



# → Hawai‘i Energy PY23 Verification Report

**Prepared for:** Hawaii Public Utilities Commission

**By:** ICF, Intl.

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# EXECUTIVE SUMMARY

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The Hawaii Public Utilities Commission (the Commission) contracted ICF, Intl. (ICF)<sup>1</sup> to verify the savings and performance of Hawai'i Energy's Public Benefits Fee Administrator (PBFA) programs in the Program Year 2023 (PY23, July 1, 2023, to June 30, 2024), and this report presents the verified savings and performance results. The verification's chief purpose was to provide an independent review of Hawai'i Energy's performance relative to the contractually agreed-upon performance targets. The targets encompass a range of performance indicators, including energy and demand savings for **Clean Energy Technologies (CET), Accessibility & Affordability (A&A), Market Transformation & Economic Development (MTED), and Customer Satisfaction.**

Successfully meeting the performance targets related to these indicators can lead to a financial award of up to \$750,000 for Hawai'i Energy's implementer, Leidos.

ICF, the independent evaluation, measurement and verification (EM&V) contractor for the Hawai'i Energy programs, completed the verification using methods and activities consistent with past years, including savings replication, documentation and desk reviews, site visits, and program manager interviews. We collaborated with Hawai'i Energy to collect the data necessary for the verification and with the Energy Efficiency Manager (EEM) and the Commission to agree on the appropriate methods and activities. Appendices D and E present detailed descriptions of the techniques employed and the sample design and expansion.

## Summary of Findings

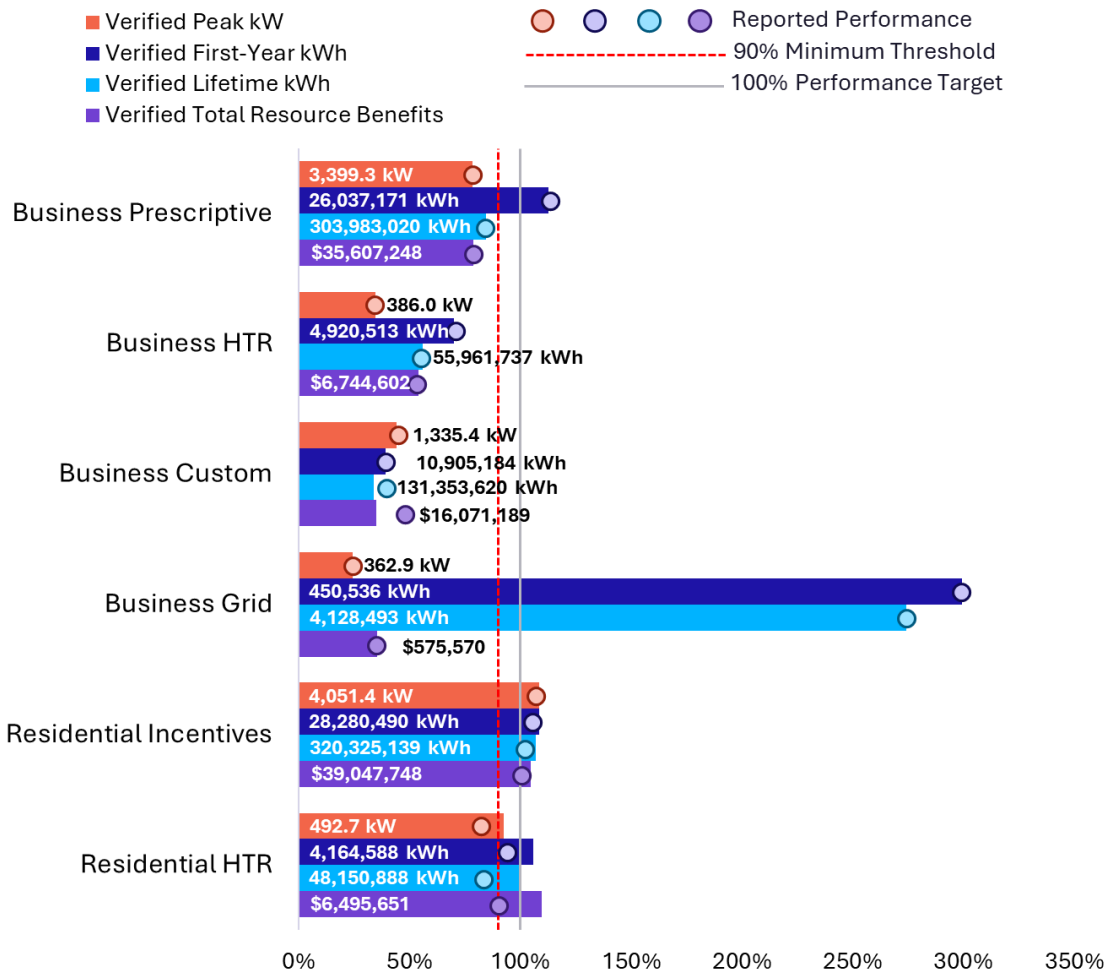
### Program Year Summary

ICF verified 74,758,482 kWh of program-level first-year energy savings, as shown in Figure ES-1. This performance amounted to 85% of Hawai'i Energy's target and represented an increase of 18,210,284 kWh (32%) compared to PY22. Hawai'i Energy achieved 54% of its awards, an increase of 14 percentage points over PY22 fueled by improved performance in CET key focus areas and Hawai'i Energy exceeding its Island Equity spending targets for Maui and Hawaii counties.

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<sup>1</sup> Formerly Applied Energy Group (AEG).

Figure ES-1 PY23 Performance Against CET Targets



Hawai'i Energy began participating in the ENERGY STAR® Retail Products Platform (ESRPP), amounting to 2% of claimed customer-level first-year savings. Hawai'i Energy staff continued to host focus groups with contractors and strengthen relationships with business customers. They worked with Hawaiian Electric Company (HECO) to assign client managers to mid-sized commercial customers and overhauled the contractor portal to improve project tracking. Hawai'i Energy also hired a specialist to educate store employees about Hawai'i Energy's programs and better understand market trends and brought in experts from outside Hawai'i to train its staff on heat pump water heater maintenance.

Hawai'i Energy fell short of many of its CET performance targets. Per Hawai'i Energy staff, businesses remained reluctant to invest in capital improvement projects such as energy efficiency upgrades, instead focusing on day-to-day operations. Meanwhile, limited contractor availability hindered the amount of work that could be completed, especially on neighbor islands.

In August 2023, a series of wildfires devastated Hawaii, destroying most of Lahaina (Maui), killing more than 100 people, and displacing thousands. The State will grapple with physical, cultural, and economic destruction for decades to come. From a Hawai'i Energy program perspective, the rebuilding effort has drawn island resources away from potential energy efficiency projects. As a result, the island equity program spending target was adjusted to 8% of the budget through PY24.

## Verified Savings and Awards

As shown in Table ES-1, Hawai'i Energy achieved \$402,676 (54%) of the potential awards. Hawai'i Energy fell short of all CET targets except for the Grid Services Ready performance indicator. Hawai'i Energy achieved non-CET performance awards for Residential A&A metrics and the Community-Based Energy Efficiency (CBEE) key focus area but fell short of targets for Business A&A metrics.

Table ES-1 Hawai'i Energy's Verified Awards Against PBFA Targets

	Performance Indicator	Fraction of Award	Target Award	Verified Award	Percent Verified
CET Awards	<b>Clean Energy Technologies</b>	<b>70%</b>	<b>\$525,000.00</b>	<b>\$207,675.82</b>	<b>40%</b>
	First-Year Energy Reduction	15%	\$112,500.00	\$70,203.69	62%
	Lifetime Energy Reduction	15%	\$112,500.00	\$32,615.14	29%
	Peak Demand Reduction	20%	\$150,000.00	\$35,455.63	24%
	Total Resource Benefits	15%	\$112,500.00	\$31,901.35	28%
	Grid Services Ready	5%	\$37,500.00	\$37,500.00	100%
Non-CET Awards	<b>Accessibility &amp; Affordability</b>	<b>20%</b>	<b>\$150,000.00</b>	<b>\$120,000.00</b>	<b>80%</b>
	Economically Disadvantaged	10%	\$75,000.00	\$45,000.00	60%
	Island Equity	10%	\$75,000.00	\$75,000.00	100%
	<b>Market Transformation &amp; Economic Development</b>	<b>8%</b>	<b>\$60,000.00</b>	<b>\$60,000.00</b>	<b>100%</b>
	Customer Satisfaction	2%	\$15,000.00	\$15,000.00	100%
<b>Total</b>		<b>100%</b>	<b>\$750,000.00</b>	<b>\$402,675.82</b>	<b>54%</b>

## Key Takeaways

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

### CET Performance

- **Hawai'i Energy achieved 40% of CET awards in PY23, an increase of 11 percentage points over PY22.** The increase in verified CET awards can be attributed to the completion of a series of large military community submetering projects, as well as ICF adjustments to Residential Hard-to-Reach (RHTR) projects during the simple desk review verification step.
- **Hawai'i Energy met its Grid Services Ready target in PY23.** Permitting and supply chain issues caused many load flexibility and demand management projects initiated in PY22 to be completed in PY23.
- **Hawai'i Energy applied PY23 Technical Reference Manual (TRM) algorithms for prescriptive and semi-prescriptive nearly perfectly.** ICF made minimal TRM adjustments to the claimed savings, resulting in TRM adjustment factors close to 1.0 for all programs.

### Non-CET Performance

- **Hawai'i Energy achieved its Island Equity award, a target it didn't meet in PY22.** After the Maui wildfires of August 2023, the Commission and Hawai'i Energy agreed to adjust Island Equity spending targets for the County of Maui from 13% to 8%. Hawai'i Energy spent 10% in

the County of Maui and 13% in the County of Hawaii (against a target of 13%). See *Non-CET Verification Findings* for more details.

- **Hawai'i Energy met Residential A&A and CBEE performance targets despite not claiming an award for residential customer lifetime bill savings.** By using verified first-year energy savings in conjunction with actual monthly effective retail rates published by HECO, ICF verified 101% of Hawai'i Energy's Residential A&A lifetime customer bill savings target. Hawai'i Energy did not achieve either of the two Business A&A awards.
- **Consistent with PY22, Hawai'i Energy met or exceeded targets for all MTED key focus areas except for Outcome Metrics.** Significant achievements included advocating for maintaining the timelines for building energy code adoption. In the commercial kitchen equipment market, Hawai'i Energy's progress continues to be hindered by small businesses' reluctance to invest in capital projects and is sensitive to the size and scope of available opportunities.
- **ICF verified customer satisfaction scores of 9.4 and 9.6 (out of 10) for business and residential participant satisfaction, respectively.** Each metric exceeded the 9.0 target by at least 4%.

## Recommendations

Based on its evaluation, ICF recommends the following opportunities to improve the verified CET metrics: energy and demand reductions, and Total Resource Benefits (TRBs). However, these recommendations, individually or cumulatively, do not materially impact the Hawai'i Energy program savings claims or performance awards.

1. **Provide the measured average loading of the distribution transformer or a reference for typical distribution transformer loading values to justify early retirement of transformers.** The Hawai'i Energy TRM allows for an effective useful life (EUL) of 50 years if the transformer has an average loading of less than 35%. In most transformer projects ICF reviewed, the average transformer loading was not measured.
2. **Correctly capture the space conditioning characteristics of the space where a distribution transformer is operating.** ICF identified several projects where the transformers operated in non-conditioned spaces; however, Hawai'i Energy calculated energy savings as if the spaces were conditioned, which resulted in overestimating the energy savings.
3. **Confirm that a linear regression model is statistically significant before using it to calculate savings.** For one billing analysis, the estimated coefficients used to calculate post-installation weather-adjusted energy use were not statistically significant and should not have been used to claim savings.
4. **At the next TRM update, specify when to use actual or default values for semi-prescriptive calculations.** For residential solar water heaters, the PY23 TRM provides a semi-prescriptive savings calculator, but its guidance is not clear for certain variables about when to use actual project inputs (if at all) instead of default values.
5. **Update all claimed savings to correspond with the current TRM.** Clothes washers were assigned PY22 savings, smart thermostats were assigned PY21 savings which slightly increased energy savings and decreased demand reductions. Some residential LEDs applied an outdated dual-baseline approach.

Figure ES-2 shows the final performance awards claimed by Hawai'i Energy and verified by ICF for each key focus area and performance indicators. For CET awards, Hawai'i Energy must exceed all performance indicator targets for all programs. It is possible for Hawai'i Energy to exceed a performance target at the portfolio level but fail to earn full awards because it did not exceed that same target for all programs at the program level. See [Appendix A](#) for details on performance targets and awards.

Figure ES-2 Performance and Award Results (Claimed and Verified)

Performance Indicator	Performance Target	Metric	Fraction of Award	Target Award	Claimed Results			Verified Results		
					Performance	Percentage of Performance Target	Award	Performance	Percentage of Performance Target	Award
<b>Clean Energy Technologies - Key Focus Areas<sup>1</sup></b>					<b>70%</b>	<b>\$525,000</b>	<b>37.6%</b>	<b>\$197,401</b>	<b>39.6%</b>	<b>\$207,676</b>
First Year Energy Reduction	87,993,581	kWh	15%	\$112,500	73,913,921	84.0%	\$68,769	74,758,482	85.0%	\$70,204
Lifetime Energy Reduction	1,195,399,370	kWh	15%	\$112,500	863,551,805	72.2%	\$28,459	863,902,897	72.3%	\$32,615
Peak Demand Reduction	14,210	kW	20%	\$150,000	9,949	70.0%	\$32,714	10,028	70.6%	\$35,456
Total Resource Benefit	\$148,429,952	\$	15%	\$112,500	\$107,905,280	72.7%	\$29,959	\$104,542,009	70.4%	\$31,901
Grid Services Ready	1,400	projects / demand management products installed or customers served	5%	\$37,500	1,725	123.2%	\$37,500	1,721	122.9%	\$37,500
Demand Flexibility (new)	1,500	potential or additional load flexibility from grid service ready technologies (kW)	0%	\$0	1,611	107.4%	\$0	1,611	107.4%	\$0
Greenhouse Gas Emissions / Barrel of Oil	62,372 / 143,920	tons / barrels	0%	\$0	50,361 / 116,259	80.7% / 80.8%	\$0	50,953 / 118,495	81.7% / 82.3%	\$0
<b>Accessibility &amp; Affordability - Key Focus Areas</b>					<b>20%</b>	<b>\$150,000</b>	<b>70%</b>	<b>\$105,000</b>	<b>80%</b>	<b>\$120,000</b>
Economically Disadvantaged										
Business A&A (Energy Advantage, Energy Relief Grant)										
Customers Served	550	Customers served	2%	\$15,000	403	73%	\$0	299	54%	\$0
Bill Savings	\$1,755,940	Customer bill savings (annual)	2%	\$15,000	\$814,771	46%	\$0	\$995,220	57%	\$0
Residential A&A (Single & Multifamily Direct Install, Water Heating Direct Install, Bulk Appliances)										
Customers Served	1,800	Customers served	2%	\$15,000	1,820	101%	\$15,000	1,820	101%	\$15,000
Bill Savings	\$2,631,891	Customer bill savings (lifetime)	2%	\$15,000	\$2,490,255	95%	\$0	\$2,658,181	101%	\$15,000
Community Based Energy Efficiency (new)	4	Communities served	2%	\$15,000	4	100%	\$15,000	4	100%	\$15,000
Island Equity										
County of Hawaii	13%	Target spend must be met in Hawaii & Maui	10%	\$75,000	13%	100%	\$75,000	13%	100%	\$75,000
County of Maui	8%	Counties for Milestone & Target Award	10%	\$75,000	10%	125%	\$75,000	10%	125%	\$75,000
<b>Economic Development &amp; Market Transformation - Key Focus Areas</b>					<b>8%</b>	<b>\$60,000</b>	<b>100%</b>	<b>\$60,000</b>	<b>100%</b>	<b>\$60,000</b>
Behavior Change										
Workshop and Presentations										
STEM based student workshop	1,200	Number of participant-hours of Training	1%	\$7,500	1,658	138%	\$7,500	1,821	152%	\$7,500
Adult learning	2,500	Number of participant-hours of Training	1%	\$7,500	2,620	105%	\$7,500	2,855	114%	\$7,500
Gamification Campaigns and Competitions	700	Number of participants	0%	\$0	758	108%	\$0	758	108%	\$0
Professional Development & Technical Training										
Clean Energy Ally Support										
Targeted Ally Training Opportunities										
Targeted Participant Training Opportunities	7,000	Number of participant-hours of Training	5%	\$37,500	8,193	117%	\$37,500	7,912	113%	\$37,500
Educator Training and Grants										
Degree Program Support										
Vocational Training										
Codes and Standards										
Appliance Standards Advocacy	7	Advocacy Events			59			59		
Improve Code Compliance	1	Establishing compliance roadmap and tracking savings	1%	\$7,500	1	133%	\$7,500	1	262%	\$7,500
Code-Related Training	150	Number of participant-hours of Training			150			354		
Clean Energy Innovation Hub										
Innovation and Emerging Technologies	1	Companies supported	0%	\$0	2	200%	\$0	2	200%	\$0
Outcome Metrics (new)	5% increase	Increase in High Efficiency Equipment Adoption	0%	\$0	Not Met	0%	\$0	Not Met	0%	\$0
<b>Customer Satisfaction - Key Focus Areas</b>					<b>2%</b>	<b>\$15,000</b>	<b>100%</b>	<b>\$15,000</b>	<b>100%</b>	<b>\$15,000</b>
Application Processing Customer Experience - Commercial	>9	Overall customer satisfaction score	1%	\$7,500	9.7	108%	\$7,500	9.4	104%	\$7,500
Application Processing Customer Experience - Residential	>9	Overall customer satisfaction score	1%	\$7,500	9.5	106%	\$7,500	9.6	107%	\$7,500
<b>Total Performance Award</b>					<b>100%</b>	<b>\$750,000</b>	<b>50%</b>	<b>\$377,401</b>	<b>54%</b>	<b>\$402,676</b>

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# 1 | Introduction

The Hawaii Public Utilities Commission (the Commission) contracted ICF, Intl. (ICF)<sup>2</sup> to verify the savings and performance of Hawai'i Energy's Public Benefits Fee Administrator (PBFA) programs in the Program Year 2023 (PY23, July 1, 2023, to June 30, 2024). This report summarizes ICF's verification results, which build upon verification efforts and protocols established during the PY17 through PY22 verifications. This is ICF's seventh verification of Hawai'i Energy's programs.

## Metrics and Verification Objectives

PY23 marked Hawai'i Energy's second year in the Triennial Plan for Program Years 2022 to 2024 (PY22–PY24) and its 14th year implementing energy efficiency programs as the PBFA. ICF verified whether or not Hawai'i Energy met targets for performance indicators and key focus areas (see Table 1-1), which determine the performance awards Hawai'i Energy is eligible to receive for PY23. Each Clean Energy Technologies (CET) performance indicator has a unique performance threshold and award amount within each program category.

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

Key Focus Area/Performance Indicator		Metric
<b>Clean Energy Technologies (70% of Award)</b>		
First-Year Energy Reduction		kWh
Lifetime Energy Reduction		kWh
Peak Demand Reduction		kW
Total Resource Benefit		\$
Grid Services Ready		Demand management projects/products (#)
Demand Flexibility		Potential/additional load flexibility (kW) from Grid Services Ready technologies
Greenhouse Gas Reductions/Barrels of Oil		Tons/barrels (#)
<b>Accessibility &amp; Affordability (20% of Award)</b>		
Economically Disadvantaged	Business	Customers served (#)
		First-year customer bill savings (\$)
	Residential	Customers served (#)
		Lifetime customer bill savings (\$)
Community-based Energy Efficiency		Communities served (#)
Island Equity		Target (%) must be met in Hawai'i & Maui Counties
<b>Economic Development &amp; Market Transformation (8% of Award)</b>		
Behavior Change	Adult learning	Participant-hours of training (#)
	STEM-based student workshops	Participant-hours of training (#)
	Gamification campaigns & competitions	Participants (#)
Professional Development & Technical Training		Participant-hours of training (#)
Codes & Standards	Appliance standards advocacy	Advocacy events (#)
	Code-related training	Participant-hours of training (#)
	Improving code compliance	Establish a compliance roadmap and track savings

<sup>2</sup> Formerly Applied Energy Group (AEG).

