

State of Hawaii

**STATUS AND PROGRESS OF CLEAN ENERGY INITIATIVES
AND
ANALYSIS OF THE ENVIRONMENTAL RESPONSE, ENERGY, AND
FOOD SECURITY TAX**

**REPORT TO THE
GOVERNOR AND THE LEGISLATURE
OF THE
STATE OF HAWAII**

Pursuant to

Act 73, Session Laws of Hawaii 2010



*Submitted By The State of Hawaii
Department of Business, Economic Development and Tourism*

December 2014

Executive Summary

On September 15, 2014, the U.S. Department of Energy and the State of Hawaii reaffirmed their commitment to the next phase of a clean energy future by endorsing HCEI 2.0. This version of the Hawaii Clean Energy Initiative (HCEI) will provide strategic guidance to new energy programs and policies focusing on grid modernization and interconnection, and bridging conventional to renewable energy sources with transitional fuels. There are also growing demands within this new ecosystem for increased energy efficiencies, and high impact, innovative programs that advance the progress towards going beyond the goal of achieving 70% clean energy by 2030.

The Hawaii State Energy Office (HSEO) works to make sustainability a reality for Hawaii and drives energy innovation by aligning policies among government agencies and the private sector. On April 29, 2014, the PUC issued decisions on integrated resource planning, reliability standards, demand response, and follow-up on a Maui Electric Company rate case that align with the State's long-term energy goals. HSEO also provides a framework and tools to attract energy developers and potential investors.

Clean energy development continues to transform Hawaii into a clean energy leader. The State is well positioned to meet, and potentially exceed, its interim clean energy goals for 2015. In 2013, the State's electric generation was 17.97 percent from renewables accompanied by energy savings of 15.7 percent from energy efficiency.¹

Achieving Hawaii's 2020 and 2030 clean energy goals, however, will require continued effort, innovation, and resources. To achieve these goals, HSEO continues to provide assistance in the deployment of high-impact solutions, and create the necessary conditions to position and attract meaningful test-bed investments.

Act 73 in 2010, established the Environmental Response, Energy and Food Security Tax (EREFST), as a funding mechanism levying a surcharge on imported oil to enable addressing Hawaii's energy and food import dependence. In 2014, the Governor signed Act 107, to firmly align resources with the State's established 2030 clean energy mandates by extending the repeal date of the EREFST from June 30, 2015 to June 30, 2030.

Energy Efficiency – Hawaii, A Leader In Energy Performance Contracting

Under HRS 196-4(3), the Energy Resource Coordinator shall formulate and recommend specific proposals, as necessary, for conserving energy resources; and shall assist public and private agencies in implementing energy conservation and efficiency programs. State energy policy is committed to maximizing cost-effective investments and fostering high impact programs. HSEO efficiency programs focus on delivery of cost-effective investments.

To date, HSEO has provided technical assistance to State and County agencies since 1996, resulting in \$320.68 million in energy performance contracting investments. In 2014, Hawaii retained its top national ranking for energy performance contracting per capita with an investment of \$235.74/capita, resulting in a third consecutive national *Race to the Top Award* from the Energy Services Coalition, a national organization focusing on energy performance contracting. Through this and our Lead by Example initiative, which

¹ Source: Hawaii Public Utilities Commission

implements State efficiency measures in State owned buildings, we are finding much success in the energy-efficiency sector. As of 2013, electricity consumption in the State and private sector achieved a 15.7% reduction to our Energy Efficiency Portfolio Standard (EEPS) of 30% by the year 2030. As of June 2013, HSEO continued providing technical assistance on performance contracting to State and County agencies to increase energy efficiency and further stimulate the clean energy industry by committing to facilitate \$300 million in energy performance contracting investments over the three year period 2013-16. Since 1996 over \$320M in performance contracting agreements have been signed by state and county agencies.

Renewable Energy – Hawaii, A Proving Ground for Clean Energy Solutions

Progress in renewable energy is measured against Renewable Portfolio Standards (RPS). Hawaii has steadily increased in quantity and energy generation since 2008. For instance, Hawaiian Electric Companies and Kauai Island Utility Cooperative reported that as of December 31, 2013, on a cumulative statewide basis, they have achieved a RPS of 17.97%, which means Hawaii has effectively surpassed the 2015 interim goal two years early.

Policy and Planning – Hawaii, Developing Innovative Solutions

The clean energy sector has become a significant driver in our State’s economy. Innovative solutions will be required to help secure Hawaii’s energy future and may bring opportunities to be deployed in communities statewide and beyond. This seedbed of innovation and creativity makes Hawaii a global leader in clean energy solutions for energy independence and economic growth.

Innovation is accelerating at a rapid rate, which in turn stimulates our economic growth. To help drive this energy evolution, HSEO is also leading with innovation, creating programs and bold policy solutions that will help make clean energy more accessible for Hawaii. For example:

- HSEO is in the process of establishing a groundbreaking high impact energy strategy and financing program, the Green Energy Market Securitization (GEMS) program with the passage of Act 211 by Governor Abercrombie in 2013, and regulatory approval for the GEMS financing and program orders in September 2014. GEMS is an innovative specialized financing structure that employs a securitization approach, typically used by the industrial sector, in order to bring low cost capital for consumers to invest in green infrastructure. In its initial launch, HSEO plans to provide financing to support underserved markets such as lower income households, renters and non-profits; thus, promoting the democratization of solar.

