Evaluation of the Hawai‘i Energy Conservation and Efficiency Programs

Calendar Year 2024

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EXECUTIVE SUMMARY

This report presents the results of all completed or partially completed Evaluation, Measurement, and Verification (EM&V) related activities associated with the Hawai'i Energy Conservation and Efficiency Programs (Hawai'i Energy programs) in the calendar year 2024 (CY24). Further, it summarizes the most critical findings from completed CY24 EM&V activities, focusing on implications for the Hawai'i Energy programs.

The EM&V work conducted for CY24 contributes to three overarching research objectives:

- **Verification of accomplishments:** Verifying Hawai'i Energy's program year 2022 (PY22) achievements.
- **Robustness of savings approaches:** Updating and improving approaches used to estimate savings for Hawai'i Energy's programs and measures.
- **Program planning:** Using results to inform future program planning.

Approach

The EM&V-related research activities for CY24 were determined in consultation with the Hawaii Public Utilities Commission (HPUC) and the Energy Efficiency Manager (EEM).

The EM&V Contractor (Applied Energy Group [AEG][1]) engaged in four research activities in CY24:

- **Completed**: Reviewing and updating the PY24 Technical Reference Manual (TRM)
- **Completed**: Verifying Hawai'i Energy's PY22 program portfolio
- **Initiated**: Verifying Hawai'i Energy's PY23 program portfolio
- **Initiated**: Reviewing and updating the PY25 TRM

AEG used various research and analysis methods. Table ES-1 summarizes the primary methods employed for each completed or initiated EM&V research activity.

Table ES-1 Summary of EM&V Research Activities & Methods for Work Completed or Initiated in CY24

EM&V Research Activity	Status at the end of CY24	Research and Analysis Methods	
PY24 TRM Major Update	Completed	• TRM review • Measure/content prioritization	• Benchmarking analysis • TRM updates
PY22 Verification	Completed	• Sample extrapolation • Engineering desk reviews • Business Custom (CBEEM) on-site visits	• Total resource benefit (TRB) analysis • Low-to-Moderate Income Performance Incentives Mechanisms (LMI PIM) analysis
PY23 Verification	Initiated	• Program tracking database review	
PY25 TRM Major Update	Initiated	• PY25–PY27 avoided costs	

Key Findings and Implications

In CY24, AEG completed the major update to the PY24 TRM and the PY22 verification of awards. Key findings and their implications for the Hawai'i Energy programs follow.

[1] ICF acquired Applied Energy Group (AEG) from Ameresco, Inc. on January 7, 2025.

PY24 TRM Major Update

Ongoing TRM updates have focused on improving the accuracy of deemed savings estimates and expanding the use of semi-prescriptive calculators to better customize savings for a given measure based on the specific installation characteristics (e.g., program delivery approach, equipment capacity, efficiency, building segment). Many updates consist of revisions to baseline criteria to address changes in federal and state codes and standards. In addition, for ENERGY STAR® equipment measures, periodic updates are needed to bring the efficient case criteria in line with the latest ENERGY STAR specifications. The TRM updates also provide deemed savings and semi-prescriptive calculators for new measures.

PY22 Verification

In CY23, AEG completed the remaining tasks associated with verifying Hawai'i Energy's claimed savings and performance for PY22, including savings replication, desk reviews, on-site visits, and verification of achievements related to Clean Energy Technologies (CET) and non-CET targets.

The verification's chief purpose was to provide an independent review of Hawai'i Energy's performance relative to the contractually agreed-upon performance targets. Performance is measured by various indicators, including targets for CET energy and demand savings and, outside of CET, targets for Accessibility & Affordability (A&A), Market Transformation & Economic Development (MTED), and Customer Satisfaction. Successfully meeting the performance targets related to these indicators can lead to a financial award of up to $750,000 for Hawai'i Energy's implementer (Leidos).

AEG completed the verification using methods and activities consistent with past years, including savings replication, documentation, desk reviews, and program manager interviews. AEG worked with Hawai'i Energy to collect the necessary data for the verification and with the EEM and HPUC to agree on the appropriate methods and activities.

AEG found that Hawai'i Energy achieved 40% ($301,421) of the potential awards. Shortfalls primarily came from not meeting CET targets. Hawai'i Energy met all non-CET performance metrics except for the A&A target for program spending in the County of Maui. Accordingly, Hawai'i Energy did not receive full awards in this area.

The following summarizes the PY22 performance targets compared with Hawai'i Energy's claimed results and the verified results derived by AEG. Specifically:

- **Hawai'i Energy did not meet the target for installing Grid Services Ready measures.** In PY21, AEG verified nearly 200% of the target. In PY22, the programs fell short of the target of 2,200 measures by 23%. The measures included grid-interactive water heaters, smart devices, smart thermostats, and smart electric panels. Grid Services Ready measures are commonly installed in hotels as part of an energy management system (EMS). Measure installation is thus dependent on room occupancy, which was higher than anticipated (based on 2021-22 trends), causing project delays.
- **Hawai'i Energy's implementation of PY22 TRM algorithms for prescriptive programs was nearly perfect.** AEG made minimal TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.0 for all programs.
- **Hawai'i Energy achieved just 29% of available CET awards in PY22,** primarily driven by the Business Prescriptive and Business Custom programs, which faced lower participation than expected and did not achieve any awards. The verification had a limited impact on the achieved awards.
- **Hawai'i Energy met all A&A performance targets despite not claiming awards for commercial customer first-year bill savings targets.** By using verified first-year energy savings and peak demand reduction in conjunction with current commercial customer retail rates, AEG verified 108% of Hawai'i Energy's A&A commercial first-year bill savings target.
- **Hawai'i Energy Public Benefits Fee Administrator (PBFA) programs met or exceeded targets for all MTED performance metrics except for Outcome Metrics,** a new focus area for the Commercial

Kitchen Equipment (CKE) channel. Hawai'i Energy fell short of the target for adopting high-efficiency kitchen equipment, which increased by 5% over the PY21 target.[2] Significant achievements included researching and advocating for updates to appliance standards passed in the legislature.