Key Focus Area/Performance Indicator		Metric
Clean Energy Innovation Hub		Companies supported (#)
Outcome Metrics		Increase (%) in high-efficiency equipment adoption
<b>Customer Satisfaction (2% of Award)</b>		
Application Processing Customer Experience	Commercial	Overall customer satisfaction score
	Residential	Overall customer satisfaction score

In conjunction with Hawai'i Energy and the Commission, ICF identified the following critical objectives for the PY23 verification:

- Determine Hawai'i Energy's achievements against targets by independently verifying the performance indicator metrics above (see results throughout Chapters 2 and 3).
- Calculate verified realization rates of 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, and successes and challenges based on program manager interviews (see *Program Year 2023 Summary*).
- Provide recommendations for program improvements based on findings from the verification activities (see *CET Highlights and Recommendations* and *Non-CET Highlights and Recommendations*).
- Identify cases where future verification efforts should consider updates to the Technical Reference Manual (TRM) or alternative verification approaches (see

- *CET Highlights and Recommendations*).
- Determine whether Hawai'i Energy implemented the recommendations from the PY22 verification as relevant to PY23 (see [Appendix B](#)).
- Determine the extent to which Hawai'i Energy served low-to-moderate income (LMI) customers and the savings associated with the LMI population using definitions included in the Hawaii Commission Decision & Order 37787<sup>3</sup> (see *Low-to-Moderate Income (LMI) Performance Incentive Mechanisms (PIM)*).
- Determine the level to which Hawai'i Energy's project documentation and savings estimation methodologies aligned with the Custom Project Guidance Document (CPGD)<sup>4</sup> (see [Appendix E](#)).

ICF did not design PY23 verification activities to review the validity of the TRM's stipulated savings or adjustment factors; instead, they were designed to assess whether Hawai'i Energy applied them appropriately when calculating claimed savings for the PY23 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.<sup>5,6</sup>

## Hawai'i Energy Programs

In the sections below, we present descriptions of the residential and commercial programs offered by Hawai'i Energy. Additionally, we summarize the successes and challenges of the program year, based on interviews conducted by ICF staff with program managers.<sup>7</sup>

### Residential Programs

In PY23, Hawai'i Energy implemented five residential sector programs, summarized below. These programs aim to reduce barriers, including up-front costs and access to measures that help customers save energy and lower utility bills. The residential programs have a network of Clean

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<sup>3</sup> This verification includes only the Hawai'i Energy portion of the Low-to-Moderate Income Performance Incentive Mechanism awards.

<sup>4</sup> The Hawai'i Energy Custom Project Guidance Document was first developed in 2022 (Version 1.0), and went into effect on July 1, 2022, at the start of PY22. The CPGD was subsequently updated in 2024 (Version 2.0). Version 2.0 went into effect on July 1, 2024, at the start of PY24.

<sup>5</sup> ICF compared Hawai'i Energy database information to the PY23 TRM v2.0 information.

<sup>6</sup> As the evaluation, measurement and verification (EM&V) Contractor, ICF reviews the TRM before it goes into effect each program year and once mid-program year based on suggested updates.

<sup>7</sup> As part of the PY23 verification effort, ICF interviewed four Hawai'i Energy program managers covering all programs in the residential and commercial sectors, as well as the Accessibility & Affordability (A&A) and Market Transformation & Economic Development (MTED) key focus areas. The interviews focused on changes to program design, successes and challenges, marketing, customer and contractor awareness, and plans for the future.

Energy Allies (CEAs) that help deliver the programs, and Hawai'i Energy works closely with CEAs to provide training and shared advertising opportunities.

- The **Residential Energy Efficiency Measures (REEM)** program provides equipment rebates and incentives through four initiatives:
  - An upstream initiative that provides rebates to retailers, which were passed to residential customers as lower-cost, energy-efficient equipment;
  - A traditional downstream initiative that delivers measures through retail and trade-ally channels;
  - An online marketplace that allows customers to directly purchase measures and measure bundles, including energy efficiency kits; and
  - The ENERGY STAR Retail Products Platform (ESRPP)<sup>8</sup> through which Hawai'i Energy provides rebates for select eligible measures.
- The **Residential Energy Services and Maintenance (RESM)** program incentivizes tune-ups by a participating contractor for existing air conditioners or solar water heaters.
- The **Residential Grid Services (RGRID)** program incentivizes the installation of smart electric panels and grid-interactive water heaters that contribute to grid flexibility.
- The **Residential Hard-to-Reach (RHTR)** program delivers measures to single- and multifamily households that can be hard to reach using traditional program outreach mechanisms. Major initiatives in the RHTR program include:
  - A single- and multifamily direct installation service package called Energy Smart 4 Homes (ES4H) that provides free LEDs, faucet aerators, showerheads, and advanced power strips to hard-to-reach communities and publicly funded housing, such as rural communities, underserved and vulnerable populations, and Section 8 housing;
  - An appliance trade-up and retrofit program that includes water heating, kitchen and laundry appliances, and other upgrades; and
  - A heat pump water heater heating initiative that assesses opportunities for centralized and in-unit heat pump water heaters within multifamily residences.
- The **Custom Residential Energy Efficiency Measures (CREEM)** program provides incentives for energy efficiency projects with measures not included in the TRM. These projects typically consist of new construction comprised of measures such as appliances; heating, ventilation,

**Residential Energy Efficiency Measures**  
Comprehensive prescriptive rebate program including upstream and downstream mechanisms.

**Residential Energy Services and Maintenance**  
Incentivizes tune-ups for air conditioners or solar water heaters.

**Residential Grid Services**  
Prescriptive rebates for smart panels, grid-interactive water heaters, and smart thermostats.

**Residential Hard-to-Reach**  
Prescriptive rebates targeting underserved customers through direct install and downstream mechanisms.

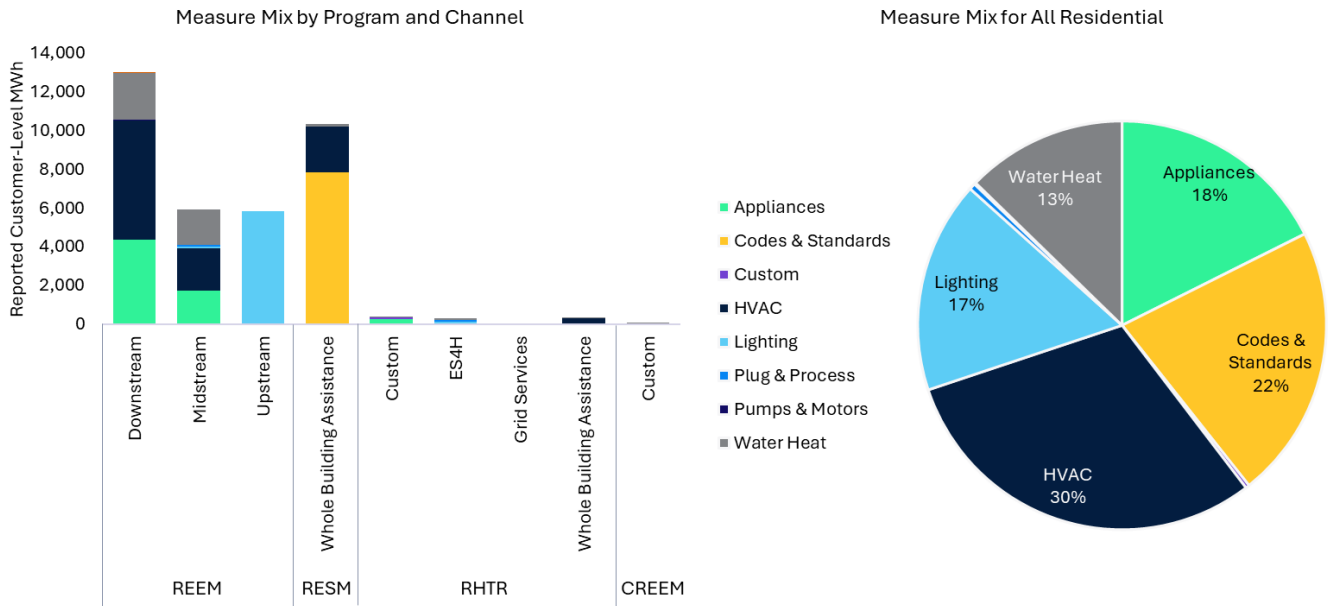
**Residential Custom Energy Efficiency Measures**  
Incentivizes rebates for non-prescriptive projects.

<sup>8</sup> <https://www.energystar.gov/partner-resources/energy-star-retail-products-platform>

and cooling (HVAC); and water heaters, for which Hawai'i Energy provides customized incentives based on a project's estimated energy savings and peak demand reductions.

Figure 1-1 illustrates the distribution of claimed customer-level first-year energy savings within and across residential delivery channels and programs. HVAC measures contributed the most savings (30%), while claimed savings from codes & standards comprised 22% of residential savings.<sup>9</sup> The share of claimed first-year customer-level residential savings contributed by LED lighting continued to fall, from 23% in PY22 to 17% in PY23.

Figure 1-1 PY23 Claimed Savings in Residential Programs Measure Mix



<sup>9</sup> Whole Building Assistance consists of energy savings from air conditioner tune-ups, water heater tune-ups, and code compliance and appliance standards (codes & standards).

## Business (Commercial) Programs

In PY23, Hawai'i Energy implemented five business sector programs, summarized to the right. These programs focused on aligning program offerings with customer needs and helping businesses access and fund their projects.

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

**Business Energy Efficiency Measures**  
Comprehensive prescriptive rebate program leveraging TRM-based savings.

**Business Energy Services and Maintenance**  
Incentivizes retrocommissioning, strategic energy management, submetering, and audits.

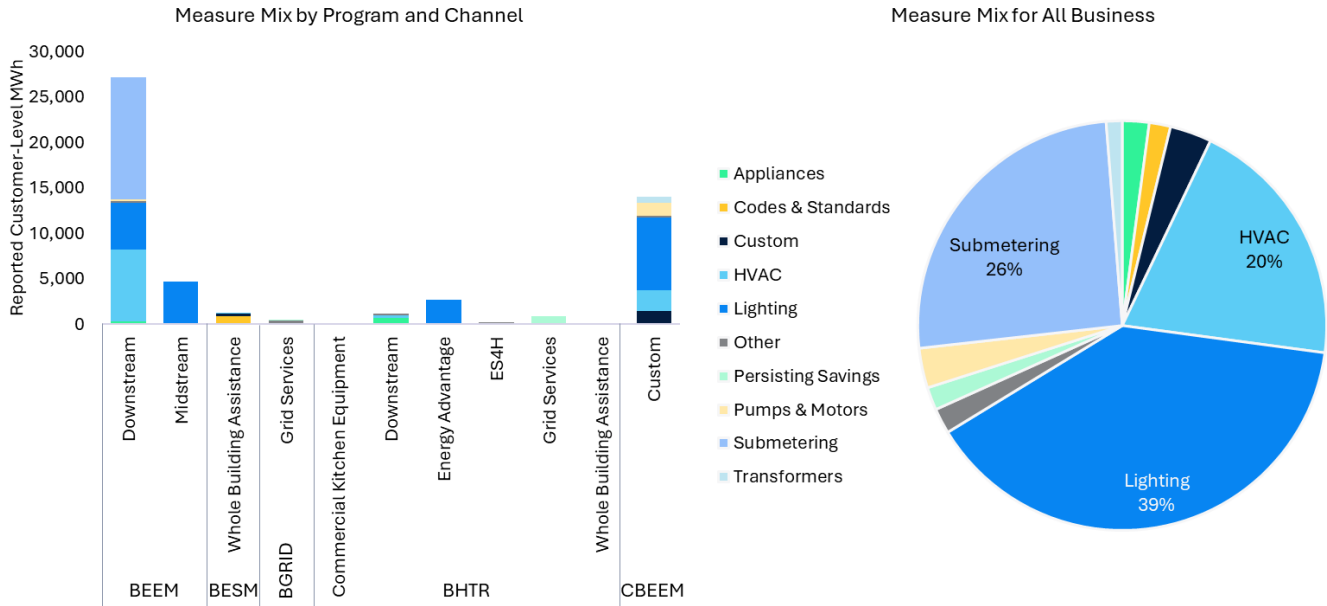
**Business Grid Services**  
Incentivizes measures that contribute to Demand Flexibility and other demand response measures.

**Business Hard-to-Reach**  
Prescriptive rebates targeting underserved customers through direct install.

**Business Custom Energy Efficiency Measures**  
Incentivizes rebates for non-prescriptive projects.

Figure 1-2 illustrates the distribution of claimed customer-level first-year energy savings within and across business delivery channels and programs. LED lighting contributed the most claimed savings (39%), driven primarily by custom lighting projects. Prescriptive submetering projects completed in military housing communities comprised a substantial portion of savings (26%), followed by HVAC projects (20%). "Other" measures contribute 2% of savings and include building envelope, plug & process, refrigeration, and water heating measures.

Figure 1-2 PY23 Claimed Savings in Business Programs Measure Mix



### Program Year 2023 Summary

Many of the same difficulties that affected Hawai'i Energy's performance in prior program years also affected its performance in PY23.

#### Uncertainty and Volatility Impact Performance

In the discussion below, we describe the challenges Hawai'i Energy faced in PY23 and identify steps they took to address them.

##### Economic Uncertainty

Businesses remained reluctant to invest in capital improvement projects, focusing on day-to-day operations and staying afloat rather than investing in energy efficiency to reduce operational costs in the medium- to long-term. In addition, employee churn, especially among "energy champions" (points of contact with whom Hawai'i Energy staff regularly connect) at large local companies, undercut Hawai'i Energy's ability to grow its custom project pipeline and, in some cases, dismantled years of institutional knowledge about a facility. Despite the financial stress many small businesses continue to face, Hawai'i Energy suffered a decline in Energy Advantage participation and awarded fewer EmPOWER grants. As one Hawai'i Energy program manager said, "People are just struggling to survive." Businesses are spread so thin that they lack the time and resources to pursue grants and funding. Outside of Hawai'i Energy, nonprofit organizations and other Accessibility & Affordability (A&A) partners have lost federal grant funding.

##### Contractor Unavailability

Hawai'i Energy noted a decline in contractor participation, specifically among projects for hard-to-reach customers. Lack of contractor availability and capacity hindered Hawai'i Energy's ability to complete enough projects to achieve its performance targets, especially on neighbor islands. As a result, Hawai'i Energy began considering ways to encourage Oahu-based contractors to complete work in Maui and Hawaii counties.

### *Commercial Kitchen Equipment Market*

The success of the Commercial Kitchen Equipment (CKE) delivery channel is sensitive not only to the number of “opportunities” (projects) but also to their size and scope. Most CKE projects in PY23 consisted of appliance purchases, such as reach-in refrigerators, freezers, or steam cookers—individual units with low savings. Meanwhile, large custom refrigeration projects that generate larger savings can take years to complete, so Hawai'i Energy's claimed savings are sensitive to timing. Most CKE projects in PY23 were individual purchases. Hawai'i Energy staff engaged more proactively with contractors to learn about pending opportunities so they can record them in the project pipeline. Hawai'i Energy also piloted a new online survey through targeted website advertisements that generated opportunity leads.

At the end of PY23, Hawai'i Energy developed a relationship with a distributor new to the Hawaii market. Hawai'i Energy also began leveraging EmPOWER grants and creating shared marketing with the Board of Water Supply (BWS) that advertised how customers and contractors can stack Hawai'i Energy and BWS incentives together for CKE projects.

### *Workforce Development*

University of Hawai'i (UH) at Mānoa Outreach College discontinued its partnership with Hawai'i Energy. The Outreach College had offered building operator certification (BOC) courses and other a la carte classes on topics such as retrocommissioning and SEM on Hawai'i Energy's behalf. When the partnership was discontinued, Hawai'i Energy was unable to find replacement instructors, so it terminated those offerings.

Maui Community College (MCC) hosted a BOC course on Maui in previous years, but the Hawai'i Energy-partnered instructor was too busy to hold classes in PY23. This marks the first time since at least 2016 (when the Market Transformation & Economic Development program manager joined Hawai'i Energy) that the course was not offered. Hawai'i Energy expects to resume BOC courses at MCC in PY24.

Hawai'i Energy entered its second year in its partnership with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Hawaii to offer intensive technical training sessions. While they are not certifications, they help fill the void left behind by UH Mānoa BOC courses by exploring fundamental and advanced technical topics in depth, appealing to a wide range of experience levels. Hawai'i Energy continues to seek ways to expand and diversify its offerings to avoid providing duplicative training topics in the workforce development space.

### *Maui Wildfires*

In August 2023, a series of wildfires devastated Hawaii, destroying Lahaina (Maui), killing more than 100 people, and displacing thousands. Maui had—and, two years later, still has—many urgent needs in the wake of this natural disaster. During PY23, the Commission and Hawai'i Energy agreed to amend Hawai'i Energy's contract to reduce the Island Equity spending target for the County of Maui from 13% to 8%.

## **Adaptability and Achievements**

### *Programs and Initiatives*

Despite PY23's challenges, Hawai'i Energy performed much better toward CET performance targets than in PY22. Hawai'i Energy surpassed its CET first-year energy savings performance target for the Business Prescriptive programs after not meeting it the prior program year. Hawai'i

Energy staff credited this success to the increased accessibility of and ease in applying for business prescriptive rebates. Hawai'i Energy also achieved its Island Equity and Grid Services Ready performance targets (both of which it missed last year) and met or exceeded all its Market Transformation & Economic Development (MTED) performance targets.

Anticipating a steep decrease in LED lighting savings, Hawai'i Energy began participating in the ESRPP. Through the ESRPP, Hawai'i Energy rebated more than 11,000 ENERGY STAR-qualified units, including air purifiers, clothes washers and dryers, freezers, smart thermostats, and induction cooking tops, amounting to 1,765 MWh (2%) of claimed customer-level first-year energy savings. To compensate for declining participation in residential solar water heating, Hawai'i Energy launched a heat pump water heater tune-up pilot, which has since become a complete program offering. Hawai'i Energy brought in experts from outside Hawaii to train its staff on heat pump water heater maintenance.

### *Relationships and Partnerships*

Hawai'i Energy began engaging more deeply with business customers to strengthen relationships and make customers more aware of Hawai'i Energy's technical services beyond simply being the rebate provider. Staff conducted more courtesy on-site visits and "energy treasure hunts"—facility tours during which Hawai'i Energy staff identify energy efficiency opportunities and potential operational and capital improvements—and Hawai'i Energy trained staff to be better able to provide these technical services as well as educate customers about custom projects and processes. These efforts emphasize long-term success and program health.

Additionally, Hawaiian Electric Company (HECO) began assigning dedicated client managers to mid-sized commercial customers, something previously reserved for large energy users. With this change, Hawai'i Energy and HECO began to develop a more formal process for building relationships by linking Hawai'i Energy's Energy Advisors (EAs) to HECO's client managers. That way, if HECO client managers hear from customers about energy efficiency needs, they have specific EAs they can contact directly, making it easier for the two entities to share information and generate leads.

Hawai'i Energy hired a retail marketing specialist. He conducted "lunch-and-learns" with employees of participating retailers to improve their knowledge about energy-efficient equipment and the rebates that Hawai'i Energy provides. He also used these meetings with residential retailers and distributors as opportunities to better understand market trends.

On the business side, Hawai'i Energy staff continue to host focus groups with contractors across all markets and fields to understand their needs, their pain points, commercial market trends, and how customer preferences are evolving.

