



Hawai'i Energy PY2022 Verification Report



Prepared for: Hawaii Public Utilities Commission

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EXECUTIVE SUMMARY

The Hawaii Public Utilities Commission (the Commission) contracted the Applied Energy Group (AEG) to verify the savings and performance of Hawai'i Energy's Public Benefits Fee Administrator (PBFA) programs in the Program Year 2022 (PY22, July 1, 2022, to June 30, 2023) and this report presents the verified savings and performance results. 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. The targets span a range of performance indicators, including energy and demand savings for **Clean Energy Technologies (CET), 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, the independent evaluation, measurement and verification (EM&V) contractor for the Hawai'i Energy programs, completed the verification using methods and activities consistent with past years, including savings replication, documentation and desk reviews, and program manager interviews. We worked with Hawai'i Energy to collect the data necessary for the verification and the Energy Efficiency Manager (EEM) and Commission to agree on the appropriate methods and activities. Appendices D and E present detailed descriptions of the methods employed and the sample design and expansion.

Summary of Findings

In PY22, Hawai'i Energy experienced significant challenges. While it achieved many of its targets and made several administrative improvements to enhance the customer and contractor experience, it struggled to hit Clean Energy Technologies (CET) targets.

Program Year Summary

Hawai'i Energy continued to grapple with the economic turbulence left in the wake of the COVID-19 pandemic. Based on input provided by Hawai'i Energy program staff, local businesses were reluctant to commit to capital improvement projects, instead focusing on near-term financial health (i.e., keeping their doors open). On the residential side, Hawai'i Energy pivoted to solar and heat pump water heaters in its outreach efforts, hoping that these measures would drive the bulk of residential savings in the absence of LED lighting savings, because of enforcement of backstop provision from the Energy Independent and Security Act (EISA) of 2007, and relative lack of heating and weatherization measures compared to other colder-weather jurisdictions. However, residential customers remained similarly wary of big-ticket purchases according to program staff and as reflected by lower residential program participation.

Additionally, some commercial and residential battery projects that would have contributed to Hawai'i Energy's Demand Flexibility targets were started but not completed in PY22 because of supply chain and project pipeline delays. Hawai'i Energy's PowerMove initiative, operating parallel to Hawaiian Electric Company's (HECO) Battery Bonus program, encountered delays that slowed project timelines. Hawai'i Energy expects the remaining projects to be completed mostly in PY23 with some trickling into PY24.

Faced with these challenges, Hawai'i Energy hired a principal development engineer to interface with commercial customers and provide technical support on the back end and also ramped up its

engagement with its Clean Energy Allies¹ (CEAs). This additional staff member conducted more in-person correspondence with commercial customers as Hawai'i Energy emphasized the importance of cultivating relationships by providing personalized support and illustrating the value proposition of energy efficiency. Hawai'i Energy also hosted focus groups and workshops (many of which resumed to an in-person format) with CEAs and local professionals ranging from suppliers to realtors to better understand consumer markets, identify pain points, improve program operations and delivery, and otherwise bolster the contractor experience. In addition, Hawai'i Energy streamlined rebate application and processing, introducing do-it-yourself ("DIY") portals and more automation to remove barriers for customer and contractors and reduce back-end resource burdens.

A key achievement of Hawai'i Energy in PY22 was consulting on and advocating for appliance standards that passed in the legislature. It also established a new hard-to-reach (HTR) community partnership in Waimānalo through which Hawai'i Energy delivered a heat pump water heater pilot and completed several direct-install solar water heater projects.

Verified Savings and Awards

In total, Hawai'i Energy achieved \$301,421 (40%) of the potential awards (shown in Table ES). Shortfalls came from not meeting all CET targets, including Grid Services Ready, which Hawai'i Energy met in PY21. Hawai'i Energy achieved all non-CET performance metrics except the A&A targets set for residential lifetime bill savings from the hard-to-reach direct-install initiative and Island Equity. Since Hawai'i Energy did not meet certain targets, they did not receive full awards in these areas.

Table ES-1 *Hawaii Energy's Verified Awards against PBFA Targets*

	Performance Indicator	Fraction of Award	Target Award	Verified Award	Percent Verified
CET Awards	Clean Energy Technologies	70%	\$525,000.00	\$151,420.82	29%
	<i>First-Year Energy</i>	15%	\$112,500.00	\$44,791.31	40%
	<i>Lifetime Energy</i>	15%	\$112,500.00	\$39,851.19	35%
	<i>Peak Demand Reductions</i>	20%	\$150,000.00	\$32,714.06	22%
	<i>Total Resource Benefits</i>	15%	\$112,500.00	\$34,064.26	30%
	<i>Grid Services Ready</i>	5%	\$37,500.00	\$0.00	0%
	<i>Barrels of Oil / Greenhouse Gases (GHG)</i>	0%	\$0.00	\$0.00	n/a
Non-CET Awards	Accessibility & Affordability	20%	\$150,000.00	\$75,000.00	50%
	<i>Economically Disadvantaged</i>	10%	\$75,000.00	\$75,000.00	100%
	<i>Island Equity</i>	10%	\$75,000.00	\$0.00	0%
	Market Transformation & Economic Development	8%	\$60,000.00	\$60,000.00	100%
	Customer Satisfaction	2%	\$15,000.00	\$15,000.00	100%
	Total	100%	\$750,000.00	\$301,420.82	40%

¹ Clean Energy Allies are contractors who help deliver the programs, and Hawai'i Energy works closely with CEAs to provide training and shared advertising opportunities.

Key Takeaways

The following bullets call attention to Hawai'i Energy's successes and key challenges in the CET and non-CET performance areas.

CET Performance

- **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, and occupancy was higher than anticipated (based on 2021-22 trends), causing projects delays.
- **Hawai'i Energy's implementation of PY22 Technical Reference Manual (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,** largely 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.

Non-CET Performance

- **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 the adoption of high-efficiency kitchen equipment, which increased by 5% over the PY21 target. Significant achievements included conducting research about and advocating for updates to appliance standards that were 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%.

Recommendations

Below we provide overarching recommendations that if taken would lead to substantive impacts on verified CET metrics, including energy and demand reductions and total resource benefits (TRBs). Each of the items below is critical to correctly calculating CET metrics or the ability of an evaluation team to confirm the type or quantity of rebated measures or projects purchased. There are additional recommendations for improving programs in Chapters 2 and 3.

1. **Adhere to the documentation requirements outlined in the Custom Project Guidance document² to avoid penalties that could hurt the future of the PFBA programs.** The evaluability of program performance and achievements remains a critical verification

² The Custom Guidance Document was being updated when this report was published.

component that gives stakeholders, including the customers who benefit from these programs, confidence in the process. AEG has seen some incremental improvement over time in the documentation collected for custom projects—for example, many more of the projects included lifetime savings calculations than in PY21. However, we continued to find the following:

- a. Cases where equipment specifications, project equipment and labor costs, or some proof of installation were not documented or aligned with how savings were claimed.
- b. Installation dates that preceded any evidence of pre-approval by Hawai'i Energy or rebate applications.
- c. A lack of documentation demonstrating that Hawai'i Energy pre-approved the project before it was underway or completed as stipulated by program eligibility requirements (e.g., email communications, pre-site inspections, consistent use of the project summary form, or another form preceding the application rebate submission).
- d. Justification of early retirement, particularly for transformers projects. The TRM requires documentation that the pre-existing transformer is underloaded during average and peak operating conditions and is in good working order to justify EULs exceeding 30 years.

These fundamental elements of documentation are critical to providing basic assurance that the rebated projects are completed, and that the measures were purchased and installed. Timing of the rebates and pre inspections helps to ensure that the program has a chance of influencing customer behavior, and that rebates are not paid for projects that are already installed. Pre-approval is also best practice considering the significant incentives associated with many of these projects. Program staff have mentioned that some customers have trouble providing the required documentation, including itemized invoices for larger projects.

2. **Account for dual baselines for custom projects.** AEG found that when custom lighting projects replaced incandescent lamps, Hawai'i Energy used the first-year energy savings for the duration of the measure life. This is consistent with the PY21 verification, although the issue was less pervasive this year. In addition, we found that transformer replacement projects that were qualified as Early Retirement did not consistently use a dual baseline approach. Hawai'i Energy has noted it is easier to apply dual baselines to prescriptive measures but more difficult for custom and some semi-prescriptive measures for which the second baseline can vary based on measure and project specifications.
3. **Continue to improve Energy Advantage documentation and data accuracy in the tracking database.** During the desk reviews, AEG found that Energy Advantage documentation was inconsistent, making it difficult to properly review the sampled opportunities. Baseline wattages and efficient quantities routinely did not reconcile with the measure information in the tracking database and often had to be inferred. Clearly and consistently tracking wattages and qualities such that they aligned with contractor invoices would go far in ensuring the verification can adequately review projects.

In addition, AEG recommends that Hawai'i Energy fixes persistent tracking database issues found for Energy Advantage projects:

- a. In the tracking database, Energy Advantage coincidence factors (CFs) routinely exceeded 1.0 due to Hawai'i Energy unintentionally including weekend peak hours in the numerator, inflating CFs.

- b. Because of database limitations, Hawai'i Energy applied a default effective useful life (EUL) of 14 years to all Energy Advantage opportunities rather than measure-specific custom EULs. Also, it did not apply a dual baseline in cases where it was necessary to do so.
 - c. The tracking database did not provide measure characteristics or savings algorithms for some Energy Advantage lighting opportunities. Other projects had measures described as "Custom Lighting" or "Hawai'i Energy Historical Product" rather than a discrete measure name from the TRM, limiting AEG's ability to verify hours of use, interactive effects, and other savings inputs.
4. **Indicate clearly in the program tracking database which year or baseline(s) a project is using for measures whose baselines depend on calendar year.** As an example, the PY22 TRM has different guidance for ductless split system AC units installed in calendar years 2022 and 2023. While claimed savings offered insight into the installation year, a small number of opportunities appeared to unintentionally mix and match TRM savings parameters, primarily regarding demand reductions. Flagging the year or baseline these projects savings are based on would make it easier for the verification to ensure that the correct baseline was used for the census of projects.
5. **Flag projects completed in a previous program year but claimed in the next one (e.g., completed in PY21 but claimed in PY22).** Per AEG's judgment, 9% of sampled opportunities appeared to have been completed and rebated during PY21. As most of these projects took place in May or June 2022, AEG interprets these projects as not claimed in PY21 and rolled forward into PY22. AEG credited Hawai'i Energy with savings for these projects but recommends, to prevent confusion, that Hawai'i Energy flags opportunities reported in a current program year but completed and rebated in a prior program year because of time constraints associated with reporting to ensure savings are not claimed twice.

Figure ES-1 shows the final performance awards claimed by Hawai'i Energy and verified by AEG for each key focus area and performance metric. Note that to achieve CET awards for first-year and lifetime energy savings, peak demand reductions, and total resource benefits, Hawai'i Energy must meet performance thresholds in specific program categories. Therefore, even though Hawai'i Energy exceeded first-year energy and peak demand savings targets overall, they missed performance targets in some program categories and did not achieve 100% of these awards. See Appendix A for details on performance and awards targets.

Figure ES-1 Performance and Award Results (Claimed and Verified)

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%	\$0	14.2%	109%	\$0
County of Maui	13%				12.6%	97%		12.6%	97%	
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	1.00%	\$7,500	15	106%	\$7,500	15	106%	\$7,500
Improve Code Compliance	1	Establishing compliance roadmap and tracking savings			1			1		
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

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1 | Introduction

The Hawaii Public Utilities Commission (the Commission) contracted the Applied Energy Group (AEG) to verify the savings and performance of Hawai'i Energy's Public Benefits Fee Administrator (PBFA) programs in the Program Year 2022 (PY22, July 1, 2022, to June 30, 2023). This report summarizes AEG's verification results, which build upon verification efforts and protocols established during the PY17 through PY21 verifications.

This report presents the results of AEG's sixth verification of Hawai'i Energy's programs. The PY22 verification is similar to past efforts but has a few key differences, as explained in Table 1-1.

Table 1-1 Comparison of Previous Verification Efforts (PY17-PY21) to the PY22 Verification

Key Similarities	Key Differences
<ul style="list-style-type: none"> • Verification of all performance metrics • Excel-based database replication to verify the population of measures that used information from the Technical Reference Manual (TRM) to estimate savings • Desk reviews to dig deeper into a sample of projects to verify data entry (for TRM-related projects) and savings (for custom projects) • On-site verification for 30 CBEEM projects • Program manager interviews, including a focus on how the pandemic affected programs • Verification of the low-to-moderate income (LMI) performance indicator metric (PIM) • Qualitative review of Hawai'i Energy's compliance with the Custom Project Guidance Document 	<ul style="list-style-type: none"> • Evaluability assessment of the new PBFA metric for Demand Flexibility under the Clean Energy Technologies (CET) focus area • Began enforcement of the Custom Project Guidance Document, which went into effect on July 1, 2022 (PY22). This enforcement led to stricter handling of some documentation requirements than in previous verifications, namely treating Early Retirement projects as Replace on Burnout when projects lacked justification

Metrics and Verification Objectives

PY22 marked Hawai'i Energy's first year in the Triennial Plan for Program Years 2022 to 2024 (PY22-24) and its 13th year implementing energy efficiency programs as a PBFA. AEG verified whether or not Hawai'i Energy met the targets for the performance indicators and key focus areas listed in Table 1-2, which determines the performance awards that Hawai'i Energy is eligible to receive for PY22. The awards for residential and business clean energy technologies (CET) targets are assessed by program category, including prescriptive, hard-to-reach (HTR), and custom programs.

Table 1-2 PBFA Performance Indicators and Metrics for Performance Awards

Performance Indicator/Key Focus Area		Metric
Clean Energy Technologies (70% of Award)		
First-Year Energy Reduction		kWh
Lifetime Energy Reduction		kWh
Peak Demand Reduction		kW
Total Resource Benefit		\$
Grid Services Ready ³		demand management projects/products
Demand Flexibility		potential/additional load flexibility (kW) from Grid Services Ready technologies
Greenhouse Gas Reductions/ Barrel of Oil		tons/barrels
Accessibility & Affordability (20% of Award)		
Economically Disadvantaged	Business – Energy Advantage and Energy Relief Grant	Customers served, first-year customer bill savings
	Residential – Single- & Multifamily Direct Install, Water Heating Direct Install, Bulk Appliance, Maintenance	Customers served, lifetime customer bill savings
	Community-Based Energy Efficiency	Communities served
Island Equity	County of Hawai‘i, County of Maui, City & County of Honolulu	Target spend must be met in Hawai‘i & Maui Counties for Milestone & Target Award
Economic Development & Market Transformation (8% of Award)		
Behavior Change	Adult Learning	Number of participant-hours of training
	STEM-Based Student Workshops	Number of participant-hours of training
	Gamification Campaigns and Competitions	Number of participants
Professional Development & Technical Training	Clean Energy Ally Support Targeted Ally Training Opportunities Targeted Participant Training Opportunities Educator Training and Grants Degree Program Support Vocational Training	Number of participant-hours of training
Energy in Decision Making	Strategic Energy Management (SEM)	Number of new participating institutions
Codes and Standards	Appliance Standards Advocacy	Advocacy Events
	Code-Related Training	Number of participant-hours of training
	Improving Code Compliance	Establishing compliance roadmap and tracking savings
Clean Energy Innovation Hub	Innovation and Emerging Technologies	Companies supported
Outcome Metrics		Percent increase in high-efficiency equipment adoption
Customer Satisfaction (2% of Award)		
Application Processing Customer Experience	Commercial, Residential	Overall customer satisfaction score

In conjunction with Hawai‘i Energy and the Commission, AEG identified the following critical objectives for the PY22 verification:

- Determine Hawai‘i Energy’s achievements against targets by independently verifying the performance indicator metrics above. (See results throughout Chapters 2 and 3).

³ Sometimes referred to as Energy Optimization (EO)

- Calculate realization rates of AEG verified to Hawai'i Energy claimed first-year and lifetime energy savings based on tracking database and verification activities. (See Table 2-8 in Chapter 2).
- Investigate and report on the program design and delivery, quality assurance/quality control (QA/QC) procedures, effects of the COVID-19 pandemic, and successes and challenges based on program manager interviews. (See *Program Year 2022 Summary* below).
- Provide recommendations for program improvements based on findings from the verification activities. (See *CET Highlights and Recommendations* in Chapter 2 and *Non-CET Highlights and Recommendations* in Chapter 3).
- Identify cases where future verification efforts should consider updates to the Technical Reference Manual (TRM) or alternative verification approaches. (See *CET Highlights and Recommendations* in Chapter 2).
- Determine whether Hawai'i Energy implemented the recommendations from the PY21 verification as relevant to PY22 (See Appendix B).
- Determine the extent to which Hawai'i Energy served low-to-moderate income (LMI) customers and the savings associated with the LMI population using definitions included in the Hawaii Commission Decision & Order 37787.⁴ (See *Low-to-Moderate Income (LMI) Performance Incentive Mechanisms (PIM)* in Chapter 3).
- Determine the level to which Hawai'i Energy's project documentation and savings estimation methodologies aligned with the Custom Project Guidance Document.
- Assess the evaluability of the new Demand Flexibility PBFA award target under the CET focus area.

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 savings 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.^{5,6}

Hawai'i Energy Programs

In the sections below, we first present descriptions of the residential and commercial programs that are offered by Hawai'i Energy. In addition, we present a summary of the program year's successes and challenges based on the program manager interviews conducted by AEG staff.⁷

⁴ This verification includes only the Hawai'i Energy portion of the LMI performance incentive mechanism and consists of three metrics. The first two are the verified kWh and kW from RHTR. The third is the number of customers in single-family and multifamily direct-install, water heating direct-install, bulk appliances, and maintenance. (D&O 37787, pages 29-31.)

⁵ AEG compared Hawai'i Energy database information to the PY22 TRM V1.0 information.

⁶ As the EM&V Contractor, AEG reviews the TRM before it goes into effect each program year and once mid-program year based on suggested updates.

⁷ As part of the PY22 verification effort, AEG interviewed four Hawai'i Energy program managers covering all programs in the residential and commercial sectors and the A&A and MTED key focus areas. The interviews focused on the effects of COVID-19, marketing, customer and contractor awareness of programs, and the future of the programs.

Residential Programs

In PY22, Hawai'i Energy implemented five residential sector programs, summarized below. These programs aim to reduce barriers, including up-front costs and access to measures that help customers save energy and lower utility bills. The residential programs have a network of Clean Energy Allies (CEAs) that help deliver the programs, and Hawai'i Energy works closely with CEAs to provide training and shared advertising opportunities.

The five residential programs offered by Hawai'i Energy in PY22 are described in more detail below.

