


## **Exhibit No. 1:**

### **Avista 2018 and 2019 Electric Impact Evaluations**



## PY 2018 Idaho Electric Impact Evaluation Report

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**Prepared for:**

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## Portfolio Executive Summary

For several decades, Avista Corporation has been administering demand-side management programs to reduce electricity and natural gas energy use for its portfolio of customers. Most of these programs have been implemented in-house, but a few have external implementers. Avista contracted with Cadmus to complete process and impact evaluations of its PY 2018 and PY 2019 electric demand-side management programs in Idaho. This report presents our electric impact evaluation findings for PY 2018. Cadmus did not apply net-to-gross adjustments to savings values, except in cases where deemed energy savings values already incorporate net-to-gross as a function of the market baseline.

### Evaluation Methodology and Activities

Cadmus conducted the Idaho portfolio evaluation using a variety of methods and activities, shown in Table 1.

**Table 1. Electric Program Evaluation Activities (PY 2018)**

Sector	Program	Document/Database Review	Verification/Metering Site Visits
Nonresidential	Prescriptive (Multiple)	✓	✓
	Site Specific	✓	✓
Residential	Simple Steps, Smart Savings™	✓	--
	HVAC	✓	--
	Shell	✓	--
	ENERGY STAR® Homes	✓	--
	Multifamily Direct Install	✓	--
Low Income	Low Income	✓	--
Fuel Efficiency	Site Specific (Nonresidential)	✓	--
	Prescriptive (Residential)	✓	--
	Low Income	✓	--

### Summary of Impact Evaluation Results

Overall, the Idaho electric portfolio achieved a 98% realization rate and acquired 29,805,007 kWh in annual verified savings (Table 2). Cadmus collected the Avista-reported savings through database extracts from Avista’s Customer Care and Billing (residential) and InforCRM (nonresidential) databases and from data provided by third-party implementers to determine the *verified savings* that represent our findings. In the second year of the two-year evaluation cycle (PY 2019), Cadmus will conduct utility billing regression analyses to evaluate the most accurate energy savings for most residential programs.

**Table 2. Reported and Verified Electric Savings (PY 2018)**

Sector	Reported Savings (kWh)	Verified Savings (kWh)	Realization Rate
Nonresidential	22,832,307	22,630,556	99%
Residential	5,400,520	5,108,673	95%
Low Income	228,498	252,699	111%
Fuel Efficiency	1,824,345	1,813,079	99%
<b>Total</b>	<b>30,285,671</b>	<b>29,805,007</b>	<b>98%</b>

## Conclusions and Recommendations

During the PY 2018 evaluation, Cadmus identified several areas for improvement, outlined below by sector.

### Nonresidential Conclusions and Recommendations

While some individual project results varied, the overall nonresidential sector performed strongly in PY 2018. Most of the projects Cadmus sampled for evaluation were well-documented and matched what we found during site visit verifications.

Cadmus has two recommendations for improving the nonresidential sector energy savings:

- Ensure that the final reported savings calculations reflect the most up-to-date project details, including post-installation verification photos, equipment submittals, and invoices. During two project verifications, Cadmus found different installed equipment sizes, quantities, or performance ratings than used in the reported savings calculations.
- Ensure that power metered data and pressure and airflow trend data collected for compressed air projects are analyzed on a day-type approach (instead of taking the overall averages for the metered period) to improve the accuracy of the energy-savings calculations. The day-type analysis method is recommended by the Department of Energy’s Advanced Manufacturing Office and Compressed Air Challenge® and is used in the AIRMaster+ free online software tool.<sup>1</sup> This method provides a more granular estimation of the baseline and installed system flow rates, performance, and energy use.

### Residential Conclusions and Recommendations

During the evaluation, Avista confirmed that unit energy savings (UES) values used to calculate reported savings for numerous residential measures had not been updated to match the 2018 Avista technical reference manual (TRM) UES values. This was especially pronounced in the residential HVAC program, where reported savings under-represented savings for heat pump measures. Under the direction of Avista, Cadmus adjusted reported savings for these measures to match the 2018 TRM UES values.

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<sup>1</sup> Office of Energy Efficiency and Renewable Energy. April 10, 2014. “AIRMaster+ Motor Driven Systems.” <https://www.energy.gov/eere/amo/articles/airmaster>



Based on reported savings, the ENERGY STAR Homes program achieved 253% of goal, but reported participation and verified savings both showed that the program achieved approximately 72% of goal, which indicates that reported savings values are well over the current TRM UES values.

Cadmus offers three recommendations regarding Avista's residential electric programs:

- Ensure that reported savings for all prescriptive measures are calculated using the current TRM or current 2017 Regional Technical Forum<sup>2</sup> (RTF) UES values.
- Continue to encourage the adoption of efficient lighting through the Simple Steps, Smart Savings program. The Northwest Energy Efficiency Alliance *Residential Building Stock Assessment II* shows that roughly 40% of installed lamps in single family homes in Washington and Idaho are incandescents or halogens.
- The Multifamily Direct Install (MFDI) program has proven to be an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units. The Northwest Energy Efficiency Alliance *Residential Building Stock Assessment II* "Multifamily Buildings Report" estimated that 44% of lighting in multifamily units use incandescent or halogen technology. Cadmus recommends to focus on replacing high-use, low-efficiency lamps where practical, to maximize program cost-effectiveness while keeping savings high.

## Fuel Efficiency Recommendations

Cadmus recommends that Avista update reported residential savings for fuel efficiency measures to use current TRM UES values, particularly for measures where the differences are especially notable, such as conversions to natural gas water heaters and natural gas wall furnaces.

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<sup>2</sup> Regional Technical Forum. 2017. *Standard Protocols*. <https://rtf.nwcouncil.org/standard-protocols>

## Nonresidential Impact Evaluation

Through its nonresidential portfolio of programs, Avista promotes the purchase of high-efficiency equipment for commercial and industrial utility customers. Avista provides rebates to partially offset the difference in cost between high-efficiency equipment and standard equipment.

### *Program Summary*

Avista completed and incented 685 nonresidential electric measures in Idaho in PY 2018 and reported total electric energy savings of 22,832,307 kWh. 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 is selected for smaller, straightforward equipment installations that generally have similar operating characteristics (such as lighting, simple HVAC systems, food service equipment, and variable frequency drives).

The Site Specific program path is reserved for more unique 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).

Fuel Efficiency measures are part of the Site Specific program path, but involve a combination of electric savings and natural gas penalties. These measures typically involve replacing electric space heating or water heating systems with natural gas equipment. Please refer to the *Fuel Efficiency Impact Evaluation* section for Cadmus' evaluation methodology and findings for nonresidential Fuel Efficiency measures.

### *Program Participation Summary*

This section summarizes nonresidential sector participation and progress toward PY 2018 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 2018 as well as reported savings and a comparison between reported savings and goals.

**Table 3. Nonresidential Prescriptive Electric Savings (PY 2018)**

Program Name	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Interior Lighting	6,635,450	8,038,814	121%
Exterior Lighting	1,405,118	4,243,826	302%
Shell Measure	629	929	148%
Green Motors	45,180	42,466	94%
Motor Control (Variable Frequency Drives [VFD])	75,595	112,931	149%
Fleet Heat	8,000	0	0%
Food Service Equipment	94,730	8,527	9%
AirGuardian	18,000	0	0%
Energy Smart Grocer <sup>a</sup>	724,348	3,402	0%
<b>Total</b>	<b>9,007,050</b>	<b>12,450,896</b>	<b>138%</b>

<sup>a</sup> The Energy Smart Grocer savings goal includes Site Specific Energy Smart Grocer measures. The Site Specific portion constitutes approximately 10% of the overall goal.

Table 4 shows participation goals by rebated equipment quantity, as provided by Avista. The PY 2018 nonresidential tracking database extract listed individual projects, but did not include rebated equipment quantity. For reference, Table 5 provides participation by unique application numbers.

**Table 4. Nonresidential Prescriptive Participation Goals by Equipment Rebated**

Program Type	Planned Participation
Interior Lighting	26,904
Exterior Lighting	4,302
Shell Measure	325
Green Motors	18
Motor Control (VFD)	55
Fleet Heat	1
Food Service Equipment	18
AirGuardian	3
Energy Smart Grocer <sup>a</sup>	2,097

<sup>a</sup> The Energy Smart Grocer goal includes Site Specific Energy Smart Grocer participants.

**Table 5. Nonresidential Prescriptive Participation by Project (PY 2018)**

Program Type	Participation Reported <sup>a</sup>
Interior Lighting	315
Exterior Lighting	273
Shell Measure	3
Green Motors	11
Motor Control (VFD)	3
Fleet Heat	0
Food Service Equipment	4
AirGuardian	0
Energy Smart Grocer	1
<b>Total</b>	<b>610</b>

<sup>a</sup> A participant is defined as a unique application number.

### Nonresidential Site Specific Program Path

Table 6 shows electric savings goals assigned to the Site Specific program path in Avista’s nonresidential sector for PY 2018, as well as reported savings. Note that the table does not include reported electric savings for the Fuel Efficiency sector, such as those associated with the Multifamily Market Transformation program.

**Table 6. Nonresidential Site Specific Electric Savings (PY 2018)**

Program Path	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Site Specific	4,000,000	10,381,411	260%

### Evaluation Goals and Objectives

For the PY 2018 quarterly, semiannual, and annual reports, Cadmus conducted nonresidential impact activities to determine verified savings for most programs.

### Nonresidential Impact Evaluation Methodology

To evaluate impact evaluation savings for the PY 2018 nonresidential sector, Cadmus performed several activities in two waves:

- Selected an evaluation sample and requested project documentation from Avista
- Performed project documentation review
- Prepared on-site M&V plans
- Performed site visits and collected on-site data (such as trend data, photos, and operating schedules)
- Used site visit findings to calculate verified savings by measure
- Applied realization rates to total reported savings population to determine overall verified savings

The program context, along with Cadmus’ sample design, document review, and on-site verification activities, is described in more detail below.

## Program Context

As the first step of our evaluation activities, we gained an understanding of the programs and measures being evaluated. Specifically, Cadmus explored documents and data records:

- Avista’s annual business plans, which detail processes and energy savings justifications
- Project documents from external sources (customers, program consultants, and implementation contractors)

Based on the initial review, Cadmus outlined the distribution of program contributions to the overall portfolio of programs. In addition, the review allowed us to understand the sources for UES for each measure offered through the programs, along with the sources for energy-savings algorithms and the internal quality assurance and quality control processes for large nonresidential sector projects.

Following this review, Cadmus designed the sample strategy for the impact evaluation activities, as discussed in the following section.

## Sample Design

We based the first evaluation sample on program data from January 2018 to April 2018, and we based the second evaluation sample on program data from May 2018 through December 2018. As a guideline, Cadmus used the proposed, overall PY 2018 and PY 2019 nonresidential sample sizes by subprogram in the M&V plan, seeking to complete approximately one-quarter of the sample during the first wave and another one-quarter during the second wave.

For each activity wave, we broke down submitted program applications by path and measure (such as Site Specific shell measure, Prescriptive lighting, or Prescriptive motor controls), allowing us to select the highest-savings applications in each category with certainty. For applications with reported savings greater than 1% of total savings by category, Cadmus assigned random numbers and sampled randomly. We removed applications with less than 1% of total savings by category from the sample consideration, except where another application at the same location or facility was previously selected (and where we could assess both applications with one site visit, which is a cost-effective verification strategy even if the second application represents minimal claimed savings).

Cadmus sampled randomly selected sites across both Washington and Idaho since Avista’s programs are implemented similarly in both states. We pooled the results from the randomly selected sites to calculate a realization rate by stratum that we applied to projects in both states. We applied verified savings for sites selected with certainty only to the state in which they had been implemented.

Table 7 summarizes the Idaho nonresidential Prescriptive program path evaluation sample. Across both states, Cadmus sampled 40 Prescriptive applications at 34 unique sites. Of the sampled applications, we selected 21 for certainty review based on the scale of savings, measure type, or location, and we

selected the remaining 19 applications randomly. There was no participation in the AirGuardian and Fleet Heat programs in Idaho in PY 2018.

**Table 7. Idaho Nonresidential Prescriptive Electric Evaluation Sample**

Program Type	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Interior Lighting	6	2,311,797	29%
Exterior Lighting	2	110,360	3%
Shell Measure	1	198	21%
Green Motors	4	18,678	44%
Motor Control (VFD)	2	104,755	93%
Fleet Heat	0	0	N/A
Food Service Equipment	0	0	0%
AirGuardian	0	0	N/A
Energy Smart Grocer	1	3,402	100%
<b>Nonresidential Prescriptive</b>	<b>16</b>	<b>2,549,190</b>	<b>20%</b>

Table 8 summarizes the Idaho nonresidential Site Specific program path evaluation sample. Across both states, Cadmus sampled 18 Site Specific applications at 15 unique sites. Of the sampled applications, we selected 12 for certainty review based on the scale of savings, measure type, or location, and we selected the remaining six applications randomly.