### *Contractor Portal*

Hawai'i Energy overhauled its contractor portal to improve how CEAs, customers, and Hawai'i Energy staff track the progress of a project through its pipeline. Previously, the process was very linear: a CEA (or customer) contacted an EA; the EA solicited an engineer for energy savings and rebate estimates; the engineer returned those estimates to the EA; and the EA delivered those estimates to the CEA—unless the engineer had further questions about the project, which would require the EA to contact the CEA again, then go back to the engineer. The process would continue in this fashion until all issues were resolved, which prolonged project timelines and created unnecessary touchpoints with prospective participants.

Under the new case system, all relevant Hawai'i Energy staff can access any project to view its status/progress, respond to requests, and provide engineering expertise. The new case system reduced unnecessary communications, expedited rebate processing times, and helped unify Hawai'i Energy's advising and engineering teams in their efforts to complete projects. Hawai'i Energy's engineering team began creating guidance for the advising team so EAs can better understand what makes a project more suitable for prescriptive or custom rebates and how to educate CEAs/customers accordingly. Hawai'i Energy continues to explore ways to reduce friction for applicants, including providing a self-service portal that would enable customers to view the progress of their applications without needing to contact their EAs.

## 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 its targets, discusses any adjustments made through verification activities, and provides recommendations ranked in order of priority.

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

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

## 2 | Clean Energy Technology Verification Findings

This chapter details the results and findings for residential and business CET programs. We first provide an overview of Hawai'i Energy's performance against its CET targets. 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. Finally, we present CET highlights and recommendations based on our verification efforts.

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

- Correctly followed the PY23 TRM to report energy savings estimates for deemed and semi-prescriptive measures,
- Applied the appropriate energy savings calculations for custom measures,
- Accurately recorded measure characteristics in the tracking system based on documentation,
- Accurately calculated Total Resource Benefits (TRBs) and avoided greenhouse gas (GHG) emissions,
- Accurately claimed project counts associated with Grid Services Ready products,
- Accurately claimed load flexibility (kW) added from Grid Services Ready technologies, and
- Aligned with the CPGD.

### Overview of CET Performance

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

Table 2-1 Programs Mapped to Program Categories

Program Category	Program
Business Custom	CBEEM
Business Hard-to-Reach	BHTR
Business Prescriptive	BEEM, BESM
Business Grid Flexibility	BGRID
Residential Hard-to-Reach	RHTR
Residential Incentives	REEM, CREEM, RESM
Residential Grid Flexibility <sup>10</sup>	RGRID

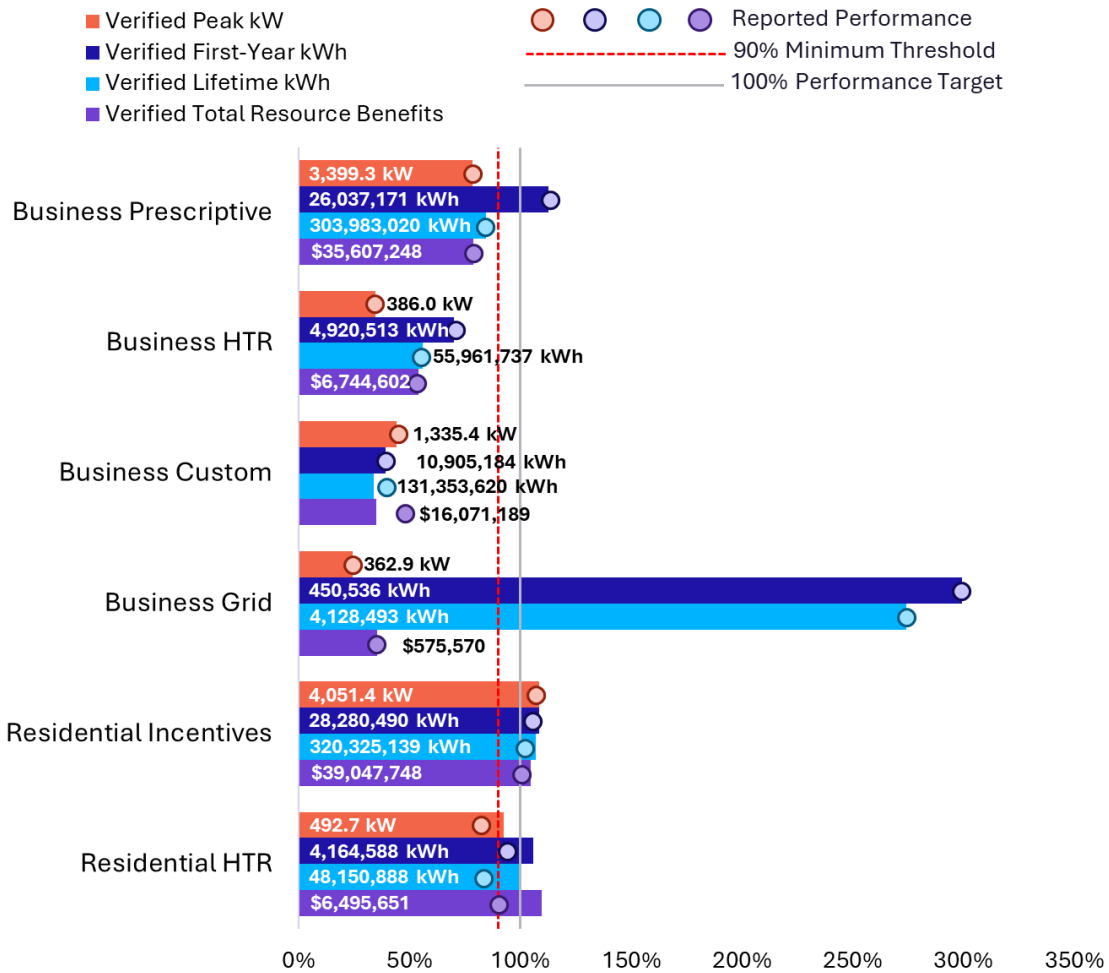
Hawai'i Energy's performance indicator targets include program-level **first-year (annual) and lifetime energy savings (kWh), peak demand reductions (kW), and TRBs** for each program category. To receive the full award, Hawai'i Energy must meet or exceed 100% of the target. For most programs, partial awards are earned by meeting 90% of the performance indicator target. The Grid Services Ready target is set at the portfolio level and is only eligible for the full award. Similarly, Demand Flexibility and Greenhouse Gas performance indicators do not have partial

<sup>10</sup> RGRID did not have energy savings targets or achievements in PY23. As such, it is omitted from most tables, charts, and figures.

targets, although they do not have any monetary awards tied to them. Performance indicators can cause realization rates to appear at odds with changes to the claimed awards.<sup>11</sup>

Figure 2-1 shows Hawai'i Energy program verified performance against CET performance indicator targets for first-year and lifetime energy savings (kWh), peak demand reductions (kW), and TRBs (\$).

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



Verification findings show:

- The **Business Prescriptive** program (BEEM and BESM) and the **Business Grid** program (BGRID) surpassed first-year energy savings targets. BGRID also surpassed its lifetime energy savings target. BGRID performance variance (299% of first-year energy savings target but 24% of peak demand reductions target) can be attributed to the distribution of installed measures. Hawai'i Energy rebated 191 grid-interactive heat pump water heaters, which generate meaningful first-year energy savings but minimal peak demand reductions. Meanwhile, Hawai'i

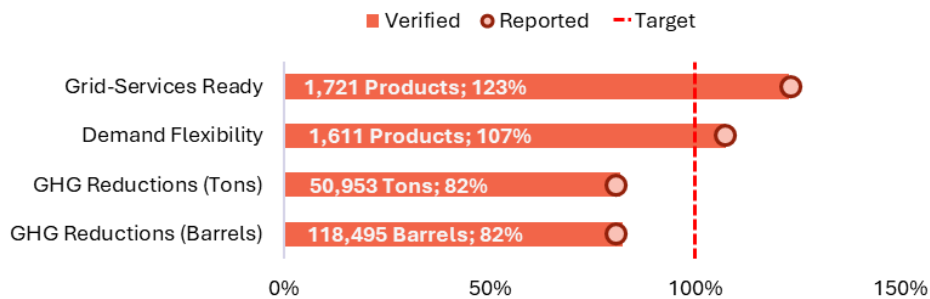
<sup>11</sup> For example, an annual energy savings realization rate of 105% could be driven by one program category, but if that program category still fell short of its annual energy savings performance target, the verified awards could fall below the claimed awards despite its realization rate exceeding 100%.

Energy completed only three energy storage (i.e., battery) projects, which contribute to peak demand reductions but no first-year energy savings.

- The **Business Hard-to-Reach** (BHTR) and **Business Custom** (CBEEM) programs fell short of the minimum award threshold for every performance metric.
- The **Residential Incentives** programs (REEM, RESM, and CREEM) and **Residential Hard-to-Reach** program (RHTR) achieved full awards in almost every category. Hawai'i Energy did not claim awards for peak demand reductions and lifetime energy savings for RHTR, but ICF verified higher realization rates (adjustment factors) based primarily on adjustments to ES4H and residential solar water heater savings. These adjustments resulted in the program surpassing the 90% target threshold and earning them partial awards for both performance metrics.

Figure 2-2 shows that Hawai'i Energy achieved its Grid Services Ready and Demand Flexibility targets but fell short of targets for reductions in GHG emissions and barrels of oil. Hawai'i Energy's performance with respect to GHG reductions is generally proportional to the claimed first-year energy savings.

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



*CET Performance Adjustments* (page 13) provide details on all performance adjustments, and [Appendix A](#) provides the final performance and achieved awards for each program category.

## Summary of CET Verification Methods

Table 2-2 shows how ICF verified each performance metric. As described, we made several adjustments to the performance claimed by Hawai'i Energy through the verification activities. [Appendix E](#) provides details on methods, including the detailed Sample Plan for desk reviews and on-site visits.

Table 2-2 Clean Energy Technology Summary of Verification Methods

Performance Metric	Description of Metric	Verification Activities and Adjustments
<b>Energy and Demand Savings*</b> First-Year Energy Savings Lifetime Energy Savings Peak Demand Reductions	<b>Customer-Level Savings</b> Gross savings for each customer before accounting for line losses or what the customer would have done absent from the program (i.e., no application of a net-to-gross ratio at this step)	<b>TRM Adjustment</b> through a savings replication for all deemed and semi-prescriptive measures in the tracking database  <b>Desk Review Adjustment</b> through engineering desk reviews on a sample of custom and non-custom projects  <b>On-Site Adjustment</b> through in-person site visits to spot-check key savings estimation parameters and confirm the installation and operation of rebated equipment
	<b>System-Level Savings</b> Savings reflected at the generator, incorporating line losses	<b>System-Loss Adjustment</b> through a review of the system loss factors (in PY23 TRM) applied to the customer-level savings
	<b>Program-Level Savings</b> Net savings that account for free-ridership and spillover (system-level savings multiplied by the net-to-gross ratio)	<b>Net-to-Gross (NTG) Adjustment</b> through a review of the NTG ratios (in PY23 TRM) applied to the system-level savings
	<b>Total Resource Benefits</b> The estimated total net present value (NPV) of the avoided cost for the utility from the reduced lifetime energy and demand from energy efficiency projects and measures	<b>TRB Adjustment</b> using customer-level verified savings and NTG ratios to calculate TRBs for each program and measure as stipulated in PY23 TRM
<b>Grid Services Ready Products</b>	The total number of projects completed, or products installed that qualify as Grid Services Ready (e.g., grid-connected water heaters)	<b>Product Adjustment</b> using the count of Grid Services Products included in the reconciled tracking database
<b>Demand Flexibility</b>	Total potential/additional load flexibility (kW) from Grid Services Ready technologies	<b>Demand Adjustment</b> using the sum of program-level flexible demand (kW) established through grid services projects
<b>Greenhouse Gas (GHG) Reductions</b>	The avoided emissions and equivalent avoided barrels of oil resulting from program-level annual energy savings.	<b>GHG Avoided Emissions Adjustments</b> using the program-level verified savings and metric tons-per-kWh and barrels of oil-to-metric tons conversion factors provided in the PY23 TRM

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

## CET Performance Adjustments

ICF determined PBFA programs' performance toward targets through multiple incremental adjustments to the savings claimed by Hawai'i Energy. This section provides key findings for:

- **Energy and Demand Savings Adjustments** to first-year energy savings, lifetime energy savings, and peak demand reductions at all three levels of savings (customer, system, and program)
- **TRB Adjustments**
- **Grid Services Ready Adjustments**
- **Demand Flexibility Adjustments**
- **GHG Reductions Adjustments**

### Energy and Demand Savings Adjustments

ICF 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 at the customer, system, and program levels by program category. We begin with the customer-level savings tracked in the database on the left and end with the verified program-level savings on the right by making the following adjustments:

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

Figure 2-3 First-Year Energy Savings Adjustments



Adjustments to customer-level savings based on TRM adjustments, desk reviews, and on-site visits resulted in increases to first-year energy savings and peak demand reductions of less than 1% and a decrease to lifetime energy savings of less than 1%. These adjustments flowed through system- and program-level savings following the application of line losses and NTG ratios, respectively, and yielded program-level portfolio realization rates of 101% (first-year energy savings), 100% (lifetime energy savings), and 101% (peak demand reductions) as shown in Table 2-8 (page 25).

### Customer-Level Savings Adjustments

ICF made three sets of adjustments to customer-level savings:

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

[Appendix E](#) describes how ICF weighted the sample desk review adjustments to the population of projects.

#### *TRM Adjustments*

Table 2-3 shows claimed savings, TRM-adjusted savings, and the TRM adjustment factors for first-year energy savings, lifetime energy savings, and peak demand reductions. ICF only calculated TRM-adjusted savings for projects with savings that were fully deemed or semi-prescribed in the PY23 TRM. Projects not included in this task, including those with custom claimed savings, were assigned a TRM adjustment factor of 1.00. ICF's TRM adjustments were infrequent and minimally impactful, resulting in almost all 1.00 TRM adjustment factors. We use **bold** text to denote adjustment factors that deviate from 1.00.

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

Program	Customer-Level First-Year Energy Savings (kWh/yr)			Customer-Level Lifetime Energy Savings (kWh)			Customer-Level Peak Demand Reductions (kW/yr)		
	Claimed	TRM-Adjusted	TRM Adj. Factor	Claimed	TRM-Adjusted	TRM Adj. Factor	Claimed	TRM-Adjusted	TRM Adj. Factor
BEEM	31,903,179	31,890,961	1.00	376,625,024	378,923,439	1.01	4,151	4,150	1.00
BESM	1,307,660	1,307,660	1.00	9,605,376	9,605,376	1.00	163	163	1.00
BGRID	433,408	433,408	1.00	3,971,540	3,971,537	1.00	349	349	1.00
BHTR	5,159,149	5,154,533	1.00	58,477,765	58,433,617	1.00	403	402	1.00
CBEEM	14,047,827	14,047,827	1.00	196,752,065	196,752,065	1.00	1,741	1,741	1.00
REEM	22,169,512	22,209,149	1.00	305,800,327	306,533,511	1.00	2,677	2,657	0.99
RESM	10,339,864	10,339,864	1.00	74,459,478	74,459,478	1.00	1,953	1,953	1.00
RGRID	0	0	N/A	0	0	N/A	0	0	N/A
RHTR	3,550,597	3,549,576	1.00	38,607,029	38,633,975	1.00	421	421	1.00
CREEM	72,237	72,237	1.00	1,162,625	1,162,625	1.00	9	9	1.00
<b>Total</b>	<b>88,983,433</b>	<b>89,005,215</b>	<b>1.00</b>	<b>1,065,461,229</b>	<b>1,068,475,624</b>	<b>1.00</b>	<b>11,866</b>	<b>11,846</b>	<b>1.00</b>

ICF’s key takeaways from TRM adjustments include:

- **ICF encountered a few savings calculation errors.** Hawai'i Energy showed notable improvement in adhering to the TRM compared to prior program years.
- **Hawai'i Energy prescribed outdated deemed savings values to REEM clothes washers and smart thermostats.** Clothes washers were prescribed PY22 TRM savings, while smart thermostats were prescribed PY21 TRM savings. ICF’s corrections increased energy savings for these measures but decreased demand reductions for clothes washers, driving the 0.99 TRM adjustment factor for REEM peak demand reductions.
- **Hawai'i Energy applied incorrect effective useful lifetimes (EULs) to roughly 2% of commercial LEDs.** Another 41 units (0.03%) were assigned incorrect hours of use (HOU). Corrected EULs drove the 1.01 TRM adjustment factor for BEEM lifetime energy savings.
- **Hawai'i Energy used Oahu inputs for numerous residential solar and heat pump water heater projects completed on the outer island.** Roughly 40% of residential water heaters were installed in Maui and Hawaii. Of those, 56% (22% of all units) were affected by the use of Oahu-specific inputs for equivalent full load hours (EFLH) and inlet temperature. However, these discrepancies were negligibly minor, and correcting them did not meaningfully impact REEM and RHTR adjustment factors.
- **Hawai'i Energy assigned building types invalid under the PY23 TRM to 10 of 18 commercial window air conditioner (AC) units.** The PY23 TRM states the following: “Applicable building types for this Window AC measure are Education, Grocery, Hotel/Motel, Office, Restaurant, and Retail.” Hawai'i Energy mistakenly assigned building types that are valid for other HVAC measures but not window ACs. For these 10 units (across five projects), ICF accessed Salesforce (Hawai'i Energy’s project tracking system) to review project documentation, assigned appropriate building types, and recalculated savings. ICF’s changes did not meaningfully impact BHTR adjustment factors.

- Hawai'i Energy applied incorrect deemed inputs to a small percentage of HVAC projects across all programs.** Savings were affected by incorrect baselines, capacities, EFLHs, and/or coincidence factors (CFs) for 18 out of 851 commercial HVAC units (2%) and 251 out of 3,264 residential HVAC units (8%). ICF's changes did not meaningfully impact BEEM, BHTR, REEM, or RHTR TRM adjustment factors.
- Hawai'i Energy applied incorrect baselines to residential LEDs.** Because of the small number of units sold, ICF's corrections did not meaningfully impact REEM TRM adjustment factors.

In addition, ICF identified an error in the PY23 TRM's calculated deemed savings values for commercial ice machines. This error increased the program-level claimed savings by 172 MWh (0.2%) during the PY23 performance period. ICF is responsible for ensuring that Hawai'i Energy adheres to the TRM regardless of its veracity. We confirmed that the savings formulas for commercial ice machines in the PY23 TRM are correct, and that Hawai'i Energy awarded claimed savings for commercial ice machines according to the deemed savings values described in the PY23 TRM, as intended. However, the deemed savings values were not calculated correctly as dictated by the savings formulas. Under the guidance of the Energy Efficiency Manager (EEM) and the Commission, commercial ice machine savings values will be corrected in the PY25 TRM. As such, this issue will also affect commercial ice machines in PY24.

*Simple Desk Review Adjustments*

Through simple engineering desk reviews, ICF verified savings for a sample of projects and estimated sample adjustment factors that were stratified by program and measure category. We weighted the sample adjustment factors to the population of projects within each stratum to estimate verified customer-level savings for the population. ICF performed simple desk reviews for measures with prescriptive or semi-prescriptive savings; the simple desk reviews do not include CBEEM projects, which have fully custom savings.

Table 2-4 shows TRM-adjusted savings, verified savings, and desk review adjustment factors for first-year energy savings, lifetime energy savings, and peak demand reductions. **Error! Reference source not found.** Simple desk review adjustments led to larger differences in savings at the program level but only slight differences at the portfolio level, with adjustment factors greater than 1.00 for first-year and lifetime energy savings and peak demand reductions.

