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## ***MEMORANDUM***

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November 15, 2013

**To:** Chris Ann Dickerson, Jim Flanagan

**Re:** Verification of Hawaii Energy Program Year 2012 Programs

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Evergreen Economics is currently under contract with the Hawaii Public Utilities Commission (Commission) to conduct a comprehensive multi-year evaluation of the Hawaii Energy Conservation and Efficiency (Hawaii Energy) Program<sup>1</sup>. The program is implemented by an independent third-party, SAIC<sup>2</sup>, serving as the “Public Benefits Fee Administrator (PBFA)” under contract to the Commission. This memorandum provides the results of validation and verification activities that the Evergreen team conducted as part of the evaluation on energy efficiency programs implemented by Hawaii Energy for Program Year 2012.

### **1. Introduction**

One component of the Program Year 2012 evaluation was to estimate energy savings (electricity only) by measuring and verifying the program’s energy savings claims. Our research to estimate the energy savings included:

- Technical Reference Manual (TRM) review;
- Savings database validation; and
- Measure installation verification.

This memorandum presents the results of the last two activities to estimate energy savings: the savings database validation and the measure verification. These two activities are typically performed as one component of a larger program impact evaluation. They are generally referred to as “verification” activities. They are intended to:

- Validate that the summary of program accomplishments from the Annual Report matches the program tracking database;

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<sup>1</sup> [www.hawaiienergy.com](http://www.hawaiienergy.com)

<sup>2</sup> SAIC recently changed their name to Leidos, however we will retain the use of SAIC in this verification memo covering Program Year 2012 which was implemented while the firm operated under the name SAIC.



- Confirm that the program is claiming savings based on the most recently approved values in the current Program Year 2012 TRM;
- Verify that the program installed the measures for which savings were claimed;
- Determine that the installed measures are program-qualifying; and
- Verify savings for custom measures using engineering analyses.

These verification activities are distinguished from “measurement” activities that are intended to measure the energy savings from the program such as through equipment metering or analysis of changes in electricity bills and from analyzing the savings values approved for use in the TRM. These evaluation efforts are conducted on different schedules, apart from the verification activities described herein.

The combination of the results from these two verification activities, the **savings database validation** and the **measure verification**, comprises the **overall verification results** that are presented in this memorandum.

## 1.1 Background

The Hawaii Energy Program is operated by SAIC, the independent third-party contractor serving as the PBFA under contract to the Hawaii Public Utilities Commission. The Program Year 2012 Hawaii Energy portfolio, which ran from July 1, 2012 through June 30, 2013, consisted of eight programs, with four programs targeting the business sector and four targeting the residential sector.<sup>3</sup>

- **Business Energy Efficiency Measures (BEEM).** Provided prescriptive incentives to business customers who purchased and installed energy efficiency measures. The program paid incentive rebates for lighting, air conditioning, motors, water heating, water pumping, building envelope improvements, energy awareness, measurement and control systems, and ENERGY STAR business equipment.
- **Custom Business Energy Efficiency Measures (CBEEM).** Provided custom financial incentives based on calculated savings to commercial, institutional, governmental, and industrial sector customers. Some examples of custom technologies include, but are not limited to, energy management systems, exhaust ventilation control systems, high performance lighting, low emissivity glass and HVAC controls.
- **Business Service and Maintenance (BESM).** Provided incentives and direct installation of measures to businesses in addition to business design, audits, and commissioning to underserved sectors. This program also conducted a

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<sup>3</sup> Hawaii Energy Conservation and Efficiency Programs. *Annual Plan Program Year 2012*. Submitted by Hawaii Energy on July 12, 2012.



more aggressive outreach effort to lighting and electrical contractors by offering training, education, promotional materials, and frequent communications on program updates.

- **Business Hard to Reach (BHTR).** Provided equipment grants and direct install lighting measures targeted to traditionally underserved geographies and demographics such as restaurants.
- **Residential Energy Efficiency Measures (REEM).** Provided prescriptive incentives to residential customers who purchased and installed energy efficiency measures. These measures included high efficiency water heating, lighting, air conditioning, appliances, as well as awareness, measurement and control systems.
- **Custom Energy Solutions for the Home (CESH).** Intended to provide incentives with more flexibility within the prescriptive portfolio to accommodate unforeseen market opportunities. In Program Year 2012 no such proposals were made, but it is expected that the program will see activity in Program Year 2013.
- **Residential Energy Services and Maintenance (RESM).** Provided incentives to direct installations, design and audits, and HVAC system tune-ups.
- **Residential Hard to Reach (RHTR).** Provided equipment grants with a focus to secure projects within traditionally underserved demographics and geographies. The most notable included bringing the refrigerator exchange program, *Hui Up*, to Lanai and a major solar water heating grant.

SAIC also conducted various market transformation activities in Program Year 2012 designed to increase and further support projects that achieve energy reductions, demonstrate energy reduction capabilities, and/or provide on the job training for individuals within energy efficiency and energy conservation fields. No direct energy savings are claimed for these activities, and as such they are not included in the tables showing verified program savings throughout this memo. However, these market transformation activities were reviewed as part of the validation task as discussed in Section 3.1.

## 1.2 Overall Validation and Verification Results

The overall validation and verification results indicate that the program realized 102 percent of the energy savings claimed in the *SAIC Hawaii Energy Annual Report Program Year 2012* (Annual Report)<sup>4</sup>. There were cases where the program realized

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<sup>4</sup> Submitted to Hawaii Public Utilities Commission, September 1, 2013. Net savings reported at the measure level in Attachment B of the Annual Report. SAIC subsequently submitted a revised Performance Award Claim on November 12, 2013, which we've used for the verification of the award claim shown in Appendix C.



less savings than it claimed due to a variety of issues, but there were also cases where the program realized more savings than it claimed. The net effect was that the program realized slightly more savings than it claimed in the Annual Report. The results are presented in more detail in Section 3, including explanations for discrepancies between claimed and verified savings. Table 1 presents the overall verification results by program. The values shown in the table by column are:

- **Sector and Program**, which indicate the sector (residential or business) and the Hawaii Energy program;
- **Claimed First-Year Net<sup>5</sup> Savings** (kWh), which summarize the first-year energy savings claims from the Annual Report in kilowatt hours by program;
- **Verified First-Year Net Savings** (kWh), which summarize the overall verified energy savings by program, based on the combination of the savings validation and measure installation verification results; and
- **Percent Verified of Claimed Savings**, which presents the overall verified savings ratios by program, also reflecting the combination of the savings validation and measure installation verification results.

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<sup>5</sup> Net savings refer to the program-level savings reported by SAIC in their Annual Report and tracking data, which use a net-to-gross ratio of 0.73 across all programs and measures to account for free-ridership. For Program Year 2013 SAIC is adopting net-to-gross ratios that will vary by program as recommended by Evergreen in the Program Year 2011 Evaluation Report.

**Table 1. Program Year 2012 Claimed and Verified First-Year Energy Savings, by Sector and Program**

		First-Year Net Savings (kWh)		Percent Verified of Claimed Savings
Sector	Program	Claimed <sup>1</sup>	Verified	
Business				
	Business Energy Efficiency Measures	25,001,128	26,768,556	107%
	Business Services and Maintenance	3,550,072	4,419,583	124%
	Business Hard to Reach	996,266	1,233,749	124%
	Custom Business Energy Efficiency Measures	12,844,300	12,653,391	99%
	<b>Business Total</b>	<b>42,391,766</b>	<b>45,075,279</b>	<b>106%</b>
Residential				
	Residential Energy Efficiency Measures	69,826,376	69,708,924	100%
	Residential Energy Services and Maintenance	594,523	593,533	100%
	Residential Hard to Reach	386,136	402,232	104%
	<b>Residential Total</b>	<b>70,807,035</b>	<b>70,704,689</b>	<b>100%</b>
<b>Program Overall</b>		<b>113,198,801</b>	<b>115,779,968</b>	<b>102%</b>

1: Claimed program-level net savings reported by SAIC in *Hawaii Energy Annual Report Program Year 2012*.