- The **Residential Energy Efficiency Measures (REEM)** is designed to provide comprehensive energy services through three initiatives:
 - An upstream initiative that provides rebates to retailers, which were passed to residential customers as lower-cost, energy-efficient equipment;
 - A traditional downstream initiative that delivers measures through retail and trade-ally channels;
 - And an online marketplace that allows customers to directly purchase certain measures and measure bundles, including energy efficiency kits.
- The **Residential Energy Services and Maintenance (RESM)** program incentivizes tune-ups, by a participating contractor, for existing air conditioners or solar water heaters. According to the program managers interviewed, the tune-ups provide good business for their contractor base.
- The **Residential Grid Services (RGRID)** program incentivizes the installation of smart panels and grid-interactive water heaters that contribute to grid flexibility. RGRID did not feature any participation in PY22.
- The **Residential Hard-to-Reach (RHTR)** program delivers measures to single- and multifamily households that can be hard to reach using traditional program outreach mechanisms. Major initiatives in the RHTR program include:
 - A single- and multifamily direct installation service package called Energy Smart 4 Homes (ES4H) that provides free LEDs, faucet aerators, showerheads, and advanced power strips to hard-to-reach communities and publicly funded housing such as rural communities, underserved and vulnerable populations, and Section 8 housing;
 - An appliance trade-up and retrofit program that includes water heating, replacement of window AC units, smart appliances, EV charging, and other upgrades;
 - And a heat pump water heater heating initiative that assesses opportunities for centralized and in-unit heat pump water heaters within multifamily residences.

Residential Energy Efficiency Measures (REEM)

Comprehensive prescriptive rebate program including upstream and downstream mechanisms.

Residential Energy Services and Maintenance (RESM)

Incentivizes tune-ups for air conditioners or solar water heaters.

Residential Grid Services (RGRID)

Prescriptive rebates for smart panels, grid-interactive water heaters, and smart thermostats.

Residential Hard-to-Reach (RHTR)

Prescriptive rebates targeting underserved customers through direct install and downstream mechanisms.

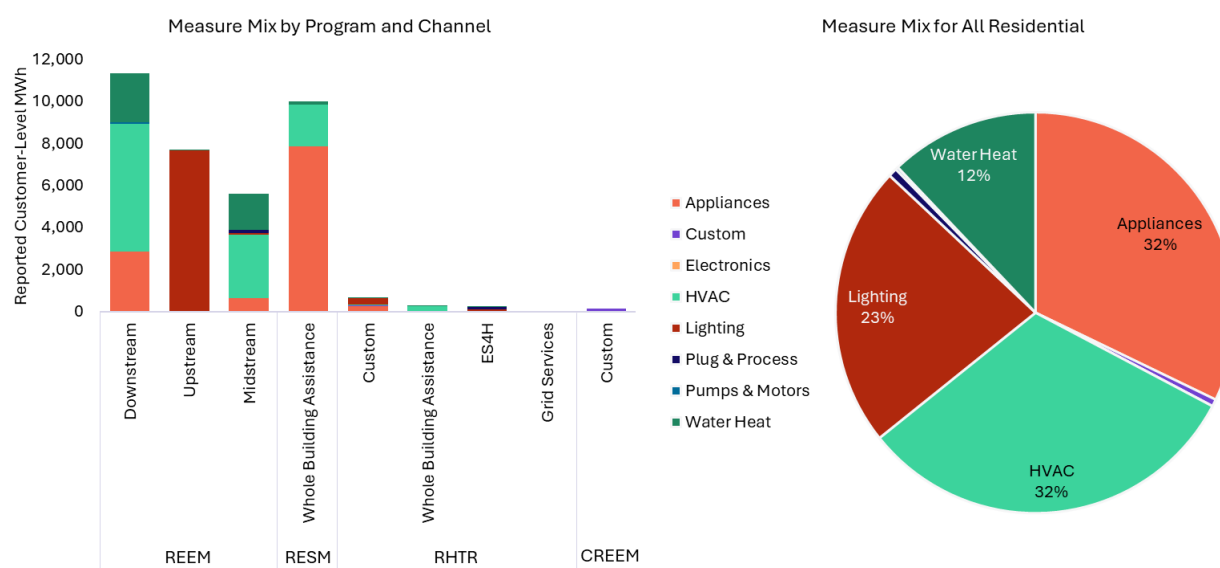
Residential Custom Energy Efficiency Measures (CREEM)

Incentivizes rebates for non-prescriptive projects.

- The **Custom Residential Energy Efficiency Measures (CREEM)** program enables Hawai'i Energy to incentivize energy efficiency projects for measures not included in the TRM. These projects typically consist of new construction for which Hawai'i Energy provides a custom incentive rate for measures such as appliances, HVAC, and water heaters.

Figure 1-1 illustrates the distribution of reported savings across the residential programs. Verified savings are presented in Chapters 2 and 3. The figure presents the mix of measure types in each PY22 residential program and delivery channel and in total across all residential programs. Where LED lighting comprised roughly half of reported residential customer-level first-year savings in PY21, it comprised only 23% of such savings in PY22 after Energy Independent and Security Act (EISA) of 2007 lighting standards took full effect in April 2022. Instead, household appliances, HVAC (heating, ventilation, and air conditioning) measures, and water heaters comprised 32%, 32%, and 12% of residential savings, respectively.

Figure 1-1 PY22 Claimed Savings in Residential Programs Measure Mix



Business (Commercial) Programs

In PY22, Hawai'i Energy implemented five business sector programs, summarized to the right. These programs focused on aligning program offerings with customer needs and helping businesses access projects. According to program managers, the main drivers of program participation include reducing upfront costs, savings on energy bills, corporate goals, and a preference for taking care of the environment.

The five business programs offered by Hawai'i Energy in PY22 are described in more detail below:

- The **Business Energy Efficiency Measures (BEEM)** program provides prescriptive incentives for standard energy efficiency technologies and utilizes the TRM to determine savings for each project.
- The **Business Energy Services and Maintenance (BESM)** program provides business customers with retro-commissioning, strategic energy management, submetering, and energy audits.
- The **Business Grid Services (BGRID)** program encompasses smart device demand response events and incentivizes energy management systems (EMS), energy storage, and grid-interactive HVAC measures that contribute to grid flexibility.
- The **Business Hard to Reach (BHTR)** program provides the installation of energy-efficient measures by program-qualified trade allies and rebates for downstream purchases of energy-efficient commercial kitchen equipment by participants. The program is designed to reach historically underserved markets based on geography and demographics. These include small businesses, restaurants, and lower-income multifamily properties on commercial-rate meters.
- The **Custom Business Energy Efficiency Measures (CBEEM)** program provides incentives for energy-saving measures not covered by prescriptive incentives. Project-specific calculations estimate the energy savings and determine the incentive offered to the customer.

Business Energy Efficiency Measures (BEEM)

Comprehensive prescriptive rebate program leveraging TRM-based savings.

Business Energy Services and Maintenance (BESM)

Incentivizes retrocommissioning, strategic energy management, submetering, and audits.

Business Grid Services (BGRID)

Incentivizes measures that contribute to Demand Flexibility and other demand response measures.

Business Hard-to-Reach (BHTR)

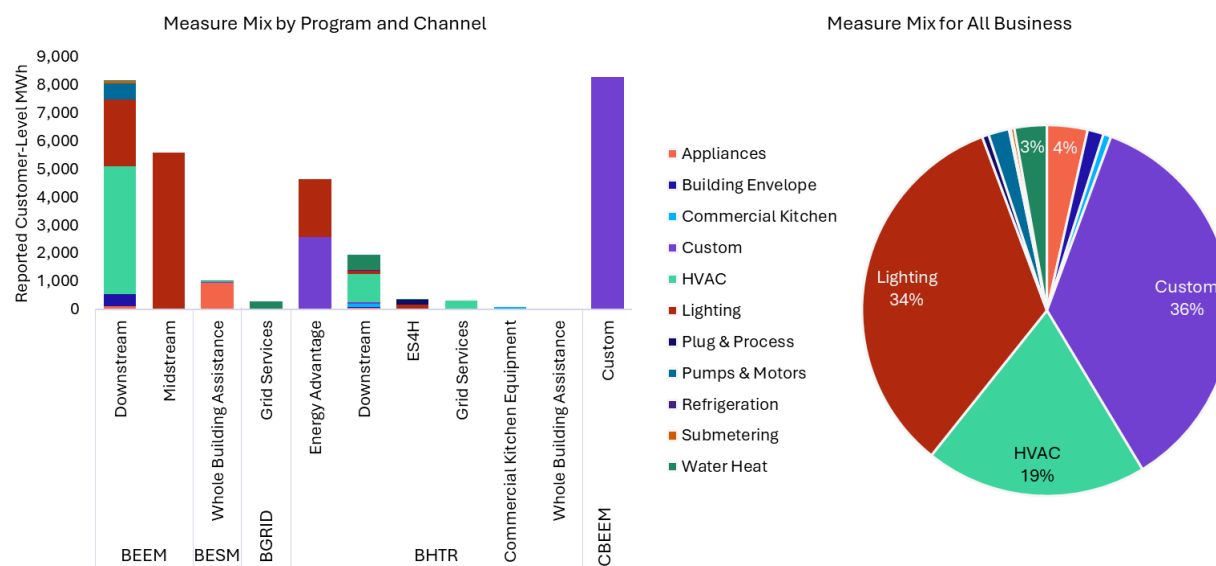
Prescriptive rebates targeting underserved customers through direct install.

Business Custom Energy Efficiency Measures (CBEEM)

Incentivizes rebates for non-prescriptive projects.

Figure 1-2 illustrates the distribution of reported savings across the commercial programs. Verified savings are presented in Chapters 2 and 3. The figure presents the PY22 measure type mix for the business programs by program and delivery channel and in total across the business portfolio. Despite the residential sector seeing a downturn in LED savings, the business sector generated 70% of reported customer-level first-year energy savings through custom projects (36%) and prescriptive lighting (34%). Custom lighting comprised 72% of custom projects (26% of all commercial projects), bringing all commercial lighting projects to 60% of reported customer-level first-year energy savings among business programs. Another 19% came from HVAC measures installed through BEEM and BHTR. Custom projects (including custom lighting) accounted for 36% of the reported business first-year energy savings in PY22, down from roughly 50% in PY21. Appliances and water heat measures comprised 4% and 3% of savings, respectively.

Figure 1-2 PY22 Business Program Measure Mix



Program Year 2022 Summary

Below we summarize the information gathered during the program manager interviews into three subsections: Lingering Effects of COVID-19, New Initiatives, and Program Administration and Implementation.

Lingering Effects of COVID-19

Business Sector

Hawai'i Energy acknowledged that PY22 was its worst-performing year in its history. Its commercial programs were characterized by lingering effects of the COVID-19 pandemic. Although the island chain has "returned to normal," local businesses still deal with economic hardships and the ensuing uncertainty caused by the pandemic, including fiscal constraints and an unsteady employment market that have lagged the pandemic's peak. Despite the challenges wrought by the pandemic, Hawai'i Energy's project pipeline remained steady because of projects planned and in progress prior to the pandemic's onset.

However, the pipeline began to slow in the latter half of PY21 before grinding to a halt in PY22 as businesses showed continued reluctance to invest in capital improvement projects. A short-term focus to simply stay afloat has superseded a longer-term focus to reduce operating costs through energy efficiency. Many large projects planned for PY22 were pushed back to PY23 or canceled entirely.

Hawai'i Energy is cautiously optimistic that the project pipeline will accelerate as businesses reach a point where their staffing stabilizes and project delays shake loose. It has many goals and aspirations for the coming program years, but its project pipeline remains at the fore.

Custom project guidance has also been more restrictive than previously anticipated. Hawai'i Energy acknowledged it has been more hesitant this year compared to prior years to green-light projects perceived to be higher-risk. Staff believes the custom project guidance was intended to be a living

document and intends to revisit it to make adjustments that reduce the barriers to participation where it makes sense to do so.⁸

Residential Sector

The residential portfolio once relied heavily on lighting savings. As federal lighting standards become stricter, annual and lifetime LED savings dry up. Given Hawaii's unique complexion, it depends much more heavily on solar water heating (rather than relying on weatherization or heating measures the way other locales and jurisdictions might). Like on the commercial side, coming out of the pandemic Hawai'i Energy saw a slowdown among residential customers in big-ticket investments—which include solar water heaters. The decommissioning of Hawaii's last coal-fired power plant in September 2022 caused energy costs to increase, exacerbating financial woes associated with inflation and an economic downturn. Hawai'i Energy has also observed that customers have been less receptive to contractors entering their homes post-pandemic, and its refrigerator trade-up program has lagged as customers opt to keep their second refrigerator rather than recycle it. Hawai'i Energy did not change how it marketed or recruited for its residential programs but did turn the focus of its outreach efforts toward solar and heat pump water heaters to cultivate interest in those high-value measures.

Struggles for Recently Developed Initiatives

Business Grid (BGRID)

The Business Grid program, Hawai'i Energy's new program intended to increase grid resilience, achieved only 1.1% of its demand reduction (kW) goal. Business Grid targets were associated primarily with the PowerMove battery program. Hawai'i Energy intended for many projects queued up in PY22 to be completed during the program year, but almost none did, which contributed to the program's low achievement. Those projects will be completed in PY23 and PY24.

Demand Flexibility

The Demand Flexibility CET key focus area is an evolution of Hawai'i Energy's Grid Services Ready metric. Hawai'i Energy forecasted the number of projects it expected to complete and the total flexible demand it would claim for each project by technology type. The key focus area corresponds strongly with the PowerMove initiative; because of project delays within PowerMove, both PowerMove and Demand Flexibility fell short of PY22 goals. Hawai'i Energy's deployment timeline was crafted around HECO's Battery Bonus program, which itself experienced timeline delays. In the future, Hawai'i Energy intends to reconfigure its achievement metrics to capture the amount of flexible demand it provides rather than the total number of projects it completes. There is also an element of "flying blind": given the absence of other similar programs, Hawai'i Energy only has as much information for its forecasts as the projects it has already completed. As it installs more batteries and collects more data, Hawai'i Energy expects to be able to better calibrate its targets and expectations.

Refrigeration Efficiency

The Refrigeration Efficiency initiative nearly achieved its target number of projects but fell short of its target energy savings. This discrepancy can be explained by the types of equipment being rebated through the initiative. Custom projects tend to generate greater savings, but in PY22, Hawai'i Energy completed smaller one-off projects (such as ENERGY STAR® refrigerators and ice machines) more often. Furthermore, the initiative overlaps significantly with the Empower grant program, which is one of Hawai'i Energy's main drivers of participation for refrigeration equipment. The availability of Empower grants varies annually depending on the BHTR budget, which is developed in advance of

⁸ The Custom Guidance Document was being updated when this report was published.

the Hawai'i Energy program triennium and includes Energy Advantage and the Commercial Kitchen Equipment (CKE) channel, among other offerings. Based on the variability of these forecasts, some program years end up with larger Empower grant funds than others, which affects potential Refrigeration Efficiency participation. To overcome these hurdles, Hawai'i Energy staff has improved its technical acumen regarding refrigeration efficiency and increasingly targeted cold storage and grocery facilities for custom projects, especially those with walk-in coolers.

Program Administration and Implementation

Hawai'i Energy sought to improve program delivery by hiring a principal development engineer who works primarily on technical on-site support and customer engagement strategy. Hawai'i Energy acknowledged that, to combat the friction and reticence it faces among its business clientele, it must engage more with customers, including more time spent face-to-face. Its current priority is its largest commercial and industrial partners, but broadly Hawai'i Energy's long-term focus is to change the participant experience and illustrate the value proposition of Hawai'i Energy programs by providing more personalized assistance and developing deeper relationships with customers. Additionally, Hawai'i Energy connected more intimately with CEAs by holding focus groups to solicit ideas on how Hawai'i Energy can improve program design and delivery, better serve CEAs, and identify gaps and challenges in the customer participation experience. Hawai'i Energy completed two focus groups in PY22—one about commercial refrigeration, another about residential solar water heaters—and staff observed that CEAs spoke more candidly about their experiences and provided actionable feedback. Hawai'i Energy views contractors as force multipliers and relies on their insights about appliance markets and consumer sentiments (e.g., about heat pump water heaters) to help shape future offerings.

Faced with the high number of residential rebate applications that it receives each year, Hawai'i Energy worked to facilitate application processing by making the process more automated. Business rebate applications tend to have project-specific concerns, but Hawai'i Energy still attempted to address previous concerns about file classifications in addition to adding supplemental quality assurance checks to catch input or data entry errors. Moving forward it hopes to roll out more DIY (“do-it-yourself”) portals for customers and CEAs to enable easier navigation and more self-sufficient interaction with Hawai'i Energy's interfaces. Ideally, these platforms will streamline the rebate payment process while reducing back-end resource burdens.

Following the peak of the pandemic, Hawai'i Energy increased its in-person workshops and trainings in PY22. Student STEM (science, technology, engineering, and math) workshops resumed to an in-person format in classrooms, and Hawai'i Energy hosted adult professional development workshops and trainings in the large training room in its downtown office (in addition to providing hybrid and online options as well). Although there are no significant changes to the delivery of market transformation and economic development initiatives, for PY23 Hawai'i Energy will take over the delivery of some STEM workshops from Blue Planet (Hawai'i Energy will conduct workshops for kindergarten through 8th grade while Blue Planet will continue to conduct workshops for 9th through 12th grades). STEM workshops were an all-inclusive turnkey offering from Blue Planet, but in delivering lower- and middle-grade workshops, Hawai'i Energy assumes additional responsibilities such as marketing and scheduling.

Hawai'i Energy consulted on and advocated for changes to appliance standards that passed in the legislature during PY22. It also piloted an offering that delivered heat pump water heaters with controls through a new community partnership in Waimanalo, helping to fulfill Hard-to-Reach objectives and address Hawai'i Energy's Accessibility and Affordability (A&A) key focus areas.

Organization of the Report

We organized the remainder of the report into two chapters:

- Chapter 2: CET Verification Findings
- Chapter 3: Non-CET Verification Findings

Each chapter presents an overview of Hawai'i Energy's performance relative to targets, discusses any adjustments made through verification activities, and finally provides recommendations ranked in priority order.

Detailed information is presented in appendices, including program-level results for performance awards and verification findings. Appendices include:

- Appendix A: Detailed Performance and Awards Tables
- Appendix B: Historical Verification Recommendations
- Appendix C: Low-to-Moderate Income Performance Incentive Mechanisms
- Appendix D: Detailed Methodologies
- Appendix E: Sample Design and Extrapolation
- Appendix F: Conformance with Custom Project Guidance Document

Additionally, AEG provided a companion Excel file that details verification findings for specific measure categories and projects by verification task.

2 | Clean Energy Technology Verification Findings

This chapter summarizes the results and findings for residential and business Clean Energy Technology (CET) programs and presents the detailed results. We first give an overview of Hawai'i Energy's performance against the five CET targets with respect to claimed and verified savings. Next, we present an overview of the methods we used during the verification. Then, we review the various adjustments to the claimed savings resulting from each verification activity. And finally, we present some highlights and our recommendations.

Verification activities informed the extent to which Hawai'i Energy:

- Correctly followed the PY22 V1.0 TRM to report impacts for deemed and semi-prescriptive measures.
- Applied the appropriate energy savings calculations for custom measures.
- Accurately recorded measure characteristics in the tracking system based on documentation.
- Accurately claimed total resource benefits (TRBs) and avoided greenhouse gas (GHG) emissions.
- Accurately claimed project counts associated with Grid Services Ready products.
- Accurately claimed load flexibility (kW) added from Grid Services Ready technologies.
- Aligned with the Custom Project Guidance Document.

