

Appendix 2

2022 - 2023
Verification of Savings

Pacific Power

May 31, 2024

AEG

2022–2023 PacifiCorp Washington Savings Verification

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EXECUTIVE SUMMARY

PacifiCorp selected Applied Energy Group, Inc. (AEG) to perform savings verification and process review of its Washington energy efficiency programs for the 2022-2023 biennial period. This study is not intended to duplicate or replace impact or process evaluations of PacifiCorp's energy efficiency programs but rather to review and validate the measurement and verification (M&V) approaches, savings tracking, and reporting practices to validate the accuracy of the savings being reported for the biennial period.

As the overall portfolio verification and process review contractor, AEG's primary goals include:

- Reviewing the practices and methods currently employed for measurement and verification, tracking, reporting, cost-effectiveness, and evaluation of EE program savings.
- Performing primary data collection activities that could not be performed during 2020-2021 verification or evaluation activities due to the COVID-19 pandemic, including onsite verification for Wattsmart Business projects.
- Verifying the calculation of total PacifiCorp portfolio MWh savings in WA State.

The executive summary provides an overview of the programs, describes AEG's approach to verification, and highlights the key findings and recommendations from the research effort. The attached report provides details by task.

Overview of Programs

The verification focused on PacifiCorp's four Washington energy efficiency programs: Home Energy Savings (HES), Home Energy Reports (HER), Low Income Weatherization (LIW), and Wattsmart Business (WSB). A brief summary of the programs follows.

Home Energy Savings (HES)

The HES program offers a comprehensive set of customer-focused, residential energy efficiency incentives, including upstream, midstream, and end-user rebates. The program implementation vendor, Resource Innovations, manages all program activities and holds weekly calls with the PacifiCorp program manager to report progress and escalate issues. The HES program contributed between 8% and 11% of portfolio savings in the 2022-2023 biennium period, driven by downstream and upstream HVAC measures like heat pumps, smart thermostats, and duct sealing and insulation.

Home Energy Reports (HER)

The HER program is designed to generate quantifiable energy savings by sending customers reports that encourage energy-savings behavior and home improvements. Bidgely has delivered the program since 2018, when it adopted the randomized control trial (RCT) approach from the previous vendor and began delivering its own style of report. Bidgely's report continued providing customers with information about their homes' energy consumption, comparing their homes to other similar homes, and offering customized, energy-saving tips and tricks. In 2020, Bidgely re-randomized the program, abandoning the original RCT in favor of reselecting the treatment and control-group customers. The treatment group receives reports through the mail and is compared against the control group, which does not receive reports. An analysis to estimate savings is completed monthly. Savings amounts are ultimately trued up and confirmed by

evaluation. Customers can opt-out, but participants are randomly selected and opted in to participate. This approach is employed to ensure statistical integrity. Attrition does occur over time, and Bidgely did a customer ‘refill’ in 2023 and is planning another in 2024 to bring the treatment group numbers back up to equilibrium. While Covid appeared to have disrupted the behavior patterns of residents in their homes and made determining savings harder, the program appears back on track in 2022 and 2023 with savings goals exceeded.

Low Income Weatherization (LIW)

PacifiCorp’s Low-Income Weatherization (LIW) program provides no-cost energy efficiency services to income-qualified residential customers through a partnership with local non-profit community service agencies that provide wraparound services to vulnerable populations. All agencies offered Low Income Home Energy Assistance Program (LIHEAP) and Weatherization Assistance Program (WAP) services as part of their service offerings and received state, federal, and utility funding for these programs. The program aims to reduce the energy burden for program participants, maintain affordable housing inventory, improve air quality and support healthy living conditions, and mitigate health and safety issues.

Wattsmart Business

PacifiCorp’s Wattsmart Business program offers engineering services and incentives to commercial, industrial, and irrigation customers through downstream (customer) and midstream (distributors/suppliers) incentive mechanisms. Incentives are available for retrofit projects, new construction, and major renovation projects. New in 2022-2023 are increased incentives targeted at named communities as part of the Clean Energy Transformation Act objectives. Also new in 2022-2023 is a Clean Buildings Accelerator. Two cohorts run by Stillwater are helping building owners understand and operationalize energy management to bring down their energy use intensity (EUI) to meet the Clean Buildings Performance Standard, signed into law in 2019 and operated by the Washington State Department of Commerce.

Wattsmart Business program measures and services are offered (and tracked) through six delivery channels.

- The **Custom Analysis Incentive** channel targets large energy users and projects that require custom analyses, though small- and mid-sized customers can also qualify. The design of these incentives offers multiple opportunities for energy efficiency upgrades; technical assistance helps customers identify energy efficiency opportunities and analyze the custom savings.
- **Typical Upgrades/Listed Incentives** primarily target small- and mid-sized customers for prescriptive energy efficiency improvements with deemed and calculated measures, although large customers are also eligible. Customers apply directly to Pacific Power or work with a trade ally to receive incentives.
- The **Small Business Enhanced Incentive** channel provides enhanced lighting and non-lighting incentives for small business customers, including named communities, through PacifiCorp’s trade ally network.
- Through the **Lighting Instant Incentives** channel, customers can receive point-of-purchase discounts on LEDs purchased through a participating lighting distributor. Customers who do not purchase from a participating distributor can apply for the incentive after purchase.

- **Energy Management** - participants receive expertise and custom incentives for verified savings achieved through operations, maintenance, and management practices.
- **Clean Buildings Accelerator** - Commercial building owners receive specialized assistance to comply with the Clean Buildings law, which requires planning to meet certain required energy use intensities (EUI).

Research Approach

AEG implemented an efficient and holistic technical approach to achieve the research objectives through five key tasks. The tasks were designed to build on each other and include inherent redundancies and cross-checks to enhance the robustness of the verification. The five key tasks included the following:

- **Task 1 Project initiation** included a kickoff meeting, data request, and program manager interviews.
- **Task 2 Review of M&V Processes and Procedures** included a review of M&V guidance, checklists, documentation, and verification of inspection rates.
- **Task 3 Review of Evaluations and Cost-Effectiveness** included reviewing impact and process evaluation reports and a high-level review of the cost-effectiveness analysis focusing on consistency with accepted Washington methodology and sourcing of inputs.
- **Task 4 Validate Savings Tracking and Reporting** included verifying the extent to which PacifiCorp accurately tracked and reported program performance metrics in its program tracking database.
- **Task 5 Verify Portfolio Savings** included engineering desk reviews and virtual and onsite verification of individual projects to verify a sample of savings directly. It also combines the results of various research activities and tasks to verify the savings reported at the portfolio level.

Because the individual tasks were designed to include overlaps, AEG’s approach leveraged multiple research activities, each of which contributed to completing one or more of the five key tasks. A description of each research activity and its contributions to each task is presented in Table ES-1 below.

Table ES-1 Research Activities by Task

Research Activity	Task 1	Task 2	Task 3	Task 4	Task 5
In-Depth Interviews Developed interview guide and conducted interviews with the residential (HES and HER), C&I (WSB), and low-income (LIW) program managers.	✓	✓	✓	✓	✓
Review EM&V Framework and Program Handbooks Identify key M&V and EM&V guidelines for each program.		✓	✓	✓	
Verify M&V Inspections Gathered inspection documentation, matched to records in DSMC extracts, and confirmed whether inspection rate targets were met.		✓		✓	
Review EM&V Reports			✓		✓

Investigated appropriateness of methods and inputs used to estimate impact, process, and cost-effectiveness results.					
Review Annual Reports for Cost-Effectiveness Confirmed that the appropriate inputs were used to calculate 2020 annual cost-effectiveness results.			✓		
DSMC Extract Reviews Investigated the inclusion and quality of program-critical fields and reviewed the extracts for duplicated records or customers.		✓		✓	✓
High-Level Portfolio Cross-Check Compared savings and counts of projects by measure category included in the 2020 Annual Report to the 2020 DSMC Extract.				✓	✓
Desk Reviews Randomly sampled projects from HES, LIW, and WSB for desk reviews.		✓		✓	✓
WSB Onsite Verification Visited four WSB projects to gather key information and confirm the installation and scope of each measure.				✓	✓

Key Findings and Recommendations

Overall, AEG was able to verify that PacifiCorp appropriately reported savings for the 2022-2023 biennium. As expected from a thorough review of PacifiCorp’s tracking, reporting, and verification practices, AEG identified recommendations for program and process improvements, which are listed below, with additional detail on each provided in the main body of this report. The recommendations AEG provides fall into four general categories: backup documentation, tracking and reporting, third-party evaluation, and cost-effectiveness.

Relating to Project Inspections

- **AEG recommends that PacifiCorp update the language in the EM&V Framework for Home Energy Savings inspection protocols to clearly define whether percent inspection rates apply at the measure group or building type for multifamily and manufactured homes level.** During this verification work, AEG identified that some of the language in the EM&V framework was open to interpretation, which led to uncertainty in intent between AEG, PacifiCorp staff, and the program implementer. While the spirit of the EM&V Framework was followed, AEG believes that clarification would help ensure a common understanding of expectations by all parties moving forward. (See *Chapter 2 M&V Processes and Procedures*.)
- **PacifiCorp should ensure that implementers are paying close attention to minimum inspection rates in the latest filed EM&V framework and program handbooks and update these documents when necessary to correct errors.** Through this verification work, AEG identified that the HES program did not satisfy the EM&V Framework inspection rate requirements for several categories. In particular, for multifamily retrofit projects in 2022 and 2023. The program implementer determined that the 100% inspection requirement for these projects in the EM&V framework was viewed as a clerical error, which was updated to 5% in 2023. Nonetheless, the expectation is that PacifiCorp’s measurement and verification practices will comply with the current EM&V framework. In the future, PacifiCorp should confirm the inspection rates implementers are using and update the EM&V Framework when necessary to correct errors or omissions. (See *Chapter 2 M&V Processes and Procedures*.)

- **Encourage HES program implementers to conduct inspections across a sample of all measure categories where possible.** AEG noted that inspections conducted in the single-family home type, where project uptake occurred across all measure types, tended to focus on heat pumps and ducting measures, with few or no inspections taking place for water heater, window, and insulation measures. While this practice complies with the established inspection protocol (i.e., inspection rates for single-family homes are defined in the aggregate, not by measure category), inspections covering a more comprehensive range of project types would both help meet inspection rate targets as well as ensure the quality of work being performed across the program. Note that this issue was irrelevant for Multifamily and Manufactured Homes where uptake was low. (See *Chapter 2 M&V Processes and Procedures*.)

Relating to Backup Documentation

- **In the future, AEG recommends that PacifiCorp’s Low Income Weatherization Program Manager collect post-inspection documentation from agencies regularly by requesting that agencies submit inspection documents during the invoice submittal process when other project paperwork is submitted.** More consistent data collection will improve PacifiCorp’s ability to internally track progress towards the inspection requirements outlined in program handbooks and the EM&V Framework. It will also enhance how inspections are tracked in the DSMC extracts. Finally, more frequent data collection will also alleviate the need for the agencies to gather this documentation all at once, which was limited to a sample in this project due to the burden it imposes on agencies to collect, copy, and send over physical paperwork. (See *Chapter 2 M&V Processes and Procedures*.)
- **When storing inspection documentation in individual project files, use the convention of the external project ID consistently across all programs and project categories.** PacifiCorp used this convention in some cases, and AEG could easily go into a .zip folder of project data and map project inspection documentation to the DSMC extract. However, the WSB project folders used the project name, and several HES folders used the project date and customer’s last name instead of a project ID, making them difficult to map. (See *Chapter 2 M&V Processes and Procedures*.)
- **Provide supporting documentation for assumptions and inputs used in savings calculations.** Particularly for the WSB custom projects involving irrigation pump VFD measures, AEG noted that the pump curve and annual operating hours are important inputs to the savings calculator. However, there was no documentation that indicates the origin of these inputs or how they were derived, which makes it difficult to verify their validity and reasonableness. (See *Chapter 5 Portfolio Savings*.)
- **Require more robust documentation of demand (kW) savings calculations.** AEG noted several WSB custom non-lighting projects that did not include demand savings calculations in the live savings calculation files. Program evaluators would require complete and robust documentation to review the methodology and assumptions that ultimately determine the claimed savings values. (See *Chapter 5 Portfolio Savings*.)
- **Encourage program implementers to provide live calculations in Excel format (rather than PDF format) for WSB projects in the project file that is uploaded to DSMC.** The savings calculations for some 2022 and 2023 projects that utilize an approved calculator were provided to AEG for review in PDF format. For documentation and savings verification, it is

necessary to have the savings calculation in the original Excel format, and these had to be requested from the program implementer by AEG. (See Chapter 5 Portfolio Savings.)