- **AEG verified customer satisfaction scores of 9.7 and 9.5 (out of 10) for business and residential participant satisfaction, respectively.** Each metric exceeded the 9.0 target by at least 6%.

Table ES-2 provides the key research findings from the PY22 verification and their implications for claimed values, which impacted Hawai'i Energy's awards.

Table ES-2 Key Research Findings and Their Implications/Outcomes: PY22 Verification

Key Result/Finding	Outcome
Ten Residential Energy Efficiency Measures (REEM) window AC opportunities (14% of all PY22 units) did not claim demand reductions. Another project omitted SEER and EER information.	After applying the correctly deemed kW values, the window AC measure achieved a 1.59 TRM adjustment factor, contributing to REEM's overall 1.06 TRM adjustment factor.
It was unclear whether some ductless split system AC opportunities were completed in 2022 or 2023. The TRM provides different guidance for these years.	Because of the issue's minimal impact, the ductless split system AC measure achieved a 1.00 TRM adjustment factor across the portfolio; however, the problem can still be seen in the TRM adjustment factors for the Business Energy Efficiency Measures (BEEM) and Residential Hard-to-Reach (RHTR) programs.
Ten Energy Advantage lighting opportunities (less than 2% of claimed Business Hard-to-Reach [BHTR] savings) did not provide measure characteristics or savings algorithms in the tracking database. Additional projects had measures described as "Custom Lighting" or "Hawai'i Energy Historical Product" rather than a discrete measure name from the TRM.	Some projects' lack of discrete measure names prevented AEG from verifying measure details with certainty. Given the accuracy of claimed savings estimates for Energy Advantage projects generally, AEG accepted the claimed savings (1.00 TRM adjustment factor) for projects with incomplete database information.
Hawai'i Energy applied an effective useful life (EUL) of 14 years to all Energy Advantage opportunities and did not apply a dual baseline where necessary. Hawai'i Energy indicated to AEG that the EUL of 14 years is a default value for Energy Advantage based on average hours of use (HOU) submitted by contractors and an average lamp life assumption of 50,000 hours.	AEG used lamp life ratings from product spec sheets to update Energy Advantage EULs, apply dual baselines, and calculate lifetime savings—this improved lifetime savings, resulting in a 1.11 desk review adjustment factor for BHTR.
Nine percent of the opportunity samples for desk review appeared to have been completed and rebated during PY21.	AEG credited Hawai'i Energy with savings for these projects, but recommends that Hawai'i Energy flag opportunities completed in a previous program year but not claimed until the current program year to prevent confusion and double-counting of savings.
Because of a data processing issue, many Energy Advantage coincidence factors (CFs) exceeded 1.0. Hawai'i Energy unintentionally included weekend peak hours (in addition to weekday peak hours) in its CF calculations, artificially inflating CFs, often above the upper bound of 1.0.	Hawai'i Energy provided corrected CFs for sampled projects, and AEG updated demand reductions accordingly, contributing to the 0.87 desk review adjustment factor for BHTR. Since discovering this issue, Hawai'i Energy noted that it has been corrected.
Within REEM, AEG changed baseline vintages for all sampled central air conditioner (CAC) retrofit desk	These two sets of changes yielded offsetting impacts on REEM desk review adjustment factors, which were close

[2] There is no performance award associated with the Outcome Metrics key focus area at this time.

Key Result/Finding	Outcome
review opportunities and updated home occupancies for all sampled solar water heater opportunities. Per project documents, the CAC retrofits replaced equipment installed before 2006, triggering lower baseline efficiencies. Similarly, documentation revealed that residential solar water heater project occupancies were smaller than the TRM's deemed average occupancy.	to 1.00 for first-year energy savings, lifetime energy savings, and peak demand reduction.
Hawai'i Energy used an Early Replacement baseline to claim savings for a large transformer project despite the age of the pre-existing transformer exceeding 30 years. Hawai'i Energy confirmed the age of the pre-existing equipment upon request. Per the PY22 TRM V2.0, justifying an EUL that exceeds 30 years requires documentation that (1) the transformer is underloaded during average and peak operating conditions and (2) is in good working order.	For this project, AEG verified only 9% of its savings. Because Hawai'i Energy did not have documentation on transformer loading, AEG calculated the savings as a Replace-on-Burnout (ROB) project using a single baseline based on DOE2016 standard efficiency, significantly reducing savings.
Two sampled transformer projects did not meet the criteria outlined in the PY22 TRM for a single-baseline approach for Early Replacements.	AEG applied dual baselines, consistent with ROB measures, which lowered lifetime savings for these projects by about 60% (a 0.40 adjustment factor).
Per the TRM guidance for custom projects, one sampled custom chiller project used an EUL of 13 years.	AEG updated this to 22 years according to the chiller-specific EUL, increasing lifetime energy savings.
In the document of record that calculated energy savings for smart device demand response (DR) measures, multiple projects lacked meter read data for May and June 2023, short-changing sampled projects of energy savings.	Supplemental documentation contained the May and June meter reads, from which AEG credited Hawai'i Energy with more savings. Additionally, AEG removed any duplicated line items, slightly lowering savings. Smart device DR opportunities achieved a 1.02 adjustment factor.
The variable flow drive (VFD) pool pump opportunity sampled for desk review did not meet program criteria. AEG verified from project documentation and confirmed with Hawai'i Energy staff that the installed pool pumps operated at one reduced speed rather than two different speeds as required by Hawai'i Energy's program eligibility requirements.	AEG accepted the project and re-calculated savings, resulting in a 0.82 project-level adjustment factor. However, zero savings could have been justified.
AEG found several cases in which projects appeared to have been installed before rebate applications were submitted to Hawai'i Energy.	Evaluating net-to-gross (NTG) ratios was outside AEG's scope for the PY22 Verification. However, AEG continued flagging projects that could be examples of free-riders of the Custom Business (CBEEM) program based on unclear timelines or a lack of documented pre-approval.
AEG could not adequately verify savings using engineering best practices in the sampled non-lighting custom projects associated with a large energy efficiency initiative at several military housing communities. The supplemental project documentation did not include any raw data used to develop per-unit savings estimates, so AEG had to rely on the per-unit savings estimates produced by the implementation contractor. AEG was also	No adjustments were made (based on onsite visits or desk reviews). AEG feels that the substantial savings and incentives associated with these military housing opportunities (which included lighting upgrades, weatherization, and HVAC upgrades at more than 5,000 housing units) warrant a more robust verification of the initiative in full upon its completion. This would include identifying all opportunities associated with the military housing energy efficiency initiative and verifying the