Overview of CET Performance

The PBFA Awards for CET energy and demand savings and total resource benefits are assessed at the program category level and mapped to individual programs, as shown in Table 2-1.

Table 2-1 Programs Mapped to Program Categories

Program Category	Program
Business Custom	CBEEM
Business Hard-to-Reach	BHTR
Business Prescriptive	BEEM, BESM
Business Grid Flexibility	BGRID
Residential Hard-to-Reach ⁹	RHTR
Residential Incentives	REEM, CREEM, RESM
Residential Grid Flexibility	RGRID

Program categories must meet a target threshold of 90% of **first-year (annual) and lifetime energy savings (kWh), peak demand reductions (kW), and TRB** targets to earn awards for these performance indicators. This can cause the realization rates between verified and reported savings to appear at odds with changes to the claimed awards.¹⁰ Grid Services Ready and GHG avoided

⁹ RHTR did not have energy savings targets or achievements in PY22. As such, it is omitted from most tables, charts, and figures.

¹⁰ For example, an annual energy savings realization rate of 105% could be driven by one program category, but if that program category still fell short of its annual energy savings performance target, the verified awards could fall below the claimed awards despite its realization rate exceeding 100%.

emissions target thresholds are set at 100% for awards, and the targets are not set for individual program categories.

Figure 2-1 shows Hawai'i Energy PBFA program verified performance against CET performance indicator targets for first-year and lifetime energy savings, peak demand reductions, and total resource benefits (\$). The verification findings show the following with respect to 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 large 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 **Residential Hard-to-Reach** program (RHTR) achieved some awards in almost every category. Among residential awards, Hawai'i Energy only fell short of achieving any awards for peak demand for RHTR.

Figure 2-1 PBFA Performance Against CET Targets—Energy and Demand Savings, TRBs

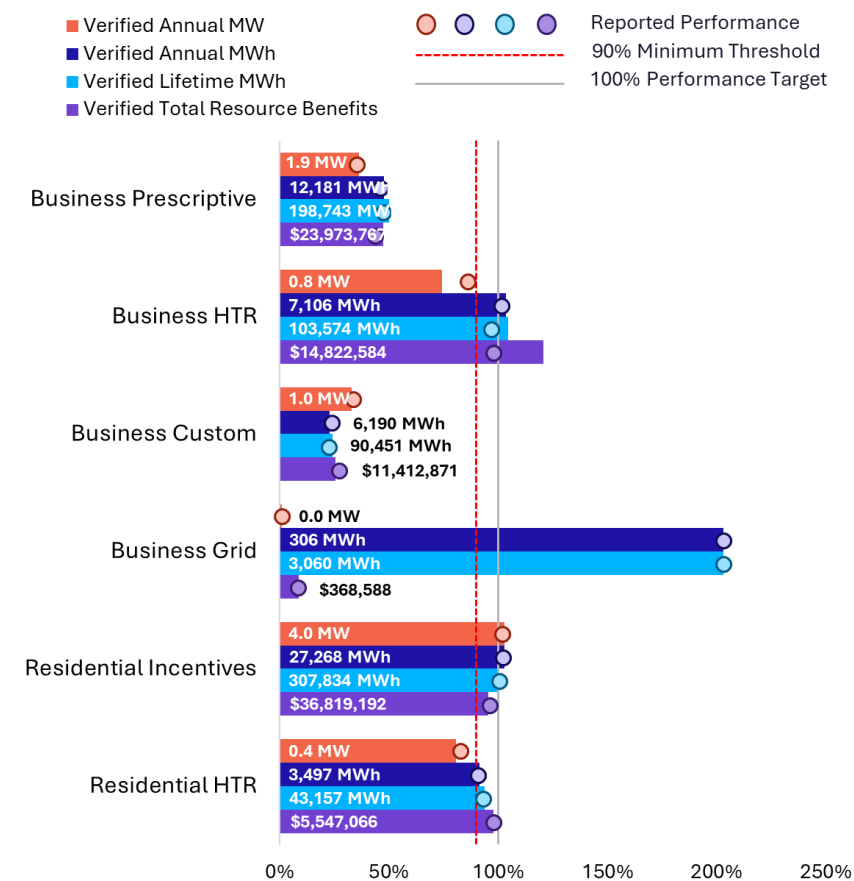
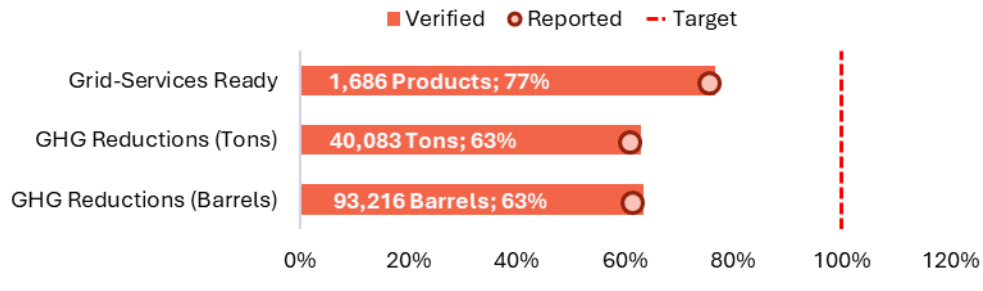


Figure 2-2 shows that, overall, the PBFA programs missed Grid Services Ready targets and both GHG avoided emissions targets for tons and barrels. While changes from reported GHG emissions were small, AEG was unable to exactly replicate the reported GHG emissions reductions using Hawai'i Energy's reported energy savings, suggesting that some of the discrepancies result from inaccurate applications of GHG conversion factors.

Figure 2-2 PBFA Performance Against CET Targets—Grid Services Ready, GHG Reductions



CET Performance Adjustments (page 14) provides details on all performance adjustments, and Appendix A provides the final performance towards targets thresholds and achieved awards for each program category.

Summary of CET Verification Methods

Table 2-2 shows how AEG verified each performance metric. As described, we made several adjustments to the performance claimed by Hawai'i Energy through the verification activities. Details on methods, including the detailed *Sample Plan* for desk reviews and on-site visits, can be found in Appendix E.

Table 2-2 Clean Energy Technology Summary of 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	Product Adjustment using the count of Grid Services Products included in the reconciled tracking database

Performance Metric	Description of Metric	Verification Activities and Adjustments
	Services Ready (e.g., grid-connected water heaters)	
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.

CET Performance Adjustments

As described in Table 2-2, AEG determined the PBFA programs' performance towards targets through multiple incremental adjustments to the savings claimed by Hawai'i Energy. This section provides key findings for:

- **Energy and Demand Savings Adjustments** to first-year energy savings, lifetime energy savings, and peak demand reductions at each of the three levels of savings (customer, system, and program-level)
- **Total Resource Benefits (TRBs) Adjustments**
- **Grid Services Ready Adjustments**
- **Demand Flexibility Adjustments**
- **GHG Reductions Adjustments**

Energy and Demand Savings Adjustments

AEG verified energy and demand savings through adjustments to the claimed customer-level savings (gross savings), system-level savings (adjusted for system line losses), and program-level savings (attributable to the PFBA programs after accounting for spillover and free ridership).

We begin with the customer-level savings tracked in the database on the left and end with the verified program-level savings on the right by making the following adjustments:

- **Customer-Level adjustments** from AEG's TRM replication, desk review, and on-site visit verification activities;
- **System-Loss adjustments** applied by both AEG and Hawai'i Energy; and
- **Net-to-Gross (NTG) adjustments** applied by both AEG and Hawai'i Energy.

Figure 2-3 shows the overall adjustments to first-year energy savings at the customer, system, and program levels by program category. Adjustments to the customer-level savings based on the desk reviews and on-site visits resulted in a less than 1% decrease in first-year energy savings, lifetime energy savings, and peak demand reductions. Both AEG and Hawai'i Energy made similar adjustments to system loss (+4.3%) and NTG (-20.0%). These adjustments all fed directly into the program-level savings. The overall program-level portfolio realization rates of 101% (first-year energy), 103% (lifetime energy), and 99% (peak demand) savings shown in Table 2-8 (page 23) were driven almost entirely by the desk review and on-site visit adjustments to claimed customer-level savings.

Figure 2-3 First-Year Energy Savings Adjustments



In the following subsections, we present more detail about the adjustments made throughout the verification process, including individual results for each Hawai'i Energy program.

Customer-Level Savings Adjustments

As described above, AEG made three sets of adjustments to customer-level savings:

- The **TRM Adjustment** compared the claimed customer-level savings to TRM-adjusted savings, which AEG calculated by applying appropriate TRM algorithms to deemed and semi-prescriptive measures in the tracking data population.
- The **Simple Desk Review Adjustment** compared the TRM-adjusted savings to the savings verified by AEG through desk reviews of a sample of deemed and semi-prescriptive measures. Simple desk reviews focused on ensuring the tracking database aligned with backup project documents such as rebate applications and invoices.
- The **Business Custom Adjustment** compared reported savings to those verified by AEG through a combination of desk reviews and on-site visits conducted with sampled business custom projects. These complex reviews also assessed savings calculation methods for engineering best practices.

See Appendix E for a description of how AEG weighted the sample desk review adjustments to the population of projects.

TRM Adjustment

Table 2-3 shows the claimed and TRM-adjusted savings for first-year energy, lifetime energy, and peak demand savings and the resulting TRM adjustment factors for each program at the customer level. AEG only calculated TRM-adjusted savings for projects with savings that were fully deemed or semi-prescribed in the PY22 TRM. Projects not included in this task, including those with custom claimed savings, were assigned a TRM adjustment factor of 1.00.

As shown in Table 2-3, AEG made few and minimally impactful TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.00 for all programs. Any programs with adjustment factors that are different from 1.00 are highlighted in **bold, orange font**.

Table 2-3 Clean Energy Technology TRM Adjustments to Business Customer-Level Savings

Program	Customer-Level First-Year Energy Savings (MWh/yr)			Customer-Level Lifetime Energy Savings (MWh/yr)			Customer-Level Peak Demand Reductions (MW/yr)		
	Claimed	TRM-Adjusted	TRM Adj. Factor	Claimed	TRM-Adjusted	TRM Adj. Factor	Claimed	TRM-Adjusted	TRM Adj. Factor
BEEM	13,754	13,749	1.00	230,611	233,297	1.01	2.12	2.09	0.99*
BESM	1,009	1,009	1.00	8,476	8,476	1.00	0.15	0.15	1.00
BGRID	294	294	1.00	2,943	2,943	1.00	0.04	0.04	1.00
BHTR	7,305	7,299	1.00	100,710	98,072	0.97	0.94	0.93	0.99
CBEEM**	8,282	8,282	1.00	109,269	109,269	1.00	1.25	1.25	1.00
REEM	22,514	22,502	1.00	322,030	321,755	1.00	2.75	2.90	1.06
RESM	10,016	10,016	1.00	73,502	73,502	1.00	1.88	1.88	1.00
RGRID	0	0	N/A	0	0	N/A	0.00	0.00	N/A
RHTR	3,315	3,329	1.00	40,953	40,993	1.00	0.41	0.41	1.01
CREEM**	148	148	1.00	2,254	2,254	1.00	0.02	0.02	1.00
Total	66,636	66,627	1.00	890,748	890,561	1.00	9.56	9.68	1.01

*Differences in demand reductions can be attributed to differences in rounding.

**AEG did not include custom projects in the savings replication analysis and used a 1.00 adjustment factor to calculate the TRM-adjusted savings for all custom projects.

Key takeaways included the following:

- **Within REEM, 10 window AC opportunities comprising 14% of all PY22 units did not claim demand reductions.** Another project omitted SEER and EER information. After applying the correct deemed kW values, the window AC measure achieved a 1.59 TRM adjustment factor, contributing to the program's 1.06 TRM adjustment factor overall.
- **It was unclear whether some ductless split system AC opportunities were completed in 2022 or in 2023.** The TRM has different guidance for calendar years 2022 and 2023. While claimed savings offered insight into the installation year, a small number of opportunities appeared to unintentionally mix and match with TRM guidance, primarily regarding demand reductions. Because of the minimal impact of the issue, the ductless split system AC measure achieved a 1.00 TRM adjustment factor across the portfolio; however, the issue can still be seen in the TRM adjustment factors for the BEEM and RHTR channels.
- **Ten Energy Advantage (small business direct-install) lighting opportunities comprising less than 2% of claimed BHTR savings did not provide measure characteristics or savings**

algorithms in the tracking database for AEG to replicate. Additional projects had measures described as “Custom Lighting” or “Hawai‘i Energy Historical Product” rather than a discrete measure name from the TRM, preventing AEG from verifying hours of use (HOU), interactive effects, and other savings inputs 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 in cases where it was necessary to do so.** In the absence of rated lifetime hours in the tracking database, AEG could not verify the EULs that Hawai‘i Energy assigned. Hawai‘i Energy indicated to AEG that the EUL of 14 years is a default value for Energy Advantage based on observed programmatic averages for HOU¹¹ and a lamp life assumption of 50,000 hours. Where relevant, AEG assigned deemed EULs and applied dual baselines to calculate lifetime savings. This resulted in a lifetime energy savings TRM adjustment factor of 0.96 for Energy Advantage, driving down BHTR’s TRM adjustment factor overall (0.97).
- **Otherwise, AEG encountered few calculation errors in accordance with the TRM.** An example of an error that AEG encountered includes the omission of coincidence factors for a very small number of LED projects. These types of errors were very infrequent and did not meaningfully affect TRM-adjusted savings. Generally, adjustment factors were influenced primarily by rounding savings values in accordance with the TRM and applying the correct line loss percentages and NTG ratios consistent with program and island.

Details on specific adjustments are included in an Excel-based appendix made available upon request.

Simple Desk Review Adjustments

AEG verified savings for a sample of customers through simple engineering desk reviews and estimated sample adjustment factors within program and equipment category strata. These reviews focused on ensuring that metrics critical to the savings for each measure matched between the tracking data and backup documentation, such as measure invoices. Other customer information, such as account number and address, were also checked using rebate applications. AEG only used this simple approach for deemed or semi-prescriptive measures.

We weighted the sample adjustment factors to the population of projects within each stratum to estimate population verified customer-level savings, which are shown in Table 2-4.

As shown, the simple desk reviews led to savings adjustments to first-year and lifetime energy savings and peak demand reductions at the program level but resulted in small differences at the portfolio level.

¹¹ Hawai‘i Energy said, on average, the average HOU that contractors enter in its system is roughly 3,600 hours: $50,000 \div 3,600 = 13.9$ years, or 14 when rounded.

Table 2-4 Clean Energy Technology Simple Desk Review Adjustments to Customer-Level Savings

Program*	Customer-Level First-Year Energy Savings (MWh/yr)			Customer-Level Lifetime Energy Savings (MWh/yr)			Customer-Level Peak Demand Reductions (MW/yr)		
	TRM-Adjusted	Verified	Desk Review Adj. Factor	TRM-Adjusted	Verified	Desk Review Adj. Factor	TRM-Adjusted	Verified	Desk Review Adj. Factor
BEEM	13,749	14,240	1.04	233,297	242,978	1.04	2.09	2.16	1.04
BHTR	7,299	7,421	1.02	98,072	108,643	1.11	0.93	0.81	0.87
REEM	22,502	22,626	1.01	321,755	317,210	0.99	2.90	2.85	0.98
RESM	10,016	10,016	1.00	73,502	73,502	1.00	1.88	1.88	1.00
RHTR	3,329	3,339	1.00	40,993	41,211	1.01	0.41	0.41	1.00
Total	56,894	57,642	1.01	767,618	783,544	1.02	8.21	8.11	0.99

*AEG did not conduct desk reviews for all components of the programs. The desk review adjustment factors shown in this table combine the desk review adjustments for the program components included in the desk reviews and the assumed 1.00 desk review adjustment for program components not included in the program.

Key takeaways from desk reviews include the following:

- Per AEG's judgment, **9% of sampled opportunities appeared to have been completed and rebated during PY21**. As most of these projects took place in May or June 2022, AEG assumes, but cannot verify with certainty, that these projects were not claimed during PY21 and were simply rolled forward into PY22. AEG credited Hawai'i Energy with savings for these projects but recommends that, to prevent confusion Hawai'i Energy flags any opportunities reported in a current program year but completed and rebated in a prior program year and ensure savings are not claimed twice.
- **Energy Advantage documentation can be inconsistent, making it difficult to properly review sampled opportunities.** Baseline wattages and efficient quantities routinely do not reconcile with measure information in the tracking database. Efficient quantities can often be inferred from baseline quantities, but it is not always clear, and sometimes assumptions must be made where clearer documentation would otherwise resolve the discrepancy in advance.
- **Because of a data processing issue, Energy Advantage coincidence factors routinely exceeded 1.0.** Per the TRM, CFs reflect the number of weekday peak hours for which a measure is in use as a percentage of all weekday peak hours.¹² In its tracking database, Hawai'i Energy unintentionally included the eight weekend peak hours in the numerator in addition to the 20 weekday peak hours, thus inflating CFs, often above the upper bound of 1.0. This issue was identified during savings replication but could not be rectified without additional documentation. 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.
- **AEG used lamp life ratings from product spec sheets to update Energy Advantage EULs, apply dual baselines, and calculate lifetime savings.** To remedy the issue of Energy Advantage's 14-year EULs (as described in *TRM Adjustment*), AEG looked up lamp life ratings and calculated EULs and remaining useful lives (RULs) according to PY22 TRM guidance. This improved lifetime savings, resulting in a 1.11 desk review adjustment factor for BHTR.

¹² For example, an LED may be in use from 6 to 9 pm each weekday during the defined peak hours of 5 to 9 pm. This translates to 15 hours of use (3 hours per day * 5 days) during 20 designated weekday peak hours (4 hours per day * 5 days), resulting in a 0.75 CF (15 ÷ 20 = 0.75).

- **BEEM desk review adjustment factors were driven exclusively by updates to commercial interior LED efficient wattages** according to wattage ratings via DesignLights Consortium (DLC) or ENERGY STAR databases. These changes typically affected first-year energy savings, demand reductions, and lifetime energy savings uniformly.
- **Within REEM, AEG changed baseline vintages for both sampled CAC retrofit and updated home occupancies for all five residential solar water heater opportunities.** Per project documentation, the CAC retrofits replaced equipment installed prior to 2006, triggering lower baseline efficiencies and increasing savings. Similarly, documentation revealed that occupancies for residential solar water heater projects were smaller than the TRM's deemed average occupancy, thus reducing savings. These two sets of changes yielded offsetting impacts on REEM desk review adjustment factors, all of which were close to 1.00. (AEG also updated home occupancy for one sampled RHTR residential solar water heater project, which increased savings minimally, as shown above.)
- Aside from issues with project dates and Energy Advantage CFs, **AEG found few systematic issues in documentation or savings reporting based on the simple desk reviews.** Systematic discrepancies were typically fixed through the TRM adjustment. Most simple desk review adjustments, such as updating LED wattages or home occupancies, occurred as expected.