**Table 8. Idaho Nonresidential Site Specific Electric Evaluation Sample**

Program Path	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Site Specific	7	7,648,853	74%

## Document Review

We requested and reviewed project documentation for each sampled application and prepared M&V plans to guide our site visits. Project documentation typically included incentive applications, calculation tools (usually based on the 2017 RTF), invoices, equipment specification sheets, and post-inspection reports.

## On-Site Verification

Cadmus performed site visits at 46 unique nonresidential locations to assess electric savings for 58 unique Prescriptive and Site Specific measures (not including Fuel Efficiency measures). Site visits involved verifying the installed equipment type, make and model numbers, operating schedules, and setpoints, as applicable. We did not consider it necessary to conduct power metering or light logging for PY 2018 site visits. Cadmus collected two weeks of trend data for two of the Site Specific industrial process measures at one industrial site. We used the project documentation review and on-site findings to adjust the reported savings calculations where necessary.

## Nonresidential Impact Evaluation Results

This section summarizes the nonresidential sector Prescriptive and Site Specific program paths' electric impact evaluation results for PY 2018.

## Nonresidential Prescriptive Programs

Table 9 shows reported and verified electric energy savings for Avista’s Nonresidential sector Prescriptive program path and the realization rates between verified and reported savings for PY 2018. The overall nonresidential sector Prescriptive program path electric realization rate was 100%.

**Table 9. Nonresidential Prescriptive Electric Impact Findings**

Program Type	Reported Savings (kWh)	Verified Savings (kWh)	Realization Rate
Interior Lighting	8,038,814	8,012,238	100%
Exterior Lighting	4,243,826	4,243,826	100%
Shell Measure	929	929	100%
Green Motors	42,466	42,870	101%
Motor Control (VFD)	112,931	113,171	100%
Fleet Heat	0	0	100%
Food Service Equipment	8,527	8,527	100%
AirGuardian	0	0	100%
Energy Smart Grocer	3,402	3,402	100%
<b>Nonresidential Prescriptive</b>	<b>12,450,896</b>	<b>12,424,964</b>	<b>100%</b>

Of the evaluated applications, Cadmus identified discrepancies for seven based on the site visit and project documentation review. Table 10 summarizes the reasons for discrepancies between reported and verified savings.

**Table 10. Nonresidential Prescriptive Evaluation Summary of Discrepancies**

Program Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	2	↓	Cadmus reduced the lighting fixture in-service rate for two projects to account for incented fixtures that were on the site but in storage.
	1	↓	Savings in project documentation were slightly lower than reported savings in program database.
	1	↑	Cadmus accounted for additional savings from delamping for reported 4-lamp LED fixtures that only had two lamps. The participant had removed two lamps per fixture due to brightness.
Green Motor Rewind	2	↑	Reported savings for two projects referenced the 2017 RTF. Cadmus applied deemed motor savings from the 2018 TRM workbook.
Motor Control (VFD)	1	↓	Cadmus reduced the reported quantity of 2.5 horsepower return air fans with VFDs from three to one and added two 3 horsepower return air fans with VFDs.

## Nonresidential Site Specific Program

Table 11 shows reported and verified electric energy savings for Avista’s PY 2018 nonresidential sector Site Specific program path, as well as a comparison between verified and reported savings for PY 2018. The overall Site Specific program path electric realization rate was 98%. Note that the table does not include reported and verified electric savings for measures in the Fuel Efficiency path.

**Table 11. Nonresidential Site Specific Electric Impact Findings (PY 2018)**

Program Path	Reported Savings (kWh)	Verified Savings (kWh)	Realization Rate
Site Specific	10,381,411	10,205,592	98%

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

**Table 12. Nonresidential Site Specific Evaluation Summary of Discrepancies**

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Exterior Lighting	1	↓	The site installed a higher quantity of exterior LED fixtures. The reported savings in database did not match the implementer’s submitted calculation workbook.
	1	↓	The site installed fewer LED pole lighting fixtures and more LED wall pack fixtures than reported.
Industrial Process	1	↑	The site converted two pressure roll vacuum units from double zone to single zone units, eliminating the need for one of the four 500-horsepower vacuum pumps. Reported savings calculations assumed the pump motor to be 100% efficient. Cadmus adjusted the savings calculations to incorporate losses for a conservative, high-efficiency 500-horsepower motor (95.8%).
Compressed Air	1	↓	The site replaced two fixed-speed air compressors with two 350-horsepower variable speed rotary-screw air compressors. Project documentation included post-installation power and airflow metered data. Cadmus updated the reported savings calculations by breaking out pre- and post-period airflow and baseline system performance on a weekday basis, rather than an overall metered period basis. Although the difference in average overall airflow was minimal between the verified and reported methodology, there were days (such as Wednesdays and Fridays) that differed by 175 CFM to 230 CFM from reported. This difference had a significant impact on the performance of the baseline air compressors.
Interior Lighting	1	↑	Cadmus included the calculated cooling load electric energy savings in the interim verified savings. These savings were calculated in the project documentation but not included in the reported savings.

### Nonresidential Conclusions and Recommendations

The nonresidential sector achieved total verified electric energy savings of 22,631 MWh in PY 2018 with a combined realization rate of 99%. The nonresidential sector also exceeded the combined Prescriptive and Site Specific program paths’ electric savings goal of 13,007 MWh by 74%.

While some individual project results varied, the overall nonresidential sector performed strongly in PY 2018. Most of the projects Cadmus sampled for evaluation were well-documented and matched what we found during site visit verification.

Cadmus has two recommendations for improving the nonresidential sector energy savings:

- Ensure that the final reported savings calculations reflect the most up-to-date project details, including post-installation verification photos, equipment submittals, and invoices. During two



project verifications, Cadmus found different installed equipment sizes, quantities, or performance ratings than used in the reported savings calculations.

- Ensure that power metered data and pressure and airflow trend data collected for compressed air projects are analyzed on a day-type approach (instead of taking the overall averages for the metered period) to improve the accuracy of the energy-savings calculations. The day-type analysis method is recommended by the U.S. Department of Energy's Advanced Manufacturing Office and Compressed Air Challenge® and is used in the AIRMaster+ free online software tool. This method provides a more granular estimation of the baseline and installed system flow rates, performance, and energy use.

## Residential Impact Evaluation

Cadmus designed the residential sector impact evaluation to verify reported program participation and energy savings. We used data collected and reported in the tracking database, online application forms, Avista TRM and RTF savings review, and applicable updated deemed savings values.

### Program Summary

Avista completed and incented 250,234 residential electric measures or units in Idaho in PY 2018 and reported total electric energy savings of 5,400,520 kWh, not including participation and savings from Fuel Efficiency measures, which are included below in the *Fuel Efficiency Impact Evaluation* section. The residential programs comprise two primary paths—Prescriptive and MFDI. The Prescriptive path includes Simple Steps, Smart Savings, which encourages consumers to purchase and install high-quality LEDs, light fixtures, and energy-efficient showerheads; the Residential HVAC program, which incentivizes high-efficiency heating and cooling equipment; the Residential Shell program, which provides rebates to encourage customers to install high-efficiency windows and storm windows; and the ENERGY STAR Homes program, which offers 15% to 25% energy savings relative to state energy code. Through the MFDI program, Avista provides free direct-install measures to multifamily residences (of five units or more) and common areas.

### Program Participation Summary

This section summarizes residential sector participation and progress toward PY 2018 goals for the residential Prescriptive and residential MFDI programs.

### Residential Prescriptive Programs

Table 13 shows savings goals assigned to Avista’s residential sector Prescriptive programs for PY 2018, as well as reported savings and the goal portion achieved in PY 2018.

**Table 13. Residential Prescriptive Reported Electric Savings (PY 2018)**

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Simple Steps, Smart Savings	1,326,717	3,693,056	278%
HVAC	730,543	765,230	105%
Shell	60,854	95,748	157%
ENERGY STAR Homes	46,144	116,567	253%
<b>Residential Prescriptive Total</b>	<b>2,164,258</b>	<b>4,670,601</b>	<b>216%</b>

Table 14 summarizes participation goals and reported participation in Avista’s residential sector Prescriptive programs for PY 2018, along with the percentage of goal achieved.

**Table 14. Residential Prescriptive Participation (PY 2018)**

Program	Participation Goals	Participation Reported	Percentage of Goal
Simple Steps, Smart Savings <sup>a</sup>	88,465	240,437	272%
HVAC <sup>b</sup>	518	462	89%
Shell <sup>c</sup>	5,016	7,979	159%
ENERGY STAR Homes <sup>b</sup>	14	26	186%
<b>Residential Prescriptive Total</b>	<b>94,013</b>	<b>248,904</b>	<b>265%</b>

<sup>a</sup> Participation is defined as the number of purchased units.

<sup>b</sup> Participation is defined as the number of rebates.

<sup>c</sup> Participation is defined as square feet of installed windows or storm windows.

### Multifamily Direct Install Program

Table 15 shows reported savings and participation for the MFDI program in PY 2018. Avista launched this program as a pilot in PY 2018 and did not set annual program goals, then transitioned this from a pilot to an ongoing study in September 2018.

**Table 15. Multifamily Direct Install Reported Electric Savings**

Program Path	Savings Reported (kWh)	Participation Reported
Multifamily Direct Install	729,920	1,330

### Evaluation Goals and Objectives

For the PY 2018 quarterly, semiannual, and annual reports, Cadmus verified savings for most programs through a combination of database review and document review, which are described below.

### Residential Impact Evaluation Methodology

To determine the residential sector verified savings for PY 2018, Cadmus employed two impact evaluation methods for most residential programs:<sup>3</sup>

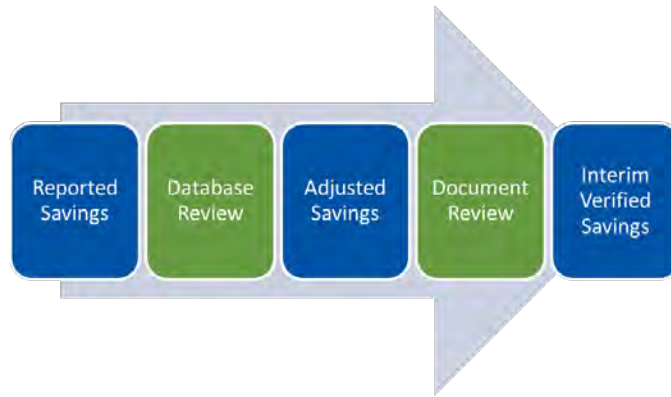
- Database review
- Document review

Similar to previous practice, Cadmus calculated adjusted savings based on results of the database review and applied realization rates from our document reviews. Verified savings represented adjusted savings multiplied by the document review realization rates, as shown in Figure 1.

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<sup>3</sup> With approval from Avista, Cadmus ceased performing a third impact activity—verification surveys—in the third quarter of PY 2018 to eliminate redundancy between verification surveys and document review.

Figure 1. Residential Impact Process



### Database Review

For the impact evaluation database review, Cadmus used UES values, as provided in the TRM, to calculate savings for measures reported in the measure tracking database. This impact activity may help identify incorrect UES values used to calculate reported savings. Savings calculated during the database review are defined as *adjusted savings*.

### Document Review

For the document review, Cadmus compared information from rebate forms and other supporting documents to measure tracking data for a random sample of projects. This impact activity may identify installed measures that did not meet eligibility requirements, quantities that did not match the measure tracking database, and other discrepancies. Following our review of all projects, we calculated a realization rate for the document review by dividing savings calculated for the sample (using the revised information) by reported savings for the sample. We then multiplied this realization rate by adjusted savings for the entire program to determine verified savings.

Cadmus conducted document reviews for the programs shown in Table 16, drawing roughly equal samples from participants in each quarter.

Table 16. Residential Prescriptive Electric Impact Document Review

Program	Completed for PY 2018
HVAC	34
Shell	34

### Residential Impact Evaluation Results

The following sections summarize findings and provide verified savings for both of Cadmus’ impact evaluation methodologies. The database review resulted in the largest number of adjustments to reported savings.

## Database Review

Table 17 shows database review findings, with adjusted savings being higher than reported savings for some programs and lower for others. Adjusted savings differed from reported savings because reported UES values differed from TRM values for several measures. Avista determined that the reported savings for these measures used values from an older customer database that did not align with those in the current TRM. For measures with reported savings based on measure-specific parameters, Cadmus could not confirm the reported savings calculations, which depended on inputs that were not included in the tracking data (such as air infiltration and duct sealing).

**Table 17. Residential Prescriptive Database Review Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Percentage Change
Simple Steps, Smart Savings	3,693,056	3,454,438	-6%
HVAC	765,230	786,170	3%
Shell	95,748	100,535	5%
ENERGY STAR Homes	116,567	83,738	-28%
<b>Residential Prescriptive Total</b>	<b>4,670,601</b>	<b>4,424,881</b>	<b>-5%</b>

## Document Review

Table 18 summarizes document review findings to date. The HVAC program had a 96% electric realization rate and the Shell program had an 85% electric realization rate.