Key Result/Finding	Outcome
limited to visiting vacant units during the onsite visits.	project, ideally with the time and budget required to sample vacant and occupied units from all affected communities.

PY23 Verification

In CY24, AEG initiated the verification of Hawai'i Energy's claimed savings and performance for PY23 by reviewing the final (reconciled) program tracking database to prepare for sampling in CY25.

PY25 Major TRM Update

In CY24, AEG initiated the TRM update process, which consisted of updating avoided costs for the PY25–PY27 triennium. These avoided costs will be introduced in PY25 TRM V1.0.

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1 | INTRODUCTION

This report presents the results of all Evaluation, Measurement and Verification (EM&V) related activities associated with the Hawai'i Energy Conservation and Efficiency Programs (Hawai'i Energy programs) initiated or completed during the prior calendar year (CY) 2024 (referred to as CY24). This report also summarizes the most critical findings from the completed CY24 EM&V activities, focusing on implications for the Hawai'i Energy programs.

Research Objectives

The EM&V work conducted for CY24 contributes to three overarching research objectives:

- **Verification of accomplishments:** Verifying Hawai'i Energy's program year 2022 (PY22) achievements.
- **Robustness of savings approaches:** Updating and improving approaches used to estimate savings for Hawai'i Energy's programs and measures.
- **Program planning:** Using results to inform future program planning.

EM&V Research Activities

The EM&V-related research activities for CY24 were determined in consultation with the Hawaii Public Utilities Commission (HPUC) and the Energy Efficiency Manager (EEM).

The EM&V Contractor (Applied Energy Group [AEG][3]) engaged in four research activities in CY24:

- **Completed:** Reviewing and updating the PY24 Technical Reference Manual (TRM)
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- **Initiated:** Verifying Hawai'i Energy's PY23 program portfolio
- **Initiated:** Reviewing and updating the PY25 TRM

The remainder of the report first presents an overview of the PY22 verification of Hawai'i Energy's portfolio, followed by an overview of EEPS research. Subsequently, we offer a summary of the TRM tasks that were completed and initiated.

[3] ICF acquired Applied Energy Group (AEG) from Ameresco on January 7, 2025.

2 | PY22 VERIFICATION (COMPLETED)

The HPUC contracted AEG to verify the savings and performance of Hawai'i Energy's Public Benefits Fee Administrator (PBFA) programs in PY22 (July 1, 2022, to June 30, 2023). PY22 marked Hawai'i Energy's first year in the Triennial Plan for program years 2022 to 2024 (PY22–PY24) and its 12th year implementing energy efficiency programs as a PBFA. AEG verified whether Hawai'i Energy met the targets for the performance indicators and key focus areas (listed in Table 2-1 and Table 2-2), which determined the performance awards Hawai'i Energy could receive in PY22.

This chapter summarizes the PY22 verification approach, results, and recommendations. More detailed information on the verification can be found in the Hawai'i Energy PY22 Verification Report[4] located on the Hawai'i Energy website.[5]

Approach to Verification

Verification activities included a tracking database review, savings replication for deemed and semi-deemed measures, engineering desk reviews, on-site visits for custom projects, documentation reviews to verify program funding equity, engagement with hard-to-reach communities, and customer satisfaction. AEG used the methods shown in Table 2-1 and Table 2-2 to verify PY22 performance in the Clean Energy Technologies (CET) and non-CET key performance areas, respectively. Non-CET performance areas include Accessibility & Affordability (A&A), Market Transformation & Economic Development (MTED), and Customer Satisfaction.

AEG did not design PY22 verification activities to review the validity of the TRM's stipulated savings or adjustment factors, only to assess whether Hawai'i Energy applied them appropriately when calculating claimed values for the PY22 programs. Therefore, our verification does not scrutinize measure-level gross savings values or associated adjustments beyond ensuring the correct application of TRM-stipulated savings and factors and documentation of incented measures through desk reviews.[6]

[4] Hawai'i Energy PY2022 Verification Report, Prepared by Applied Energy Group, Prepared for Hawaii Public Utilities Commission, June 11, 2024. https://hawaiienergy.com/wp-content/uploads/PY22_EMV-Verification-Report.pdf

[5] https://hawaiienergy.com/about/information-reports

[6] AEG compared Hawai'i Energy database information to the PY22 TRM V2.0.

