should be relatively certain if the operating hours are well-characterized. Once Avista identifies the most likely projects for real-time EM&V, we will coordinate with implementation engineers and/or contractors to track project installation progress and estimate the completion date.

We will develop a site-specific EM&V plan for each project. Our metering engineer will be prepared to travel to the site to install meters during a timeframe estimated by Avista's implementation team. After removing the meter, we will follow our standard procedures for analyzing the data. We will summarize our methodology and results for further discussion with Avista before finalizing the energy savings.

EM&V for Advanced Metering Infrastructure (AMI)

Where relevant, and to support Avista's move toward advanced meter infrastructure (AMI), Cadmus will conduct EM&V for projects with AMI data. To support this type of analysis, we assume that electricity interval consumption data will be available for the pre-treatment, or ***baseline***, and treatment, or ***reporting****,* periods.

The approach to calculating energy savings starts with building a predictive statistical model using baseline data, which includes baseline weather conditions and facility operating conditions as explanatory variables in the model. By applying the baseline model to the explanatory data measured during the reporting period, the model outputs represent the expected energy usage during the reporting period that would have occurred without the influence of the energy-saving measures. Therefore, subtracting the observed energy usage and predicted energy usage at each point in time results in the evaluated energy savings (adjusted for reporting period weather and facility operations).

Our proposed method has several advantages over other approaches:

- The method allows for ***flexible modeling*** of each facility's energy consumption. Because we conduct a separate analysis for each facility, it is possible to select a set of variables that are specific to that facility.
- Baseline models are ***uncontaminated*** by project treatment effects. Because the model is fit with baseline period data, the parameters of the adjusted baseline consumption reflect only baseline period operation.
- The model-building process is ***objective***. Because we rely on automated machine-learning to select the model variables, we can identify relevant variables affecting a facility's consumption from a larger set of candidate variables based on pre-determined criteria, which reduces time and the possibility for idiosyncratic choice by the analyst in building a model.

- The proposed approach is ***versatile, scalable, and cost-effective***. Much of the estimation can be automated and applied to a variety of commercial building types and samples with large numbers of facilities.

Our proposed analysis approach has four main steps—data collection and pre-processing, modeling, savings estimation, and reporting— as described in the next sections.

Data Collection and Preprocessing

Cadmus will collect the following data for the evaluation:

- Interval data of facility energy consumption
- Project implementation data including installation dates, project description, and *ex ante* savings estimate
- Building systems data from the facility's energy management system (if available)
- Interval weather data from nearest weather station

Cadmus will then conduct a quality review of the raw data. This process involves a visual inspection by a domain expert and automated checks for max and min values, consumption per square footage, rates of change, completeness of the data, etc. Once the validity of the data is established, we will define the facility's baseline and reporting periods from documentation about the project implementation.

Modeling

Cadmus will develop models using these steps:

- **Identify candidate model inputs**. Cadmus will begin by plotting energy usage against all explanatory variables and identify trends. Trends identified from visual inspection will be linear, non-linear, or periodic. These will require evaluation in the context of Cadmus' understanding of the physical systems involved and experience modeling similar facilities. We will also consider derived variables, such as day of week or degree days, and will assess correlations of these inputs and interactive effects between variables.
- **Select model type**. Cadmus has applied a range of modeling techniques and methods and knows that performance of an algorithm can depend on the dataset it is attempting to fit. Our approach is to select a class of models based on a specific use case and test performance (that is, predictive accuracy, minimization of prediction error, minimal data requirements, etc.) for the various model types within that class. Table 5 summarizes the collection of models we have used.