Relating to Tracking and Reporting (DSMC)

- **Continue to improve the process by which WSB implementors work directly in the DSMC database.** A handful of 2022-2023 project files did not appear to be stored in DSMC as expected across several delivery channels, which led to some delays in the verification effort. Ultimately, AEG was able to collect most of the documentation needed to complete the verification, but it had to be tracked down through implementation contractors and subcontractors. PacifiCorp noted that it has contracted with a new delivery company and is transitioning them in at the time of this writing. They will be creating a new process with the new company, Evergreen Consulting Group, to ensure project documentation is available for all projects going forward. (See Chapter 4 Tracking and Reporting.)
- **Ensure the “Measure Effective Date” field in DSMC is filled in.** This field is important for savings verification, and AEG found several HES projects where the field was blank. (See Chapter 5 Portfolio Savings.)

Relating to Third-Party Evaluation and Cost-Effectiveness

- **Encourage high-quality reporting on sample design from program evaluators.** AEG determined that the HES 2021-2022 evaluation report met a minimum standard. However, the report would be more robust and valuable for designing future studies with better information about how the evaluator developed the sample frame and which customers were ultimately represented in their analysis. (See Chapter 3 Program Evaluations and Cost-Effectiveness.)
- **Include cost-effectiveness analysis inputs and findings in the program evaluation reports.** The 2020-2021 Home Energy Reports evaluation report did not include a cost-effectiveness analysis and findings. The Evaluation Work Plan for 2021-2022 Home Energy Savings program, which includes Home Energy Reports, notes that a PacifiCorp-selected consultant will calculate cost-effectiveness and that the results will be included in ADM’s report. Cost-effectiveness analysis inputs and findings should be consistent with the accepted Washington methodology and presented in the evaluation reports. (See Chapter 3 Program Evaluations and Cost-Effectiveness.)
- The NEI value documentation does not make it clear what the source of the NEIs are. High-level documentation indicating NEIs come from the Regional Technical Forum (RTF) or a specific study, would make it clear that the cost-effectiveness tests include all required components. (See Chapter 3 Program Evaluations and Cost-Effectiveness.)



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INTRODUCTION

PacifiCorp selected Applied Energy Group, Inc. (AEG) to perform savings verification and process review of its Washington energy efficiency programs for the 2022-2023 biennial period. This study is not intended to duplicate or replace impact or process evaluations of PacifiCorp's energy efficiency programs. Instead, AEG reviewed and validated PacifiCorp's measurement and verification (M&V) approaches, savings tracking, and reporting practices to verify the accuracy of energy savings reported for the biennial period.

Research Objectives

AEG's primary objectives for this study included:

- Reviewing PacifiCorp's practices and methods employed for measurement and verification, tracking, reporting, cost effectiveness, and evaluation of energy efficiency programs during the 2022-2023 biennial period.
- Performing primary data collection activities to supplement PacifiCorp's inspections for a sample of Wattsmart Business projects.
- Verifying the total portfolio energy savings calculation for the 2022-2023 biennial period.

Overview of Research Approach

AEG implemented an efficient and holistic technical approach to achieve the research objectives through five key tasks. The tasks were designed to build on each other and include inherent redundancies and cross-checks to enhance the robustness of the verification.

The five key tasks were:

- **Task 1 Project Initiation** included a kickoff meeting, data request, and program manager interviews.
- **Task 2 Review of M&V Processes and Procedures** included a review of M&V guidance, checklists, documentation, and verification of inspection rates.
- **Task 3 Review of Evaluations and Cost Effectiveness** included reviewing impact and process evaluation reports and a high-level review of the cost-effectiveness analysis focusing on consistency with accepted Washington methodology and sourcing of inputs.
- **Task 4 Validate Savings Tracking and Reporting** included verifying the extent to which PacifiCorp accurately tracked and reported program performance metrics in its program tracking database.
- **Task 5 Verify Portfolio Savings** included engineering desk reviews and onsite verification of individual projects to directly verify a sample of savings. It also combines the results of various research activities and tasks to verify the savings reported at the portfolio level.

Because the individual tasks were designed to include overlaps, AEG's approach leveraged multiple research activities, each of which contributed to completing one or more of the five key tasks. A description of each research activity and its contributions to each task is presented in Table 1-2 below.

Table 1-1 Research Activities by Task

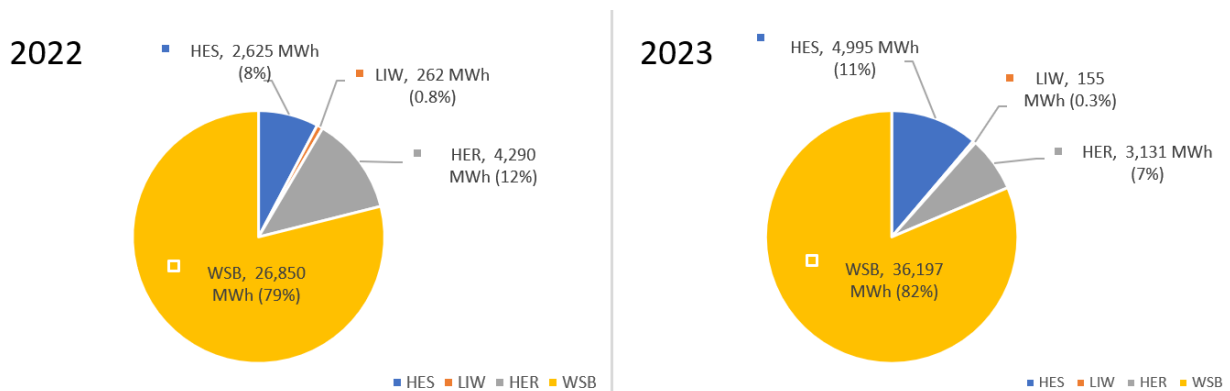
Research Activity	Task 1	Task 2	Task 3	Task 4	Task 5
In-Depth Interviews Developed interview guide and conducted interviews with the residential (HES and HER), C&I (WSB), and low-income (LIW) program managers.	✓	✓	✓	✓	✓
Review EM&V Framework and Program Handbooks Identify key M&V and EM&V guidelines for each program.		✓	✓	✓	
Verify M&V Inspections Gathered inspection documentation, matched to records in the DSMC extracts, and confirmed whether inspection rate targets were met.		✓		✓	
Review EM&V Reports Investigated appropriateness of methods and inputs used to estimate impact, process, and cost-effectiveness results.			✓		✓
Review Annual Reports for Cost-Effectiveness Confirmed that the appropriate inputs were used to calculate 2022 annual cost-effectiveness results.			✓		
DSMC Extract Reviews Investigated the inclusion and quality of program-critical fields and reviewed the extracts for duplicated records or customers.		✓		✓	✓
High-Level Portfolio Cross-Check Compared savings and counts of projects by measure category included in the 2022 Annual Report to the 2022 DSMC Extract.				✓	✓
Desk Reviews Randomly sampled projects from HES, LIW, and WSB for desk reviews.		✓		✓	✓
WSB Onsite Verification Visited five WSB projects to gather key information and confirm the installation and scope of each measure.				✓	✓

Program Descriptions

PacifiCorp realizes energy savings in Washington through four separate customer programs plus the Northwest Energy Efficiency Alliance (NEEA) efforts.¹ The contribution of each of the four programs based on PacifiCorp’s tracking database is shown in Figure 1-1 . AEG used this distribution of savings and the nature of each program to guide verification efforts. While AEG reviewed savings tracking and verification processes, evaluation methods, and cost-effectiveness analyses for all programs, engineering review, and virtual or onsite verification of individual projects focused on Wattsmart Business, Home Energy Savings (non-upstream lighting), and Low Income Weatherization, which jointly represent over 90% of savings.

¹ Verifying savings attributed to the efforts of the Northwest Energy Efficiency Alliance (NEEA) was outside the scope of this study.

Figure 1-1 Contribution to Overall Savings by Program



Each of the four programs offered by PacifiCorp in Washington is described below.

Home Energy Savings (HES)

The Home Energy Savings (HES) program offers a comprehensive set of customer-focused, residential energy efficiency incentives, including upstream, midstream, and end-user rebates. The program implementation vendor (Resource Innovations) manages all program activities and holds weekly calls with the PacifiCorp program manager to report progress and escalate issues.

Savings claimed through the HES program are primarily from measures with deemed savings values developed by the Regional Technical Forum (RTF). Because of this, verification efforts are relatively straightforward, ensuring that the correct deemed savings value is applied to the proper measure. However, savings for certain measures are based on specific home characteristics or derived from energy modeling and require additional effort to verify that sufficient savings documentation is available.

Home Energy Reports (HER)

The HER program is designed to generate quantifiable behavioral savings. The HER program provides customized reports via email (or regular mail) to customers comparing their energy consumption to other similar homes and encouraging energy-saving behaviors and home improvements. The reports are intended to employ social norming and behavioral nudges to drive customers to conserve energy.

HER is a turnkey program implemented by Bidgely. Savings for HER participants are estimated using treatment and control-group customers. The treatment group receives reports through the mail and is compared against the control group, which does not receive reports. After defining an eligible population, the vendor randomly assigns potential participants to a treatment or control group. The control group usage is used to develop a counterfactual for the treatment customers and estimate the program impacts. Savings are also independently estimated by a third-party evaluator using the same treatment and control groups. Savings are reported by Bidgely once a month, showing comparisons between treatment and control groups and pre- and post-energy usage. The granular data on treatment and control groups and the number of recipients for each report are not tracked in DSMC. Still, they are available to PacifiCorp, if needed, upon request to the implementation vendors.

Because PacifiCorp’s reported biennial savings for this program are ex-post based on a concurrent program evaluation, savings verification for this program is not included within AEG’s scope.

Low Income Weatherization (LIW)

PacifiCorp’s Low Income Weatherization (LIW) program provides no-cost energy efficiency services to income-qualified residential customers through a partnership with local non-profit community service agencies that provide wraparound services to vulnerable populations. All agencies offered Low Income Home Energy Assistance Program (LIHEAP) and Weatherization Assistance Program (WAP) services as part of their service offerings. Agencies receive state, federal, and utility funding for these programs. The program’s goals include reducing the energy burden for program participants, maintaining affordable housing inventory, improving air quality and healthy living conditions, and reducing health and safety issues. PacifiCorp estimates program energy savings using a single measure ex-ante value per home that represents the bundled effect of all installed measures and additional gross incremental annual savings tracked separately for the installation of a ductless heat pump to replace permanently installed electric heat and space heaters or to replace or augment oil, propane, and wood heating equipment.

Wattsmart Business

PacifiCorp’s Wattsmart Business program offers services and incentives to commercial, industrial, and irrigation customers through midstream (distributors/suppliers) and downstream (customer) incentive mechanisms. Incentives are available for retrofit projects, new construction, and major renovation projects.

Wattsmart Business program measures and services are offered (and tracked) through five delivery channels.

