

Hawai'i Energy PY2020 Verification Report

Prepared for: Hawaii Public Utilities Commission By: Applied Energy Group, Inc. Date: May 20, 2022 AEG Key Contact: Kelly Marrin

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EXECUTIVE SUMMARY

This report presents the verified savings and performance results of program year 2020¹ (PY20) for Hawai'i Energy. 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 \$850,000 for Hawai'i Energy's implementer (Leidos).

AEG 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. Appendix E and Appendix F present detailed descriptions of the methods employed and the sample design and expansion.

Summary of Findings

In PY20, Hawai'i Energy took action to mitigate issues associated with the COVID-19 pandemic in residential and commercial programs. However, they fell short of some energy-related goals with a subsequent reduction in potential awards.

Highlights of Actions to Overcome COVID-19 Pandemic Issues

In the **residential programs**, Hawai'i Energy prioritized installing measures in homes and leveraging online forums. The programs also relaxed several requirements to limit in-person interactions (e.g., customers did not have to be present and sign forms when appliances were recycled) and extended the time frame for turning in applications due to supply chain issues. They also shifted the tone of the program marketing materials, presenting the programs as a valuable resource that could help during a difficult period. Materials focused on providing opportunities to save energy and money while improving indoor air quality, which was top of mind for many during the pandemic.

Hawai'i Energy provided enhanced rebates within the Residential Hard to Reach (RHTR) program to overcome barriers to participation that were magnified by the pandemic. Additionally, late in the program year, when it was safe to resume in-person interactions, the program focused on direct install measures to make up for lost time. These combined actions allowed Hawai'i Energy to achieve nearly double its targets for RHTR.

Within the **commercial programs**, Hawai'i Energy made the following changes as part of their COVID response:

- Created a *grant program* for small businesses that provided over \$2 million in funding and expected to save customers over \$500,000 a year.
- Created a *hotel guest room bonus program*. Hawai'i Energy designed this initiative to drive participation in the hospitality sector when occupancy rates were low, and it was conducive to making improvements without disturbing guests.
- Doubled the restaurant commercial equipment incentive.
- Created a "do more, get more" incentive tier. If customers had more than one project, they got larger incentives.

Verified Savings and Awards

PY20 proved a challenging year, and in total, Hawai'i Energy achieved \$607,864.17 (72%) of the potential awards. Most shortfalls came from not meeting CET targets, specifically targets set for first-year and lifetime

¹ Program Year 2020 began on July 1, 2020, and ended June 30, 2021.

energy savings, peak demand reductions, and total resource benefits (TRBs). Hawai'i Energy met all the non-CET performance metrics except the A&A targets set for residential customers served and bill savings from hardto-reach direct-install initiatives. Since Hawai'i Energy did not meet certain targets, they did not receive full awards in these areas.

	Performance Indicator	Fraction of Award	Target Award	Verified Award	Percent Verified
	Clean Energy Technologies	74%	\$625,000.00	\$427,864.17	68%
(0	First-Year Energy	16%	\$135,577.00	\$88,085.81	65%
ards	Lifetime Energy	16%	\$135,577.00	\$72,648.52	54%
AW	Peak Demand Reductions	16%	\$135,577.00	\$120,504.35	89%
CET	Total Resource Benefits	21%	\$180,769.00	\$109,125.48	60%
	Grid Service Ready	4%	\$37,500.00	\$37,500.00	100%
	Barrels of Oil / GHG	0%	\$0.00	\$0.00	N/A
ls	Accessibility & Affordability	18%	\$150,000.00	\$105,000.00	70%
varc	Economically Disadvantaged	9%	\$75,000.00	\$30,000.00	40%
ΓAν	Island Equity	9%	\$75,000.00	\$75,000.00	100%
on-CE1	Market Transformation & Economic Development	7%	\$60,000.00	\$60,000.00	100%
Ž	Customer Satisfaction	2%	\$15,000.00	\$15,000.00	100%
	Total	100%	\$850,000.00	\$607,864.17	72%

Table ES-1Verified Performance Award – Summary

CET Performance Key Takeaways

- AEG found that Hawai'i Energy's implementation of the TRM algorithms for prescriptive programs was near perfect. We made few impactful TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.0 for all programs.
- Hawai'i Energy met the four CET targets (first-year and lifetime energy savings, demand savings, and TRBs) for **Residential Hard-to-Reach**, **Residential Incentives**, and **Business Prescriptive** program categories.
- **Business Custom** (CBEEM) fell short of all but one of the targets because of adjustments made during the verification process.
 - The most impactful performance adjustments made by AEG resulted from updates to regression models that impacted CBEEM HVAC and general custom projects, updates to project Effective Useful Lives (EULs), and updates to lifetime savings that incorporated dual baselines for sampled CBEEM projects.
 - Another impactful adjustment occurred in CBEEM lighting. Two opportunities included custom and prescriptive lighting projects that all received rebates under the CBEEM program. For one of these projects, Hawai'i Energy applied TRM-deemed per-unit savings meant for linear LEDs to nonlinear bulb installations, which increased the verified savings by 1.5 to nearly 3.0 times the claimed savings for this project overall. Hawai'i Energy also did not incorporate the dual-baseline when calculating LED lifetime savings or TRBs for either project. We also removed a small portion of savings (~6% of claimed first-year kWh for the custom lighting sample) that had been double-counted between custom and prescriptive projects across both these opportunities.
- **Business Hard-to-Reach** also fell short of targets, which appeared to be because of the COVID-19 pandemic (and not because of any verification adjustments). Hawai'i Energy and its customers faced numerous

challenges with supply chains and direct installation of measures because of the economic uncertainty and health concerns related to the pandemic.

Non-CET Performance Key Takeaways

- Hawai'i Energy met most A&A performance targets. They fell short on the number of customers served and customer bill savings from single-family and multifamily direct-install projects, initiatives under the RHTR and BHTR programs, and the number of customers served through the Energy Advantage channel of the BHTR program. This shortfall was not due to verification adjustments but was believed to be a result of the COVID-19 pandemic, which discouraged customers from participating in direct-install programs and investing in energy efficiency in general.
- Hawai'i Energy met or exceeded targets for all Market Transformation and Economic Development performance metrics except the Innovation and Emerging Technologies key focus area. The shortfall in the Innovation area came about as Hawai'i Energy directed funds to other areas to accommodate the pandemic.
- Hawai'i Energy exceeded the customer satisfaction target of 9.0 with values of 9.6 and 9.4 for business and residential participant satisfaction, respectively.

Recommendations

Below we include recommendations that have the largest impact on verified CET metrics, including energy and demand reductions and 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.

Hawai'i Energy achieved program-level realization rates of 99% (first-year energy savings), 92% (lifetime energy savings), 98% (peak demand savings), and 88% (TRBs) in PY20 based on recommendations 1, 3, and 4. If AEG had discounted claimed savings based on recommendation 2, Hawai'i Energy would have realized only 94%, 88%, 95%, and 84% of their claimed first-year and lifetime energy savings, peak demand savings, and TRBs.

- 1. Account for dual baselines when calculating TRBs. AEG found that Hawai'i Energy did not consistently implement dual-baselines for lighting projects under BHTR Energy Advantage (small-business direct-install), CBEEM, REEM, or BEEM lighting. For BHTR and CBEEM lighting, dual-baseline corrections affected both lifetime energy savings and TRBs. However, for REEM and BEEM, corrections only affected TRBs. REEM and BEEM lifetime savings were correct because the PY20 TRM provided accurate per-unit lifetime savings that Hawai'i Energy could copy and apply in the tracking database. The TRM did not include per-unit TRBs for any measures. Hawai'i Energy needs to use the dual-baseline approach to calculate TRBs for BHTR Energy Advantage and prescriptive lighting measures (including prescriptive lighting implemented under the CBEEM program) to avoid overestimating TRBs in the tracking database.
- 2. Collect invoices (or an equivalent form of documentation) for all measures and projects prior to paying incentives. To independently verify the savings claimed by Hawai'i Energy, the evaluation contractor needs to have the ability to review backup documentation for all custom, semi-prescriptive, and fully deemed measures rebated through the programs to confirm that the claimed equipment was purchased. The PY19 verification recommended that Hawai'i Energy collect either invoices, purchase orders, or submittals (similar to purchase orders that include detailed measure specifications) as proof that the project was implemented as scoped. Additionally, Hawai'i Energy's commercial incentive application indicates that proof of purchase (and equipment specification sheets) is required. However, AEG found the lack of this type of basic documentation continued to be an issue for custom projects.

AEG recommends that only invoices or detailed post-inspection reports serve as adequate confirmation of project completion. Hawai'i Energy should collect and process invoices for all projects before paying incentives to ensure that ratepayer dollars are being used appropriately. If invoices cannot be collected, Hawai'i Energy may substitute detailed post-installation reports that itemize the census of measures and quantities included in the project and note which were covered by the inspections. The COVID-19 pandemic

made it difficult for Hawai'i Energy to conduct post-installation inspections in PY20. They instead began requesting that participants sign installation verification forms, which were typically reserved for military projects before the pandemic. These forms, which itemized the census of measures and quantities installed, are acceptable so long as they are used sparingly and only as a last resort.

It is important to note that if AEG had required this type of documentation (and set any project without it to zero savings), it would have resulted in program-level first-year energy realization rates of <u>0.66 for CBEEM</u> and <u>0.63 for CREEM</u> (vs. <u>0.86 and 0.97 respectively</u>), a reduction in savings of 23-35%.

- 3. Either include prescriptive portions of CBEEM projects under the appropriate prescriptive tracks or clearly indicate in the tracking database that these projects are prescriptive and ensure their savings contribute to the appropriate performance targets. Two of the CBEEM lighting projects sampled for desk reviews included prescriptive lighting measures that Hawai'i Energy combined under one CBEEM project to make processing the incentives easier for the customer. While combining custom and prescriptive projects under a single rebate is not inherently inappropriate, AEG could not tell that these portions of the projects were prescriptive without reviewing the detailed project documentation. Furthermore, even though the prescriptive portions of savings comprised between 93% and 99% of the total projects' savings, all savings from each project contributed to Hawai'i Energy's performance towards Business Custom targets. AEG did not reallocate these prescriptive savings for the PY20 Verification but may do so going forward. Hawai'i Energy needs to ensure that combined custom and prescriptive projects are either entered in the tracking system as separate projects and rebate opportunities or identify them in a way that allows savings within an opportunity to be allocated towards the appropriate programs and performance targets and clearly identifiable to the evaluation contractor.
- 4. 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. Energy efficiency projects often save energy at different rates over the year because of changes in weather, facility operations, etc. Therefore, the savings estimated from a regression model that uses only partial year data can over- or underestimate annual savings. Including pre- and post-implementation data covering the range of weather and operating conditions will improve savings accuracy and mitigate differences in claimed and verified savings. Ideally, both pre- and post-implementation observations will cover the same weather and operation months.

Hawai'i Energy should also calculate and report the uncertainty of the savings estimates to show that the point estimates are statistically different from zero (i.e., to show that the project had a meaningful impact on consumption). For example, Hawai'i Energy calculated annual savings for one custom BHTR project (an energy management system [EMS]) of 0.4% of baseline consumption. However, after quantifying the uncertainty during the verification, AEG found that the savings were not statistically associated with the EMS and therefore verified zero savings. To detect the small savings for this project, Hawai'i Energy would have needed higher-frequency interval data.

This and other guidance will be provided in the forthcoming Custom Project Guidance Document, which Hawai'i Energy should have access to and be able to reference prior to when it goes into effect for PY22.

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.

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

Performance inderiorPerformance inderior <th< th=""><th></th><th>Borformanco</th><th></th><th>Fraction</th><th>Target</th><th colspan="2">Target Claimed Results</th><th colspan="3">Verified Results</th></th<>		Borformanco		Fraction	Target	Target Claimed Results		Verified Results			
Clan Accord TA336 Stature	Performance Indicator	Target	Metric	of Award	Award	Performance	Percentage of Performance Target	Award	Performance	Percentage of Performance Target	Award
int int<	Clean Energy Technologies - Key Focus Areas			73.53%	\$625,000			\$559,169			\$427,864
Lifemate name, Reduction Like 11/4 (208 Work 13.08 353.08,20.7 14.08 571.469 971.469 Deal Research Research 51.49,407,240 Karl 13.28 51.05,207 11.08 51.97,241 51.99,25	First Year Energy Reduction	92,734,781	kWh	15.95%	\$135,577	91,555,092	98.7%	\$103,130	90,768,272	97.9%	\$88,086
Pack Description 14.405 WW 15.395 1	Lifetime Energy Reduction	1,166,174,708	kWh	15.95%	\$135,577	1,161,894,529	99.6%	\$111,591	1,068,096,834	91.6%	\$72,649
Total Reserve Reneff 548 627,420 92.07 9	Peak Demand Reduction	14,405	kW	15.95%	\$135,577	16,685	115.8%	\$137,315	16,411	113.9%	\$120,504
Grind services freedy (new) projects/ demand management products installed or custommer arved 4,11s 537,500 2,208 301,1% 537,500 2,203 314,7% 537,500 Greenhouse Gis Beduction/ Same of Oll (new) 65,731 / 153,174 Bont / barrels 0,00% 50 61,157 / 147,604 60 65,157 / 147,607 50 61,157 / 147,607 50 61,157 / 147,607 50 61,157 / 147,607 50 51,000	Total Resource Benefit	\$149,667,430	Ś		\$180,769	\$165,977,342	110.9%	\$169,633	\$145,833,272	97.4%	\$109,125
General Case Reduction/ Surved 50 61.05 / 140.073 92.3% / 92.9% / 92.0% 50 Controlling 17.654 \$10.000	Grid Services Ready (new)	700	projects/ demand management products installed or customers served		\$37,500	2,108	301.1%	\$37,500	2,203	314.7%	\$37,500
Accessibility & Affordability & Afforda	Greenhouse Gas Reductions/ Barrel of Oil (new)	65.733 / 151.874	tons / barrels		\$0	63.187 / 147.004	96.1% / 96.9%	\$0	61.053 / 140.875	92.9% / 92.9%	\$0
Economic Plashering Economic Plashering <theconomic plashering<="" th=""> Economic Plashering</theconomic>	Accessibility & Affordability - Key Focus Areas			17.65%	\$150,000			\$105,000			\$105,000
Concept Customers served Concent bill saving 1.76 \$15,000 576 88.6% 50 576 88.6% 50 Bill Saving \$1,720,000 Customers served 1.76 \$15,000 \$1,928.209 110.2% \$51,000 \$1,928.209 110.2% \$51,000 \$1,928.209 110.2% \$51,000 \$1,928.209 110.2% \$51,000 \$1,928.209 110.2% \$51,000 \$1,928.209 110.2% \$51,000 \$1,928.209 \$10.00% \$51,000 \$1,928.209 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$51,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$50,000 \$10.00% \$5	Economically Disadvantaged										
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Single & Multilamip (breach tabul) Database	Bill Savings	\$1,750,000	Customer bill savings	1.76%	\$15,000	\$1,928,209	110.2%	\$15.000	\$1,928,209	110.2%	\$15,000
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Bit Suring 53.773.37 Custome bill swings 1.78% 515.00 51.256.022 33.35% 50 51.005.618 22.26% 50 Community Based Tergy Efficiency 7 Participating non-profits 0.88% 57,500 8 114.37% 57,500 8 113.43% 57,500 County of Nawaii 13% Target spend must be met in Hawaii & Mail Counties for Nawai 8.28% 57,500 1.55% 15.5% 57.500 15.51 15.5% 15.5% 15.5% 57.500 15.51 15.5% 57.500 15.51 15.5% 57.500 15.51 15.5% 57.500 15.5% 57.500 15.5% 57.500 15.5% 57.500 15.5% 57.500 15.5% 57.500 <t< td=""><td>Customers Served</td><td>1 365</td><td>Customers served</td><td>1 76%</td><td>\$15,000</td><td>663</td><td>48.6%</td><td>\$0</td><td>663</td><td>48.6%</td><td>ŚŊ</td></t<>	Customers Served	1 365	Customers served	1 76%	\$15,000	663	48.6%	\$0	663	48.6%	ŚŊ
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Economic Development & Market Transformation - Key Focus Areas 7.0ex 560,000 560,000 560,000 Behavior Change Workshop and Presentations	City & County of Honolulu	74%	-	/		71%	95.9%		71%	95.9%	
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Application Processing Customer Experience - Residential >9 Overall customer satisfaction score 0.88% \$7,500 9.4 104.4% \$7,500 9.4 104.4% \$7,500 Total Performance Award 100% \$850,000 \$729,160 \$607,964	Application Processing Customer Experience - Commercial	>9	Overall customer satisfaction score	0.88%	\$7,500	9.6	106.7%	\$7,500	9.6	106.7%	\$7,500
ncalerina Total Performance Award 100% \$850.000 <u>\$739.160</u> \$607.864	Application Processing Customer Experience - Residential	>9	Overall customer satisfaction score	0.88%	\$7,500	9.4	104.4%	\$7,500	9.4	104.4%	\$7,500
	Total Performance Award			100%	\$850.000			\$739 169			\$607.864