Table 2-1 PY22 CET Verification Methods

Performance Metric	Description of Metric	Verification Activities and Adjustments
Energy and Demand Savings* *First-Year Energy Savings* *Lifetime Energy Savings* *Peak Demand Reductions*	**Customer-Level Savings** Gross savings for each customer before accounting for line losses or what the customer would have done, absent the program (i.e., no application of a net-to-gross ratio at this step).	**TRM Adjustment** through a savings replication for all deemed and semi-prescriptive measures in the tracking database. **Desk Review Adjustment** through engineering desk reviews on a sample of custom and non-custom projects. **On-site Adjustment** through in-person site visits to spot-check key savings estimation parameters and confirm the installation and operation of rebated equipment.
	System-Level Savings Savings reflected at the generator, incorporating line losses.	**System-Loss Adjustment** through a review of the system loss factors (in PY22 TRM) applied to the customer-level savings.
	Program-Level Savings Net savings that account for free-ridership and spillover (system-level savings multiplied by the net-to-gross ratio).	**Net-to-Gross (NTG) Adjustment** through a review of the NTG ratios (in PY22 TRM) applied to the system-level savings.
Total Resource Benefits	The estimated total net present value (NPV) of the avoided cost for the utility from the reduced lifetime demand (kW) and energy (kWh) from energy efficiency projects and measures.	**TRB Adjustment** using customer-level verified savings and NTG ratios to calculate TRBs for each program and measure (avoided costs already include line losses, so are not included in savings at this step); avoided costs as stipulated in PY22 TRM.
Grid Services Ready Products	The total number of projects completed, or products installed that qualify as Grid Services Ready (e.g., grid-connected water heaters).	**Product Adjustment** using the count of Grid Services Products included in the reconciled tracking database.
Demand Flexibility	Total potential/additional load flexibility (kW) from Grid Services Ready technologies.	**Demand Adjustment** using the sum of program-level flexible demand (kW) established through grid services projects.
GHG Reductions	The avoided emissions and equivalent avoided barrels of oil due to program-level annual energy savings.	**GHG Avoided Emissions Adjustments** using the program-level verified savings and metric tons-per-kWh and barrels of oil-to-metric tons conversion factors provided in the PY22 TRM

*Performance targets for energy and demand savings metrics are based on program-level savings, which are built up from customer- and system-level savings.

Table 2-2 PY22 Non-CET Verification Methods

Performance Area	Metric	Verification Approach
Affordability & Accessibility	**Economically Disadvantaged** Requires serving a minimum number of customers (who save a minimum amount on their energy bills) through the Energy Advantage and single- and multi-family direct install programs, distinct communities through the Community-Based Energy Efficiency program, and nonprofits through the EmPOWER Hawaii Project.	**Energy Advantage**. Confirmed customer counts in the tracking database. **Single Family/Multifamily Direct Install.** Confirmed customer counts in the tracking database and calculated customer bill savings using average Hawaiian Electric rates and 2019 customer billing data. **Community-Based Energy Efficiency (CBEE).** Confirmed community counts through project documentation review.
	Island Equity Requires that 13 percent of program spending occurs in each of the Hawaii and Maui counties.	Confirmed equitable distribution of funds by reviewing program spending by island (program tracking database includes a variable that states the island for each rebate).
Market Transformation & Economic Development	Behavior Change Professional Development & Technical Training Codes & Standards Clean Energy Innovation Hub Outcome Metrics	Reviewed contractor invoices, attendance records, participant agreements, and other backup documents.
Customer Satisfaction	Residential Customer Satisfaction Business Customer Satisfaction	Reviewed survey results from Medallia and in-house survey tools.

Verification Results

In total, Hawai'i Energy achieved 40% of the potential awards. Shortfalls primarily came from not meeting CET targets (Figure 2-1, page 16). Hawai'i Energy met all the non-CET performance metrics except for the A&A target (Figure 2-2 page 17) set for program spending in the County of Maui (Figure 2-3, page 17). Accordingly, it did not receive full awards in this area.

Table 2-3 (page 15) summarizes the PY22 performance targets compared with Hawai'i Energy's claimed results and the verified results derived by AEG. Specifically:

- **Hawai'i Energy did not meet the target for installing Grid Services Ready measures.** In PY21, AEG verified nearly 200% of the target. In PY22, the programs fell short of the target of 2,200 measures by 23%. The measures included grid-interactive water heaters, smart devices, smart thermostats, and smart electric panels. Grid Services Ready measures are commonly installed in hotels as part of an energy management system (EMS). Measure installation is thus dependent on room occupancy, which was higher than anticipated (based on 2021-22 trends), causing project delays.
- **Hawai'i Energy's implementation of PY22 TRM algorithms for prescriptive programs was nearly perfect.** AEG made minimal TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.0 for all programs.
- **Hawai'i Energy achieved just 29% of available CET awards in PY22**, primarily driven by the Business Prescriptive and Business Custom programs, which faced lower participation than expected and did not achieve any awards. The verification had a limited impact on the awards achieved overall.
- **Hawai'i Energy met all A&A performance targets despite not claiming awards for commercial customer first-year bill savings targets**. By using verified first-year energy savings and peak demand reduction in conjunction with current commercial customer retail rates, AEG verified 108% of Hawai'i Energy's A&A commercial first-year bill savings target.
- **Hawai'i Energy PBFA programs met or exceeded targets for all MTED performance metrics except for Outcome Metrics**, a new focus area for the Commercial Kitchen Equipment (CKE) channel. Hawai'i Energy fell short of the target for adopting high-efficiency kitchen equipment, which increased by 5%

over the PY21 target.[7] Significant achievements included researching and advocating for updates to appliance standards passed in the legislature.