## 2. Research Methods

### 2.1 Overview

As described above, this memorandum presents results from five research tasks that were intended to evaluate the program's energy savings claims:

1. **Savings database validation.** We obtained a database from SAIC including program participants and energy savings values for Program Year 2012 and summarized the savings claims by program (e.g., REEM) and energy efficiency measure (e.g., ceiling fans) and compared that to SAIC's program and measure-level summary of its savings claims in the Annual Report. We also compared per unit savings values against the approved ("deemed") values in the approved Program Year 2012 TRM.
2. **Measure verification.** We conducted telephone and site surveys with statistically representative samples of participants by program. We also conducted on-site surveys of prescriptive residential and business projects as well as business custom projects. These on-site surveys were conducted to verify that measures contained in the program tracking database were actually installed, program-qualifying, operational, and the correct savings inputs and calculations were being used. For business large projects and



custom measures, we conducted engineering analyses based on on-site surveys and desk reviews to confirm claimed savings.

3. **Residential Hard-to-Reach Verification.** As part of our overall program savings verification, we conducted additional verification on the Lanai *Hui Up* refrigerator trade-in and Advanced Power Strips (APS) distributed under the RHTR program. For Program Year 2012 this Residential Hard-to-Reach verification included a thorough review of program documentation and verification of the number of measures claimed versus what was shown in the hard copy documentation.
4. **Upstream Lighting Verification.** Evergreen also conducted a separate verification of the upstream CFLs and LED distributed through the REEM program. A sample of invoices and distribution documentation was requested from Hawaii Energy and checked against the final tracking database to verify the number of bulbs claimed.
5. **Condominium Submetering Verification.** Evergreen conducted a billing analysis of completed submetering projects as part of a measurement analysis that will be presented in the Program Year 2012 comprehensive evaluation report. The results of this billing analysis were used to inform the verification of savings for condominium submetering projects for Program Year 2012.

The combination of the results from these activities comprises the overall verification results that are presented below. The **savings database validation** provides a set of ratios by program and energy efficiency measure category that reflects the proportion of energy savings we validated in the program tracking database relative to the savings reported in Annual Report. The **measure verification** provides a second set of ratios, also by program and measure, that reflect the proportion of measures and their associated savings that we verified to be installed, program qualifying and with appropriate savings claims.

We multiplied the two sets of ratios to yield a final set of **overall verification and validation ratios** that are applied by program and measure to the values found in the Annual Report. The resulting savings are our independent assessment of the verified energy savings associated with Program Year 2012 operations.

## 2.2 Savings Database Validation

SAIC provided the evaluation team with the final data from its tracking system for the entire 2012 Program Year. We used the data to generate an independent estimate of claimed savings and compared our estimate to that reported in the Hawaii Energy 2012 Annual Report.



The validation exercise included summarizing the measure installation counts and total kWh savings in the final tracking database and comparison to the Annual Report.

Similarly, the per unit savings values used in the final tracking data were also checked against the TRM (for those measures included in the TRM) to ensure that the appropriate values from the TRM were being used for each measure and program. Finally, we validated net kW savings, and net Total Resource Benefit (TRB) results from the Annual Report by comparing the tracking data to the claimed values in the Annual Report. We developed validation ratios based on the fraction of the claimed kWh savings from the Annual Report that we validated in the program tracking data.

## **2.3 Measure Verification**

The measure verification research methods included fielding telephone and site surveys, reviewing program participation records, confirming savings inputs and calculations and conducting engineering analyses. Below we provide an overview of the approach to sampling, data collection, and analysis.

### **2.3.1 Sample Design**

We used program tracking data from the first three quarters of the Program Year 2012 as the basis for the first stage of the sample frame, from which we drew samples for the measure verification for all but business custom and large prescriptive projects. We used this subset of the full-year program tracking database because the verification results were due in the fall of 2013, requiring us to pull the majority of our research samples before the close of the program year. Our intent was that the samples drawn from the first three quarters and the subsequent research results would be representative of the full-year program, since the program design did not change in the fourth quarter.

SAIC provided Evergreen an extract of the program tracking database covering the first three quarters (Q1-Q3) on May 1, 2013. We used this dataset to develop samples for phone and on-site surveys, which we used to verify the REEM, BEEM, BESM, BHTR and CBEEM programs. Additional participant-level data was downloaded from the Salesforce database on August 1, 2013 to include a sample of quarter four (Q4) large and custom projects in our on-site surveys.

For the business programs, we supplemented the Q1-Q3 sample frame with large projects in the BEEM, BESM, and BHTR programs and all projects in the CBEEM program recorded in the tracking database in Q4 of the Program Year 2012. We worked closely with SAIC over the summer to collect additional detailed information to support the sampling approach. We conducted on-site surveys of a





selection of those projects, to ensure our sample included significant projects not already included in the sample frame based on the first three quarters.

Table 2 below compares the first-year net energy savings covered by the sample to the total savings claimed by the program. The first two columns indicate the sector and program, the third column the first-year net energy savings claims represented by the sample, the fourth column the first-year net energy savings claims represented by the full-year participation database, and the fifth and final column the fraction full-year energy savings that is represented by the sample.

The sample represents 39 percent of the full-year program savings. Appendix B provides more detail on our sampling approach.

**Table 2. Program Year 2012 Net Energy Savings for Measure Verification Sample as a Fraction of the Participant Population, by Sector and Program**

		First-Year Net Savings		Sample as a
		Total		% of Total
Sector	Program	Sample	Program Savings	Program Savings
Business				
	Business Energy Efficiency Measures	5,702,041	25,001,128	23%
	Business Services and Maintenance	281,889	3,550,072	8%
	Business Hard to Reach	13,501	996,266	1%
	Custom Business Energy Efficiency Measures	7,562,247	12,844,300	59%
	<b>Business Total</b>	13,559,678	42,391,766	32%
Residential				
	Residential Energy Efficiency Measures	30,891,584	69,826,376	44%
	Residential Energy Services and Maintenance	262	594,523	0%
	Residential Hard to Reach	106,282	386,136	28%
	<b>Residential Total</b>	30,998,128	70,807,035	44%
<b>Program Overall</b>		44,557,807	113,198,801	39%

### 2.3.2 Data Collection

The evaluation team implemented a variety of research methods to verify program measure installations and program qualifications. The research approach varied based on the type of customer.

Most of the program participants were “downstream” customers that resided in a residential home or operated a commercial, industrial, or government facility and received a rebate for program-qualifying equipment. Typically they mailed in a rebate application and were later mailed a check. The program also paid rebates directly to lighting manufacturers and distributors (“upstream” or “mid-stream” market actors) for compact fluorescent lamps (CFLs) and LEDs. The manufacturers and distributors then sold discounted product to lighting retailers. The retailers pass on that discount directly to customers who buy CFLs or LEDs and receive their





discount via a point-of-sale rebate that is redeemed instantly at the time of purchase.

Research methods used for the downstream customers included telephone surveys to confirm that customers received a rebate, bought program-qualifying equipment, and presently had the equipment installed and operational. Evergreen also conducted on-site surveys and reviewed project files to confirm savings for residential, business, and large and custom business projects. For Program Year 2012 the RHTR verification was conducted to ensure that measures were recorded correctly and that claimed quantities matched the quantities found on program documentation. For upstream CFLs and LEDs, we performed a verification of invoices and rebate documentation to ensure that the quantities claimed matched the database and the Annual Report and that a sample of measures were found to be program-qualifying.

The following is a brief description of the methods we used to verify measure installations and program qualifications.

- **Telephone surveys.** SMS, a Hawaii-based telephone survey research firm, conducted computer-assisted telephone interview (CATI) surveys for both residential and business customers in Summer 2013. The surveys included questions to verify that the customer had received a rebate for a program measure, installed the measure, and that the measure was still operable.

The telephone surveys were conducted with a sample of participants from REEM and small and medium projects from BEEM, BESM, BHTR, and CBEEM programs. For residential customers, to determine the allocation, we first constructed a proportional allocation of 350 sample points based on the percentage of energy savings of each measure/island combination. We then adjusted the target sample to ensure a minimum number of sample points by strata (geography and measure category) to arrive at the sample allocation. We increased the sample allocation for certain measure categories and Hawaii and Maui Counties to ensure adequate sample for islands other than Oahu.