**Table 18. Residential Prescriptive Electric Impact Document Review Realization Rates**

Program	Document Audit Count	Sample Reported Savings (kWh)	Sample Verified Savings (kWh)	Document Audit Realization Rate
HVAC	34	32,997	31,691	96%
Shell	34	49,224	41,915	85%

Cadmus identified several discrepancies during the document review through PY 2018:

- For two window measures, documentation showed a square footage for installed windows that differed from that reported. In both cases, the documented square footage was lower than that reported and resulted in lower verified savings based on the corrected area.
- For four window measures reported at sites with electric heating, project documents identified heating fuels other than electricity. Cadmus added natural gas savings and removed electricity savings at two sites identified as using natural gas heating. Documentation for the other two sites identified the heating fuel as liquid propane for one site and wood pellets for the other, so Cadmus removed electricity savings for these sites.
- One heat pump water heater measure had a tank capacity of 80 gallons per the documentation. To qualify for the measure, however, the heat pump water heater had to have a tank size below 55 gallons, so Cadmus removed savings for this measure.

Table 19 shows verified savings, which apply the realization rates shown in Table 18 to the adjusted savings calculated based on the database review. The verified savings represent Cadmus’ best estimate of savings without conducting a billing analysis.

**Table 19. Residential Prescriptive Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Verified Electric Savings (kWh) <sup>a</sup>	Realization Rates
Simple Steps, Smart Savings	3,693,056	3,454,352	3,454,352	94%
HVAC <sup>b</sup>	765,230	786,170	755,054	99%
Shell	95,748	100,535	85,608	89%
ENERGY STAR Homes	116,567	83,738	83,738	72%
<b>Residential Prescriptive Total</b>	<b>4,670,601</b>	<b>4,424,796</b>	<b>4,378,753</b>	<b>94%</b>

<sup>a</sup> Verified savings represents adjusted savings only for Simple Steps, Smart Savings and ENERGY STAR Homes.

<sup>b</sup> Includes heat pump water heater installations not included in Table 17 of the *PY 2018 Idaho Annual Conservation Report*. Table 19 of that report includes heat pump water heater savings.

### Residential Conclusions and Recommendations

Verified electricity savings show a realization rate of 94% on realized savings of 4,378,753 kWh for the residential Prescriptive programs, which is 202% of the savings goal for the year, due largely to program participation that was 265% of goal. Reported savings for the MFDI program added 729,920 kWh, for total acquired savings of 5,108,673 kWh.

Lighting measures account for a high percentage of residential sector program path savings: Simple Steps, Smart Savings provided 68% of residential savings, mostly through lighting measures, and MFDI provided 14% of savings, also mostly through lighting measures. The HVAC program accounted for 15% of savings, with Shell and ENERGY STAR Homes accounting for a combined 3% of residential sector savings.

During the evaluation, Avista confirmed that the UES values used to calculate reported savings for numerous residential sector measures had not been updated to match 2018 TRM UES values. This was especially pronounced in the Residential HVAC program, where reported savings under-represented savings for heat pump measures. Under the direction of Avista, Cadmus adjusted reported savings for these measures to match the 2018 TRM UES values.

Based on reported savings, the ENERGY STAR Homes program achieved 253% of goal, but reported participation and verified savings both showed that the program achieved approximately 72% of goal, which indicates that reported savings values are well over the 2018 TRM UES values.

Cadmus offers three recommendations regarding Avista’s residential sector electric programs:

- Ensure that reported savings for all Prescriptive measures are calculated using current TRM or RTF UES values.
- Continue to encourage the adoption of efficient lighting through the Simple Steps, Smart Savings program. The Northwest Energy Efficiency Alliance *Residential Building Stock Assessment II*

shows that roughly 40% of installed lamps in single family homes in Washington and Idaho are based either on incandescent or halogen technology.

- The MFDI program has proven to be an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units. The Northwest Energy Efficiency Alliance *Residential Building Stock Assessment II “Multifamily Buildings Report”* estimated that 44% of lighting in multifamily units use incandescent or halogen technology. Cadmus recommends to focus on replacing high-use, low-efficiency lamps where practical, to maximize program cost-effectiveness while keeping savings high.

## Low Income Impact Evaluation

Cadmus designed the Low Income programs’ impact evaluation to verify reported program participation and energy savings. We used data collected and reported in the tracking database and conducted a TRM savings review.

### Program Summary

Avista leverages the infrastructure of a single Community Action Partnership agency to deliver energy efficiency programs for the company’s low-income residential customers in the Idaho service territory. The program is designed to serve Avista residential customers in Idaho whose income falls between 175 percent and 250 percent of federal poverty level. For PY 2018, the program achieved 228,498 kWh of reported electric savings in Idaho, not including savings for the Low Income Fuel Efficiency measures, which are reported separately in the *Fuel Efficiency Impact Evaluation* section.

### Program Participation Summary

Table 20 shows Avista savings goals for the Low Income sector for PY 2018, as well as reported savings and goal portions achieved in PY 2018.

**Table 20. Low Income Reported Savings (PY 2018)**

Program	Savings Goals (kWh)	Reported Savings (kWh) <sup>a</sup>	Percentage of Goal
Low Income	159,162	228,498	144%

<sup>a</sup> Reported savings do not include Low Income Fuel Efficiency savings, shown in the *Fuel Efficiency Impact Evaluation* section.

Table 21 summarizes participation goals for the Low Income programs, along with participation reported and achieved in PY 2018.

**Table 21. Low Income Participation (PY 2018)**

Program	Participation Goals <sup>a</sup>	Participation Reported <sup>a</sup>	Percentage of Goal
Low Income	16,419	63,436	386%

<sup>a</sup> Participation numbers do not include Low Income Fuel Efficiency participation, shown in the *Fuel Efficiency Impact Evaluation* section, or recipients of LED bulbs at giveaway events. Participation is defined as the number of installed units or square feet of installed insulation or windows.

### Evaluation Goals and Objectives

For quarterly and semiannual reports in PY 2018 and PY 2019, Cadmus will determine verified savings for the Low Income programs through a database review (described above in the *Database Review* section). This approach will provide a strong estimate of achieved savings until Cadmus can perform billing analysis at the end of the two-year evaluation cycle.

### Low Income Impact Evaluation Methodology

Cadmus’ impact evaluation for the Low Income programs’ measures consisted of database review (described above in the *Database Review* section). We used UES values provided in the TRM to calculate



savings for measures reported in the measure tracking database. Cadmus labeled savings calculated during the database review as *adjusted savings*.

### Low Income Impact Evaluation Results

Table 22 shows reported and adjusted electric savings for Low Income conservation measures. The table does not include savings for Low Income programs Fuel Efficiency path measures (shown in the *Low Income Fuel Efficiency Impact Findings* section below).

**Table 22. Low Income Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Verified Electric Savings (kWh)	Realization Rate
Low Income	228,498	252,699	252,699	111%

### Low Income Conclusions and Recommendations

With a realization rate of 111% for electricity savings, the Low Income programs achieved savings of 252,699 kWh in PY 2018, or about 159% of goal. Reported program participation reached 386% of the expected value. Cadmus recommends that Avista adjust its participation goal to better align with PY 2018 findings, and also adjust savings per participant, as the participation goal was exceeded by a much larger margin than the total savings goal.

Roughly one third of verified Low Income program savings resulted from LED bulbs given out at events.

Cadmus understands that Avista relies on a Community Action Partnership to deliver Low Income savings in Idaho. Cadmus’ PY 2019 evaluation activities will include a process review of the Low Income programs, which may help identify opportunities to improve program performance.

## Fuel Efficiency Impact Evaluation

Cadmus designed the Fuel Efficiency sector impact evaluation to verify reported program participation and energy savings. We used data collected and reported in the tracking database and details from online application forms, as well as reviewed TRM and RTF savings and applicable updated deemed savings values.

### 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 path, Residential Prescriptive programs, and Low Income programs. Across these programs, the Fuel Efficiency measures reported participation of 190 in PY 2018 and electric energy savings of 1,824,345 kWh.

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. We report the negative natural gas savings in the *PY 2018 Idaho Natural Gas Impact Evaluation Report*.

### Program Participation Summary

This section summarizes Fuel Efficiency sector participation and progress toward PY 2018 goals for the Nonresidential Site Specific path, Residential Prescriptive programs, and Low Income programs.

### Nonresidential Site Specific Path

The Nonresidential sector Site Specific program path includes Fuel Efficiency measures that replace electric space heating or water heating systems with natural gas equipment. Fuel Efficiency measures provide positive electricity savings and negative natural gas savings, reflecting negative avoided costs. Two types of measures are considered Fuel Efficiency in the PY 2018 Idaho Nonresidential sector database:

- Site Specific HVAC combined
- Site Specific multifamily

Table 23 shows electric savings goals and reported electric savings for the Nonresidential sector Fuel Efficiency measures. There were only five participants in PY 2018. Avista confirmed that it did not set participation goals for Site Specific Fuel Efficiency measures outside the Multifamily Market Transformation program.

**Table 23. Nonresidential Site Specific Fuel Efficiency Electric Savings (PY 2018)**

Fuel Efficiency Measure	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Nonresidential Site Specific	N/A	65,061	N/A
Multifamily Market Transformation	299,574	207,408	69%

## Residential Prescriptive Programs

Table 24 shows Avista PY 2018 savings goals for Residential Prescriptive Fuel Efficiency measures as well as reported savings and percentage of goal through PY 2018.

**Table 24. Residential Prescriptive Fuel Efficiency Reported Electric Savings (PY 2018)**

Fuel Efficiency Measure	Savings Goals (kWh)	Reported Savings (kWh)	Percentage of Goal
Residential Prescriptive Fuel Efficiency	2,727,600	1,449,994	53%

Table 25 shows the Avista PY 2018 participation goal and reported participation for Residential Prescriptive Fuel Efficiency measures, as well as the participation percentage of goal through PY 2018.

**Table 25. Residential Prescriptive Fuel Efficiency Reported Participation (PY 2018)**

Fuel Efficiency Measure	Participation Goals <sup>a</sup>	Participation Reported <sup>a</sup>	Percentage of Goal
Residential Prescriptive Fuel Efficiency	271	170	63%

<sup>a</sup> Participation is defined as the number of rebates.

## Low Income Programs

Table 26 shows Avista PY 2018 savings goals for Low Income Fuel Efficiency measures, as well as reported savings and percentage of goal through PY 2018.

**Table 26. Low Income Fuel Efficiency Reported Electric Savings (PY 2018)**

Fuel Efficiency Measure	Savings Goals (kWh)	Reported Savings (kWh)	Percentage of Goal
Low Income Fuel Efficiency	344,850	101,882	30%

Table 27 summarizes participation goals for Low Income Fuel Efficiency measures, as well as participation reported and achieved through PY 2018.

**Table 27. Low Income Fuel Efficiency Participation (PY 2018)**

Fuel Efficiency Measure	Participation Goals <sup>a</sup>	Participation Reported <sup>a</sup>	Percentage of Goal
Low Income Fuel Efficiency	46	15	33%

<sup>a</sup> Participation is defined as the number of rebates.

## Evaluation Goals and Objectives

For quarterly and semiannual reports in PY 2018 and PY 2019, Cadmus will determine verified savings for Nonresidential Site Specific and Residential Prescriptive Fuel Efficiency measures through database review (described above in the *Database Review* section) and document review (described above in the *Document Review* section). For Low Income Fuel Efficiency measures, Cadmus will determine adjusted savings through database review. These approaches will provide strong estimates of achieved savings until Cadmus can perform billing analysis at the end of the two-year evaluation cycle.

## Fuel Efficiency Impact Evaluation Methodology

The impact methodology for Fuel Efficiency measures is outlined below for the Nonresidential Site Specific path, Residential Prescriptive programs, and Low Income programs.

### 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. We selected six Multifamily Market Transformation program projects for our evaluation of the Nonresidential sector Fuel Efficiency measures, all of which were in Washington. Of the sampled applications, we selected five for certainty review based on the scale of savings, measure type, or location, and selected the remaining application randomly.

Cadmus performed site visits at five unique Nonresidential locations to assess electric savings for the six unique Multifamily Market Transformation program measures. Site visits involved verifying installed equipment type, make and model numbers, operating schedules, and set points, as applicable.

### Residential Prescriptive Fuel Efficiency Impact Methodology

For our impact evaluation of Residential Prescriptive Fuel Efficiency measures, we followed the methodology described in the *For the PY 2018* quarterly, semiannual, and annual reports, Cadmus verified savings for most programs through a combination of database review and document review, which are described below.

Residential Impact Evaluation Methodology section and conducted database review and document review. We completed document reviews for 34 Fuel Efficiency participants in PY 2018.

### Low Income Fuel Efficiency Impact Methodology

For our impact evaluation of Low Income Fuel Efficiency measures, we focused on a database review (described above in the *Database Review* section). We used unit savings values provided in the TRM to calculate savings for measures reported in the measure tracking database. Savings calculated during the database review are *adjusted savings*. For Low Income programs' measures in general (including Low Income Fuel Efficiency measures), these savings are also considered *verified savings*.

## Fuel Efficiency Impact Evaluation Results

The following sections summarize findings for the Nonresidential Site Specific path, Residential Prescriptive programs, and Low Income programs Fuel Efficiency measures. All Fuel Efficiency measures provide positive electricity savings and negative natural gas savings because these measures replace electric space heating or water heating systems with equipment that uses natural gas. Negative savings, reflecting negative avoided costs, are incorporated in the electric cost-effectiveness calculations. We also report these negative savings in the *PY 2018 Idaho Natural Gas Impact Evaluation Report*.