Business Custom Adjustments

The AEG Team, including subcontractor RHA Energy Partners, conducted on-site visits with 30 randomly sampled CBEEM customers, stratified by lighting and non-lighting projects. For each, the AEG Team completed a desk review, interviewed customers about baseline conditions, visually inspected key equipment, and made post-on-site visit adjustments to savings as needed. In addition, AEG completed another 20 desk reviews for CBEEM projects that were held outside of the on-site visit sample.¹³

Table 2-5 shows the results of all CBEEM verification activities (desk reviews and on-site visits). A lack of documentation justifying early replacement led to substantial decreases in non-lighting project savings. Corrections to EULs and using appropriate dual-baseline approaches led to larger reductions in lifetime energy savings compared to first-year energy and peak demand savings for non-lighting projects. Adjustments to lighting projects were generally minor, such as updated wattages and hours of use.

¹³ The desk reviews for the on-site visit sample were limited to projects with customers who willingly agreed to participate in the on-site visits. With this restriction, the overall desk review sample would be biased towards this subgroup of projects without including the additional desk reviews.

Table 2-5 Adjustments to CBEEM Customer-Level Savings

CBEEM Stratum	Customer-Level First-Year Energy Savings (MWh/yr)			Customer-Level Lifetime Energy Savings (MWh/yr)			Customer-Level Peak Demand Reductions (MW/yr)		
	Claimed	Verified	Adj. Factor	Claimed	Verified	Adj. Factor	Claimed	Verified	Adj. Factor
Lighting	3,222	3,067	0.95	47,252	48,477	1.03	0.50	0.47	0.93
Lighting (Census)*	2,070	2,044	0.99	22,428	24,985	1.11	0.30	0.33	1.12
HVAC (Census)*	2,404	2,404	1.00	28,675	37,914	1.32	0.38	0.38	1.00
Other Non-Lighting	585	405	0.69	10,914	4,467	0.41	0.07	0.05	0.67
Total	8,282	7,920	0.96	109,269	115,842	1.06	1.25	1.23	0.98

* The AEG Team purposefully selected specific high-savings projects into the sample. AEG did not extrapolate verified savings from these projects to other custom projects because they were not randomly sampled.

Key takeaways from custom project desk reviews and on-site visits include the following:

- **More than 30% of claimed first-year energy savings for Other Non-Lighting projects sampled for desk reviews came from a single transformer project that AEG verified with a 9% realization rate.** Hawai'i Energy used an Early Replacement baseline to claim savings for this 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. Because Hawai'i Energy did not have documentation available, AEG calculated the savings as a Replace-on-Burnout (ROB) project using a single baseline based on DOE2016 standard efficiency. This resulted in significantly reduced peak demand, annual kWh, and lifetime kWh savings.
- **AEG adjusted the lifetime savings for two early-replacement transformer projects based on the need for a dual baseline approach.** AEG applied a dual baseline because the transformers did not meet any of the criteria outlined in the PY22 TRM for a single-baseline approach. Using a dual baseline lowered lifetime savings for these projects by about 60% (a 0.40 adjustment factor).
- **One sampled custom chiller project used an EUL of 13 years, per the TRM guidance for custom projects. However, AEG updated this to 22 years according to the chiller-specific EUL.** Hawai'i Energy may deviate from the TRM custom EUL when the TRM provides an EUL for the specific measure. The custom EUL is meant for projects that (1) are not included as a measure in the TRM, or (2) have been implemented alongside other initiatives under the same opportunity and a weighted EUL cannot be determined.
- **Several smart device demand response opportunities had incomplete post-installation data, which short-changed these projects of energy savings.** In the document of record that calculated energy savings for smart device demand response measures, multiple projects lacked meter read data for May and June 2023. Supplemental documentation contained the May and June meter reads and the unique coefficients associated with those projects. AEG calculated the additional savings and credited them accordingly. Additionally, a couple of projects contained one duplicate line of meter read data that AEG removed, lowering savings very slightly for these projects. Smart device demand response opportunities achieved a 1.02 adjustment factor.
- **The sampled VFD pool pump project 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. Ultimately, 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 could not adequately verify savings using engineering best practices in any of 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 of the raw data used to develop per-unit savings estimates. AEG had to rely on the per-unit savings estimates developed by the implementation contractor.

This initiative touched more than 5,000 residential units. The scope of the on-site visits did not allow for robust verification of all neighborhoods and measures (which included lighting upgrades, weatherization, and HVAC upgrades) covered by the sampled opportunities. This is because the AEG Team was limited to visiting vacant units, as it would have been time consuming and burdensome to request access from occupants, especially those on a U.S. Army base, where all customer contact and on-site coordination would need to be made through a military intermediary. However, at least a few vacant units in each of the sampled opportunities (i.e., separately-incentivized projects, in this case defined by measure bundle and neighborhood) were available for on-site verification, allowing us to spot-check some of the measures associated with the larger initiative. Overall, we found that measures had been properly installed and matched the equipment specifications used to calculate savings.

AEG feels that the substantial savings and incentives associated with these military housing opportunities warrants 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 project as a whole, ideally with the time and budget required to sample vacant and occupied units from all affected communities.

- **AEG found several cases where project appeared to have been installed before applications for rebates were submitted to Hawai'i Energy.** Evaluating NTG ratios was outside of AEG's scope for the PY22 Verification. However, AEG continued flagging projects that could be examples of free riders of the CBEEM program based on unclear timelines or a lack of documented pre-approval.

Customer-Level Savings Realization Rates

Table 2-6 shows the final customer-level savings realization rates for each program. These final customer-level savings adjustments incorporate the TRM savings replication, desk review, and on-site visit adjustments to the claimed savings. Overall, AEG verified customer-level realization rates of 101% for first-year energy savings, 103% for lifetime energy savings, and 100% for peak demand reductions.

Table 2-6 Clean Energy Technology Customer-Level Savings Realization Rates by Program

Program	Customer-Level First-Year Energy Savings (MWh/yr)			Customer-Level Lifetime Energy Savings (MWh/yr)			Customer-Level Peak Demand Reductions (MW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	13,754	14,240	1.04	230,611	242,978	1.05	2.12	2.16	1.02
BESM	1,009	1,009	1.00	8,476	8,476	1.00	0.15	0.15	1.00
BGRID	294	294	1.00	2,943	2,943	1.00	0.04	0.04	1.00
BHTR	7,305	7,421	1.02	100,710	108,643	1.08	0.94	0.81	0.86
CBEEM	8,282	7,920	0.96	109,269	115,842	1.06	1.25	1.23	0.98
REEM	22,514	22,626	1.00	322,030	317,210	0.99	2.75	2.85	1.04
RESM	10,016	10,016	1.00	73,502	73,502	1.00	1.88	1.88	1.00
RGRID	-	-	N/A	-	-	N/A	-	-	N/A
RHTR	3,315	3,339	1.01	40,953	41,211	1.01	0.41	0.41	1.01
CREEM	148	148	1.00	2,254	2,254	1.00	0.02	0.02	1.00
Total	66,636	67,014	1.01	890,748	913,059	1.03	9.56	9.56	1.00

System- and Program-Level Savings Adjustments

AEG applied the system loss factors from the PY22 Hawai'i Energy TRM by island to estimate system-level savings. Table 2-7 shows how the verified system-level savings compared to the claimed system-level savings for each business and residential program. The system-loss adjustments made by Hawai'i Energy did not always align with the system-loss adjustments verified by AEG, particularly for projects implemented outside of Oahu. These adjustments were small, and therefore, these realization rates are largely driven by discrepancies from the customer-level savings verification activities (i.e., the system-level realization rates are nearly identical to the customer-level realization rates shown in Table 2-6). The system-loss discrepancies were largely concentrated in BEEM, BHTR, and REEM. Overall, AEG verified system-level realization rates of 101% for first-year energy savings, 103% for lifetime energy savings, and 99% for peak demand reductions.

Table 2-7 Clean Energy Technology System-Level Savings Realization Rates by Program

Program	System-Level First-Year Energy Savings (MWh/yr)			System-Level Lifetime Energy Savings (MWh/yr)			System-Level Peak Demand Reductions (MW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	14,327	14,847	1.04	240,190	253,260	1.05	2.20	2.28	1.04
BESM	1,050	1,050	1.00	8,814	8,815	1.00	0.16	0.16	1.00
BGRID	306	306	1.00	3,060	3,060	1.00	0.05	0.05	1.00
BHTR	7,623	7,743	1.02	105,141	113,390	1.08	0.98	0.84	0.86
CBEEM	8,630	8,254	0.96	113,762	120,601	1.06	1.31	1.28	0.98
REEM	23,437	23,617	1.01	335,200	331,123	0.99	2.86	2.86	1.00
RESM	10,415	10,416	1.00	76,418	76,420	1.00	1.96	1.96	1.00
RGRID	-	-	N/A	-	-	N/A	-	-	N/A
RHTR	3,472	3,497	1.01	42,886	43,157	1.01	0.43	0.42	0.97
CREEM	154	154	1.00	2,343	2,343	1.00	0.02	0.02	1.00
Total	69,414	69,883	1.01	927,813	952,166	1.03	9.96	9.86	0.99

AEG applied NTG ratios from the PY22 Hawai'i Energy TRM to estimate program-level savings for each program and delivery channel. Table 2-8 shows how the verified program-level savings compared to the claimed program-level savings for each program. For most programs, the program-level realization rates are driven by discrepancies from the customer-level savings verification activities. Overall, AEG verified program-level realization rates of 101% for first-year energy savings, 103% for lifetime energy savings, and 99% for peak demand reductions.

Table 2-8 Clean Energy Technology Program-Level Savings Realization Rates by Program

Program	Program-Level First-Year Energy Savings (MWh/yr)			Program-Level Lifetime Energy Savings (MWh/yr)			Program-Level Peak Demand Reductions (MW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	10,745	11,135	1.04	180,142	189,945	1.05	1.65	1.70	1.03
BESM	1,045	1,046	1.00	8,798	8,798	1.00	0.15	0.15	1.00
BGRID	306	306	1.00	3,060	3,060	1.00	0.05	0.05	1.00
BHTR	6,988	7,106	1.02	95,945	103,574	1.08	0.89	0.77	0.86
CBEEM	6,473	6,190	0.96	85,322	90,451	1.06	0.98	0.96	0.98
REEM	16,799	16,933	1.01	233,829	230,460	0.99	1.99	2.02	1.02
RESM	10,234	10,235	1.00	75,849	75,851	1.00	1.92	1.92	1.00
RGRID	-	-	N/A	-	-	N/A	-	-	N/A
RHTR	3,472	3,497	1.01	42,886	43,157	1.01	0.43	0.42	0.97
CREEM	100	100	1.00	1,523	1,523	1.00	0.02	0.02	1.00
Total	56,163	56,548	1.01	727,355	746,818	1.03	8.08	8.00	0.99

Major findings from the system- and program-level adjustments included the following:

- **Overall, the system-level savings claimed in the tracking database aligned closely with the verified savings.** Therefore, these realization rates are largely driven by discrepancies identified in the customer-level savings verification activities (i.e., the system-level realization rates are

nearly identical to the customer-level realization rates shown in Table 2-6). However, the island-specific system loss factors included in the tracking database did not always match the verified system loss factors from the PY22 TRM, particularly for projects implemented outside of Oahu. When projects are created in Hawai'i Energy's database, its system defaults to Oahu's line loss value. In PY22, when Hawai'i Energy assigned a project to a customer account, the line loss value did not always update to reflect the correct island. Hawai'i Energy reportedly has fixed this issue for PY23.

- **Hawai'i Energy applied correct NTG ratios in nearly all cases, leading to very few discrepancies in PY22 program-level savings.** Discrepancies only occurred in BHTR, where Hawai'i Energy applied the BEEM NTG ratio to a few select projects. AEG continued allowing Hawai'i Energy to use non-deemed NTG ratios for multifamily direct-install records under the BHTR ES4H program since this is considered a residential hard-to-reach program and bundled with single-family direct install under A&A.¹⁴ Another exception included Grid Services projects implemented under the BHTR program; we treated these like BGRID projects and applied a 100% NTG ratio, consistent with Hawai'i Energy.

Total Resource Benefits (TRBs) Adjustments

Table 2-9 shows the claimed and verified total resource benefits calculated for each program. TRB realization rates reflect all the adjustments AEG made to the claimed customer-level savings and any differences in how AEG and Hawai'i Energy applied the TRB algorithms provided in the PY22 TRM.

Table 2-9 Clean Energy Technologies Total Resource Benefits (TRBs) Performance

Program	Claimed TRBs	Verified TRBs	Realization Rate
BEEM	\$21,121,752.38	\$22,963,444.43	109%
BESM	\$1,010,308.71	\$1,010,322.14	100%
BGRID	\$369,410.18	\$368,588.22	100%
BHTR	\$12,033,868.34	\$14,822,584.01	123%
CBEEM	\$12,290,179.72	\$11,412,871.44	93%
REEM	\$27,568,489.52	\$27,197,818.88	99%
RESM	\$9,451,278.97	\$9,451,743.21	100%
RGRID	\$0.00	\$0.00	N/A
RHTR	\$5,554,600.60	\$5,547,065.74	100%
CREEM	\$169,629.93	\$169,629.93	100%
Total	\$89,569,518.35	\$92,944,068.00	104%

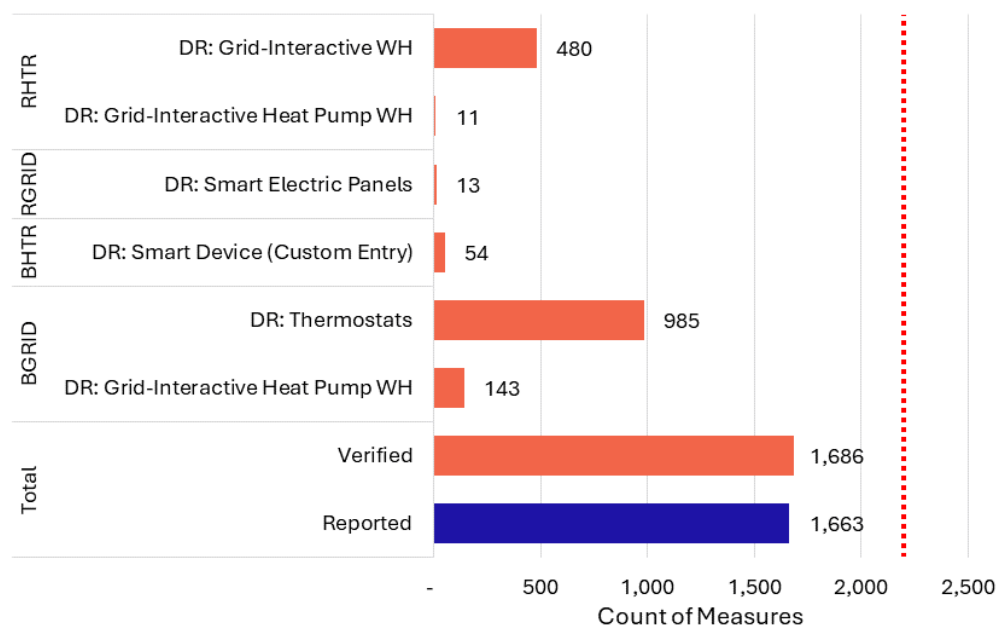
In general, AEG verified similar TRBs as claimed in the tracking database, so realization rates are similar to the customer-level savings realizations rates shown in Table 2-6 (page 22). In particular, AEG found that issues impacting lifetime energy savings similarly impacted the TRBs, including applying incorrect EULs and not using dual baselines when required to calculate savings for CBEEM projects. However, Hawai'i Energy correctly applied the dual-baseline approach when estimating TRBs for BEEM lighting measures, which AEG had previously found to be a persisting issue despite lifetime savings being calculated appropriately.

¹⁴ Since multifamily housing is still considered commercial buildings, multifamily ES4H records show up under the BHTR program.

Grid Services Ready Adjustments

Figure 2-4 shows the number of Grid Services Ready projects claimed by Hawai'i Energy and verified by AEG using the tracking database. Claimed and verified project counts generally aligned in total, but AEG could not identify the discrepancies. Both claimed and verified counts fell short of the target number of measures.

Figure 2-4 Grid Services Ready Performance Against Target



Demand Flexibility Adjustments

To claim flexible demand, Hawai'i Energy uses the following assumptions to calculate kW per opportunity:

- **Residential smart panels:** 1.522 kW per unit
- **GridPoint HVAC:** 20% of site kW savings
- **Guestroom EMS:** 100% reduction from average unit coincident kW
- **Energy storage:** 100% of committed kW

Hawai'i Energy claimed 1,286 kW of load flexibility (37% of target), which it achieved through 11 residential, commercial, and residential hard-to-reach Grid Services Ready opportunities. Other BGRID and RGRID opportunities that achieved energy savings and demand reductions but did not contribute to Demand Flexibility consisted exclusively of smart device demand response measures.

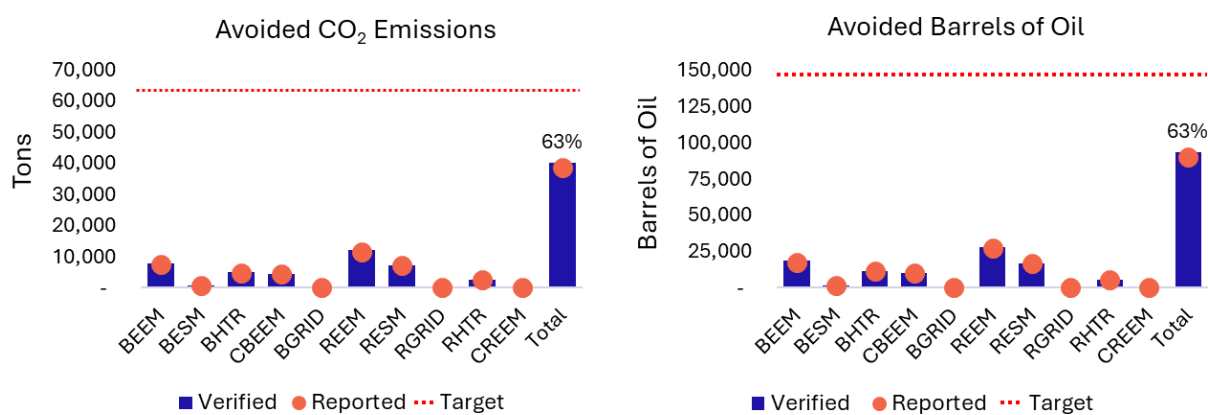
Using the tracking database, AEG confirmed 100% of program-level load flexibility that Hawai'i Energy claimed. However, AEG can only verify deemed flexible kW for smart panels; there is not enough information to independently verify HVAC, EMS, or energy storage opportunities. Because Hawai'i Energy fell short of targets, AEG accepted its claimed flexible demand as verified. In the future, AEG will work with Hawai'i Energy to compile more-comprehensive documentation for Demand Flexibility opportunities to verify flexible kW with more certainty.

GHG Reductions Adjustments

AEG estimated the GHG emissions avoided in barrels of oil and metric tons of carbon dioxide (CO₂) through the Hawai'i Energy PBFA programs using the conversion factors provided in the TRM and verified first-year program-level energy savings.