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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 2020 (PY20, July 1, 2020, to June 30, 2021). This report summarizes AEG's verification results, which build upon verification efforts and protocols established during the PY17 through PY19 verifications.

This report presents the results of AEG's fourth verification of Hawai'i Energy's programs. The PY20 verification is similar to past efforts but has a few key differences, as explained in the following table.

Table 1-1Key Similarities and Differences between the past Verification Efforts (PY17-PY19) and the PY20Verification

Key Similarities		Кеу	Differences
 Verification of Excel-based dathe population information fr Manual (TRM) Desk reviews to projects to ver related project projects 	all performance metrics atabase replication to verify of measures that used om the Technical Reference to estimate savings to dig deeper into a sample of ify data entry (for TRM ts) and savings (for custom	•	AEG performed all activities Conducted program manager interviews, including a focus on how the pandemic affected programs ² Reorganized the findings into two sections that better align with awards and targets, CET Verification findings and Non- CET Verification findings Explored the impacts of more stringent requirements around required documentation based on previous recommendations Included a small effort to show that the data is available for use by Hawaii Electric Companies in their low-to-moderate income performance indicator metric (See Appendix D)

Metrics and Verification Objectives

PY20 marked Hawai'i Energy's second year in the Triennial Plan for program years 2019 to 2021 (PY19-21) and its 11th year implementing energy efficiency programs as a Public Benefits Fee Administrator (PBFA). AEG verified whether 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 in PY20. The awards for residential and business clean energy technologies targets are assessed by program category, including prescriptive, hard to reach, and custom programs.

² Program manager interviews last took place in PY18.

Performa	nce Indicator/Key Focus Area	Metric
Clean Energy Technologie	s (70% of Award)	
First Year Energy Reductio	n	kWh
Lifetime Energy Reduction		kWh
Peak Demand Reduction		kW
Total Resource Benefit		\$
Grid Services Ready ³		projects/ products
Greenhouse Gas Reduction	ns/ Barrel of Oil	tons / barrels
Accessibility & Affordabili	ity (20% of Award)	
Economically	Energy Advantage	Customers served, customer bill savings
Disadvantaged	Single & Multifamily Direct Install	Customers served, customer bill savings
	Community-Based Energy Efficiency	Communities served
	EmPower Hawai'i Project	Participating non-profits
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	Workshop and Presentations	Number of participant hours of Training
	Gamification Campaigns and Competitions	Number of participants
	Exhibit Educational Resources	Number of Stakeholder Collaboration Events
	Sustained Outreach	Participation Agreements
	Behavioral Insights	Number of Program Interventions
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	Number of new participating institutions
Codes and Standards	Appliance Standards Advocacy	Advocacy Events
	Improve Code Compliance	Establishing compliance roadmap and tracking savings
	Code-Related Training	Number of participant hours of Training
	Leading-edge technologies and strategies	Meeting and one final report
Clean Energy Innovation Hub	Innovation and Emerging Technologies	Companies supported
Customer Satisfaction (2%	of Award)	
Application Processing Customer Experience	Commercial, Residential	Overall customer satisfaction score

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

³ Sometimes referred to as Energy Optimization or EO

In conjunction with Hawai'i Energy and the Commission, AEG identified the following critical objectives for the PY20 verification:

- Determine how Hawai'i Energy performed against its performance targets by independently verifying the performance indicator metrics above. (See results throughout Chapters 2 and 3).
- 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).
- 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 using program manager interviews. (See COVID-19 Response and Effects Section below).
- Provide recommendations for program improvements based on findings from the verification activities. (See AEG's Recommendations at the end of Chapters 2 and 3).
- Identify cases where future verification efforts should consider updates to the technical reference manual (TRM) or alternative verification approaches. (See AEG's Recommendations at the end of Chapters 2 and 3).
- Determine whether Hawai'i Energy implemented the recommendations from the PY19 verification as relevant to PY20 (See Appendix C).
- 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 Performance Incentive Mechanisms Section in Chapter 2).

AEG did not design PY20 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 PY20 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

Hawai'i Energy Programs and Response to COVID-19 Pandemic

As part of the PY20 verification effort, AEG interviewed five 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 and awareness, and the future of the programs. Below, we summarize the information collected during the interviews and provide descriptions of each program. Appendix A also provides comprehensive documentation of the program manager interviews.

COVID-19 Response and Effects

The COVID-19 Recovery and Resilience Plan⁶, filed at the end of PY19, focused on supporting economic recovery, including increasing program incentives, improving engagement with the Clean Energy Allies (CEA's), and launching innovative initiatives, including the Energy Relief Grant. The increased incentive amounts were largely successful in maintaining participation rates but resulted in a higher cost per kWh saved for the programs. As the pandemic continued, funding from the public benefits fees decreased, and the portfolio of programs faced budget cuts that resulted in reduced scope for the market transformation, education, and outreach efforts. In addition, delays with the supply chain posed challenges for programs, as did general uncertainty in the market

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 the single-family and multifamily direct install, water heating direct install, and bulk appliances. (D&O 37787, pages 29-31).

⁵ AEG compared Hawai'i Energy database information to the PY20 TRM V2.0 information.

⁶ Available from the Hawai'i Energy website here: <u>https://hawaiienergy.com/images/about/information-and-reports/Hawaii-Energy_COVID19-</u> <u>Recovery-Resilience-Plan.pdf</u>

around investment in capital improvement projects. However, due to Hawai'i Energy's efforts and because goals were also adjusted to reflect these challenges, the programs claimed at least 95% of their targets in most areas.

The Strategic Advisory Board, whose members provided feedback on programming to program staff, was instrumental to Hawai'i Energy's efforts throughout the pandemic. The program managers attributed their ability to be flexible and innovative during the pandemic, in part, to the support they received from the Board. In particular, the Board helped them better understand the issues faced by their constituents and industry trends related to the pandemic. The Board was also instrumental in focusing Hawai'i Energy's communication strategies and messaging.

Residential Programs

In PY20, Hawai'i Energy implemented four residential sector programs, summarized in the figure to the right. These programs aimed 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 strong network of CEAs that help deliver the programs and work closely with CEAs to provide training and shared advertising opportunities. During the program year, Hawai'i Energy processed **18,852 rebates**, totaling **\$9.4 million**, resulting in **50.3 million kWh** claimed in first-year savings for residential programs.

Due to the pandemic, the residential programs prioritized selfinstalled measures in homes and leveraging online forums. They saw higher engagement in online educational materials and qualified contractor searches, and they focused on enhancements to the online marketplace offerings. Hawai'i Energy also relaxed several requirements to limit in-person interactions (e.g., customers did not have to be present and sign forms when appliances were recycled) and extended the time frame for turning in applications due to supply chain issues.

The RHTR program also provided enhanced rebates to overcome barriers to participation that were magnified by the pandemic. Late in the program year, when it was safe to resume in-person interactions, they focused on direct install measures to make up for lost time. Despite this effort, the direct install portion of the program fell short of its goals.

Hawai'i Energy also shifted the tone of its marketing materials in response to the pandemic. Hawaii had the highest unemployment

Residential Energy Efficiency Measures (REEM)

Comprehensive prescriptive rebate program including upstream and downstream mechanisms.

Residential Hard-to-Reach (RHTR)

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

Residential Energy Services and Maintenence (RESM)

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

Residential Custom Energy Efficiency Measures (CREEM)

Incentivizes rebates for nonprescriptive projects.

rate in the country during the pandemic, and the marketing materials repositioned the programs as a valuable resource that could help during a difficult period with a focus on providing opportunities to save energy and money while improving indoor air quality, which was top of mind for many during the pandemic.

The four residential programs offered by Hawai'i Energy in PY20 are described in more detail below.

- The **Residential Energy Efficiency Measures (REEM**) is designed to provide comprehensive energy services through four initiatives:
 - An upstream initiative that provided rebates to retailers, which were passed to residential customers as lower cost, energy-efficient equipment;
 - A traditional downstream initiative that delivered measures through retail and trade-ally channels;

- The Peer Program,^{7,8} which was a behavioral initiative that delivered Home Energy Reports (HERs) to all residential customers via US Mail and email;
- And an online marketplace that allowed customers to directly purchase certain measures and measure bundles, including energy efficiency kits.
- The Residential Hard-to-Reach (RHTR) program delivers measures to single-family and multifamily households that can be hard to reach using traditional mechanisms. Major initiatives in the RHTR program include:
 - A single and multi-family direct installation service package targeting 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 which includes water heating, replacement of window AC units, smart appliances, EV charging, and other upgrades.
 - A heat pump water heater heating initiative to assess opportunities for centralized and in-unit heat pump water heaters within multi-family residences.
- 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 **Custom Residential Energy Efficiency Measures (CREEM)** program enables Hawai'i Energy to incentivize energy efficiency projects for measures not included in the TRM.

Hawai'i Energy is working on several residential program improvements, including an online portal where customers can submit applications electronically. In addition, they are working on expanding their CEA network to contractors who have experience with new technologies such as Heat Pump Water Heaters.

⁷ The Peer Program was discontinued mid-PY20 based on a variety of factors including reduced funding due to the COVID 19 pandemic.

⁸ During PY20, the HER vendor found an issue with the first batch of reports delivered to customers in the fall. They amended the issue and redelivered the reports at the start of calendar year 2021.

Business (Commercial) Programs

In PY20, Hawai'i Energy implemented four business sector programs, summarized in the figure to the right. These programs focused on aligning program offerings with customer needs and helping local businesses expand project pipelines through increased rebates and incentives. Hawai'i Energy saw 1,092 businesses participate with \$13.4 million in rebates during the program year, resulting in **65.7 million kWh** claimed in first-year savings. 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 greatest COVID-related challenge was an inability to meet with customers in person – particularly with small businesses. Post-project visits were discontinued, and trying to accomplish the same goals via email and phone calls was much less effective.

To mitigate some challenges, take advantage of opportunities, and better support the hardest-hit sectors, the nonresidential programs made the following changes as part of their COVID response:

- Created a *grant program* for small businesses that provided over \$2 million in funding and expected to save customers over \$500,00 a year.
- Created a *hotel guest room bonus program*. Hawai'i Energy designed this initiative to drive participation in the hospitality sector when occupancy rates were low, and it was conducive to making improvements without disturbing guests.
- Doubled the restaurant commercial equipment incentive.
- Created a "do more, get more" incentive tier. If customers had more than one project, they got larger incentives.
- Conducted all technical trainings virtually.

According to the program managers, the increased incentives for the hospitality and restaurant sectors were largely successful and increased program participation. However, the "do, more get more" incentive was less successful. Program managers were excited about this incentive that paid more if a customer did more, but it was challenging to implement. Determining the incentive amount was complicated, and customers preferred a simple prescriptive rebate over one that fluctuated based on the rebate bundle.

Despite the success of several initiatives, the Small Business direct install portion of the program fell short of its goals due to limited in-person interactions, closed facilities, or uncertainty in operations due to the pandemic.

Finally, the switch to virtual training was very successful early in the pandemic, but Hawai'i Energy did see evidence of "Zoom fatigue" as the pandemic continued.

The four business programs offered by Hawai'i Energy in PY20 are described in more detail below:

- **Business Energy Efficiency Measures (BEEM)** program provides prescriptive incentives for standard energy efficiency technologies and utilizes the TRM to claim savings for each project.
- The Business Hard to Reach (BHTR) program provides the installation of energy-efficient measures by program-qualified trade allies and rebates downstream purchases of energy-efficient commercial kitchen equipment by participants. The program is designed to reach historically underserved markets based on

Business Energy Efficiency Measures (BEEM)

Comprehensive prescriptive rebate program leveraging TRM-based savings.

Business Hard-to-Reach (BHTR)

Prescriptive rebates targeting underserved customers through direct install.

Business Energy Services and Maintenence (BESM)

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

Business Custom Energy Efficiency Measures (CBEEM)

Incentivizes rebates for nonprescriptive projects. geography and demographics. These include small businesses, restaurants, and lower-income multifamily properties on commercial-rate meters.

- **Business Energy Services and Maintenance (BESM)** program provides business customers with retrocommissioning, strategic energy management, submetering, and energy audits.
- **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.

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.

This organization is quite different from past years. The reorganization intends to streamline the report and focus on key takeaways from the analysis related to verifying the portfolio's performance as a whole. Detailed information previously included in the body of the report is presented in appendices, including program-level results for performance awards and verification findings. Appendices include:

- Appendix A: Program Manager Interviews
- Appendix B: Detailed Performance and Awards Tables
- Appendix C: Historical Verification Recommendations
- Appendix D: Low-to-Moderate Income Performance Incentive Mechanisms
- Appendix E: Detailed Methodologies
- Appendix F: Sample Design and Extrapolation

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

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 PY20 V2.0 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.
- Claimed accurate total resource benefits (TRB) and avoided GHG emissions.
- Accurately claimed project counts associated with Grid Services Ready products.