The survey targeted 350 customers, addressing up to two measures per customer. For business customers, due to the small number of participants across all islands, no sample allocation was made. Instead, a census of all retained participants was pursued in an effort to complete the target number of 100 surveys. Since the survey addressed up to two measures for participants who installed more than one measure, the number of completed surveys at the measure level was expected to exceed 100. SMS completed

343 residential surveys covering 367 measures and 100 business surveys covering 111 measures.<sup>6</sup>

- **Customer on-site surveys and document reviews.** Evergreen conducted on-site surveys on a nested sample of small and medium business projects in the BEEM, BESM, and CBEEM programs. We also conducted a sample of on-site surveys of measures installed in business locations for CBEEM and large BEEM projects. Michaels Energy based in Wisconsin conducted the on-site surveys to verify that the measures were installed, that they qualified for the program, and were operational.

The large business prescriptive on-site sample was generated by taking a random stratified sample based on energy savings of projects from the 59 projects with the highest savings from Q1-Q4.<sup>7</sup> Sixteen large prescriptive sites (representing 12 percent of total BEEM savings) had on-site or document reviews. Another 25 small and medium business sites had on-site reviews. We were sure to include sites that received Small Business Direct Install Lighting (SBDIL) in our on-site surveys, and we ultimately reviewed 15 sites that received this measure.

The business on-site surveys also supported the engineering analyses performed on all custom measures. During the on-site visits, the quantity of installed equipment was verified by inspection, and equipment nameplate information was recorded. These two pieces of information were used to ensure the installed equipment was consistent with the information presented in the application, and to determine if it was program qualifying. Additionally, we collected operational characteristics such as temperature set points, operating schedules, typical loading characteristics, baseline system equipment, and baseline system operational details. This information was used to verify the accuracy of any original calculations, and to determine if customer's actual operation was consistent with program assumptions.

For the CBEEM program, a random stratified sampling approach utilized four different strata based on energy savings that included all projects. Of the 320

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<sup>6</sup> Note that for Program Year 2009 and Program Year 2010, we conducted a nested sample of on-site verification surveys for residential programs and small/medium projects within the BEEM program. We found very high verification rates from the phone survey, which were confirmed during the on-sites for these same customers. For Program Year 2011, we conducted only telephone verification surveys for a sample of the participant population, reserving on-site surveys for the custom and large business projects. For Program Year 2012 we have returned to our approach from Program Years 2009 and 2010 and conducted nested on-site verification surveys for REEM and small/medium business projects.

<sup>7</sup> The sample frame of the top 59 sites was pulled in two stages. First, the top 52 sites from the Q1-Q3 program tracking data were pulled, and then another 7 sites were pulled from the Q4 data. The cutoff point for both iterations was based on projects claiming more than 100,000 kWh savings.



custom projects in Q1-Q4, seven had both on-sites and document reviews, and eight had document reviews only.

- **Upstream CFL and LED verification.** We reviewed a random stratified sample of invoices representing 70 percent of REEM LED bulbs and 57 percent of REEM CFL bulbs included in the program tracking data to ensure that they matched invoice detail from the Salesforce database and the claimed quantities found in the final tracking data.
- **RHTR measure verification.** For this part of the measure verification, a random stratified sample of Akamai Advanced Power Strip distribution forms was requested from Hawaii Energy. Additionally, all documentation for Lanai *Hui Up* refrigerator trade-ins was requested as part of the RHTR documentation request.
- **BEEM condominium submetering verification.** Condominium Submetering projects were analyzed as part of a separate task to measure the realized savings associated with this measure. Billing data and temperature data was provided by Hawaii Energy for use in this analysis. The savings estimate from this analysis was used to verify savings for this measure for Program Year 2012.

## 2.4 Residential Hard-to-Reach Verification

As part of our overall program savings verification, we conducted additional verification work on the Lanai *Hui Up* refrigerator trade-ins and Advanced Power Strips (APS) distributed through the RHTR program. For Program Year 2012 this RHTR verification was conducted to develop a verification ratio for these two measures that were not included in the CATI or on-site surveys.

To conduct the RHTR verification, Hawaii Energy provided us with tracking spreadsheets with distribution information for both Lanai *Hui Up* and APS along with documentation in PDF form of distribution logs from giveaway events in the community. Tracking spreadsheets for the full program year were provided, while only a sample of distribution logs for APS were sent at our request.

Due to the small number of Lanai *Hui Up* measures, we requested 100 percent of the documentation for this measure. A stratified random sample was requested for APS which represented 88 percent of all APS units distributed by the RHTR program. Both Lanai *Hui Up* and APS were verified by comparing the quantities logged on paper to the quantities reflected in the tracking spreadsheets.

## 2.5 Upstream Lighting Verification

Additional verification was conducted for CFLs and LEDs rebated through the upstream portion of the REEM program. Hawaii Energy supplied tracking data and



Evergreen developed a stratified random sample to request invoices and rebate forms for CFLs and LEDs rebated through the program.

The CFL and LED verification for Program Year 2012 was conducted in three parts:

1. Checking compliance with the participation requirements set forth by the Memorandum of Understanding that all retailers are required to sign in order to participate in the program;
2. Verifying quantities of equipment between tracking spreadsheets, final program data, and the Hawaii Energy Program Year 2012 Annual Report; and
3. Reviewing a sample of CFL and LED model numbers to ensure that the rebated measures are program qualifying (e.g., matching the unique retail product number with the ENERGY STAR website.)

To conduct the upstream lighting verification, Hawaii Energy provided us with tracking spreadsheets with purchase and distribution information for both CFLs and LEDs along with invoices and rebate forms in PDF form. Tracking spreadsheets for the full program year were provided, while only a sample of invoices were sent at our request.

The sample of CFL invoices covered 57 percent of all REEM CFLs, while the sample of LED invoices represented 70 percent of all REEM LEDs. The quantities of CFLs and LEDs reflected in the invoices were compared to the final tracking data to verify the number of bulbs claimed. After bulb quantities were verified, we checked model numbers in the tracking data against the current list of ENERGY STAR approved bulbs to ensure that they were program qualifying.

Finally, we reviewed the number of bulbs distributed at each retailer and the size of rebated multi-packs. During our review we learned that although SAIC claimed savings for all sizes of multi-packs, they only provided rebates for up to 10 bulbs per multi-pack. To best align verified savings with the level of rebates provided, we verified a maximum of 10 bulbs per multi-pack.

## **2.6 Condominium Submetering Verification**

The current savings for the Program Year 2012 BEEM Condominium Submetering in the TRM is deemed as a 10 percent reduction in a customer's annual kWh usage. Evergreen conducted an independent billing regression analysis to determine the realized savings for this measure. Our findings indicated that the 10 percent deemed value may lie on the low end of realized savings for this measure. After discussing our findings with the contract manager, we decided to treat submetering as a custom measure for Program Year 2012 and verify the savings according to the findings of our measurement analysis, rather than treating it as a set deemed savings percentage of 10 percent.



We calculated a verification ratio for the Condominium Submetering measure equivalent to the ratio of the estimated savings from the billing model to the savings value reported in the TRM.

Note that this measurement analysis is a separate task for the Program Year 2012 evaluation, and as such the full write-up of methods and results will be included in the Program Year 2012 Comprehensive Evaluation Report. Evergreen plans to re-analyze the savings for this measure again next year and then determine whether an update to the TRM is necessary. This evaluation approach is consistent with the overall evaluation approach for deemed measures.

## 2.7 Total Resource Benefit Verification

A separate verification was done for the net Total Resource Benefit (TRB) presented in the Annual Report. Using validated net savings (kW and kWh) from the final program tracking data and approved measure lives given in the TRM, we replicated the TRB calculations described in the Annual Report. Some measures were verified at over 100 percent due to the use of TRM-approved measure lives in our calculations that were higher than the measure lives used by Hawaii Energy. The resulting verified net TRB values are shown in the detailed verification tables in Appendix A.

## 2.8 Analysis

We used data collected from the surveys, project reviews, documentation reviews, and invoice audits to develop verification ratios by program and measure category, which are the fraction of energy savings that was verified to be installed and program-qualifying. Where samples were used, we developed sample weights so that results are reflective of the population of participating customers.

For **end-use customers**, a measure was counted as verified if:

- The respondent recalled receiving a rebate or we confirmed the respondent received a rebate check based on SAIC's database check fields;
- The measure was program-qualifying based on confirming the model number against program qualifications;
- The savings inputs and calculations were appropriate and accurate; and
- The equipment was still operable and in use.

For telephone surveys, we relied on customers to provide this information. We developed an initial verification ratio equal to the fraction of measures verified by telephone for each stratum.