Figure 2-5 shows how claimed and verified GHG reductions performance compared to those claimed by Hawai'i Energy. Across all programs, AEG verified 103% of Hawai'i Energy's reported GHG emissions. Most differences in verified and claimed GHG avoided emissions appeared driven by the application of TRM algorithms and conversion factors, although AEG could not identify the specific causes. Regardless, the PBFA programs fell far short of both GHG reduction targets, consistent with the claimed GHG emission reductions.

Figure 2-5 GHG Reductions Performance Against Targets



CET Performance Awards

Hawai'i Energy must achieve at least 90% of performance targets for first-year and lifetime energy savings, peak demand reductions, and total resource benefits at the program category level to claim any of the performance awards in these key focus areas. AEG calculated the awards Hawai'i Energy received based on its verified performance according to the rules shown in Appendix A.

Table 2-10 shows the target, reported, and verified awards by metric and program category. Hawai'i Energy achieved 40% of the first-year energy savings award, 35% of the lifetime energy savings award, 22% of the peak demand reductions award, and 30% of the TRBs award.

- The Business Prescriptive (BEEM and BESM) and Business Custom (CBEEM) programs missed the minimum awards threshold for all metrics. The Business Hard-to-Reach (BHTR) and Business Grid (BGRID) programs achieved awards for first-year and lifetime energy savings but fell short of the peak demand threshold. BHTR additionally met the threshold for TRBs. BHTR adjustments increased lifetime energy savings and TRB awards to 100% of their targets.
- The Residential Incentives (REEM, RESM, and CREEM) programs achieved awards in every category. Adjustments decreased the lifetime energy savings award slightly (from 100% to 98%) and the TRBs award (from 83% to 77%). Residential Hard-to-Reach (RHTR) achieved at least 58% of awards in nearly all categories but failed to achieve an award for peak demand. Adjustments increased awards for first-year energy savings (from 55% to 58%) and lifetime energy savings (from 66% to 69%) and reduced the award for TRBs by 0.5 percentage points.

Table 2-10 CET Performance Awards

Performance Indicator Metric (Program Category)	Target	Claimed		Verified	
	\$ Award	\$ Award	% of Target	\$ Award	% of Target
First-Year Energy Reduction	\$112,500	\$44,528	40%	\$44,791	40%
Business Prescriptive	\$32,001	\$0	0%	\$0	0%
Business HTR	\$8,598	\$8,598	100%	\$8,598	100%
Business Custom	\$33,698	\$0	0%	\$0	0%
Business Grid	\$189	\$189	100%	\$189	100%
Residential Incentives	\$33,231	\$33,231	100%	\$33,231	100%
Residential HTR	\$4,783	\$2,511	55%	\$2,774	58%
Lifetime Energy Reduction	\$112,500	\$38,952	35%	\$39,851	35%
Business Prescriptive	\$36,278	\$0	0%	\$0	0%
Business HTR	\$9,068	\$7,708	85%	\$9,068	100%
Business Custom	\$34,475	\$0	0%	\$0	0%
Business Grid	\$138	\$138	100%	\$138	100%
Residential Incentives	\$28,321	\$28,321	100%	\$27,754	98%
Residential HTR	\$4,220	\$2,785	66%	\$2,891	69%
Peak Demand Reduction	\$150,000	\$32,714	22%	\$32,714	22%
Business Prescriptive	\$43,447	\$0	0%	\$0	0%
Business HTR	\$8,844	\$0	0%	\$0	0%
Business Custom	\$24,799	\$0	0%	\$0	0%
Business Grid	\$35,809	\$0	0%	\$0	0%
Residential Incentives	\$32,714	\$32,714	100%	\$32,714	100%
Residential HTR	\$4,387	\$0	0%	\$0	0%
Total Resource Benefits	\$112,500	\$34,679	31%	\$34,064	30%
Business Prescriptive	\$36,395	\$0	0%	\$0	0%
Business HTR	\$8,850	\$8,054	91%	\$8,850	100%
Business Custom	\$32,269	\$0	0%	\$0	0%
Business Grid	\$3,084	\$0	0%	\$0	0%
Residential Incentives	\$27,813	\$22,945	83%	\$21,555	77%
Residential HTR	\$4,089	\$3,680	90%	\$3,659	90%
Grid Services Ready	\$37,500	\$0	n/a	\$0	0%
Demand Flexibility	\$0	\$0	n/a	\$0	n/a
GHG Reductions (Tons)	\$0	\$0	n/a	\$0	n/a
GHG Reductions (Barrels of Oil)	\$0	\$0	n/a	\$0	n/a
Total	\$525,000	\$150,873	29%	\$151,421	29%

CET Highlights and Recommendations

We close this chapter with a set of highlights from the CET verification findings that call attention to areas where Hawai'i Energy is doing well and a set of recommendations that identify areas for improvement.

Highlights

The following bullets call attention to several key successes for the CET Performance.

- **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, and occupancy was higher than anticipated (based on 2021-22 trends), causing projects delays.
- **AEG found that Hawai'i Energy's implementation of the TRM algorithms for prescriptive programs was nearly perfect.** We made minimal impactful TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.00 for all programs.
- **Hawai'i Energy achieved just 29% of available CET awards in PY22,** largely driven by the Business Prescriptive and Business Custom programs, which did not achieve any awards. The verification had a limited impact on the achieved awards.

Recommendations

Our verification found that Hawai'i Energy is still struggling with implementing dual baselines and collecting sufficient documentation for custom projects. Below we present two groups of recommendations based largely on the effect or implication of each recommendation on either AEG's ability to verify savings or the accuracy of the savings estimates.

High-Priority Recommendations

High-priority recommendations are those that have the largest impact on verified CET metrics, including energy and demand reductions and TRBs. Each of the items below is critical to either correctly calculating CET metrics or the ability to verify the type or quantity of rebated measures or projects purchased.

1. **Adhere to the documentation requirements outlined in the Custom Project Guidance document to avoid penalties that could hurt the future of the PFBA programs.** The evaluability of program performance and achievements remains a critical verification component that gives stakeholders, including the customers who benefit from these programs, confidence in the process. AEG has seen some incremental improvement over time in the documentation collected for custom projects—for example, many more of the projects included lifetime savings calculates than in PY21. However, we continued to find the following:
 - a. Cases where equipment specifications, project equipment and labor costs, or some proof of installation were not documented or aligned with how savings were claimed.
 - b. Installation dates that preceded any evidence of pre-approval by Hawai'i Energy or rebate applications.
 - c. A lack of documentation showing that Hawai'i Energy pre-approved the project before it was underway or completed as stipulated by program eligibility requirements (e.g., email communications, pre-site inspections, consistent use of the project summary form, or another form preceding the application rebate submission).
 - d. Justification of early retirement, particularly for transformers projects. The TRM requires documentation that the pre-existing transformer is underloaded during average and peak operating conditions and is in good working order to justify EULs exceeding 30 years.

These fundamental elements of documentation are critical to providing basic assurance that the rebated projects are completed, and that the measures were purchased and installed. Timing of

the rebates and pre inspections helps to ensure that the program has a chance of influencing customer behavior, and that rebates are not paid for projects that are already installed. Pre-approval is also best practice considering the significant incentives associated with many of these projects.

2. **Account for dual baselines for custom projects.** AEG found that when custom lighting projects replaced incandescent lamps, Hawai'i Energy used the first-year energy savings for the duration of the measure life. This is consistent with the PY21 verification, although the issue was much less pervasive this year. In addition, we found that transformer replacement projects that were qualified as Early Retirement did not consistently use a dual baseline approach. Hawai'i Energy has noted it is easier to apply dual baselines to prescriptive measures but more difficult for custom and some semi-prescriptive measures for which the second baseline can vary based on measure and project specifications.
3. **Ensure custom smart device DR savings have complete and correct post-install billing data to correctly calculate claimed savings attributable to program.** AEG found that multiple smart device demand response measures projects lacked meter read data for May and June 2023. Supplemental documentation contained the May and June meter reads and the unique coefficients associated with those projects. AEG calculated the additional savings and credited them accordingly. Additionally, a couple of projects contained one duplicate line of meter read data that AEG removed, lowering savings very slightly for these projects. Smart device demand response opportunities achieved a 1.02 adjustment factor. Better screening of the billing data when finalizing savings will improve the accuracy of savings for these measures.
4. **Continue improving Energy Advantage documentation and the data in the tracking database.** During the desk reviews, AEG found that Energy Advantage documentation was inconsistent, making it difficult to properly review the sampled opportunities. Baseline wattages and efficient quantities routinely did not reconcile with the measure information in the tracking database and often had to be inferred. Clearly and consistently tracking wattages and qualities such that they aligned with contractor invoices would go far in ensuring the verification can adequately review projects.

In addition, AEG recommends that Hawai'i Energy fixes persistent tracking database issues found for Energy Advantage projects:

- a. In the tracking database, Energy Advantage CFs routinely exceeded 1.0 due to Hawai'i Energy unintentionally including weekend peak hours in the numerator, inflating CFs.
 - b. Because of database limitations, Hawai'i Energy applied a default EUL of 14 years to all Energy Advantage opportunities rather than custom measure-specific EULs. It also did not apply a dual baseline in cases where it was necessary to do so.
 - c. The tracking database did not provide measure characteristics or savings algorithms for some Energy Advantage lighting opportunities. Other projects had measures described as "Custom Lighting" or "Hawai'i Energy Historical Product" rather than a discrete measure name from the TRM, limiting AEG's ability to verify hours of use, interactive effects, and other savings inputs.
5. **Indicate clearly in the program tracking database which year or baseline(s) a project is using for measures whose baselines depend on calendar year.** As an example, the PY22 TRM has different guidance for ductless split system AC units installed in calendar years 2022

and 2023. While claimed savings offered insight into the installation year, a small number of opportunities appeared to unintentionally mix and match TRM savings parameters, primarily regarding demand reductions. Flagging the year or baseline these projects savings are based on would make it easier for the verification to ensure that the correct baseline was used for the census of projects.

6. **Flag projects completed in a previous program year but claimed in the next one (e.g., completed in PY21 but claimed in PY22).** Per AEG’s judgment, 9% of sampled opportunities appeared to have been completed and rebated during PY21. As most of these projects took place in May or June 2022, AEG assumes, but cannot verify with certainty, that these projects were not claimed during PY21 and were simply rolled forward into PY22. AEG credited Hawai‘i Energy with savings for these projects but recommends that, to prevent confusion Hawai‘i Energy flags any opportunities reported in a current program year but completed and rebated in a prior program year and ensure savings are not claimed twice.

Additional Recommendations

Additional recommendations focus on enhancing the accuracy of energy and demand reduction estimates; however, they are not linked to issues that directly impacted the verified CET metrics in a meaningful way.

1. **Conduct a thorough investigation of the large military housing initiative upon its completion.** AEG sampled several opportunities (i.e., separately-incentivized projects) for desk reviews and on-site visits that were associated with various project phases, measure bundles, and neighborhoods within military housing communities. AEG could not identify all the opportunities associated with this initiative, but altogether, these opportunities touched more than 5,000 residential units. Once all project phases have been implemented, a more robust verification of the initiative is warranted given the substantial savings and incentives associated with the opportunities. This would include identifying all opportunities associated with the military housing communities energy efficiency initiative and verifying the project as a whole, ideally with the time and budget required to sample vacant and occupied units from all affected communities.
2. **Consider a NTG study for CBEEM.** AEG identified several CBEEM projects with unclear timelines that would have benefitted from clearer documentation showing that Hawai‘i Energy pre-approved the project before it was underway or completed. This indicates that there could be much higher free ridership than the 25% assumed by the TRM. Accurate estimates of free ridership ensure that public funds are spent responsibly and influence customers who would not participate otherwise to install energy efficient measures.
3. **Include desk reviews of BGRID (and RGRID) projects in the next verification.** The PY22 verification focused its efforts elsewhere since these programs included few projects and fell far short of its targets. This was largely due projects taking longer than expected to complete. As Hawai‘i Energy completes these projects in PY23, the EM&V Contractor should conduct a full review of the documentation and savings calculation approach to ensure they adhere to industry standard practices. This effort would also serve to verify Demand Flexibility achievements.
4. **Instead of increasing the existing Refrigeration Efficiency target by 5%, set the target as a 5% increase over the previous year’s participation.** Despite falling short of its target, Hawai‘i Energy successfully increased its participation over the previous year by 8%. Rather than increase the existing target (78) by 5%, it may be more realistic to expectations to

increase the existing participation (68) by 5%. Instead, if the target increases by another 5% (to 82 customers), Hawai'i Energy will need to increase its observed participation by roughly 20% to achieve that metric.

3 | Non-CET Verification Findings

Non-CET activities are categorized into Accessibility & Affordability (A&A), Economic Development & Market Transformation (MTED), and Customer Satisfaction. Each of these performance categories is comprised of several key focus areas, as outlined in Table 3-1.

Table 3-1 Non-CET Performance Categories and Key Focus Areas

Performance Category	Key Focus Area
Accessibility & Affordability (A&A)	Economically Disadvantaged
	Island Equity
Economic Development & Market Transformation (MTED)	Behavior Change
	Professional Development & Technical Training
	Codes & Standards
	Clean Energy Innovation Hub
	Outcome Metrics
Customer Satisfaction	Application Processing Customer Experience

Each key focus area is evaluated according to a metric(s) that suits its purpose and contributions toward Hawai'i Energy's overarching goals. AEG verified Hawai'i Energy's performance towards each non-CET target and award by reviewing backup documentation (e.g., invoices, contract agreements, third-party reports, etc.) and conducting independent analyses of the tracking database. Details on methods are provided in the following sections and in Appendix D.

Non-CET Categories and Performance

The sections below outline the purpose of the non-CET category and the key focus areas and metrics that comprise them as well as adjustments and exceptions to claimed performance as identified by AEG. For most metrics, Hawai'i Energy met or exceeded non-CET performance targets.

Accessibility & Affordability (A&A)

A&A performance goals ensure that program services and benefits are equitably allocated across eligible geographies and underserved demographics. As shown in Table 3-2, there are two separate verification efforts under the A&A award for Economically Disadvantaged customers and Island Equity.

Table 3-2 A&A Summary of Metrics and Verification Methods

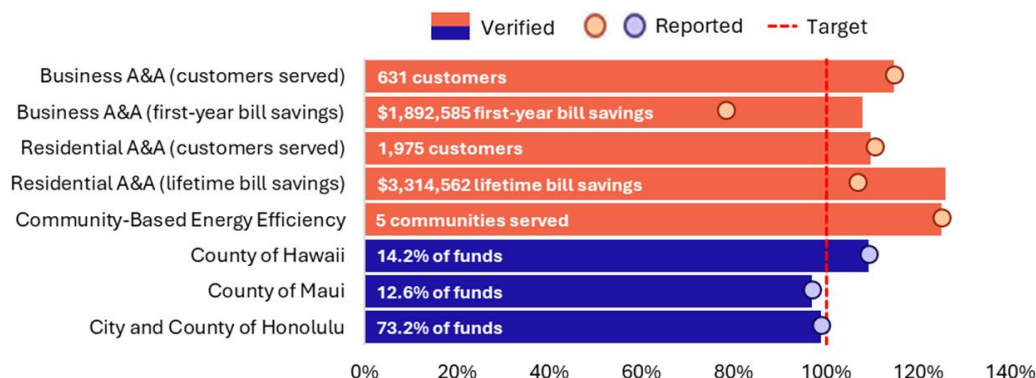
Metric	Verification Approach
Economically Disadvantaged Requires serving a minimum number of customers (who save a minimum amount on their energy bills) through the Energy Advantage and single- and multifamily direct install programs and distinct communities through the Community-Based Energy Efficiency program.	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. ¹⁵ Community-Based Energy Efficiency (CBEE). Confirmed community counts through project documentation review.
Island Equity Requires that 13% of program spending occurs in each of 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).

AEG verified A&A efforts by reviewing a combination of program tracking data, geographic distribution of incentives, and agreements with community and non-profit organizations and adjusted lifetime bill savings for CET verification findings.

As shown in Figure 3-1, 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 3-1 A&A Verified Performance Against Key Focus Area Targets



Economic Development & Market Transformation (MTED)

MTED performance goals and programs seek to identify and overcome market barriers that prevent residential and business customers from becoming energy-efficient by encouraging customers to

¹⁵ AEG used the 2019 billing to determine the bill savings customers would receive from each tier in the Hawaiian Electric's rate structure, assuming that most bill savings would be recognized at the top-most tier rate.

engage in energy-saving behavior and/or invest in energy-saving equipment. In particular, these programs:

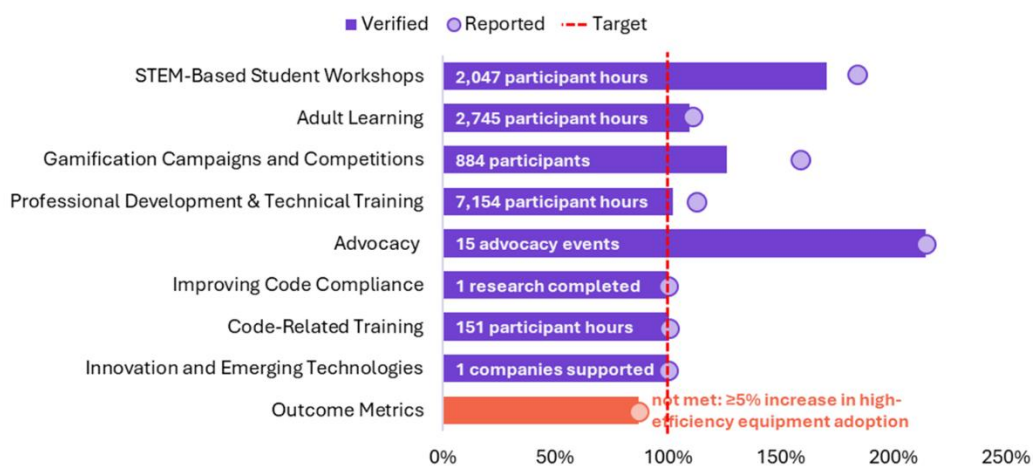
- Work to raise energy literacy at every level in [Hawaii] communities,
- Support policies and workforce training that make it easier for industries to adopt clean energy practices,
- Stay at the cutting-edge of new technology developments, and
- Establish strong relationships that help grow Hawai'i Energy's capacity to provide needed trainings and support and improve their reach within communities.

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 3-2, Hawai'i Energy met all MTED performance targets except for its new Outcome Metrics target, which pertains to high-efficiency refrigeration equipment adoption.

In PY22, Hawai'i Energy occasionally sent Leidos and affiliated staff to trainings and seminars and counted their attendance hours toward professional development and technical training participant hours. Typically, Hawai'i Energy removes Leidos employees from attendance records when it is the entity that administers the training or workshop. In these instances it was evident to AEG that Hawai'i Energy employees were in attendance for their own professional development and technical expertise, which AEG acknowledges is important for understanding codes and standards, interfacing with contractors and local officials, and administering and implementing programs. However, it would be helpful if Hawai'i Energy indicated on attendance records whether employees at training, workshops, and seminars are implementers or attendees and to provide substantiation (e.g., a brief explanation) as to why employees are attending as participants.

In documentation pertaining to 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.