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 2-1Programs Mapped to Program Categories

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

Program categories must meet a target threshold of 95% of energy and demand savings and TRBs targets to earn awards for these performance indicators. Grid Services Ready and GHG avoided emissions target thresholds are set at 100% for awards, and the targets are not set for individual program categories.

Figure 2-1 shows how the Hawai'i Energy PBFA programs performed against the following four CET performance indicator targets: **first-year energy reduction**, **lifetime energy reduction**, **demand reduction**, **and total resource benefits**. Each metric is presented in one quadrant of the figure. We present the verified performance by program category as a percentage of the target within each quadrant. The verified performance is illustrated in each colored bar, the claimed performance is indicated with a green dot, and the target is shown as a vertical line representing 100%.

We also present the implication of using a strict vs. lenient verification approach for program documentation. The **strict approach** required backup documentation to include either an invoice or a post-installation report to verify the type and number of rebated measures purchased. In contrast, the **lenient approach** gave Hawai'i Energy the benefit of the doubt and did not adjust savings when documentation was insufficient to verify a measure. The gray section of the bar in the figure represents the portion of savings (or TRBs) that Hawai'i Energy risks losing under a strict verification approach relative to the lenient verification approach.

AEG chose to investigate the implication of a strict verification approach because of insufficient backup documentation for projects sampled as part of the desk reviews.⁹ During the PY19 verification, AEG recommended that Hawai'i Energy provide better documentation, including invoices or post-installation inspection reports. Unfortunately, we did not see much improvement in the robustness of the documentation provided, especially for custom projects. While we used the lenient approach to verify desk review savings and TRBs for PY20, we recommend using the strict approach in future verifications. Therefore, the grey bars show the implications of a stricter verification approach by quantifying the risk to Hawai'i Energy's future claimed performance.

The verification findings show the following with respect to the CET targets:

- Hawai'i Energy met the CET first year and lifetime energy savings, demand savings, and TRBs targets for **Residential Hard-to-Reach**, **Residential Incentives**, and **Business Prescriptive** program categories.
- **Business Custom** fell short of all but one of its four targets. The most impactful performance adjustments resulted from updates to regression models that impacted CBEEM HVAC and general custom projects, updates to project EULs, and updates to lifetime savings that incorporated dual baselines.
- **Business Hard-to-Reach** also fell short of targets. The claimed and verified savings missed the 95% threshold, mainly resulting from the COVID-19 pandemic. Hawai'i Energy and its customers faced numerous challenges with supply chains and direct installation of measures because of the economic uncertainty and health concerns related to the pandemic.
- AEG found that Hawai'i Energy did not consistently account for dual-baselines for lighting projects under BHTR Energy Advantage (small-business direct-install), BEEM, or REEM lighting when calculating TRBs, lowering the verified lifetime energy savings and TRBs in the Business Hard-to-Reach, Business Prescriptive, and Residential Incentive program categories.

Details on all performance adjustments follow in the CET Performance Adjustments.

⁹ Strict and lenient approaches were also used for residential custom projects under CREEM, but the impacts were minimal in relation to the overall residential incentives program category.



Figure 2-1 PBFA Performance Against CET Targets—Energy and Demand Savings, TRBs¹

¹ The gray bars show the savings and TRBs that Hawaii Energy would have lost had AEG used a stricter approach to verify custom project savings. The stricter approach requires invoices or at least purchase orders for every measure rebated through CBEEM or CREEM.

Figure 2-2 shows that overall, the PBFA programs exceeded Grid Services Ready targets but fell short of both GHG avoided emissions targets. The shortfall directly results from adjustments to claimed energy savings (see Figure 2-1), not a result of the inaccurate application of GHG conversion factors by Hawai'i Energy.

Appendix B provides the final performance towards targets thresholds and achieved awards for each program category.

2,108 Grid Services Ready Residential Incentives Residential HTR GHG Reductions (Tons) 63,187 Business Prescriptive Business HTR Business Custom 147,004 GHG Reductions (Barrels) -Target Claimed 0% 50% 100% 200% 250% 300% 350% 150%

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

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, can be found in Appendix E.

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Performance Metric	Description of Metric	Verification Activities and Adjustments
Energy and Demand Savings ¹ First-Year Energy Savings Lifetime Energy Savings	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
Peak Demand Reductions	System-Level Savings Savings reflected at the generator incorporating line losses	System-Loss Adjustment through a review of the system loss factors (in PY20 TRM V2.0) 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 PY20 TRM V2.0) 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 NTGRs to calculate TRBs for each program and measure (avoided costs already include line losses so are not included in savings at this step)
Grid Services Products	The total number of projects completed or products installed that qualify as Grid Service Ready (e.g., grid-connected water heaters)	Product Adjustment using the count of Grid Services Products included in the reconciled tracking database.
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 tonsper-kWh and barrels of oil-to-metric tons conversion factors provided in the PY21 TRM. ¹⁰

¹Performance targets for energy and demand savings metrics are based on program-level savings, which are built up from customer- and system-level savings.

¹⁰ As specified in the PY20 Verification Workplan, AEG used the PY21 Hawai'i Energy TRM to estimate GHG avoided emissions because these metrics were not included in the PY20 TRM.

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. The remainder of this section provides key findings for:

- Energy and Demand Savings Adjustments, with metrics including 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 Adjustments
- Grid Services Ready 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).

Figure 2-3 shows the overall adjustments to first-year energy savings, lifetime energy savings, and peak demand reductions at the customer-level, system-level, and program-level. We begin with the customer-level savings tracked in the database on the far left and end with the claimed and verified program-level savings on the far right. Green boxes indicate that the adjustment increased savings, while red boxes show a decrease. These adjustments fall into three categories:

- Customer Level adjustments, which result only from AEG's TRM replication and desk review verification activities (using the lenient desk review approach),
- System-Loss adjustments, which were applied by both AEG and Hawai'i Energy, and
- Net to Gross adjustments, which were also applied by both AEG and Hawai'i Energy.

The differences in percentages and height of these boxes indicate how closely the verified and claimed adjustments aligned for the system-loss and net-to-gross adjustments. Figure 2-4 also shows these adjustments to first-year energy savings for each program category.

Figure 2-3 shows that AEG made minimal adjustments to customer-level first-year claimed savings based on the TRM review, with all adjustments being 1% or less. In contrast, AEG did make meaningful adjustments to the customer-level savings based on the desk reviews, which resulted in a 3% decrease in peak demand reductions. Desk review adjustments were largely driven by Business Custom (-14% of claimed savings) and Residential Incentives (+6% of claimed savings) program categories. Both AEG and Hawai'i Energy made similar adjustments to system loss (+5%) and NTG (-25%). These adjustments all fed directly into the program-level savings. The overall program-level portfolio realization rate of 99% (first-year energy), 92% (lifetime energy), and 98% (peak demand) savings were driven almost entirely by the desk review adjustments to claimed customer-level savings.



Figure 2-3 Energy and Demand Savings Adjustments Overall¹

¹ The red line indicates the portfolio-level target (across the five program categories) for each performance indicator metric.



Figure 2-4 First-Year Energy Savings Adjustments by Program Category¹

¹ The red line indicates the portfolio-level target (across the five program categories) for each performance indicator metric.

In the following subsections, we present more detail around 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 two 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 **Desk Review Adjustment** compared the TRM-adjusted savings to the savings verified by AEG through desk reviews of a sample of projects. (See <u>Appendix F Sample Design and Extrapolation</u> for a description of how AEG weighted the sample desk review adjustments to the population of projects.)

TRM-Adjustments

Table 2-3 shows the claimed and TRM-adjusted savings for customer-level, first-year energy, lifetime energy, and peak demand savings and the resulting TRM adjustment factors for each program. AEG only calculated TRM adjusted savings for projects with savings fully deemed or semi-prescribed in the PY20 TRM. The tracking database must have included all relevant fields, including custom input fields, in the savings replication. Projects

not included in this task, including those with custom claimed savings, were assigned a TRM adjustment factor of 1.0.

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 1.0 for all programs**. Any programs with adjustment factors that are different from 1.0 are highlighted in bold, orange font.

	Customer Sa	-Level First-Ye vings (MWh/y	ear Energy /r)	Customer Sav	-Level Lifetime vings (MWh/yr	Energy)	Customer-Level Peak Demand Reductions (MW/yr)			
Program	Claimed	TRM- Adjusted	TRM Adj. Factor	Claimed	TRM- Adjusted	TRM Adj. Factor	Claimed	TRM- Adjusted	TRM Adj. Factor	
BEEM	27,013	26,990	1.00	390,559	391,426	1.00	5.43	5.44	1.00	
BESM	193	193	1.00	873	873	1.00	0.02	0.02	1.00	
BHTR	8,800	8,795	1.00	117,199	110,716	0.94	1.01	1.02	1.00	
CBEEM	29,721	29,721	1.00	501,820	501,820	1.00	4.24	4.24	1.00	
REEM	44,384	45,004	1.01	404,441	405,544	1.00	9.78	9.99	1.02	
RESM	1,967	1,967	1.00	6,327	6,327	1.00	0.42	0.42	1.00	
RHTR	4,102	4,102	1.00	54,076	54,091	1.00	0.58	0.58	1.00	
CREEM	172	172	1.00	1,015	1,015	1.00	0.02	0.02	1.00	
Total	116,351	116,943	1.01	1,476,309	1,471,811	1.00	21.52	21.73	1.01	

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

¹AEG did not include custom projects in the savings replication analysis and used a 100% adjustment factor to calculate the TRM-adjusted savings for all custom projects.

Key takeaways included the following. Details on specific adjustments are included in an Excel-based appendix that can be made available upon request.

- BHTR lighting projects installed through Energy Advantage (small business direct install) incorrectly used single baselines when replacing halogen, incandescent, and pre-existing fluorescent equipment, which led to a TRM adjustment factor of 0.94 for BHTR verified customer-level lifetime savings. AEG adjusted lifetime savings for over 7,000 fixtures (25%) of the Energy Advantage lighting projects that applied the pre-existing fixture wattage across the efficient equipment's full estimated useful life (EUL). AEG verified lifetime savings for these projects using the dual-baseline approach outlined in the PY20 TRM for direct-install commercial lighting.
- REEM upstream lighting, BEEM lighting, and HVAC projects drove portfolio TRM adjustment factors. Half of
 the residential program claimed savings came from REEM upstream lighting projects. The savings replication
 found a TRM adjustment factor of 1.0 for these projects, heavily contributing to the near-1.0 TRM adjustment
 factor for the residential programs overall.
- AEG found that more customers received home energy reports (HERs) than Hawai'i Energy claimed in the tracking database. Based on the program tracking data from the HER vendor, nearly 250,000 customers received at least two HERs in PY20, making them eligible for 50% of the annual savings deemed in the PY20 TRM. Hawai'i Energy claimed 50% of the deemed savings for only 207,500 customers. After prorating savings for the number of months each customer remained active during PY20, AEG verified a TRM adjustment of 111% for HERs, which were 12% of the REEM claimed savings.
- The tracking database lacked the relevant custom inputs for several semi-prescriptive measure categories in Business Prescriptive and Hard-to-Reach programs leading to TRM adjustment factors closer to 1.0. AEG intended to include all semi-prescriptive measures in the savings replication task but had to remove commercial fan and pump VFDs, commercial heat pump and solar water heaters, and commercial submetering because the tracking database lacked the relevant custom inputs for all projects in these categories. For these projects, AEG

did not make any adjustments (assumed a TRM adjustment factor of 1.0). In total, these measures accounted for only 4% of claimed first-year energy savings and minimally impacted overall savings replication findings.

• Rounding accounted for most of the differences in per-unit verified and claimed savings but did not have a meaningful impact on the overall TRM adjustment factors. Hawai'i Energy did not consistently round savings in the tracking database, leading to differences of less than 1% between the per-unit claimed and verified savings. In some cases, Hawai'i Energy used unrounded first-year energy savings to calculate lifetime energy savings, which caused minor differences in claimed and verified lifetime savings, though differences were minimal.

Desk Review Adjustments

Next, AEG verified savings for a sample of customers through engineering desk reviews and estimated sample adjustment factors within program and equipment category strata. 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 noted in the <u>overview of CET performance</u>, AEG used two approaches to verify savings during the desk reviews: a strict and lenient approach. We used the lenient approach to verify PY20 savings but provided the implications of employing the strict approach (shown by the gray bars in Figure 2-1) to show how future verifications could impact Hawai'i Energy's claimed savings if they do not improve their documentation collection processes. Both approaches verified the savings calculations; the following describes key differences between approaches.

- The **strict approach** verified that the type and number of rebated measures were, in fact, purchased through either an invoice or post-installation report. When sufficient documentation was not available through Hawai'i Energy's tracking database as expected, AEG requested backup documentation for individual projects directly from program staff. These additional requests focused on CBEEM and CREEM projects. If adequate documentation remained unavailable, the measure was given zero savings.¹¹
- A **lenient approach** gives Hawai'i Energy the benefit of the doubt and does not adjust savings when documentation is insufficient to verify a measure.

Even using the lenient approach, the most impactful adjustments were made to the CBEEM. Updates to estimated useful lives, custom inputs to savings algorithms, and updates to regression models led to the decrease in verified savings.

¹¹ Documentation issues persisted beyond CBEEM and CREEM projects. If AEG did not make a request specific to an individual project, we did not apply the strict approach to that project. Therefore, the gray bars shown in Figure 2-1 should be considered conservative in terms of the savings that Hawai'i Energy could lose under a stricter approach.

Customer-Level First-Year Energy Savings (MWh/yr)			Customer- Sav	Level Lifetim ings (MWh/y	e Energy r)	Customer-Level Peak Demand Reductions (MW/yr)			
Program	TRM- Adjusted	Verified	Desk Review Adj. Factor	TRM- Adjusted	Verified	Desk Review Adj. Factor	TRM- Adjusted	Verified	Desk Review Adj. Factor
BEEM	26,990	27,094	1.00	391,426	393,402	1.01	5.44	5.42	1.00
BESM ¹	193	193	1.00	873	873	1.00	0.02	0.02	1.00
BHTR	8,795	8,848	1.01	110,716	111,934	1.01	1.02	1.00	0.99
CBEEM ²	29,721	25,522	0.86	501,820	346,301	0.69	4.24	3.76	0.89
REEM ³	45,004	47,683	1.06	405,544	447,372	1.10	9.99	9.95	1.00
RESM ¹	1,967	1,967	1.00	6,327	6,327	1.00	0.42	0.42	1.00
RHTR ³	4,102	4,102	1.00	54,091	54,091	1.00	0.58	0.58	1.00
CREEM ²	172	167	0.97	1,015	1,383	1.36	0.02	0.03	1.15
Total	116,943	115,575	0.99	1,471,811	1,361,683	0.93	21.73	21.18	0.97

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

¹AEG did not conduct desk reviews for BESM or RESM projects and assumed an adjustment factor of 100%.

²TRM-adjusted savings for CBEEM and CREEM projects equal the savings claimed in the tracking database since AEG did not include custom projects in the savings replication task.

³AEG did not conduct desk reviews for all components of the REEM or RHTR 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 100% desk review adjustment for program components not included in the program.