- **AEG verified customer satisfaction scores of 9.7 and 9.5 (out of 10) for business and residential participant satisfaction, respectively**. Each metric exceeded the 9.0 target by at least 6%.

[7] There is no performance award associated with the Outcome Metrics key focus area this time.

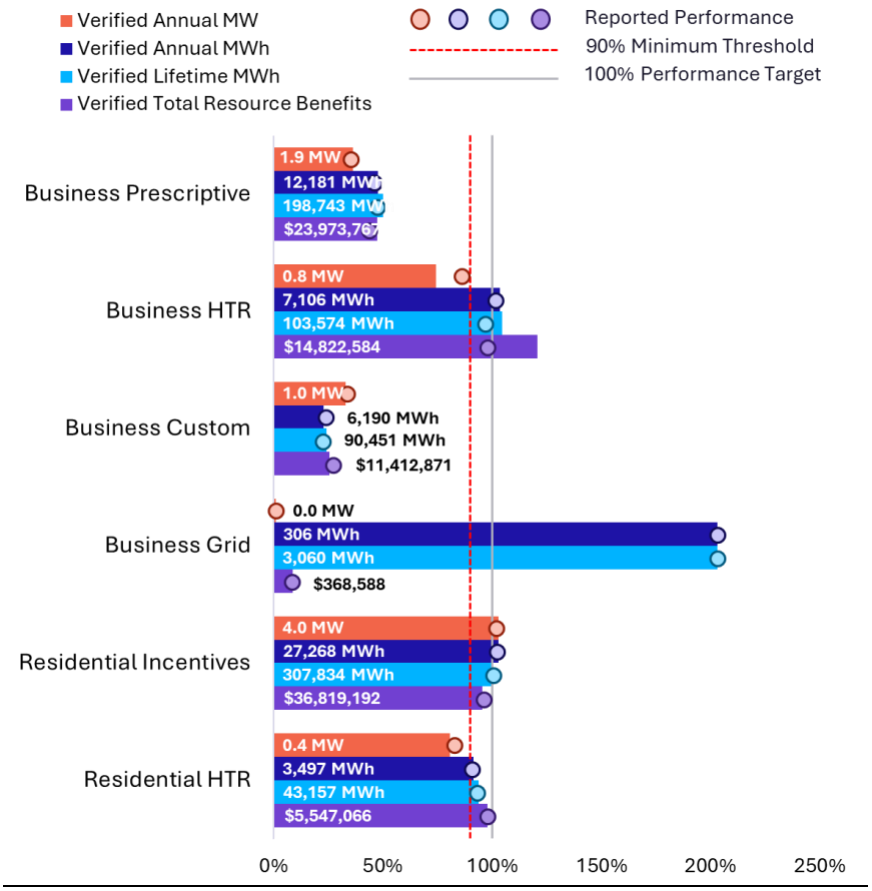
Table 2-3 PY22 Claimed and Verified Performance Award by Performance Indicator

Performance Indicator	Performance Target	Metric	Fraction of Award	Target Award	Claimed Results			Verified Results		
					Performance	Percentage of Performance Target	Award	Performance	Percentage of Performance Target	Award
Clean Energy Technologies - Key Focus Areas[1]			**70.00%**	**$525,000**		**28.7%**	**$150,873**		**28.8%**	**$151,421**
First Year Energy Reduction	89,807,910	kWh	15.00%	$112,500	56,162,776	62.5%	$44,528	56,548,198	63.0%	$44,791
Lifetime Energy Reduction	1,227,351,042	kWh	15.00%	$112,500	727,354,827	59.3%	$38,952	746,817,730	60.8%	$39,851
Peak Demand Reduction	17,605	kW	20.00%	$150,000	8,079	45.9%	$32,714	8,005	45.5%	$32,714
Total Resource Benefit	$155,921,667	$	15.00%	$112,500	$89,569,518	57.4%	$34,679	$92,944,068	59.6%	$34,064
Grid Services Ready	2,200	projects/ demand management products installed or customers served	5.00%	$37,500	1,663	75.6%	$0	1,686	76.6%	$0
Demand Flexibility (new)	3,500	potential or additional load flexibility from grid service ready technologies (kW)	0.00%	$0	1,286	36.7%	$0	1,286	36.7%	$0
Greenhouse Gas Emissions/ Barrel of Oil	63,659 / 146,887	tons / barrels	0.00%	$0	38,760 / 90,192	60.9% / 61.4%	$0	40,083 / 93,216	63.0% / 63.5%	$0
Accessibility & Affordability - Key Focus Areas			**20.00%**	**$150,000**		**40.0%**	**$60,000**		**50.0%**	**$75,000**
Economically Disadvantaged										
Business A&A (Energy Advantage, Energy Relief Grant)										
Customers Served	550	Customers served	2.00%	$15,000	631	115%	$15,000	631	115%	$15,000
Bill Savings	$1,754,612	Customer bill savings (annual)	2.00%	$15,000	$1,375,541	78%	$0	$1,892,585	108%	$15,000
Residential A&A (Single & Multifamily Direct Install, Water Heating Direct Install, Bulk Appliances)										
Customers Served	1,800	Customers served	2.00%	$15,000	1,990	111%	$15,000	1,975	110%	$15,000
Bill Savings	$2,631,891	Customer bill savings (lifetime)	2.00%	$15,000	$2,810,182	107%	$15,000	$3,314,562	126%	$15,000
Community Based Energy Efficiency (new)	4	Communities served	2.00%	$15,000	5	125%	$15,000	5	125%	$15,000
Island Equity										
County of Hawaii	13%	Target spend must be met in Hawaii & Maui Counties for Milestone & Target Award	10.00%	$75,000	14.2%	109%		14.2%	109%	
County of Maui	13%				12.6%	97%	$0	12.6%	97%	$0
City & County of Honolulu	74%				73.2%	99%		73.2%	99%	
Economic Development & Market Transformation - Key Focus Areas			**8.00%**	**$60,000**		**100.0%**	**$60,000**		**100.0%**	**$60,000**
Behavior Change										
Workshop and Presentations										
STEM based student workshop	1,200	Number of participant-hours of Training	1.00%	$7,500	2,208	184%	$7,500	2,047	171%	$7,500
Adult learning	2,500	Number of participant-hours of Training	1.00%	$7,500	2,774	111%	$7,500	2,745	110%	$7,500
Gamification Campaigns and Competitions	700	Number of participants	0.00%	$0	1,111	159%	$0	884	126%	$0
Professional Development & Technical Training										
Clean Energy Ally Support										
Targeted Ally Training Opportunities										
Targeted Participant Training Opportunities	7,000	Number of participant-hours of Training	5.00%	$37,500	7,890	113%	$37,500	7,154	102%	$37,500
Educator Training and Grants										
Degree Program Support										
Vocational Training										
Codes and Standards										
Appliance Standards Advocacy	7	Advocacy Events			15			15		
Improve Code Compliance	1	Establishing compliance roadmap and tracking savings	1.00%	$7,500	1	106%	$7,500	1	106%	$7,500
Code-Related Training	150	Number of participant-hours of Training			151			151		
Clean Energy Innovation Hub										
Innovation and Emerging Technologies	1	Companies supported	0.00%	$0	1	100%	$0	1	100%	$0
Outcome Metrics (new)	5% increase	Increase in High Efficiency Equipment Adoption	0.00%	$0	Not Met	0.0%	$0	Not Met	N/A	$0
Customer Satisfaction - Key Focus Areas			**2.00%**	**$15,000**		**100.0%**	**$15,000**		**100.0%**	**$15,000**
Application Processing Customer Experience - Commercial	>9	Overall customer satisfaction score	1.00%	$7,500	9.70	108%	$7,500	9.66	107%	$7,500
Application Processing Customer Experience - Residential	>9	Overall customer satisfaction score	1.00%	$7,500	9.50	106%	$7,500	9.50	106%	$7,500
Total Performance Award			**100%**	**$750,000**		**38%**	**$285,873**		**40%**	**$301,421**