## Nonresidential Fuel Efficiency Impact Findings

Table 28 shows reported and verified electric energy savings for Avista’s Nonresidential sector Fuel Efficiency measures—along with realization rates—through PY 2018.

**Table 28. Nonresidential Fuel Efficiency Electric Impact Findings**

Fuel Efficiency Measure	Reported Savings (kWh)	Verified Savings (kWh)	Realization Rate
Nonresidential Site Specific	65,061	65,061	100%
Multifamily Market Transformation	207,408	202,324	98%
<b>Total</b>	<b>272,469</b>	<b>267,385</b>	<b>98%</b>

Of the evaluated applications, Cadmus identified discrepancies in the randomly-sampled Multifamily Market Transformation program measure based on the evaluation site visit and project documentation review. The site installed more efficient furnaces than reported, which resulted in lower natural gas energy consumption of the installed units versus baseline efficiency units, meaning that less electricity was offset for this measure than reported.

## Residential Prescriptive Fuel Efficiency Impact Findings

Table 29 shows reported, adjusted, and verified electric energy savings for the Residential Prescriptive Fuel Efficiency measures. Database review yielded higher savings than reported because of discrepancies in the UES values used.

**Table 29. Residential Prescriptive Fuel Efficiency Electric Impact Findings**

Fuel Efficiency Measure	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Verified Electric Savings (kWh)	Realization Rate
Residential Prescriptive Fuel Efficiency	1,449,994	1,508,360	1,442,640	100%

In reviewing documentation for 34 Residential Fuel Efficiency measures, Cadmus found an issue with two measures. Both were natural gas furnaces installed at sites where the furnace replaced an oil-fired heating system. We eliminated the electricity savings for the natural gas furnaces, because the replaced system did not heat using electricity. These adjustments led to a document review realization rate of 96%, as shown in Table 30.

**Table 30. Residential Prescriptive Fuel Efficiency Electric Impact Document Review Realization Rate**

Fuel Efficiency Measure	2018-2019 Target Document Audit Count	Document Audit Count Achieved to Date	Sample Reported Savings (kWh)	Sample Verified Savings (kWh)	Document Audit Realization Rate
Residential Prescriptive Fuel Efficiency	68	34	343,579	328,609	96%

## Low Income Fuel Efficiency Impact Findings

Table 31 shows reported and adjusted electric energy savings for Low Income Fuel Efficiency measures.

**Table 31. Low Income Fuel Efficiency Program Electric Impact Findings**


Fuel Efficiency Measure	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Verified Electric Savings (kWh)	Realization Rate
Low Income Fuel Efficiency	101,882	103,054	103,054	101%

*Fuel Efficiency Conclusions and Recommendations*

Nonresidential Site Specific and Multifamily Market Transformation Fuel Efficiency measures achieved verified savings of 267,385 kWh, yielding a 98% realization rate. The Multifamily Market Transformation Fuel Efficiency measures achieved only 69% of the electric energy savings goal of 299,574 kWh.

Residential Prescriptive Fuel Efficiency measures achieved verified savings of 1,442,640 kWh, yielding a 99% realization rate and achieving 53% of savings goal. Cadmus recommends that Avista update reported savings to use current TRM UES values, particularly for measures where the differences are especially notable, such as conversions to natural gas water heaters and conversions to natural gas wall furnaces.

For Low Income Fuel Efficiency measures, verified savings fell short of Avista’s savings goals, achieving 30% of the savings target and 33% of the participation target.



## PY 2019 Idaho Electric Impact Evaluation Report

May 29, 2020

**Prepared for:**

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## Portfolio Executive Summary

For several decades, Avista Corporation has administered demand-side management programs to reduce the electricity and natural gas energy use of its portfolio of customers. Avista contracted with Cadmus to complete process and impact evaluations of its program year (PY) 2018 and PY 2019 electric demand-side management programs in Idaho. This report presents Cadmus’ electric impact evaluation findings for PY 2019. Cadmus did not apply net-to-gross adjustments to savings values, except in cases where deemed energy savings values already incorporated net-to-gross as a function of the market baseline.

### Evaluation Methodology and Activities

Cadmus conducted the Idaho portfolio evaluation using a variety of methods and activities, shown in Table 1.

**Table 1. Electric Program Evaluation Activities**

Sector	Program	Document/Database Review	Verification/Metering Site Visits	Billing Analysis
Nonresidential	Prescriptive (Multiple)	✓	✓	--
	Site Specific	✓	✓	✓
Residential	Simple Steps, Smart Savings™	✓	--	--
	HVAC	✓	--	✓
	Shell	✓	--	✓
	ENERGY STAR® Homes	✓	--	--
	Multifamily Direct Install	✓	--	✓
	Multifamily Direct Install Supplemental Lighting	✓	--	--
Low-Income	Low-Income	✓	--	✓
Fuel Efficiency	Site Specific (Nonresidential)	✓	--	--
	Residential	✓	--	✓
	Low-Income	✓	--	✓

### Summary of Impact Evaluation Results

Overall, the Idaho electric portfolio achieved a 97% realization rate and acquired 25,230,990 kWh in annual evaluated savings (Table 2). Cadmus collected Avista’s reported savings through database extracts from its Customer Care and Billing (residential) and InforCRM and iEnergy (nonresidential) databases and from data provided by third-party implementers to determine evaluated savings.

Although some individual project results varied, both the Residential and Nonresidential sector performed strongly in PY 2018 and PY 2019.

**Table 2. Reported and Evaluated Electric Savings**

Sector	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Nonresidential	17,826,108	16,443,270	92%
Residential	6,426,003	7,035,960	109%
Low-Income	234,102	232,126	99%
Fuel Efficiency	1,521,494	1,519,634	102%
<b>Total</b>	<b>26,007,707</b>	<b>25,230,990</b>	<b>97%</b>

Note: totals may not sum due to rounding.

## Conclusions and Recommendations

During the PY 2019 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 16,443 MWh in PY 2019, with a realization rate of 92%. The Nonresidential sector achieved 78% of the combined Prescriptive and Site Specific program paths’ electric savings goal of 21,215 MWh.

While some individual project results varied, the overall Nonresidential sector performed strongly in PY 2019. Most of the projects Cadmus sampled for evaluation were well documented and matched what the team found during site visit verification.

Cadmus encountered some challenges evaluating the PY 2019 Nonresidential program due to midyear changes Avista made to its application tracking database system. The new iEnergy database stores and reports data in different formats and different aggregation levels than the previous system.

As the transition occurred midyear and some applications were entered into both systems, Avista and Cadmus staff had to manually combine and recategorize data from the new database to match up with the format used for the old database. Cadmus identified several issues with exports from the new database as well as underlying errors with the way the new system calculated some savings. Avista has corrected the issues Cadmus identified, and the new iEnergy database has the potential to facilitate more accurate savings estimates, more detailed project tracking, and more thorough evaluations in the future.

Cadmus offers the following recommendations for improving the Nonresidential sector’s energy savings:

- Ensure that the final reported savings calculations reflect the most up-to-date project details, including post-installation verification photos, equipment submittals, and invoices. During two project verifications, Cadmus found the installed equipment sizes, quantities, or performance ratings differed from those used in the reported savings calculations.
- Review hours of use (HOU) estimates for interior and exterior lighting projects when reviewing submissions and conducting installation verification (IV). Applications claiming 8,760 hours should be particularly scrutinized. Before any new equipment installations, confirm the presence or absence of lighting controls and record how they were configured. Cadmus found a small

percentage of Prescriptive and Site Specific projects where lighting HOU and controls varied from the submitted details.

- Ensure lighting projects are correctly categorized as interior or exterior. Cadmus evaluated two Prescriptive lighting projects with fixtures listed under the wrong measure category.
- Review measurement and verification plans for Site Specific projects carefully and early in the process to ensure an appropriate measurement basis. Also, work with site contacts to establish trend logs for relevant building management system or industrial control system data points during the baseline period.
- Continue to pursue improvements with Avista IV reports. Cadmus staff found that the level of detail in IV reports varied. Cadmus recommends that all IV reports include basic information and 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.

## Residential Conclusions and Recommendations

Evaluated electricity savings show a realization rate of 109% on evaluated savings of 7,036 MWh for the Residential programs, which is 156% of the savings goal for the year. The high percentage of achieved savings relative to the goal results largely from high program participation (134% of goal) and the strong overall realization rate for the Residential sector (109%).

Lighting measures accounted for 73% of the total Residential sector savings. The following list shows the percentage of Residential evaluated savings provided by each program:

- The Simple Steps, Smart Savings program provided 55% of Residential evaluated savings, mostly through lighting measures.
- The Multifamily Direct Install and Multifamily Direct Install Supplemental Lighting programs provided 23% of evaluated savings, again mostly through lighting measures.
- The Residential HVAC program accounted for 19% of evaluated savings.
- The Shell and ENERGY STAR Homes programs accounted for a combined 3% of Residential evaluated savings.

Realization rates varied by program, from 84% for the Shell program to 202% for the HVAC program, which resulted in a strong overall realization rate of 109% for PY 2019. Cadmus identified few discrepancies through the document review, finding that the great majority of projects were well documented and met program requirements.

Cadmus offers three recommendations regarding Avista's Residential electric programs:

- Based on billing analysis conducted for this evaluation, adjust Avista's Technical Reference Manual (TRM) to provide higher savings values for variable-speed motors installed with the G Natural Gas Furnace measure and lower savings for replacement windows in electrically heated homes. The billing analysis showed savings for the variable-speed motor measure nearly four times the Avista TRM value on average. This was seemingly due to a shift away from

secondary electric heating (such as portable heaters or wall heaters) in some homes after replacing a gas furnace with a high-efficiency model. For replacement windows in electrically heated homes, the billing analysis estimated unit savings of 72% the 2019 TRM value.

- The MFDI program has proven to be an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units. Continue to focus on replacing high-use, low-efficiency lamps where practical, to maximize program cost-effectiveness while maintaining high savings.
- Ensure that reported savings for all measures are calculated using current TRM or Regional Technical Forum unit energy savings (UES) values, and that the TRM provides values for all measures. Cadmus did not find large-scale problems with the PY 2019 measure tracking data, but the team did note numerous measure-tracking records that reported zero savings, despite the record showing the measure was completed and that a rebate was issued. In addition, some instances of PY 2019 measures used UES values from the 2018 TRM, and reported values for some measures (most notably, smart thermostats) did not match TRM values.

## Fuel Efficiency Recommendations

Nonresidential Site Specific and Multifamily Market Transformation Fuel Efficiency measures achieved evaluated savings of 300,230 kWh, yielding a 100% realization rate. The Multifamily Market Transformation Fuel Efficiency measures exceeded the electric energy savings goal of 234,960 kWh by 28%. Cadmus does not recommend any changes to the Nonresidential Site Specific and Multifamily Market Transformation Fuel Efficiency programs.

Residential Fuel Efficiency measures achieved evaluated savings of 1,181,596 kWh, yielding a 102% realization rate and achieving 118% of savings goal. Cadmus recommends that Avista update TRM values to match measure-level UES values calculated by the billing analysis. Cadmus also recommends that Avista ensure all measures are represented in the TRM.

For Low-Income Fuel Efficiency measures, evaluated savings were 37,808 kWh, with a realization rate of 100%, but fell short of Avista's savings goals, achieving 37% of the savings target and 43% of the participation target. Billing analysis indicated that program electric savings are likely higher, based on the billing analysis realization rate of 144% for Low-Income Fuel Efficiency measures as a whole. Based on this finding, Cadmus recommends increasing the Avista TRM's UES values.

## Nonresidential Impact Evaluation

Through its Nonresidential portfolio of programs, Avista promotes the purchase of high-efficiency equipment for 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 program year (PY) 2019 evaluated savings for most programs; the team conducted measurement and verification of Prescriptive and Site Specific projects across the full PY 2019 sample.

### *Program Summary*

Avista completed and rebated 542 nonresidential electric measures in Idaho in PY 2019 and reported total electric energy savings of 17,826,108 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 variable-frequency drives). 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 the evaluation methodology and the results discussion for Nonresidential Fuel Efficiency measures.

### *Program Participation Summary*

This section summarizes Nonresidential sector participation and progress toward PY 2019 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 2019, as well as reported savings and a comparison between reported savings and goals.

**Table 3. Nonresidential Prescriptive Electric Savings**

Program Name	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Interior Lighting	7,414,179	4,669,357	63%
Exterior Lighting	4,299,232	3,192,110	74%
Shell Measure	1,109	8,871	800%
Green Motors	49,098	38,828	79%
Motor Control (Variable Frequency Drives [VFD])	75,595	0	0%
Fleet Heat	8,000	0	0%
Food Service Equipment	32,429	9,506	29%
AirGuardian	18,000	136,244	757%
Energy Smart Grocer <sup>a</sup>	317,248	0	0%
<b>Total</b>	<b>12,214,890</b>	<b>8,054,916</b>	<b>66%</b>

<sup>a</sup> The Energy Smart Grocer savings goal includes Site Specific Energy Smart Grocer measures. The Site Specific portion constitutes approximately 10% of the overall goal.