Key takeaways for all programs *excluding* CBEEM and CREEM included the following:

- AEG identified minor calculation issues for prescriptive or semi-prescriptive measures and projects, including REEM, BEEM, and BHTR.¹²
 - AEG adjusted savings for two of three sampled REEM downstream HVAC projects. In one case, Hawai'i Energy used the incorrect rated capacity, which led to lower verified savings. In the other case, Hawai'i Energy used the incorrect rated capacity and applied the incorrect EER, leading to an increase in verified savings.
 - Hawai'i Energy treated one BHTR Commercial Downstream project as a custom project and estimated saving for the energy management system (EMS) at the restaurant through a billing analysis of energy consumption. However, when AEG reviewed the billing analysis, it verified zero savings for the project because the estimated savings impacts were not statistically different from zero savings by industry standards (i.e., we could not determine whether the EMS was associated with decreased energy consumption at the building).
 - Based on the backup documentation provided, AEG adjusted the facility types for three of the 12 sampled Energy Advantage (BHTR) projects and one of the 19 sampled BEEM Controls projects and also adjusted the rated capacity for another sampled BEEM project, leading to higher overall verified savings for both programs.

Table 2-5 shows the desk review adjustments that AEG made to specific equipment categories within CBEEM and CREEM (based on the lenient approach). AEG made the largest adjustments to general CBEEM custom projects, but updates to CBEEM HVAC and lighting also contributed to the reduction in claimed savings for CBEEM projects. Adjustments to sampled CBEEM projects were extrapolated to the population as per the sample design memo.

¹² These issues also impacted RHTR, but the adjustments were too minor to result in a non-1.0 adjustment factor.

As shown, AEG did not make any adjustments to the three CREEM projects that were not sampled for desk reviews (leading to an adjustment of 1.0 for non-sampled CREEM projects). AEG reduced first-year energy savings for the two sampled projects but verified higher lifetime energy and peak demand savings.

Table 2-5Desk Review Adjustments to CBEEM and CREEM

Program (Stratum)	Custom Energy	ner-Level Fir Savings (M	st-Year Wh/yr)	Custome Sa	r-Level Lifeti vings (MWh	me Energy /yr)	Customer-Level Peak Demand Reductions (MW/yr)		
	TRM- Adj.	Verified	Desk Review Adj. Factor	TRM- Adj.	Verified	Desk Review Adj. Factor	TRM- Adj.	Verified	Desk Review Adj. Factor
CBEEM	29,721	25,522	0.86	501,820	346,301	0.69	4.24	3.76	0.89
Custom (N=124; n=4)	12,321	9,056	0.73	195,868	93,166	0.48	1.62	1.20	0.74
HVAC (N=8; n=3)	7,568	6,453	0.85	116,897	70,639	0.60	1.03	0.92	0.89
Lighting (N=65; n=21)	9,832	10,013	1.02	189,055	182,497	0.97	1.59	1.64	1.03
CREEM	172	167	0.97	1,015	1,383	1.36	0.02	0.03	1.15
Sampled (N=2; n=2)	68	63	0.93	339	707	2.08	0.01	0.01	1.47
Not-Sampled (N=3; n=0)	104	104	1.00	676	676	1.00	0.02	0.02	1.00

Key takeaways for CBEEM and CREEM included the following.

- AEG identified several calculation issues for CBEEM custom lighting projects.
 - Two opportunities included custom and prescriptive lighting projects that all received rebates under the CBEEM program. For one of these projects, Hawai'i Energy applied TRM-deemed per-unit savings meant for linear LEDs to nonlinear bulbs installation, which increased the verified savings by 1.5 to nearly 3.0 times the claimed savings for this project overall. Hawai'i Energy did not incorporate the dual-baseline when calculating LED lifetime savings or TRBs for either project. We also removed a small portion of savings (~6% of claimed first-year kWh for the custom lighting sample) that had been double-counted between custom and prescriptive projects across both these opportunities.
 - A handful of projects (5/21) incorrectly used a single baseline to calculate lifetime savings when replacing halogen, incandescent, or fluorescent lamps or fixtures. Using the dual baseline approach reduced lifetime savings for these measures by about 30%.
 - Two projects' first-year claimed savings were based on incorrect baseline wattages, which slightly lowered verified first-year energy and demand savings and lifetime energy savings.
- Lack of adherence to industry best practices in regression modeling led to adjustments for one sampled custom HVAC project and one general custom project. AEG updated the regression analysis for one of the three sampled HVAC projects, leading to slightly lower savings for this project (94% of claimed first-year energy savings). After updating the regression analysis for the general custom project (of four sampled), AEG verified a realization rate of 64% for first-year energy savings. Similar issues affected both projects: The Hawai'i Energy models included too few observations for a valid model and used actual weather, instead of from a typical meteorological year, to estimate savings. While similar, the AEG models included more observations by using both pre- and post-installation data and estimated savings for a typical year. The AEG approach follows the forthcoming Custom Project Guidance Document.
- Correcting EULs lowered lifetime energy savings for two custom HVAC projects and increased lifetime energy savings for one general custom project. AEG lowered the lifetime savings for two of the three sampled custom

HVAC projects. For one project, a cooling tower, AEG corrected the applied EUL of 25 years to 15 years, and for the other, a smart thermostat, AEG corrected the applied EUL of 15 years to three years. AEG also lowered the lifetime savings for the third HVAC custom project that had not been calculated using a dual baseline approach but also increased the applied EUL from 15 years to 20 years, overall increasing lifetime savings for this project. Finally, AEG updated the lifetime savings for two (of four) sampled projects listed in the tracking database as general custom projects: Hawai'i Energy had applied an EUL of 10 years to one VFD project and 25 years to the other, which AEG updated to 15 years as appropriate for the equipment installed.

• AEG lowered first-year energy savings and increased peak demand savings for both sampled CREEM projects by calculating savings for each measure in the residential new construction bundles and increased lifetime savings by applying measure-specific EULs. We could not see how Hawai'i Energy calculated savings for individual measures. However, we found that they applied an EUL of five or less for all projects when longer EULs were appropriate for the measures in the bundle.

AEG also identified the following additional issues based on a stricter verification approach or that may impact Hawai'i Energy's performance going forward. Although these findings did not contribute to any savings adjustments in the lenient approach case (which AEG used to verify Hawai'i Energy's awards), they provide important context around several of the high-priority recommendations.

- Two of the CBEEM lighting projects sampled for desk reviews included prescriptive lighting measures that Hawai'i Energy combined under one CBEEM project to make processing the incentives easier for the customer. While combining custom and prescriptive projects under a single rebate is not inherently inappropriate, AEG could not tell that these portions of the projects were prescriptive without reviewing the detailed project documentation. Furthermore, even though the prescriptive portions of savings comprised between 93% and 99% of the total projects' claimed savings, all savings from each project contributed to Hawai'i Energy's performance towards Business Custom targets. AEG did not reallocate these prescriptive savings for the PY20 Verification.
- Lack of invoices or equivalent post-installation inspection reports would have been the source of most adjustments for CBEEM non-lighting custom projects. Only three of the seven non-lighting projects sampled under CBEEM included sufficient documentation to confirm that all the rebated equipment was installed as scoped. Under the strict verification approach, AEG would have verified zero savings for the other projects. Extrapolating these results to the population of CBEEM projects would have heavily reduced verified savings in both the Business Custom program category and the portfolio, reducing CBEEM the realization rate to 0.63 from 0.83.
- Insufficient documentation for CREEM new construction projects. Neither of the two sampled CREEM new construction projects included sufficient documentation to confirm that all the rebated equipment was installed as scoped. Under the strict verification approach, AEG would have verified zero savings for both projects, out of five total projects, resulting in a CREEM realization rate of 0.63 vs. 0.97. It is important to note that the lack of documentation was also a concern in the PY19 verification.

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 and desk review adjustments to the claimed savings. Overall, AEG verified realization rates of 99% for first-year energy savings, 92% for lifetime energy savings, and 98% for peak demand reductions.

Program	Customer-Level First-Year Energy Savings (MWh/yr)			Customer-Level Lifetime Energy Savings (MWh/yr)			Customer-Level Peak Demand Reductions (MW/yr)		
5	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	27,013	27,094	100%	390,559	393,402	101%	5.43	5.42	100%
BESM	193	193	100%	873	873	100%	0.02	0.02	100%
BHTR	8,800	8,848	101%	117,199	111,934	96%	1.01	1.00	99%
CBEEM	29,721	25,522	86%	501,820	346,301	69%	4.24	3.76	89%
REEM	44,384	47,683	107%	404,441	447,372	111%	9.78	9.95	1 02%
RESM	1,967	1,967	100%	6,327	6,327	100%	0.42	0.42	100%
RHTR	4,102	4,102	100%	54,076	54,091	100%	0.58	0.58	99%
CREEM	172	167	97%	1,015	1,383	1 36 %	0.02	0.03	115%
Total	116,351	115,575	99%	1,476,309	1,361,683	92%	21.52	21.18	98%

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

System- and Program-Level Savings Adjustments

AEG applied the system loss factors from the PY20 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. Overall, the system-loss adjustments made by Hawai'i Energy aligned with the system-loss adjustments verified by AEG. Therefore, these realizations rates are largely driven by discrepancies persisting from the customer-level savings verification activities (i.e., the system-realization rates are nearly identical to the customer-level realization rates shown in Table 2-6).

Program	System-Level First-Year Energy Savings (MWh/yr)			System-Level Lifetime Energy Savings (MWh/yr)			System-Level Peak Demand Reductions (MWh/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	28,265	28,350	100%	408,621	411,595	101%	5.68	5.67	100%
BESM	203	203	100%	922	922	100%	0.02	0.02	100%
BHTR	9,189	9,239	101%	122,409	116,910	95%	1.06	1.05	99%
CBEEM	31,023	26,640	86%	523,693	361,396	69%	4.42	3.92	89%
REEM	46,448	49,900	1 07 %	423,122	468,036	111%	10.24	10.41	102%
RESM	2,053	2,053	100%	6,607	6,607	100%	0.44	0.44	100%
RHTR	4,317	4,317	100%	56,918	56,934	100%	0.61	0.61	99%
CREEM	179	174	97%	1,063	1,448	136%	0.02	0.03	115%
Total	121,677	120,876	99%	1,543,355	1,423,848	92%	22.51	21.16	98%

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

AEG applied net-to-gross ratios from the PY20 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. Similar to the system-level realization rates, the program-level realization rates are driven by discrepancies persisting from the customer-level savings verification activities, as both AEG and Hawai'i Energy made the same net-to-gross adjustments.

Proaram	Program-Level First-Year Energy Savings (MWh/yr)			Program Sa	-Level Lifetin vings (MWh,	ne Energy /yr)	Program-Level Peak Demand Reductions (MWh/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	21,199	21,262	100%	306,466	308,696	101%	4.26	4.25	100%
BESM	193	193	100%	876	876	100%	0.02	0.02	100%
BHTR	8,363	8,409	101%	111,400	106,396	95%	0.96	0.95	99%
CBEEM	23,267	19,980	86%	392,770	271,047	69%	3.32	2.94	89%
REEM	32,211	34,605	107%	286,696	317,129	111%	7.09	7.20	1 02%
RESM	1,889	1,889	100%	6,078	6,078	100%	0.40	0.40	100%
RHTR	4,317	4,317	100%	56,918	56,934	100%	0.61	0.61	99%
CREEM	116	113	97%	691	941	136%	0.01	0.02	115%
Total	91,555	90,768	99%	1,161,895	1,068,097	92%	16.69	16.41	98%

Table 2-8	Clean Energy	Technology Program-	Level Savings Realizatio	n Rates by Program
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Major findings from the system-level and program-level adjustments included the following:

- Overall, the system- and program-level savings claimed in the tracking database aligned closely with the verified savings. Therefore, these realizations rates are largely driven by discrepancies persisting from the customer-level savings verification activities (i.e., the system- and program-level realization rates are nearly identical to the customer-level realization rates shown in Table 2-6).
- The island-specific system loss factors included in the tracking database matched the verified system loss factors exactly. Similarly, the program and delivery channel net-to-gross ratios included in the tracking database matched the verified net-to-gross ratios exactly.
- AEG could not determine the cause of several differences in the claimed and verified system- and programlevel peak demand savings, but differences were too small to show up in the realization rates. AEG applied the system loss factors in the tacking database to the claimed customer-level peak demand savings but could not exactly replicate the system-level savings claimed in the tracking database. Differences in rounding likely led to some of these small differences. AEG found similarly small discrepancies when applying the net-to-gross ratios to the claimed system-level savings.

Total Resource Benefits 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 PY20 TRM.

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. However, AEG found that Hawai'i Energy consistently overstated TRBs from measures that required a dual baseline approach, which had the largest impact on lighting measures in BHTR Energy Advantage lighting, REEM, and BEEM programs.

Updates to REEM and BEEM lighting TRBs did not similarly impact lifetime savings. The PY20 TRM provided accurate per-unit lifetime savings that Hawai'i Energy could copy and apply in the tracking database but did not include per-unit TRBs for any measures. Hawai'i Energy would need to implement the dual-baseline approach to calculate accurate TRBs.

Program	Claimed TRBs	Verified TRBs	Realization Rate
BEEM	\$44,435,533	\$43,824,324	99%
BESM	\$127,223	\$127,223	100%
BHTR	\$13,952,511	\$13,319,917	95%
CBEEM	\$48,992,552	\$35,996,304	73%
REEM	\$49,491,180	\$43,382,353	88%
RESM	\$1,000,803	\$1,000,812	100%
RHTR	\$7,879,783	\$8,055,539	102%
CREEM	\$97,757	\$126,800	130%
Total	\$165,977,342	\$145,833,272	88%

Table 2-9 Clean Energy Technologies Total Resource Benefits Performance

Grid Services Ready Adjustments

Figure 2-5 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 aligned except where AEG verified an additional RHTR grid-interactive water heater rebate associated with 95 projects.

Figure 2-5 Grid Service Ready Performance Against Target



GHG Reductions Adjustments

AEG estimated the GHG emissions avoided through the Hawai'i Energy PBFA programs (in barrels of oil and metric tons of CO₂) using the conversion factors provided in the PY21 TRM¹³ and verified first-year program-level energy savings.

Figure 2-6 shows how claimed and verified GHG reductions performance compared to those claimed by Hawai'i Energy. The PBFA programs did not meet either GHG reductions targets, consistent with the claimed GHG emission reductions. REEM, CBEEM, and BEEM projects contributed most GHG avoided emissions (~84% across metrics). BHTR projects contributed another nine percent, with RHTR, RESM, BESM, and CREEM projects delivering a combined seven percent.

Hawai'i Energy used the appropriate TRM algorithms and conversion factors to estimate GHG avoided emissions. Differences between verified and claimed customer-level savings drove differences in verified and claimed GHG avoided emissions.

¹³ As specified in the PY20 Verification Workplan, AEG used the PY21 Hawai'i Energy TRM to estimate GHG avoided emissions because these metrics were not included in the PY20 TRM.