Table 5. Model Classes for Selection

Model Class	Model Type	Use Case
Linear	Single and multiple linear, ridge, Lasso regression	Low temporal resolution usage data, known physical relationships, observed linear trends
Time Series	Autoregressive integrated moving average (ARIMA), error term models, transfer functions	High temporal periodicity and seasonality, predicting future response
Bayesian	Decision trees, random forests, neural networks	Nonlinear relationships, complex systems, large amounts of data

Model validation and testing. Cadmus will create a set of candidate models based on prior experience and understanding of energy-savings projects and will rigorously evaluate these models against the facility-specific data and choose the best model in the energy-savings calculations. As a starting point in selecting the best model, we will apply graphical analysis of the relationship between energy usage and possible explanatory variables. We will then evaluate existing seasonality or temporal changes in selecting model types. In this initial step, we will consider using the model that is the simplest, has the fewest explanatory variables, and can be interpreted based on good engineering judgment.

Cadmus will test model prediction ability using a procedure that minimizes selection bias. This involves randomly splitting the baseline period data into training and testing sets, giving us two datasets of independent variables and measured energy consumption. Models are fit to the training data, applied to the test data, and scored on bias, model fit, and prediction accuracy metrics, such as the mean prediction error, relative root mean-squared error of prediction, mean absolute percentage error of prediction, and the median and other percentiles of prediction errors, r-square, and Akaike information criterion (AIC).

Randomly splitting the data does introduce bias and to fully understand a model we repeat this process for each model many times. These simulations build distributions of test statistics for each model that inform the selection of a final model.

Furthermore, we will identify patterns in the prediction errors by plotting or regressing the errors against variables such as hour of the day and day of the week. Also, we will investigate the evolution of errors over weeks and months to determine if there are prolonged trends that require further investigation.

Cadmus will fit the selected model to the entire set of baseline data. If, in the model validation and testing phase, we find that several models provide relatively good fit and predictions, we will calculate energy savings using several models and provide the results to Avista. For any given model that is chosen during the validation and testing phase, we will calculate the uncertainty in energy savings obtained using the entire dataset.

Cadmus expects that a variety of factors could confound the savings analysis. For example, a facility may undertake energy efficiency projects that are not funded through Avista during the reporting period. If these other projects are unaccounted for, the estimate of electricity savings could be biased upward. Table 6 lists possible confounding factors and the strategies for addressing them.

Table 6. Potential Confounding Variables

Confounding Variable	Problem	Solution Strategy
Other Energy Efficiency Projects	Unaccounted savings from other energy efficiency projects during the reporting period may bias the savings estimate.	Develop an engineering estimate of savings for the other project(s) and subtract validated savings estimates from Cadmus' regression-based estimate.
Floor Space Additions or Changes in Use of Facility Space	These changes can bias the savings estimates.	Cadmus will review project documentation and available energy management system data to identify significant changes. Cadmus may make engineering-based adjustments to the savings estimates or model energy intensity instead of consumption.

Savings Estimation

After developing a model, estimating savings is straightforward. Cadmus will fit the model to the baseline data and apply it to the conditions present during the reporting period, generating facility consumption at each interval, and subtract these estimates from the actual measured consumption. To calculate "typical year" savings, Cadmus fits a baseline model and a reporting period model, applies each of these models to TMY3 data, and takes the difference in the estimated energy consumption. Savings are provided on a per-site basis in each of these cases.

Cost-Effectiveness Analysis

Cadmus will calculate and report the program's cost-effectiveness using evaluated savings, avoided energy costs, and actual incurred implementation costs. We will use Portfolio Pro+ to provide cost-effectiveness assessments by portfolio, program, fuel type, year, measure, and state level.

We will determine the economic performance of a program from four standard perspectives—a combination of the utility and program participants, the utility, program participants, and all ratepayers (including nonparticipants). Cadmus will evaluate these perspectives using four cost-effectiveness tests—total resource cost (TRC) test, utility cost test (UCT), participant cost test (PCT), and rate impact measure (RIM) test. If requested, we may also look into applying the Resource Valuation Test (RVT).

We will populate a database with Avista's utility data common to all programs (such as discount rates, avoided costs, load shapes, and retail rates) so that we can maintain a consistent approach to cost-effectiveness valuation across all programs and portfolios.