- **Typical Upgrades/Listed Incentives.** This channel offers prescriptive incentives primarily for small and mid-sized customers, although large customers are also eligible. Customers apply directly to PacifiCorp or work with a trade ally to receive incentives.
- **Custom Analysis Incentive.** This channel is targeted toward large energy users with projects that require custom analysis. The incentives are designed to offer multiple opportunities for energy efficiency upgrades. Small and midsize customers are also eligible for this incentive. Technical assistance is provided to help customers identify energy efficiency opportunities and provide analysis and verification of custom savings.
- **Energy Management.** Participants receive expertise and custom incentives for verified savings achieved through operations, maintenance, and management practices.
- **Small Business Enhanced Incentive.** This channel provides enhanced lighting and non-lighting incentives for small business customers through PacifiCorp’s trade ally network.
- **Midstream/Lighting Instant Incentives.** Customers can receive point-of-purchase discounts on LEDs purchased through a participating lighting distributor through this channel. Customers who do not purchase from a participating distributor can apply for the incentive after purchase.
- **Energy Project Manager Co-funding.** Available to customers that commit to an annual goal of completing energy projects resulting in at least 1 million kWh/year in savings.

- **Project Financing.** PacifiCorp is teamed with the National Energy Improvement Fund, an energy efficiency project financing firm, to provide customers with access to financing options when funds are not available from within the customer’s organization.

Structure of this Report

The remainder of this report is organized to present the methodology, findings, and recommendations for each task, followed by overall study conclusions and recommendations:

- Task 1. Program Manager Interviews
- Task 2. Review M&V Processes and Procedures
- Task 3. Review Program Evaluations and Cost-Effectiveness
- Task 4. Validate Savings Tracking and Reporting
- Task 5. Verify Portfolio Level Savings

1 | PROGRAM MANAGER INTERVIEWS

AEG interviewed key PacifiCorp program staff to gain insight into the 2022-2023 program design, implementation, goals and tracking, customer satisfaction, and desired verification outcomes. The interviews also discussed how the COVID-19 pandemic impacted various aspects of the programs from the perspective of program staff.

Three staff interviews were completed:

- Jay Olson, Home Energy Savings (HES) and Home Energy Reports (HER) Program Manager
- Charity Spires, Low Income Weatherization (LIW) Program Manager
- Nancy Goddard, Wattsmart Business (WSB) Program Manager and Hallie Gallinger, WSB Energy Efficiency Project Manager.

Home Energy Savings

The HES program went through a staff transition in late 2022 with the retirement of Don Jones, longtime Program Manager of the HES program. Jay Olson joined PacifiCorp as the new Program Manager in January 2023. The implementation company, Resource Innovations, has been managing the program for numerous years and uses several subcontractors, including C+C, to deliver different portions of the program and outreach.

The main drivers of participation recently have been direct install, trade ally, then retail/coupons, and limited-time offers. Language has historically been a barrier to participation in the past, with approximately 40% of customers being Spanish speakers, but now all communications/marketing are in Spanish and English. COVID has had a significant negative impact on the programs in recent years, and lingering impacts to supply chain, labor availability, and higher costs due to inflation continue to challenge the program, but overall operations appear to be returning to normal.

PacifiCorp made the following changes to the HES in the 2022-2023 biennial period, including some in response to the COVID pandemic.

1. Direct Install free services (duct sealing, lighting, smart thermostats) began being offered to all housing types in 2023. Previously these services were targeted to manufactured housing only.
 2. Limited-time offers through email blitz for good deals like smart thermostats.
 3. Outreach is extending its reach and contacting large property owners and campuses to make them aware of all the different program offerings.
 4. Increased incentives to high-impact (hard to reach) customers
- The HES program tracks savings in the internal Demand Side Management Central (DSMC) system.
 1. The DSMC system includes all HES projects.
 2. PacifiCorp has an extensive measure library that feeds most inputs into the tracking system directly.
 - Residential customer satisfaction with PacifiCorp programs is high

Home Energy Reports

- The implementation contractor for HER, Bidgely, performs analysis to estimate savings by month, showing the comparison between the treatment and control groups, then savings get trued up through third-party program evaluation to confirm that they are reasonable.
- Customers can opt out, but no one opts in; participation is randomly selected to ensure statistical integrity. Attrition occurs (customer moves or drops out somehow), and Bidgely had not recently backfilled the declining participant pool. In 2023, Bidgely performed a ‘refill’ to restore the numbers to equilibrium. There are plans to add more customers in 2024 as well.

Low Income Weatherization

The PacifiCorp Low-Income Weatherization Program has contracts with four local partner agencies, including Blue Mountain Action Council (BMAC) in Walla Walla, Opportunities Industrialization Center (OIC) of Washington in Yakima, Northwest Community Action Center (NCAC) in Toppenish, and Yakama Nation Housing Authority (YNHA) in Wapato. While YNHA was added as an agency to PacifiCorp’s program in 2018, the others have been partner agencies since 1986.

COVID had a significant impact on the agencies operations as state rules required agencies to pause programs and pushed staff to work on other priorities and delayed work on customer projects. After a decrease in participation, programs are ramping back up as seen in the following participation numbers: 2019 = 134, 2020 = 43, 2021 = 68, 2022 = 76, 2023 = 95.

PacifiCorp made the following changes to the LIW program in the 2022-2023 biennial period.

- The cap for repairs has historically been 15% of the annual cost of eligible measures, but on February 1, 2022, the cap was increased to 30%. The purpose is to better mitigate homes that are deferred due to needed repairs. The larger cap allows some of those repairs to be made as part of the weatherization project.
- PacifiCorp no longer has a spending cap on this program, while it was formerly set at \$1 million.

Wattsmart Business

The WSB program primarily provides incentives to customers to drive project participation, and is implemented by Resource Innovations, with Evergreen as subcontractor. The program also provides engineering services through its managed accounts program, which is implemented by Cascade Energy. This program was very successful in 2023 and brought in 19 million kWh in savings.

The program, while recovering from COVID impacts, is actively addressing lingering issues such as supply chain issues that result in longer lead times to get equipment. Inflation and interest rate increases have made projects much costlier and prices harder to predict. Staffing shortages for contractors to do work has impacted projects and timelines, and shortages on the customer side has meant they have less time to do new things and consider energy efficiency projects. In response, the program has raised incentives to mitigate inflation and interest rates, demonstrating its commitment to keeping offerings attractive to customers. It has also worked

to retain contractors in their service territory by providing vendor incentives, especially for lighting and small business retrofits.

- PacifiCorp made the following changes to the WSB program in the 2022-2023 biennial period.
 1. The Clean Energy Transformation Act created specific targets in 2022-2023, and PacifiCorp has responded with Utility Actions to increase Named Community customer participation by targeting named communities (census tract-based) with increased incentives. The incentive cap on these projects is up to 100% of eligible project cost for business customers located in Highly Impacted Communities.
 2. The Clean Buildings Accelerator is new in 2022-2023. Stillwater Energy currently runs two cohorts to help building owners meet new clean building requirements. These would result in energy management savings, but none have been logged during the 2022-2023 period. The program assists participants in complying with the Clean Buildings Performance Standard. This law is between the building owner and Department of Commerce, and PacifiCorp’s program runs alongside to offer assistance.
 3. Custom non-lighting incentives have steadily increased over recent years: \$0.18/kWh in 2020, \$0.24/kWh in 2022, and increase to \$0.28/kWh in 2024.
- Tracking program data and savings:
 1. Implementers enter project data directly into DSMC project by project. The reports and analysis that go into the projects generate the values, which are then entered into DSMC for program tracking purposes. Supporting documentation is in DSMC as well. Deemed savings projects self-populate the savings associated with the measure completed.
 2. Non-energy impacts (NEIs) are not calculated in DSMC, so per unit NEI assumptions are taken from the measure library, and a calculation is done outside of DSMC to get the totals.

2 | M&V PROCESSES AND PROCEDURES

This task primarily consisted of **reviewing the measurement and verification (M&V) procedures** used by PacifiCorp to verify ex-ante savings estimates. M&V procedures included activities or processes to ensure the validity of savings estimates during program implementation by PacifiCorp program staff, program implementers, or trade allies and contractors.

AEG reviewed PacifiCorp's current M&V procedures, plans, and approaches through in-depth interviews with crucial PacifiCorp staff and by completing the following activities:

- Reviewing the procedures in Appendix 3 of PacifiCorp's Evaluation, Measurement and Verification Framework for Washington. Note, inspection requirements in the EM&V framework were updated mid-way through the biennial period; AEG applied the appropriate inspection requirements based on the date of projects.
- Reviewing sampling methods and M&V plans and approaches currently in place.
- Verifying the procedures were followed by reviewing program data.
- Reviewing any M&V checklists that are available and benchmarking against industry best practices.
- Reviewing program handbooks that describe M&V procedures, such as those for reviewing custom projects or for conducting an inspection.

Summary of Findings

AEG's findings regarding PacifiCorp's current M&V activities are summarized below for each program.

Home Energy Savings

According to PacifiCorp's program guidelines and interviews with PacifiCorp staff, projects undergo the following verification procedures:

- PacifiCorp requires that a sample of downstream projects be inspected post-installation if they include at least one of the following measures: insulation, windows, ducting, heat pumps, and water heaters. In 2022, all heat pump conversions required a pre-inspection to verify the existing heating source. In 2023, this requirement was changed to require pre-approval of heat pump conversion measures, where certain contractors were pre-approved based on their history with the program, and other contractors required a pre-inspection. For randomly selected projects, the program implementer should visit the homes where the measures were installed or verify virtually. In 2022-2023, all inspections were performed in person at the home.
- All post-purchase incented (downstream) measures undergo a quality assurance review before issuing the customer/dealer incentive and recording savings (e.g., proof-of-purchase receipt review) and eligible equipment review. Additionally, the customer account and address are checked to ensure the program administrator does not pay for the same measure twice or double-count measure savings.
- For the upstream component of the HES program, no site or virtual inspections are conducted. The program administrator ensures quality control and verifies measures for product eligibility and correct pricing. Pricing is also confirmed by program administrator

field visits to retail locations. Customer eligibility for Wattsmart Starter Kits is verified using the customer’s account number and last name and cross-verifying with the current PacifiCorp customer database.

AEG’s M&V review focused on ensuring that PacifiCorp met its post-installation inspection targets. As part of Task 4 (Validate Savings Tracking and Reporting) and Task 5 (Verify Portfolio Savings), AEG assessed the extent to which PacifiCorp’s internal quality control procedures captured duplicate incentive payments for customers and ensured proof of purchase.

To verify whether the HES program had met the minimum inspection thresholds identified in PacifiCorp’s filed EM&V Framework, AEG requested all post-inspection documentation from PacifiCorp to verify post-installation inspections, matched these records to the tracking database extracts. Table 2-1 shows the results of AEG’s inspection review compared to the thresholds in the EM&V Framework. Note, that PacifiCorp updated certain inspection rates as part of its 2023 Annual Conservation Plan filing, with changes taking effect on January 1, 2023.

As shown, AEG found that PacifiCorp generally hit its minimum inspection rates but notes two areas where additional scrutiny was necessary:

1. For multifamily and manufactured home retrofit projects, AEG found that the language in the EM&V Framework was somewhat ambiguous, such that it is unclear whether the percent of projects inspected should be assessed in aggregate or by measure group. The program implementor interpreted the protocol at the building type level, which is why thresholds were reached in aggregate, but not for certain measure groups. AEG recommends that the language be clarified in the EM&V Framework to ensure a common understanding moving forward.
2. For multifamily retrofit projects in 2022, AEG determined that implementers were not using the proper inspection rate from the filed EM&V Framework. However, this was adjusted for 2023, and all inspection rates were met at the building type level across the board.

Despite not being able to confirm that PacifiCorp satisfied all of its minimum inspection thresholds, the level of savings that could potentially be impacted is not significant and AEG does not recommend making any adjustments to claimed savings. Rather, AEG provides specific recommendations for improved tracking of required inspection rate later in this chapter.