Figure 2-6 GHG Reductions Performance Against Targets

Verified Claimed

CET Performance Awards

Hawai'i Energy must achieve at least 95% of performance targets for first-year and lifetime energy savings and peak demand reductions at the program category level to claim any of the performance award in these key focus areas. AEG calculated the awards Hawai'i Energy received based on its verified performance according to the rules shown in Table B-1 in Appendix B.

Table 2-10 shows the target, reported, and verified awards by metric and program category. Hawai'i Energy achieved 65% of the first-year energy savings award, 54% of the lifetime energy savings award, 89% of the peak demand reductions award, and 60% of the TRBs award.

AEG verified similar awards to those reported by Hawai'i Energy in nearly every program category. The Business Custom program category (CBEEM) drove most of the differences between reported and verified awards. Hawai'i Energy reported awards for all three energy and demand performance metrics based on achieving 99%, 103%, and 107% of the first-year energy savings, lifetime energy savings, and peak demand reductions performance targets, respectively. However, after verification activities reduced the claimed savings by about 15%, Hawai'i Energy no longer met the 95% performance threshold in any metrics except for peak demand, leading to only 9% of the available awards from CBEEM.

Hawai'i Energy only met TRB performance targets in three program categories (Business Prescriptive, Residential HTR, and Residential Incentives). It fell short in Business Custom and Business HTR program categories, consistent with its performance towards first-year and lifetime energy savings targets.

Performance Indicator Metric	Target Award	Claimed Award		Verified Award		
(Program Category)	(\$)	(\$)	(% of Target)	(\$)	(% of Target)	
First-Year Energy Reduction	\$135,577.00	\$103,130.08	76%	\$88,085.81	65%	
Business Prescriptive	\$30,728.12	\$31,588.51	103%	\$31,680.69	103%	
Business HTR	\$16,594.20	\$0.00	0%	\$0.00	0%	
Business Custom	\$34,790.71	\$27,832.57	80%	\$0.00	0%	
Residential Incentives	\$50,784.46	\$40,627.57	80%	\$53,323.68	105%	
Residential HTR	\$2,679.51	\$3,081.44	115%	\$3,081.44	115%	
Lifetime Energy Reduction	\$135,577.00	\$111,590.50	82%	\$72,648.52	54%	
Business Prescriptive	\$36,698.15	\$29,358.52	80%	\$33,028.34	90%	
Business HTR	\$19,504.15	\$0.00	0%	\$0.00	0%	
Business Custom	\$44,666.65	\$46,140.65	103%	\$0.00	0%	
Residential Incentives	\$32,674.57	\$33,752.83	103%	\$37,281.68	114%	
Residential HTR	\$2,033.48	\$2,338.50	115%	\$2,338.50	115%	
Peak Demand Reduction	\$135,577.00	\$137,315.26	101%	\$120,504.35	89%	
Business Prescriptive	\$33,410.87	\$38,422.50	115%	\$38,422.50	115%	
Business HTR	\$14,236.92	\$0.00	0%	\$0.00	0%	
Business Custom	\$29,287.29	\$31,454.55	107%	\$14,643.65	50%	
Residential Incentives	\$56,118.84	\$64,536.67	115%	\$64,536.67	115%	
Residential HTR	\$2,523.08	\$2,901.54	115%	\$2,901.54	115%	
Total Resource Benefits	\$180,769.00	\$169,633.45	94%	\$109,125.48	60%	
Business Prescriptive	\$48,329.74	\$54,370.96	113%	\$53,646.01	111%	
Business HTR	\$26,041.55	\$0.00	0%	\$0.00	0%	
Business Custom	\$58,154.69	\$59,783.02	103%	\$0.00	0%	
Residential Incentives	\$45,283.91	\$52,076.50	115%	\$52,076.50	115%	
Residential HTR	\$2,959.11	\$3,402.98	115%	\$3,402.98	115%	
Grid Services Ready	\$37,500.00	\$37,500.00	100%	\$37,500.00	100%	
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	

Table 2-10CET Performance Awards

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 exceeded targets for RHTR during the pandemic, a time with participants likely placed a high value on saving money and energy. The Claimed program-level CET performance metrics reached nearly 200% of the target, and AEG verified claimed reductions at near 100% across the board.
- Hawai'i Energy also exceeded the target for installation of Grid Service Ready measures which are a critical component of Hawaii's clean energy transition. AEG verified 315% of the target relative to Hawai'i Energy's

claimed 301%. The measures included not only grid-interactive water heaters but also smart devices and general DR equipment.

- AEG found that Hawai'i Energy's implementation of the TRM algorithms for prescriptive programs was near perfect. We made minimal impactful TRM adjustments to the claimed savings, leading to TRM adjustment factors close to 1.0 for all programs.
- Accurate application of system- and program-level adjustments. The island-specific system loss factors included in the tracking database exactly matched the verified system loss factors. Similarly, the program and delivery channel net-to-gross ratios included in the tracking database matched the verified net-to-gross ratios exactly.

Recommendations

Our verification found that Hawai'i Energy is still struggling with implementation of 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 on 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. Account for dual baselines when calculating TRBs. AEG found that Hawai'i Energy did not consistently implement dual-baselines for lighting projects under BHTR Energy Advantage (small-business direct-install), CBEEM, REEM, or BEEM lighting. For BHTR and CBEEM lighting, dual-baseline corrections affected both lifetime energy savings and TRBs. However, for REEM and BEEM, corrections only affected TRBs. REEM and BEEM lifetime savings were correct because the PY20 TRM provided accurate per-unit lifetime savings that Hawai'i Energy could copy and apply in the tracking database. The TRM did not include per-unit TRBs for any measures. Hawai'i Energy needs to use the dual-baseline approach to calculate TRBs for BHTR Energy Advantage and prescriptive lighting measures (including prescriptive lighting implemented under the CBEEM program) to avoid overestimating TRBs in the tracking database.
- 2. Collect invoices (or an equivalent form of documentation) for all measures and projects prior to paying incentives. To independently verify the savings claimed by Hawai'i Energy, the evaluation contractor needs to have the ability to review backup documentation for all custom, semi-prescriptive, and fully deemed measures rebated through the programs to confirm that the claimed equipment was purchased. The PY19 verification recommended that Hawai'i Energy collect either invoices, purchase orders, or submittals (similar to purchase orders that include detailed measure specifications) as proof that the project was implemented as scoped. Additionally, Hawai'i Energy's commercial incentive application indicates that proof of purchase (and equipment specification sheets) is required. However, AEG found the lack of this type of basic documentation continued to be an issue for custom projects.

AEG recommends that only invoices or detailed post-inspection reports serve as adequate confirmation of project completion. Hawai'i Energy should collect and process invoices for all projects before paying incentives to ensure that ratepayer dollars are being used appropriately. If invoices cannot be collected, Hawai'i Energy may substitute detailed post-installation reports that itemize the census of measures and quantities included in the project and note which were covered by the inspections. The COVID-19 pandemic made it difficult for Hawai'i Energy to conduct post-installation inspections in PY20. They instead began requesting that participants sign installation verification forms, which were typically reserved for military projects before the pandemic. These forms, which itemized the census of measures and quantities installed, are acceptable so long as they are used sparingly and only as a last resort.

It is important to note that if AEG had required this type of documentation (and set any project without it to zero savings), it would have resulted in program-level first-year energy realization rates of <u>0.66 for CBEEM</u> and <u>0.63 for CREEM</u> (vs. <u>0.86 and 0.97 respectively</u>), a reduction in savings of 23-35%.

- 3. Either include prescriptive portions of CBEEM projects under the appropriate prescriptive tracks or clearly indicate in the tracking database that these projects are prescriptive and ensure their savings contribute to the appropriate performance targets. Two of the CBEEM lighting projects sampled for desk reviews included prescriptive lighting measures that Hawai'i Energy combined under one CBEEM project to make processing the incentives easier for the customer. While combining custom and prescriptive projects under a single rebate is not inherently inappropriate, AEG could not tell that these portions of the projects were prescriptive without reviewing the detailed project documentation. Furthermore, even though the prescriptive portions of savings comprised between 93% and 99% of the total projects' savings, all savings from each project contributed to Hawai'i Energy's performance towards Business Custom targets. AEG did not reallocate these prescriptive savings for the PY20 Verification but may do so going forward. Hawai'i Energy needs to ensure that combined custom and prescriptive projects are either entered in the tracking system as separate projects and rebate opportunities or identify them in a way that allows savings within an opportunity to be allocated towards the appropriate programs and performance targets and clearly identifiable to the evaluation contractor.
- 4. 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. Energy efficiency projects often save energy at different rates over the year because of changes in weather, facility operations, etc. Therefore, the savings estimated from a regression model that uses only partial year data can over- or underestimate annual savings. Including pre- and post-implementation data covering the range of weather and operating conditions will improve savings accuracy and mitigate differences in claimed and verified savings. Ideally, both pre- and post-implementation observations will cover the same weather and operation months.

Hawai'i Energy should also calculate and report the uncertainty of the savings estimates to show that the point estimates are statistically different from zero (i.e., to show that the project had a meaningful impact on consumption). For example, Hawai'i Energy calculated annual savings for one custom BHTR project (an energy management system [EMS]) of 0.4% of baseline consumption. However, after quantifying the uncertainty during the verification, AEG found that the savings were not statistically associated with the EMS and therefore verified zero savings. To detect the small savings for this project, Hawai'i Energy would have needed higher-frequency interval data.

This and other guidance will be provided in the forthcoming Custom Project Guidance Document, which Hawai'i Energy should have access to and be able to reference prior to when it goes into effect for PY22.

Additional Recommendations

Additional recommendations are focused 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. Consider using typical meteorological year (TMY) weather data when using regression analysis to estimate lifetime savings for custom projects. AEG found that Hawai'i Energy tends to estimate weather-sensitive custom project savings using regression models that only use weather from the post period (usually only a few weeks or a few months—see AEG's recommendation in the high priority section above about including more months of data in Hawai'i Energy's regression analyses). While current-year weather best estimates first-year savings as they occurred during the current program year, they are subject to over-or underestimating savings over the lifetime of the projects, particularly when projects have long estimated useful lives. We recommended that Hawai'i Energy use TMY weather when estimating first-year annual savings to estimate lifetime savings with greater accuracy. Such recommendations are included in the forthcoming Custom Project Guidance Document, which will go into effect in PY22.
- 2. Collect supplemental project documentation before paying out incentives for projects. Project documentation should include measure specification sheets that clearly identify the model being installed and rebated under the program to ensure that the measure is the expected high-efficiency measure.

- **3.** Beginning in PY21, use the updated baseline to calculate savings for residential faucet aerators and showerheads. The baseline for residential faucet aerators and showerheads increased beginning in 2021, partway through PY20, but Hawai'i Energy continued using the 2020 baseline. Since purchase dates were not consistently provided in the tracking database, AEG verified savings using the 2020 baseline for these measures as well, but evaluation contractors should verify savings using the updated 2021 baseline going forward.
- 4. Hawai'i Energy should continue updating its tracking database to include custom inputs for measures that are semi-prescribed in the TRM, enabling the verification contractor to include these measures in the savings replication. Because the TRM does not include default values for these inputs, we cannot replicate savings. Some examples include:
 - a. Energy Advantage: missing coincident factors
 - b. Commercial solar water heaters: missing area served by the new water heater
 - c. Commercial pump or fan VFDs: missing rater motor efficiencies
 - d. Submetering: missing baseline per-unit consumption
- 5. Include project descriptions for custom projects. These help the evaluation team to better understand the intended scope and impacts of custom projects.
- 6. Consider collecting DLC screenshots consistently for all custom lighting projects. The actual screenshots provide more than just confirmation that the project is DLC certified—they include key information that the evaluation firm needs for verification of savings, including fixture wattages and total bulbs and model numbers (which do not always match the measure specification sheets).
- 7. To the best of its abilities, Hawai'i Energy should mitigate cases of missing custom inputs to semiprescribed projects. The tracking database included the fields required for replicating savings for several semi-prescribed measures; however, AEG found that in a few one-off cases, specific projects (AC & Heat Pump, VRF AC, and Chiller measures) were missing the unit rated capacity. To complete the census replication, AEG applied the midpoint of the capacity bin to these records, causing some variance in claimed and TRM-adjusted savings that would not have occurred if rated capacities had been recorded.

NON-CET VERIFICATION FINDINGS

Non-CET activities focus on the number of customers or communities served, customer bill savings, training, stakeholder, and advocacy events, training hours, and customer satisfaction scores. AEG verified the extent to which Hawai'i Energy:

- Equitably distributed PBFA funds across islands.
- Met key performance indicator targets for economic development and market transformation focus areas and customer satisfaction.
- Tracked the values needed for verifying the low-to-moderate income PIM.

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 independent analyses of the tracking database. Details on methods are provided in the following sections and described in detail in Appendix E.

Overview of Non-CET Performance Adjustments

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 as follows:

- Hawai'i Energy met all A&A performance targets except for the number of customers served and customer bill savings from single-family and multifamily direct install projects in the RHTR program and the number of customers served through the Energy Advantage channel of the BHTR program. Consistent with the verification, Hawai'i Energy did not claim awards for these key focus areas.
- Similarly, Hawai'i Energy PBFA programs met or exceeded targets for all Market Transformation and Economic Development performance metrics except the Innovation and Emerging Technologies key focus area.
- AEG verified 100% of the claimed customer satisfaction scores of 9.6 and 9.4 for business and residential participant satisfaction, respectively. Each metric exceeded the 9.0 target.

Accessibility and Affordability

The **Affordability & Accessibility (A&A)** performance goals ensure that program services and benefits are equitably allocated across eligible geographies and underserved demographics. There are two separate verification efforts under the A&A award: economically disadvantaged and island equity.

Metric	Verification Approach
<i>Economically Disadvantaged</i> 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, distinct communities through the Community-Based Energy Efficiency program, and nonprofits through the EmPOWER Hawaii Project.	Energy Advantage. Confirmed customer counts in the tracking database Single Family/Multifamily Direct Install. Confirmed customer counts in the tracking database and calculated customer bill savings using average Hawaiian Electric rates and 2019 customer billing data Community-Based Energy Efficiency. Confirmed community counts through project documentation review EmPOWER Hawaii Project. Confirmed number of projects by reviewing contractor invoices
Island Equity Requires that 13 percent of program spending occurs in each of the Hawaii and Maui counties.	Confirmed equitable distribution of funds by reviewing program spending by island (program tracking database includes a variable that states the island for each rebate).

Table 3-1A&A Summary of Verification Methods

As shown in Figure 3-1, Hawai'i Energy met all A&A performance targets except for the number of customers served and customer bill savings from single-family and multifamily direct install projects in the RHTR program and the number of customers served through the Energy Advantage channel of the BHTR program. Consistent with the verification, Hawai'i Energy did not claim awards for these key focus areas.