Process Evaluation

The process evaluation approach considers past evaluation findings, insight from the kickoff meeting, and Avista's 2020 Annual Conservation Plans.

For all programs, our research methods will consider these three fundamental objectives:

- Assess participant and market actor program journey including motivation for participation, barriers to participation, and satisfaction
- Assess Avista and implementer staff experiences including organizational structure, communication, and program processes
- Document areas of success, challenge, and changes to the program

To address these research objectives, we will conduct implementation and customer research. Our implementation research will include a document and database review for each program, in-depth interviews with key Avista and implementation staff and contractor and Community Action Partner (CAP) agencies for relevant programs. Our customer research will include participant surveys and interviews, as well as builder and property manager interviews for relevant programs (Figure 2). We discuss each of these research areas and the associated tasks in more detail below.

Figure 2. Process Evaluation Research Areas and Tasks

Table 7 shows the research areas by program and year in Idaho and Table 8 shows the research areas by program and year in Washington. Cadmus will not complete a process evaluation for Simple Steps Smart Savings because the program will be discontinued soon.

Table 7. PY 2020–2021 Idaho Process Evaluation Activities

Program Name	Implementation Research		Customer Research	
	PY 2020	PY 2021	PY 2020	PY 2021
Residential Programs				
ENERGY STAR Homes	✓			
Shell		✓		✓
HVAC		✓		✓
Water Heat		✓		✓
Fuel Efficiency		✓		✓
Low-Income Programs				
Low-Income		✓		
Multifamily Programs				
Multifamily Direct Install	✓		✓	
Multifamily Market Transformation	✓		✓	
Nonresidential Programs				
Site Specific	✓		✓	
Prescriptive*		✓		✓
Grocer		✓		✓

*Nonresidential Prescriptive: Lighting, HVAC, Shell, Motor Control HVAC (VFD), Food Services, Green Motors, Compressed Air, and Fleet Heat.

Table 8. PY 2020–2021 Washington Process Evaluation Activities

Program Name	Implementation Research		Customer Research	
	PY 2020	PY 2021	PY 2020	PY 2021
Residential Programs				
ENERGY STAR Homes	✓			
Shell		✓	✓	✓
HVAC		✓	✓	✓
Water Heat		✓	✓	✓
Low-Income Programs				
Low-Income		✓		
Community Energy Efficiency Program		✓		
Multifamily Programs				
Multifamily Direct Install	✓		✓	
Nonresidential Programs				
Site Specific	✓		✓	✓
Prescriptive**		✓	✓	✓
Grocer		✓	✓	✓

*Residential prescriptive: space and water heating, smart thermostats, insulation, and windows.
**Prescriptive: Lighting, HVAC, Shell, Motor Control HVAC (VFD), Food Services, Green Motors, Compressed Air, and Fleet Heat.

The next sections describe the task methods for each research area.

Implementation Research

Cadmus will assess program processes and provide timely and actionable recommendations for continuous implementation improvement by reviewing the database and program documentation and conducting interviews with key Avista and third-party implementation staff, such as SBW Consulting, Washington State University Energy Program, 4 Sight Energy Group, the Green Motors Practices Group, contractors in the residential programs, and CAP agencies in the Low-Income program. Our reviews of key program documents and corresponding databases will inform what data we collect to meet the research objectives.

Table 9 lists the implementation research by program.