Table 2-1 HES Inspection Verification

Building Type	Measure	Target	% Inspected by Measure Category	% Inspected by Building Type	Notes
2022					
Multi Family	Ducting	100%	0%	85%	2 measures installed
	Heat Pumps	100%	90%		31 Measures installed
Manufactured Home	Ducting	5%	8%	8%	427 measures installed
	Heat Pumps	5%	5%		41 measures installed
	Water Heater	5%	N/A		1 measure installed
Single Family	Insulation	5%	3%	3%	Single family inspection rates are applied to the aggregate of downstream and mechanical measures.
	Windows				
	Ducting				
	Heat Pumps				
	Water Heater				
Single Family	New Construction	20%	N/A	N/A	2 measures installed - virtual inspections completed and under review
2023					
Multi Family	Insulation	5%	0%	11%	27 measures installed
	Heat Pumps	5%	14%		169 measures installed
	Water Heater	5%	N/A		1 measure installed
	Windows	5%	N/A		2 measures installed
Manufactured Home	Windows	5%	N/A	5%	1 measure installed
	Ducting	5%	5%		1,334 measures installed
	Water Heater	5%	N/A		1 measure installed
	Heat Pumps	5%	29%		34 measures installed
Single Family	Insulation	5%	7%	7%	Single family inspection rates are applied to the aggregate of downstream and mechanical measures.
	Windows				
	Ducting				
	Heat Pumps				
	Water Heater				
Single Family	New Construction	20%	N/A	N/A	6 measures installed - virtual inspections completed and under review

Low Income Weatherization

The Low Income Weatherization Program guidelines require measure eligibility screening and post-installation inspections. Specifically, after homes have been treated through the program and receive payments,

- all projects should be inspected by an agency inspector,
- an independent third party should inspect between 5-10% of participating homes, and
- a State inspector should randomly inspect a small subset of project.

Similar to the HES M&V review, AEG focused its review on assessing the extent to which PacifiCorp achieved post-inspection targets for Low Income Weatherization projects. The PacifiCorp program manager travels to the agency offices twice a year, typically in Q1 and Q3 to inspect randomly selected records. Since PacifiCorp’s program manager routinely inspects the agency paperwork, and because requesting this documentation is a time-consuming manual process for agency staff to collect and scan hard copy paper project files, AEG limited its requested post-inspection documentation to a 10% random sample of projects from the four participating cap agencies to reduce this administrative burden.

AEG reviewed documentation from PacifiCorp’s third-party inspector and matched this information to records in the tracking database. Documentation supporting the state inspections are held with agencies and because AEG requested project files from a 10% sample only, we were able to review a couple state inspections, but do not know how many were completed in total. AEG prioritized review of third-party and agency inspections and feels the State inspections are generally outside of PacifiCorp’s purview.

As shown in Table 2-2, PacifiCorp exceeded the inspection rate targets for third-party inspections for 2022 and 2023, significantly exceeding it in 2023. According to PacifiCorp’s program manager, their contracted third-party inspector typically conducts inspections twice a year. Due to occasional cancellations, additional inspections are scheduled to ensure the sample size is met. Additionally, when scheduling at multifamily buildings, appointments are made with several participating units since the inspector will already be there onsite. These factors sometimes result in more robust numbers of inspections that exceed the guidelines.

Table 2-2 *LIW Inspection Verification*

Year	Inspector Type	Target	% Inspected	Notes
2022	Third Party	5-10%	17%	
	Agency	100%	100%	
	State	Spot-Check	N/A	Data not available
2023	Third Party	5-10%	36%	
	Agency	100%	100%	
	State	Spot-Check	N/A	Data not available

Wattsmart Business

Inspection requirements for Wattsmart Business projects are summarized in Appendix A. Inspection requirements, described in the EM&V Framework, vary depending on the amount of the incentive or savings and the type of project.

To verify that PacifiCorp met the WSB inspection targets, AEG looked at how inspections were flagged in the DSMC extracts and collected backup documentation (e.g., inspection reports or inspection summaries) from PacifiCorp and third-party implementors. In the 2020-2021 savings verification project, AEG made a recommendation to PacifiCorp to include a field in the DSMC extract that categorized the WSB projects according to the groups in the EM&V framework. PacifiCorp explored and assessed this improvement, but they were unable to implement it into

the DSMC system. As an alternative, PacifiCorp program managers requested that implementors compile project-level data from the DSMC and manually add inspection protocols to the data. With the data presented this way, AEG was able to effectively match up and categorize inspection levels into the categories that aligned with the associated inspection protocol, effectively resolving the issue.

Based on the results of AEG’s analysis, PacifiCorp met the minimum inspection rates specified in the protocols, and therefore, AEG does not recommend any adjustments to savings or project counts. AEG does continue to recommend the following updates, if possible, to streamline the process of getting the data from implementors in the properly categorized format:

- The level of summary detail provided by the implementors was not standardized, and at times it was challenging to understand which elements pertained to which project groups, though the “Managed By” field in the DSMC extracts identified the responsible implementor and delivery channel. That said, PacifiCorp and the implementation vendors helped fill the gaps and lend support where possible.
- Wattsmart Business implementors work directly in DSMC; however, AEG found during its requests for inspection reports and program files for sampled projects that this type of supporting documentation is often not in DSMC. PacifiCorp indicated that a key cause of this is that projects are locked in DSMC after they are paid.

Recommendations

Based on its review of M&V processes and procedures, AEG provides the following recommendations.

- **AEG recommends that PacifiCorp update the language in the EM&V Framework for Home Energy Savings inspection protocols to clearly define whether percent inspection rates apply at the measure group or building type for multifamily and manufactured homes level.** During this verification work, AEG identified that some of the language in the EM&V framework was open to interpretation, which led to uncertainty in intent between AEG, PacifiCorp staff, and the program implementer. While the spirit of the EM&V Framework was followed, AEG believes that clarification would help ensure a common understanding of expectations by all parties moving forward.
- **PacifiCorp should ensure that implementors are paying close attention to minimum inspection rates in the latest filed EM&V framework and program handbooks and update these documents when necessary to correct errors.** Through this verification work, AEG identified that the HES program did not satisfy the EM&V Framework inspection rate requirements for several categories. In particular, for multifamily retrofit projects in 2022 and 2023. The program implementer determined that the 100% inspection requirement for these projects in the EM&V framework was viewed as a clerical error, which was updated to 5% in 2023. Nonetheless, the expectation is that PacifiCorp’s measurement and verification practices will comply with the current EM&V framework. In the future, PacifiCorp should confirm the inspection rates implementors are using, and update the EM&V Framework when necessary to correct errors or omissions.
- **Encourage HES program implementors to conduct inspections across a sample of all measure categories where possible.** AEG noted that inspections conducted in the single-family home type, where project uptake occurred across all measure types, tended to focus

on heat pumps and ducting measures, with few or no inspections taking place for water heater, window, and insulation measures. While this practice complies with the established inspection protocol (i.e., inspection rates for single-family homes are defined in aggregate, not by measure category), inspections covering a more comprehensive range of project types would both help meet inspection rate targets, as well as ensure the quality of work being performed across the program. Note that this issue was not relevant for Multifamily and Manufactured Homes where uptake was low.

- **In the future, AEG recommends that PacifiCorp’s Low Income Weatherization Program Manager collect post-inspection documentation from agencies regularly by requesting that agencies submit inspection documents during the invoice submittal process when other project paperwork is submitted.** More consistent data collection will improve PacifiCorp’s ability to internally track progress towards the inspection requirements outlined in program handbooks and the EM&V Framework. It will also improve how inspections are tracked in the DSMC extracts. Finally, more frequent data collection will also alleviate the need for the agencies to gather this documentation all at once, which was limited to a sample in this project due to the burden it imposes on agencies to collect, copy, and send over physical paperwork.
- **When storing inspection documentation in individual project files, use the convention of the external project ID consistently across all programs and project categories.** In some cases, PacifiCorp used this convention, and AEG could easily go into a .zip folder of project data and map project inspection documentation to the DSMC extract. However, the WSB project folders used project name, and several HES folders used the project date and customer’s last name instead of a project ID, making them difficult to map.

3 | PROGRAM EVALUATIONS AND COST-EFFECTIVENESS

After reviewing PacifiCorp’s Evaluation Measurement and Verification Framework for Washington (EM&V Framework) as part of Task 2 (Review M&V Processes and Procedures) to understand how PacifiCorp integrates and plans evaluation activities across its portfolio, AEG then worked with PacifiCorp to gain a comprehensive view of previous and current third-party program evaluation efforts. AEG also reviewed the cost-effectiveness analysis in PacifiCorp’s 2022 Annual Report.

Given the staggered timing of PacifiCorp’s program evaluations, none of the programs had a complete evaluation report covering the full 2022-2023 biennium period. However, given PacifiCorp’s consistent and established evaluation approaches, AEG was able to supplement the available EM&V reports with either the latest EM&V report not reviewed as part of the previous (2020-2021) verification effort or a work plan for part of the 2022-2023 biennium period as follows:

- 2021-2022 Home Energy Savings Program Evaluation Report²
- Evaluation Work Plan for 2021-2022 Home Energy Savings and 2020-2021 Home Energy Reports programs³
- 2018-2019 Low Income Weatherization Program Evaluation Report⁴
- 2020-2021 Home Energy Reports Program Evaluation Report⁵
- 2020-2021 Wattsmart Business Program Evaluation Report⁶

Summary of Findings

Below, we present a summary of our findings in two subsections: (1) Impact and Process Evaluation, and (2) Cost-effectiveness.

Impact and Process Evaluation

PacifiCorp’s EM&V Framework establishes the overall approach to conducting EM&V of its energy efficiency programs, incorporating industry best practices regarding principles of operation, methodologies, evaluation methods, definitions of terms, and protocols. The framework is based on several pertinent sources, including the Uniform Methods Project (UMP),⁷ The National Action

² ADM Associates, Inc. Evaluation, Verification & Measurement Report. Washington Home Energy Savings Program. Program Years 2021-2022 (October 2023). Prepared for PacifiCorp.

³ ADM Associates, Inc. Evaluation Work Plan for 2021-22 HES and WHS Programs and 2020-2021 HERs Program (April 2022). Prepared for PacifiCorp.

⁴ Opinion Dynamics. PacifiCorp Washington Low Income Weatherization: Program Evaluation for Program Years 2018-2019 (July 25, 2023).

⁵ ADM Associates, Inc. Evaluation, Verification and Measurement Report. Home Energy Reports Program: Washington (April 13, 2022). Prepared for Pacific Power.

⁶ Cadmus, VuPoint Research. 2020-2021 Washington Wattsmart Business Program Evaluation (January 2023). Prepared for Pacific Power.

⁷ Uniform Methods Project of Determining Energy Efficiency Program Savings, Protocols, NREL, Cadmus Group, US DOE. <https://www.nrel.gov/docs/fy18osti/70472.pdf>

Plan for Energy Efficiency,⁸ the SEE Action Energy Efficiency Program Impact Evaluation Guide,⁹ and the International Performance Measurement and Verification Protocols (IPMVP).¹⁰

AEG developed checklists to ensure its reviews of the impact, process, and cost-effectiveness analyses were consistent across programs and focused on critical components aligned with industry best practices, including:

- Presentation of appropriate background information, which defines the scope of EM&V activities across the portfolio.
- Guidance for the planning of evaluations, including timing, budgets, goals, and guidelines for the level of rigor required.
- Establishment of reasonable guidelines around levels of precision and error for savings estimation, which includes the consideration of competing constraints on budgets and timing.
- Presentation of well-documented guidelines regarding the collection and storage of measure data.
- Guidance regarding timing, frequency, and common goals of process evaluation.
- Guidance regarding the inclusion of actionable recommendations.
- Recommendations to incorporate EM&V findings into program implementation in real-time.
- Guidance regarding analyzing the cost-effectiveness of programs.

Figure 3-1 shows the criteria included in the process and impact evaluation checklists. We also present the ratings used to evaluate the EM&V methods and results based on alignment with industry best practices.