Table 4 shows participation goals by rebated equipment quantity, as provided by Avista. The PY 2019 nonresidential tracking database extract listed individual projects but did not include rebated equipment quantity. For reference, Table 5 provides participation by unique application numbers.

**Table 4. Nonresidential Prescriptive Participation Goals by Equipment Rebated**

Program Type	Planned Participation
Interior Lighting	121,200
Exterior Lighting	9,850
Shell Measure	435
Green Motors	17
Motor Control (VFD)	55
Fleet Heat	1
Food Service Equipment	6
AirGuardian	3
Energy Smart Grocer <sup>a</sup>	814

<sup>a</sup> The Energy Smart Grocer goal includes Site Specific Energy Smart Grocer participants.

**Table 5. Nonresidential Prescriptive Participation by Project**

Program Type	Participation Reported <sup>a</sup>
Interior Lighting	249
Exterior Lighting	260
Shell Measure	6
Green Motors	12
Motor Control (VFD)	0
Fleet Heat	0
Food Service Equipment	3
AirGuardian	1
Energy Smart Grocer	0
<b>Total<sup>b</sup></b>	<b>492</b>

<sup>a</sup> Participant is defined as a unique application number.

<sup>b</sup> Total unique applications. One application may contain measures from multiple programs.

### Nonresidential Site Specific Program Path

Table 6 shows electric savings goals assigned to the Site Specific program path in Avista’s Nonresidential sector for PY 2019, as well as reported savings. The table does not include reported electric savings for the Fuel Efficiency sector, such as those associated with the Multifamily Market Transformation program.

**Table 6. Nonresidential Site Specific Electric Savings**

Program Path	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Site Specific	9,000,000	9,771,192	109%

### Nonresidential Impact Evaluation Methodology

As the first step in evaluating PY 2019 savings for the Nonresidential 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)

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. Cadmus performed the following evaluation activities in two waves:

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

## Sample Design

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

For each activity wave, Cadmus organized submitted program applications by path and measure (such as the Site Specific Shell Measure, Prescriptive Lighting, or Prescriptive Motor Controls), allowing the team to select the highest-savings applications in each category with certainty. For non-certainty applications, the team assigned random numbers and developed a random sample. In some cases, Cadmus sampled another application at the same location or a facility that was previously selected (and where the team could assess both applications with one site visit). This was a cost-effective verification strategy even if the second application represented minimal claimed savings.

As Avista implements its programs similarly in both states, Cadmus sampled randomly selected sites across Washington and Idaho. The team pooled results from the randomly selected sites to calculate a realization rate by stratum and applied that realization rate to projects in both states. Cadmus applied evaluated savings for sites selected with certainty only to the state in which they had been implemented.

Table 7 summarizes the Idaho Nonresidential Prescriptive program evaluation sample. In Idaho, Cadmus sampled 18 Prescriptive applications at 14 unique sites. Of the sampled applications, the team selected three for certainty review based on the scale of savings, measure type, or location. Cadmus then selected the remaining 15 applications randomly. No customers participated in the Fleet Heat, Motor Control, and Energy Smart Grocer programs in Idaho in PY 2019.

**Table 7. Idaho Nonresidential Prescriptive Electric Evaluation Sample**

Program Type	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Interior Lighting	7	576,688	12%
Exterior Lighting	5	26,001	1%
Shell Measure	1	3,920	44%
Green Motors	4	19,706	51%
Food Service Equipment	2	4,393	46%
AirGuardian	1	136,244	100%
<b>Nonresidential Prescriptive</b>	<b>18</b>	<b>766,951</b>	<b>10%</b>

Note: Totals may not sum due to rounding. Two applications contained both interior and exterior lighting measures.

Table 8 summarizes the Idaho Nonresidential Site Specific program path evaluation sample. In Idaho, Cadmus sampled five Site Specific applications at two unique sites. Of the sampled applications, the team selected four for certainty review based on the scale of savings, measure type, or location. Cadmus selected the remaining application randomly.

**Table 8. Idaho Nonresidential Site Specific Electric Evaluation Sample**

Program Path	Applications Sampled	Sampled Savings (kWh)	Percentage of Reported Savings
Site Specific	5	7,737,047	79%

### Document Review

Cadmus requested and reviewed project documentation for each sampled application and prepared measurement and verification plans to guide its site visits. Typically, project documentation included incentive applications, calculation tools (usually based on the 2017 Regional Technical Forum [RTF]),<sup>1</sup> invoices, equipment specification sheets, and installation verification (IV) reports.

### On-Site Verification

Cadmus performed site visits at 16 unique nonresidential locations to assess electric savings for 25 unique Prescriptive and Site Specific measures (not including Fuel Efficiency measures). Site visits involved verifying the installed equipment type, make and model numbers, operating schedules, and setpoints, as applicable. Cadmus used the project documentation review and on-site findings to adjust reported savings calculations where necessary. The team did not consider it necessary to conduct power metering or light logging for PY 2019 site visits and used trend data provided by the participant to evaluate Site Specific industrial process measures.

### Nonresidential Impact Evaluation Results

This section summarizes the Nonresidential Prescriptive and Site Specific program paths’ electric impact evaluation results for PY 2019.

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<sup>1</sup> Regional Technical Forum. 2017. “Standard Protocols.” <https://rtf.nwcouncil.org/standard-protocols>

## Nonresidential Prescriptive Programs

Table 9 shows reported and evaluated electric energy savings for Avista’s Nonresidential Prescriptive program and the realization rates between evaluated and reported savings for PY 2019. The overall Nonresidential Prescriptive program path electric realization rate was 100%.

**Table 9. Nonresidential Prescriptive Electric Impact Findings**

Program Type	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Interior Lighting	4,669,357	4,518,758	97%
Exterior Lighting	3,192,110	3,303,660	103%
Shell Measure	8,871	10,400	117%
Green Motors	38,828	38,828	100%
Food Service Equipment	9,506	9,506	100%
AirGuardian	136,244	136,244	100%
<b>Nonresidential Prescriptive</b>	<b>8,054,916</b>	<b>8,017,396</b>	<b>100%</b>

Of the evaluated applications, Cadmus identified discrepancies for 18 based on the site visit 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
Attic Insulation	1	↓	<ul style="list-style-type: none"> <li>Avista reported incorrect savings values for one attic insulation project due to an error in its new database software. Cadmus reviewed all Prescriptive Shell measures to confirm that only one project was affected by the bug. Cadmus treated the affected project as a certainty project and evaluated savings using the typical savings calculator methodology.</li> </ul>
Refrigerated Cases	1	↓	<ul style="list-style-type: none"> <li>Cadmus was only able to verify installation of 15 of the 17 refrigerator doors claimed on the application of one refrigerated cases measure and reduced the savings proportionally.</li> </ul>

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
Interior Lighting	5	↓	<ul style="list-style-type: none"> <li>• Cadmus reduced the fixture counts for one project as the evaluated installed quantity on the site was lower than the quantity reported on the application.</li> <li>• Cadmus reduced the hours of use (HOU) for one project that reported 24/7 operations after determining that occupancy controls and schedule controls were in place to reduce the lighting runtime prior to and after the project.</li> <li>• The Avista database categorized two projects as interior lighting that only had exterior fixtures. These savings were subtracted from interior lighting and added to exterior lighting.</li> <li>• Cadmus reduced fixture counts and increased HOU at one site where the building underwent a remodel shortly after completing the project and no longer matched the conditions reported at the time the application was submitted.</li> </ul>
	4	↑	<ul style="list-style-type: none"> <li>• Cadmus determined that the store hours at one site were higher than reported on the application. The team also determined that new occupancy controls were added that were not reported on the application, further decreasing installed HOU relative to baseline HOU.</li> <li>• Cadmus found that the installed fixtures for one project had a lower wattage than reported on the application.</li> </ul>
Exterior Lighting	3	↓	<ul style="list-style-type: none"> <li>• Cadmus reduced fixture counts and increased HOU at one site where the building underwent a remodel shortly after completing the project and no longer matched the conditions reported at the time the application was submitted.</li> <li>• Cadmus calculated savings for an outdoor display sign using the actual quantity and wattage of the lamps inside the sign. The Avista calculator used an estimated watts-per-square-foot method for exterior sign lighting based on assumed typical values. The team found the assumed baseline watts per square foot to be unreasonably high for the type of lighting typically installed in outdoor signs.</li> </ul>
	4	↑	<ul style="list-style-type: none"> <li>• Cadmus updated the savings calculations to use the actual verified fixture wattage instead of the assumed typical value for three projects.</li> <li>• Cadmus determined that two exterior lighting measures were incorrectly categorized as interior lighting measures in the Avista database and transferred those savings to exterior lighting.</li> </ul>

Throughout the evaluation, Cadmus found that the level of detail in IV reports varied. Most IV reports the team reviewed only stated that the reviewer “found the installation to match the application submitted,” including for a portion of projects where the inspections found discrepancies between the installation and the application. Some IV reports did not contain any text at all and only provided unlabeled photos. Cadmus evaluated a lighting project where the IV report only contained one photograph of each fixture type and no information about quantities.

## Nonresidential Site Specific Program

Table 11 shows reported and evaluated electric energy savings for Avista’s PY 2019 Nonresidential Site Specific program path, as well as a comparison between evaluated and reported savings for PY 2019.

The overall Site Specific program path electric realization rate was 86%. 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	9,771,192	8,425,874	86%

Of the evaluated applications, Cadmus identified discrepancies in three based on the site visit 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
Green Motor Rewind	1	↑	<ul style="list-style-type: none"> <li>The reported savings reference for 2017 RTF. Cadmus applied deemed motor savings from the 2018 Technical Reference Manual (TRM) workbook.</li> </ul>
Refrigerator Door Gaskets	1	↓	<ul style="list-style-type: none"> <li>The reported savings for one refrigerator door gasket project corresponded to 17 doors. Cadmus only received documentation for and verified installation of 15 doors at this site.</li> </ul>
Interior Lighting	14	↓	<ul style="list-style-type: none"> <li>Cadmus reduced the fixture counts for three projects as the verified installed quantity on the site was lower than the quantity reported on the application.</li> <li>Cadmus reduced the HOU for four projects that reported 24/7 operations after determining that occupancy controls and schedule controls were in place to reduce the lighting runtime prior to and after the project.</li> <li>The Avista database categorized two projects as interior lighting that only had exterior fixtures. These savings were subtracted from interior lighting and added to exterior lighting.</li> <li>Cadmus reduced the lighting hours from 100% on to 75% on one project, based on interviews with on-site staff. Cadmus also found a lower installed fixture quantity than that reported in the application.</li> <li>Cadmus could not replicate the reported savings on one project based on reported fixture types and quantities. However, the team retained the reported quantities as they could not visit all spaces at the site for verification.</li> <li>Cadmus determined that 13 W fixtures were installed in place of the 9 W fixtures reported on the application.</li> </ul>
	2	↑	<ul style="list-style-type: none"> <li>Cadmus determined that the store hours at one site were higher than reported on the application. The team also determined that new occupancy controls were added which were not reported on the application, further decreasing installed HOU relative to baseline HOU.</li> <li>Cadmus found that the installed fixtures for one project had a lower wattage than reported on the application.</li> </ul>
Exterior Lighting	3	↓	<ul style="list-style-type: none"> <li>Cadmus reduced exterior lighting HOU from 8,760 to 4,288 for one project after determining that all exterior fixtures at the site were controlled by photocells.</li> </ul>

Project Type	Number of Occurrences	Savings Impact	Reason(s) for Discrepancy
			<ul style="list-style-type: none"> <li>• Cadmus reduced fixture counts and increased HOU at one site where the building underwent a remodel shortly after completing the project and no longer matched the conditions reported at the time the application was submitted.</li> <li>• Cadmus calculated savings for an outdoor display sign using the actual quantity and wattage of the lamps inside the sign. The Avista calculator used an estimated watts-per-square-foot method for exterior sign lighting based on assumed typical values.</li> </ul>
	4	↑	<ul style="list-style-type: none"> <li>• Cadmus updated the savings calculations to use the actual verified fixture wattage instead of the assumed typical value for two projects.</li> <li>• Cadmus determined that two exterior lighting measures were incorrectly categorized as interior lighting measures in the Avista database and transferred those savings to exterior lighting.</li> </ul>
Motor Control (VFD)	2	↓	<ul style="list-style-type: none"> <li>• Cadmus determined that two return air fans with VFDs and reported as 3.0 horsepower were actually 2.5 horsepower.</li> </ul>
Shell Measure	1	↓	<ul style="list-style-type: none"> <li>• Cadmus determined there was no space cooling and space was heated with natural gas. As a result, the team removed electric savings from ceiling/wall insulation.</li> </ul>
	2	↓	<ul style="list-style-type: none"> <li>• Avista reported incorrect savings values for two Shell insulation projects due to an error in their new database software. Cadmus reviewed all Prescriptive Shell measures to confirm that only two projects were affected by the bug. Cadmus treated the two affected projects as certainty projects and evaluated savings using the typical savings calculator methodology.</li> </ul>
Industrial Process	2	↑	<ul style="list-style-type: none"> <li>• Cadmus recalculated savings for two motor replacement and VFD installation projects in a paper mill based on trend data from the post-installation period. The team found that the average kilowatt consumption of some installed motors was lower than predicted.</li> </ul>
Industrial Motor Controls	1	↓	<ul style="list-style-type: none"> <li>• Cadmus determined that the baseline power consumption estimation for a motor replacement project included unrelated equipment from the same power distribution bus. Cadmus revised the analysis using additional trend data and updated assumptions to ensure the baseline and post-installation calculations were consistent. The team found the estimated power consumption in both periods to be lower than reported in the original analysis, but significantly lower in the baseline, resulting in reduced savings.</li> </ul>

## Nonresidential Conclusions and Recommendations

The Nonresidential sector achieved total evaluated electric energy savings of 16,443 MWh in PY 2019, with a combined realization rate of 92%. The Nonresidential sector achieved 78% of the combined Prescriptive and Site Specific program paths' electric goal of 21,215 MWh.