According to program manager interviews, the COVID-19 pandemic made it difficult for direct installations to gain traction during PY20, hindering Hawai'i Energy's progress toward direct-install targets. This was particularly notable in the business portion of the program.¹⁴

Figure 3-1 Accessibility & Affordability Verified Performance



Market Transformation & Economic Development

The **Market Transformation & Economic Development (MTED)** performance goals and programs seek to identify and overcome market barriers that prevent residential and business customers from becoming energy efficient by engaging in energy-saving behavior or investing in energy-saving equipment. In particular, these programs:¹⁵

- 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.

¹⁴ Recall that RHTR met and exceeded their CET targets, which may seem counterintuitive given some of the challenges Hawai'i Energy faced with the economically disadvantaged metrics. Based on the program manager interviews, we believe that HTR targets were primarily achieved by shifting the focus of the program to digital communications through the appliance trade-up and retrofit and water heating channels of the program.

¹⁵ Per the Hawai'i Energy PY19 Annual Report, page 10.

- Stay at the cutting-edge of new technology developments; and
- Establish strong relationships that help grow the movement's capacity and reach.

The AEG team verified the Economic Development and Market Transformation activities and achievements provided by Hawai'i Energy during PY20 relative to the program year's performance target categories and metrics through reviews of contractor invoices, participant agreements, and other backup documents.

Figure 3-2 shows that the Hawai'i Energy programs met or exceeded all performance metrics targets except the key focus area of Innovation and Emerging Technologies. Hawai'i Energy initially expected this to be a priority in PY20, but the COVID-19 pandemic pushed them to prioritize other efforts, such as indoor air quality products and services and initiatives within hard-to-reach communities.

Across all other metrics, AEG verified near 100% of claimed performance. AEG verified slightly more Adult Learning and Gamification Campaigns and Competition participant training hours through a review of project invoices. Hawai'i Energy claimed conservative participant hours by excluding hours for participants who left trainings exceedingly early (after ten minutes for hour-long meetings and after five minutes for 30- to 45-minute meetings), and while we tried to implement the same process, some insubstantial differences persisted.



Figure 3-2 Market Transformation & Economic Development Verified Performance

Customer Satisfaction

Similar to prior years, one of Hawai'i Energy's performance targets relates to customers' satisfaction around 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. For business participants, Hawai'i Energy sends monthly surveys to new participants through an in-house customer experience management tool. To meet PY20 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 9.6 and 9.4 for business and residential participant satisfaction, respectively. Each metric exceeded the 9.0 target%.

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 Hawaii Energy in the delivery of energy savings to LMI residential customers.

As part of the PY20 verification effort, AEG calculated the LMI PIM rewards associated with the RHTR and A&A programs implemented by Hawai'i Energy as a test of the approach prior to the PIM coming into effect for the PY21 programs. To calculate rewards, AEG applied the approach laid out in D&O 37787 to estimate the

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

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 PY20 verification). AEG also calculated the participation reward associated with Single-Family and Multifamily Direct Install efforts (i.e., the residential A&A Economically Disadvantaged customers).

As shown in Table 3-2, Hawaiian Electric would have achieved \$74,142.29 in energy savings rewards and \$13,425.17 in peak demand reductions rewards but would not have achieved any of the participation rewards since the A&A programs did not meet the targets for residential customers served. (See Appendix D for calculation details.)

Table 3-2LMI PIM Achieved Awards

PIM Award Component	Verified Reward
Total Energy Savings Award	\$74,142.29
Total Peak Demand Reductions Award	\$13,425.17
Total Participation Award	\$0.00
Total LMI PIM Award	\$87,567.46

Non-CET Performance Awards

As shown in Table 3-3, AEG verified 70% of the A&A target awards and 100% of MTED and Customer Satisfaction target awards, leading to overall non-CET verified awards of \$180,000 (80% of non-CET target awards). Hawai'i Energy's claimed awards aligned with the final verified awards.

Lost awards resulted from the Economically Disadvantaged performance indicator of the A&A key focus area. As discussed, Hawai'i Energy did not meet three of the four performance targets, totaling \$75,000 in lost awards. The COVID-19 pandemic heavily impacted Hawai'i Energy's ability to reach these targets, which are driven by small business and residential direct-install initiatives.

Table 3-3Non-CET Performance Awards

Key Focus Area	Target Award	Claimed Award		Verified Award	
(Performance Indicator)	(\$)	(\$)	(% of Target)	(\$)	(% of Target)
Affordability & Accessibility	\$150,000	\$105,000	70%	\$105,000	70%
Economically Disadvantaged	\$75,000	\$30,000	40%	\$30,000	40%
Island Equity	\$75,000	\$75,000	100%	\$75,000	100%
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	\$30,000	\$30,000	100%	\$30,000	100%
Energy in Decision Making	\$7,500	\$7,500	100%	\$7,500	100%
Codes & Standards	\$7,500	\$7,500	100%	\$7,500	100%
Clean Energy Innovation Hub	\$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	\$180,000	80%	\$180,000	80%

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 of the performance targets.

- Hawai'i Energy met all A&A performance targets except for those associated with direct install portions of the BHTR and RHTR programs. This is not unexpected, given that program managers noted during interviews that the pandemic resulted in limited in-person interactions.
- Similarly, Hawai'i Energy PBFA programs met or exceeded targets for all MTED performance metrics except the Innovation and Emerging Technologies key focus area. Further, they far exceeded targets in some focus areas, including:
 - Gamification Campaigns and Competitions (416% of target)
 - Strategic Energy Management (225% of target)
 - Appliance Standards Advocacy (700% of target)
- AEG verified 100% of the claimed customer satisfaction scores of 9.6 and 9.4 for business and residential participant satisfaction, respectively. Each metric exceeded the 9.0 target by over 104%.

Recommendations

AEG did not have any substantive recommendations resulting from the non-CET verification; however, we did note the following potential improvements.

- 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.
- 2. Hawai'i Energy could consider incorporating discount rates to calculate the net present value of lifetime customer bill savings for the single-family and multifamily direct install components of RHTR and BHTR. Customers will not experience their lifetime billing savings in a single year; instead, most of these savings will be recognized in future years when the dollars will have less value to each customer at present. The discount rates account for this effect and better represent the impact of the lifetime bill savings on hard-to-reach customers.

PROGRAM MANAGER INTERVIEWS

COVID-19 Recovery Resilience Plan

According to the program managers interviewed, the COVID-19 Recovery and Resilience plan filed at the end of PY19 for the portfolio took a sweeping approach focused on increasing program incentives and improving engagement with the Clean Energy Allies (CEAs). The increased incentive amounts were largely successful in maintaining participation rates but resulted in a higher cost per kWh saved for the programs. As the pandemic continued, collections went down from the public benefit fee that funds the programs, and the portfolio had a second round of deeper budget cuts resulting in reduced scope for the market transformation, education, and outreach efforts.

Marketing and Awareness

The programs are marketed through email campaigns, social media, customer-focused trainings, shared advertising with CEAs, and focused newsletters. Individual program managers also rely on the Hawai'i Energy website for marketing and outreach. They often provide copies of the website information and links to the website to customers. This approach helps with consistent messaging and communication.

Hawai'i Energy has good brand awareness, but the program managers feel there is still work to be done to continue to increase awareness. The program managers state that the upfront cost of energy efficiency improvements is the biggest barrier to program participation, followed by an unwillingness to invest in uncertain times due to the pandemic. The program managers feel the incentives are very effective in addressing the upfront cost barrier and are the largest driver of participation. CEAs appreciate being able to use rebates as part of their sales tactics. They feel the incentives also provide a stamp of approval by a third party and help overcome any trust issues with emerging technologies.

Strategic Advisory Board

The Strategic Advisory Board¹⁷ was started in recognition that Hawai'i Energy wanted to broaden the impact of the energy efficiency programs and get straightforward input from local industry leaders. The members provide feedback on programming during board meetings and in one-on-one meetings with program staff.

The program managers have found the board to be very helpful and attribute their ability to be flexible, innovate, and rally during the pandemic in part to the support they received from the Board. In particular, the Board helped them better understand the issues their constituents are facing during the pandemic and trends in the industry due to the pandemic, such as the increased interest in shared spaces for businesses which may complicate participation drivers given the challenges related to shared incentives. The Board was also instrumental in helping Hawai'i Energy's communication strategies and messaging. They helped sell the programs and shared feedback on constituents' priorities.

Future of the Programs

Some future program adaptations planned for the portfolio include pursuing energy optimization and supporting customer-sited energy storage. Hawai'i Energy also plans to increase their midstream offers to try and catch more customers in the act of making purchasing decisions.

¹⁷ The Strategic Advisory Board includes eight local industry leaders. See Hawai'i Energy's press release for more details on each member. https://hawaiienergy.com/news-events/news/523-hawaii-energy-announces-strategic-advisory-board

Supply chain issues remain a challenge for the program, as well as a general uncertainty in the market around investing in capital improvement projects.

Hawai'i Energy's contract provides performance payments if they meet a 95% performance goal. The program managers find meeting the 95% performance goal challenging. It leaves very little room for missteps – if an innovative idea fails, they may not be able to recover to achieve the goal. They also feel it hinders some flexibility to shift resources from struggling programs to other more popular programs.

Residential Programs

According to the residential program manager, a main driver of participation in the residential programs is comfort, in addition to the rebates lowering the upfront cost. Achieving cost-effectiveness for the residential programs can be challenging, and the Energy Independence and Security Act (EISA), which included higher efficiency standards for light bulbs, means program savings from lighting are diminishing, another key challenge for the programs.

The programs have had some problems with the post office and delays in receiving rebate applications. They are currently working on an online portal where customers can submit applications electronically. They are also working to expand their CEA network to contractors who are experienced with new technologies such as Heat Pump Water Heaters.

Due to the pandemic, the residential programs placed a higher priority on "stuff in homes" and discontinued the Home Energy Reports (HERs) in the second half of the year. In an effort to limit in person interactions, several requirements were relaxed (e.g., customers did not have to be present and sign forms when appliances were recycled), and due to supply chain issues, they extended the time frame for turning in applications.

Program managers reported that they also shifted the tone of their marketing materials. Hawaii had the highest unemployment rate in the country during the pandemic, and the marketing materials tried to position the programs as a valuable resource that can help during a difficult period. They were careful to avoid any language that alluded to customers doing anything wrong and framed the messaging as "here are some things you can do to help improve a really bad situation." The marketing messages also focused on indoor air quality, which was top of mind for many during the pandemic.

Business Programs

According to business 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. With that said, they feel the purchasing decision is primarily dependent on the project financials. If the project can show a two-to-five-year return on investment, most non-residential customers will move forward with the project.

In addition to the financial argument, the programs also try and highlight the non-energy benefits customers will receive. It is unclear, however, how receptive customers are to that messaging.

The main barriers to program participation are competing priorities. Even if the project looks good and meets the financial criteria, other priorities can delay implementation.

The non-residential programs made the following changes as part of their COVID response:

- Created a grant program for small businesses
- Created a hotel guest room bonus program. This initiative was designed to drive participation in the hospitality sector when occupancy rates were low, and they were able to make improvements without disturbing guests.
- Doubled the restaurant commercial equipment incentive.
- Created a "do more, get more" incentive tier. If customers had more than one project, they got larger incentives.
- Conducted all technical trainings virtually.

The increased incentives were largely successful and increased program participation. The "do, more get more" incentive was less successful. Program managers were excited about this change, but it did not work very well in practice. Determining the incentive amount was too complicated, and customers preferred a set prescriptive rebate over one that changed depending on what it was bundled with.

The switch to virtual trainings was very successful early in the pandemic, but they did experience some "Zoom fatigue" as the pandemic continued.

These changes aimed to meet customer needs during the pandemic, and program managers felt they achieved their goal in sectors of focus (e.g., small businesses, hotels, restaurants). The greatest challenge due to COVID was an inability to meet with customers in person – particularly with small businesses. Post-project visits were discontinued, and trying to accomplish the same goals via email and phone calls that were accomplished in the post-project business was much less effective. Achieving post-project follow-up goals was particularly challenging in rural areas since many small businesses in remote areas don't even have email addresses which make the follow-up particularly difficult.

Affordability & Accessibility

The program managers felt that the increased incentives due to COVID were particularly successful for the A&A programs. Even with the increased incentives, however, direct install programs (particularly the single-family and multifamily direct-install initiatives) could not rebound sufficiently after six months of not being able to get into customers' homes.

In PY20, Hawai'i Energy implemented an A&A zip code classification as a way to improve the impact they were having on the state's most vulnerable populations. They used census data to rank zip codes by need and found that 25-30% of the population falls into high-need zip codes. They then focused community efforts in those areas and counted other program participation in those zip codes toward the A&A program goals.

Economic Development and Market Transformation

COVID Response

Due to COVID, all the trainings, workshops, and education activities were conducted virtually. This made it more difficult to verify attendees and avoid double counting. The program managers initiated several quality control steps to ensure attendees were being accurately counted. Overall, however, the virtual trainings went very well and have been well attended, particularly during the beginning of the pandemic. They have noted recently that there does seem to be an erosion of attendance due to Zoom fatigue.

Cuts to the program budget decreased the number of subcontractors in the program from four to two subcontractors. The program goals were also cut to align with the budget.

Also, as a result of the pandemic, healthy building messaging became very important. The program managers created a well-attended webinar outlining the strategy of coordinating healthy buildings improvements with energy efficiency measures. Specifically, the webinar stressed that combining energy efficiency with healthy building projects can provide cost savings that cannot be achieved by healthy building projects alone.

Success and Challenges

The main program challenges cited by the program managers are convincing their community partners that the information provided during the trainings and workshops is worthwhile to their constituents. They have also struggled with some specific types of training virtually; sales trainings for CEAs, for example, do not seem to work as well online.

Messaging focusing on how trainings and workshops will provide concrete ways attendees can reduce energy costs is very effective, even more so during the pandemic when the need to lower costs is greater for many customers. The program managers felt their email marketing campaigns and outreach conducted by their

partners was very effective in getting attendees to the events. They found these strategies to be much more effective than social media.

In the future, program managers are hoping to be able to track the program participation of workshop attendees to determine if the education received results in concrete action. This can be challenging, particularly for professional/business trainings, because organizations have high turnover, and it can be hard to keep track of business participants. Program managers are also hoping to conduct more training around workforce development.

Customer Satisfaction

Satisfaction scores remained on par for the residential sector and improved for the non-residential sector. Program managers attribute the improved satisfaction to their ability to be flexible and rally during COVID. They felt the increased efforts to help customers in this challenging time were well received.

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 B-1 shows how AEG calculated performance awards for each performance metric and key focus area.