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

Program	Customer-Level First-Year Energy Savings (kWh/yr)			Customer-Level Lifetime Energy Savings (kWh)			Customer-Level Peak Demand Reductions (kW/yr)		
	TRM-Adjusted	Verified	Desk Review Adj. Factor	TRM-Adjusted	Verified	Desk Review Adj. Factor	TRM-Adjusted	Verified	Desk Review Adj. Factor
BEEM	31,890,961	31,642,592	0.99	378,923,439	376,651,511	0.99	4,150	4,140	1.00
BHTR	5,154,533	5,101,365	0.99	58,433,617	58,972,770	1.01	402	408	1.01
REEM	22,209,149	23,044,940	1.04	306,533,511	323,163,076	1.05	2,657	2,741	1.03
RHTR	10,339,864	10,339,864	1.00	74,459,478	74,459,478	1.00	1,953	1,953	1.00
CREEM	3,549,576	3,979,300	1.12	38,633,975	46,017,337	1.19	421	471	1.12
<b>Total</b>	<b>73,144,083</b>	<b>74,108,061</b>	<b>1.01</b>	<b>856,984,021</b>	<b>879,264,171</b>	<b>1.03</b>	<b>9,584</b>	<b>9,713</b>	<b>1.01</b>

ICF's key takeaways from desk reviews include:

- **ICF found very few errors on Hawai'i Energy's recording of project information into its program tracking database.** In general, Hawai'i Energy accurately entered project information into its program tracking database and used that data to estimate its claimed energy savings and demand reductions.
- **Hawai'i Energy calculated the baseline consumption for military submetering projects as a simple average of all monthly meter data of sampled homes.** The data spanned July 2021 through September 2022. As such, the months of July, August, and September appear in the data twice. Because these three summer months are hotter than the rest of the year, this inflated the baseline energy use against which Hawai'i Energy estimated energy savings. ICF recalculated the baseline using only the latest 12 months of meter data (October 2021 through September 2022) and weighted each calendar month equally within the baseline (to account for homes with missing meter reads). These changes resulted in decreases of 1.7% and 1.6% in average monthly baseline consumption and peak demand, respectively. This is the primary driver of the 0.99 BEEM desk review adjustment factors.
- **For residential solar water heaters, ICF used actual parameter data to calculate savings instead of default values.** Project documentation provided key inputs such as home occupancies, tank volumes, and solar fractions, which increased energy savings and demand reduction. Consistent with the TRM, solar fractions cannot exceed 100%. These changes were the primary drivers of the REEM and RHTR desk review adjustment factors exceeding 1.00.
- **ICF updated rated lamp lives of Energy Advantage LEDs using product specification sheets.** Hawai'i Energy uses a 14-year EUL for all Energy Advantage LEDs, which assumes a lamp life of 50,000 hours divided by 3,600 HOU per year.<sup>12</sup> ICF identified several models for which the rated lamp life exceeded 50,000 hours, which increased lifetime energy savings. ICF also updated efficient-case wattages to align with DesignLights Consortium (DLC) or ENERGY STAR qualified product lists and adjusted interactive effects to map to facility types accurately. These changes did not meaningfully impact BEEM and BHTR desk review adjustment factors.
- **For HVAC projects, ICF updated efficiencies to use SEER2 and EER2 ratings where available and applicable.** Many desk-reviewed HVAC projects used SEER and EER ratings for equipment, where SEER2 and EER2 are currently the preferred efficiency metrics. ICF also updated capacities according to Air-Conditioning, Heating, and Refrigeration Institute (AHRI) certificates where necessary. These changes did not meaningfully impact BEEM and BHTR desk review adjustment factors.
- **ICF observed that ES4H participant households had larger occupancies than deemed by the PY23 TRM for typical multifamily homes.** The PY23 TRM assumes an average household size of 2.34 people for low-flow faucet aerators and showerheads. Two ES4H projects, spanning 46 homes, yielded an average occupancy of 3.41 people, roughly 45% higher.
- **Several rebate applications were not signed and dated by the customer or marked with a processing date by Hawai'i Energy.** ICF confirmed with Hawai'i Energy that these projects were completed in PY22 (e.g., in late June) but not processed until PY23 (e.g., in early July) because of their timing at the end of PY22. However, Hawai'i Energy did not provide evidence

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<sup>12</sup> Hawai'i Energy settled on a universal HOU of 3,600 based on average Energy Advantage contractor feedback.

of this in project documents. For applications without customer signatures, it is possible that Hawai'i Energy uploaded these applications to Salesforce before acquiring the necessary signatures or stamping the application as processed. ICF did not decrement savings for these projects.

*Business Custom Adjustments*

The verification team (ICF and subcontractor RHA Energy Partners, a Hawaii-based engineering firm) conducted desk reviews and on-site visits with 30 CBEEM projects, sampled randomly and stratified by lighting and non-lighting projects (as classified by Hawai'i Energy in its program tracking database). ICF conducted the desk reviews, and RHA Energy Partners completed the on-site visits,<sup>13</sup> during which they interviewed the customer about baseline conditions and visually inspected key equipment. ICF then adjusted savings based on the desk reviews, on-site visit observations, and data collection. In addition, ICF completed 19 desk reviews for CBEEM projects not included in the on-site visit sample.<sup>14</sup>

Table 2-5 shows claimed savings, verified savings, and realization rates for first-year energy savings, lifetime energy savings, and peak demand reductions resulting from all CBEEM verification activities (desk reviews and on-site visits). The verification team reduced savings for custom non-lighting projects based on observations collected during on-site visits, especially for pumps & motors and transformer projects. Lifetime energy savings for custom lighting projects were affected by issues with Hawai'i Energy's custom lighting savings workbook and how it is used.

Table 2-5 Adjustments to CBEEM Customer-Level Savings

Program	Customer-Level First-Year Energy Savings (kWh/yr)			Customer-Level Lifetime Energy Savings (kWh)			Customer-Level Peak Demand Reductions (kW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
Lighting	5,983,585	5,980,372	1.00	80,027,571	70,951,244	0.89	871	805	0.92
Lighting (Census)	1,969,242	1,960,488	1.00	34,271,664	21,971,434	0.64	238	238	1.00
Non-Lighting	1,649,361	1,406,464	0.85	20,977,717	18,489,725	0.88	191	159	0.83
Non-Lighting (Census)	4,445,639	4,607,773	1.04	61,475,113	56,779,168	0.92	441	507	1.15
<b>Total</b>	<b>14,047,827</b>	<b>13,955,097</b>	<b>0.99</b>	<b>196,752,065</b>	<b>168,191,571</b>	<b>0.85</b>	<b>1,741</b>	<b>1,709</b>	<b>0.98</b>

ICF's key takeaways from custom project desk reviews and on-site visits include:

- **ICF identified numerous issues with Hawai'i Energy's custom lighting workbook and how users populated it.** We confirmed that these issues were present in PY22, and our team corrected them, but we had not identified their causes, as described below.
  - o **Hawai'i Energy did not correctly adjust the rated lamp life** (hours) for measures with dimming settings or controlled by occupancy sensors. For LED measures controlled by sensors or timers, Hawai'i Energy subdivided individual measures into multiple line items. Each line item represents a brightness setting for that measure, and the HOU for the line item reflects the operational hours for that brightness setting. When doing this, the user

<sup>13</sup> RHA conducted 29 of 30 site visits; ICF conducted one.

<sup>14</sup> The desk reviews for the on-site visit sample were limited to projects with customers who willingly agreed to participate in the on-site visits. With this restriction, the overall desk review sample would be biased towards this subgroup of projects without including the additional desk reviews.

must adjust the lamp life for each line item so it is proportional to its HOU.<sup>15</sup> If not, the custom lighting workbook can overstate energy use for the baseline and/or efficient cases.

- o **The custom lighting workbook may not calculate lifetime energy savings correctly** if the user does not ensure that every baseline case line item is matched one-to-one with an efficient case line item.<sup>16</sup> The custom lighting workbook sets the EUL of a baseline measure equal to that of its efficient counterpart. If a baseline line item does not have an efficient counterpart, it has no EUL and no lifetime energy use, which erroneously reduces lifetime energy savings. This was problematic for measures with settings or controls that were newly implemented for the efficient case but did not exist for the base case (see bullet above).
- o **Custom lighting projects did not incorporate the CBEEM NTG ratio into TRBs.** See *Total Resource Benefits (TRB) Adjustments* (page 24) below.
- Aside from our findings above regarding projects that use the custom lighting workbook, **ICF adjusted the hours of operation (including peak demand hours) and controls (e.g., sensors, timers, and dimming settings) most frequently.** We also adjusted efficient wattages to match the DLC's qualified product list or product cutsheets, rated lamp lives to match cutsheets, and interactive effects to match the facility's HVAC characteristics. ICF identified one project for which the as-built lighting plan did not match the submittal. The verification team used the as-built lighting plan and on-site observations to verify savings. The impact of this discrepancy on custom lighting and portfolio-level savings was negligible.
- **ICF applied a dual baseline to, and extended the EUL of, a large commercial chiller and variable frequency drive (VFD) project.** Per project documentation and on-site reports, the efficiencies of the preexisting chillers being replaced were significantly lower than the federal minimum. Hawai'i Energy used these efficiencies, rather than the federal minimum efficiency, as the baseline to calculate lifetime energy savings. Following guidance from the CPGD, ICF treated the chiller replacements as early retirements, which allowed for the preexisting chillers to be used for the baseline efficiencies for their remaining useful life (RUL) of seven years. We then calculated energy savings against the federal baseline for the remaining 15 years of the chiller EUL. These changes reduced lifetime energy savings and TRBs by 47% and 43%, respectively, but did not affect first-year energy savings or peak demand reduction. This project was Hawai'i Energy's 2nd-largest custom project and 6th-largest project overall, excluding codes & standards.
- **ICF verified energy savings and peak demand reduction with hourly energy use data for another large commercial chiller project.** ICF specified separate pre-treatment ("pre") and post-treatment ("post") linear regression models using hourly energy use data and cooling degree day (CDD) weather data,<sup>17</sup> as well as a peak-hours dummy (binary) variable interacted with CDDs ("peak-hours flag"). Hawai'i Energy specified a combined *pre/post* model using daily energy use and CDD data to estimate energy savings. It used an arithmetic approach

<sup>15</sup> For example, if a measure is split into two line items where it is used half the time at 100% brightness and the other half at 30% brightness, each line item's lamp life must also be reduced by half.

<sup>16</sup> For example, if line 2 is populated for the baseline case, line 2 must also be populated for the efficient case.

<sup>17</sup> Consistent with Uniform Methods Project (UMP) guidance. National Renewable Energy Laboratory (NREL): *The Uniform Methods Project: Methods for Determining Energy Efficiency savings for Specific Measures. Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Protocol*, Section 4.3.1 The Two-Stage Approach: Individual Premise Analysis. <https://docs.nrel.gov/docs/fy17osti/68564.pdf>

based on its linear regression results to calculate demand reduction. The lack of granularity in Hawai'i Energy's daily model significantly underestimated energy savings compared to an hourly model. Meanwhile, because the project provides hourly energy use data, ICF estimated peak demand reduction as part of an hourly linear regression, rather than calculating it arithmetically.<sup>18</sup> ICF's hourly models ultimately yielded project realization rates of 155% for first-year energy savings and 251% for peak demand reduction compared to the claimed savings. This project was Hawai'i Energy's 4th-largest custom project and 10th-largest project overall, excluding codes & standards.

- ICF refreshed Hawai'i Energy's billing analysis for a custom grocery refrigeration project.** Due to human error by the installing contractor, Hawai'i Energy was unable to analyze the pre-installation logger data as planned. To address this issue, Hawai'i Energy compiled HECO billing data for the customer and treated the project as a whole-building retrofit, utilizing a regression-based approach rather than an engineering approach. Billing data for the project originally contained enough *pre* data but only five months of *post* data, which was not enough to estimate *post* energy use with statistical significance. ICF requested additional billing data from Hawai'i Energy and specified separate *pre* and *post* models using the 12 months of *pre* data closest to installation and the latest 12 months of *post* data. ICF then calculated peak demand reductions proportionally to Hawai'i Energy's original engineering analysis. The revised models yielded realization rates of 116% for first-year energy savings and peak demand reductions.
- ICF updated efficiencies and capacities of measures installed for another refrigeration project.** The customer installed ductless mini-split units in its walk-in coolers, which were less energy-efficient and had greater capacity than initially planned. ICF corrected the savings calculations to use the specifications of the installed models, resulting in a realized rate of 51% for first-year energy savings. There were no peak demand reductions for claimed or verified savings.
- ICF made several changes to three VFD projects.** For one project, ICF removed three (out of 10 installed) pool pump VFDs because the verification team discovered that the customer had bypassed two VFDs as they were tripping the motors offline. Another VFD was never installed because its pool pump had been permanently decommissioned. For another project, ICF reduced the baseline HOU to ensure consistent facility operating hours between the pre- and post-installation scenarios. We also changed the calculation approach to use the measured power demand for the pumps in the baseline. (This project was Hawai'i Energy's 3rd-largest custom project and 9th-largest project overall, excluding codes & standards.) A third project presented several issues, including a poorly defined measure description and unknown horsepower capacities of the motors used in the old vacuum system. This lack of information (and our inability to collect this data from the customer and vendor) prevented ICF from revising energy savings beyond updating the baseline HOU. These adjustments yielded realization rates of 66% for first-year energy savings and 78% for peak demand reduction for all CBEEM pumps and motors projects.
- ICF accepted Hawai'i Energy's average loading values for most distribution transformers.** Hawai'i Energy documentation demonstrated that 98% of 5,400 distribution transformers

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<sup>18</sup> ICF initially specified a model that included a dummy (binary) variable for peak hours. We determined that energy use during peak hours was not statistically significantly different from energy use during off-peak hours and that it was not necessary to include the peak hours dummy variable in the model for the purpose of estimating peak demand reduction.

field-tested by PowerSmith showed an average loading less than 30%, which is considered lightly loaded and justifies classifying a project as early retirement. As such, ICF accepted Hawai'i Energy's claimed EULs.

- **ICF adjusted four transformer projects for which the verification team conducted on-site visits.** For one project, the verification team determined that one transformer had a lower capacity (30 kVA, not 45 kVA) and was installed in a conditioned space (rather than an unconditioned one). For another project, the model of the installed transformer differed from the one used in the energy savings calculations, and no evidence was provided to support the user-input value for no-load losses of the pre-existing transformer. For a third project, the verification team confirmed the transformer was installed in an unconditioned space (rather than a conditioned space). For the fourth project, ICF removed one of three transformers, as the verification team was also unable to locate it, and determined the remaining two transformers were installed in an unconditioned space (rather than a conditioned space). These adjustments resulted in realization rates of 97% for first-year energy savings and 96% for peak demand reductions across all CBEEM transformer projects.
- In general, **many of Hawai'i Energy's custom project calculation workbooks included hard-coded cells.** For the chiller and refrigeration projects described above, as well as many others we reviewed, Hawai'i Energy hard-coded values in cells that were used not only for intermediate calculations (such as calculating CDDs or rolling up hourly energy use into daily consumption) but also for final savings. This made it more difficult for ICF to QC and verify savings.

#### *Customer-Level Savings Realization Rates*

Table 2-6 compares claimed and verified customer-level savings by program. These final customer-level savings account for all TRM, desk review, and on-site visit adjustments to claimed savings. Overall, ICF verified realization rates of 101% for first-year energy savings, 100% for lifetime energy savings, and 101% for peak demand reductions at the customer level.

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

Program	Customer-Level First-Year Energy Savings (kWh/yr)			Customer-Level Lifetime Energy Savings (kWh)			Customer-Level Peak Demand Reductions (kW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	31,903,179	31,642,592	0.99	376,625,024	376,651,511	1.00	4,151	4,140	1.00
BESM	1,307,660	1,307,660	1.00	9,605,376	9,605,376	1.00	163	163	1.00
BGRID	433,408	433,408	1.00	3,971,540	3,971,537	1.00	349	349	1.00
BHTR	5,159,149	5,101,365	0.99	58,477,765	58,972,770	1.01	403	408	1.01
CBEEM	14,047,827	13,955,097	0.99	196,752,065	168,191,571	0.85	1,741	1,709	0.98
REEM	22,169,512	23,044,940	1.04	305,800,327	323,163,076	1.06	2,677	2,741	1.02
RESM	10,339,864	10,339,864	1.00	74,459,478	74,459,478	1.00	1,953	1,953	1.00
RGRID	0	0	N/A	0	0	N/A	0	0	N/A
RHTR	3,550,597	3,979,300	1.12	38,607,029	46,017,337	1.19	421	471	1.12
CREEM	72,237	72,237	1.00	1,162,625	1,162,625	1.00	9	9	1.00
<b>Total</b>	<b>88,983,433</b>	<b>89,876,463</b>	<b>1.01</b>	<b>1,065,461,229</b>	<b>1,062,195,281</b>	<b>1.00</b>	<b>11,866</b>	<b>11,942</b>	<b>1.01</b>

**System- and Program-Level Savings Adjustments**

Table 2-7 compares claimed and verified system-level savings by program. All system-level realization rates match customer-level realization rates at the program and portfolio levels.

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

Program	System-Level First-Year Energy Savings (kWh/yr)			System-Level Lifetime Energy Savings (kWh)			System-Level Peak Demand Reductions (kW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	33,196,900	32,925,943	0.99	392,054,733	392,086,355	1.00	4,320	4,309	1.00
BESM	1,364,641	1,364,641	1.00	10,011,342	10,011,342	1.00	170	170	1.00
BGRID	450,536	450,536	1.00	4,128,495	4,128,493	1.00	363	363	1.00
BHTR	5,379,227	5,319,005	0.99	60,968,122	61,483,225	1.01	420	426	1.01
CBEEM	14,638,700	14,540,246	0.99	204,889,009	175,138,160	0.85	1,814	1,781	0.98
REEM	23,137,144	24,049,105	1.04	319,155,461	337,241,810	1.06	2,795	2,864	1.02
RESM	10,753,149	10,753,149	1.00	77,416,939	77,416,939	1.00	2,032	2,032	1.00
RGRID	0	0	N/A	0	0	N/A	0	0	N/A
RHTR	3,715,455	4,164,588	1.12	40,390,744	48,150,888	1.19	440	493	1.12
CREEM	75,092	75,092	1.00	1,208,572	1,208,572	1.00	9	9	1.00
<b>Total</b>	<b>92,710,845</b>	<b>93,642,304</b>	<b>1.01</b>	<b>1,110,223,417</b>	<b>1,106,865,783</b>	<b>1.00</b>	<b>12,364</b>	<b>12,445</b>	<b>1.01</b>

Table 2-8 compares claimed and verified program-level savings by program. All program-level realization rates match customer- and system-level realization rates.

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

Program	Program–Level First–Year Energy Savings (kWh/yr)			Program–Level Lifetime Energy Savings (kWh)			Program–Level Peak Demand Reductions (kW/yr)		
	Claimed	Verified	RR	Claimed	Verified	RR	Claimed	Verified	RR
BEEM	24,897,674	24,694,456	0.99	294,041,051	294,064,769	1.00	3,240	3,231	1.00
BESM	1,342,715	1,342,715	1.00	9,918,252	9,918,252	1.00	168	168	1.00
BGRID	450,536	450,536	1.00	4,128,495	4,128,493	1.00	363	363	1.00
BHTR	4,975,316	4,920,513	0.99	55,492,993	55,961,737	1.01	381	386	1.01
CBEEM	10,979,025	10,905,184	0.99	153,666,757	131,353,620	0.85	1,361	1,335	0.98
REEM	16,959,194	17,686,483	1.04	228,359,787	242,771,413	1.06	2,004	2,059	1.03
RESM	10,545,197	10,545,197	1.00	76,768,155	76,768,155	1.00	1,987	1,987	1.00
RGRID	0	0	N/A	0	0	N/A	0	0	N/A
RHTR	3,715,455	4,164,588	1.12	40,390,744	48,150,888	1.19	440	493	1.12
CREEM	48,810	48,810	1.00	785,572	785,571	1.00	6	6	1.00
<b>Total</b>	<b>73,913,921</b>	<b>74,758,482</b>	<b>1.01</b>	<b>863,551,805</b>	<b>863,902,897</b>	<b>1.00</b>	<b>9,949</b>	<b>10,028</b>	<b>1.01</b>

ICF’s key takeaways from the system– and program–level adjustments include:

- **Hawai'i Energy applied all system line losses correctly.**
- **Hawai'i Energy applied NTG ratios correctly in nearly all cases, leading to very few discrepancies in PY23 program–level savings.** ICF identified only four REEM Midstream lighting projects that were assigned the NTG ratio for upstream lighting.
- Although Business Midstream CKE is categorized as a BHTR delivery channel in its program tracking database, Hawai'i Energy applied the BEEM Midstream NTG ratio (0.75) instead of the BHTR NTG ratio (0.91). ICF confirmed with Hawai'i Energy that this was intentional, and ICF did not make any adjustments as a result.