⁸ National Energy Efficiency Best Practices Study, Volume S – Cross Cutting Best Practices and Project Summary, Quantum Consulting for Pacific Gas and Electric Company, 2004. http://www.eebestpractices.com/pdf/BP_Summary.pdf

⁹ SEE Action Energy Efficiency Program Impact Evaluation Guide, 2012. https://www4.eere.energy.gov/seeaction/system/files/documents/emv_ee_program_impact_guide_0.pdf

¹⁰ Efficiency Valuation Organization, International Performance Measurement and Verification Protocols. <https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp>

Figure 3-1 Ratings and Criteria for EM&V Review

<p>Ratings: Unknown (U) – Not enough detail to rate Inappropriate (I) – Does not meet minimum Minimum (M) – Meets minimum requirement Appropriate (A) – Aligns with best practice Gold Standard (GS) – Exceeds best practice</p>	<p style="text-align: center;">Impact Criteria</p> <p>Data Validation</p> Data sources described Cleaning and validation described Tracking Database Review <p>Sample Design</p> Stratification Sample Sizes Representativeness Expansion Method <p>Primary Data Collection</p> Participant/Non-participant Surveys Interviews Onsite/virtual Metering <p>Reporting</p> Transparency Documentation Recommendations <p>Approaches and Methods by Measure</p> Appropriateness of M&V Approach Appropriateness of EM&V Approach COVID-19 Effects Timing of Activities Results Presentation
<p style="text-align: center;">Process Criteria</p> <p>Data Validation</p> Data sources described Cleaning and validation described Tracking Database Review <p>Program Descriptions</p> Program Challenges and Successes Database Management <p>Sample Design</p> Stratification Sample Sizes Representativeness <p>Primary Data Collection</p> Participant/Non-participant Surveys Interviews <p>Analysis & Reporting</p> Results presentation Confidence & precision	

In the following subsections, we present a summary of our results for each program.

Home Energy Savings

AEG reviewed the 2021-2022 Home Energy Savings program evaluation report, prepared by ADM Associates in October 2023. AEG found that the process and impact EM&V approaches to evaluating the Home Energy Savings program seemed appropriate and generally conformed with industry best practices. However, the report lacked detailed documentation throughout the impact and process portions of the evaluation, leading to us giving numerous key metrics a “Minimal” or ‘Unknown’ rating and “Minimum” and ‘Appropriate’ scores for the process and impact evaluation sections.

The evaluation report provided minimal detail about the sample design. It also did not adequately define the sample frame, how the evaluator developed the frame via data cleaning, or how the frame compared to the population of participants. There was also no discussion about the representativeness of the survey respondents relative to the target population or the precision of the survey results.

See the complete Home Energy Savings EM&V verification [checklist](#).

Low Income Weatherization

AEG reviewed the 2018-2019 Low Income Weatherization program evaluation report prepared by Opinion Dynamics in July 2023. Overall, AEG found that the EM&V approaches used for both the process and impact evaluations were appropriate and conformed with industry best practices. The report was well organized and clearly written, with excellent documentation of the various methods used in the analysis, which led to an overall rating of “Gold Standard.”

See the complete Low Income Weatherization EM&V verification [checklist](#).

Home Energy Reports

AEG reviewed the 2020-2021 Home Energy Reports evaluation report prepared by ADM Associates in April 2022. AEG found that, overall, the EM&V approaches used for the process and impact evaluations met industry gold standards based on the methods used to estimate savings, conduct customer surveys, and the amount of interim and final information they provided (e.g., validity testing and model specifications, customer counts, etc.). In particular, the report did an excellent job of documenting all steps in the analysis. Overall, we assigned a rating of “Gold Standard” to this evaluation.

See the complete Home Energy Reports EM&V verification [checklist](#).

Wattsmart Business

AEG reviewed the 2020-2021 Wattsmart Business program evaluation report prepared by the Cadmus Group in January 2023. AEG found that, overall, the EM&V approaches used for the process and impact evaluations were appropriate and conformed with industry best practices. In particular, the report did an excellent job of documenting the sample design and the engineering analysis. The report also made clear that the process results were based on small sample sizes. Overall, we assigned a rating of “Gold Standard” to this evaluation.

See the complete Wattsmart Business EM&V verification [checklist](#).

Evaluation Cost-Effectiveness Review

AEG conducted a high-level review of the cost-effectiveness analysis presented in evaluation reports, focusing on consistency with accepted Washington methodology and sourcing of inputs. To perform this review, AEG relied on the following sources:

- PacifiCorp’s Demand-Side Management 2022-2023 Business Plan – Washington
- PacifiCorp’s 2021 Integrated Resource Plan (IRP) Volume 1 (September 1, 2021)
- Washington Administrative Code Section 480-109-100 (8)¹¹
- The Northwest Power and Conservation Council’s (Council) 2021 Power Plan, specifically the cost-effective methodology in the supporting documentation¹².

Based on a review of these sources, AEG developed the checklist shown in Table 3-1. The checklist is designed as a structured guide to check consistency with Commission guidance,

¹¹ <https://apps.leg.wa.gov/WAC/default.aspx?cite=480-109-100>

¹² https://www.nwccouncil.org/2021powerplan_cost-effective-methodology/

Council methodology, and best practices for documentation and data presentation. Cost-effectiveness test definitions are provided in Table 3-3.

Table 3-1 Evaluation Report Cost-Effectiveness Checklist

Question	Checklist
Is the Total Resource Cost Test, as modified by the Council, the primary cost-effectiveness test?	ü
Are cost-effectiveness results also reported from the Utility Cost Test perspective?	ü
Do benefits include a regional 10% conservation credit (PTRC test only)?	ü
Did PacifiCorp appropriately summarize measure-level detail to develop program cost-effectiveness inputs?	ü
Are line losses consistent with values used to report portfolio-level savings?*	ü
Are discount and inflation rates taken from PacifiCorp's IRP?*	ü
Do benefit-cost ratios fall into expected ranges based on program type?	ü
Does Home Energy Reports analysis appropriately account for lifetime savings?	ü

* Reviewed only for evaluation reports that covered 2022 and/or 2023.

AEG found that PacifiCorp's Home Energy Savings, Wattsmart Business, and Low Income Weatherization evaluation reports aligned with Commission guidance, Council methodology, and industry best practices for cost-effectiveness analysis, as shown in the checklist below.

Table 3-2 Evaluation Report Cost-Effectiveness Findings

Question	Home Energy Savings	Wattsmart Business	Low Income Weatherization
Is the Total Resource Cost Test, as modified by the Council, the primary cost-effectiveness test?	Yes	Yes	Yes
Are cost-effectiveness results also reported from the Utility Cost Test perspective?	Yes	Yes	Yes
Do benefits include a regional 10% conservation credit (PTRC test only)?	Yes	Yes	Yes
Did PacifiCorp appropriately summarize measure-level detail to develop program cost-effectiveness inputs?	Yes	Yes	Yes
Do line losses match values used to report portfolio-level savings?*	No (value is rounded)	N/A	N/A
Do discount and inflation rates match PacifiCorp's IRP?*	Yes	N/A	N/A
Do benefit-cost ratios fall into expected ranges based on program type?	Yes	Yes	Yes
Does Home Energy Reports analysis appropriately account for lifetime savings?	N/A	N/A	N/A

* Only reviewed for evaluation reports that cover 2022 and/or 2023.

Annual Report Cost-Effectiveness Review

The reviewer's objective was to assess whether the methodology, inputs, and assumptions used to determine cost-effectiveness were appropriate and consistent with Washington Utilities and Transportation Commission (WUTC or Commission) guidance and industry standards, and best practices. To verify the 2022 Annual Report cost-effectiveness analysis, AEG reviewed specific inputs (e.g., avoided costs, line losses, and discount rates), outputs, and documentation to

validate and assess the appropriateness of cost-effectiveness analysis. A detailed review of cost-effectiveness model algorithms was outside the scope of this review.

To perform this review, AEG relied on the following sources:

- PY2022 Annual Report Cost-Effectiveness Memos and Input Spreadsheets
- PacifiCorp’s 2022-2023 Biennial Conservation Plan for its Washington Service Area
- PacifiCorp’s 2021 Integrated Resource Plan (IRP) Volume 1 (September 1, 2021)
- Washington Administrative Code Section 480-109-100 (8)
- The Northwest Power and Conservation Council’s (Council) 2021 Power Plan, specifically the cost-effective methodology in the supporting documentation¹³.

PacifiCorp Washington reports on the cost-effectiveness of its energy efficiency programs and portfolio from five different perspectives, consistent with industry standards and Commission guidance. The National Action Plan for Energy Efficiency (NAPEE) guide for Understanding Cost-Effectiveness of Energy Efficiency Programs¹⁴ provides an overview of the industry-standard test perspectives (Table 3-3). A “benefit-to-cost ratio” can be calculated for each perspective by dividing the net present value benefits by the net present value costs, with categories of applicable benefits and costs varying by perspective. If this ratio is greater than or equal to 1.0 (i.e., benefits meet or exceed costs) from a given perspective, the program or portfolio is considered cost-effective from that perspective.

Table 3-3 Overview of Standard Cost-Effectiveness Tests¹⁵

Test	Acronym	Key Question Answered	Summary Approach
Participant cost test	PCT	Will the participants benefit over the measure life?	Comparison of costs and benefits of the customer installing the measure
Program administrator cost test	PACT	Will utility bills increase?	Comparison of program administrator costs to supply-side resource costs
Ratepayer impact measure	RIM	Will utility rates increase?	Comparison of administrator costs and utility bill reductions to supply side resource costs
Total resource cost test	TRC	Will the total costs of energy in the utility service territory decrease?	Comparison of program administrator and customer costs to utility resource savings
Societal cost test	SCT	Is the utility, state, or nation better off as a whole?	Comparison of society’s cost of energy efficiency to resource savings and non-cash costs and benefits

PacifiCorp includes five perspectives in its cost-effectiveness analysis and reporting: the PCT, PACT, RIM, TRC, and the “PacifiCorp Total Resource Costs” (PTRC). Per Commission guidance, the PTRC test is the primary test used to assess the cost-effectiveness of the energy efficiency programs and portfolio. The PTRC is the TRC with an additional 10% adder on the benefits, consistent with Commission direction and the Council’s methodology.

¹³ https://www.nwccouncil.org/2021powerplan_cost-effective-methodology/

¹⁴ NAPEE’s Understanding Cost-Effectiveness of Energy Efficiency Programs, November 2008. www.epa.gov/sites/production/files/2015-08/documents/cost-effectiveness.pdf

¹⁵ NAPEE Guide page 2-2.

AEG developed the checklist shown in Table 3-4, designed as a structured guide to check consistency with Commission guidance, Council methodology, and best practices for documentation and data presentation.

Table 3-4 2022 Annual Report Cost-Effectiveness Checklist

Question	Checklist
Is the Total Resource Cost Test, as modified by the Council, the primary cost-effectiveness test?	✓
Are cost-effectiveness results also reported from the Utility Cost Test perspective?	✓
Do benefits include:	
Avoided energy costs	✓
Generation deferral costs	✓
Transmission deferral costs	✓
Distribution deferral costs	✓
Non-electric impacts, where quantifiable and attributable	✓
Regional 10% conservation credit (PTRC test only)	✓
Social cost of carbon	✓
Did PacifiCorp appropriately summarize measure-level detail to develop program cost-effectiveness inputs?	✓
Are load shape assignments reasonable?	✓
Are line losses consistent with values used to report portfolio-level savings?	✓
Are discount and inflation rates taken from PacifiCorp's 2021 IRP?	✓
Do benefit-cost ratios fall into expected ranges based on program type?	✓
Is the Low-Income Weatherization program removed from portfolio-level cost-effectiveness analysis?	✓

AEG found that PacifiCorp's 2022 Annual Report cost-effectiveness analysis aligned with Commission guidance, Council methodology, and industry best practices. However, an opportunity to enhance clarity was identified and is summarized in the Recommendations section below.