While some individual project results varied, the overall Nonresidential sector performed strongly in PY 2019. Most of the projects Cadmus sampled for evaluation were well documented and matched what the team found during site visit verification.

Cadmus encountered some challenges evaluating the PY 2019 Nonresidential program due to midyear changes Avista made to their application tracking database system. The new iEnergy database stores and reports data in different formats and different aggregation levels than the previous system.

As the transition occurred midyear and some applications were entered into both systems, Avista and Cadmus staff had to manually combine and recategorize data from the new database to match up with the format used for the old database. Cadmus identified several issues with exports from the new database as well as underlying errors with the way some savings were calculated by the new system. Avista has corrected the issues Cadmus identified, and the new iEnergy database has the potential to facilitate more accurate savings estimates, more detailed project tracking, and more thorough evaluations in the future.

Cadmus offers the following recommendations for improving the Nonresidential sector's energy savings:

- Ensure that the final reported savings calculations reflect the most up-to-date project details, including post-installation verification photos, equipment submittals, and invoices. During two project verifications, Cadmus found different installed equipment sizes, quantities, or performance ratings than used in the reported savings calculations.
- Review HOU estimates for interior and exterior lighting projects when reviewing submissions and conducting IV. Applications claiming 8,760 hours should be particularly scrutinized. Before any new equipment installations, confirm the presence or absence of lighting controls and record how they were configured. Cadmus found several Prescriptive and Site Specific projects where lighting HOU and controls varied from submitted details.
- Ensure the correct categorization of lighting projects as interior or exterior. Cadmus evaluated two Prescriptive lighting projects with fixtures listed under the wrong measure category.
- Review measurement and verification plans for Site Specific projects carefully early in the process to ensure an appropriate measurement basis, and work with site contacts to establish trend logs for relevant building management system or industrial control system data points during the baseline period.
- Provide more thorough documentation with Avista IV reports. Cadmus staff found that the level of detail in IV reports varied. Cadmus recommends that all IV reports include basic information, explicitly stating the quantity and type of equipment found. For lighting projects this would include confirmed fixture types, quantities, installation locations, controls, and estimated HOU. For most other equipment, this would include nameplates, model numbers, and quantities.

## Residential Impact Evaluation

Cadmus designed the Residential sector impact evaluation to verify reported program participation and energy savings. The team used data collected and reported in the tracking database, online application forms, Avista TRM and RTF savings review, and analysis of participant electricity consumption data 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 billing data.

### *Program Summary*

Avista completed and rebated 349,056 residential electric measures or units in Idaho in PY 2019 and reported total electric energy savings of 6,426,003 kWh, not including participation and savings from Fuel Efficiency measures, which are included in the *Fuel Efficiency Impact Evaluation* section.

Participation is defined as installed pieces of equipment (such as a furnace or showerhead) for some measures and square feet of surface for others (such as wall insulation and windows replacement).

The Residential path includes several programs:

- Simple Steps, Smart Savings, which encourages consumers to purchase and install high-quality LEDs, light fixtures, and energy-efficient showerheads
- Residential HVAC, which offers incentives for high-efficiency heating and cooling equipment
- Residential Shell, which provides rebates to encourage customers to install high-efficiency windows and storm windows
- ENERGY STAR Homes, which offers 15% to 25% of energy savings relative to state energy codes
- Multifamily Direct Install (MFDI), which provides free direct-install measures to multifamily residences (five units or more) and common areas
- MFDI Supplemental Lighting, which revisited multifamily properties served by the MFDI program to install additional common area lighting.

### *Program Participation Summary*

This section summarizes Residential sector participation and progress toward PY 2019 goals.

### Residential Programs

Table 13 shows savings goals assigned to Avista's Residential sector programs for PY 2019, as well as reported savings and the goal portion achieved in PY 2019. All programs except ENERGY STAR Homes and Residential HVAC exceeded savings goals based on reported savings, leading to an overall achievement of 142% of the savings goal for Residential programs.



**Table 13. Residential Reported Electric Savings**

Program	Savings Goals (kWh)	Savings Reported (kWh)	Percentage of Goal
Simple Steps, Smart Savings	2,495,393	3,879,137	155%
HVAC	674,367	659,957	98%
Shell	139,065	190,390	137%
ENERGY STAR Homes	86,190	66,262	77%
Multifamily Direct Install	957,450	1,289,539	135%
Multifamily Direct Install Supplemental Lighting	168,000	340,719	203%
<b>Residential Total</b>	<b>4,520,465</b>	<b>6,426,003</b>	<b>142%</b>

Note: totals may not sum due to rounding.

Table 14 summarizes participation goals and reported participation in Avista’s Residential sector programs for PY 2019, along with the percentage of goal achieved.

**Table 14. Residential Participation**

Program	Participation Goals	Participation Reported	Percentage of Goal
Simple Steps, Smart Savings <sup>a</sup>	190,126	317,124	167%
HVAC <sup>b</sup>	462	750	162%
Shell <sup>c</sup>	67,184	27,404	41%
ENERGY STAR Homes <sup>b</sup>	26	18	69%
Multifamily Direct Install <sup>d</sup>	1,473	3,057	208%
Multifamily Direct Install Supplemental Lighting <sup>e</sup>	750	703	94%
<b>Residential Total</b>	<b>260,021</b>	<b>349,056</b>	<b>134%</b>

<sup>a</sup> Participation is defined as the number of purchased units.

<sup>b</sup> Participation is defined as the number of rebates.

<sup>c</sup> Participation is defined as square feet of installed windows or storm windows.

<sup>d</sup> Participation is defined as the number of living units and common areas served.

<sup>e</sup> Participation is defined as the number of installed units.

## Residential Impact Evaluation Methodology

To determine the Residential sector’s evaluated savings for PY 2019, Cadmus employed a combination of three impact evaluation methods:<sup>2</sup>

- Database review
- Document review
- Billing analysis

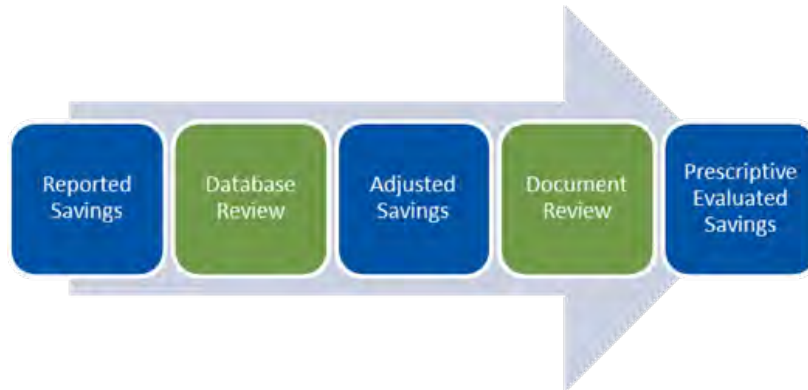
First, Cadmus calculated adjusted savings for each program based on results of a database review. For the HVAC, Shell, and Fuel Efficiency programs, Cadmus also applied realization rates for the document

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<sup>2</sup> With approval from Avista, Cadmus ceased performing a fourth impact activity—verification surveys—in Q3 PY 2018; this eliminated redundancy between verification surveys and document reviews.

reviews. For these programs, the team calculated prescriptive evaluated savings by multiplying adjusted savings by the document review realization rate, as shown in Figure 1.

**Figure 1. Residential Impact Process**



To provide the most rigorous evaluation method where practical, Cadmus analyzed consumption data for all available participants of the HVAC, Shell, Fuel Efficiency, and MFDI programs. As described in more detail in the *Billing Analysis* section, the team 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) and where confidence and precision met specific targets. Program-level realization rates for the HVAC, Shell, and Fuel Efficiency programs incorporate billing analysis results for some measures.

## Database Review

For the impact evaluation database review, Cadmus used UES values, as provided in the TRM, to calculate savings for measures reported in the measure tracking database. This impact activity may help identify incorrect UES values used to calculate reported savings. Savings calculated during the database review are defined as *adjusted savings*.

## Document Review

For the document review, Cadmus compared information from rebate forms and other supporting documents to measure tracking data for a random sample of projects. This impact activity may identify installed measures that did not meet eligibility requirements, quantities that did not match the measure tracking database, and other discrepancies. Following a review of all projects, Cadmus calculated a realization rate for the document review by dividing savings calculated for the sample (using the revised information) by reported savings for the sample. The team then multiplied this realization rate by adjusted savings for the entire program to determine prescriptive evaluated savings for PY 2019.

Cadmus conducted document reviews for the programs shown in Table 15, drawing roughly equal samples from participants in each quarter.

**Table 15. Residential Electric Impact Document Review**

Program	Completed through Q2 PY 2019
HVAC	51
Shell	51

### Billing Analysis

For the Residential sector, Cadmus conducted billing analysis using available electricity and natural gas consumption data from Avista for the HVAC, Shell, Fuel Efficiency, and MFDI programs. Evaluating Simple Steps, Smart Savings program savings through billing analysis was not practical because participants of the midstream retail program were largely unknown. The ENERGY STAR Homes program had too few participants to produce meaningful billing analysis results.

#### *HVAC, Shell, and Fuel Efficiency Savings Estimates*

With the HVAC, Shell, and Fuel Efficiency programs, Cadmus eliminated the effects of multiple energy efficiency measures by only including participants in the analysis who installed one measure. With these programs, the goal was to provide average unit savings values at the measure level to ensure the most accurate values possible were used for evaluated savings and cost-effectiveness.

Cadmus used the unit savings value provided by the billing analysis for a given measure when results for that measure met two requirements: the number of sites in the participant group was at least five, and the relative precision achieved was no greater than  $\pm 40\%$  at the 90% confidence level. If results calculated using only Idaho participants met these requirements, the team used those results. If results based only on Idaho participants failed to meet the requirements, Cadmus used combined results for Idaho and Washington if those results passed. If no billing analysis results passed for a given measure, Cadmus applied the results of database review and document review to determine evaluated savings.

#### Data Sources

To conduct the consumption analysis, Cadmus used program measure tracking data provided by Avista, monthly electric and gas consumption data provided by Avista, and weather data (which included actual average daily temperatures for 13 weather stations in Idaho and Washington from the National Oceanic and Atmospheric Administration) for the billing analysis period. The team used zip codes to match daily heating and cooling degree days to respective monthly bill read dates. Additionally, Cadmus used typical meteorological year (TMY3) 15-year normal weather values from 1991–2005, obtained from National Oceanic and Atmospheric Administration for the same weather stations, in assessing energy use under normal weather conditions.

#### Participant and Comparison Group Designation

Cadmus gathered data for a participant (treatment) group comprising all HVAC, Shell, and Fuel Efficiency program participants with measures installed in 2018. This allowed for enough pre- and post-consumption data to analyze the various measures' effects.

To isolate the impact of exogenous factors (such as energy rate changes, economic condition changes, and non-programmatic effects) on energy use, Cadmus utilized a quasi-experimental<sup>3</sup> design that involved selection of a comparison group, composed of participants with installation dates in late PY 2019. Through this approach, the team compared the treatment group's pre- and post-change energy use (assumed to capture the program treatment) to the comparison group's change in energy use (reflecting what would have happened absent the program). To ensure similarity between treatment and control groups, the team chose to use future participants as the comparison group because they would have similar qualifications and could be assumed to have not participated in energy efficiency programs prior to program treatment.

## Data Screening

Starting with all HVAC, Shell, and Fuel Efficiency participants and the comparison group, Cadmus cleaned the data and screened for several criteria to identify final analysis samples. Data cleaning included performing account-level reviews of the pre- and post-period monthly consumption of all individual participants to identify anomalies (such as periods of unoccupied units) that could bias the results. Cadmus conducted the consumption analysis using participants who had not moved since participating and who had at least 10 months of pre- and post-period billing data.