**Total Resource Benefits (TRB) Adjustments**

Table 2–9 compares claimed and verified TRBs by program. TRB realization rates reflect ICF’s adjustments to customer–level claimed savings as well as any differences in NTG ratios and TRB avoided costs between Hawai'i Energy’s program tracking database and the PY23 TRM.

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

Program	Claimed TRBs	Verified TRBs	Realization Rate
BEEM	\$34,341,816	\$34,392,388	100%
BESM	\$1,214,852	\$1,214,860	100%
BGRID	\$571,566	\$575,570	101%
BHTR	\$6,653,209	\$6,744,602	101%
CBEEM	\$22,215,820	\$16,071,189	72%
REEM	\$27,594,820	\$29,104,191	105%
RESM	\$9,858,079	\$9,858,090	100%
RGRID	\$0	\$0	N/A
RHTR	\$5,369,655	\$6,495,651	121%
CREEM	\$85,463	\$85,466	100%
<b>Total</b>	<b>\$107,905,279</b>	<b>\$104,542,009</b>	<b>97%</b>

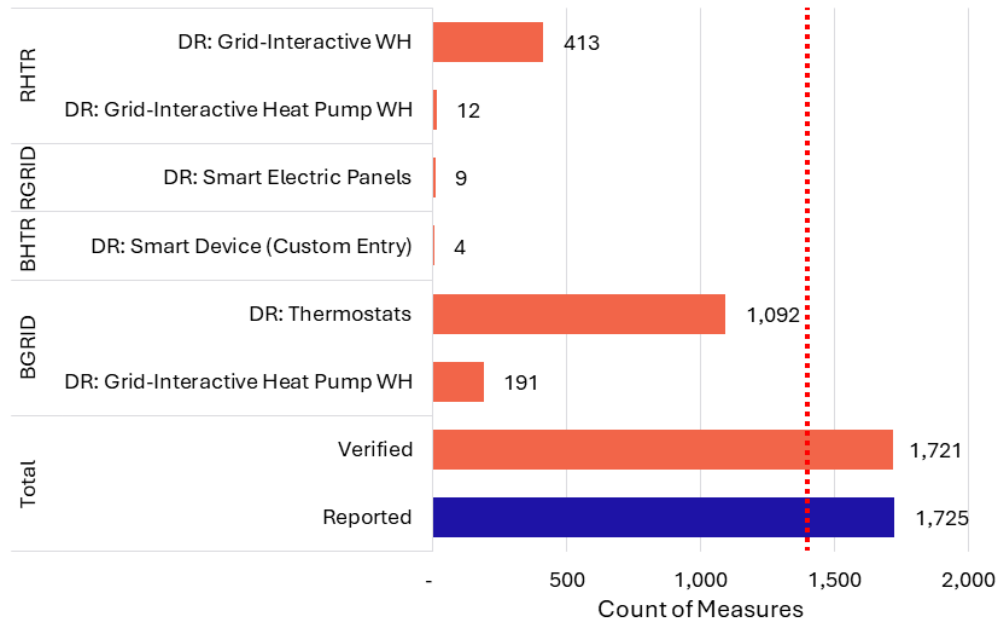
ICF's key takeaways from TRB adjustments include:

- **Custom lighting projects did not incorporate the CBEEM NTG ratio into TRBs.** It is sensible for Hawai'i Energy's custom lighting workbook to omit NTG considerations from TRBs because it is used by laypeople who may not understand NTG and need accurate estimates of project financials. However, Hawai'i Energy did not apply the NTG ratio to TRBs for these custom lighting projects when entering them into its program tracking database. This issue appears to affect all custom lighting projects, overstating custom lighting TRBs by 33%.
- **Otherwise, Hawai'i Energy generally applied TRB avoided costs correctly.** While completing TRM and desk review adjustments, ICF confirmed that TRBs were calculated correctly for almost all projects. Any differences in TRBs typically arose from discrepancies between claimed and verified first-year energy savings and peak demand reductions rather than the application of the PY23 TRM's TRB avoided cost values. Only a handful of projects (identified by ICF during TRM adjustments) appeared to have TRB avoided cost values that Hawai'i Energy misapplied. ICF encountered the most significant differences between claimed and verified TRBs when evaluating custom projects, primarily due to changes in savings associated with dual baselines and updated EULs.

### Grid Services Ready Adjustments

Figure 2-4 shows the number of Grid Services Ready projects claimed by Hawai'i Energy and verified by ICF using the tracking database. Claimed (1,725) and verified (1,721) project counts generally aligned in total, but ICF was unable to diagnose the discrepancies. Both claimed and verified counts exceeded the target number of measures (1,400).

Figure 2-4 Grid Services Ready Performance Against Target



### Demand Flexibility Adjustments

To claim flexible demand (kW), Hawai'i Energy uses the following assumptions:

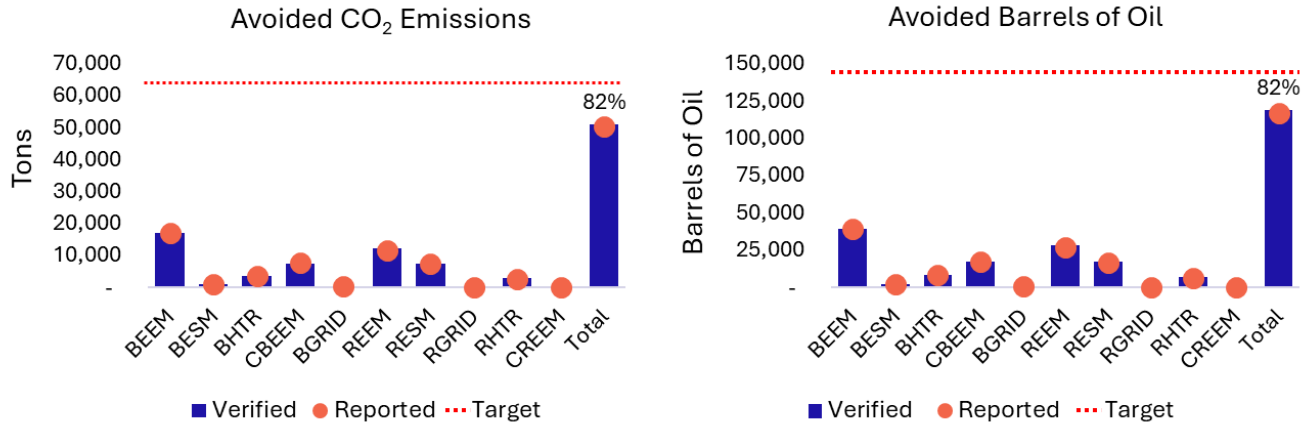
- **Residential smart panels:** 1.522 kW per unit
- **GridPoint HVAC (“Smart Device”):** 20% of site kW savings
- **Guestroom EMS (thermostats):** 100% reduction from average unit coincident kW
- **Energy storage:** 100% of committed kW
- **Water heaters:** 0.344 kW per water heater
- **Heat pump water heaters:** 0.091 kW per water heater

Hawai'i Energy claimed 1,611 kW of load flexibility (107% of target), which it achieved through 22 Grid Services Ready projects. Due to data limitations, ICF could only verify the deemed flexible kW for smart panels. Otherwise, there was not enough information to independently verify the remaining Grid Services Ready projects. There were also five GridPoint HVAC projects for which Hawai'i Energy did not claim flexible demand because it lacked sufficient information to claim demand reductions.

### GHG Reductions Adjustments

Using PY23 TRM conversion factors and verified first-year program-level energy savings, ICF verified GHG reductions achieved by Hawai'i Energy programs. Figure 2-5 compares claimed and verified performance concerning GHG reductions. For avoided emissions (measured in metric tons of carbon dioxide, or CO<sub>2</sub>), ICF verified realization rates between 99% and 112% by program and 101% for the portfolio. For avoided barrels of oil (measured in tons), ICF verified realization rates between 100% and 113% by program, with an overall rate of 102%.

Figure 2-5 GHG Reductions Performance Against Targets



### CET Performance Awards

Hawai'i Energy must achieve at least 90% of performance targets for first-year and lifetime energy savings, peak demand reductions, and TRBs at the program category level to claim any of the performance awards in these key focus areas. ICF calculated the awards Hawai'i Energy received based on its verified performance, as outlined by the rules in [Appendix A](#).

Table 2-10 shows the target, claimed, and verified awards by metric and program category. Hawai'i Energy achieved 62% of the first-year energy savings award, 29% of the lifetime energy savings award, 24% of the peak demand reductions award, and 28% of the TRBs award.

- The Business Hard-to-Reach (BHTR) and Business Custom (CBEEM) programs fell short of the minimum award thresholds for all performance metrics. The Business Prescriptive programs (BEEM and BESM) and Business Grid program (BGRID) achieved full awards for first-year energy savings. BGRID also earned the full award for lifetime energy savings.
- All Residential Incentives programs (REEM, RESM, and CREEM) and the Residential Hard-to-Reach program (RHTR) achieved awards for every performance metric. ICF's desk review adjustments to ES4H and residential solar water heater projects yielded higher realization rates for RHTR, verifying larger performance awards than what Hawai'i Energy claimed.

Table 2-10 CET Performance Awards

Key Focus Area	Target Award	Claimed Award		Verified Award	
<b>First-Year Energy Reduction</b>	<b>\$112,500</b>	<b>\$68,769</b>	<b>61%</b>	<b>\$70,204</b>	<b>62%</b>
Business Prescriptive	\$32,001	\$32,001	100%	\$32,001	100%
Business HTR	\$8,598	\$0	0%	\$0	0%
Business Custom	\$33,698	\$0	0%	\$0	0%
Business Grid	\$189	\$189	100%	\$189	100%
Residential Incentives	\$33,231	\$33,231	100%	\$33,231	100%
Residential HTR	\$4,783	\$3,348	72%	\$4,783	100%
<b>Lifetime Energy Reduction</b>	<b>\$112,500</b>	<b>\$28,459</b>	<b>25%</b>	<b>\$32,615</b>	<b>29%</b>
Business Prescriptive	\$36,278	\$0	0%	\$0	0%
Business HTR	\$9,068	\$0	0%	\$0	0%
Business Custom	\$34,475	\$0	0%	\$0	0%
Business Grid	\$138	\$138	100%	\$138	100%
Residential Incentives	\$28,321	\$28,321	100%	\$28,321	100%
Residential HTR	\$4,220	\$0	0%	\$4,157	99%
<b>Peak Demand Reduction</b>	<b>\$150,000</b>	<b>\$32,714</b>	<b>22%</b>	<b>\$35,456</b>	<b>24%</b>
Business Prescriptive	\$43,447	\$0	0%	\$0	0%
Business HTR	\$8,844	\$0	0%	\$0	0%
Business Custom	\$24,799	\$0	0%	\$0	0%
Business Grid	\$35,809	\$0	0%	\$0	0%
Residential Incentives	\$32,714	\$32,714	100%	\$32,714	100%
Residential HTR	\$4,387	\$0	0%	\$2,742	63%
<b>Total Resource Benefits</b>	<b>\$112,500</b>	<b>\$29,959</b>	<b>27%</b>	<b>\$31,901</b>	<b>28%</b>
Business Prescriptive	\$36,395	\$0	0%	\$0	0%
Business HTR	\$8,850	\$0	0%	\$0	0%
Business Custom	\$32,269	\$0	0%	\$0	0%
Business Grid	\$3,084	\$0	0%	\$0	0%
Residential Incentives	\$27,813	\$27,813	100%	\$27,813	100%
Residential HTR	\$4,089	\$2,147	53%	\$4,089	100%
<b>Grid Services Ready</b>	<b>\$37,500</b>	<b>\$37,500</b>	<b>100%</b>	<b>\$37,500</b>	<b>100%</b>
<b>Demand Flexibility</b>	<b>\$0</b>	<b>\$0</b>	<b>N/A</b>	<b>\$0</b>	<b>N/A</b>
<b>GHG Reductions (Tons)</b>	<b>\$0</b>	<b>\$0</b>	<b>N/A</b>	<b>\$0</b>	<b>N/A</b>
<b>GHG Reductions (Barrels of Oil)</b>	<b>\$0</b>	<b>\$0</b>	<b>N/A</b>	<b>\$0</b>	<b>N/A</b>
<b>Total</b>	<b>\$525,000</b>	<b>\$197,401</b>	<b>38%</b>	<b>\$207,676</b>	<b>40%</b>

## CET Highlights and Recommendations

This section highlights areas where Hawai'i Energy is performing well and provides recommendations for improving CET activities.

### Highlights

- **Hawai'i Energy achieved 40% of CET awards in PY23, an increase of 11 percentage points over PY22.** The increase in verified CET awards can be attributed to the completion of a series of large military community submetering projects, as well as ICF adjustments to RHTR projects during the simple desk review verification step.
- **Contrary to PY22, Hawai'i Energy met its Grid Services Ready target in PY23.** Permitting and supply chain issues caused projects that commenced in PY22 or earlier to not be completed until PY23.
- **Hawai'i Energy applied PY23 TRM algorithms for prescriptive and semi-prescriptive nearly perfectly.** ICF made minimal TRM adjustments to the claimed savings, resulting in TRM adjustment factors close to 1.0 for all programs.

### Recommendations

Based on its evaluation, ICF recommends the following opportunities to improve the verified CET metrics: energy and demand reductions and TRBs. However, these recommendations, individually or cumulatively, do not materially impact the Hawai'i Energy program savings claims or performance awards.

1. **Provide the measured average loading of the distribution transformer or a reference for typical distribution transformer loading values) to justify early retirement of transformers.** The Hawai'i Energy TRM allows for an EUL of 50 years if the transformer has an average loading of less than 35%. If the average loading is greater than 35%, the TRM specifies the use of a 30-year EUL. In most transformer projects ICF reviewed, the average transformer loading was not measured. Upon request, Hawai'i Energy provided ICF with a graph developed by PowerSmith that showed 98% of distribution transformers (out of 5,400 measured) with loading measured below 30%. ICF has accepted this justification but recommends that Hawai'i Energy include PowerSmith's transformer loading documentation as part of all future transformer projects when no direct measurement of the transformer loading is performed.
2. **Correctly capture the HVAC characteristics of the space where a distribution transformer is operating.** ICF identified several projects where the transformers operated in non-conditioned spaces; however, Hawai'i Energy calculated energy savings as if the spaces were conditioned, which resulted in overestimating the energy savings.
3. **Confirm that a linear regression model (e.g., billing analysis) is statistically significant before using it to calculate savings.** For one project, Hawai'i Energy specified separate *pre* and *post* models to estimate a facility's use pre- and post-installation using meter and weather data. The coefficient of determination (R-Squared, or  $R^2$ ) indicated that the estimated coefficients, which are used to calculate post-installation energy use adjusted for weather, for the *post* model were not statistically significant and should not have been used to claim savings. In this case, the *post* model had only five observations (i.e., months of meter data), which satisfied guidance from the CPGD but was not enough to yield

statistically significant results. In these instances, it would be more appropriate to gather more post-installation meter data or adopt a different savings methodology, such as an engineering approach.

4. **At the next TRM update, specify when to use actual or default values for semi-prescriptive savings calculations.** For residential solar water heaters, the PY23 TRM provides a semi-prescriptive savings calculator, but its guidance is not clear for certain variables about when to use actual project inputs instead of default values.
5. **Update all claimed savings to correspond with the current TRM.** Clothes washers were assigned PY22 savings, smart thermostats were assigned PY21 savings, and some residential LEDs applied a dual-baseline approach from the PY22 TRM.

### Additional Recommendations

The following recommendations will improve the evaluability of the program in the future; however, they are not linked to issues that directly impacted the verified CET metrics.

- **Ensure that project records are complete.** Hawai'i Energy continues to improve the consistency of its project documentation as required by the CPGD, but ICF still encountered the following documentation issues in PY23:<sup>19</sup>
  - a. Cases where project equipment and labor costs were not itemized. Several transformer projects were submitted with non-itemized invoices, including some submitted with shipping slips (rather than invoices). When an itemized invoice is not available, the CPGD specifies that Hawai'i Energy must provide a written explanation in the project file for the lack of an itemized invoice and must then use another acceptable form of proof of purchase. There were projects without an explanation for unavailable invoices and without an acceptable substitute. Furthermore, equipment ordered and stored by the customer as backup equipment must be excluded from the submitted project cost, as it does not contribute to the project's energy savings. For example, the ICF team identified a pump VFD project with submitted project costs for eleven VFDs, where the customer stores one of the purchased VFDs in a warehouse as a backup. However, Hawai'i Energy did not remove the costs for backup VFD from the project costs.
  - b. A lack of documentation demonstrating that Hawai'i Energy pre-approved the project before it was underway or completed (e.g., email communications, pre-site inspections, consistent use of the project summary form, or another form preceding the application rebate submission) as stipulated by program eligibility requirements.
  - c. Incomplete or missing measure and baseline descriptions. In a few instances, the projects, measures, and baselines were poorly described. For example, the VFD-driven vacuum system project discussed in *Business Custom Adjustments* included no detailed description of the measure beyond the invoice. Not even the Hawai'i Energy post-install inspection report described the pre- and post-install vacuum system motor capacities and motor efficiencies. ICF recommends that Hawai'i Energy include a measure description in all post-inspection reports. If no post-inspection report is

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<sup>19</sup> Monthly meetings with ICF (initiated during PY24) will help Hawai'i Energy and ICF develop a mutual understanding of the documentation requirements and the limitations that arise during the implementation process.

included as part of the project package, a project or measure description should be provided.

While these are fundamental elements of documentation and are critical to providing basic assurance that the rebated projects are completed and that the measures are purchased and installed, the PY23 instances of these occurrences were minimal. It should be noted that, pre-inspections help ensure that rebates are not offered for projects that are already completed. Pre-approval is also the best practice, considering the significant incentives associated with many of these projects. Program staff have mentioned that some customers have trouble providing important project documentation, including itemized invoices for larger projects.

- **Consider updating the default occupancy for ES4H low-flow faucet aerators and showerheads.** Data reviewed by ICF for 46 homes showed that the occupancy of the average ES4H household was 45% higher than the multifamily average. Reviewing a larger sample of homes would both establish an average occupancy that's more accurate for ES4H participants and better estimate ES4H energy savings.
- **Do not hard-code cells that were calculated as part of steps toward estimating energy savings; leave them as formulas.** This will facilitate QC internally (Hawai'i Energy) and externally (PBFA evaluator) by making it easier to validate calculations and trace references. There are obvious exceptions, such as primary data collection and raw measurements, and there are some cases when using a tool such as Microsoft Excel's Data Analysis Regression package produces hard-coded results. However, there were numerous instances in which Hawai'i Energy's analysis workbooks contained hard-coded values that were evidently calculated from primary data, but Hawai'i Energy did not provide the calculations or cell references.
- **Ensure all rebate applications are signed and dated by customers** before processing and scanning them for digital upload and storage. Several projects sampled by ICF for desk review contained applications that lacked a date with the signature, and other documentation included with those projects did not indicate when the project was completed or processed. It would also be helpful to the PBFA evaluator if all applications were stamped with the date that Hawai'i Energy processed/uploaded them, especially for projects that appear to be completed at the end of the previous program year (e.g., late June). ICF trusts that Hawai'i Energy solicits customer signatures on all applications and that customers consent to applying for and receiving a rebate, but the project documents (when transmitted to the evaluator) should reflect this.
- **Ensure all projects include an invoice or receipt.** This type of documentation not only provides proof of purchase but also helps verify quantities and types of equipment during desk reviews and on-site visits.
- Fix multiple issues with the custom lighting workbook template and how it is used.
  - *Calculate lifetime energy savings correctly by pairing baseline measures one-to-one with efficient measures.* Many projects involve the installation of new controls. These controls typically have multiple settings that must be accounted for on separate line items and require custom HOU's (see next bullet point). This often results in fewer line items among baseline measures, creating mismatched EULs (the custom lighting workbook uses the

efficient case EUL to inform the base case EUL). ICF recommends aligning efficient case custom HOU to the corresponding base case line items so EULs are applied correctly.