Avoided Costs

AEG reviewed PacifiCorp's 2022-2023 Business Plan for its Washington Service Area to determine whether the avoided costs included the components dictated by the Council's methodology. PacifiCorp derived energy efficiency avoided costs from the preferred portfolio in the 2021 IRP. Based on our review, we believe that the avoided costs incorporate several factors, including:

- Avoided Energy Costs
- Generation Deferral Costs
- Transmission Deferral Costs
- Distribution Deferral Costs
- Social Cost of Carbon

Discount and Inflation Rate

The 2022 Annual Report inflation and discount rates matched PacifiCorp's 2021 IRP values.

Non-Electric Impacts

AEG reviewed PacifiCorp’s 2022-2023 Biennial Conservation Plan for its Washington Service Area and the 2022-2023 Business Plan for its Washington Service Area and found that the 2022 Annual Report included three (3) quantified non-energy impacts:

- **10% Power Act Credit.** The 10% Northwest Power Act Credit is accounted for in the PTRC.
- **Quantifiable Environmental Externalities.** The portfolio incorporates the social cost of carbon as specified in Senate Bill 5116, Clean Energy Transformation Act (CETA). PacifiCorp’s 2021 IRP analyzed four different price scenarios that aligned with the social cost of greenhouse gases and established their target using the CETA-compliant preferred portfolio.
- **Quantifiable Non-Energy Impacts (NEIs).** Two types of NEIs were included in the 2021 IRP: (1) measure level NEIs from the Regional Technical Forum (RTF), including water/wastewater savings, avoided replacement (lighting), and health impacts of avoided wood smoke (heat pumps), and (2) program-level NEIs from the United States Environmental Protection Agency (US EPA) proxy value.
- **A third set of NEI values was developed by DNV on behalf of PacifiCorp and other Washington investor-owned utilities.** The values were not used in the 2021 IRP because they were less certain than the US EPA value. However, the DNV values replaced the EPA value for assessing cost-effectiveness for PacifiCorp’s 2022 portfolio. While outside of the current review, AEG notes that PacifiCorp updated DNV NEI values for the 2023 cost-effectiveness analysis based on feedback from its DSM Advisory Group.

Recommendations

In summary, AEG has the following recommendations.

- **Encourage high-quality reporting on sample design from program evaluators.** AEG determined that the HES 2021-2022 evaluation report met a minimum standard. However, the report would be more robust and valuable for designing future studies with better information about how the evaluator developed the sample frame and which customers were ultimately represented in their analysis.
- **Include cost-effectiveness analysis inputs and findings in the program evaluation reports.** The 2020-2021 Home Energy Reports evaluation report does not include cost-effectiveness analysis and findings. The Evaluation Work Plan for the 2021-2022 Home Energy Savings program, which includes Home Energy Reports, notes that cost-effectiveness will be calculated by a PacifiCorp-selected consultant and that the results will be included in ADM’s report. Cost-effectiveness analysis inputs and findings should be consistent with the accepted Washington methodology and presented in the evaluation reports.
- **Include descriptions of non-energy impact (NEI) assumptions in the 2022-2023 Business Plan.** The NEI value documentation does not make it clear what the source of the NEIs are. High-level documentation indicating NEIs come from the Regional Technical Forum (RTF) or a specific study would make it clear that the cost-effectiveness tests include all required components.

4 | TRACKING AND REPORTING

AEG verified the extent to which PacifiCorp accurately tracked and reported program performance metrics in its program tracking database, DSM Central (DSMC), and examined PacifiCorp's program tracking procedures for accuracy and procedural reliability. Specifically, AEG determined how DSMC (1) was configured to capture program-critical information and (2) accurately captured the information for which it was configured.

AEG conducted the following activities to make these determinations:

- Reviewed 2022 and 2023 DSMC extracts for program-critical information, missing or inadequate data in key fields, and duplicated records.
- Performed a high-level comparison of savings and participant counts as tracked in PacifiCorp's 2022 tracking system and reported in portfolio reports to determine their consistency and identify inaccuracies.¹⁶
- Assessed the extent to which PacifiCorp or the EM&V contractors adequately documented values used to estimate program energy savings and other metrics in the program records through engineering desk reviews.

The following sections summarize findings related to these goals and provide recommendations for improvement.

Summary of Tracking and Reporting Validation Findings

The subsections below present our findings related to program data collection and tracking and the program tracking processes.

Tracking and Reporting Process

AEG interviewed program managers to learn about their current tracking and reporting procedures, focusing on any processes that have changed since the 2020-2021 biennial period verification. The 2022-2023 biennium verification found that the program managers generally followed robust data reconciliation and validation procedures across all transfer cadences, including weekly data transfers, monthly incentive reconciliations when generating incentive invoices, and quarterly extracts for program implementors to reconcile against internal tracking systems. Because PacifiCorp's Measure Library ties into DSMC, most measure inputs (e.g., savings) are imported automatically when projects are entered into the system.

One improvement mentioned in the interviews is that business contractors now work exclusively in the DSMC tracking system. Previously, these contractors provided PacifiCorp with data from their own internal tracking systems that PacifiCorp configured for DSMC. However, these contractors do not include the agencies through which the LIW program reaches eligible customers; PacifiCorp still manually enters information for LIW projects using the invoices provided by the agencies, which leaves room for errors.

The 2020-2021 biennium period verification also noted that PacifiCorp did not store detailed project data or backup documentation for most programs implemented by a third party. AEG confirmed that this was still the case as it went through the 2022-2023 verification process. As

¹⁶ Since the 2023 annual report was not completed by the time of the savings verification, AEG only reviewed the 2022 annual report for consistency.

mentioned in the [program manager interviews](#), the Wattsmart Business implementors work directly in DSMC; however, AEG found during its requests for inspection reports and program files for sampled projects that often this type of supporting documentation is not in DSMC. PacifiCorp indicated that a key cause of this is that projects are locked in DSMC after they are paid.

DSMC Review

Next, AEG reviewed the DSMC extracts to verify whether they included all program-critical information and assessed the quality of data in these fields. Finally, we developed a [checklist](#) based on the Summary of the National Energy Efficiency Best Practices study¹⁷ and our industry experience providing program tracking services to guide this exercise. Note that because of the verification timing, AEG was not able to conduct a full review of the final 2023 DSMC extract.

Key findings include the following:

- **Nearly all fields identified as program-critical were included in the 2022 and 2023 DSMC extracts.** These included appropriate program and project identifiers, including measure categories, types, and quantities; measure energy and demand savings and estimated useful lives; and information on costs and incentives required for cost-effectiveness calculations.
- **Most fields were useable and included few missing or erroneous records.** In particular, all measure description fields (e.g., “Measure Category,” “Measure Type,” “Measure Sub-Type”) were extremely clean. Accounting or payment records were clearly identified, as were records associated with post-inspection adjustments. The 2020-2021 report indicated that Home Type was missing for most Home Energy Savings records in the 2021 DSMC extract, but this field was thoroughly populated in both the 2022 and 2023 DSMC extracts, with only a minor number of measures missing the field. This information is critical for determining if PacifiCorp met its inspection targets for this program. (See Chapter 2 for further discussion)
- **There is room for minor improvement within the tracking system.** In the 2020-2021 Savings Verification Report, AEG described a concern that the “Managed By” field listed “Agency-LIW” for all Low Income Weatherization projects, and did not include the actual agency name. AEG suggested including the name of the agency and tracking the agency post-inspections in DSMC could help ensure that required inspection rate thresholds are met. In the 2022 and 2023 DSMCs, the name of the agency is listed under the ‘Primary Project Partner’ field, which alleviates the prior concern. That said, sub-programs and delivery streams are tracked in the current system through several fields. Currently, the upstream lighting component of HES is identified through the customer name (i.e., customer name = “Upstream”). The Small Business Lighting and Midmarket/Instance Incentives components of the Wattsmart business program can be identified through the “Managed By” field. Having a single field to house sub-program or delivery stream information would improve clarity and usability.

DSMC Accuracy

Through engineering desk reviews, AEG investigated whether PacifiCorp’s current tracking and reporting processes and procedures led to an accurate tracking system. For a sample of projects from HES, LIW, and WSB programs, AEG collected backup project files such as invoices and

¹⁷ National Energy Efficiency Best Practices Study, Volume S – Cross Cutting Best Practices and Project Summary, Quantum Consulting for Pacific Gas and Electric Company, 2004. http://www.eebestpractices.com/pdf/BP_Summary.pdf

savings calculation workbooks to confirm whether measure types, quantities, savings, and costs were entered correctly into the system. As described in detail in [Chapter 5](#), AEG found that the DSMC extracts aligned with the backup project documentation in nearly all cases, suggesting that PacifiCorp's quality control processes are effective at preventing errors when entering information into the database.

Annual Reporting Accuracy

AEG performed a high-level cross-check of project counts and savings by measure category between the 2022 annual report and the 2022 DSMC extract to determine whether PacifiCorp ultimately used the savings and projects reported out by DSMC to calculate cost-effectiveness. During this review, AEG did not find any discrepancies between the results reported by DSMC and the savings, measure counts, and estimated useful lives included in the 2022 annual reports for each program to calculate cost-effectiveness.

Recommendations

AEG offers the following recommendations for consideration.

- **Continue to improve the process by which WSB implementors work directly in the DSMC database.** A handful of 2022-2023 project files did not appear to be stored in DSMC as expected across several delivery channels, which led to some delays in the verification effort. Ultimately, AEG was able to collect most of the documentation needed to complete the verification, but it had to be tracked down through implementation contractors and subcontractors. PacifiCorp noted that it has contracted with a new delivery company and is transitioning them in at the time of this writing. They will be creating a new process with the new company, Evergreen Consulting Group, to ensure project documentation is available for all projects going forward.

5 | PORTFOLIO SAVINGS

To verify that PacifiCorp appropriately claimed savings during the 2022-2023 biennial period, AEG performed independent engineering desk reviews for a sample of projects from the HES, LIW, and WSB programs, and onsite visits with a sample of WSB participants. Consistent with the 2020-2021 savings verification methods, AEG excluded the Home Energy Reports program from these verification activities. The independent engineering desk reviews allowed AEG to check for systematic errors and other inconsistencies, while the site visits provided us with an opportunity to verify the installed measures and equipment for a sample of projects.

The following sections describe how AEG designed the desk review and site visit samples for each program, summarizing each activity's findings, and providing recommendations to improve program tracking, documentation, or evaluation practices. As noted above, this study is not intended to duplicate or replace impact or process evaluations of PacifiCorp's Washington energy efficiency programs and verification approaches, which is reflected in the sample sizes.

Sample Design

Table 5-1 shows the desk review sample design by program, measure group, and the portfolio level. AEG designed the desk review sample using the final 2022 DSMC extract and the draft 2023 DSMC extract.¹⁸ Within each program, AEG stratified by major measure category, with a focus on heat pumps installed through the HES program because of their substantial contribution to HES savings, while also investigating the backup documentation for non-heat pump measures. Similarly, while lighting measures comprised a large portion of the WSB savings, AEG also wanted to capture custom projects and other types of measures in the desk review sample.

For the HES and LIW programs, AEG randomly sampled projects within each of the identified measure groups. The samples for each program were designed to achieve a precision of at least $\pm 15\%$ at the 85% confidence level.

For the WSB program, AEG first took a census of large projects (first-year savings greater than 500 MWh), then took a random sample of remaining projects within each measure group. This process ensured that the sample included projects with large contributions to overall program savings, along with smaller projects that were more representative of the overall project population. Of the 28 sampled WSB projects, AEG completed onsite visits with five participants.

¹⁸ The reconciled DSMC extract for 2023 was not available when AEG was designing the sample.