The remainder of this section details the key findings from the CET and non-CET verification activities.

Figure 2-1 shows Hawai'i Energy PBFA program verified performance against CET performance indicator targets for first-year and lifetime energy savings (MWh), peak demand reductions (MW), and total resource benefits ($).

Figure 2-1 Achievement of Performance Targets for Clean Energy Technologies for PY22



The verification findings show the following concerning the CET targets:

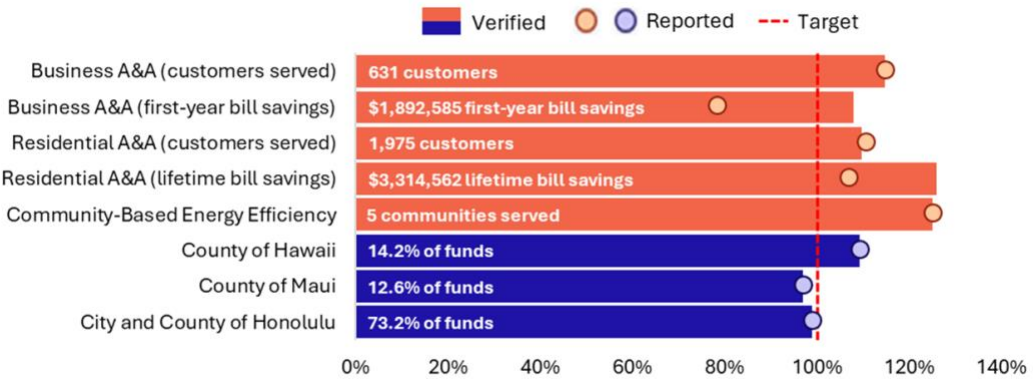
- The **Business Prescriptive** programs (BEEM and BESM) and the **Business Custom** program (CBEEM) missed the minimum awards threshold for every metric. Energy savings fell short of targets as claimed by Hawai'i Energy and verified by AEG (the verification did not contribute to these shortfalls). Hawai'i Energy stated that local businesses still face economic hardships and uncertainty caused by the pandemic, which leaves them wary of or unable to commit to significant capital investments in energy efficiency.
- The **Business Hard-to-Reach** (BHTR) and **Business Grid** (BGRID) programs achieved 100% of first-year and lifetime energy savings but fell short of the peak demand minimum threshold. Only BHTR met the threshold for TRBs among business programs. BGRID targets were associated primarily with the PowerMove battery program, which did not gain as much traction as expected until late in PY22.
- The **Residential Incentives** programs (REEM, RESM, and CREEM) and the **Residential Hard-to-Reach** program (RHTR) achieved some awards in almost every category. Among residential awards, Hawai'i Energy only fell short of attaining any awards for peak demand for RHTR.

As shown in Figure 2-2, Hawai'i Energy met all **Economically Disadvantaged** performance targets. Despite Hawai'i Energy not claiming an award for business A&A first-year bill savings, AEG verified 108% of its target

using verified first-year energy savings and demand reduction in conjunction with current commercial customer retail rates. This increased Hawai'i Energy's non-CET awards by $15,000.