- o *Adjust rated lamp lifetimes to be proportional with custom HOU when accommodating multiple control settings.* A measure with multiple control settings requires custom HOU for each setting that sum to the measure's total HOU. As such, the setting's rated lamp life should be proportional to its custom HOU and, similarly, must sum to the measure's total rated lamp life. When the rated lamp life is not adjusted, it artificially inflates the EUL, which can overestimate lifetime energy use for both the base and efficient cases.
- o *Calculate TRBs correctly.* The custom lighting workbook does not incorporate the CBEEM NTG ratio. Hawai'i Energy must remember to apply the CBEEM NTG ratio to TRBs when entering project information into the program tracking database.

### 3 | Non-CET Verification Findings

Non-CET activities are categorized into A&A, MTED, and Customer Satisfaction. Each of these performance categories is comprised of one or more key focus areas, as outlined in Table 3-1.

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

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

Each key focus area is evaluated according to a metric(s) that is relevant to its contributions toward Hawai'i Energy's overarching goals (for example, vocational trainings are assessed according to the number of participant-hours of training that Hawai'i Energy administered). ICF verified Hawai'i Energy's performance towards each non-CET target and award by reviewing backup documentation (e.g., invoices, contract agreements, third-party reports, etc.) and conducting independent analyses of the program tracking database. Details on ICF's methods are provided in the following sections and [Appendix D](#).

#### Non-CET Categories and Performance

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

##### Accessibility & Affordability (A&A)

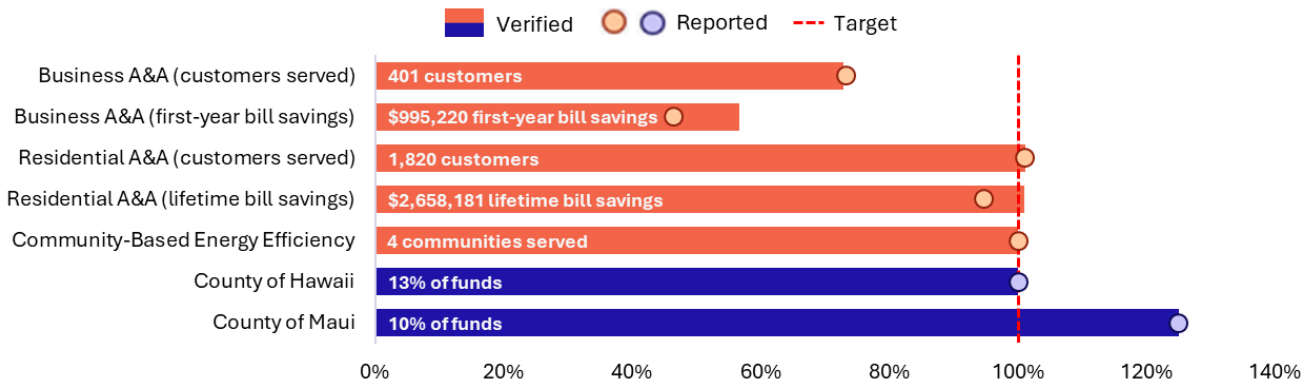
A&A performance goals ensure that program services and benefits are equitably allocated across eligible geographies and underserved demographics. As shown in Table 3-2, there are two separate verification efforts under the A&A award for Economically Disadvantaged customers and Island Equity.

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

Metric	Verification Approach
<b>Economically Disadvantaged</b> Requires serving a minimum number of customers (who save a minimum amount on their energy bills) through the Energy Advantage and single- and multifamily direct install programs and distinct communities through the Community-Based Energy Efficiency (CBEE) program.	<b>Energy Advantage.</b> Confirmed customer counts in the tracking database.
	<b>Single-Family/Multifamily Direct Install.</b> Confirmed customer counts in the tracking database and calculated customer bill savings using average effective retail rates from July 2022 through June 2023, per monthly HECO effective rate schedules.
	<b>Community-Based Energy Efficiency.</b> Confirmed community counts through project documentation review.
<b>Island Equity</b> Requires program spending of at least 8% in the County of Maui and 13% in the County of Hawaii.	Confirmed equitable distribution of funds by reviewing program spending by island (program tracking database includes a variable that states the island for each rebate).

ICF verified A&A efforts by reviewing a combination of program tracking data, geographic distribution of incentives, and agreements with community and non-profit organizations, and adjusted lifetime bill savings for CET verification findings. Figure 3-1 shows Hawai'i Energy's progress toward A&A performance targets by category.

Figure 3-1 A&A Verified Performance Against Key Focus Area Targets



### Economically Disadvantaged

ICF verified that Hawai'i Energy achieved Economically Disadvantaged performance targets for Residential A&A customers served, Residential A&A lifetime bill savings, and Community-Based Energy Efficiency (CBEE) communities served. It did not meet targets for Business A&A customers served or first-year bill savings. Hawai'i Energy initially claimed that it did not meet its Residential A&A lifetime bill savings target. However, adjustments made during the simple desk review verification step to RHTR projects (described below) yielded higher realization rates, which improved first-year and lifetime energy savings for Residential A&A projects.

To calculate Residential A&A lifetime bill savings, Hawai'i Energy multiplies a measure's first-year energy savings by a retail rate (i.e., the price per kWh that a customer pays for electricity) for the duration of the measure's EUL. By this methodology, lifetime bill savings are a nominal cash flow; they neither escalate the retail rate to account for inflation nor discount future benefits to adjust for the time value of money. When verifying Residential A&A lifetime bill savings, ICF used actual

marginal effective retail rates by rate class,<sup>20</sup> escalated effective rates at 2.5% annually,<sup>21, 22</sup> and discounted future bill savings at 6%,<sup>23</sup> resulting in a net present value (NPV) rather than a nominal sum. Through this, ICF verified that Hawai'i Energy achieved its performance target for Residential A&A lifetime bill savings, thereby increasing its non-CET award amount by \$15,000.

Hawai'i Energy prioritizes the unique needs of the communities being served. Most of the services that Hawai'i Energy provides to hard-to-reach and underserved communities consist of appliance upgrades, ranging from refrigerators and freezers to clothes washers and dryers. However, each community's needs vary, affecting RHTR energy savings and, thus, Residential A&A lifetime bill savings. Furthermore, as noted in

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<sup>20</sup> From July 2023 through June 2024. Provided monthly by HECO on behalf of Maui Electric Company (MECO) and Hawaii Electric Light Company (HELCO).

<sup>21</sup> Consistent with PY22, based on the 10-year average national inflation rate for all goods, courtesy of the U.S. Bureau of Labor Statistics (BLS) Consumer Price Index (CPI). The 10-year average inflation rate for energy in Urban Hawaii, not seasonally adjusted (series CUURS49FSAOE), was 2.9%. ICF used the PY22 escalation rate to maintain consistency and provide more-conservative estimates.

<sup>22</sup> An escalation rate sensitivity analysis confirmed that, based on verified first-year energy savings and EULs, Hawai'i Energy would have still achieved the Residential A&A lifetime bill savings award with an escalation rate as low as 2.3%.

<sup>23</sup> Consistent with PY23 TRM guidelines for TRBs.

*CET Highlights and Recommendations*, the ES4H energy savings do not account for potential demographic differences among ES4H participants, which likely underestimate ES4H energy savings.

### Island Equity

ICF verified that Hawai'i Energy met its Island Equity performance targets. After the Maui wildfires in August 2023, the Commission and Hawai'i Energy agreed to amend Hawai'i Energy's contract to reduce Island Equity spending targets for the County of Maui from 13% to 8%. ICF confirmed that Hawai'i Energy spent 10% in the County of Maui and 13% in the County of Hawaii (against a target of 13%).

### Economic Development & Market Transformation (MTED)

MTED performance goals and programs identify and overcome market barriers that prevent residential and business customers from becoming energy-efficient by encouraging customers to engage in energy-saving behavior and/or invest in energy-saving equipment. These programs:

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

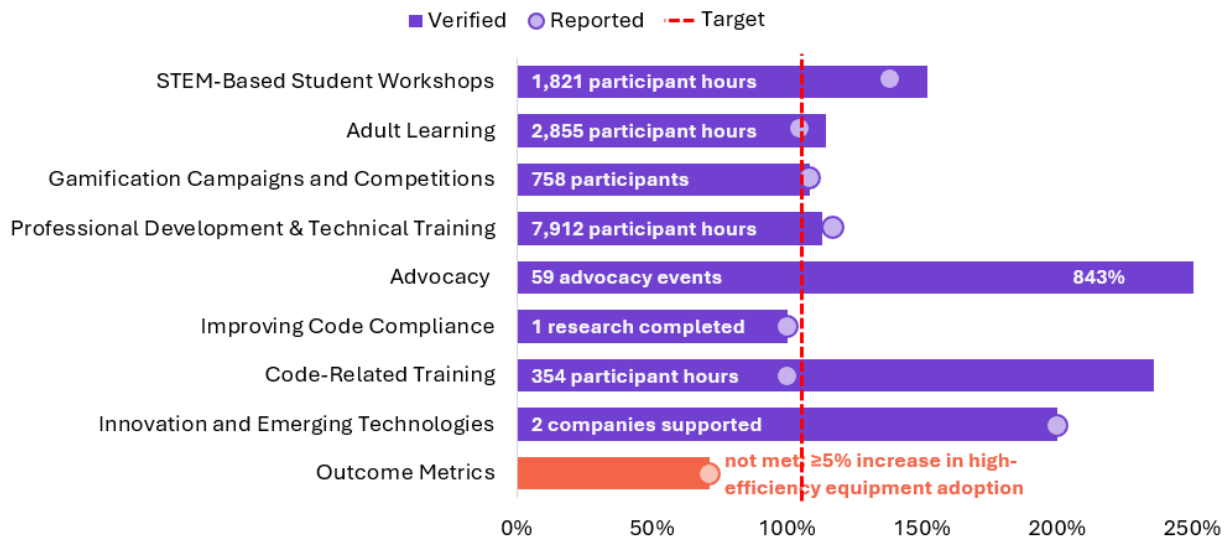
ICF verified MTED activities and achievements by reviewing contractor invoices, participant agreements, virtual workshop rosters and screenshots, and other backup documents. As shown in Figure 3-2, Hawai'i Energy met all MTED performance targets except for its new Outcome Metrics target, which pertains to high-efficiency refrigeration equipment adoption. It eclipsed its advocacy target and supported two companies under Innovation and Emerging Technologies.

Hawai'i Energy counted 204 participant training hours toward Professional Development & Technical Training that appeared to be related to Code-Related Training. ICF verified that Hawai'i Energy would meet both Professional Development & Technical Training and Code-Related Training targets regardless of how these hours were credited. To account for training hours more accurately, we reclassified the hours as Code-Related Training, with no effect on awards.

ICF attempted to credit participant training hours consistently across all training courses in all MTED categories. We recommend that Hawai'i Energy count participant training hours, whether it be in 1-, 5-, 10-, or 15-minute increments. These differences tend to have little effect on verified performance, and ICF recognizes that Hawai'i Energy often rounds down to err conservatively in its counting of participant training hours. However, the counting methodology is not uniform.

Hawai'i Energy continues to struggle to make headway in the commercial kitchen equipment market. The number of projects it sees, as well as the size and scope of those projects, can vary significantly from year to year. Hawai'i Energy staff continue to work closely with local vendors, distributors, contractors, and customers to monitor the market, nurture relationships, and find ways to encourage adoption despite economic uncertainty.

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



### Customer Satisfaction

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

To meet PY23 targets, Hawai'i Energy had to achieve customer satisfaction scores of at least 9.0 (out of a possible 10) in overall customer satisfaction for both the residential and business sectors. Using output from the Medallia and in-house survey tools, ICF verified that Hawai'i Energy exceeded its targets. However, it appeared that Hawai'i Energy claimed its residential customer satisfaction score for the business target, and vice versa. In addition, Hawai'i Energy calculated business satisfaction scores as a simple average of the monthly average satisfaction scores rather than an average of all responses, irrespective of month. In doing this, ICF verified a slightly lower satisfaction score (9.4, down from 9.7).

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

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

As part of the PY23 verification effort, ICF calculated the LMI PIM rewards associated with the RHTR and A&A programs implemented by Hawai'i Energy. To calculate rewards, ICF applied the approach laid out in D&O 37787 to estimate the additional net benefits customers received from these initiatives by gathering RHTR incentive and non-incentive funds gathered from Hawai'i Energy and using the targeted and verified first-year energy and peak demand reductions and targeted TRBs associated with RHTR (and resulting from the PY23 verification). ICF also calculated the participation award associated with Residential A&A customers.

As shown in Table 3-3, Hawaiian Electric achieved \$50,015 in total rewards. (See [Appendix C](#) for calculation details.)

Table 3-3 Hawaiian Electric LMI PIM Achieved Awards

LMI PIM Award Component	Verified Reward
Total Energy Savings Award	\$48,593
Total Peak Demand Reductions Award	\$0
Total Participation Award	\$1,422
<b>Total LMI PIM Award</b>	<b>\$50,015</b>

## Non-CET Performance Awards

As shown in Table 3-4, ICF verified 80% of the A&A target awards and 100% of MTED and Customer Satisfaction target awards, leading to overall non-CET verified awards of \$195,000 (87% of all possible non-CET awards). Because ICF verified higher Residential A&A savings than claimed, Hawai'i Energy's claimed awards were lower than the final awards verified by ICF.

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

Performance Indicator: Key Focus Area	Target Award	Claimed Award		Verified Award	
<b>Affordability &amp; Accessibility</b>	<b>\$150,000</b>	<b>\$105,000</b>	<b>70%</b>	<b>\$120,000</b>	<b>80%</b>
Economically Disadvantaged	\$75,000	\$30,000	40%	\$45,000	60%
Island Equity	\$75,000	\$75,000	100%	\$75,000	100%
<b>Market Transformation &amp; Economic Development</b>	<b>\$60,000</b>	<b>\$60,000</b>	<b>100%</b>	<b>\$60,000</b>	<b>100%</b>
Behavior Change	\$15,000	\$15,000	100%	\$15,000	100%
Professional Development & Technical Training	\$37,500	\$37,500	100%	\$37,500	100%
Codes & Standards	\$7,500	\$7,500	100%	\$7,500	100%
Clean Energy Innovation Hub	\$0	\$0	N/A	\$0	N/A
Outcome Metrics	\$0	\$0	N/A	\$0	N/A
<b>Customer Satisfaction</b>	<b>\$15,000</b>	<b>\$15,000</b>	<b>100%</b>	<b>\$15,000</b>	<b>100%</b>
Business Customer Application Experience	\$7,500	\$7,500	100%	\$7,500	100%
Residential Customer Application Experience	\$7,500	\$7,500	100%	\$7,500	100%
<b>Total</b>	<b>\$225,000</b>	<b>\$180,000</b>	<b>80%</b>	<b>\$195,000</b>	<b>87%</b>

## Non-CET Highlights and Recommendations

Here, ICF highlights areas where Hawai'i Energy is performing well and makes recommendations that identify areas for improvement among non-CET activities.

### Highlights

- Hawai'i Energy achieved its Island Equity award**, a target it didn't meet in PY22. After the Maui wildfires of August 2023, the Commission and Hawai'i Energy agreed to adjust Island Equity spending target for the County of Maui County from 13% to 8%. Hawai'i Energy spent 10% in the County of Maui and 13% in the County of Hawaii (against a target of 13%).
- Hawai'i Energy met Residential A&A and CBEE performance targets despite not claiming an award for residential customer lifetime bill savings.** By using verified first-year energy savings in conjunction with actual monthly effective retail rates published by HECO, ICF verified 101% of Hawai'i Energy's Residential A&A lifetime customer bill savings target. Hawai'i Energy did not achieve either of the two Business A&A awards.
- Consistent with PY22, Hawai'i Energy met or exceeded targets for all MTED key focus areas except for Outcome Metrics.** Significant achievements included advocating for maintaining the timelines for building energy code adoption. In the commercial kitchen equipment market, Hawai'i Energy's progress continues to be hindered by small businesses' reluctance to invest in capital projects. It is sensitive to the size and scope of available opportunities.
- ICF verified customer satisfaction scores of 9.4 and 9.6 (out of 10) for business and residential participant satisfaction**, respectively. Each metric exceeded the 9.0 target by at least 4%.

## Recommendations

Based on Hawai'i Energy's achievements, ICF did not identify significant needs for improvement. We make the following potential recommendations:

1. **Calculate Residential A&A lifetime bill savings as a net present value.** Hawai'i Energy calculated lifetime bill savings as a nominal cash flow, which does not capture discount rates or the escalation of retail rates.
2. **Provide the evaluation, measurement and verification (EM&V) contractor with the raw data for the residential satisfaction survey.** This would allow for more meaningful or engaging insights in reporting beyond the overall score. It would also facilitate recommendations that could be helpful to Hawai'i Energy in the future.

## A | Detailed Performance and Awards Tables

Appendix A provides detailed targets, claimed and verified performance, and verified and claimed awards by performance indicator and/or program (for CET). Table A-1 shows how ICF calculated performance awards for each performance metric and key focus area.

Table A-1 Rules for Calculating Performance Awards

Performance Metric/ Key Focus Area	% of Target	Rule for Calculating Award
<b>First-Year Energy Savings, Lifetime Energy Savings, Peak Demand Reductions, and Total Resource Benefits</b> (metrics and targets set for five program categories)	< 90%	No award.
	≥ 90% and < 100%	The PBFA earns the first 50% of an award when it achieves 90% of the performance target. Each percentage-point increase in performance above 90% corresponds to a 5% increase in the award (e.g., 91% of the performance target results in 55% of the award, etc.).
	≥ 100%	The PBFA earns 100% of the award.
<b>Other CET, A&amp;A, MTED, and Customer Satisfaction</b>	< 100%	No award.
	≥ 100%	The PBFA earns 100% of the award.