Figure 3-2 MTED Verified Performance Against Key Focus Area Targets



Customer Satisfaction

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

To meet PY22 targets, Hawai'i Energy had to achieve customer satisfaction scores of at least 9.0 (out of a possible 10) on overall customer satisfaction for each of the residential and business sectors. Using output from the Medallia and in-house survey tools, AEG verified 100% of the claimed customer satisfaction scores of 9.7 and 9.5 for business and residential participant satisfaction, respectively.

Low-to-Moderate Income (LMI) Performance Incentive Mechanisms (PIM)

In D&O 37787, the Commission approved the LMI PIM that seeks to incent Hawaiian Electric¹⁶ to collaborate with Hawai'i Energy in the delivery of energy savings to LMI residential customers.

As part of the PY22 verification effort, AEG calculated the LMI PIM rewards associated with the RHTR and A&A programs implemented by Hawai'i Energy. To calculate rewards, AEG applied the approach laid out in D&O 37787 to estimate the additional net benefits customers received from these initiatives by gathering RHTR incentive and non-incentive funds gathered from Hawai'i Energy and using the targeted and verified first-year energy and peak demand reductions and targeted TRBs associated with RHTR (and resulting from the PY22 verification). AEG also calculated the participation award associated with residential A&A Economically Disadvantaged customers.

As shown in Table 3-3, Hawaiian Electric achieved \$12,047 in total rewards.¹⁷ (See Appendix C for calculation details.)

Table 3-3 Hawaiian Electric LMI PIM Achieved Awards

PIM Award Component	Verified Reward
Total Energy Savings Award	\$0
Total Peak Demand Reductions Award	\$0
Total Participation Award	\$12,047
Total LMI PIM Award	\$12,047

Non-CET Performance Awards

As shown in Table 3-4, AEG verified 50% of the A&A target awards and 100% of MTED and Customer Satisfaction target awards, leading to overall non-CET verified awards of \$150,000 (67% of non-CET target awards). Hawai'i Energy's claimed awards align with the final awards as verified by AEG.

¹⁶ Hawaiian Electric is comprised of Hawaiian Electric Company, Inc, Hawaii Electric Light Company, Inc., and Maui Electric Company, LTD.

¹⁷ The awards indicated by the Energy Efficiency Manager (EEM) via a memo dated 4/5/24 (\$11,212.01) were \$835.31 lower than shown in this report (\$12,047.32). This memo used verified savings that were expected to be final as of the end of February. However, in completing its verification tasks, AEG made slight updates that affected verified savings throughout the Hawai'i Energy portfolio, including A&A within RHTR, which impacted LMI PIM awards.

Table 3-4 Non-CET Claimed and Verified Performance Awards

Key Focus Area (Performance Indicator)	Target Award (\$)	Claimed Award (\$)	(% of Target)	Verified Award (\$)	(% of Target)
Affordability & Accessibility	\$150,000	\$60,000	40%	\$75,000	50%
Economically Disadvantaged	\$75,000	\$60,000	80%	\$75,000	100%
Island Equity	\$75,000	\$0	0%	\$0	0%
Market Transformation & Economic Development	\$60,000	\$60,000	100%	\$60,000	100%
Behavior Change	\$15,000	\$15,000	100%	\$15,000	100%
Professional Development & Technical Training	\$37,500	\$37,500	100%	\$37,500	100%
Codes & Standards	\$7,500	\$7,500	100%	\$7,500	100%
Clean Energy Innovation Hub	\$0	\$0	N/A	\$0	N/A
Outcome Metrics	\$0	\$0	N/A	\$0	N/A
Customer Satisfaction	\$15,000	\$15,000	100%	\$15,000	100%
Business Customer Application Experience	\$7,500	\$7,500	100%	\$7,500	100%
Residential Customer Application Experience	\$7,500	\$7,500	100%	\$7,500	100%
Total	\$225,000	\$135,000	60%	\$150,000	67%

Lost awards resulted from the Island Equity performance indicator of the A&A key focus area, totaling \$75,000.

Non-CET Highlights and Recommendations

We close this chapter with a set of highlights from the non-CET verification findings that call attention to areas where Hawai'i Energy is doing well and recommendations that identify areas for improvement.

Highlights

As noted at the beginning of this chapter, AEG verified 100% of the claimed performance for nearly all the non-CET performance metrics, and Hawai'i Energy also met or exceeded most performance targets.

- **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 key focus area for the CKE channel.** Hawai'i Energy fell short of the target for the adoption of high-efficiency kitchen equipment, which increased by 5% over the PY21 target. Significant achievements reported by Hawai'i Energy included conducting research about and advocating for updates to appliance standards that were 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%.

Recommendations

In its evaluation AEG did not identify significant needs for improvement. We note the following potential improvements:

1. Indicate if Leidos employees are intended to be counted as part of training-hours.

Previously, Hawai'i Energy excluded its own employees from the cumulative training hours and participants. In PY22, Hawai'i Energy counted its own employees' participation in certain trainings and seminars. These employee hours pushed Hawai'i Energy over the target in one non-CET metric; without them, Hawai'i Energy would have missed that award.

It is important for Hawai'i Energy and affiliated employees to be well-versed in codes and standards and current market conditions, especially when coordinating with CEAs and local officials. It also appears that Hawai'i Energy counted these hours in a consistent manner, e.g., for seminars hosted by third parties but not those that Hawai'i Energy itself hosted, such as a CEA workshop. As such, AEG has allowed the hours to count toward targets. However, it would be helpful for Hawai'i Energy to clarify when they count their own employees' hours toward targets and to provide justification as to why.

2. As in the PY20 and PY21 Verifications, AEG recommends that Hawai'i Energy provide the EM&V contractor with the raw data for the satisfaction survey.

This would allow for more meaningful or interesting insights in reporting beyond the overall score. It would also facilitate recommendations that could be helpful to Hawai'i Energy in the future.

3. Calculate residential A&A lifetime bill savings as a net present value.

Hawai'i Energy calculates customer-level lifetime bill savings as a nominal cashflow wherein the effective rate (\$/kWh) as stipulated in Hawai'i Energy's annual plan is multiplied by the reported customer-level energy (kWh) savings for the duration of a measure's EUL. It does not escalate the initial effective rate according to a rate forecast or escalation rate, nor does it discount future bill savings to account for time value of money. To verify lifetime bill savings, AEG used marginal effective rates by rate class as submitted in HECO rate summaries,¹⁸ escalated effective rates at 2.5% annually,¹⁹ and discounted future bill savings at 6% consistent with PY22 TRM guidance for TRBs.

¹⁸ From June 2022 through July 2023. Provided by HECO monthly on behalf of Maui Electric Company (MECO) and Hawaii Electric Light Company (HELCO). Effective rates were substantially higher in PY22 than in PY21.

¹⁹ Based on the average annual national inflation rate from 2014 through 2023, courtesy of the U.S. Bureau of Labor Statistics (BLS) Consumer Price Index (CPI).

A | Detailed Performance and Awards Tables

In this section, we provide the detailed target, claimed, and verified performance and awards by program category (CET only), program (CET only), and performance indicator metric. Table A-1 shows how AEG calculated performance awards for each performance metric and key focus area.

Table A-1 Rules for Calculating Performance Awards

Performance Metric/Key Focus Area	Verified Metric as % of Performance Target	Rule for Calculating Award
First-Year Energy Savings, Lifetime Energy Savings, Peak Demand Reductions, and Total Resource Benefits. (metrics and targets set for five program categories)	< 90.0%	No award.
	≥ 90.0% and ≤ 100.0%	A 1% increase in percentage performance corresponds to a 5% increase in achieved awards, starting with 50% of the target award (e.g., 90% of the performance target results in 50% of award achieved, 91% of the performance target results in 55% of award achieved, etc.).
	≥ 100.0%	The achieved awards equal 100% of the target award.
Other CET, A&A, MTED, and Customer Satisfaction	< 100.0%	No award.
	≥ 100.0%	Achieved awards equal 100% of target award.

CET Performance and Awards Tables

This section provides the CET target, claimed, and verified performance awards by key focus area and program category:

- Table A-2 Clean Energy Technology Verified Performance
- Table A-3 Clean Energy Technology Verified Awards
- Table A-4 Clean Energy Technology Verified Performance by Program Category
- Table A-5 Clean Technology Verified Awards by Program Category

CET Performance Overall

Table A-2 Clean Energy Technology Verified Performance

Key Focus Areas	Target Performance	Claimed (% of Target)	Verified (% of Target)
First-Year Energy Reduction (MWh/yr)	89,808	56,163 63%	56,548 63%
Lifetime Energy Reduction (MWh)	1,227,351	727,355 59%	746,818 61%
Peak Demand Reduction (MW)	17.6	8.1 46%	8.0 46%
Total Resource Benefits (\$)	\$155,921,667	\$89,569,518 57%	\$92,944,068 60%
Grid Services Ready (Projects)	2,200	1,663 76%	1,686 77%
Demand Flexibility (kW)	3,500	1,286 37%	1,286 37%
GHG Reductions (Tons)	63,659	38,760 61%	40,083 63%
GHG Reductions (Barrels of Oil)	146,887	90,192 61%	93,216 64%

Table A-3 Clean Energy Technology Verified Awards

Key Focus Areas	Target Award	Claimed (% of Target)	Verified (% of Target)
First-Year Energy Reduction	\$112,500.00	\$44,528.23 40%	\$44,791.31 40%
Lifetime Energy Reduction	\$112,500.00	\$38,951.85 35%	\$39,851.19 35%
Peak Demand Reduction	\$150,000.00	\$32,714.06 22%	\$32,714.06 22%
Total Resource Benefits	\$112,500.00	\$34,678.83 31%	\$34,064.26 30%
Grid Services Ready	\$37,500.00	\$0.00 0%	\$0.00 0%
Demand Flexibility	\$0.00	\$0.00 n/a	\$0.00 n/a
GHG Reductions (Tons)	\$0.00	\$0.00 n/a	\$0.00 n/a
GHG Reductions (Barrels of Oil)	\$0.00	\$0.00 n/a	\$0.00 n/a
Total Award	\$525,000.00	\$150,872.97 29%	\$151,420.82 29%

CET Performance by Program Category

Table A-4 Clean Energy Technology Verified Performance by Program Category

Key Focus Areas	Target Performance	Claimed (% of Target)	Verified (% of Target)
First-Year Energy Reduction (kWh/yr)	89,807,910	56,162,776	63%
Business Prescriptive	25,546,423	11,790,622	46%
Business HTR	6,863,630	6,987,816	102%
Business Custom	26,901,196	6,472,844	24%
Business Grid	150,577	305,962	203%
Residential Incentives	26,527,695	27,133,910	102%
Residential HTR	3,818,390	3,471,622	91%
Lifetime Energy Reduction (kWh)	1,227,351,042	727,354,827	59%
Business Prescriptive	395,785,912	188,940,300	48%
Business HTR	98,934,407	95,945,412	97%
Business Custom	376,115,928	85,321,527	23%
Business Grid	1,505,765	3,059,617	203%
Residential Incentives	308,971,831	311,201,726	101%
Residential HTR	46,037,199	42,886,245	93%
Peak Demand Reduction (kW)	17,605	8,079	46%
Business Prescriptive	5,099	1,809	36%
Business HTR	1,038	895	86%
Business Custom	2,911	980	34%
Business Grid	4,203	45	1%
Residential Incentives	3,840	3,924	102%
Residential HTR	515	427	83%
Total Resource Benefits (\$)	\$155,921,667	\$89,569,518	57%
Business Prescriptive	\$50,442,070	\$22,132,061	44%
Business HTR	\$12,265,940	\$12,033,868	98%
Business Custom	\$44,724,352	\$12,290,180	28%
Business Grid	\$4,274,981	\$369,410	9%
Residential Incentives	\$38,547,499	\$37,189,398	97%
Residential HTR	\$5,666,825	\$5,554,601	98%
Grid Services Ready (Projects)	2,200	1,663	76%
Demand Flexibility (kW)	3,500	1,286	37%
GHG Reductions (Tons)	63,659	38,760	61%
GHG Reductions (Barrels of Oil)	146,887	90,192	61%

Table A-5 Clean Technology Verified Awards by Program Category

Key Focus Areas	Target Award	Claimed (% of Target)		Verified (% of Target)	
First-Year Energy Reduction	\$112,500	\$44,528	40%	\$44,791	40%
Business Prescriptive	\$32,001	\$0	0%	\$0	0%
Business HTR	\$8,598	\$8,598	100%	\$8,598	100%
Business Custom	\$33,698	\$0	0%	\$0	0%
Business Grid	\$189	\$189	100%	\$189	100%
Residential Incentives	\$33,231	\$33,231	100%	\$33,231	100%
Residential HTR	\$4,783	\$2,511	55%	\$2,774	58%
Lifetime Energy Reduction	\$112,500	\$38,952	35%	\$39,851	35%
Business Prescriptive	\$36,278	\$0	0%	\$0	0%
Business HTR	\$9,068	\$7,708	85%	\$9,068	100%
Business Custom	\$34,475	\$0	0%	\$0	0%
Business Grid	\$138	\$138	100%	\$138	100%
Residential Incentives	\$28,321	\$28,321	100%	\$27,754	98%
Residential HTR	\$4,220	\$2,785	66%	\$2,891	69%
Peak Demand Reduction	\$150,000	\$32,714	22%	\$32,714	22%
Business Prescriptive	\$43,447	\$0	0%	\$0	0%
Business HTR	\$8,844	\$0	0%	\$0	0%
Business Custom	\$24,799	\$0	0%	\$0	0%
Business Grid	\$35,809	\$0	0%	\$0	0%
Residential Incentives	\$32,714	\$32,714	100%	\$32,714	100%
Residential HTR	\$4,387	\$0	0%	\$0	0%
Total Resource Benefits	\$112,500	\$34,679	31%	\$34,064	30%
Business Prescriptive	\$36,395	\$0	0%	\$0	0%
Business HTR	\$8,850	\$8,054	91%	\$8,850	100%
Business Custom	\$32,269	\$0	0%	\$0	0%
Business Grid	\$3,084	\$0	0%	\$0	0%
Residential Incentives	\$27,813	\$22,945	83%	\$21,555	77%
Residential HTR	\$4,089	\$3,680	90%	\$3,659	90%
Grid Services Ready	\$37,500	\$0	0%	\$0	0%
Demand Flexibility	\$0	\$0	n/a	\$0	n/a
GHG Reductions (Tons)	\$0	\$0	n/a	\$0	n/a
GHG Reductions (Barrels of Oil)	\$0	\$0	n/a	\$0	n/a
Total	\$525,000	\$150,873	29%	\$151,421	29%

Non-CET Performance and Awards Tables

The following sections provide the target, claimed, and verified performance and awards for each component of the non-CET key focus areas:

- Table A-6 Accessibility & Affordability Verified Performance
- Table A-7 Accessibility & Affordability Verified Awards

- Table A-8Market Transformation & Economic Development Verified Performance
- Table A-9Market Transformation & Economic Development Verified Awards
- Table A-10Customer Satisfaction Verified Performance
- Table A-11Customer Satisfaction Verified Awards

Affordability & Accessibility

Table A-6 Accessibility & Affordability Verified Performance

Key Focus Areas		Target Performance	Claimed (% of Target)		Verified (% of Target)	
Economically Disadvantaged	Business A&A Customers Served	550	631	115%	631	115%
	Business A&A Bill Savings	\$1,754,612	\$1,375,541	78%	\$1,892,585	108%
	Residential A&A Customers Served	1,800	1,990	111%	1,975	110%
	Residential A&A Bill Savings	\$2,631,891	\$2,810,182	107%	\$3,314,562	126%
	Community Based Energy Efficiency	4	5	125%	5	125%
Island Equity	County of Hawaii	13.0%	14.2%	109%	14.2%	109%
	County of Maui	13.0%	12.6%	97%	12.6%	97%
	City & County of Honolulu	74.0%	73.2%	99%	73.2%	99%

Table A-7 Accessibility & Affordability Verified Awards

Key Focus Areas		Target Award	Claimed (% of Target)		Verified (% of Target)	
Economically Disadvantaged	Business A&A Customers Served	\$15,000.00	\$15,000.00	100%	\$15,000.00	100%
	Business A&A Bill Savings	\$15,000.00	\$0.00	0%	\$15,000.00	100%
	Residential A&A Customers Served	\$15,000.00	\$15,000.00	100%	\$15,000.00	100%
	Residential A&A Bill Savings	\$15,000.00	\$15,000.00	100%	\$15,000.00	100%
	Community Based Energy Efficiency	\$15,000.00	\$15,000.00	100%	\$15,000.00	100%
Island Equity	County of Hawaii	\$75,000.00	\$0.00	0%	\$0.00	0%
	County of Maui					
	City & County of Honolulu					
Total		\$150,000.00	\$60,000.00	40%	\$75,000.00	50%

Market Transformation & Economic Development

Table A-8 Market Transformation & Economic Development Verified Performance

Key Focus Areas		Target Performance	Claimed (% of Target)		Verified (% of Target)	
Behavior Change	STEM-Based Student Workshops	1,200	2,208	184%	2,047	171%
	Adult Learning	2,500	2,774	111%	2,745	110%
	Gamification Campaigns and Competitions	700	1,111	159%	884	126%
Prof. Dev. & Technical Training	Clean Energy Ally Support, Targeted Ally Training Opportunities, Targeted Participant Training Opportunities, Educator Training and Grants, Degree Program Support, Vocational Training	7,000	7,890	113%	7,154	102%
Codes and Standards	Appliance Standards Advocacy	7	15	214%	15	214%
	Improve Code Compliance	1	1	100%	1	100%
	Code-Related Training	150	151	101%	151	101%
Clean Energy Innovation Hub	Innovation and Emerging Technologies	1	1	100%	1	100%
Outcome Metrics	High-efficiency equipment adoption	5% increase	Not met	0%	Not met	0%

Table A-9 Market Transformation & Economic Development Verified Awards

Key Focus Areas		Target Award	Claimed (% of Target)		Verified (% of Target)	
Behavior Change	STEM-Based Student Workshops	\$7,500.00	\$7,500.00	100%	\$7,500.00	100%
	Adult Learning	\$7,500.00	\$7,500.00	100%	\$7,500.00	100%
	Gamification Campaigns and Competitions	\$0.00	\$0.00	n/a	\$0.00	n/a
Prof. Dev. & Technical Training	Clean Energy Ally Support, Targeted Ally Training Opportunities, Targeted Participant Training Opportunities, Educator Training and Grants, Degree Program Support, Vocational Training	\$37,500.00	\$37,500.00	100%	\$37,500.00	100%
Codes and Standards	Appliance Standards Advocacy	\$7,500.00	\$7,500.00	100%	\$7,500.00	100%
	Improve Code Compliance					
	Code-Related Training					
Clean Energy Innovation Hub	Innovation and Emerging Technologies	\$0.00	\$0.00	n/a	\$0.00	n/a
Outcome Metrics	High-efficiency equipment adoption	\$0.00	\$0.00	n/a	\$0.00	n/a
Total		\$60,000.00	\$60,000.00	100%	\$60,000.00	100%

Customer Satisfaction

Table A-10 Customer Satisfaction Verified Performance

Key Focus Areas		Target	Claimed (% of Target)		Verified (% of Target)	
Application Processing Customer Experience	Commercial	>9.0	9.70	108%	9.66	107%
	Residential	>9.0	9.50	106%	9.50	106%

Table A-11 Customer Satisfaction Verified Awards

Key Focus Areas		Target	Claimed (% of Target)		Verified (% of Target)	
Application Processing Customer Experience	Commercial	\$7,500.00	\$7,500.00	100%	\$7,500.00	100%
	Residential	\$7,500.00	\$7,500.00	100%	\$7,500.00	100%
Total		\$15,000.00	\$15,000.00	100%	\$15,000.00	100%

B | Historical Verification Recommendations

Table B-1 documents historical recommendations made by AEG beginning in PY17 that remain relevant. Other recommendations may have been made over the past five evaluations; however, either they were implemented by Hawai'i Energy, or they are no longer relevant for another reason, i.e., change in awards, targets, or focus.