Table 9. Implementation Research by Program

<table>
<tr><th rowspan="2">Program</th><th colspan="4">Implementation Research</th></tr>
<tr><th>Document Review</th><th>Avista Interviews</th><th>Implementer Interviews</th><th>Contractor and CAP Agency Interviews</th></tr>
<tr><td colspan="5">Residential Programs</td></tr>
<tr><td>ENERGY STAR Homes</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Shell</td><td>✓</td><td>✓</td><td></td><td rowspan="3">✓*</td></tr>
<tr><td>HVAC</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Water Heat</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Fuel Efficiency</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td colspan="5">Low-Income Programs</td></tr>
<tr><td>Low-Income</td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Community Energy Efficiency Program</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td colspan="5">Multifamily Programs</td></tr>
<tr><td>Multifamily Direct Install</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Multifamily Market Transformation</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td colspan="5">Nonresidential Programs</td></tr>
<tr><td>Site Specific</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Prescriptive Lighting</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>HVAC</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Prescriptive Shell</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Motor Control HVAC (VFD)</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Food Services</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Green Motors</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Compressed Air</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Fleet Heat</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Grocer</td><td>✓</td><td>✓</td><td></td><td></td></tr>
</table>

*Contractor group to be determined after consulting with Avista.

The following sections describe the implementation research tasks. Program-level details are provided in the *Process Evaluation Activities by Program* section of this work plan.

Document and Database Review

Cadmus will review operation manuals, the program website, and the program database to gain a thorough understanding of how the program is implemented. In our database review, we will also assess the quality of program tracking data as it relates to our customer research.

We also will review Avista's most recent process and impact evaluation results to learn how Avista has incorporated earlier recommendations and to identify trends in program performance. We will apply our findings from the program document and database reviews to refine program-specific research objectives and develop data-collection instruments.

Avista Staff and Third-Party Implementer Interviews

Avista and its third-party implementers hold critical insight into program administration and delivery processes. Telephone interviews with these key stakeholders will focus on these topics:

- Program roles and responsibilities
- Program goals and objectives
- Program design and implementation
- Data tracking
- Program participation
- Marketing and outreach
- Program successes
- Market barriers
- Program impact on the market
- Future program changes including redesign

During the interview, we will be conscientious of staff members' time. Because we know they sometimes oversee multiple programs, our interview guides will avoid repetitive questions for programs with similar processes, such as data tracking, and we may cover all programs overseen by one or more staff members in one interview. We will build on our early findings from these program staff interviews to focus interviews with third-party staff about areas of interest.

For Residential and low-income programs in which contractors or agencies play a vital role, we will conduct contractor and CAP agency interviews.

Contractor Interviews

For many customers, contractors are an important source of program awareness and their involvement, cooperation, and understanding can be an indicator of program success. Cadmus proposes to conduct in-depth interviews to gain insights into contractors' motivations, experience, marketing strategies, how contractors identify customers, their standard business practices, knowledge about customer perceptions and experience, perspectives on program processes, the program's influence on business, and the opportunities for improvement.

Cadmus plans to complete up to 10 interviews with residential contractors (five per state). We will probably concentrate Residential contractor interviews on the HVAC program but will consult with Avista staff to determine if this is the best group to target. We will ask Avista program managers and account executives to identify target contactors and will coordinate communication to program contractors.

CAP Agency Interviews

Cadmus plans to complete up to five interviews with CAP Agency staff. These interviews will be focused on program experience, marketing strategies, knowledge about customer perceptions and experience, and program successes and opportunities for improvement.

Customer Research

As shown in Table 10, Cadmus will conduct online participant surveys, as well as interviews with trade allies where smaller populations exist.

Table 10. Customer Research by Program

Program Category	Customer Research	
	Participant Surveys	Trade Ally Interviews
Residential Programs		
Shell	✓	
HVAC	✓	
Water Heat	✓	
Fuel Efficiency	✓	
Multifamily Programs		
Multifamily Market Transformation (Builders)		✓
Multifamily Direct Install (Property Managers)		✓
Nonresidential Programs		
Site Specific	✓	
Prescriptive*	✓	
Grocer	✓	

*Nonresidential Prescriptive: Lighting, HVAC, Shell, Motor Control HVAC (VFD), Food Services, Green Motors, Compressed Air, and Fleet Heat.

Participant Online Surveys and Interviews

Cadmus will prepare participant survey and interview guides in each of Avista's programs. Questions will focus on topics that can help Avista understand trends in measure adoption and overall program performance and that gather critical data to inform the impact evaluation.