### CET Performance and Awards Tables

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

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

### CET Performance Overall

Table A-2 Clean Energy Technology Verified Performance

Key Focus Area	Target Performance	Claimed Performance		Verified Performance	
First-Year Energy Reduction (kWh/yr)	87,993,581	73,913,921	84%	74,758,482	85%
Lifetime Energy Reduction (kWh)	1,195,399,370	863,551,805	72%	863,902,897	72%
Peak Demand Reduction (kW)	14,210	9,949	70%	10,028	71%
Total Resource Benefits (\$)	\$148,429,952	\$107,905,280	73%	\$104,542,009	70%
Grid Services Ready (Projects)	1,400	1,725	123%	1,721	123%
Demand Flexibility (kW)	1,500	1,611	107%	1,611	107%
GHG Reductions (Tons)	62,372	50,361	81%	50,953	82%
GHG Reductions (Barrels of Oil)	143,920	116,259	81%	118,495	82%

Table A-3 Clean Energy Technology Verified Awards

Key Focus Area	Target Award	Claimed Award		Verified Award	
First-Year Energy Reduction	\$112,500.00	\$68,768.73	61%	\$70,203.69	62%
Lifetime Energy Reduction	\$112,500.00	\$28,458.63	25%	\$32,615.14	29%
Peak Demand Reduction	\$150,000.00	\$32,714.06	22%	\$35,455.63	24%
Total Resource Benefits	\$112,500.00	\$29,959.21	27%	\$31,901.35	28%
Grid Services Ready	\$37,500.00	\$37,500.00	100%	\$37,500.00	100%
Demand Flexibility	\$0.00	\$0.00	N/A	\$0.00	N/A
GHG Reductions	\$0.00	\$0.00	N/A	\$0.00	N/A
GHG Reductions	\$0.00	\$0.00	N/A	\$0.00	N/A
<b>Total Award</b>	<b>\$525,000.00</b>	<b>\$197,400.63</b>	<b>38%</b>	<b>\$207,675.82</b>	<b>40%</b>

### CET Performance by Program Category

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

Key Focus Area: Program	Target Performance	Claimed Performance		Verified Performance	
<b>First-Year Energy Reduction (kWh/yr)</b>	<b>87,993,581</b>	<b>73,913,921</b>	<b>84%</b>	<b>74,758,482</b>	<b>85%</b>
Business Prescriptive	23,083,861	26,240,389	114%	26,037,171	113%
Business HTR	7,013,443	4,975,316	71%	4,920,513	70%
Business Custom	27,737,999	10,979,025	40%	10,905,184	39%
Business Grid	150,577	450,536	299%	450,536	299%
Residential Incentives	26,073,540	27,553,200	106%	28,280,490	109%
Residential HTR	3,934,161	3,715,455	94%	4,164,588	106%
<b>Lifetime Energy Reduction (kWh)</b>	<b>1,195,399,370</b>	<b>863,551,805</b>	<b>72%</b>	<b>863,902,897</b>	<b>72%</b>
Business Prescriptive	359,679,496	303,959,303	85%	303,983,020	85%
Business HTR	99,929,404	55,492,993	56%	55,961,737	56%
Business Custom	386,994,368	153,666,757	40%	131,353,620	34%
Business Grid	1,505,765	4,128,495	274%	4,128,493	274%
Residential Incentives	299,010,587	305,913,514	102%	320,325,139	107%
Residential HTR	48,279,751	40,390,744	84%	48,150,888	100%
<b>Peak Demand Reduction (kW)</b>	<b>14,210</b>	<b>9,949</b>	<b>70%</b>	<b>10,028</b>	<b>71%</b>
Business Prescriptive	4,340	3,408	79%	3,399	78%
Business HTR	1,107	381	34%	386	35%
Business Custom	3,010	1,361	45%	1,335	44%
Business Grid	1,486	363	24%	363	24%
Residential Incentives	3,734	3,996	107%	4,051	109%
Residential HTR	533	440	83%	493	93%
<b>Total Resource Benefits (\$)</b>	<b>\$148,429,952</b>	<b>\$107,905,280</b>	<b>73%</b>	<b>\$104,542,009</b>	<b>70%</b>
Business Prescriptive	\$45,080,589	\$35,556,668	79%	\$35,607,248	79%
Business HTR	\$12,428,668	\$6,653,209	54%	\$6,744,602	54%
Business Custom	\$46,061,615	\$22,215,820	48%	\$16,071,189	35%
Business Grid	\$1,627,322	\$571,566	35%	\$575,570	35%
Residential Incentives	\$37,306,830	\$37,538,361	101%	\$39,047,748	105%
Residential HTR	\$5,924,927	\$5,369,655	91%	\$6,495,651	110%
<b>Grid Services Ready (Projects)</b>	<b>1,400</b>	<b>1,725</b>	<b>123%</b>	<b>1,721</b>	<b>123%</b>
<b>Demand Flexibility (kW)</b>	<b>1,500</b>	<b>1,611</b>	<b>107%</b>	<b>1,611</b>	<b>107%</b>
<b>GHG Reductions (Tons)</b>	<b>62,372</b>	<b>50,361</b>	<b>81%</b>	<b>50,953</b>	<b>82%</b>
<b>GHG Reductions (Barrels of Oil)</b>	<b>143,920</b>	<b>116,259</b>	<b>81%</b>	<b>118,495</b>	<b>82%</b>

Table A-5 Clean Technology Verified Awards by Program Category

Key Focus Area: Program	Target Award	Claimed Award		Verified Award	
<b>First-Year Energy Reduction</b>	<b>\$112,500.00</b>	<b>\$68,768.73</b>	<b>61%</b>	<b>\$70,203.69</b>	<b>62%</b>
Business Prescriptive	\$32,001.33	\$32,001.33	100%	\$32,001.33	100%
Business HTR	\$8,597.89	\$0.00	0%	\$0.00	0%
Business Custom	\$33,698.42	\$0.00	0%	\$0.00	0%
Business Grid	\$188.62	\$188.62	100%	\$188.62	100%
Residential Incentives	\$33,230.54	\$33,230.54	100%	\$33,230.54	100%
Residential HTR	\$4,783.20	\$3,348.24	72%	\$4,783.20	100%
<b>Lifetime Energy Reduction</b>	<b>\$112,500.00</b>	<b>\$28,458.63</b>	<b>25%</b>	<b>\$32,615.14</b>	<b>29%</b>
Business Prescriptive	\$36,278.06	\$0.00	0%	\$0.00	0%
Business HTR	\$9,068.41	\$0.00	0%	\$0.00	0%
Business Custom	\$34,475.09	\$0.00	0%	\$0.00	0%
Business Grid	\$138.02	\$138.02	100%	\$138.02	100%
Residential Incentives	\$28,320.61	\$28,320.61	100%	\$28,320.61	100%
Residential HTR	\$4,219.81	\$0.00	0%	\$4,156.51	99%
<b>Peak Demand Reduction</b>	<b>\$150,000.00</b>	<b>\$32,714.06</b>	<b>22%</b>	<b>\$35,455.63</b>	<b>24%</b>
Business Prescriptive	\$43,447.46	\$0.00	0%	\$0.00	0%
Business HTR	\$8,843.81	\$0.00	0%	\$0.00	0%
Business Custom	\$24,798.72	\$0.00	0%	\$0.00	0%
Business Grid	\$35,809.43	\$0.00	0%	\$0.00	0%
Residential Incentives	\$32,714.06	\$32,714.06	100%	\$32,714.06	100%
Residential HTR	\$4,386.52	\$0.00	0%	\$2,741.58	63%
<b>Total Resource Benefits</b>	<b>\$112,500.00</b>	<b>\$29,959.21</b>	<b>27%</b>	<b>\$31,901.35</b>	<b>28%</b>
Business Prescriptive	\$36,394.77	\$0.00	0%	\$0.00	0%
Business HTR	\$8,850.07	\$0.00	0%	\$0.00	0%
Business Custom	\$32,269.34	\$0.00	0%	\$0.00	0%
Business Grid	\$3,084.47	\$0.00	0%	\$0.00	0%
Residential Incentives	\$27,812.64	\$27,812.64	100%	\$27,812.64	100%
Residential HTR	\$4,088.71	\$2,146.57	53%	\$4,088.71	100%
<b>Grid Services Ready</b>	<b>\$37,500.00</b>	<b>\$37,500.00</b>	<b>100%</b>	<b>\$37,500.00</b>	<b>100%</b>
<b>Demand Flexibility</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>N/A</b>	<b>\$0.00</b>	<b>N/A</b>
<b>GHG Reductions (Tons)</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>N/A</b>	<b>\$0.00</b>	<b>N/A</b>
<b>GHG Reductions (Barrels of Oil)</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>N/A</b>	<b>\$0.00</b>	<b>N/A</b>
<b>Total</b>	<b>\$525,000.00</b>	<b>\$197,400.63</b>	<b>38%</b>	<b>\$207,675.82</b>	<b>40%</b>

## Non-CET Performance and Awards Tables

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

- Table A-6 Accessibility & Affordability Verified Performance

\* Note: By achieving the Island Equity goal, the City and County of Honolulu will naturally fall below the target.

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

### Affordability & Accessibility

Table A-6 Accessibility & Affordability Verified Performance

Key Focus Area	Target Performance	Claimed Performance	Verified Performance
<b>Economically Disadvantaged</b>			
Business A&A Customers Served	550	403	73%
Business A&A Bill Savings	\$1,755,940	\$814,771	46%
Residential A&A Customers Served	1,800	1,820	101%
Residential A&A Bill Savings	\$2,631,891	\$2,490,255	95%
Community-Based Energy Efficiency	4	4	100%
<b>Island Equity</b>			
County of Hawaii	13%	13%	100%
County of Maui	8%	10%	125%
City & County of Honolulu	84.0%	77.5%	92%

\* Note: By achieving the Island Equity goal, the City and County of Honolulu will naturally fall below the target.

Table A-7 Accessibility & Affordability Verified Awards

Key Focus Area	Target Award	Claimed Award	Verified Award
<b>Economically Disadvantaged</b>			
Business A&A Customers Served	\$15,000	\$0	0%
Business A&A Bill Savings	\$15,000	\$0	0%
Residential A&A Customers Served	\$15,000	\$15,000	100%
Residential A&A Bill Savings	\$15,000	\$0	0%
Community-Based Energy Efficiency	\$15,000	\$15,000	100%
<b>Island Equity</b>			
County of Hawaii	\$75,000	\$75,000	100%
County of Maui			
City & County of Honolulu			

<b>Total</b>	<b>\$150,000</b>	<b>\$105,000</b>	<b>70%</b>	<b>\$120,000</b>	<b>80%</b>
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### Market Transformation & Economic Development

Table A-8 Market Transformation & Economic Development Verified Performance

Key Focus Area	Target Performance	Claimed Performance	Verified Performance
<b>Behavior Change</b>			
STEM-based Student Workshops	1,200	1,658 138%	1,821 152%
Adult Learning	2,500	2,620 105%	2,855 114%
Gamification Campaigns and Competitions	700	758 108%	758 108%
<b>Professional Development &amp; Technical Training</b>			
Clean Energy Ally Support, Targeted Ally Training, Targeted Participant Training, Educator Training and Grants, Degree Program Support, Vocational Training	7,000	8,193 117%	7,912 113%
<b>Codes and Standards</b>			
Appliance Standards Advocacy	7	59 843%	59 843%
Improve Code Compliance	1	1 100%	1 100%
Code-related Training	150	150 100%	354 236%
<b>Clean Energy Innovation Hub</b>			
Innovation and Emerging Technologies	1	2 200%	2 200%
<b>Outcome Metrics</b>			
High-efficiency Equipment Adoption	5% increase	Not Met 0%	Not Met 0%

Table A-9 Market Transformation & Economic Development Verified Awards

Key Focus Area	Target Award	Claimed Award	Verified Award
<b>Behavior Change</b>			
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
<b>Professional Development &amp; Technical Training</b>			
Clean Energy Ally Support, Targeted Ally Training Opportunities, Targeted Participant Training Opportunities, Educator Training and Grants, Degree Program Support, Vocational Training	\$37,500	\$37,500 100%	\$37,500 100%
<b>Codes and Standards</b>			
Appliance Standards Advocacy	\$7,500	\$7,500 100%	\$7,500 100%
Improve Code Compliance			
Code-related Training			
<b>Clean Energy Innovation Hub</b>			
Innovation and Emerging Technologies	\$0	\$0 N/A	\$0 N/A

<b>Outcome Metrics</b>					
High-efficiency Equipment Adoption	\$0	\$0	N/A	\$0	N/A
<b>Total</b>	<b>\$60,000</b>	<b>\$60,000</b>	<b>100%</b>	<b>\$60,000</b>	<b>100%</b>

## Customer Satisfaction

Table A-10 Customer Satisfaction Verified Performance

Key Focus Area	Target Performance	Claimed Performance		Verified Performance	
<b>Application Processing Custom Experience</b>					
Commercial	> 9.0	9.70	108%	9.38	104%
Residential	> 9.0	9.50	106%	9.60	107%

Table A-11 Customer Satisfaction Verified Awards

Key Focus Area	Target Award	Claimed Award		Verified Award	
<b>Application Processing Custom Experience</b>					
Commercial	\$7,500	\$7,500	100%	\$7,500	100%
Residential	\$7,500	\$7,500	100%	\$7,500	100%
<b>Total</b>	<b>\$15,000</b>	<b>\$15,000</b>	<b>100%</b>	<b>\$15,000</b>	<b>100%</b>

## B | Historical Verification Recommendations

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

Table B-1 Verification Recommendations

Recommendations	PY17	PY18	PY19	PY20	PY21	PY22	PY23	Comments
Collect invoices (or an equivalent form of documentation) for all measures and projects before paying out incentives.		X	X	X	X	X	X	ICF saw improvement over PY22, particularly for custom projects, but a couple of custom projects were submitted without invoices or an equivalent form of documentation.

## C | Low-to-Moderate Income Performance Incentive Mechanisms

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

Table C-1 LMI PIM Inputs

Cell Ref.	Description	Value	Source
[a]	Total RHTR budget (incentives + non-incentives)	\$3,972,812	Hawai'i Energy provided to ICF by email (not publicly available)
[b]	Target RHTR energy savings	3,934,161	PY23 Performance Metrics Achievement Table_09.09.24_(submitted) rev2.xlsx (not publicly available)
[c]	Total verified kWh savings	4,164,588	PY23 Verification Report ( <b>Error! Reference source not found.</b> )
[d]	Target RHTR demand reductions	533	PY23 Performance Metrics Achievement Table_09.09.24_(submitted) rev2.xlsx (not publicly available)
[e]	Total verified kW savings	492.65	PY23 Verification Report ( <b>Error! Reference source not found.</b> )
[f]	Target RHTR TRBs	\$5,924,927	PY23 Performance Metrics Achievement Table_09.09.24_(submitted) rev2.xlsx (not publicly available)
[g]	Target residential A&A customers served	1,800	PY23 Performance Metrics Achievement Table_09.09.24_(submitted) rev2.xlsx (not publicly available)
[h]	Target residential A&A customer bill savings	\$2,631,891	PY23 Performance Metrics Achievement Table_09.09.24_(submitted) rev2.xlsx (not publicly available)
[i]	Weighted EUL for residential A&A	10.28	PY23 Verification Report (see text below this table)
[j]	Total verified participation	1,820	PY23 Verification Report (Figure 3-1)

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

Among residential A&A projects within RHTR, ICF verified annual savings of 818,288 kWh and lifetime savings of 8,412,167 kWh, resulting in a weighted EUL of 10.28 years. Table C-2 presents the calculation of the LMI PIM as it is described in Decision and Order 37787.

Table C-2 LMI PIM Calculations

Cell Ref	Description	Value
[a]	Total RHTR costs (incentives + non-incentives)	\$3,972,812
[b]	Target RHTR energy savings	3,934,161
[c]	Total Verified kWh Savings	4,164,588
[d]	Target RHTR demand reduction	533
[e]	Total Verified kW Savings	492.65
[f]	Target RHTR TRBs	\$5,924,927
[g]	Target residential A&A customers served	1,800
[h]	Target residential A&A customer bill savings	\$2,631,891
[i]	Weighted EUL for residential A&A	10.28
[j]	Total Verified Participation	1,820
Line #	Description	Value

[L1] = [b]	Target RHTR energy savings	3,934,161
[L2] = [a] x 85%	RHTR total budget (85% to energy)	\$3,376,890
[L3] = [f] x 85%	Target RHTR TRBs (85% to energy)	\$5,036,188
[L4] = ([L3]-[L2])/[L1]	Net utility system benefit per kWh	\$0.42
[L5] = [L4] x 0.5	Net benefit share to Companies	\$0.21
[L6] = ([c]-[L1]) x [L5]	<b>Total Energy Savings Award</b>	<b>\$48,593.09</b>

[L7] = [d]	Target RHTR demand reduction	533
[L8] = [a] x 15%	RHTR total budget (15% to demand)	\$595,922
[L9] = [f] x 15%	Target RHTR TRBs (15% to demand)	\$888,739
[L10] = ([L9]-[L8])/[L7]	Net utility system benefit per kWh	\$549.56
[L11] = [L10] x 0.5	Net benefit share to Companies	\$274.78
[L12] = ([e]-[L7]) x [L11]	<b>Total Demand Reductions Savings Award</b>	<b>\$0.00</b>

[L13] = [g]	Target residential A&A customers served	1,800
[L14] = [h]	Target residential A&A customer bill savings	\$256,016
[L15] = [L14]/[L13]	First-year bill savings per target customers served	\$142.23
[L16] = [L15] x 0.5	Net benefit share to Companies	\$71.12
[L17] = ([j]-[L13]) x [L16]	<b>Participation Award</b>	<b>\$1,422.31</b>

[L18] = [L6] + [L12] + [L17]	<b>Total Award</b>	<b>\$50,015.40</b>
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ICF and the EEM determined that (1) the Total Energy Savings Award [L6], Total Demand Reductions Savings Award [L12], and Participation Award [L17] exist independently of one another, and (2) Hawai'i Energy cannot incur negative awards. As such, ICF converted the negative award amounts shown above to zero prior to calculating the Total Award [L18], and the sum of the three awards reflects only the positive amount awarded for participation (\$50,015.40).

## D | Detailed Methodologies

Consistent with prior verifications, ICF divided verification activities into two groups: CET and non-CET.

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

- **Deemed (Prescriptive) and Semi-Prescriptive.** Deemed measures should follow the algorithms and assumptions prescribed by the Hawai'i Energy PY23 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 Energy Efficiency Measures programs (REEM and BEEM), Energy Services and Maintenance programs (RESM and BESM), and Hard-to-Reach programs (RHTR and BHTR) include measures with deemed and semi-prescriptive savings.
- **Custom.** The PY23 TRM does not include stipulated savings for custom measures or projects. Savings estimates for these measures should follow the industry best practices outlined in documentation such as the Uniform Methods Project (UMP) and International Performance Measurement and Verification Protocol (IPMVP). Only the Custom Energy Efficiency Measures programs (CREEM and CBEEM) include projects with custom savings. We also expect some custom projects to have prescriptive components.

Table D-1 summarizes by task and program the activities explicitly designed to verify CET first-year energy savings, lifetime energy savings, and peak demand reductions. ICF also verified other metrics, including TRBs, Grid Services Ready projects, and GHG emissions.

Table D-1 Clean Energy Technologies Verified Performance

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

**Non-CET verification activities** were designed to verify the remaining 30% of Hawai'i Energy's performance awards. 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. Such activities included:

- Program documentation collection and review,

- Verification of A&A metrics,
- Verification of MTED metrics, and
- Verification of Customer Satisfaction metrics.

In addition, ICF also verified the calculation of HECO's LMI 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

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

- Mireya Norman, Deputy Director; oversees operations, including residential and transformational programs
- Eileen Stewart, Business Solutions Manager; oversees business programs
- Vinh-Phong Ngo, Technical Services Engineering Manager; oversees technical services, including TRM
- Karen Shishido, Market Transformational Program Manager; manages transformational programs within MTED

### Tracking Systems Audit

Before conducting the CET verification activities, ICF reviewed Hawai'i Energy's program-tracking database. This audit covered the population of projects and CET customers participating in the PY23 portfolio of programs.

ICF reviewed the PY23 program tracking database in two steps:

1. ICF conducted a preliminary review of completed projects and served as the basis for developing sample plan for desk reviews and on-site visits. ICF staff downloaded project documentation as needed from Salesforce, an online repository where Hawai'i Energy tracks and stores data for each opportunity and project.
2. ICF received the final reconciled PY23 tracking system data. This database contained finalized project data, which ICF used to verify all CET performance and some non-CET performance.

### Sample Plan

The final sample design was designed based on Hawai'i Energy's final tracking database. The database includes equipment and rebate-level savings and TRM inputs for replication, plus incentive amounts, customer bill savings, 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 at the meter (i.e., for each customer); they do not account for line losses or NTG.

- **System Level:** Gross savings at the generator; they apply line losses to customer-level savings.
- **Program Level:** Net savings that account for free-ridership and spillover; they apply NTG ratios to system-level savings.

ICF focused the sample design on customer-level savings. Line losses and NTG ratios are fixed across customers within each island or program and do not add variance to program-level savings and would not affect a sample design.

### Population Customer Savings

Table D-2 shows the verification activities performed for each program and is sorted descending by claimed customer-level first-year energy savings. Like PY23, REEM and BEEM contribute the most savings to Hawai'i Energy's claimed performance.