Table B-1 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 an equivalent form of documentation) for all measures and projects prior to paying out incentives.		X	X	X	X	X	AEG saw little 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 both the pre- and post-implementation period 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 with best practices.
Adhere to Custom Project Guidance.					X	X	Custom projects adhered to guidance more consistently than in PY21 but leaves room for improvement.
Ensure site inspections are sufficiently rigorous to verify 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 with the Custom Project Guidance Document.

C | Low-to-Moderate Income Performance Incentive Mechanisms

This appendix describes how AEG calculated the LMI PIM rewards associated with the RHTR and A&A programs implemented by Hawai'i Energy. Metrics for each program were tracked as part of the verification, and Table C-1 shows the following values AEG used in the calculation:

Table C-1 LMI PIM Inputs

Cell Ref.	Description	Value	Source
[a]	Total RHTR budget (incentives + non-incentives)	\$3,816,295	PY22 Bottom Up M2.6.0FINAL.xlsm (not publicly available)
[b]	Target RHTR energy savings	3,818,389.63	Metrics by Performance Category_06.15.22 (submission).xlsx (not publicly available)
[c]	Total verified kWh savings	3,496,927.99	(Program-Level Annual kWh) PY22 Verification Report (full public report expected June 2024)
[d]	Target RHTR demand reductions	514.83	Metrics by Performance Category_06.15.22 (submission).xlsx (not publicly available)
[e]	Total verified kW savings	415.78	(Program-Level Annual kW) PY22 Verification Report (full public report expected June 2024)
[f]	Target RHTR TRBs	\$5,666,825	Metrics by Performance Category_06.15.22 (submission).xlsx (not publicly available)
[g]	Target residential A&A customers served	1,800	Performance Goal and Metrics_PY22-PY24_06.15.22_Final (submission) v1.xlsx (not publicly available)
[h]	Target residential A&A customer bill savings	\$2,631,891	Performance Goal and Metrics_PY22-PY24_06.15.22_Final (submission) v1.xlsx (not publicly available)
[i]	Weighted EUL for residential A&A	10.62	PY22 Verification Report (see text below this table)
[j]	Total verified participation	1,975	PY22 Verification Report (Figure 3-1)

*Weighted EUL is calculated by dividing the total lifetime kWh savings by the total annual kWh.

Specifically, among residential A&A projects, AEG verified annual savings of 936,326 kWh and lifetime savings of 9,943,510 kWh, resulting in a weighted EUL of 10.62 years. Table C-2 presents the calculation of the LMI PIM as it is described in Decision and Order 37787.

Table C-2 LMI PIM Calculations

Line #	Description	Value
[L1] = [b]	Target RHTR energy savings	3,818,390
[L2] = [a] x 85%	RHTR total budget (85% to energy)	\$3,243,851
[L3] = [f] x 85%	Target RHTR TRBs (85% to energy)	\$4,816,801
[L4] = ([L3]-[L2])/[L1]	Net utility system benefit per kWh	\$0.41
[L5] = [L4] x 0.5	Net benefit share to Companies	\$0.21
[L6] = ([c]-[L1]) x [L5]	Total Energy Savings Award	\$0.00
[L7] = [d]	Target RHTR demand reduction	515
[L8] = [a] x 15%	RHTR total budget (15% to demand)	\$572,444
[L9] = [f] x 15%	Target RHTR TRBs (15% to demand)	\$850,024
[L10] = ([L9]-[L8])/[L7]	Net utility system benefit per kWh	\$539.17
[L11] = [L10] x 0.5	Net benefit share to Companies	\$269.58
[L12] = ([e]-[L7]) x [L11]	Total Demand Reductions Savings Award	\$0.00
[L13] = [g]	Target residential A&A customers served	1,800
[L14] = [h]	Target residential A&A customer bill savings	\$247,831
[L15] = [L14]/[L13]	First-year bill savings per target customers served	\$137.68
[L16] = [L15] x 0.5	Net benefit share to Companies	\$68.84
[L17] = ([j]-[L13]) x [L16]	Participation Award	\$12,047.32
[L18] = [L6] + [L12] + [L17]	Total Award	\$12,047.32

AEG and the EEM determined that (1) the Total Energy Savings Award [L6], Total Demand Reductions Savings Award [L12], and Participation Award [L17] exist independently of one another, and (2) Hawai'i Energy cannot incur negative awards. As such, AEG converted the negative award amounts shown above to zero prior to calculating the Total Award [L18], and the sum of the three awards reflects only the positive amount awarded for participation (\$12,047.32).

D | Detailed Methodologies

Similar to the PY21 work plan, AEG has broken the verification activities into two distinct groups for this verification plan: CET program verification activities and non-CET verification activities.

The **CET program verification activities** were designed to verify 70% of Hawai'i Energy's total performance award. AEG conducted two levels of verification depending on the type of measure or project:

- **Deemed and Semi-Prescriptive.** Deemed measures should follow the algorithms and assumptions stipulated in the Hawai'i Energy TRM. Partially deemed, semi-prescriptive measures within the TRM allow Hawai'i Energy to use other primary or secondary sources for specific parameters to derive tailored savings. The Residential and Business Energy Efficiency Measures (REEM and BEEM), Energy Services and Maintenance (RESM and BESM), and Hard-to-Reach (RHTR and BHTR) programs include measures with deemed and semi-prescriptive savings.
- **Custom.** The Hawai'i TRM does not include stipulated savings for custom measures or projects. Savings estimates for these measures should follow industry best practices outlined in documentation such as the UMP and IPMVP. Only the Residential and Business Custom Energy Efficiency Measures (CREEM and CBEEM) programs include projects with custom savings. We also expect some custom projects to have prescriptive components. We assume that the prescriptive elements will be clearly labeled and allocated to the appropriate program track.

Table D-1 presents a summary of the verification activities conducted by task and program designed specifically to verify first-year savings, lifetime savings, and demand savings. AEG also verified other metrics, including total resource benefits, Grid Services Ready, and greenhouse gas emissions as part of the CET verification activities.

Table D-1 Clean Energy Technologies Verified Performance

Verification Activity	Deemed and Semi-Prescriptive			Custom				
	REEM	RESM	RHTR	BEEM	BESM	BHTR	CREEM	CBEEM
Program Manager Interviews	Four interviews to cover all programs							
Tracking System Audit	Audit covered all programs							
Sample Plan	Sample plan developed for each program							
CET Verification Activities								
Savings Replication	✓			✓			✓	✓
Simple Engineering Desk Review	✓			✓				
Complex Engineering Desk Review							✓	✓
On-site Verification								✓

Non-CET verification activities were designed to verify the remaining 30% of Hawai'i Energy's performance award. These activities focused on collecting and verifying information from Hawai'i Energy around the number of customers or communities served, customer bill savings, training sessions, stakeholder and advocacy events, and customer satisfaction scores. Non-CET Verification Activities included:

- Program documentation collection and review
- Verification of Accessibility and Affordability (A&A) metrics
- Verification of Economic Development and Market Transformation metrics
- Verification of Customer Satisfaction metrics

In addition, AEG also verified the calculation of the Low to Moderate Income (LMI) Performance Incentive Mechanism (PIM) award attributable to RHTR and A&A aspects of the Hawai'i Energy programs.

The following sections describe the verification approach and specific verification activities in greater detail.

Program Manager Interviews

AEG conducted interviews with four key Hawai'i Energy program staff to gain insight into the program design and delivery, assess quality assurance/quality control (QA/QC) procedures, discuss successes and challenges, and identify and prioritize verification tasks. AEG interviewed the following staff members:

- Mireya Norman, Deputy Director; oversees Operations including Residential (including A&A) and Transformational Programs
- Eileen Stewart, Business Solutions Manager; oversees Business Programs including A&A programs.
- Vinh Ngo, Technical Services Engineering Manager; oversees Technical Services, including TRM
- Karen Shishido, Market Transformational Program Manager; manages Transformational Programs within MTED

Tracking Systems Audit

Before conducting the CET verification activities, AEG reviewed Hawai'i Energy's data-tracking system database. This audit covered the population of projects and CET customers participating in the PY22 portfolio of programs.

AEG reviewed the PY22 program tracking database in two steps:

- The **first step** allowed AEG to conduct a preliminary review of completed projects and served as the basis for developing the sample plan and memo (including desk review samples). Documentation for the desk review samples was then pulled from the Hawai'i Energy database by AEG staff.
- The **second step** included the final reconciled PY22 tracking system data. This data was used for the savings replication activity and the verification of CET and some non-CET metrics.

We verified the accuracy of the tracking system, including input assumptions and savings calculations. The savings replication and desk reviews supported much of the tracking system assessment. We also reviewed the data dictionary associated with the tracking system to confirm that it correctly defines and references program tracking elements and covers an appropriately comprehensive suite of project information.

Sample Plan

The final sample design was designed based on Hawai'i Energy's final tracking database. The database includes equipment and rebate-level savings and TRM inputs for replication,

plus incentive amounts, customer bill savings, total resource benefits (TRBs), and barrels of oil avoided, among other fields. Each equipment/service and rebate includes first-year energy and demand savings and lifetime energy savings at the following levels:

- **Customer Level:** Gross savings for each customer before accounting for line losses or net-to-gross (NTG).
- **System Level:** Savings reflected at the generator that incorporates line losses.
- **Program Level:** Net savings that account for free-ridership and spillover (system-level savings multiplied by the NTG ratio).

AEG focused the sample design on customer-level savings; line losses and NTG ratios are fixed across customers within each island or program and do not add variability to the program-level savings (so would not affect a sample design). Keep in mind that the PY22 verification plan included two levels of verification: database replication (no sampling involved for this) and desk reviews (sampling plan covers this effort). Both types of savings are needed to estimate overall program and portfolio level savings and realization rates.

Population Customer Savings

Like PY21, the Residential Energy Efficiency Measures and Business Energy Efficiency Measures (REEM and BEEM) programs contribute most of PY22's claimed customer first-year and lifetime savings. Residential Energy Services and Maintenance (RESM) passed Custom Business Energy Efficiency Measures (CBEEM) in claimed savings. In total, these four programs account for 82% of customer first-year energy savings, as shown in Table D-2. Business and Residential Hard to Reach (BHTR and RHTR) each contributed another 11% and 5%, respectively, and the remaining programs account for slightly more than 2%.

Table D-2 Population Claimed Customer First-Year and Lifetime Savings

Program	Type of Verification	Annual MWh (% of Total)	Peak MW (% of Total)	Lifetime MWh (% of Total)
REEM	Database Replication; Simple Desk Reviews	22,514 (33.7%)	2.75 (28.7%)	322,030 (36.1%)
BEEM	Database Replication; Simple Desk Reviews	13,754 (20.6%)	2.12 (22.1%)	230,611 (25.8%)
RESM	Database Replication; Simple Desk Reviews	10,016 (15.0%)	1.88 (19.6%)	73,502 (8.2%)
CBEEM	Complex Desk Reviews; On-site Visits	8,282 (12.4%)	1.25 (13.1%)	109,269 (12.2%)
BHTR	Database Replication; Simple Desk Reviews; Complex Desk Reviews	7,305 (10.9%)	0.94 (9.8%)	100,710 (11.3%)
RHTR	Database Replication; Simple Desk Reviews	3,315 (4.9%)	0.41 (4.2%)	40,953 (4.5%)
BESM	Database Replication	1,009 (1.5%)	0.15 (1.5%)	8,476 (0.9%)
BGRID	N/A	294 (0.4%)	0.04 (0.4%)	2,943 (0.3%)
CREEM	Database Replication	148 (0.2%)	0.02 (0.2%)	2,254 (0.2%)
RGRID	N/A	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total		66,636 (100%)	9.56 (100%)	890,748 (100%)

Sample Design

To maximize the efficiency of the budgeted number of desk reviews and on-sites, AEG designed the sample to focus on the three programs with the largest contribution to savings (REEM, BEEM, and CBEEM), while also reviewing a small sample of projects for the smaller programs (RHTR, BHTR, and RESM). AEG designed the sample to verify savings with $\pm 10\%$ relative precision at the 90% confidence level for REEM, BEEM, and CBEEM. The samples for RHTR, BHTR, and RESM represent a less rigorous check of savings estimation and approaches with a target of $\pm 20\%$ precision at 80% confidence.²⁰

AEG stratified the population of projects by program, delivery stream, and major equipment/service type. Table D-3 shows how AEG allocated the sample points to each program and stratum using Neyman's Allocation. Widely used in industry, Neyman's Allocation²¹ considers the distribution of claimed savings across strata and the expected variability in stratum-level realization rates to appropriately allocate sample points. As shown here, we based the allocation on customer first-year energy savings, but because the customer demand and lifetime energy savings follow a similar distribution, the design will be optimized for all three types of savings.

Table D-3 Sample Stratification

Program	Stratum	Type of Review	Unique Projects	Customer First-Year Savings MWh	% of Sample Frame	Sampled Projects
Sampled Strata			15,522	32,652	49.0%	156
REEM	Downstream	Simple	5,792	9,232	13.9%	30
BEEM	Downstream	Simple	478	8,174	12.3%	30
RESM	Whole Building Assistance	Simple	5,301	2,171	3.3%	8
CBEEM	Custom	Complex (15); On-site + Complex (30)	52	2,544	3.8%	45
BHTR	Energy Advantage	Complex	978	4,632	7.0%	17
	Downstream	Simple	340	1,940	2.9%	7
	ES4H	Simple	32	355	0.5%	2
	Grid Services	Complex	39	310	0.5%	3
	BHTR Total		1,389	7,237	10.9%	29
RHTR	Downstream	Simple	1,539	2,112	3.2%	8
	Custom	Simple	45	650	1.0%	2
	Whole Building Assistance	Simple	829	285	0.4%	2
	ES4H	Simple	106	245	0.4%	2
	RHTR Total		2,520	3,315	5.0%	14
Non-Sampled Strata			1,911	33,984	51.0%	0

²⁰ Consistent with PY20, we did not perform desk reviews for Upstream and Midstream REEM components. In addition, some components of BESM and BHTR were not sampled due to the low overall contribution of savings. Note that savings are no longer being claimed for the Peer Comparison program, which was ended partway through PY20.

²¹ Available Online: <https://www.nrel.gov/docs/fy17osti/68567.pdf>

Program	Stratum	Type of Review	Unique Projects	Customer First-Year Savings		Sampled Projects
				MWh	% of Sample Frame	
REEM	Upstream	None	581	7,675	11.5%	0
	Midstream	None	434	5,607	8.4%	0
	REEM Total		1,015	13,282	19.9%	0
BEEM	Midstream	None	648	5,579	8.4%	0
RESM	Whole Building Assistance	None	1	7,844	11.8%	0
CBEEM	Custom	None	38	4,737	8.6%	0
BHTR	Midstream Commercial Kitchen Equipment	None	46	67	0.1%	0
	Whole Building Assistance	None	9	3	0.0%	0
	BHTR Total		55	71	0.1%	0
RHTR	Grid Services	None	1	19	0.0%	0
BESM	Whole Building Assistance	None	147	1,009	1.5%	0
BGRID	Grid Services	None	3	294	0.4%	0
CREEM	Custom	None	3	148	0.2%	0
Total			17,433	66,636	100.0%	156

Note that for the CBEEM we propose both complex desk reviews, and complex desk reviews + on-sites. The process for sampling CBEEM projects into these two groups is as follows:

- Establish measure-based sub-stratification for CBEEM if needed (e.g., lighting and non-lighting)²²
- Select a random sample of 15 complex desk reviews independently by sub-strata
- Sub-stratify remaining projects ($52 - 15 = 37$)
- Recruit customers for on-site visits using targets for each substratum
- Conduct complex desk reviews and on-site visits

AEG calculated the expected precision (at 90% confidence) for each program and type of desk review, in Table D-4 below. In addition to the sample sizes, the assumed error ratios²³ largely drive the expected precision within each stratum. Error ratios provide a metric of variability around realization rates that we can expect. AEG assumed an error ratio of 0.5 for all strata, which we consider conservative.

²² The program tracking database identifies CBEEM projects as lighting, HVAC, or miscellaneous so that AEG can easily stratify the CBEEM population. AEG anticipates the need for sub-stratification based on an initial review of these identifiers.

²³ An error ratio is a measure of variability around a ratio estimator, i.e., the verification realization rates. When the claimed and verified savings for the sample projects are closely aligned (i.e., near-100% realization rates), the error ratio is close to zero. If they are not well-aligned, then the claimed savings tell us less about what the verified savings are for projects that we did not directly observe through the sample, and error ratios will be higher (e.g., near 1.0).

Table D-4 Expected Precision from Desk Review by Program

Program	Type of Desk Review	# Unique Projects	Customer First-Year Savings MWh	% of Sample Frame	Desk Review Sample Size	Expected Precision
Sampled Strata		15,522	32,652	49.0%	126	±3.1%
REEM	Simple	5,792	9,232	13.9%	30	±11.7%
BEEM	Simple	478	8,174	12.3%	30	±11.7%
RESM	Simple	5,301	2,172	3.3%	8	±22.7%
CBEEM	Complex	52	2,544	3.8%	15	±22.0%
BHTR	Simple	1,380	7,234	10.9%	29	±10.8%
RHTR	Simple	2,519	3,297	4.9%	14	±15.0%
Non-Sampled Strata		1,911	33,984	51.0%	0	±0.0%
REEM	None	1,015	13,282	19.9%	0	±0.0%
BEEM	None	648	5,579	8.4%	0	±0.0%
RESM	None	1	7,844	11.8%	0	±0.0%
CBEEM	None	38	5,737	8.6%	0	±0.0%
BHTR	None	55	71	0.1%	0	±0.0%
RHTR	None	1	19	0.0%	0	±0.0%
BESM	None	147	1,009	1.5%	0	±0.0%
BGRID	None	3	294	0.4%	0	±0.0%
CREEM	None	3	148	0.2%	0	±0.0%
Total		17,433	66,636	100.0%	156	±1.5%

In Table D-5, we compare the current sample design to the planned design included in the PY22 Verification Workplan, which was largely based on previous verification sample designs. AEG made the following updates to the planned design:

- Added eight sample points to RESM (and removed seven sample points from BHTR and RHTR) to allow a review for a spot check. RESM projects contributed more to the overall savings population than anticipated when we created the PY22 Verification Workplan.