For **large and custom business facilities** that were reviewed by engineers based on electronic project files and on-site surveys, we attempted to confirm the energy



savings claims in the database. We reviewed vendor records, observed equipment size and specifications on-site and interviewed customers. We developed verification ratios for each project based on the energy savings that we could confirm from data gathered on-site or project documentation.

We applied the verification ratios by program and measure that we developed based on the process described above to the final program tracking database, which covered the entire year.

### **3. Overall Verification Results**

This section presents the overall verification results, which is the combined effect of applying the savings database validation research and the installed verification to the claimed savings numbers. As described previously, the overall verification results reflect our independent assessment of the verified energy savings associated with Hawaii Energy's Program Year 2012.

The results of the two steps of the verification, the savings database validation (step one) and the installation verification (step two), are discussed separately below.

#### **3.1 Savings Database Validation – Step One (of Two)**

The savings validation exercise was intended to provide an independent verification of the savings accomplishments from the Annual Report based on the final program tracking database extract provided by SAIC. We compared the results to the Hawaii Energy 2012 Annual Report by program and measure category.

Hawaii Energy reported first-year energy savings of 113,198,801 kWh in the Annual Report and the evaluation team validated 100 percent of first-year energy savings from the tracking database.

The validation task also included comparing kW savings and quantity values between the program tracking data and the Program Year 2012 Annual Report. All kW and quantity values were reviewed at the program and measure level and were validated at 100 percent of claimed values.

An additional validation task that we conducted was to review market transformation activities. SAIC provided a description of all market transformation activities in the Program Year 2012 Annual Report. Upon review of this list and independent validation of these activities, we confirmed that Hawaii Energy has met the goal for Market Transformation.

#### **3.2 Installation Verification – Step Two (of Two)**

The verification surveys and engineering analyses resulted in a set of verification ratios that were used to adjust the savings claimed by SAIC in the Annual Report.





The verification ratio represents the percentage of savings associated with the measures that we verified to be installed, program qualifying, and operational. We developed verification ratios for business sector programs at the measure level. Results are shown at the program and measure levels. For the residential sector, we also developed verification ratios at the measure level, and we provide results at the measure level.

We verified a total of 100 percent of residential and 106 percent of business energy savings to be installed, program qualifying, operational, and with accurate savings claims based on the methods described above. A total of 102 percent of the overall program savings were verified (a weighted average of results from the two sectors).

For the business sector, we verified a total of 107 percent of BEEM, 124 percent of both BESM and BHTR, and 99 percent of CBEEM savings.

- For the CBEEM program, we developed a verification ratio for the program based on weighting the sample results from the telephone and on-site surveys and engineering analyses, which represented 59 percent of the total claimed CBEEM savings.
- For BEEM and BESM, we combined the telephone and on-site survey results with engineering analyses to produce a verification ratio at the program-level by weighting the sample results, which represented 23 percent of the total claimed BEEM savings and 8 percent of the total claimed BESM savings.
- Besides SBDIL measures that were included in the telephone or on-site surveys, we did not sample from the BHTR program (which makes up less than 3 percent of total business program savings claims). The telephone surveys are focused on simple prescriptive measures (including those in REEM, RESM, BEEM, BESM, BHTR, and CBEEM where prescriptive categories could be assigned), and the on-site surveys and engineering analyses focused on the largest projects and customized measures.
- The SBDIL measure was covered in 15 on-site surveys and a verification ratio of 125 percent was found due to two projects with different quantities of lamps installed compared to what was claimed. One of these projects had many more lamps installed than claimed, and the other project had slightly fewer lamps installed than claimed.
- Measures not included in the telephone surveys telephone or on-site surveys were assigned verification ratios from similar measures or programs that were verified. These measures accounted for a very small portion of overall program savings when we drew the Q1-Q3 sample frame. For BEEM, we assigned the overall BEEM verification ratio (107 percent) to cool roof technologies, kitchen exhaust hood demand ventilation, and window tinting which were not covered in the telephone or on-site surveys.





As mentioned above, 106 percent of business program claimed savings were verified. This is a weighted average of project-level results, with a varying range of realization rates. For CBEEM, there were fifteen projects that we sampled for on-sites or technical reviews (representing 59 percent of the program total, as stated above). For large prescriptive (BEEM, BESM, and BHTR customers with cumulative savings of greater than 100,000 kWh), we conducted on-sites and technical reviews for sixteen projects (representing 44 percent of the large prescriptive population), and on-sites for 25 sites that were a nested sample of the business CATI surveys. Discrepancies between claimed and realized savings were due to the following reasons:

- Two prescriptive measures asked about in the telephone survey were not confirmed to be installed and operational
- A custom chiller project had the analysis normalized to Typical Meteorological Year Three weather data, and the loading was adjusted to be consistent in the baseline and energy efficient cases
- A difference in the installed quantity of lamps for a large prescriptive lighting project
- Additional savings for a custom lighting project were calculated due to the lighting being installed in a refrigerated warehouse
- A custom lighting project was found to only have approximately two thirds of the lamp replacements completed
- One variable frequency drive project did not have automatic controls as required by the prescriptive program
- A large prescriptive lighting project had the building type changed from retail to hotel/motel
- A large prescriptive project had savings claimed for four foot lamps when only two foot lamps were installed
- Two SBDIL projects had different quantities of lamps installed compared to what was claimed

Evaluators typically find and correct a few errors of this type when conducting verification activities of the type described in this memorandum. Despite having identified and corrected the discrepancies mentioned above, we find that on the whole, program tracking was done properly and the correct values were applied.

The amount of variation in project level verification rates for the CBEEM program is common for this type of program. The two most common adjustments, differences in operating conditions or inappropriate baselines, are typical adjustments for custom projects. Due to the complexity of the projects and calculations, adjustments to projects will almost always lead to varying realization rates.



The amount of variation seen in claimed versus verified savings with regards to the large business prescriptive projects was also typical. Prescriptive projects can have similar amounts of variation as custom projects. However, the adjustments are generally the same across building types or technologies.

For the residential sector, we verified a total of 100 percent of REEM and RESM and 104 percent of RHTR program savings. There were three measures that were not verified based on the telephone surveys (three sampled measures of a total of 343 surveyed customers representing 367 measures). These were either not installed, no longer operational or had been removed.

- For REEM, we included downstream customer rebate measures in the telephone survey sample. CFLs and LEDs were delivered upstream and were verified by reviewing tracking data and invoice documentation. The REEM peer group comparison was verified by analyzing tracking data and additional information provided by SAIC.<sup>8</sup> We developed measure-level verification ratios for the downstream customer rebate measures using telephone and on-site survey results and for upstream lighting measures based on our separate verification of CFLs and LEDs. Room occupancy sensors in the REEM program were not covered by the telephone or on-site surveys, so we applied the lighting sensor verification rate from the BEEM program (101 percent). Whole house energy monitors and dishwashers were also not in the survey completes, so we applied the average REEM verification ratio to those measures (100 percent).
- Two measures (Custom Packed Proposals and Efficiency Inside Home Design) in the RESM program were not verified via telephone or on-site survey. These measures make up less than one percent of residential portfolio savings, and very few were recorded by the program at the time that the Q1-Q3 sample was formed. We applied the average REEM verification ratio (100 percent) to the two measure categories claimed under RESM for Program Year 2012, and will conduct a more comprehensive review of these measures in the Program Year 2013 evaluation.
- For RHTR, Lanai *Hui Up* and Akamai Power Strips were verified by a thorough review of program tracking data and event documentation. Verification ratios were developed based on the results of this review. For the Solar Water Heater Grant, we applied the solar water heater verification ratio (105 percent) from the REEM program.

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<sup>8</sup> The Residential Peer Group Comparison was verified at 100 percent this year based on our review of Hawaii Energy's savings documentation for this measure. Savings were claimed according to the deemed 1.73 percent of energy usage given in the TRM. Starting in Program Year 2013 Hawaii Energy will adopt Evergreen's recommended deemed value of 0.89 percent of energy usage.



### **3.2.1 Residential Hard-to-Reach Verification Results**

Our review of documentation for Lanai *Hui Up* refrigerator trade-ins found that all measures claimed in the final tracking data and Annual Report were verified on the trade-in forms. As a result, the verification ratio for this measure was determined to be 100 percent.

Akamai Power Strips were also verified by comparing a sample of distribution event logs to the final tracking data. Quantities on event logs were compared to quantities in the data, and an overall verification rate for power strips was found to be 102 percent.