Cadmus applied several screens to remove anomalies, incomplete records, and outlier accounts. The following are examples of accounts excluded from the analyses:

- Accounts missing records, prohibiting the team from merging participant program tracking data with consumption data.
- Accounts with low annual use in the pre- or post-period, such as less than 1,240 kWh annually.
- Customers with incorrect signs on Princeton Scorekeeping Method (PRISM) parameter estimates.
- Accounts with other extreme values, including vacancies in billing data (outliers), non-program-related heating or cooling system changes (such as added or removed heating or cooling loads), baseload equipment changes, or changes in occupancy. This included screening for accounts with large gaps in interval data, such as having zero consumption across multiple months.

## Analysis

To estimate measure-level impacts, Cadmus employed a pre- and post-installation savings analysis using household-level PRISM models that accounted for differences in pre- and post-installation weather conditions. The team estimated the heating and cooling PRISM model using variable 45°F to 85°F heating and cooling bases in both the pre- and post-period for each customer.

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<sup>3</sup> A quasi-experimental design is when treatment and control groups are not randomized prior to treatment. In this case, the comparison group was created after the treatment had occurred and participants self-selected the treatment.

### *Multifamily Direct Install*

With the MFDI program, isolating individual measures was not possible, because most living units received a range of LED light bulbs as well as water saving measures such as aerators and showerheads. To provide an accurate estimate of the energy savings for the program as a whole, Cadmus performed a complex and rigorous evaluation involving matching tracking data with billing data at the account level.

Cadmus estimated weather-normalized facility level usage. There were two main components of usage that were combined to develop the pre- and post-facility level usage estimates: unit-level usages and common area usages.

Cadmus referenced the same data sources for MFDI consumption analysis as those identified for HVAC, Shell, and Fuel Efficiency analyses (see *Data Sources* section above) as well as the participant and comparison group approach to isolate the impact of exogenous factors (see *Participant and Comparison Group Designation*). Additionally, Cadmus cleaned the data to remove anomalies, incomplete records, and outlier accounts (see *Data Screening*).

### **Analysis**

To estimate program impacts, Cadmus employed a pre- and post-installation savings analysis using household-level PRISM models that account for differences in pre- and post- installation weather conditions.

Cadmus estimated the heating and cooling PRISM model using variable 45°F to 85°F heating and cooling bases in both the pre- and post-period for each MFDI unit and common area account. Because some units in a facility could not be matched to billing data or did not pass the screening process, the team found it necessary to extrapolate the available weather normalized pre- and post-period unit level PRISM usages to the facility level for all units. For each facility, the number of units in the facility was known. To obtain the final unit level component, Cadmus calculated the average pre-period usage, post-period usage, and savings per unit. Cadmus then multiplied those per-unit values by the number of units in the facility to obtain the total unit component facility usages, savings, and *ex ante* estimates. If the facility also had a common area component, Cadmus added usage for that area to the facility level unit usage component to develop the final total facility usage.

Cadmus then applied weighting to calculate the final program savings estimate. A facility with 100 units has more weight than a facility with 10 units. The final savings estimates and *ex ante* estimates were weighted by the number of units.

The MFDI Idaho participant group showed a reliable relative precision estimate of  $\pm 17\%$  at the 90% confidence level for the 34 facilities included in the analysis and savings of 5.8%. The comparison group had only four facilities and showed a reduction in usage of 1.2%; however, with very high relative precision estimate of  $\pm 303\%$ . This large confidence band around the comparison group shows that the change in usage was not significantly different than zero (that is, a savings increase was within the error bound), so a comparison group adjustment was not applied.

## Residential Impact Evaluation Results

The following sections summarize findings and provide evaluated savings for both of Cadmus’ impact evaluation methodologies. The database review resulted in the largest number of adjustments to reported savings.

### Database Review

Table 16 shows database review findings, with adjusted savings being higher than reported savings for some programs and lower for others. Adjusted savings differed from reported savings because reported UES values differed from TRM values for several measures. The larger adjusted savings for the HVAC, ENERGY STAR Homes, and Shell programs resulted partly from some instances where the tracking data reported zero energy savings, despite the records showing the projects were complete and rebates were paid. For the MFDI program, adjustments included applying RTF UES values for multifamily direct-install aerators that were lower than the older values used by the implementer. The discrepancy with MFDI Supplemental Lighting resulted mostly from the omission of heating interactive effects for measures in common areas indicated as heated.

**Table 16. Residential Database Review Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Percentage Change
Simple Steps, Smart Savings	3,879,137	3,879,137	0%
HVAC	659,957	684,425	4%
Shell	190,390	216,838	14%
ENERGY STAR Homes	66,262	69,615	5%
Multifamily Direct Install	1,289,539	1,258,897	-2%
Multifamily Direct Install Supplemental Lighting	340,719	332,718	-2%
<b>Residential Total</b>	<b>6,426,003</b>	<b>6,441,629</b>	<b>0%</b>

Note: totals may not sum due to rounding.

### Document Review

Table 17 summarizes document review findings. The HVAC program had a 100% electric realization rate, and the Shell program had an 90% electric realization rate.

**Table 17. Residential Electric Impact Document Review Realization Rates**

Program	Document Audit Count	Sample Reported Savings (kWh)	Sample Evaluated Savings (kWh)	Document Review Realization Rate
HVAC	51	50,106	48,800	97%
Shell	51	73,925	64,268	87%

Cadmus’ document review (through Q2 PY 2019) identified the following discrepancies:

- For four window measures, documentation showed a square footage for installed windows that differed from the reported window area. In three cases, the documented window area was lower than the reported area and resulted in lower evaluated savings. In one case, the

documented window area was more than that reported and resulted in higher evaluated savings based on the corrected area.

- For four window measures reported for sites with electric heating, project documents identified heating fuels other than electricity. Cadmus added natural gas savings and removed electricity savings at two sites identified as using natural gas heating. Documentation for the other two sites identified liquid propane as the heating fuel for one site and wood pellets as the fuel for the other; consequently, Cadmus removed electricity savings for these sites.
- One PY 2018 heat pump water-heater measure had a tank capacity of 80 gallons, per the documentation. However, conditions for the rebate required a tank size below 55 gallons in PY 2018; consequently, Cadmus removed savings for this measure.

### Billing Analysis

Table 18 shows measure-level billing analysis results, used when calculating evaluated electric energy savings. The participant count and relative precision for each measure easily met requirements established to ensure meaningful results, which required a participant count of at least five and a relative precision no greater than  $\pm 40\%$  at the 90% confidence level.

**Table 18. Residential Programs Billing Analysis Results**

Measure	2019 Avista TRM UES (kWh)	n <sup>a</sup>	Pre-Installation Weather Normalized Usage (kWh)	Annual UES (kWh)	Realization Rate	Relative Precision at 90% Confidence	Participant State
E Variable Speed Motor <sup>b</sup>	414.00	195	12,251	1,528.63	369%	30%	Idaho
E Storm Window with Electric Heat	10.30	15,876	17,543	11.00	107%	26%	Idaho and Washington
E Window Replc from Single Pane W Electric Heat <sup>b</sup>	15.25	15,876	17,543	11.00	72%	26%	Idaho and Washington

<sup>a</sup> To provide unit savings values that align with TRM units, this table presents participant count in sq. ft. of window surface for storm widow and replacement window measures.

<sup>b</sup> Results shown represent combined analysis of storm window and window-replacement measures, to maximize relative precision. Separate results for each measure appeared similar.

Billing analysis results showed surprisingly high savings for the E Variable Speed Motor measure, with a realization rate of 369% relative to the 2019 Avista TRM UES value of 414 kWh. These participants generally also replaced an existing gas furnace with a high-efficiency model (via the G Natural Gas Furnace measure). The high electric energy savings appears to have resulted at least partly from a shift in some homes away from secondary electric heating, such as portable electric heaters or electric wall heaters, after installing the new gas furnace. Specifically, 66 of 159 participants in Idaho increased natural gas usage after installing the high-efficiency furnace with variable speed fan motor, and they sharply reduced electricity consumption. This pattern was not strong enough to suggest that the primary

heating system had changed from some other fuel to natural gas, but it did suggest that the high-efficiency furnace prompted participants to move away from secondary heating with electricity.

Billing analysis provided relatively low electric energy savings for replacement windows relative to the 2019 TRM value of 15.25 kWh per square foot of window area, resulting in a realization rate of 72%. To provide participant counts high enough to support statistically significant estimates, Cadmus combined participants for the storm window and replacement window measures. Because billing analysis results for only Idaho failed to meet the  $\pm 40\%$  precision requirement, Cadmus based evaluated Idaho savings on the combined results for Idaho and Washington participants. Note that in PY 2019, only one Idaho project reported savings through the storm window measure, claiming savings for 150 square feet of installed storm window, the realization rate for that measure has little impact on program savings.

Billing analysis for the MFDI program showed strong electric energy savings for the program as a whole. As noted previously in

*Residential Impact Evaluation Methodology*, isolating the impact of individual measures was not possible for MFDI because most living units received a range of LED light bulbs as well as water saving measures such as aerators and showerheads. To provide an accurate estimate of the energy savings for the program as a whole, Cadmus performed a complex and rigorous evaluation involving 1,549 living units in 34 apartment buildings and complexes. The analysis yielded a realization rate of 96% for electric energy savings in Idaho, with a relative precision of  $\pm 17\%$  at a 90% confidence level. The billing analysis did not evaluate savings from the MFDI Supplemental Lighting program.

## Evaluated Savings

To calculate evaluated savings, Cadmus used unit savings values determined through billing analysis for the measures shown in Table 18. For the remaining measures, Cadmus applied the results of database review and, where applicable, document 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 19 shows the resulting evaluated savings and realization rates.

**Table 19. Residential Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Evaluated Electric Savings (kWh) <sup>a</sup>	Realization Rates
Simple Steps, Smart Savings	3,879,137	3,879,137	100%
HVAC	659,957	1,335,085	202%
Shell	190,390	160,507	84%
ENERGY STAR Homes	66,262	69,615	105%
Multifamily Direct Install	1,289,539	1,258,897	98%
Multifamily Direct Install Supplemental Lighting	340,719	332,718	98%
<b>Residential Total</b>	<b>6,426,003</b>	<b>7,035,960</b>	<b>109%</b>

Note: totals may not sum due to rounding.



## *Residential Conclusions and Recommendations*

Evaluated electricity savings show a realization rate of 109% on evaluated savings of 7,036 MWh for the Residential programs, which is 156% of the savings goal for the year. The high percentage of achieved savings relative to the goal results from program participation that was 134% of goal and the strong overall realization rate for the Residential sector.

Lighting measures accounted for 73% of the total Residential sector savings. The following shows the percentage of residential evaluated savings provided by each program:

- The Simple Steps, Smart Savings program provided 55% of Residential evaluated savings, mostly through lighting measures.
- The MFDI and MFDI Supplemental Lighting programs provided 23% of evaluated savings, again mostly through lighting measures.
- The Residential HVAC program accounted for 19% of evaluated savings.
- The Shell and ENERGY STAR Homes programs accounted for a combined 3% of residential evaluated savings.

Realization rates varied by program from 84% for the Shell program to 202% for the HVAC program, resulting in a strong overall realization rate of 109% for PY 2019. Cadmus identified few discrepancies through document review, which found that the great majority of projects were well documented and met program requirements.

Cadmus offers three recommendations regarding Avista's Residential electric programs:

- Based on billing analysis conducted for this evaluation, adjust the Avista TRM to provide higher savings values for variable-speed motors installed with the G Natural Gas Furnace measure and lower savings for replacement windows in electrically heated homes. The billing analysis showed savings for the variable-speed motor measure nearly four times the Avista TRM value on average, seemingly due to a shift away from secondary electric heating (such as portable heaters or wall heaters) in some homes after replacing a gas furnace with a high-efficiency model. For replacement windows in electrically heated homes, the billing analysis estimated unit savings of 72% the 2019 TRM value.
- The MFDI program has proven to be an efficient, effective mechanism for installing high-efficiency lighting and aerators in multifamily units. Continue to focus on replacing high-use, low-efficiency lamps where practical, to maximize program cost-effectiveness while maintaining high savings.
- Ensure that reported savings for all measures are calculated using current TRM or RTF UES values, and that the TRM provides values for all measures. Cadmus noted no large-scale problems with the PY 2019 measure tracking data but did note numerous measure-tracking records that reported zero savings, despite appearing to have been completed and a rebate having been issued. In addition, some instances of PY 2019 measures used UES values from the 2018 TRM, and reported values for some measures (most notably, smart thermostats) did not match TRM values.

## Low-Income Impact Evaluation

Cadmus designed the Low-Income program impact evaluation to verify reported program participation and energy savings. Evaluation methods included database review and billing analysis.

### Program Summary

Avista leverages the infrastructure of a single Community Action Partnership agency to deliver energy efficiency programs for the company’s low-income residential customers in the Idaho service territory. The program is designed to serve Avista’s residential customers in Idaho whose income falls between 175% and 250% of federal poverty level. For PY 2019, the program achieved 234,102 kWh of reported electric savings in Idaho, not including savings for the Low-Income Fuel Efficiency measures, which are reported separately in the *Fuel Efficiency Impact Evaluation* section.

### Program Participation Summary

Table 20 shows Avista savings goals for the Low-Income sector for PY 2019, as well as reported savings and goal portions achieved in PY 2019.