Table D-5 Comparison of Actual Sample Design to Initial Planned Design

Program	Type of Desk Review	Customer First-Year Savings MWh	% of Sample Frame	Actual Sample Sizes	Sample Sizes from PY22 Plan
REEM	Simple	9,232	13.9%	30	30
BEEM	Simple	8,174	12.3%	30	30
RESM	Simple	2,172	3.3%	8	0
CBEEM	Complex + site visits	2,544	3.8%	45 total (15 desk reviews, 30 site visits)	45 total (15 desk reviews, 30 site visits)
BHTR	Simple + complex	7,234	10.9%	29	35
RHTR	Simple	3,297	4.9%	14	15
Total		32,652	49.0%	156	155

CET Activities

Savings Replication

AEG used TRM algorithms to directly calculate energy and demand savings and total resource benefits (TRBs) for all deemed and semi-prescriptive measures in the tracking system, assuming the necessary measure attributes for the deemed and semi-prescriptive measures were tracked. We compared the replicated values to those that Hawai'i Energy claimed in the tracking database to catch systematic and isolated errors from incorrect inputs and algorithm implementation.

AEG continued to use the tool that it developed during the PY20 verification to automate the replication process. We updated the tool to include all PY22 measures and comply with the Hawai'i TRM in effect at the time of the measure installations (TRM Program Year 2022 v2.0).

Desk Reviews

AEG conducted engineering desk reviews for deemed, semi-prescriptive, and custom measures on a representative sample of projects. For each sampled project, we reviewed all project documentation and savings calculations to assess the alignment between project documentation and inputs in the tracking system, thereby confirming the accuracy and reasonableness of the input data and project savings. The desk reviews are in addition to the program documentation and tracking system audit and cover a broad range of project-specific documentation, which AEG reviewed in greater depth for the sampled projects. For example, project documentation included project applications, participant terms and agreements, project calculators, manufacturer's specification, invoices, pre- and/or post-installation site inspection reports or photos of equipment, engineering reports that include baseline, ex-ante, and claimed data calculations, custom calculations of savings, and other documentation AEG deemed necessary for verification.

AEG reviewed the engineering algorithms that Hawai'i Energy applied to calculate the claimed savings estimates. The depth of the algorithm review differed for deemed and semi-prescriptive measures and custom projects:

- **Simple Desk Reviews.** The simple desk review for sampled deemed and semi-prescriptive measures ensures that the inputs and parameters that we found in the tracking database match those on the backup documentation requested, such as the invoice. We also checked to see that the correct incentives were applied for each of the sample points. We did not assess the validity of such algorithms, and we only determined whether Hawai'i Energy correctly used the algorithms in the TRM and applied appropriate factors when calculating the claimed savings.
- **Complex Desk Reviews.** For custom projects sampled for desk reviews, AEG assessed the extent to which savings calculation methods were reasonable and based on fundamental engineering practices. We focused the desk review on the key parameters that drive savings for each type of project when determining whether to accept the savings as verified. When we found substantial deficiencies in the calculation methods, we proposed alternative methods based on industry best practices and reference documentation such as the UMP and IPMVP.

AEG carefully documented any discrepancies found during the desk reviews and reviewed with Hawai'i Energy, the EEM, and the Commission, as appropriate, to resolve before finalizing the verification.

On-site Visits

Best practice verification methods include physical assessments of a sample of individual projects through on-site visits. On-site verifications enabled AEG to provide more accurate and meaningful

verification findings to Hawai'i Energy, the EEM, and the Commission. AEG identified the following primary goals of on-site visits for the PY22 verification:

- Ensure that projects have been installed correctly and have the potential to generate savings (i.e., in place and operating)
- Gather installation dates and equipment specification data
- Verify inputs key to the custom project calculations
- Inform future TRM updates (to the extent possible) such as for custom project protocols
- Inform best practice guidance for custom savings calculations

For the PY22 Verification, the AEG team conducted in-person on-site visits only for projects implemented through the CBEEM program. This is where we expected to see the greatest value from on-site visits for two primary reasons. First, prior verification efforts have uncovered a persistent lack of basic documentation that made verifying the type and quantity of measures rebated difficult without a physical assessment. (We have not had similar and persisting difficulties verifying non-custom projects.) Second, the custom project guidance document went into effect in PY22.²⁴ The on-sites allowed the AEG to assess and provide proactive recommendations to Hawai'i Energy around alignment with the guidance document.

Data Collection Plans

AEG developed data collection plans specific to the projects. These site-specific data collection plans included key parameters to check or confirm during the on-site visits. They were used by the engineers to ensure that all information of interest was gathered consistently. We developed the data collection plans while completing the desk review verification for each site.

As part of the process, we submitted data collection plan templates to the EEM for feedback. We also worked with Hawai'i Energy to ensure that we had the most up-to-date information about each customer before the visit. We gathered information on the following, depending on the type of project:

- (If early-replacement measure) Information about the system in place before the replacement, e.g., operating conditions, photos, cut sheets, owner's manuals, or the equipment itself (if retired in place) to verify that installation conditions are consistent with project documentation.
- Make, model, counts, capacities, and efficiencies of the new equipment.
- Descriptions of the operating conditions at the time of project implementation.
- Interactions (if any) with other energy-consuming systems.

Participant Contact and Appointment

Below we describe the process we employed for participant contact and scheduling.

- Initial contact was made by Hawai'i Energy to introduce AEG/RHA and alert the participant that they have been selected for a study. At this time Hawai'i Energy also screened the sample for particularly sensitive customers. AEG/RHA staff took extra care when contacting sensitive customers.

²⁴ In the PY20 Verification report, AEG recommended that Hawai'i Energy reference the custom project guidance document in PY21, but because that document was not final until well into PY21, they are not required follow the custom project guidance document until PY22.

- AEG/RHA staff then followed up via phone and/or email to schedule the in-person verification activities. We followed-up to schedule with participants a maximum of three times and included additional coordination with Hawai'i Energy if needed.

Data Gathering and Analysis

AEG contracted with RHA Energy Partners (RHA), a Hawaii-based engineering consulting group, to conduct Oahu on-site visits. AEG staff conducted the outer Island visits.

RHA has historically been involved with implementing Hawai'i Energy. To avoid any actual or perceived conflicts of interest, RHA reviewed the project sample and identified those with which it had any associations. They provided a description of all known associations to the EEM and PUC, who determined whether RHA or AEG should perform the on-site visit. The EEM and PUC did not feel that RHA needed to recuse itself from any of the projects.

Safety and Training

Safety procedures – COVID-related. AEG and RHA staff followed the following procedures established by the CDC to prevent transmission of COVID-19.

- Reschedule the visit if on-site staff or business or household member is experiencing any potential symptoms of COVID-19.
- Reschedule the visit if on-site staff or close contact of staff is under direction to quarantine due to exposure to COVID-19.
- Wear a fabric mask, always covering the nose and mouth when requested or required.

Safety procedures – General. Because AEG/RHA staff are not licensed electricians, they are limited to visual inspection only. They did not touch live circuits or conduct any metering or measurements that would require interfacing with live electric circuits.

In addition, on-site staff followed the safety procedures established at each site by participant staff including:

- Follow established rules and signage indicating safe and unsafe areas for entry, stepping, etc.
- Additional general safety procedures include:
- Dress appropriately: Long pants, closed-toe shoes or boots, and badge.
- Prep survey tools: Charge tablets and phones; bring customer information sheet, survey spreadsheet, and printout of survey as backup.
- Bring PPE: Hardhat, safety glasses, earplugs, and gloves. An unlikely but possible requirement is steel toe boots.

Training. AEG and RHA followed internal training for all on-site covering the following key topics:

- Overview of verification
- Pre-visit preparation
- Data collection and templates
- Beginning the visit
- Walk-through of the facility
- Ending the visit
- After the visit

- Logistics, safety, and other considerations
- Customer concerns
- Special cases

Non-CET Activities

The non-CET metrics focus on three key areas:

- Affordability & Accessibility (A&A) performance goals encourage program services and benefits to be equitably allocated across eligible geographies and underserved demographics
- Market Transformation & Economic Development (MTED) performance goals set minimum standards for identifying and overcoming market barriers through education and outreach
- Customer Satisfaction metrics require ongoing proof of satisfaction of residential and business PBFA program participants

We verified the extent to which Hawai'i Energy met key performance indicator targets in each of these areas. AEG also calculated the low-to-moderate (LMI) performance incentives mechanism (PIM) awards for use by HECO.

Program Documentation Request and Achievement Verification

AEG requested additional program documentation to support the verification of non-CET metrics:

- Customer equity reports, as available
- Hawai'i Energy's residential and commercial customer satisfaction survey reports and underlying data from the customer experience management tool, Medallia
- Documents to support MTED metrics:
 - List of participants
 - List of events as tracked in the MTED Dashboard
 - Summary of activities and supporting documentation

Accessibility and Affordability (A&A)

There are two separate verification efforts under the A&A award: Economically Disadvantaged and Island Equity.

Targets for reaching economically disadvantaged customers require serving a minimum number of customers (who save a minimum amount on their energy bills) through the following outreach channels and initiatives:

- Energy Advantage
- Energy Relief Grant
- Single- and multifamily direct-install
- Water heaters direct-install
- Bulk appliances purchases
- Community-Based Energy Efficiency (CBEE)

As part of its verification, AEG confirmed:

- The number of hard-to-reach (HTR) small business and residential customers served by direct-install initiatives using the tracking database and estimate their bill savings using verified energy savings, Hawaiian Electric (HECO) effective rates, and customer billing data
- The number of communities engaged in Community-Based Energy Efficiency through a high-level review of project documentation

Targets related to Island Equity provide expectations for the distribution of PBFA funds to the Hawaii and Maui counties. To verify that the distribution of funding met performance targets, we confirmed incentive payments using the tracking database and Hawai'i Energy's Island Equity Report, which includes the full program spending by island.

Market Transformation and Economic Development (MTED)

The PBFA performance indicators for the market transformation and economic development (MTED) efforts fall into one of five groups: (1) Behavior Change, (2) Professional Development & Technical Training, (3) Energy in Decision Making, (4) Codes and Standards, and (5) Clean Energy Innovation Hub. Performance targets are based on the number of participant hours, the number of participants attending, and the number of events. AEG verified achievements by reviewing event, presentation, and workshop sign-up sheets/attendance spreadsheets, advocacy spreadsheets and documentation, and other documents that substantiated non-CET achievements.

Customer Satisfaction

AEG reviewed the output results from Hawai'i Energy's customer experience management tool, Medallia, to verify whether it achieved an overall satisfaction score greater than 9.0 (out of a possible 10) for each residential and business sector.

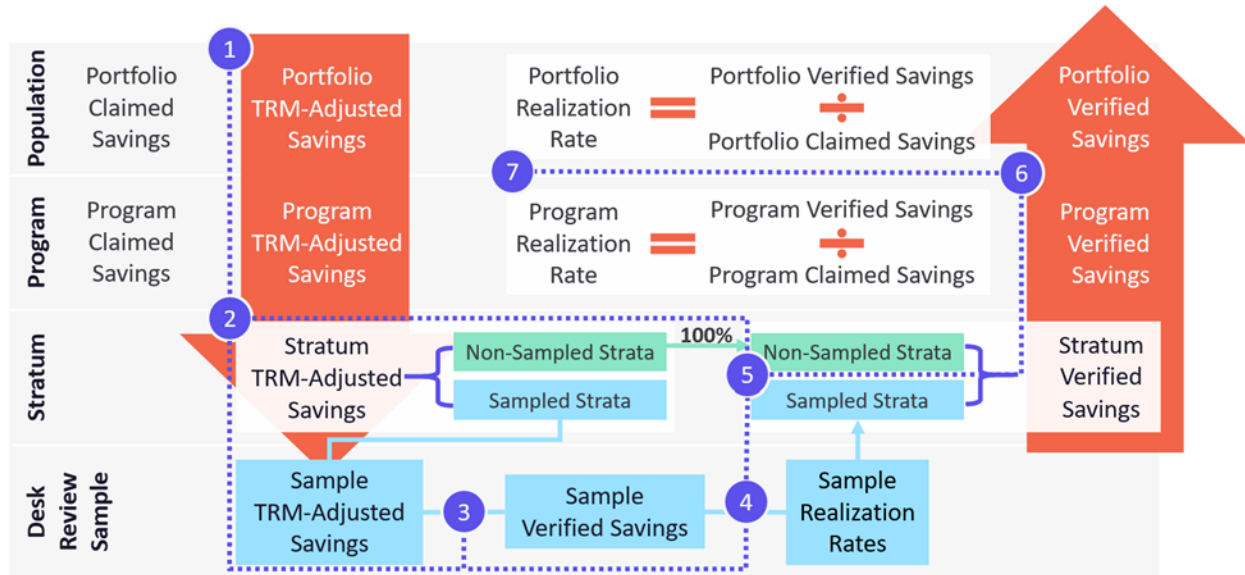
Low-to-Moderate Income Performance Incentive Mechanisms (LMI PIM)

AEG calculated the LMI PIM incentive associated with the RHTR and A&A programs implemented by Hawai'i Energy using results from the verification. See Appendix B for details and results.

E | Sample Design and Extrapolation

Using the steps in Figure E-1, AEG used the database replication results and desk review findings to inform population-level savings. The figure below shows these steps in general.

Figure E-1 Stratification Approach



- 1. Calculate TRM-Adjusted Claimed Savings.** AEG completed its audit of the tracking system and re-calculated the claimed savings (X) with any adjustments. Throughout this report, we refer to these as *TRM-adjusted savings* (X^*). For custom projects not included in the tracking system audit, AEG used the claimed savings as the TRM-adjusted savings.
- 2. Stratify Program Savings.** AEG stratified the population of savings by program and major measure category. In addition, RHTR and CREEM were stratified by whether the projects were sampled for desk reviews or not, as we did not extrapolate the sample realization rates to the remaining RHTR and CREEM project populations. For the population, we refer to these as *stratum TRM-adjusted savings* \hat{X}_{hm}^* .
- 3. Verify Sampled Project Savings.** AEG gathered backup documentation for each sampled project i within each program h and stratum m and conducted desk reviews to determine the sample-verified savings ($y_{hm,i}$).
- 4. Estimate Sample Realization Rates.** Within each program h and stratum m , AEG estimated the *sample realization rate* (\hat{r}_{hm}) as the sum of the sample-verified savings (\hat{y}_{hm}) divided by the sum of the sample TRM-adjusted savings (\hat{x}_{hm}^*).
 - For programs and strata where AEG did not conduct desk reviews, savings are the TRM-adjusted savings. This includes projects in the RHTR and CREEM “Not Sampled” strata.
 - Sample realization rates are incremental to changes made to the population of claimed savings during the tracking database audit (i.e., the sample realization rates are not double-count any TRM adjustments).

5. **Calculate Stratum Verified Savings.** Within each stratum, we calculated the *stratum verified savings* (\hat{Y}_{hm}) by multiplying the sample realization rate and *stratum TRM-adjusted savings* (\hat{X}^*_{hm}). For REEM, BEEM, and CBEEM, we calculated three values, while for BHTR, RHTR, and CREEM, we used a single value.
6. **Aggregate to Program and Portfolio Levels.** We calculated *program verified savings* (\hat{Y}_h) as the sum of stratum verified savings. For programs without stratification (e.g., BHTR), the program verified savings equal the stratum verified savings. Similarly, we calculated *portfolio verified savings* ($\hat{Y}_{..}$) as the sum of program verified savings.
7. **Estimate Program and Portfolio Realization Rates.** To estimate weighted realization rates for each program, AEG divided program verified savings (\hat{Y}_h) by program claimed savings (\hat{X}_h). Similarly, we estimated the portfolio realization rate as the portfolio verified savings ($\hat{Y}_{..}$) divided by the portfolio claimed savings ($\hat{X}_{..}$). Program and portfolio realization rates incorporate all TRM adjustments and extrapolated desk review results.

F | Conformance with Custom Project Guidance Document

As part of the PY22 verification, AEG reviewed the sampled custom projects to determine whether they complied with key elements of the custom project guidance document. This review was conducted independently of the CET verification which followed the same lenient approach to documentation we have employed in past years.

Table F-1 presents the key elements from the custom project guidance document we reviewed and the percent of projects that were compliant. Note that the percentage is calculated based on the CBEEM sample and that projects received partial credit for elements where multiple measures were installed and a portion of the rebated measures were in compliance.

As shown, most projects captured general customer information, included appropriate descriptions of the project and baseline conditions, and captured the relevant data. Most also complied with industry best practices for savings estimates of annual kW and kWh. We also saw improvements in, although not universal application of, lifetime kWh savings that were routinely missing in PY21. That said, some documentation issues persisted from previous verifications. Projects often lacked equipment specifications, project equipment and labor costs, or proof of installation. If documentation was provided, it often could not be reconciled: for example, a pre-approval letter might be post-dated compared to a project cost estimate, or there would be no invoice and no evidence of post-installation inspection.

In the rightmost column, we present the adjustments that AEG proposes to apply in PY23 when various key elements of PY23 custom projects are missing or not compliant with the Custom Project Guidance document. For documentation, AEG graded leniently: as long as there was evidence to show the project was completed and rebated in PY22, credit was given. **However, AEG proposes that the evaluator applies zero savings in the absence of appropriate proof of project pre-approval, completion, installation, and costs.** These fundamental elements of documentation are critical to providing basic assurance that the rebated projects are completed, and that the measures were purchased and installed. Timing of the rebates and pre-inspections help ensure that the program has a chance of influencing customer behavior, and that rebates are not paid for projects that are already installed.

Table F-1 Project Conformance with Customer Project Guidance Document Elements

Key Documentation Element	Detail	% of Compliant Projects	Potential Adjustments to PY23 Non-Compliant projects**
General customer information	Customer Name	100%	Apply zero savings
	Facility Type	100%	
	Street Address	100%	
Appropriate description of project and baseline conditions	Project/Measure Type	100%	Use engineering best practices to develop assumptions for missing/unverified parameters
	Baseline Conditions	92%	
Proof of key implementation dates (purchase, completion, rebate processing) tracked with qualifying documentation		87%	Apply zero savings

Key Documentation Element	Detail	% of Compliant Projects	Potential Adjustments to PY23 Non-Compliant projects**
<i>Appropriate data was collected for the measure and IPMVP option</i>		100%	Apply zero savings or use engineering best practices to develop assumptions for missing/unverified parameters
<i>Industry best practice savings calculations were used for the IPMVP option</i>	Annual kW	100%	Use engineering best practices to develop assumptions for missing/unverified parameters
	Annual kWh	100%	
	Lifetime kWh	79%	
<i>Able to reproduce savings</i>		86%	Use engineering best practices to develop assumptions for missing/unverified parameters
<i>Appropriate equipment specifications were collected and documented</i>		97%	Use engineering best practices to develop assumptions for missing/unverified parameters
<i>Project costs collected through an invoice, purchase order, or other qualifying document</i>		92%	Apply zero savings
<i>Proof of installation through an invoice, post-inspection report, or other qualifying document</i>		89%	Apply zero savings
<i>Justification for early retirement</i>		34%	Assume replace-on-burnout

* Adjustments will be applied in PY23 in compliance with the Custom Project Guidance Document effective date of July 1, 2023.

** AEG will request clarification and/or missing data elements from Hawai'i Energy before making these adjustments.



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