### **3.2.2 Upstream Lighting Verification Results**

In our invoice and documentation review of upstream CFLs and LEDs, we were able to verify that 100 percent of the bulbs claimed in the random sample we selected were found on the invoice and rebate forms that Hawaii Energy provided.

A second part of our verification for upstream lighting included counting savings only for bulbs that were rebated by Hawaii Energy. We discovered that Hawaii Energy did not provide rebates for any bulbs over 10 in a single multi-pack, so we adjusted our verification to count savings for at most 10 bulbs per multi-pack. After scaling back savings for multi-packs with greater than 10 bulbs, CFLs were found to be verified at 99 percent. All LEDs distributed through the program were single bulbs or multi-packs of less than 10 bulbs so no correction was needed for LED savings. Thus, the verification ratio for REEM CFLs was determined to be 99 percent and for REEM LEDs it was 100 percent.

Finally, we checked a sample of model numbers for CFLs and LEDs against the ENERGY STAR approved list and found that the models we reviewed were program qualifying.

### **3.2.3 Condominium Submetering Verification Results**

Using billing data provided by Hawaii Energy, we conducted a billing regression analysis to determine the savings achieved by the condominium submetering measure. Our analysis found a decrease in energy usage of 22.7 percent. After discussion with the contract manager, the decision was made to treat condominium submetering as a custom measure this year and apply our analysis results to the savings verification. As a result, we verified condominium submetering savings at 22.7 percent rather than the 10 percent given in the TRM, which resulted in a verification ratio of 227 percent for this measure. Additional analysis will be conducted next year to include more sample points and re-evaluate the savings estimate.



### 3.3 Overall Verification Results

Table 3 shows the final verification results for the business program, which are the combination of the savings database validation and the measure installation verification. The first two columns indicate the sector and program, and the third column indicates the name of the measure (as reported in the tracking database). The fourth column shows the claimed first-year net energy savings. The fifth column is the energy savings as validated and verified by Evergreen. The sixth column shows the final ratio of verified and validated savings relative to the savings reported by SAIC in the Annual Report. To calculate the final ratio, we divided the verified and validated energy savings in this table by the claimed savings in the Annual Report. The last column shows each measure's percent of total validated and verified savings in the business program.

Table 4 presents the verification ratio results for the residential programs. It also shows the overall ratio for both the business and residential programs. The final column shows each measure's percent of total validated and verified savings in the residential program. Overall, the business program accounts for 39 percent and the residential program accounts for 61 percent of total validated and verified savings.

The overall verification results are 100 percent of residential and 106 percent of business savings were validated and verified based on the combination of research activities described in this document. The overall verification ratios shown here were applied to kW savings by program and measure to arrive at the verified and validated kW values shown in Appendix A. A separate verification of TRB values was conducted and the results of this are also shown in the tables in Appendix A.

**Table 3. Program Year 2012 Overall Verification Results by Program and Measure, Business Programs**

Sector	Program	Measure	Claimed First Year Net Energy Savings (kWh)	Verified and Validated Net First-year Savings (kWh)	Verified and Validated % of Claimed Net First Year Savings	Verified Savings as % of Total Sector Savings
Business	Business Energy Efficiency Measures	CEE Tier 1 - Premium Efficiency Motors	23,917	24,254	101%	0%
		Ceiling Fans	27,424	27,421	100%	0%
		CFL	1,784,176	1,811,440	102%	4%
		Chillers	1,432,943	1,450,319	101%	3%
		Clothes Washer (Tier II/III) + (Tier I GF)	37,055	37,418	101%	0%
		Commercial Solar Water Heating	1,868	1,868	100%	0%
		Condominium Submetering	1,134,484	2,579,817	227%	6%
		Cool Roof Technologies	20,799	22,268	107%	0%
		Delamp/Reflector	1,068,743	1,073,923	100%	2%
		Delamping	1,385,780	1,401,117	101%	3%
		ECM	182,994	183,223	100%	0%
		ECM - Evaporator Fans	23,880	23,880	100%	0%
		Garage Refrigerator / Freezer Bounty	12,404	12,404	100%	0%
		Heat Pump - Upgrade	284,006	290,635	102%	1%
		Heat Pumps	2,416	2,416	100%	0%
		HID Pulse Start	152,604	148,210	97%	0%
		HVAC - Packaged/Split	1,385,188	1,404,647	101%	3%
		Induction	26,514	25,923	98%	0%
		Kitchen Exhaust Hood Demand Ventilation	231,687	248,050	107%	1%
		LED	4,514,505	4,562,708	101%	10%
		LED - Refrigerated Case Lighting	151,436	153,091	101%	0%
		Refrigerator (<\$600)	3,906	3,931	101%	0%
		Refrigerator with Recycling	419,633	400,745	95%	1%
		Sensors	584,435	592,760	101%	1%
		Solar Water Heating - Commercial	47,842	47,842	100%	0%
		Solar Water Heating Incentive - Contractor	3,286	3,286	100%	0%
		T8 /T8LW	6,457,585	6,525,333	101%	14%
		VFD - AHU	233,652	237,015	101%	1%
		VFD - Pump	1,390,718	1,415,872	102%	3%
		VFD Domestic Water Booster Packages	381,392	382,685	100%	1%
		VFD Pool Pump Packages	197,429	199,267	101%	0%
		VFR - Variable Refrigerant Flow AC	306,712	308,172	100%	1%
		Whole House Fan	814	814	100%	0%
		Window Tinting	1,088,902	1,165,804	107%	3%
		Subtotal	25,001,128	26,768,556	107%	59%
	Business Services and Maintenance	Central Plant Performance - Benchmark Metering	-	-	0%	0%
		Central Plant Performance - Commissioning	-	-	0%	0%
		Design Assistance - 50%	-	-	0%	0%
		Energy Project Catalyst	-	-	0%	0%
		Energy Study Assistance	26,913	26,913	100%	0%
		SBDI - Lighting Retrofits	3,523,159	4,392,670	125%	10%
		Subtotal	3,550,072	4,419,583	124%	10%
	Business Hard to Reach	Hawaii Energy Hero Landlord Program	-	-	0%	0%
		Kitchen Exhaust Hood Demand Ventilation	64,947	64,947	100%	0%
		SBDI - Restaurant Lighting	931,318	1,168,801	125%	3%
		Subtotal	996,266	1,233,749	124%	3%
	Custom Business Energy Efficiency Measures	Co-funded Leveraged Project Assistance	-	-	0%	0%
		Customized Measures - Over 5 year Life	12,467,766	12,282,453	99%	27%
		Customized Project Measures - Under 5 Year Life	330,672	325,757	99%	1%
		Garage Active Ventilation Control	40,166	45,181	99%	0%
		High Efficiency HVAC	5,697	-	0%	0%
		Subtotal	12,844,300	12,653,391	99%	28%
	<b>All Business - Total</b>		<b>42,391,766</b>	<b>45,075,279</b>	<b>106%</b>	<b>100%</b>