Our participant survey and interview guides will gather critical insights into participants' program journey, such as these aspects:

- Program awareness
- How respondents learned about the program
- General program participation
- Program delivery experience
- Overall program satisfaction
- Satisfaction with Avista

- Reasons for participation
- Program benefits
- Current energy-efficient behaviors and purchases
- Suggestions for program improvements

All participant surveys will be online and will involve emailing a link to the survey to participating customers for whom an email address is available.

We typically recommend simple random sampling when the population is sufficiently large but will finalize the sampling plan according to the target sample sizes and expected response rates and after receiving comprehensive participant tracking data. See Table 11 in the *Process Sampling Plans* section for sampling details.

For programs with unique populations (Multifamily Market Transformation and Multifamily Direct Install), we will conduct participating builder and property manager telephone interviews, respectively, to allow for a greater range of topic exploration. We will conduct up to five builders participating in the Multifamily Market Transformation program and up to five property managers in each state for the Multifamily Direct Install program.

Process Sampling Plans

For the participant surveys, Cadmus will calculate sample sizes for each program category and fuel type based on unique participant population sizes, expected variation, and confidence and precision targets. For this work plan, we have described the sample design and estimated sample sizes but will revise them according to actual participant and project population sizes.

In Table 11, we provide the anticipated survey sample sizes for each program category and fuel type, determined based on target 90% confidence and 15% precision for each program category and to far exceed 90% confidence and 10% precision for the portfolio overall with error ratios of 0.5. For programs with limited sample sizes, we will send the survey to a census of participants in the planned year and gather as many survey responses as possible.

We will conduct in-depth interviews with up to five builders participating in the Multifamily Market Transformation program and up to five property managers in each state of the Multifamily Direct Install program.

Table 11. Estimated Participant Survey Sample Design

Program Category	Fuel Type	Idaho and Washington Combined	
		Annual Participant Size*	Survey Target **
HVAC, Shell, Water Heat	Electric	~4,000	30
	Natural Gas	~12,000	40
Fuel Efficiency	Natural Gas	~500	AMAP (estimating between 10 and 20)
Residential Total		**~16,500**	**~90**
Site Specific	Both	~400	AMAP (estimating between 10 and 20)
Prescriptive Lighting	Electric	~700	30
HVAC	Natural Gas	~400	AMAP (estimating between 10 and 20)
Prescriptive Shell	Both		
Motor Control HVAC (VFD)	Electric		
Food Services	Both		
Green Motors	Electric		
Compressed Air	Electric		
Fleet Heat	Electric		
Nonresidential Total		**~1,500**	**~70**
Portfolio Total		**~18,000**	**~160**

* Participant size is the number of residential program participants and nonresidential program projects. These are estimates based on previous years.

**Final survey target will be based on actual unique participants/project by state in each program category in the year survey is scheduled. Due to small population sizes, Cadmus will send email invite to census and gather as many completed surveys as possible.

Process Evaluation Activities by Program

This section describes the process evaluation activities by program. Although many process research activities are similar, such as reviewing program documents and tracking database to assess roles and responsibilities, marketing and outreach, participation trends, and informing subsequent interview and survey questions, the following descriptions note more program-specific focus areas.

Residential HVAC, Shell, and Water Heat Programs

The process evaluation of these programs will include the following data-collection activities:

- **Review program documents and database** to assess program changes and determine if database contains all necessary fields for customer surveys.
- **Interview Avista staff** to assess differences between the implementation of the program in Idaho and Washington, assess the impact of Washington's Clean Energy Transformation Act on program design and implementation, document program changes and goals, and identify program successes and challenges.

- **Interview participating contractors (n=10)** to assess program understanding, experience, and satisfaction, how contractors identify customers, use of rebates as a sales factor, customer awareness of the program prior to engaging the contractor, standard business practices, influence of the program on business, and qualifying equipment offered.
- **Survey participating customers** to explore their experience, including application processing and influence of the contractor, continued levels of satisfaction, and marketing preferences.