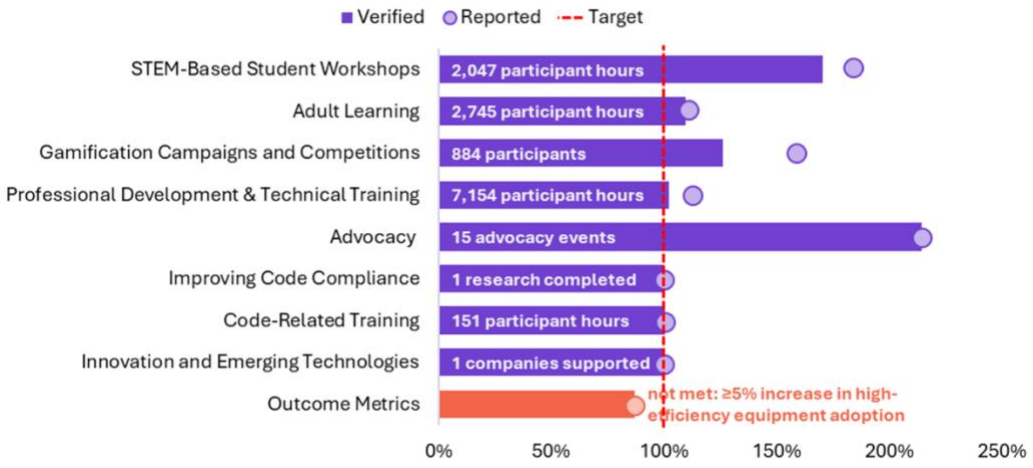
AEG verified Hawai'i Energy's claim that it did not achieve **Island Equity** awards because incentive spending for the Counties of Hawaii and Maui fell short of the performance target.

Figure 2-2 Achievement of Performance Targets for Accessibility & Affordability for PY22



AEG verified MTED activities and achievements by reviewing contractor invoices, participant agreements, virtual workshop rosters and screengrabs, and other backup documents. As shown in Figure 2-3, Hawai'i Energy met all MTED performance targets except for its new Outcome Metrics target, which pertains to adopting high-efficiency refrigeration equipment.

Figure 2-3 Market Transformation & Economic Development Verified Performance



In documentation about the Refrigeration Efficiency initiative, program staff indicated it sought to increase the number of customers participating in a refrigeration efficiency project by 5%, increasing its target number of participants from 75 in PY21 to 78 in PY22. To Hawai'i Energy's credit, it increased its participant count by 8% (from 63 in PY21 to 68 in PY22); however, it did not achieve the original target number of participants in PY21, which set itself up to fall short of a similarly aggressive target in PY22.

One of Hawai'i Energy's performance targets is customer satisfaction with their rebate experience. Hawai'i Energy uses the customer management tool Medallia to measure residential participant satisfaction. This tool sends customers an automated email survey soliciting feedback on their experience with various program interaction elements. Once a month, Hawai'i Energy sends surveys to new business participants through an in-house customer experience management tool.

Recommendations

Based on the verification activities, AEG developed a set of recommendations for Hawai'i Energy to consider. **Error! Reference source not found.** documents historical recommendations made by AEG beginning in PY17 that remain relevant. Other recommendations may have been made over the past five evaluations; however, Hawai'i Energy implemented them, or they are no longer applicable for another reason, i.e., change in awards, targets, or focus.

Table 2-4 Verification Recommendations

Recommendation	PY17	PY18	PY19	PY20	PY21	PY22	Comments
Account for dual baselines when calculating Lifetime Energy savings and TRBs.			X	X	X	X	Adjustments for dual baselines were still needed in BHTR and CBEEM.
Collect invoices (or equivalent documentation) for all measures and projects before paying incentives.		X	X	X	X	X	AEG saw a slight improvement over PY21, particularly for custom projects.
When using regression models to estimate annual savings for custom projects, ensure that models incorporate sufficient data from the pre- and post-implementation to cover the range of operating conditions experienced in a typical year and produce accurate and precise savings estimates.		X		X	X	X	CBEEM chiller projects sampled for desk review lacked sufficient pre- and post-implementation data to conform to best practices.
Adhere to Custom Project Guidance.					X	X	Custom projects adhered to guidance more consistently than in PY21 but leave room for improvement.
Ensure site inspections are sufficiently rigorous to verify the measure type and quantity.		X	X	X	X	X	Post-installation site inspections often do not collect sufficient data to verify the type and quantity of all measures. This issue has been significant and ongoing for custom and new construction projects.
Consider using typical meteorological year (TMY) weather data when using regression analysis to estimate lifetime savings for custom projects.				X	X	X	Using TMY is a best practice and conforms with the Custom Project Guidance Document.
Collect supplemental project documentation before paying out incentives for projects.				X	X	X	This is a documentation best practice that conforms to the Custom Project Guidance Document.

3 | PY23 VERIFICATION (INITIATED)

The HPUC contracted AEG to verify the savings and performance of Hawai'i Energy's PBFA programs in PY23 (July 1, 2023, to June 30, 2024). PY23 marked Hawai'i Energy's second year in the Triennial Plan for PY22–PY24 and its 13th year implementing energy efficiency programs as a PBFA.

AEG initiated verifying the PY23 Hawai'i Energy programs by reviewing the final (reconciled) program tracking database. This task preceded the development of sampling plans for desk reviews and on-site visits in January of CY25. At the time of the publication of the present report, the verification is incomplete; thus, there are no results to report.