**Table 4. Program Year 2012 Overall Verification Results by Program and Measure, Residential Programs**

					Verified and Validated % of Claimed Net First Year Savings	Verified Savings as % of Total Sector Savings
Sector	Program	Measure	Claimed First Year Net Energy Savings (kWh)	Verified and Validated Net First-year Savings (kWh)		
Residential	Residential Energy Efficiency Measures	AC Bounty (GF)	-	-	0%	0%
		Ceiling Fans	420,620	420,620	100%	1%
		CFL	51,964,575	51,694,359	99%	73%
		Clothes Washer (Tier II/III) + (Tier I GF)	866,135	825,111	95%	1%
		Dishwasher (GF)	53	53	100%	0%
		Energy Hero Gift Packs - Akamai PowerStrips	8,102	8,256	102%	0%
		Garage Refrigerator / Freezer Bounty	573,362	573,362	100%	1%
		Heat Pumps	385,339	385,339	100%	1%
		LED	1,197,241	1,197,241	100%	2%
		Peer Group Comparison	5,841,701	5,841,701	100%	8%
		Refrigerator (<\$600)	32,592	32,592	100%	0%
		Refrigerator with Recycling	3,789,226	3,789,226	100%	5%
		Room Occupancy Sensors	770	770	100%	0%
		Solar Attic Fans	90,092	67,569	75%	0%
		Solar Water Heating Incentive - Contractor	4,016,021	4,224,525	105%	6%
		Solar Water Heating Incentive - Lender	147,488	155,145	105%	0%
		VFD Controlled Pool Pumps	119,241	119,241	100%	0%
		VFR Split System AC	192,365	192,365	100%	0%
		Whole House Energy	2,545	2,541	100%	0%
		Whole House Fan	178,907	178,907	100%	0%
		Subtotal	69,826,376	69,708,924	100%	99%
	Residential Energy Services and Maintenance	Central AC Maintenance	6,003	6,003	100%	0%
		Custom Packaged Proposals	14,057	14,033	100%	0%
		Efficiency Inside Home Design	574,462	573,496	100%	1%
		Hawaii Energy Hero Audits	-	-	0%	0%
		Solar Water Heater Tune-Ups	-	-	0%	0%
		TBD	-	-	0%	0%
		Subtotal	594,523	593,533	100%	1%
	Residential Hard to Reach	CFL Exchange	-	-	0%	0%
		Custom SWH Proposals	-	-	0%	0%
		Energy Hero Gift Packs	-	-	0%	0%
		Energy Hero Gift Packs - Akamai PowerStrips	88,650	90,325	102%	0%
		Hawaii Energy Hero Audits	-	-	0%	0%
		Hawaii Energy Hero Landlord Program	-	-	0%	0%
		Lanai Hui Up	19,723	19,723	100%	0%
		Solar Inspections (WAP)	-	-	0%	0%
		Solar Water Heater - Grant	277,763	292,184	105%	0%
		Subtotal	386,136	402,232	104%	1%
	All Residential - Total			70,807,035	70,704,689	100%
Program Overall			113,198,801	115,779,968	102%	100%



## **Appendix A-Detailed Validation Tables**

This appendix provides detailed data of Evergreen’s savings database validation and verification and calculation of verified net TRB. The overall verification ratio for kWh savings is 102 percent, for kW savings is 102 percent, and for net TRB is 112 percent. SAIC’s claims in the Program Year 2012 Annual Report for net kWh, net kW, and net TRB were 113,198,801 kWh, 15,145 kW, and \$116,789,535 respectively.

### **A-1 Business Programs**

Table A-1 shows Evergreen’s independent estimate of measure installation counts and savings for the business programs. The evaluation team used the final data from SAIC’s tracking system for entire Program Year 2012 to generate the data in the table. The table shows the following data:

- The first two columns indicate the program and measure.
- The third column (labeled A) shows the claimed net kWh savings—the subtotal and total lines show the summed total of claimed net kWh savings.
- The fourth column (labeled B) shows the claimed net kW savings—the subtotal and total lines show the summed total of claimed net kW savings.
- The fifth column (labeled C) shows the overall verification ratio, as reported in Table 3 of this memorandum. It represents the portion of savings for each measure that Evergreen verified to be installed and program qualifying.
- The sixth and seventh columns (labeled D and E) show verified and validated net savings, in kWh and kW, respectively. The figures are the product of the net kWh savings (or the net kW savings) and the verification ratio—the subtotal and total lines show the summed number of savings.
- The eighth column (labeled F) shows the effective useful life (EUL) for each measure, as represented in the final tracking data—the subtotal and total rows show the EUL for that category.
- The final column (labeled G) shows the verified and validated net Total Resource Benefit (TRB).

### **A-2 Residential Programs**

Table A-2 shows Evergreen’s independent estimate of measure installation counts and savings for the residential programs. The evaluation team used the final data from SAIC’s tracking system for entire Program Year 2012 to generate the data in the table. The table shows the following data:

- The first two columns indicate the program and measure.
- The third column (labeled A) shows the claimed net kWh savings—the subtotal and total lines show the summed total of claimed net kWh savings.





- The fourth column (labeled B) shows the claimed net kW savings—the subtotal and total lines show the summed total of claimed net kW savings.
- The fifth column (labeled C) shows the overall verification ratio, as reported in Table 4 of this memorandum. It represents the portion of savings for each measure that Evergreen verified to be installed and program qualifying.
- The sixth and seventh columns (labeled D and E) show verified and validated net savings, in kWh and kW, respectively. The figures are the product of the net kWh savings (or the net kW savings) and the verification ratio—the subtotal and total lines show the summed number of savings.
- The eighth column (labeled F) shows the effective useful life (EUL) for each measure, as represented in the final tracking data—the subtotal and total rows show the EUL for that category.
- The final column (labeled G) shows the verified and validated net Total Resource Benefit (TRB).



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**Table A-1. Program Year 2012 Validated and Verified Participation and Savings by Program and Measure, Business Program**

Program	Measure	Sum Net kWh Savings (A)	Sum Net kW Savings (B)	Overall Verification Ratio (C)	Verified & Validated Net kWh Savings (D = A x C)	Verified & Validated Net kW Savings (E=B x C)	EUL (F) - Avg of Useful Life	Verified & Validated Net TRB (G)
Business Energy Efficiency Measures	CEE Tier 1 - Premium Efficiency Motors	23,917	11	101%	24,253.85	11.58	15.0	\$ 72,686.86
	Ceiling Fans	27,424	3	100%	27,421.12	3.12	5.0	\$ 18,326.17
	CFL	1,784,176	185	102%	1,811,439.86	187.83	3.0	\$ 718,327.91
	Chillers	1,432,943	284	101%	1,450,318.75	287.88	20.0	\$ 3,343,649.14
	Clothes Washer (Tier II/III) + (Tier I GF)	37,055	5	101%	37,418.06	5.09	11.8	\$ 52,914.58
	Commercial Solar Water Heating	1,868	2	100%	1,868.11	2.00	15.0	\$ 10,049.15
	Condominium Submetering	1,134,484	143	227%	2,579,817.10	324.79	9.0	\$ 1,173,157.87
	Cool Roof Technologies	20,799	8	107%	22,267.88	8.91	10.8	\$ 42,402.56
	Delamp/Reflector	1,068,743	107	100%	1,073,922.68	107.20	14.0	\$ 1,583,679.75
	Delamping	1,385,780	126	101%	1,401,116.60	127.86	14.0	\$ 2,008,956.10
	ECM	182,994	20	100%	183,223.48	19.70	15.0	\$ 289,752.22
	ECM - Evaporator Fans	23,880	3	100%	23,879.76	2.57	15.0	\$ 37,811.20
	Garage Refrigerator / Freezer Bounty	12,404	0	100%	12,404.39	0.49	14.0	\$ 15,576.34
	Heat Pump - Upgrade	284,006	9	102%	290,634.99	9.25	10.0	\$ 272,392.08
	Heat Pumps	2,416	0	100%	2,415.68	0.34	10.0	\$ 3,081.22
	HID Pulse Start	152,604	20	97%	148,209.66	19.38	14.0	\$ 243,867.53
	HVAC - Packaged/Split	1,385,188	209	101%	1,404,647.18	211.78	15.0	\$ 2,428,987.20
	Induction	26,514	3	98%	25,922.90	2.63	2.0	\$ 7,160.39
	Kitchen Exhaust Hood Demand Ventilation	231,687	40	107%	248,049.91	42.39	15.0	\$ 424,632.58
	LED	4,514,505	586	101%	4,562,707.90	592.28	14.8	\$ 7,544,068.03
	LED - Refrigerated Case Lighting	151,436	24	101%	153,090.82	24.61	5.0	\$ 112,778.97
	Refrigerator (<\$600)	3,906	1	101%	3,930.76	0.64	14.0	\$ 6,697.43
	Refrigerator with Recycling	419,633	17	95%	400,744.63	16.58	14.0	\$ 529,744.23
	Sensors	584,435	24	101%	592,759.61	24.20	8.0	\$ 482,371.45
	Solar Water Heating - Commercial	47,842	51	100%	47,842.18	51.30	15.0	\$ 257,358.12
	Solar Water Heating Incentive - Contractor	3,286	1	100%	3,286.24	0.73	15.0	\$ 6,693.43
	T8 /T8LW	6,457,585	690	101%	6,525,333.08	696.91	13.9	\$ 9,738,258.22
	VFD - AHU	233,652	92	101%	237,015.13	93.71	15.0	\$ 634,603.56
	VFD - Pump	1,390,718	377	102%	1,415,871.54	384.28	13.6	\$ 3,098,822.66
	VFD Domestic Water Booster Packages	381,392	41	100%	382,684.90	40.84	15.0	\$ 602,703.52
	VFD Pool Pump Packages	197,429	16	101%	199,267.34	15.97	15.0	\$ 291,336.16
	VFR - Variable Refrigerant Flow AC	306,712	29	100%	308,172.38	29.32	15.0	\$ 470,696.69
	Whole House Fan	814	0	100%	813.98	0.41	20.0	\$ 3,054.73
	Window Tinting	1,088,902	289	107%	1,165,803.83	309.29	9.8	\$ 1,789,864.74
	Subtotal	25,001,128	3,417	107%	26,768,556	3,656		\$ 38,316,462.82