Table 5-1 Desk Review Sample Design

Program	Measure Group	Population Count of Projects	Population MWh	Sampled Projects	Expected Precision	Confidence Level
Home Energy Savings	Non-Heat Pump	5,416	4,067	24	±15%	85%
	Heat Pump	1,553	3,572	24	±15%	85%
	Total	6,969	7,589	48	±11%	85%
Low Income Weatherization	All	237	416	22	±15%	85%
	Total	237	416	22	±15%	85%
Wattsmart Business	Custom	47	9,877	8	±24%	85%
	Lighting	217	11,219	15	±18%	85%
	Other	43	1,876	5	±33%	85%
	Total	307	22,973	28	±15%	85%
Total		7,513	30,978	98	≥ ±15%	85%

Summary of Findings

The following sections describe the engineering desk reviews and WSB onsite visits in greater detail and summarize the findings.

Engineering Desk Reviews

AEG collected all available backup documentation for the projects sampled for desk reviews, primarily invoices, savings calculation workbooks, measure specification sheets, and inspection reports. The desk reviews focused on verifying that the savings, costs, and other metrics reported in the DSMC extracts aligned with the information provided in the project documentation. To guide the desk reviews, AEG developed a [checklist](#) that divided the reviews into four parts:

- Project Documentation Verification
- Measure Verification
- Savings Verification

The documentation that AEG used for the desk reviews fell into several categories, including full project files, invoices, and inspection reports. With the exception of WSB lighting, AEG collected full project files and verified all three key categories for the projects in its desk review sample, as shown in Table 5-2.

Table 5-2 Desk Review Documentation

Program (Subcomponent)	Documentation Received	Proportion of Sample Verified	Project Documentation	Measure Type	Savings
HES	Program files (invoices)	100%	✓	✓	✓
LIW	Agency and third-party inspection reports	100%	✓	✓	✓
WSB (Lighting)	Program files (invoices, savings verification reports)	100%	✓	✓	✓
WSB (Custom)		100%			
WSB (Other)		100%			

Key findings included the following.

- **HES and LIW measures were entered correctly into DSMC in most cases and aligned with the values deemed in the Measure Library.** AEG replicated the savings for all HES and LIW measures included in the sample for desk reviews and found that savings aligned between the DSMC extract and the deemed savings provided in the Measure Library. However, a few issues were noted:
 - The “Measure Effective Date” field in the DSMC extract was blank for some HES projects. AEG was able to verify whether the correct deemed savings entry in the Measure Library was used by examining the date of project completion from available project documentation, such as invoices. AEG was unable to find the project completion date for one project (RESWA_412986) but was able to verify the correct Measure Library entry was used for the claimed savings.
- **Savings for deemed measures implemented through WSB were found to align with assumptions in the Measure Library.**
- **Overall, PacifiCorp and its implementation vendors appeared to use industry-standard practices and engineering best judgement to document and estimate savings for WSB custom projects and WSB projects that utilize an approved savings calculator.** After a high-level review of the project documentation, AEG identified some issues:
 - For two projects (iWBPPWA_510874 and iWBPPWA_507240) that involved the installation of irrigation pump VFD, AEG found that the horsepower rating of the installed VFD per the project invoices was different from the horsepower rating of the pump entered in the calculator. As such, it is unclear whether the correct pump horsepower rating was used in the calculator for these projects. However, when AEG changed the pump horsepower rating used in the calculator to match the VFD horsepower rating per the invoices, the project savings did not change significantly.
 - PacifiCorp and its implementer were unable to provide files containing live savings calculations for custom project WBWA_504044. As such, AEG could not review the savings calculations for this project. This project was also missing invoice documentation for the installed measures; however, an invoice is not required for this type of energy management project.

- For custom project WBWA_385369, the provided savings calculation file only contained the baseline calculations but not the efficient case calculations. As such, savings calculation documentation for this project is incomplete. Furthermore, the baseline kWh consumption per the provided file appears to be smaller than the project's total savings. This suggests incomplete baseline calculations were also provided for AEG's review.
- For three custom projects (WBWA_425984, WBWA_385369, and WBWA_32373), demand (kW) savings were not calculated in the provided savings calculation files. Instead, demand savings were estimated in the incentive calculator without an explanation of the methodology or assumptions behind the calculation.
- For custom project WBWA_425984, which has a total of 19 entries in the DSMC extract, AEG noted that one of the entries has a demand (kW) savings of zero, but the project files indicate a savings of 2 kW for that measure.
- **When documentation was provided, it generally aligned with the information included in the DSMC extract.** AEG found that information such as facility type, project numbers, site address, measure types, and savings aligned with the inputs in the DSMC extract in nearly all cases across HES, LIW, and WSB programs when the information was provided in the backup documentation and readily available. Exceptions to this finding are noted above.
- **These findings may not apply to projects for which documentation was not readily available, as noted above.** Based on the documentation we have received, we do not believe it necessary to recommend a change in savings; however, our findings are limited to the projects we were able to verify.

WSB Onsite Visits

AEG conducted onsite visits with five customers who implemented projects through the WSB program. During the onsite visits, AEG investigated equipment installation and operations and verified parameters key to energy savings calculations for each measure.

Once onsite, AEG directly verified that all equipment claimed in the DSMC extracts was installed and operating as expected and in alignment with the methods and parameters provided in the project files. AEG does not recommend making any adjustments to savings based on the findings from our site visits.

Recommendations

Please consider the following recommendations.

- **Ensure the “Measure Effective Date” field in DSMC is filled in.** This field is important for savings verification, and AEG found several HES projects where the field was blank.
- **Provide supporting documentation for assumptions and inputs used in savings calculations.** Particularly for the WSB custom projects involving irrigation pump VFD measures, AEG noted that the pump curve and annual operating hours are important inputs to the savings calculator. However, there was no documentation that indicates the origin of these inputs or how they were derived, which makes it difficult to verify their validity and reasonableness.
- **Require more robust documentation of demand (kW) savings calculations.** AEG noted several WSB custom non-lighting projects that did not include demand savings calculations

in the live savings calculation files. Program evaluators would require complete and robust documentation to review the methodology and assumptions that ultimately determine the claimed savings values.

- **Encourage program implementers to provide live calculations in Excel format (rather than PDF format) for WSB projects in the project file that is uploaded to DSMC.** The savings calculations for some 2022 and 2023 projects that utilize an approved calculator were provided to AEG for review in PDF format. For documentation and savings verification, it is necessary to have the savings calculation in the original Excel format, and AEG had to request this from the program implementer.

A | PROJECT INSPECTION CRITERIA

Home Energy Savings Program

Table A-1 HES Inspection Status by Measure – Downstream Delivery Mechanism

Inspections	No Inspections
Central air conditioning duct sealing	Central air conditioners
Duct sealing and insulation	Clothes washers
Heat pumps	Evaporative cooler
Heat pump water heaters	Hybrid/heat pump clothes dryers
Insulation	Line voltage thermostats
Windows	New manufactured homes
	Smart thermostats

Measures that receive inspections are performed by program administrator staff for a sample of single-family, manufactured, multifamily, and new homes projects. Specific inspection rates required for each WSB building type remain confidential to protect program integrity.

Wattsmart Business

Table A-2 Wattsmart Business Inspection Status – By Project Type and Size (2022-2023)

Lighting Projects (Typical Upgrades)

Incentive above high threshold*

- Retrofits - 100 percent pre/post-installation site or virtual inspections of all projects with incentives over a specified dollar amount. Project cost documentation reviewed for all projects.
- New construction - 100 percent post-installation site inspections of all projects with incentives over a specified dollar amount.

Incentive between low and high thresholds*

- Retrofits - 100 percent pre-installation site or virtual inspections of all projects with incentives between the low and high threshold amounts. Note inspections may be waived on a case by case basis for projects completed by Premium Vendors and below a threshold that is between the low and high threshold. A percent of post-installation site or virtual inspections by program administrator of projects with incentives between the low and high threshold amounts. Project cost documentation reviewed for all projects. For lighting controls only retrofit projects, 100 percent post-installation site or virtual inspections.
- New construction – 100 percent post-installation site or virtual inspections of projects with incentives between the low and high threshold amounts.

Incentive below low threshold*

- A percent of post-installation site or virtual inspections by program administrator of projects with incentives under a specified dollar amount.

Lighting – Small Business

- Onsite or virtual post-incentive inspections are performed by third-party program administrator on a minimum of X* percent of approved projects for each approved Small Business Vendor based on project count per calendar year.
- Onsite or phone surveys will be conducted with participating customers to ensure documentation accuracy, installation and product quality, and customer satisfaction.

Lighting – Midmarket/Instant Incentives

- Third party program administrator conducts regular spot checks on a sampling of approved projects after incentive processing. Inspections will include phone, virtual and onsite inspections.
- All projects with customer incentives over \$X* will receive an onsite or virtual inspection.
- A minimum of X* percent sampling of all remaining projects will be selected for phone inspections. An additional X* percent sampling will be selected for onsite or virtual inspections.
- For typical upgrades, required inspections are performed by a third-party consultant. For the small business and instant incentive offers, required inspections are performed by the program administrator.

Non-Lighting Projects

- Typical upgrades/listed measures where savings are deemed
- 100 percent of applications with an incentive that exceeds a specified dollar amount will be inspected (via site or virtual inspection) (typically by program administrator).
- A minimum of a specified percent of remaining non-lighting applications will be inspected, either in person or via telephone interview, (typically by program administrator).
- Typical upgrades/listed measures where savings are determined using a simplified analysis tool)
- 100 percent of applications with project savings that exceeds a specified threshold will be inspected (via site or virtual inspection) (typically by program administrator).
- A minimum of a specified percent of remaining non-lighting applications will be inspected, either in person or via telephone interview, (typically by program administrator).

Custom Projects

- 100 percent pre/post installation inspections, invoice reconciled to inspection results. Site or virtual pre/post inspections are required for projects with savings over a specified threshold. For projects with savings below threshold, inspection information may be collected by phone or email.
- No pre-inspection for new construction.

- Inspections are conducted by the program administrator

* Specific thresholds and inspection rates are omitted from this table to protect program integrity.

B | EM&V REVIEW CHECKLISTS

Home Energy Savings

Table B-1 HES Process Evaluation Checklist – 2021-2022 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	M	Data sources and survey methods described as online surveys, including general population for process and impact.
Cleaning and validation described	M	Home type validation controls are included in the measure selection process.
Tracking Database Review	GS	Reviewed a census of program tracking data, associated savings values, input assumptions and calculations contained in the ML referenced files provided by PacifiCorp.
Program Descriptions		
Program Challenges and Successes	A	
Database Management	A	
Sample Design		
Stratification	M	HVAC measure stratified by measure type as reported in table 3-5.
Sample Sizes	M	Sample frame not provided. Only number sampled and surveys returned.
Representativeness	U/I	Response rates provided; no comparison to census or population; no discussion of weighting; not clear if 90/10 applied to measure review and survey or measure review only.
Primary Data Collection		
Participant/Non-participant Surveys	A	General customer survey, energy kit participant survey
Interviews	A	Interviews with implementers, staff
Analysis & Reporting		
Results presentation	A	
Confidence & precision	U	No discussion of confidence and precision of the survey results.
Overall	M	Need more insight into representativeness and precision.