Table B-1Rules for Calculating Performance Awards

Performance Metric/Key Focus Area	Verified Metric as % of Performance Target	Rule for Calculating Award
First-Year Energy Savings,	< 95.0%	No award.
Lifetime Energy Savings, Peak Demand Reductions, and Total Resource Benefits. (metrics and targets set for five program categories)	≥ 95.0% and ≤ 100.0%	A 1% increase in percentage performance corresponds to a 10% increase in achieved awards, starting with 50% of the target award (e.g., 95% of the performance target results in 50% of award achieved, 96% of the performance target results in 60% of award achieved, etc.).
	≥ 100.0% and ≤ 115.0%	The achieved awards equal the proportion of the target award corresponding to the percentage performance, e.g., a performance of 105% means receiving 105% of the target awards.
	≥ 115.0%	Awards are capped at 115% of the target awards.
Other CET, A&A, MTED, and	< 100.0%	No award.
Customer Satisfaction	≥ 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 B-2 Clean Energy Technology Verified Performance
- Table B-3 Clean Energy Technology Verified Awards
- Table B-4 Clean Energy Technology Verified Performance by Program Category
- Table B-5 Clean Energy Technology Verified Awards by Program

CET Performance Overall

Table B-2	Clean Energy	Technology	Verified	Performance
			~	

Key Focus Areas	Target	Claimed (% of T	arget)	Verified (% of Target)		
First-Year Energy Reduction	92,735	91,555	99%	90,768	98%	
Lifetime Energy Reduction	1,166,175	1,161,895	100%	1,068,097	92%	
Peak Demand Reduction	14.41	16.69	116%	16.41	114%	
Total Resource Benefits	149,667,430	165,977,342	111%	145,833,272	97%	
Grid Services Ready	700	2,108	301%	2,203	315%	
GHG Reductions (tons)	65,733	63,187	96%	61,053	93%	
GHG Reductions (barrels of oil)	151,874	147,004	97%	140,875	93%	

Table B-3Clean Energy Technology Verified Awards

Key Focus Areas	Target Award	Claimed Award (%	6 of Target)	Verified (% of Target)		
First-Year Energy Reduction	\$135,577	\$103,130	76%	\$88,086	65%	
Lifetime Energy Reduction	\$135,577	\$111,591	82%	\$72,649	54%	
Peak Demand Reduction	\$135,577	\$137,315	101%	\$120,504	89%	
Total Resource Benefits	\$180,769	\$169,633	94%	\$109,125	60%	
Grid Services Ready	\$37,500	\$37,500	100%	\$37,500	100%	
GHG Reductions (Tons)	\$0	\$0	N/A	\$0	N/A	
GHG Reductions (Barrels of Oil)	\$0	\$0	N/A	\$0	N/A	
Total Award	\$625,000	\$559,169	89%	\$427,864	68%	

CET Performance by Program Category

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

Key Focus Areas	Target	Claimed (% of T	arget)	Verified (% of Target)		
First-Year Energy Reduction (MWh/yr)	92,735	91,555	99%	90,768	98%	
Business Prescriptive	20,812	21,391	103%	21,455	103%	
Business HTR	11,239	8,363	74%	8,409	75%	
Business Custom	23,564	23,267	99%	19,980	85%	
Residential Incentives	34,851	34,217	98%	36,607	105%	
Residential HTR	2,269	4,317	190%	4,317	190%	
Lifetime Energy Reduction (MWh)	1,166,175	1,161,895	100%	1,068,097	92%	
Business Prescriptive	312,450	307,342	98%	309,572	99%	
Business HTR	166,059	111,400	67%	106,396	64%	
Business Custom	380,294	392,770	103%	341,396	90%	
Residential Incentives	284,126	293,465	103%	324,148	114%	
Residential HTR	23,246	56,918	245%	56,934	245%	
Peak Demand Reduction (MW)	14.41	16.69	116%	16.41	114%	
Business Prescriptive	3.52	4.28	122%	4.27	121%	
Business HTR	1.50	0.96	64%	0.95	64%	
Business Custom	3.09	3.32	107%	2.94	95%	
Residential Incentives	5.97	7.51	126%	7.63	128%	
Residential HTR	0.32	0.61	193%	0.61	193%	
Total Resource Benefits (\$)	\$149,667,430	\$165,977,342	111%	\$145,833,272	97%	
Business Prescriptive	\$39,608,396	\$44,562,756	113%	\$43,951,548	111%	
Business HTR	\$21,342,222	\$13,952,511	65%	\$13,319,917	62%	
Business Custom	\$47,660,386	\$48,992,552	103%	\$35,996,304	76%	
Residential Incentives	\$37,871,754	\$50,589,740	134%	\$44,509,964	118%	
Residential HTR	\$3,184,672	\$7,879,783	247%	\$8,055,539	253%	
Grid Services Ready (Projects)	700	2,108	301%	2,203	315%	
GHG Reductions (Tons)	65,733	63,187	96%	61,053	93%	
GHG Reductions (Barrels of Oil)	151,874	147,004	97%	140,875	93%	

Key Focus Areas	Target	Claimed (% of	Target)	Verified (% of Target)		
First-Year Energy Reduction	\$135,577	\$103,130	76%	\$88,085.81	65%	
Business Prescriptive	\$30,728	\$31,589	103%	\$31,680.69	103%	
Business HTR	\$16,594	\$0	0%	\$0.00	0%	
Business Custom	\$34,791	\$27,833	80%	\$0.00	0%	
Residential Incentives	\$50,784	\$40,628	80%	\$53,323.68	105%	
Residential HTR	\$2,680	\$3,081	115%	\$3,081.44	115%	
Lifetime Energy Reduction	\$135,577	\$111,591	82%	\$72,648.52	54%	
Business Prescriptive	\$36,698	\$29,359	80%	\$33,028.34	90%	
Business HTR	\$19,504	\$0	0%	\$0.00	0%	
Business Custom	\$44,667	\$46,141	103%	\$0.00	0%	
Residential Incentives	\$32,675	\$33,753	103%	\$37,281.68	114%	
Residential HTR	\$2,033	\$2,339	115%	\$2,338.50	115%	
Peak Demand Reduction	\$135,577	\$137,315	101%	\$120,504.35	89%	
Business Prescriptive	\$33,411	\$38,423	115%	\$38,422.50	115%	
Business HTR	\$14,237	\$0	0%	\$0.00	0%	
Business Custom	\$29,287	\$31,455	107%	\$14,643.65	50%	
Residential Incentives	\$56,119	\$64,537	115%	\$64,536.67	115%	
Residential HTR	\$2,523	\$2,902	115%	\$2,901.54	115%	
Total Resource Benefits	\$180,769	\$169,633	94%	\$109,125.48	60%	
Business Prescriptive	\$48,330	\$54,371	113%	\$53,646.01	111%	
Business HTR	\$26,042	\$0	0%	\$0.00	0%	
Business Custom	\$58,155	\$59,783	103%	\$0.00	0%	
Residential Incentives	\$45,284	\$52,076	115%	\$52,076.50	115%	
Residential HTR	\$2,959	\$3,403	115%	\$3,402.98	115%	
Grid Services Ready	\$37,500	\$37,500	100%	\$37,500	100%	
GHG Reductions (Tons)	\$0	\$0	N/A	\$0	N/A	
GHG Reductions (Barrels of Oil)	\$0	\$0	N/A	\$0	N/A	
Total	\$625,000	\$559,169	89%	\$427,864	68%	

Table B-5 Clean Energy Technology Verified Awards by Program Category

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 B-6 Accessibility & Affordability Verified Performance
- Table B-7 Accessibility & Affordability Verified Awards
- Table B-8 Market Transformation & Economic Development Verified Performance
- Table B-9 Market Transformation & Economic Development Verified Awards
- Table B-10 Customer Satisfaction Verified Performance
- Table B-11 Customer Satisfaction Verified Awards

Affordability & Accessibility

 Table B-6
 Accessibility & Affordability Verified Performance

	Key Focus Areas	Target	Claimed (% c	of Target)	Verified (% of	Target)
Economically Disadvantaged	Energy Advantage (customers served)	650	576	89%	576	89%
	Energy Advantage (customer bill savings)	\$1,750,000	\$1,928,209	110%	\$1,928,209	110%
	SBDI and MFDI (customers served)	1,365	663	49%	663	49%
	SBDI and MFDI (customer bill savings	\$3,773,374	\$1,256,082	33%	\$1,065,618	28%
	Community-Based Energy Efficiency (number of communities served)	3	3	100%	3	100%
	EmPOWER Hawaii Project (number of participating nonprofits)	7	8	114%	8	114%
Island Equity	County of Hawaii	13%	15%	115%	15%	115%
Incentive Spending	County of Maui	13%	14%	108%	14%	108%
-py	City and County of Honolulu	74%	71%	96%	71%	96%

Table B-7 Accessibility & Affordability Verified Awards

			Claime	d	Verified	ł
	Key Focus Areas	Target	(% of Tar	get)	(% of Targ	et)
Economically Disadvantaged	Energy Advantage (customers served)	\$15,000	\$0	0%	\$0	0%
	Energy Advantage (customer bill savings)	\$15,000	\$15,000	100%	\$15,000	100%
	SBDI and MFDI (customers served)	\$15,000	\$0	0%	\$0	0%
	SBDI and MFDI (customer bill savings	\$15,000	\$0	0%	\$0	0%
	Community-Based Energy Efficiency (number of communities served)	\$7,500	\$7,500	100%	\$7,500	100%
	EmPOWER Hawaii Project (number of participating nonprofits)	\$7,500	\$7,500	100%	\$7,500	100%
Island Equity	County of Hawaii					
Incentive Spending	County of Maui	\$75,000	\$75,000	100%	\$75,000	100%
	City and County of Honolulu					

Market Transformation & Economic Development

Table B-8 Market Transformation & Economic Development Verified Performance

Key	r Focus Areas	Target	Clain (% of 1	med Target)	Veri (% of 1	fied Target)
Behavior Change	STEM-Based Student Workshops	1,200	1,518	127%	1,519	127%
	Adult Learning	2,500	3,926	157%	3,949	158%
	Gamification Campaigns and Competitions	450	1,870	416%	1,870	416%
	Exhibit Educational Resources	0	0	N/A	0	N/A
	Sustained Outreach	1	1	100%	1	100%
	Behavioral Insights	0	0	N/A	0	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	6,500	6,882	106%	6,907	106%
Energy in Decision Making	Strategic Energy Management	4	9	225%	9	225%
	Appliance Standards Advocacy	1	7	700%	7	700%
	Improve Code Compliance	0	0	N/A	0	N/A
Codes and Standards	Code-Related Training	50	50	100%	50	100%
	Leading-edge technologies and strategies	2	2	100%	2	100%
Clean Energy Innovation Hub	Innovation and Emerging Technologies	2	0	0%	0	0%

Key Focus Areas		Target	Claim (% of Ta	ed arget)	Verifi (% of Ta	ied arget)
Behavior Change	STEM-Based Student Workshops	\$7,500	\$7,500	100%	\$7,500	100%
	Adult Learning	\$7,500	\$7,500	100%	\$7,500	100%
	Gamification Campaigns and Competitions	\$0	\$0	N/A	\$0	N/A
	Exhibit Educational Resources	\$0	\$0	N/A	\$0	N/A
	Sustained Outreach	\$0	\$0	N/A	\$0	N/A
	Behavioral Insights	\$0	\$0	N/A	\$0	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	\$30,000	\$30,000	100%	\$30,000	100%
Energy in Decision Making	Strategic Energy Management	\$7,500	\$7,500	100%	\$7,500	100%
Codes and Standards	Appliance Standards Advocacy Improve Code Compliance Code-Related Training Leading-edge technologies and strategies	\$7,500	\$7,500	100%	\$7,500	100%
Clean Energy Innovation Hub	Innovation and Emerging Technologies	\$0	\$0	N/A	\$0	N/A

Table B-9 Market Transformation & Economic Development Verified Awards

Customer Satisfaction

 Table B-10
 Customer Satisfaction Verified Performance

Key Focus Areas	Target	Claimed (%	% of Target)	Verified (% of Target)		
Application Processing Customer	Commercial	>9.0	9.6	107%	9.6	107%
Experience	Residential	>9.0	9.4	104%	9.4	104%

Table B-11 Customer Satisfaction Verified Awards

Key Focus Areas	Target	Claimed (%	6 of Target)	Verified (% of Target)		
Application Processing Customer	Commercial	\$7,500	\$7,500	100%	\$7,500	100%
Experience	Residential	\$7,500	\$7,500	100%	\$7,500	100%

HISTORICAL VERIFICATION RECOMMENDATIONS

Table C-1 documents the recommendations made by the AEG team beginning in PY17 that remain relevant. Additional recommendations may have been made over the past four 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.

Recommendation	PY17	PY18	PY19	PY20	Comments			
Continuing Recommendations								
Account for dual baselines when calculating Lifetime Energy savings and TRBs.			x	х	While there was some improvement over PY18, dual baselines still caused reductions in awards under BHTR, REEM, and BEEM.			
Collect Invoices (or an equivalent form of documentation) for all measures and projects prior to paying out incentives.		x	x	x	There were several recommendations focused on documentation in PY18 and PY19. PY20's recommendation focuses on documentation for custom projects since they were disproportionately affected.			
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	N/A	х	While the team did not review any regression-based projects in PY19, this recommendation has been ongoing with little improvement since PY18. Adjustments related to this recommendation resulted in significant loss of savings in CBEEM.			
Ensure all data is collected and tracked so that semi-prescriptive savings can be replicated.			x	x	Similar recommendations were made in PY19 and PY20 to collect and track semi- prescriptive inputs. Without these inputs, the team is unable to replicate savings.			
Ensure site inspections are sufficiently rigorous to verify measure type and quantity.		x	x	х	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.			
Collect and use custom inputs, when possible, especially for CBEEM and CREEM projects, to improve accuracy of savings estimates and mitigate against large differences between claimed and verified savings.		x	x	x	Basing reported savings on deemed values from the TRM when project documentation includes detailed information can lead to much lower or higher realization rates.			
Hawai'i Energy should continue updating its tracking database to include custom inputs for measures that are semi-prescribed in the TRM, enabling the verification contractor to include these measures in the savings replication.			x	х	Basing reported savings on deemed values from the TRM when project documentation includes detailed information can lead to much lower or higher realization rates.			
Correct rounding issues within the tracking database that lead to minor inconsistencies in savings.	x	x	x	NR	AEG chose not to continue this recommendation as the implications of rounding errors are truly minor.			

Table C-1 Historical Verification Recommendations

Recommendation	PY17	PY18	PY19	PY20	Comments				
New Recommendations									
Consider using typical meteorological year (TMY) weather data when using regression analysis to estimate lifetime savings for custom projects.				х	Additional new recommendations were				
Collect supplemental project documentation before paying out incentives for projects.				х	focused on enhancing the accuracy of energy and demand reduction estimates;				
Beginning in PY21, use the updated baseline to calculate savings for residential faucet aerators and showerheads.				х	however, they were not linked to issues that directly impacted the verified CET metrics in a meaningful way.				
Include project descriptions for custom projects.				х					
Consider collecting DLC screenshots consistently for all custom lighting projects.				х					

D

LOW-TO-MODERATE INCOME PERFORMANCE INCENTIVE MECHANISMS

This appendix describes how the AEG team 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 AEG used the following values in the calculation:

- [A] RHTR Total Budget: \$2,991,427.00
- [B] <u>Target</u> RHTR TRBs: \$3,184,672.00
- [C] Verified RHTR Total Program-Level First-Year kWh Savings: 4,317,161.35 kWh/yr
- [D] Verified RHTR Total Program-Level kW Savings: 614.49 kW
- [E] Target A&A Single-Family and Multifamily DI Customer Lifetime Bill Savings: \$3,77,374.00
- [F] Verified A&A Single-Family and Multifamily DI Estimated Useful Life: 7.24 years
- [G] Verified A&A Single-Family and Multifamily DI Customers Served: 663 customers

Table D-1 presents the calculation of the LMI PIM as it is described in Decision and Order 37787.