**Table 20. Low-Income Reported Savings**

Program	Savings Goals (kWh)	Reported Savings (kWh) <sup>a</sup>	Percentage of Goal
Low-Income	148,972	234,102	157%

<sup>a</sup> Reported savings do not include Low-Income Fuel Efficiency savings, shown in the *Fuel Efficiency Impact Evaluation* section.

Table 21 summarizes participation goals for the Low-Income programs, along with participation reported and achieved in PY 2019.

**Table 21. Low-Income Participation<sup>a</sup>**

Program	Participation Goals	Participation Reported	Percentage of Goal
Low-Income	24,834	39,758	160%

<sup>a</sup> Participation numbers do not include Low-Income Fuel Efficiency participation, shown in the *Fuel Efficiency Impact Evaluation* section. Participation is defined as the number of installed units or square feet of installed insulation or windows.

### Low-Income Impact Evaluation Methodology

Cadmus evaluated Low-Income program measures by conducting a database review (described in the *Database Review* section) and billing analysis. The team used UES values provided in the TRM to calculate savings for measures reported in the measure tracking database. Cadmus labeled savings calculated during the database review as *adjusted savings*.

For many measures reported in the tracking database, notes indicated that savings were capped at 20% of consumption. When duplicating savings calculations using TRM values, Cadmus used the newly calculated value if it was less than the capped value, but used the capped value where the TRM value indicated greater savings.

Cadmus conducted billing analysis for the Low-Income program using all electricity consumption data available from Avista for PY 2018 and PY 2019 program participants. Because of the relatively small number of Low-Income program participants, Cadmus was unable to isolate measure-level savings for the program (which are necessary for cost effectiveness calculations). In addition, realization rates for Idaho participants showed enough variation that billing analysis results did not meet the required confidence and precision threshold, either for Idaho participants or for Idaho and Washington participants combined.

## Low-Income Impact Evaluation Results

Table 22 shows reported and adjusted electric savings for Low-Income conservation measures. The table does not include savings for Low-Income programs Fuel Efficiency path measures (shown in the *Low-Income Fuel Efficiency Impact Findings* section below).

**Table 22. Low-Income Electric Impact Findings**

Program	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Evaluated Electric Savings (kWh)	Realization Rate
Low-Income	234,102	232,126	232,126	99%

During the database and TRM review, Cadmus noted a number of errors or challenges with the measure tracking data. For example, although the 2019 Avista TRM moved to providing a savings value per square foot of living space for air sealing, many instances of air sealing in the tracking data used the previous TRM value and did not include the area of the home. Some instances of some measures reported low or high electric savings values. The errors largely offset one another at the program level, as shown by the program’s 99% realization rate.

## Low-Income Conclusions and Recommendations

With a realization rate of 99% for electricity savings, the Low-Income program achieved savings of 232,126 kWh in PY 2019, or 156% of goal. Reported program participation reached 160% of the expected value. Roughly 26% of evaluated Low-Income program savings resulted from LED bulbs given out at events.

For many instances of measures in the Low-Income tracking data, notes indicated that savings were capped at 20% of consumption. The tracking data did not include adequate information to determine when savings values are appropriately capped. Cadmus recommends providing annual consumption for each measure in the tracking data, if practical, so that the evaluation can verify savings were capped at 20% of consumption for applicable measures.

## 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, document review, and billing analysis.

### 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 path (which includes HVAC Combined, refrigerator case doors, industrial process, and Multifamily Market Transformation measures), Residential programs, and Low-Income programs. Across these programs, Avista reported electric energy savings of 1,494,614 kWh for 161 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 2019 Idaho Natural Gas Impact Evaluation Report*.

### Program Participation Summary

This section summarizes Fuel Efficiency sector participation and progress toward PY 2019 goals for the Nonresidential Site Specific path, Residential programs, and Low-Income programs.

Table 23 shows savings goals, reported savings, and percentage of goal for Nonresidential Site Specific, Multifamily Market Transformation, Residential, and Low-Income Fuel Efficiency measures. Avista did not set savings goals for the Site Specific Fuel Efficiency measures outside of the Multifamily Market Transformation program.

**Table 23. Avista Portfolio Fuel Efficiency Reported Electric Savings**

Program	Savings Goals (kWh)	Reported Savings (kWh)	Percentage of Goal
Multifamily Market Transformation	234,960	300,230	128%
Residential Fuel Efficiency	1,002,795	1,156,576	115%
Low-Income Fuel Efficiency	101,640	37,808	37%

Table 24 shows Avista’s PY 2019 participation goals and reported participation for Multifamily Market Transformation, Residential, and Low-Income Fuel Efficiency measures. Avista did not set participation goals for Site Specific Fuel Efficiency measures outside of the Multifamily Market Transformation program. There were four Multifamily Market Transformation program participants and no Nonresidential Site Specific participants in PY 2019.

**Table 24. Avista Portfolio Fuel Efficiency Reported Participation**

Fuel Efficiency Measure	Participation Goals <sup>a</sup>	Participation Reported <sup>a</sup>	Percentage of Goal
Multifamily Market Transformation	40	4	10%
Residential Fuel Efficiency	141	143	101%
Low-Income Fuel Efficiency	30	13	43%

<sup>a</sup> Participation is defined as the number of rebates.

### Fuel Efficiency Impact Evaluation Methodology

The impact methodology for Fuel Efficiency measures is outlined below for the Nonresidential Site Specific path, Residential programs, and Low-Income programs.

#### 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 randomly sampled one Multifamily Market Transformation program project in Washington for the evaluation of the Nonresidential Fuel Efficiency measures. Cadmus did not evaluate the single Nonresidential Site Specific Combined HVAC application in the Idaho Fuel Efficiency program; however, the team evaluated two applications with the same measure category in the electric and gas Site Specific programs and found realization rates of 100% on those two projects. Verification site visits involved verifying installed equipment type, make and model numbers, operating schedules, and set points.

#### Residential Fuel Efficiency Impact Methodology

Cadmus applied billing analysis results to evaluate electric consumption impacts for all Residential Fuel Efficiency measures using the methodology described previously in *Billing Analysis*. Cadmus also completed database review of all PY 2019 reported Residential Fuel Efficiency savings as well as document reviews for 50 Fuel Efficiency participants from Q1 PY 2018 through Q2 PY 2019.

#### Low-Income Fuel Efficiency Impact Methodology

To evaluate electric consumption impacts for the Low-Income Fuel Efficiency measures, Cadmus conducted a database review (described above in the *Database Review* section) and billing analysis. The relatively low number of participants for the Low-Income program made it impractical for the billing analysis to isolate consumption impacts for specific measures. Using unit savings values provided in the TRM, Cadmus calculated electric consumption impacts for measures reported in the measure-tracking database. For Low-Income program measures in general (including Low-Income Fuel Efficiency measures), the evaluation relied on results from the database review to determine evaluated electric energy consumption impacts.

### Fuel Efficiency Impact Evaluation Results

The following sections summarize findings for the Nonresidential Site Specific path, Residential programs, and Low-Income programs Fuel Efficiency measures. All Fuel Efficiency measures provide positive electricity savings and negative natural gas savings because these measures replace electric space heating or water heating systems with equipment that uses natural gas. Negative savings,

reflecting negative avoided costs, are incorporated in the electric cost-effectiveness calculations. The team also report these negative savings in the *PY 2019 Idaho Natural Gas Impact Evaluation Report*.

### Nonresidential Fuel Efficiency Impact Findings

Table 25 shows reported and evaluated electric energy savings for Avista’s Nonresidential Fuel Efficiency measures, along with realization rates, through PY 2019.

**Table 25. Nonresidential Fuel Efficiency Electric Impact Findings**

Fuel Efficiency Measure	Reported Savings (kWh)	Evaluated Savings (kWh)	Realization Rate
Multifamily Market Transformation	300,230	300,230	100%
<b>Total</b>	<b>300,230</b>	<b>300,230</b>	<b>100%</b>

Cadmus did not identify any discrepancies affecting electric savings in the randomly sampled Multifamily Market Transformation program application based on the evaluation site visit and project documentation review.

### Residential Fuel Efficiency Impact Findings

Table 26 shows measure-level billing analysis results used when calculating PY 2019 electric consumption impacts. The participant count and relative precision for each measure easily met requirements established to ensure meaningful results, which required a participant count of at least five and relative precision no greater than  $\pm 40\%$  at the 90% confidence level. The billing analysis found the electric energy savings to be higher than predicted by the 2019 Avista TRM values for all but the wall heater measure. Realization rates relative to 2019 TRM values ranged from 63% for the wall heater measure to a high of 178%.

**Table 26. Residential Fuel Efficiency Analysis Results**

Measure	2019 Avista TRM Unit Energy Savings (kWh)	n <sup>a</sup>	Pre-Installation Weather Normalized Usage (kWh)	Annual Unit Energy Savings (kWh)	Realization Rate	Relative Precision at 90% Confidence	Participant State
E Electric To Natural Gas Furnace	6,104	39	19,054	7,384	121%	16%	Idaho
E Electric To Natural Gas Furnace & Water Heat	8,513	35	19,284	9,789	115%	12%	Idaho
E Electric To Natural Gas Wall Heater <sup>a</sup>	10,624	9	17,597	6,745	63%	30%	Idaho
E Multifamily Electric to Natural Gas Furnace and Water Heat	4,566	21	12,259	8,133	178%	13%	Idaho and Washington

<sup>a</sup> The 2019 Avista TRM does not include the E Electric to Natural Gas Wall Heater measure. The TRM value shown is taken from the 2018 Avista TRM.

Table 27 shows reported, adjusted, and evaluated electric energy savings for the Residential Fuel Efficiency measures. Based on the measure-level billing analysis results listed in Table 26, Cadmus calculated a 102% realization rate for evaluated electric energy savings for the Residential Fuel Efficiency path.

**Table 27. Residential Fuel Efficiency Electric Impact Findings**

Fuel Efficiency Measure	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Evaluated Electric Savings (kWh)	Realization Rate
Residential Fuel Efficiency	1,156,576	1,010,460	1,181,596	102%

Database review of Residential Fuel Efficiency measures resulted in roughly a 12% reduction in adjusted savings, primarily because reported savings in some instances used a higher UES value than the 2019 TRM value. Because billing analysis produced valid estimates for all Residential Fuel Efficiency measures, adjusted savings had no effect on evaluated savings.

In reviewing documentation for 50 Residential Fuel Efficiency measures, Cadmus found issues with two conversions to gas furnaces: documentation for each site indicated that the furnace replaced an oil-fired heating system. The team eliminated electricity savings for the natural gas furnaces, given that the replaced system did not use electric heating. These adjustments led to a document review realization rate of 97%, but Cadmus did not apply document review results to estimate evaluated savings because billing analysis produced valid estimates for all Residential Fuel Efficiency measures.

### Low-Income Fuel Efficiency Impact Findings

Table 28 shows reported and adjusted electric energy savings for Low-Income Fuel Efficiency measures.

**Table 28. Low-Income Fuel Efficiency Program Electric Impact Findings**

Fuel Efficiency Measure	Reported Electric Savings (kWh)	Adjusted Electric Savings (kWh)	Evaluated Electric Savings (kWh)	Realization Rate
Low-Income Fuel Efficiency	37,808	37,808	37,808	100%

Cadmus found no discrepancies between reported and TRM UES values for electric energy savings with Low-Income Fuel Efficiency measures, leading to a realization rate of 100% for electric energy savings.

The billing analysis estimated a realization rate of 144% for Low-Income Fuel Efficiency electric savings, with a relative precision of  $\pm 27\%$  at the 90% confidence level. Participation was not high enough to estimate savings at the measure level, which is necessary for calculating cost-effectiveness, but the results do indicate greater electric savings for Low-Income Fuel Efficiency measures as a whole than indicated by 2019 Avista TRM values. This finding also supports the natural gas billing analysis finding that the natural gas penalties for Low-Income Fuel Efficiency measures are much higher than estimated by the 2019 Avista TRM (see *PY 2019 Idaho Natural Gas Impact Evaluation Report*). Together, the electric and natural gas billing analysis results suggest a much greater heating load than indicated by TRM values, which is evident as the heating load shifts from electricity to natural gas.

### *Fuel Efficiency Conclusions and Recommendations*

Nonresidential Site Specific and Multifamily Market Transformation Fuel Efficiency measures achieved evaluated savings of 300,230 kWh, yielding a 100% realization rate. The Multifamily Market Transformation Fuel Efficiency measures achieved 128% of the electric energy savings goal of 234,960 kWh.

Residential Fuel Efficiency measures achieved evaluated savings of 1,181,596 kWh, yielding a 102% realization rate and achieving 118% of savings goal. Cadmus recommends that Avista update TRM values to match measure-level UES values calculated by the billing analysis. Cadmus also recommends that Avista ensure all measures are represented in the TRM.

For Low-Income Fuel Efficiency measures, evaluated savings were 37,808, with a realization rate of 100%, but fell short of Avista's savings goals, achieving 37% of the savings target and 43% of the participation target. Billing analysis indicated that program electric savings are likely higher, based on the billing analysis realization rate of 144% for Low-Income Fuel Efficiency measures as a whole. Based on this finding, Cadmus recommends increasing the Avista TRM UES values.