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**Table A-1 (continued). Program Year 2012 Validated and Verified Participation and Savings by Program and Measure, Business Programs**

Program	Measure	Sum Net kWh Savings (A)	Sum Net kW Savings (B)	Overall Verification Ratio (C)	Verified & Validated Net kWh Savings (D = A x C)	Verified & Validated Net kW Savings (E=B x C)	EUL (F) - Avg of Useful Life	Verified & Validated Net TRB (G)
<b>Business Services and Maintenance</b>	Central Plant Performance - Benchmark Metering	-	-		-	-	14.0	\$ -
	Central Plant Performance - Commissioning	-	-		-	-	14.0	\$ -
	Design Assistance - 50%	-	-		-	-		\$ -
	Energy Project Catalyst	-	-		-	-	0.0	\$ -
	Energy Study Assistance	26,913	-	100%	26,913.19	-	14.0	\$ 29,796.67
	SBDI - Lighting Retrofits	3,523,159	259	125%	4,392,669.53	322.40	13.7	\$ 4,871,249.25
	<b>Subtotal</b>	<b>3,550,072</b>	<b>259</b>	<b>124%</b>	<b>4,419,583</b>	<b>322</b>		<b>\$ 4,901,045.91</b>
<b>Business Hard to Reach</b>	Hawaii Energy Hero Landlord Program	-	-		-	-	0.0	\$ -
	Kitchen Exhaust Hood Demand Ventilation	64,947	11	100%	64,947.42	11.10	15.0	\$ 119,034.50
	SBDI - Restaurant Lighting	931,318	105	125%	1,168,801.49	131.42	13.5	\$ 1,424,183.04
	<b>Subtotal</b>	<b>996,266</b>	<b>116</b>	<b>124%</b>	<b>1,233,749</b>	<b>143</b>		<b>\$ 1,543,217.54</b>
<b>Custom Business Energy Efficiency Measures</b>	Co-funded Leveraged Project Assistance	-	-		-	-	0.0	\$ -
	Customized Measures - Over 5 year Life	12,467,766	1,664	99%	12,282,453.41	1,638.80	13.4	\$ 19,034,801.02
	Customized Project Measures - Under 5 Year Life	330,672	52	99%	325,757.23	51.57	11.1	\$ 452,209.65
	Garage Active Ventilation Control	45,862	5	99%	45,180.75	4.48	10.0	\$ 33,410.27
	High Efficiency HVAC	-	-		-	-		\$ -
<b>Subtotal</b>		<b>12,844,300</b>	<b>1,720</b>	<b>99%</b>	<b>12,653,391</b>	<b>1,695</b>		<b>\$ 19,520,420.95</b>
<b>All Business - Total</b>		<b>42,391,766</b>	<b>5,512</b>	<b>106%</b>	<b>45,075,279</b>	<b>5,816</b>		<b>\$ 64,281,147.22</b>



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**Table A-2. Program Year 2012 Validated and Verified Participation and Savings by Program and Measure, Residential Programs**

Program	Measure	Sum Net kWh Savings (A)	Sum Net kW Savings (B)	Overall Verification Ratio (C)	Verified & Validated Net kWh Savings (D = A x C)	Verified & Validated Net kW Savings (E=B x C)	EUL (F) - Avg of Useful Life	Verified & Validated Net TRB (G)
Residential Energy Efficiency Measures	AC Bounty (GF)	-	-		-	-	9.0	\$ -
	Ceiling Fans	420,620	48	100%	420,620.40	47.85	5.0	\$ 281,082.91
	CFL	51,964,575	7,158	99%	51,694,359.49	7,120.44	6.0	\$ 43,251,113.92
	Clothes Washer (Tier II/III) + (Tier I GF)	866,135	118	95%	825,111.07	112.15	11.8	\$ 1,239,804.83
	Dishwasher (GF)	53	0	100%	53.22	0.01	12.0	\$ 93.07
	Energy Hero Gift Packs - Akamai PowerStrips	8,102	1	102%	8,255.56	0.95	4.4	\$ 5,435.80
	Garage Refrigerator / Freezer Bounty	573,362	23	100%	573,361.83	22.69	14.0	\$ 719,977.09
	Heat Pumps	385,339	54	100%	385,338.83	53.84	10.0	\$ 491,502.36
	LED	1,197,241	216	100%	1,197,241.43	216.37	15.0	\$ 2,240,519.98
	Peer Group Comparison	5,841,701	667	100%	5,841,701.29	667.01		\$ 833,663.22
	Refrigerator (<\$600)	32,592	5	100%	32,591.56	5.28	14.0	\$ 55,890.20
	Refrigerator with Recycling	3,789,226	157	100%	3,789,226.12	156.73	14.0	\$ 4,783,513.88
	Room Occupancy Sensors	770	0	100%	769.89	0.17	8.0	\$ 976.07
	Solar Attic Fans	90,092	3	75%	67,569.18	2.50	5.0	\$ 48,945.07
	Solar Water Heating Incentive - Contractor	4,016,021	895	105%	4,224,525.49	941.06	15.7	\$ 9,832,169.38
	Solar Water Heating Incentive - Lender	147,488	33	105%	155,145.22	34.56	15.0	\$ 300,403.51
	VFD Controlled Pool Pumps	119,241	1	100%	119,240.71	1.20	10.0	\$ 106,755.27
	VFR Split System AC	192,365	83	100%	192,364.60	82.58	14.8	\$ 548,117.21
	Whole House Energy	2,545	0	100%	2,540.92	0.06	4.6	\$ 1,330.59
	Whole House Fan	178,907	89	100%	178,906.89	89.19	20.0	\$ 671,410.63
	Subtotal	69,826,376	9,550	100%	69,708,924	9,555		\$ 65,412,705.01



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**Table A-2 (continued). Program Year 2012 Validated and Verified Participation and Savings by Program and Measure, Residential Programs**

Program	Measure	Sum Net kWh Savings (A)	Sum Net kW Savings (B)	Overall Verification Ratio (C)	Verified & Validated Net kWh Savings (D = A x C)	Verified & Validated Net kW Savings (E=B x C)	EUL (F) - Avg of Useful Life	Verified & Validated Net TRB (G)
<b>Residential Energy Services and Maintenance</b>	Central AC Maintenance	6,003	1	100%	6,003.26	1.38	1.0	\$ 1,090.35
	Custom Packaged Proposals	14,057	8	100%	14,033.41	8.03	5.0	\$ 2,066.57
	Efficiency Inside Home Design	574,462	-	100%	573,496.00	-	20.0	\$ 666,557.94
	Hawaii Energy Hero Audits	-	-		-	-	0.0	\$ -
	Solar Water Heater Tune-Ups	-	-		-	-	0.0	\$ -
	TBD	-	-		-	-	0.0	\$ -
	<b>Subtotal</b>	<b>594,523</b>	<b>9</b>	<b>100%</b>	<b>593,533</b>	<b>9</b>		<b>\$ 669,714.86</b>
<b>Residential Hard to Reach</b>	CFL Exchange	-	-		-	-	0.0	\$ -
	Custom SWH Proposals	-	-		-	-	0.0	\$ -
	Energy Hero Gift Packs	-	-		-	-	0.0	\$ -
	Energy Hero Gift Packs - Akamai PowerStrips	88,650	10	102%	90,325.22	10.42	4.5	\$ 59,473.83
	Hawaii Energy Hero Audits	-	-		-	-	0.0	\$ -
	Hawaii Energy Hero Landlord Program	-	-		-	-	0.0	\$ -
	Lanai Hui Up	19,723	1	100%	19,722.77	0.82	13.5	\$ 24,898.06
	Solar Inspections (WAP)	-	-		-	-	0.0	\$ -
	Solar Water Heater - Grant	277,763	62	105%	292,184.49	65.09	15.2	\$ 565,750.23
	<b>Subtotal</b>	<b>386,136</b>	<b>73</b>	<b>104%</b>	<b>402,232</b>	<b>76</b>		<b>\$ 650,122.12</b>
<b>All Residential - Total</b>		<b>70,807,035</b>	<b>9,632</b>	<b>100%</b>	<b>70,704,689</b>	<b>9,640</b>		<b>\$ 66,732,541.99</b>
<b>Program Overall</b>		<b>113,198,801</b>	<b>15,145</b>	<b>102%</b>	<b>115,779,968</b>	<b>15,456</b>		<b>\$ 131,013,689.21</b>



## **Appendix B-Sample Design**

This appendix provides detailed data regarding Evergreen's sample design for the measure verification research.