Table D-1LMI PIM Calculations1,2

Description	Line #	Source	Value
Energy Savings			
Target RHTR Energy Savings	L1	kWh Savings	2,268,903
RHTR Total Budget towards Energy Savings ³ (incentive and non-incentive costs)	L2	[A] x 0.85	\$2,542,712.95
Target RHTR TRBs towards Energy Savings ³	L3	[B] x 0.85	\$2,706,971.20
Net Utility System Benefit per kWh	L4	(L3 – L2)/L1	\$0.07
Net Benefit Share to the Companies	L5	L4 x 0.5	\$0.04
Total Energy Savings Reward	L6	([C]– L1) x L5	\$74,142.29
Peak Demand Reduction			
Target RHTR Demand Reduction	L7	kW Reduction	319
RHTR Total Budget towards Demand Reductions ³ (incentive and non-incentive costs)	L8	[A] x 0.15	\$448,714.05
Target RHTR TRBs towards Demand Reductions ³	L9	[B] x 0.15	\$477,700.80
Net Utility System Benefit per kW reduced	L10	(L9 – L8)/L7	\$90.87
Net Benefit Share to the Companies	L11	L10 x 0.5	\$45.43
Total Demand Reduction Reward	L12	([D]– L7) x L11	\$13,425.17
Participation			
Target Residential A&A Customers Served	L13	Customers Served	1,365
Target Residential First-Year Bill Savings	L14	[E]/[F]	\$521,118.88
First-Year Bill Savings per Target Customer Served	L15	L14/L13	\$381.77

Description	Line #	Source	Value
Net Benefit Share to the Companies	L16	L15 x 0.5	\$190.89
Total Participation Reward	L17	([G]– L13) x L16	\$0.00
Total PIM Reward ²	L18	L6 + L12 + L17	\$87,567.46

¹ When targets are not met, the resulting negative reward values are set to \$0.

² Total LMI PIM rewards are capped at a maximum of \$2 million/yr.

³ Decision and Order 37787 specifies that 85% of the RHTR total budget and target TRBs should be allocated to energy savings and the remaining 15% to peak demand reductions.

Ε

DETAILED METHODOLOGIES

AEG broke the verification activities into two distinct groups: CET program verification activities and non-CET verification activities. This organizational change clearly communicates how we verified the various metrics associated with each portion of the award.

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.

The table below 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 service ready, and greenhouse gas emissions as part of the CET verification activities.

	Deemed and S	emi-Prescriptive	Custom				
Verification Activity	REEM RESM RHTR	BEEM BESM BHTR	CREEM	CBEEM			
Program Manager Interviews	Five interviews to cover all programs						
Tracking System Audit	Audit covered all programs						
CET Verification Activities							
Savings Replication	•	•	•	•			
Simple Engineering Desk Review	•	٠	-	-			
Complex Engineering Desk Review	-	_	•	•			

Table E-1 Clean Energy Technologies Verified Performance

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 five 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. In particular, PY20 interviews focused on how the COVID-19 pandemic impacted various aspects of the programs from the perspective of program staff. The five staff members interviewed were:

- Caroline Carl, Deputy Director
- Clair Krebs, Residential Programs
- Ramsey Brown, Commercial Programs
- Chester Carson, Affordability & Accessibility
- Karen Shishido, Market Transformation, Trainings and Professional Development

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 PY20 portfolio of programs.

AEG reviewed the PY20 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 PY20 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 achieved in two phases. First, AEG used the draft tracking database¹⁸ provided by Hawai'i Energy to design the sample plan. Then, after receiving Hawai'i Energy's fully reconciled tracking database,¹⁹ we adjusted the sample plan as appropriate given the differences in the draft and reconciled 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.

¹⁸ Provided by Leidos on August 13, 2021: EMV_DataExtract_20210917_154360.xlsx

¹⁹ Provided by Leidos on September 17, 2021: EMV_DataExtract_20210917_132436.xlsx

- 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 net-to-gross ratio).

AEG focused the sample design on customer-level savings; line losses and net-to-gross 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 PY20 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 PY19, the Residential Energy Efficiency Measures, Business Energy Efficiency Measures, and Custom Business Energy Efficiency Measures (REEM, BEEM, and CBEEM) programs contribute most of PY20's claimed customer first-year and lifetime savings. In total, these three programs account for 87% of the customer first-year energy savings, as shown in the table below. Business and Residential Hard to Reach (BHTR and RHTR) each contributed another 8% and 4% of portfolio first-year energy savings, respectively, while the remaining programs each account for less than 2%.

	# Unique	Customer First-	Year Savings	Customer Lifetime Savings		
Program	Rebates	MWh/yr	(% of Total)	MWh	(% of Total)	
REEM	8,667	44,063	38.0%	400,515	27.2%	
CBEEM	197	29,721	25.6%	501,820	34.1%	
BEEM	579	27,013	23.3%	390,559	26.5%	
BHTR	940	8,800	7.6%	117,199	8.0%	
RHTR	2,914	4,095	3.5%	54,018	3.7%	
RESM	7,129	1,965	1.7%	6,322	0.4%	
BESM	293	193	0.2%	873	0.1%	
CREEM	5	172	0.1%	1,015	0.1%	
Total	20,724	116,021	100%	1,472,319	100%	

Table F-2	Population C	laimed C	ustomer l	First-Year	and Li	fetime	Savinas
	i opulution c	l'unneu e	asconneri	inst icui	unu Li	Jetime	Juvings

Sample Design

To maximize the efficiency of the 121 budgeted number of desk reviews (91 simple and 30 complex), AEG designed the desk review sample to focus on the four programs that contributed ~95% of portfolio savings (REEM, CBEEM, BEEM, and BHTR), intending to verify savings with ±10% relative precision at the 90% confidence level for each of these programs. Consistent with PY19, we did not perform desk reviews for Upstream and Midstream REEM components and Energy Services & Maintenance programs because the PY18 did not find any issues from the desk reviews. Similarly, we did not perform desk reviews for the Peer Comparison program because savings are fully deemed and were verified during the savings replication. Also, because of the low overall contribution of savings in RHTR and CREEM, the desk reviews of rebates in these programs served as qualitative assessments of database accuracy.

AEG stratified the population of rebates by program, delivery stream, and major equipment/service type.

Program	Stratum	Type of Desk Review	Unique Rebates	Customer Firs-Year MWh	(% of Sample Frame)	Assumed Error Ratio	Sampled Desk Reviews
	Sampled Strata		9,607	77,216	66.6%		121
	Downstream- Other/Unknown	Simple	3,774	4,320	3.7%	0.25	13
REEM	Downstream-HVAC	Simple	2,657	6,556	5.7%	0.10	3
	Downstream- Appliances	Simple	1,449	725	0.6%	0.10	2
	HVAC/Other/Unknown	Complex	8	7,568	6.5%	0.10	3
CBEEM	Custom	Complex	124	12,321	10.6%	0.10	4
	Lighting	Complex	65	9,832	8.5%	0.65	21
BEEM	Midstream	Simple	225	8,878	7.7%	0.15	13
	Downstream-Controls	Simple	33	8,149	7.0%	0.25	19
	Downstream- Other/Unknown	Simple	238	8,594	7.4%	0.10	8
	Downstream-HVAC	Simple	83	1,393	1.2%	0.10	3
BHTR	All	Simple	940	8,800	7.6%	0.25	21
RHTR	Sampled	Simple	9	13	0.0%	0.25	9
CREEM	Sampled	Complex	2	69	0.1%	0.25	2
	Non-Sampled Strata		11,117	38,805	33.4%		0
	Upstream	None	724	26,625	22.9%	N/A	0
REEM	Midstream	None	53	332	0.3%	N/A	0
	Peer Comparison	None	10	5,505	4.7%	N/A	0
RHTR	Non-Sampled	None	2,905	4,083	3.5%	N/A	0
BESM	All	None	293	193	0.2%	N/A	0
RESM	All	None	7,129	1,965	1.7%	N/A	0
CREEM	Non-Sampled	None	3	103	0.1%	N/A	0
	Total		20,724	116,021	100%	-	121

Table E-3Sample Stratification

¹ These values are estimated based on the average per-opportunity savings and the allocated number of sampled projects (since they are based on specific projects included in the sample, these savings won't be finalized until we draw the sample).

Table E-4 shows how AEG allocated the sample points to each program and stratum using Neyman's Allocation. Widely used in industry, Neyman's Allocation²⁰ 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 was optimized for all three types of savings. The assumed error ratios provide a metric of variability around realization rates that we can expect. When possible, we calculated the error ratios based on the precision achieved from the PY19 verification.²¹ In cases where we could not calculate error ratios at a granular-enough level, we assumed 0.25, which is also consistent with the PY19 verification. AEG calculated the expected precision for each program and type of desk review, provided in

²⁰ Available Online: https://www.nrel.gov/docs/fy17osti/68567.pdf

²¹ AEG chose the largest error ratio of the customer first-year energy, demand, and lifetime energy savings error ratios such that the allocation was based on the highest-variance metric for each stratum.

the table below. We expect to verify program savings through desk reviews with at least ±10% precision at the 90% confidence level for each program.

	Type of Desk	# Unique	Customer First-Year Savings		Desk Review	Expected Precision (@
Program	Review	Rebates	MWh	% of Sample Sample Siz		90% Confidence)
Across Samı Program	oled Strata within	9,607	77,216	66.6%	121	±3.5%
REEM	Simple	7,880	11,601	10.0%	18	±7.3%
CBEEM	Complex	197	29,721	25.6%	28	±7.7%
BEEM	Simple	579	27,013	23.3%	43	±3.5%
BHTR	Simple	940	8,800	7.6%	21	±9.3%
RHTR	Simple	9	13 ¹	0.0% ¹	9	±0.0%
CREEM	Complex	2	69 ¹	0.1% ¹	2	±0.0%
Across Non- within Prog	Sampled Strata ram	11,117	38,805	33.4%	0	±0.0%
REEM	None	787	32,462	28.0%	0	±0.0%
RHTR	None	2,905	4,083 ¹	3.5% ¹	0	±0.0%
BESM	None	7,129	1,965	1.7%	0	±0.0%
CREEM	None	293	193	0.2%	0	±0.0%
Total		20,724	116,021	100%	121	±2.3%

Table E-4Expected Precision of Desk Reviews by Program

¹ These values are estimated based on the average per-opportunity savings and the allocated number of sampled projects (since they are based on the specific projects included in the sample, these savings won't be finalized until we draw the sample).

The table below compares the final sample design to the planned sample design in the PY20 Verification Workplan, which was largely based on the PY19 sample design. AEG made the following updates to the sample design:

- In PY19, the AEG Team (which included AEG's subcontractor, TetraTech) used Neyman's Allocation to distribute the sample points across programs. However, the allocation appeared to be based on program population savings, not just the savings included in the desk review sample frame. This likely drove more sample points to REEM than appropriate since REEM Upstream savings contributed a large portion of savings. For the PY20 Verification, AEG applied Neyman's Allocation using only savings from strata included in the desk review sample frame.
- The PY19 sample plan used fixed error ratios of 0.25 to allocate sample points across strata. For PY20, AEG used error ratios from the PY19 Verification results when possible.
- The overall PY20 sample design places more of a focus on verifying commercial projects, which tend to be less deemed and have higher variance than residential projects.
- In PY19, AEG sampled one BESM project for desk reviews. AEG excluded BESM projects from the sample frame in PY20 because of the low overall contribution of savings to the portfolio, instead opting to allocate these sample points to strata with a larger portion of savings.
- Since custom projects will not be adjusted during the tracking database audit, AEG included two of the four CREEM projects in the PY20 desk review sample in order to verify savings in this stratum.

		Customer Fi	st-Year Savings	Actual Comple	Sample Sizes from	
Program	Type of Desk Review	MWh	% of Sample Frame	Sizes	PY20 Verification Plan	
REEM	Simple	11,601	10.0%	18	45	
CBEEM	Complex	29,721	25.6%	28	30	
BEEM	Simple	27,013	23.3%	43	30	
BHTR	Simple	8,800	7.6%	21	5	
RHTR	Simple	13 ¹	0.0%1	9	10	
RESM	-	-	-	0	0	
BESM	-	-	-	0	1	
CREEM	Complex	69 ¹	0.1%1	2	0	
Total		75,094	100.0%	121	121	

Table E-5 Comparison of PY19 Sample Design to PY20 Sample Size

¹ These values are estimated based on the average per-opportunity savings and the allocated number of sampled projects (since they are based on the specific projects included in the sample, these savings won't be finalized until we draw the sample).

CET Activities

Savings Replication

AEG used the excel-based tool developed during the PY19 verification to calculate savings for the population of deemed and semi-prescriptive residential and non-residential measures for which the tracking system records the necessary measure attributes. The focus of this task was to ensure that Hawai'i Energy applied the appropriate TRM-stipulated savings and algorithms for each measure. It was able to catch systematic errors from incorrect inputs, rounding errors, or incorrect algorithm implementation. We updated the tool to ensure it includes all PY20 measures and complies with the Hawai'i TRM in effect at the time of the measure installations (TRM Program Year 2020 v2). When discrepancies arose between the automated savings and the claimed savings in the tracking system for specific projects, AEG collaborated with Hawai'i Energy, the EEM, and the Commission, as appropriate, to determine the source of the discrepancy and suggest a resolution before finalizing the verification.

Savings for custom projects cannot be directly verified through the TRM. Instead, AEG replicated the savings of custom projects included in the desk review sample using calculations provided by Hawai'i Energy and confirmed that they conform to industry best practices.

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.

Non-CET Activities

Customer Satisfaction

The AEG team received the output results from their customer experience management tool, Medallia, for the residential sector programs. For the residential sector programs, when a customer receives a rebate from Hawai'i Energy, Medallia sends this customer an automated email survey soliciting feedback on their experience with a variety of program interaction elements. For residential participants, these included satisfaction with the rebate experience, likelihood to recommend, and field service experience. For the business sector, Hawai'i Energy created a manual survey based on the Medallia survey. According to Hawai'i Energy, they "send out monthly surveys to new program participants, timed approximately with receiving their rebate check to maximize recognition and awareness. Hawai'i Energy's survey procedures minimized outreach duplication and maximized the number of recipients." Business sector participants were asked about their satisfaction with the rebate experience, likelihood to recommend, and communications.

SAMPLE DESIGN AND EXTRAPOLATION

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



- 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{rr}_{hm}) as the sum of the sample-verified savings $(\hat{y}_{hm.})$ divided by the sum of the sample TRM-adjusted savings $(\hat{x}^*_{hm.})$.
 - a. 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.
 - b. Sample realization rates are <u>incremental</u> 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.

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