4 | PY24 TRM MAJOR UPDATE (COMPLETED)

During CY23, AEG completed planning, received input from the Technical Advisory Group (TAG), and prioritized updates for the PY24 TRM's major review and update. Then, in CY24, AEG completed the following steps, which culminated in the final PY24 TRM v1.0:

- Conducting benchmarking analysis to inform measure updates
- Drafting updates to TRM measures and other content
- Reviewing updates and receiving feedback from Hawai'i Energy and the EEM
- Making additional adjustments to address feedback
- Finalizing the PY24 TRM
- Receiving final approval and signatures from Hawai'i Energy, the EEM, and the HPUC

The PY24 TRM updates consisted of revisions to the following content, with asterisks (*) indicating new measures:

- Commercial HVAC: Variable Refrigerant Flow (VRF)
- Commercial Lighting: Dimmable (Non-Linear) LED
- Commercial Lighting: Downlight LED Retrofit
- Commercial Lighting: Energy Advantage
- Commercial Lighting: General LED
- * Commercial Lighting: Horticulture Lighting
- * Commercial Miscellaneous: Distribution Transformer
- Commercial Pumps & Motors: Electronically Commutated Motor (ECM)
- Commercial Pumps & Motors: VFD Pool Pump
- Residential Lighting: General LED
- Residential Lighting: Security Lights
- Residential Pumps & Motors: Variable Frequency Drive (VFD) Pool Pump
- Residential Water Heating: Heat Pump Water Heater
- Residential Water Heating: Solar Water Heater
- Key Metrics
- Codes & Standards Tracking
- Master Effective Useful Life (EUL) List

AEG expects the TRM updates will affect the PY24 portfolio-level savings in several ways:[8]

- Allowing custom entry of the uniform energy factor (UEF) and increasing the default UEF for the ENERGY STAR equipment for the Heat Pump Water Heater measure will likely increase the first-year peak demand savings, first-year energy savings, and lifetime energy savings for the Residential Energy Efficiency Measures (REEM) program component.
- Adding a custom entry of household occupancy and clarifying the baseline conditions for the Solar Water Heater measure will increase the first-year peak demand savings, first-year energy savings, and lifetime energy savings for some projects and decrease the savings for others. The net impact on REEM will depend on the projects implemented.

[8] AEG used measure quantities from Hawai'i Energy's PY24 bottom-up analysis to estimate whether the updates to the PY24 TRM are likely to result in positive or negative portfolio-level savings relative to the PY24 program plan.

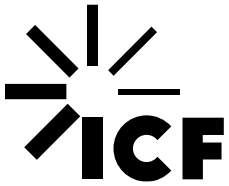
- Updates to the baseline and efficient case specifications for the variable frequency drive (VFD) pool pump measure will decrease REEM's first-year peak demand savings, first-year energy savings, and lifetime energy savings.
- Adding a sunset date of Dec. 31, 2024, to the LED and security light measures will substantially decrease the program impacts for REEM. LEDs implemented through Energy Smart for Homes (ES4H) and Residential Hard to Reach (RHTR) will not affect PY24.
- Changes and expansion to the electronically commutated motor (ECM) measure will increase the first-year peak demand savings, first-year energy savings, and lifetime energy savings for some projects and decrease the savings for others. The net impact on the Business Energy Efficiency Measures (BEEM) program component will depend on the projects implemented.
- Changes to the baseline criteria for the commercial HVAC variable refrigerant flow (VRF) measure will likely result in a significant decrease in first-year and lifetime energy savings for BEEM unless the efficiency of the new high-efficiency equipment installed increases in proportion to the rise in the federal standard baseline efficiency. At the same time, the first-year peak demand savings may not be affected since there were no changes to the full load efficiency (energy efficiency ratio, EER) baseline.
- Updates to the baseline and efficient case specifications for the VFD pool pump measure will decrease BEEM's first-year peak demand savings, first-year energy savings, and lifetime energy savings.
- Corrections to the lifetime energy savings calculations for Type A linear lamps will decrease lifetime energy savings for BEEM but will not affect first-year peak demand savings or first-year energy savings.
- Updates to the default hours of use for Energy Advantage will likely have a minimal effect on first-year and lifetime energy savings for the Business Hard to Reach (BHTR) program component since the hours of use are typically a custom entry. There will be no effect on first-year peak demand savings.
- Retiring the early replacement portion of the LED downlight retrofit measure will decrease first-year peak demand savings, first-year energy savings, and lifetime energy savings for BEEM.
- Adding a sunset date of Dec. 31, 2024, to the replace-on-burnout portion of the LED downlight retrofit measure and the screw-in lamp portions of the general lighting and dimmable (non-linear LED) lighting measures will decrease the program impacts for BEEM.
- Adding a semi-prescriptive approach for the distribution transformer measure will simplify implementation. AEG expects the main effect on BEEM to be a decrease in lifetime energy savings now that the single versus dual baseline calculation has been clarified and automated (previously, Hawai'i Energy used a single baseline approach in the custom calculations for most projects).
- Adding the horticulture lighting measure creates a new opportunity for savings.
- Changes to the emission rates in the GHG calculator will decrease portfolio-level avoided emissions by roughly 2.6%.

5 | PY25 TRM MAJOR UPDATE (INITIATED)

The Hawai'i Energy TRM Framework calls for an annual TRM content review and update. The workflow includes several steps, one of which was completed in CY24:

- Completed in CY24
  - Updated PY25–PY27 avoided costs
- To complete in CY25
  - Annual TRM update planning
  - Input on updates from the TAG
  - Prioritization of measures and content to update
  - Benchmarking analysis
  - Draft TRM updates
  - Review and feedback
  - TRM adjustments
  - Final TRM presented for HPUC approval

During CY24, AEG updated the avoided costs for the PY25–PY27 triennium. These will be introduced as part of the PY25 TRM v1.0 major update.



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