Evergreen developed sample frames by customer category, based on our research approach. For the business sector, we developed four customer strata:

- Small and Medium Business End-Use Customers – small and medium business customers who installed prescriptive measures based on the Q1-Q3 data extract;
- Large Business End-Use Customers – business customers who completed projects in the business programs with large savings in Q1-Q4; and
- Custom – business customers who completed custom projects through CBEEEM in Q1-Q4.

For the residential sector, we developed three customer strata:

- Residential End-Use Customers – residential customers who pay their own utility bill based on the Q1-Q3 data extract and participate through the REEM and RESM programs. Upstream CFLs and LEDs from the REEM program are separated into another customer segment described below;
- Residential Hard-to-Reach – Lanai *Hui Up* and power strip measures distributed through the RHTR program from the full program year; and
- Upstream CFLs and LEDs– CFL and LED sales through the REEM program.

Each sample frame was developed based on the most current data available to the team at the time that the sample frame was created.

The following sample strata used data from Q1-Q3 to form the sample frame:

- Small and Medium Business End-Use Customers
- Residential End-Use Customers

The following sample strata used data from Q1-Q4 to form the sample frame:

- Residential Hard-to-Reach
- Upstream CFLs and LEDs
- Large Business End-Use Customers
- Custom Projects



Tables B-1 and B-2 below present a summary of the fraction of savings each sample category represents of the total claimed program savings. The first row shows the survey mode used and the second row shows the sample category.

**Table B-1. Program Savings Represented by Verification Samples  
(First-Year Net Energy kWh Savings Claimed by the Program)**

Sector		Program	Telephone Survey		On-site Survey			
			Residential End-Use Customers	Small and Medium Business End-Use Customers	Residential End-Use Customers	Small and Medium Business End-Use Customers	Large Business End-Use Customers	Custom Business Energy Efficiency Measures
Business								
		Business Energy Efficiency Measures		465,437		277,274	2,973,622	
		Business Services and Maintenance		281,889		37,642		
		Business Hard to Reach		13,501				
		Custom Business Energy Efficiency Measures		60,861		1,338	3,209,790	
		Business Total		821,689	-	316,254	6,183,412	-
Residential								
		Residential Energy Efficiency Measures	332,700		42,454			
		Residential Energy Services and Maintenance	262					
		Residential Hard to Reach	13,145					
		Residential Total	346,108	-	42,454	-	-	-
Program Overall			346,108	821,689	42,454	316,254	6,183,412	-





**Table B-1 (continued). Program Savings Represented by Verification Samples  
(First-Year Net Energy kWh Savings Claimed by the Program)**

		Desk Reviews		Technical Review				Total
		Large Business End-Use Customers	Custom Business Energy Efficiency Measures	Residential Hard to Reach Power Strips	Residential Hard to Reach Lanai Hui Up	Residnetial Energy Efficiency Measures CFLs	Residential Energy Efficency Measures LEDs	
Sector	Program							
Business								
	Business Energy Efficiency Measures	2,262,982						5,702,041
	Business Services and Maintenance							281,889
	Business Hard to Reach							13,501
	Custom Business Energy Efficiency Measures		4,291,595					7,562,247
	Business Total	2,262,982	4,291,595	-	-	-	-	13,559,678
Residential								
	Residential Energy Efficiency Measures					29,718,540	840,343	30,891,584
	Residential Energy Services and Maintenance							262
	Residential Hard to Reach			73,414	19,723			106,282
	Residential Total	-	-	73,414	19,723	29,718,540	840,343	30,998,128
Program Overall		2,262,982	4,291,595	73,414	19,723	29,718,540	840,343	44,557,807



**Table B-2. Verification Samples as a Percent of Program kWh Savings  
(First-Year Net Energy Savings Claimed by the Program)**

Sector		Telephone Survey		On-site Survey			
		Residential End-Use Customers	Small and Medium Business End-Use Customers	Residential End-Use Customers	Small and Medium Business End-Use Customers	Large Business End-Use Customers	Custom Business Energy Efficiency Measures
Business							
	Business Energy Efficiency Measures	-	2%	-	1%	12%	-
	Business Services and Maintenance	-	8%	-	1%	-	-
	Business Hard to Reach	-	1%	-	-	-	-
	Custom Business Energy Efficiency Measures	-	0%	-	0%	25%	-
	Business Total	-	2%	-	1%	15%	-
Residential							
	Residential Energy Efficiency Measures	0%	-	0%	-	-	-
	Residential Energy Services and Maintenance	0%	-	-	-	-	-
	Residential Hard to Reach	3%	-	-	-	-	-
	Residential Total	0%	-	0%	-	-	-
Program Overall		0%	1%	0%	0%	5%	0%



**Table B-2 (continued). Verification Samples as a Percent of Program kWh Savings  
(First-Year Net Energy Savings Claimed by the Program)**

		Desk Reviews		Technical Review				
		Large Business End-Use Customers	Custom Business Energy Efficiency Measures	Residential Hard to Reach Power Strips	Residential Hard to Reach Lanai Hui Up	Residential Energy Efficiency Measures CFLs	Residential Energy Efficiency Measures LEDs	
Sector	Program							Total
Business								
	Business Energy Efficiency Measures	9%	-	-	-	-	-	23%
	Business Services and Maintenance	-	-	-	-	-	-	8%
	Business Hard to Reach	-	-	-	-	-	-	1%
	Custom Business Energy Efficiency Measures	-	33%	-	-	-	-	59%
	Business Total	5%	10%	-	-	-	-	32%
Residential								
	Residential Energy Efficiency Measures	-	-	-	-	43%	1%	44%
	Residential Energy Services and Maintenance	-	-	-	-	-	-	0%
	Residential Hard to Reach	-	-	19%	5%	-	-	28%
	Residential Total	-	-	0%	0%	42%	1%	44%
Program Overall		2%	4%	0%	0%	26%	1%	39%



## Appendix C – Verified Performance Award Claim

After finalizing our verification ratios we applied our results to Hawaii Energy's performance award claim presented in the Program Year 2012 Annual Report. We used our verified net kWh, net kW, and net TRB to calculate a verified performance award. Market transformation activities were confirmed as part of our validation task discussed in the body of this memo. Island equity claims were not adjusted using verification ratios, however we did validate incentive claims at 100 percent as part of our validation activities. The results of these calculations on the performance award are shown below in Table C-1. The performance award claim shown here reflects the revised award claim filed by SAIC on November 12, 2013.

**Table C-1. Summary of Verified Performance Award Claim**

Performance Indicator	Target	Claimed Results	Verified Results	Claimed % of Target	Verified % of Target	Award Claim	Verified Award Claim
First Year Energy Reduction (kWh)	117,558,943	113,198,801	115,779,968	96%	98%	\$235,913	\$241,293
Peak Demand Reduction (kW)	17,771	15,145	15,456	85%	87%	\$29,827	\$30,441
Total Resource Benefit (TRB)	\$125,934,759	\$116,789,535	\$131,013,689	93%	104%	\$259,667	\$293,410
Market Transformation	8	21	21	263%	263%	\$70,000	\$70,000
Island Equity							
C&C Honolulu	\$19,352,231	\$14,053,368	\$14,053,368	-13%	-13%	\$0	\$0
County of Hawaii	\$3,366,167	\$4,933,056	\$4,933,056	76%	76%		
Count of Maui	\$3,441,657	\$2,827,628	\$2,827,628	-1%	-1%		
<b>Total Award</b>						<b>\$595,407</b>	<b>\$635,143</b>