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Table B-2 HES Impact Evaluation Checklist – 2021-2022 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	GS	
Cleaning and validation described	GS	Cleaning and validation discussed for each measure
Tracking Database Review	GS	Reviewed a census of program tracking data, associated savings values, input assumptions and calculations contained in the Measure Library files provided by PacifiCorp
Sample Design		
Stratification	A	Stratified by measure
Sample Sizes	A	Several measures involve a census. When sampled, sample sizes are listed but not the sample criteria or the sample frame
Representativeness	M	90/10 for all measures; limited detail provided
Expansion Method	A	
Primary Data Collection		
Participant/Non-participant Surveys	A	General customer survey, energy kit participant survey
Interviews	NA	Not conducted for this evaluation
Onsite/virtual	NA	Not conducted for this evaluation
Metering	NA	Not conducted for this evaluation
Reporting		
Transparency	A	
Documentation	A	Other than the sample frame issues above; well documented
Recommendations	A	
Approaches and Methods by Measure		
Appropriateness of M&V Approach	A	Deemed savings using RTF
Appropriateness of EM&V Approach	GS	UES review all measures, additional billing analysis for HVAC measures. Surveys to determine ISRs for energy kits and upstream lighting
COVID-19 Effects	U	Mentioned COVID in the Impact Evaluation section but provided limited high-level information on how COVID impacted savings. No discussion on whether COVID effects were accounted for in impact estimation approach.
Timing of Activities	A	
Results	A	
Overall	A	Would like to see more discussion regarding the sample design and the impact of COVID

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Low Income Weatherization

Table B-3 LIW Process Evaluation Checklist 2018-2019 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	GS	Program tracking data, participant consumption data, monthly external payment records, and inputs for RIMS-II Model
Cleaning and validation described	GS	Merged data with participant tracking data and removed invalid and outlier consumption values.
Tracking Database Review	GS	Each program year's dataset was reviewed for completeness, consistency, and compliance with the provided MEASURE LIBRARY files
Program Descriptions		
Program Challenges and Successes	A	
Database Management	A	
Sample Design		
Stratification	N/A	Census, no stratification required
Sample Sizes	GS	Census
Representativeness	GS	Achieved required survey completes for 90/10
Primary Data Collection		
Participant/Non-participant Surveys	A	Participant Survey with a total of 184 participants
Interviews	A	Interviews with program staff, total of 31
Analysis & Reporting		
Results presentation	A	
Confidence & precision	GS	90/10
Overall	GS	

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Table B-4 LIW Impact Evaluation Checklist 2018-2019 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	GS	DSMC and MEASURE LIBRARY data pulls and reports, billing data, weather data, and other program data and verification, as necessary. Uses LFER Model to determine ex-post net program savings.
Cleaning and validation described	GS	Program tracking data and billing data cleaned; all steps described. Consumption data cleaning steps described.
Tracking Database Review	GS	Each program year's dataset was reviewed for completeness, consistency, and compliance with the provided MEASURE LIBRARY files. Tracked at measure level and used to identify program participants and measures they had installed
Sample Design		
Stratification	N/A	All participants that had the necessary data were included
Sample Sizes	N/A	
Representativeness	GS	
Expansion Method	N/A	
Primary Data Collection		
Participant/Non-participant Surveys	A	Participant survey
Interviews	N/A	
Onsite/virtual	A	Telephone survey
Metering	N/A	
Reporting		
Transparency	A	
Documentation	A	
Recommendations	A	
Approaches and Methods by Measure		
Appropriateness of M&V Approach	GS	Single measure ex ante value per home representing the bundled effect of all installed measures; based on previous evaluation reports
Appropriateness of EM&V Approach	GS	Billing analysis for energy savings; difference in difference vs. comparison group for payment analysis, RIMS II for economic analysis
COVID-19 Effects	M	Mentions economic factors the industry is experiencing post-COVID
Timing of Activities	A	
Results	A	
Overall	GS	

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Home Energy Reports

Table B-5 HER Process Evaluation Checklist 2020-2021 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	U	Assuming that they used the program tracking data cleaned as part of the impact evaluation, but should be explicitly stated.
Cleaning and validation described	U	Assuming that they used the program tracking data cleaned as part of the impact evaluation, but should be explicitly stated.
Tracking Database Review	U	Assuming that they used the program tracking data cleaned as part of the impact evaluation, but should be explicitly stated.
Program Descriptions		
Program Challenges and Successes	A	Interviewed PacifiCorp and implementation program staff and summarizes successes with the program.
Database Management	U	Assuming that they used the program tracking data cleaned as part of the impact evaluation, but should be explicitly stated.
Sample Design		
Stratification	GS	Type of survey received (treatment only) and treatment/control designation.
Sample Sizes	GS	
Representativeness	GS	Random sample from treatment and control populations.
Primary Data Collection		
Participant/Non-participant Surveys	GS	Participant Survey
Interviews	A	Interviews with PacifiCorp and implementation program staff
Analysis & Reporting		
Results presentation	GS	
Confidence & precision	A	No precision provided around results of the participant survey. Stated in the text whether there were significant differences between treatment- and control-group responses.
Overall	GS	

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Table B-6 HER Impact Evaluation Checklist 2020-2021 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	GS	Gathered monthly billing data for a year pre-treatments and through 2020 and 2021.
Cleaning and validation described	GS	Provided detailed cleaning steps and demonstrated pre-period balance between treatment and control groups.
Tracking Database Review	N/A	
Sample Design		
Stratification	N/A	
Sample Sizes	N/A	Billing analysis included the population of treatment and control customers.
Representativeness	N/A	
Expansion Method	N/A	
Primary Data Collection		
Participant/Non-participant Surveys	GS	Conducted a survey with treatment and control customers to determine upstream lighting impacts.
Interviews	N/A	
Onsite/virtual	N/A	
Metering	GS	Gathered monthly billing data for a year pre-treatments and through 2020 and 2021.
Reporting		
Transparency	GS	Detailed methodologies, include cleaning steps, and provided detailed analysis results by year and wave.
Documentation	GS	
Recommendations	A	
Approaches and Methods by Measure		
Appropriateness of M&V Approach	A	Monthly estimates of savings calculated using a difference-in-differences regression analysis using monthly billing data that included all program treatment and control customers by wave. Evaluator noted concerning differences in customer counts.
Appropriateness of EM&V Approach	GS	Estimates of savings calculated by modeling calendarized monthly billing data using a difference-in-differences panel regression model following the UMP. Tested both linear regression with fixed effects and post-only regression models to investigate impact-sensitivity to model specification. Accounted correctly for uplift.
COVID-19 Effects	GS	Month-by-year fixed effects controlled for the naturally-occurring changes in consumption over time, including the impacts of COVID-19, so that differences reflected true program-drives changes to consumption. Tested the impact of a standalone COVID indicator.
Timing of Activities	GS	Collected sufficient post-period data.
Results	GS	Results appear reasonable. Although the re-randomized waves saved more in their first year of treatment than their second, ADM clearly shows that per-household consumption was substantially higher in the first year, likely

driven by COVID. ADM also notes that lower-than-typical savings is likely driven by included previously treated customers in the control groups.

Overall **GS**

Wattsmart Business

The following tables summarize AEG’s review of the Wattsmart Business process and impact evaluations.

Table B-7 WSB Process Evaluation Checklist 2020-2021 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	GS	Includes tracking database, participant/non-participant surveys, annual report
Cleaning and validation described	A	Removed “Don’t Know” and “Refused” responses from survey sampling frame, also marking notable response options
Tracking Database Review	GS	Cadmus team reviewed tracking database to ensure participant number and report savings matched annual reports
Program Descriptions		
Program Challenges and Successes	A	
Database Management	A	
Sample Design		
Stratification	GS	Team selected sample of sites from PacifiCorp program database and stratified distribution of measures mostly by end-use type
Sample Sizes	A	Fell short of target number of completed surveys
Representativeness	A	
Primary Data Collection		
Participant/Non-participant Surveys	GS	Online participant surveys, telephone partial participant surveys, and non-participant
Interviews	GS	Program staff, administrators, and trade allies
Analysis & Reporting		
Results presentation	GS	
Confidence & precision	U	Not listed
Overall	GS	

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

Table B-8 WSB Impact Evaluation Checklist 2020-2021 Report

Criteria	Rating	Comments/Questions
Data Validation		
Data sources described	A	
Cleaning and validation described	A	
Tracking Database Review	GS	Validated the accuracy of data in the program tracking database and whether the results matched the annual reports
Sample Design		
Stratification	GS	Team selected sample of sites from PacifiCorp program database and stratified distribution of measures mostly by end-use type
Sample Sizes	A	Out of 639 unique projects, Cadmus team evaluated 100 projects that represent 25% of 2020-2021 programs
Representativeness	A	Designed to achieve 80/20 per stratum and 90/10 at nonresidential portfolio level.
Expansion Method	GS	
Primary Data Collection		
Participant/Non-participant Surveys	GS	Participant, partial participant and nonparticipant surveys
Interviews	GS	Where applicable, conducted a phone interview with facility personnel to gather information such as equipment types replaced and hours of operation
Onsite/virtual	A	Supplemental virtual assessments
Metering	N/A	
Reporting		
Transparency	GS	
Documentation	GS	Reviewed the reported documentation to verify that the quantity and specifications of equipment receiving incentives matched the associated reported energy-savings calculations and confirmed that installed equipment met program eligibility requirements
Recommendations	GS	Ties recommendations to conclusions
Approaches and Methods by Measure		
Appropriateness of M&V Approach (IPMVP)	GS	Used deemed savings, measure specific calculator workbooks or models,
Appropriateness of EM&V Approach	GS	Virtual assessments and engineering analysis. Reviewed all available calculations and inputs, verified reported documentation with customers and collected site specific data where possible
COVID-19 Effects	GS	Asked customers if hours of operation were affected by COVID
Timing of Activities	A	
Results	GS	
Overall	GS	

Ratings: Unknown (U), Inappropriate (I), Minimum (M), Appropriate (A), Gold Standard (GS)

C | TRACKING DATABASE REVIEW CHECKLIST

Table C-1 Tracking Database Review Checklist

Metric Category	Data Element	DSMC Field
Identifiers	Program Number; Program Name	Program Name
	Project ID	External Project ID
	Application Number	Application Number
	Sub-Program	(Included in program name)
	Selection for M&V	Number of Measure Library
	Implementor or Delivery Mechanism	Managed By; Customer Name = "Upstream"
Measure Descriptors	Measure Category	Measure Category
	Measure Type	Measure Type
	Measure Sub-Type	Measure Sub-Type
	Measure Name	Measure Name
	Measure Custom Name	Measure Custom Name
	Quantity	Quantity
	Quantity Units	Unit
Savings	kWh savings	kWh/Yr Savings
	kW savings	kW (Savings)
	Measure Life	Measure Cost
Costs	Measure Cost	Reported Measure Cost; Report Cust CoPay; Admin Cost
	Incentive Amount	Customer Incentive; Partner Incentive
	Cost Recovery Date	Cost Recover Date

D | DESK REVIEW CHECKLIST

Table D-1 Desk Review Checklist

Review Category	Review Element
Project Documentation Verification	Complete Project Doc? (1/0)
	Info Rating (1-5)
	Project # Match? (1/0)
	Site Match?
	Facility Type
	C&I: Evidence of Inspection? (1/0)
	C&I: Inspection Report Description?
	C&I: Verification Report Complete?
Measure Verification	Measure Description
	Type Match? (1/0)
	Quantity Match? (1/0)
Savings Verification	kWh Match? (1/0)
	UES Match?
	Measure Life Match? (1/0)
	Savings Calc Type (From Measure Library)
	(Deemed Savings Measure) Right Savings Chosen?
	(Deemed Savings Measure) Deemed Value Up to Date?
	(Deemed Savings Measure) UES*Qty Track Savings?
	(Calculated Savings Measure) Appropriate Calculator Provided?
	(Calculated Savings Measure) Inputs Reasonable?
	(Calculated Savings Measure) Data Methods
	(Custom Savings Measure) Inputs Reasonable?
(Custom Savings Measure) Measured Data for Baseline?	
(Custom Savings Measure) Measured Data for EE Case?	
Costs and Incentives Verification	Cost Match? (1/0)
	Incentive Match? (1/0)
	Incentive <= Measure Cost?
	Invoice Attached? (1/0)
	Invoice Date
	True Incentive Percentage
	Project Cap Percentage

A decorative graphic element consisting of a horizontal line that steps up twice and then continues horizontally to the right. The line starts as a purple line, steps up to a darker purple line, and then steps up to an orange line.

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