Table D-2 Population Claimed Customer-Level Energy Savings and Demand Reductions

Program	Verification Activities	Annual kWh	Peak kW	Lifetime kWh
BEEM	Database Replication; Simple Desk Reviews	31,903,179 (36%)	4,151 (35%)	376,625,024 (35%)
REEM	Database Replication; Simple Desk Reviews	22,169,512 (25%)	2,677 (23%)	305,800,327 (29%)
CBEEM	Complex Desk Reviews; On-site Visits	14,047,827 (16%)	1,741 (15%)	196,752,065 (18%)
RESM	Database Replication; Simple Desk Reviews	10,339,864 (12%)	1,953 (16%)	74,459,478 (7%)
BHTR	Database Replication; Simple Desk Reviews; Complex Desk Reviews	5,159,149 (6%)	403 (3%)	58,477,765 (5%)
RHTR	Database Replication; Simple Desk Reviews	3,550,597 (4%)	421 (4%)	38,607,029 (4%)
BESM	Database Replication	1,307,660 (1%)	163 (1%)	9,605,376 (1%)
BGRID	N/A	433,408 (0.5%)	349 (3%)	3,971,540 (0.4%)
CREEM	Database Replication	72,237 (0.1%)	9 (0.1%)	1,162,625 (0.1%)
RGRID	N/A	0 (0%)	0 (0%)	0 (0%)
<b>Total</b>		<b>88,983,433</b>	<b>11,866</b>	<b>1,065,461,229</b>

### Sample Design

To maximize the efficiency of the budgeted number of desk reviews and on-sites, ICF designed the sample to focus on the three programs with the largest contribution to savings (REEM, BEEM, and CBEEM), while also reviewing a small sample of projects for the smaller programs (RHTR, BHTR, and RESM). ICF designed the sample to verify savings with  $\pm 10\%$  relative precision at the 90% confidence level for REEM, BEEM, and CBEEM. The samples for RHTR, BHTR, and RESM represent a less-rigorous check of savings estimation and approaches with a target of  $\pm 20\%$  precision at 80% confidence.<sup>24</sup>

<sup>24</sup> Consistent with PY20, we did not perform desk reviews for Upstream and Midstream REEM components. In addition, some components of BESM and BHTR were not sampled due to the low overall contribution of savings. Note that savings are no longer being claimed for the Peer Comparison program, which was ended partway through PY20.

ICF stratified the population of projects by program, delivery stream, and major equipment/service type. Table D-3 shows how ICF allocated the sample points to each program and stratum using Neyman’s Allocation. Widely used in industry, Neyman’s Allocation<sup>25</sup> 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 is optimized for all three types of savings.

Table D-3 Sample Stratification

Program	Stratum	Type of Review	Unique Projects	Customer-Level First-Year Savings (kWh)	Sampled Projects	
<b>Sampled Strata</b>			<b>17,569</b>	<b>53,260,648</b>	<b>60%</b>	<b>155</b>
BEEM	Downstream	Simple	610	13,721,705	15%	26
	Submetering	Simple	14	13,479,335	15%	4
	<i>BEEM Total</i>			624	27,201,040	31%
BHTR	Downstream	Simple	338	1,207,207	1%	8
	Energy Advantage	Simple	268	2,718,216	3%	16
	ES4H	Simple	37	178,043	0.2%	2
	Whole Building Assistance	Simple	27	9,157	0.0%	2
	<i>BHTR Total</i>			670	4,112,622	5%
CBEEM	Custom	Complex (15); On-site + Complex (30)	98	5,501,161	6%	45
REEM	Downstream	Simple	7,105	10,419,630	12%	30
RESM	Whole Building Assistance	Simple	5,771	2,496,030	3%	8
RHTR	Custom	Simple	36	363,764	0.4%	2
	Downstream	Simple	2,208	2,524,189	3%	8
	ES4H	Simple	77	290,169	0.3%	2
	Whole Building Assistance	Simple	980	352,042	0.4%	2
	<i>RHTR Total</i>			3,301	3,530,165	4%
<b>Non-Sampled Strata</b>			<b>1,789</b>	<b>35,722,786</b>	<b>40%</b>	<b>0</b>
BEEM	Midstream	None	168	4,702,139	5%	0
BGRID	Grid Services	None	3	433,408	0.5%	0
BHTR	Grid Services	None	31	913,768	1%	0
	Midstream CKE	None	55	132,759	0.1%	0
	<i>BHTR Total</i>			86	1,046,527	0.1%
CBEEM	Custom	None	32	8,517,158	10%	0
CREEM	Custom	None	2	72,237	0.1%	0

<sup>25</sup> Available Online: <https://www.nrel.gov/docs/fy17osti/68567.pdf>

Program	Stratum	Type of Review	Unique Projects	Customer-Level First-Year Savings (kWh)		Sampled Projects	
REEM	Upstream	None		497	5,837,781	7%	0
	Midstream	None		641	5,912,101	7%	0
	<i>REEM Total</i>			<i>1,138</i>	<i>11,749,882</i>	<i>13%</i>	<i>0</i>
RESM	Whole Building Assistance	None	1	7,843,834	9%		0
<b>Total</b>			<b>19,358</b>	<b>88,983,433</b>	<b>100%</b>		<b>155</b>

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

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

ICF calculated the expected precision (at 90% confidence) for each program and type of desk review, in Table D-4 below. In addition to the sample sizes, the assumed error ratios<sup>26</sup> primarily drive the expected precision within each stratum. Error ratios provide a metric of variability around the realization rates that we can expect. For nearly all strata, ICF assumed an error ratio of 0.5, which we consider conservative. For CBEEM Lighting and Non-Lighting, we assumed error ratios of 0.6 and 0.8, respectively.

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<sup>26</sup> An error ratio is a measure of variability around a ratio estimator, i.e., the verification realization rates. When the claimed and verified savings for the sample projects are closely aligned (i.e., near-100% realization rates), the error ratio is close to zero. If they are not well-aligned, then the claimed savings tell us less about what the verified savings are for projects that we did not directly observe through the sample, and error ratios will be higher (e.g., near 1.0).

Table D-4 Expected Precision from Desk Review by Program

Program	Type of Desk Review	# Unique Projects	Customer-Level First-Year Savings (kWh)		Desk Review Sample Size	Expected Precision
<b>Sampled Strata</b>		<b>17,569</b>	<b>53,260,648</b>	<b>60%</b>	<b>155</b>	<b>±3.2%</b>
BEEM	Simple	624	27,201,040	31%	30	±10.6%
BHTR	Simple	670	4,112,622	5%	28	±11.3%
CBEEM	Complex	98	5,501,161	6%	15	±21.0%
REEM	Simple	7,105	10,419,630	12%	30	±11.7%
RESM	Simple	5,771	2,496,030	3%	8	±22.7%
RHTR	Simple	3,301	3,530,165	4%	14	±16.1%
<b>Non-Sampled Strata</b>		<b>1,789</b>	<b>35,722,786</b>	<b>40%</b>	<b>0</b>	<b>±0.0%</b>
BEEM	None	168	4,702,139	5%	0	±0.0%
BGRID	None	3	433,408	0.5%	0	±0.0%
BHTR	None	86	1,046,527	0.1%	0	±0.0%
CBEEM	None	32	8,517,158	10%	0	±0.0%
CREEM	None	2	72,237	0.1%	0	±0.0%
REEM	None	1,138	11,749,882	13%	0	±0.0%
RESM	None	1	7,843,834	9%	0	±0.0%
<b>Total</b>		<b>19,358</b>	<b>88,983,433</b>	<b>100%</b>	<b>125</b>	<b>±1.9%</b>

In Table D-5, we compare the current sample design to the planned design included in the PY23 Verification Workplan, which was based mainly on previous verification sample designs. We underlined changes for ease of identification. ICF made the following updates to the planned design:

- ICF created a new stratum within BEEM for submetering projects and allocated four of BEEM’s 30 sample points to the BEEM Submetering stratum, leaving 26 sample points for the BEEM Downstream stratum. Fourteen submetering projects comprised 15% of all customer-level first-year energy savings in PY23.
- ICF conducted complex desk reviews for four CBEEM projects for which the verification team (ICF and RHA Energy Partners) planned but was unable to conduct on-site visits. ICF included the results of these four additional completed CBEEM complex desk reviews with the original 15 CBEEM complex desk reviews.

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

Program	Type of Desk Review	Customer-Level First-Year Savings		Actual Sample Sizes	Planned Sample Sizes
		kWh	Percentage		
BEEM	Simple	13,910,820	16%	30	30
BHTR	Simple	10,536	< 0.1%	28	28
CBEEM	Complex + site visit	10,023,038	11%	49 total (19 desk reviews, 30 site visits)	45 total (15 desk reviews, 30 site visits)
REEM	Simple	39,436	< 0.1%	30	30
RESM	Simple	3,285	< 0.1%	8	8
RHTR	Simple	22,063	< 0.1%	14	14
<b>Total</b>		<b>24,293,646</b>	<b>27%</b>	<b>159</b>	<b>155</b>

## CET Activities

### Savings Replication

ICF replicated Hawai'i Energy's claimed performance by using TRM algorithms to calculate energy savings, demand reductions, and TRBs for all deemed and semi-prescriptive measures in the tracking system. We compared the replicated values to those that Hawai'i Energy claimed in the tracking database to identify systematic and isolated errors from incorrect inputs and algorithm implementation.

ICF continued to use the tool that it developed during the PY20 verification to automate the replication process. We updated the tool to include all PY23 measures and comply with the Hawai'i Energy TRM in effect at the time of the measure installations (PY23 v2.0).

### Desk Reviews

ICF 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 (such as applications, participant terms and agreements, project calculators, product cutsheets, invoices, and post-installation inspection reports) and savings calculations to assess the alignment between project documentation and inputs in the tracking system and confirm the accuracy and reasonableness of the input data and project savings.

ICF 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 TRM algorithms as an explicit verification task,<sup>27</sup> and we only determined whether Hawai'i Energy correctly used the algorithms in the TRM and applied appropriate factors when calculating the claimed savings.

<sup>27</sup> We did, however, identify an error in the calculated savings for commercial ice machines. See *CET Performance Adjustments: TRM Adjustments* in Chapter 2 for discussion.

- **Complex Desk Reviews.** For custom projects sampled for desk reviews, ICF assessed the reasonableness of savings calculation methods and their adherence to 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.

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

### On-Site Visits

Best-practice verification methods include physical assessments of a sample of individual CBEEM projects through on-site visits. On-site verifications enabled ICF to provide more accurate and meaningful verification findings to Hawai'i Energy, the EEM, and the Commission. ICF identified the following primary goals of on-site visits for the PY23 verification:

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

### Data Collection Plans

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

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

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

### Participant Contact and Appointment

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

- Initial contact was made by Hawai'i Energy to introduce RHA (or, in one instance, ICF) and alert the participant that they have been selected for a study. At this time Hawai'i Energy also screened the sample for particularly sensitive customers. RHA and ICF staff took extra care when contacting sensitive customers.
- RHA and ICF staff then followed up via phone and/or email to schedule the in-person verification activities. We followed up with participants a maximum of three times and included additional coordination with Hawai'i Energy if needed.

### *Safety and Training*

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

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

- Follow established rules and signage indicating safe and unsafe areas for entry, stepping, etc.
- Dress appropriately: long pants, closed-toe shoes or boots, and a badge.
- Prep survey tools: charge tablets and phones; bring customer information sheet, survey spreadsheet, and printout of survey as back-up.
- Bring PPE: hard hat, safety glasses, earplugs, and gloves. An unlikely but possible requirement is steel-toe boots.

**Training.** ICF and RHA followed internal training for all on-site visits, covering the following key topics:

- Overview of verification
- Pre-visit preparation
- Data collection and templates
- Beginning the visit
- Walk-through of the facility
- Ending the visit
- After the visit
- Logistics, safety, and other considerations
- Customer concerns
- Special cases

### **Non-CET Activities**

The non-CET metrics focus on three key areas:

- A&A performance goals encourage program services and benefits to be equitably allocated across eligible geographies and underserved demographics
- MTED performance goals set minimum standards for identifying and overcoming market barriers through education and outreach

- Customer Satisfaction metrics require ongoing proof of satisfaction of residential and business PBFA program participants

We verified the extent to which Hawai'i Energy met key performance indicator targets in each of these areas. ICF also calculated HECO's LMI PIM awards.

### Program Documentation Request and Achievement Verification

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

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

### Accessibility and Affordability (A&A)

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

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

- Energy Advantage
- Energy Relief Grant
- Single- and multi-family direct-install
- Water heaters direct-install
- Bulk appliance purchases
- CBEE

As part of its verification, ICF confirmed:

- The number of hard-to-reach small business and residential customers served by direct-install initiatives using the tracking database
- Business first-year customer bill savings and residential lifetime customer bill savings using verified energy savings and monthly HECO effective retail rate schedules
- Communities engaged in CBEE through a high-level review of project documentation

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

### *Market Transformation and Economic Development (MTED)*

The PBFA performance indicators for MTED efforts fall into one of five groups:

1. Behavior Change
2. Professional Development & Technical Training
3. Codes and Standards
4. Clean Energy Innovation Hub
5. Outcome Metrics

Performance targets are based on the number of participant hours, the number of participants attending, and the number of events. ICF verified achievements by reviewing event, presentation, and workshop sign-up sheets/attendance spreadsheets; advocacy spreadsheets and documentation; and other documents that substantiated non-CET achievements.

### *Customer Satisfaction*

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

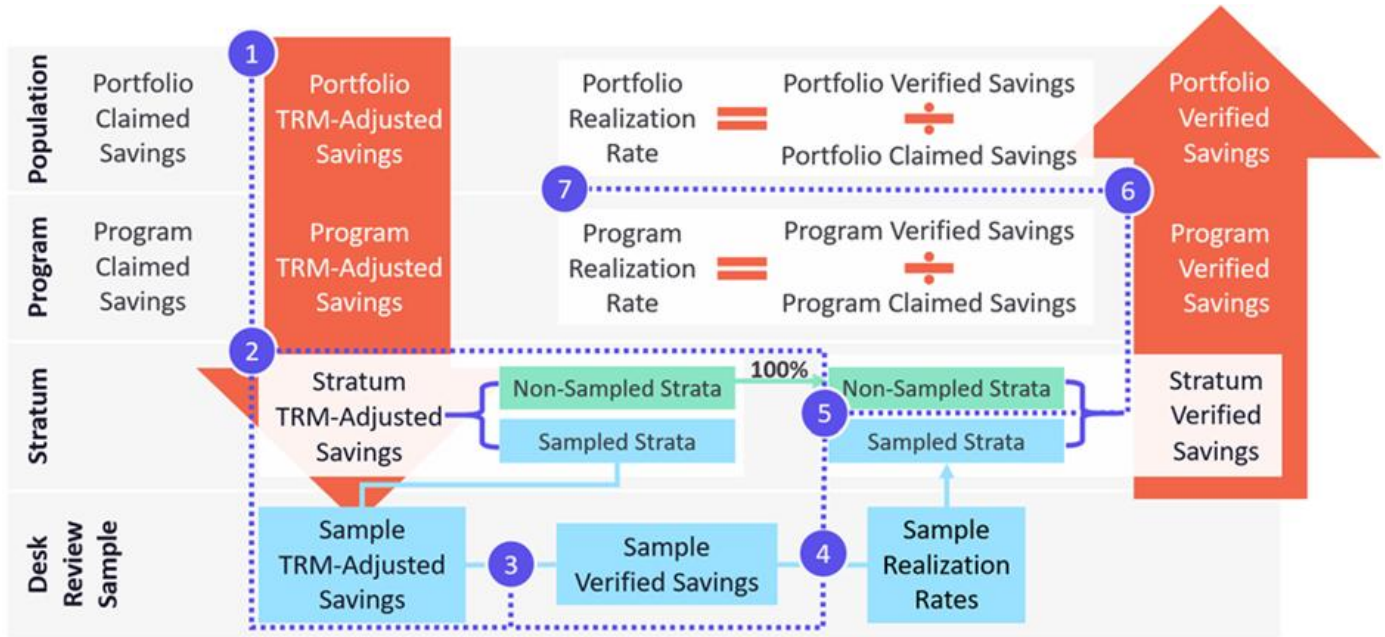
### *Low-to-Moderate Income Performance Incentive Mechanisms (LMI PIM)*

ICF calculated the LMI PIM incentive associated with the RHTR and A&A programs implemented by Hawai'i Energy using results from the verification. See [Appendix C](#) for details and results.

## E | Sample Design and Extrapolation

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

Figure E-1 Stratification Approach



1. **Calculate TRM-adjusted claimed savings.** ICF completed its audit of the tracking system and recalculated the claimed savings ( $X$ ) with any adjustments. In Figure E-1, we refer to these as “portfolio TRM-adjusted savings” ( $X^*$ ). For custom projects not included in the tracking system audit, ICF used the claimed savings as the TRM-adjusted savings. We provide TRM-adjusted savings at the program and portfolio levels in the *TRM Adjustments* subsection in Chapter 2.
2. **Stratify program savings.** ICF stratified the population of savings by program and major measure category. In addition, some programs 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 program project populations. We refer to these as “stratum TRM-adjusted savings” ( $\hat{X}_{hm}^*$ ).
3. **Verify sampled project savings.** ICF 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  $m$ , ICF estimated the “sample realization rate” ( $\hat{r}_{hm}$ ) as the sum of the “sample-verified savings” ( $\hat{y}_{hm}$ ) divided by the sum of the “sample TRM-adjusted savings” ( $\hat{x}_{hm}^*$ ).
  - a. For programs and strata where ICF did not conduct desk reviews, savings are set equal to the TRM-adjusted savings.

- b. Sample realization rates are incremental to changes made to the population of claimed savings during the tracking database audit (i.e., sample realization rates do 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 the "stratum TRM-adjusted savings" ( $\hat{X}^*_{hm}$ ).
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, the "program verified savings" equal the "stratum verified savings." Similarly, we calculated "portfolio verified savings" ( $\hat{Y}_p$ ) as the sum of "program verified savings."
7. **Estimate program and portfolio realization rates.** To estimate the weighted "program realization rate" for each program, ICF 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" ( $\hat{Y}_p$ ) divided by the "portfolio claimed savings" ( $\hat{X}_p$ ). Program and portfolio realization rates incorporate all TRM adjustments and extrapolated desk review results.

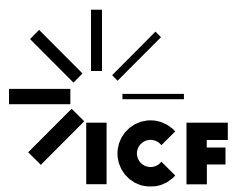
## F | Conformance with Custom Project Guidance Document

ICF reviewed CBEEM projects sampled for complex desk reviews and site visits to determine if they complied with key elements outlined in the CPGD. In PY23, Hawai'i Energy continued to improve in its adherence to the CPGD. As shown in Table F-1, most projects captured provided information and data critical to confirming project completion and verifying savings. Most also complied with industry best practices for calculating savings. That said, some issues persisted from previous program years. Some projects lacked key project dates (e.g., installation or completion), equipment specifications, project equipment costs (i.e., invoiced costs rather than estimated costs provided on application forms), labor costs, and/or proof of installation. These fundamental elements of documentation provide basic assurance that measures were purchased and installed and that rebated projects were completed when and as planned.

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

Key Documentation Element	Detail	% of Compliant Projects
General customer information	Customer Name	100%
	Facility Type	100%
	Street Address	100%
Industry best practice savings calculations were used for the IPMVP option	Annual kW	100%
	Annual kWh	100%
	Lifetime kWh	96%*
Appropriate equipment specifications were collected and documented		100%
Able to reproduce savings		97%*
Proof of installation through an invoice, post-inspection report, or other qualifying document		95%
Justification for early retirement		94%
Appropriate data was collected for the measure and the IPMVP option		93%
Appropriate description of the project and baseline conditions	Baseline Conditions	93%
	Project/Measure Type	92%
Proof of key implementation dates (purchase, completion, rebate processing) tracked with qualifying documentation		85%
Project costs collected through an invoice, purchase order, or other qualifying document		85%

\* As described in *Business Custom Adjustments* (Chapter 2), Hawai'i Energy's custom lighting savings workbook miscalculates lifetime energy savings under certain circumstances. This is an arithmetic error and not an issue with using industry best practices or TRM-prescribed methodologies. ICF can replicate the incorrect savings and has provided recommendations for remedying this problem.



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