ENERGY STAR Homes Program

The process evaluation of the ENERGY STAR Homes program will include the following data-collection activities:

- **Review program documents** to assess program changes.
- **Interview Avista staff** to document program changes and goals, assess differences between the implementation of the program in Idaho and Washington, identify program successes and challenges, assess regional communication and coordination with NEEA and other partnering utilities, and assess builder and dealer perceived experience and relationship.

Residential Fuel Efficiency Program (Idaho only)

The process evaluation of the Fuel Efficiency program will include the following data-collection activities:

- **Review program documents and database** to assess program changes and determine if database contains all necessary fields for customer surveys.
- **Interview Avista staff** to document program changes and goals and identify program successes and challenges.
- **Survey participating customers** to explore their experience, including application processing and influence of the contractor, continued levels of satisfaction, and marketing preferences.

Low-Income Program

The process evaluation of the Low-Income program will include the following data-collection activities:

- Review program document to assess program changes.
- Interview Avista staff to assess program changes and goals, assess differences between the implementation of the program in Idaho and Washington, identify program successes and challenges, and assess CAP agency and contractor experience and relationship.
- **Interview CAP agencies (up to n=5)** to assess program implementation, document marketing methods, assess experience with contractors, Avista staff, and customers, and identify program successes and challenges.

Community Energy Efficiency Program (Washington Only)

The process evaluation of the Community Energy Efficiency Program will include the following data-collection activities:

- **Review program documents** to document program processes, marketing efforts, and data tracking.

- **Interview Avista and implementer staff** to document program design including goal setting, delivery process, customer eligibility, incentive structure, and data tracking, as well as roles and responsibilities, and areas of success and challenge.

Multifamily Direct Install Program

The process evaluation of the Multifamily Direct Install program will include the following data collection activities:

- Review program documents to assess program changes.
- Interview Avista staff to document program changes and goals, assess differences between the implementation of the program in Idaho and Washington, identify program successes and challenges, and assess trade ally relationship.
- Interview implementer to document program understanding, including coordination of program marketing and outreach, and overall program experience, including satisfaction and suggestions for improvement.
- **Interview participating property managers (up to 5 per state)** to explore customer experience, including program awareness, satisfaction, energy efficiency actions, barriers to energy efficiency programs, and marketing preferences.

Multifamily Market Transformation (Idaho Only)

The process evaluation of the Multifamily Market Transformation program will include the following data collection activities:

- Review program documents to assess program changes.
- Interview Avista staff to document program changes and goals, identify program successes and challenges, and assess trade ally relationship.
- **Interview participating builders (up to 5)** to assess motivation and challenges, explore customer satisfaction and experience, and asses influence of the program on business practices.

Nonresidential Site Specific and Prescriptive Programs

The process evaluation of the Site Specific and Prescriptive programs (Interior and Exterior lighting, HVAC, Shell, Motor Control HVAC [VFD], Food Services, Green Motors, Compressed Air, Fleet Heat, and Grocer) will include the following data-collection activities:

- Review program documents and database to assess program changes and determine if database contains all necessary fields for customer surveys.
- Interview Avista staff to assess differences between the implementation of the program in Idaho and Washington, assess the impact of Washington’s Clean Energy Transformation Act on program design and implementation, document program changes and goals, identify program successes and challenges and to assess contractor relationships.
- **Interview implementers** to document program understanding, roles and responsibilities, experience, satisfaction, and suggestions for improvement.

  - Green Motors: Green Motor Program Group
  - Compressed Air: 4Sight Energy Group, LLC
- **Survey participating customers** to explore their experience and continued levels of satisfaction, including satisfaction with and influence of the contractor or designer, assess energy-saving behavior and document marketing preferences.

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AVISTA

Coffee shop, Wallace, Idaho