HSEO has also been focused on developing self-help tools and resources that empower users to better understand the regulatory requirements for individual renewable energy projects in Hawaii, which facilitates better project planning, design, and development.

Demonstrating Hawaii’s innovation and leadership in this area, some of these resources were featured by the National Association of State Energy Officials (NASEO) in November 2013 as best-practice state energy office streamline initiatives designed to maximize the potential for abating the soft costs associated with renewable energy permitting processes. Also, in a May 2014 peer review of its grant awardees, the United States Department of Energy (USDOE) described HSEO’s Renewable Energy Permitting Wizard as a “particularly impressive”

component of HSEO's permit facilitation suite (discussed infra) developed to help reduce the implementation costs of solar energy in Hawaii.

Currently, HSEO is able to track the visitation traffic for many of its resource websites, and provides additional metrics to measure the impact of each resource where available. For each resource, a brief summary of the following are provided:

- **Tool Usage:** Describes how the tool is being used by targeted stakeholders.
- **Challenges/Issues Addressed:** Describes the known challenges and issues the tool seeks to address.
- **Impact:** Quantifies, based on best data available to HSEO, the impact this tool has on facilitating the permitting and lowering the cost of renewable energy projects in Hawaii.

Developer & Investor Center (Center) (<http://energy.hawaii.gov/developer-investor>)

HSEO's online Developer & Investor Center provides important technical assistance, permitting tools and local connections to accelerate a renewable energy project's journey to the marketplace, where the rewards will be felt statewide. The Center is a dynamic resource that offers guidance on key phases of project development: permitting, local utility interconnection, regulation, Hawaii business registration, project financing and local incentives, local consultants, and site acquisition in Hawaii. It links to Project Permitting Assistance and Resources, which hosts the Guide to Renewable Energy Facility Permits in Hawaii, Permit Briefs, a list of consultants with permitting experience in Hawaii, and the Hawaii Department of Health (DOH) e-Permitting Portal (discussed infra). The Center connects users to the Hawaii Business Express Online Business Registration website to allow users to create and register a new business in Hawaii online. The Center also hosts the Self-Help Energy Suite, created and maintained by HSEO to advance high impact, clean energy alternatives.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: sophisticated developers who need information or need to apply for one particular permit or process; start-up companies who need to know all aspects of doing business in Hawaii; homeowners who need information on their solar installations. Additionally, users from the following countries have accessed the Center, demonstrating a global interest in the Hawaii renewable energy industry: U.S., India, Germany, Australia, Canada, France, Japan, South Korea, Czech Republic, China, Spain, Sweden, Switzerland, and the United Kingdom.
- **Challenges/Issues Addressed:** Developing or installing a renewable energy project in Hawaii requires approvals from multiple public and private entities. The Center is the only "one-stop shop" resource in Hawaii that provides valuable information across all phases of project development, including: state policies, regulatory compliance, grid interconnection, project siting, incentives, developing a project team, and registering a business in Hawaii.
- **Impact:** The Center's resources are designed to reduce project due diligence costs and timelines by providing a comprehensive central repository of information. The Center has

recorded 3,649 webpage views since its launch in October 2012, with over 890 webpage views from January 1, 2014, to November 3, 2014, not including hits to the individual resource links within the Center.

Project Permitting Assistance and Resources (<http://energy.hawaii.gov/developer-investor/project-permitting-assistance-and-resources>) HSEO's Project Permitting Assistance and Resources website is the only online resource HSEO is aware of that provides detailed information on obtaining individual permits from numerous county, state, and federal permitting agencies in Hawaii; reducing project due diligence costs and timelines by providing a comprehensive central repository of project permitting and siting information.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: sophisticated developers who need information or need to apply for one particular permit or process; start-up companies who need to know all permits required for a project without retaining a consultant; homeowners who need information on their solar installation permits; permitting agencies who are interested in other agency processes; policymakers and citizens who want a better understanding of cross-jurisdictional permitting regimes.
- **Challenges/Issues Addressed:** Project development and financing (investments, tax credits) timelines are significantly impacted by permitting schedules. This cross-jurisdictional resource helps users draft a realistic timeline for the permitting of specific projects. It also speeds project development and minimizes project impacts by identifying pitfalls and effective mitigation/avoidance strategies specific to developing renewable energy projects in Hawaii.
- **Impact:** The Project Permitting Assistance and Resources website has recorded over 2,000 webpage views since its launch in October 2012, with just over 200 webpage views from January 1, 2014, to November 3, 2014.

The Project Permitting Assistance and Resources website provides:

Guide to Renewable Energy Facility Permits in the State of Hawaii (Guide)

The Guide was developed to help those proposing renewable energy projects in Hawaii understand the county, state, and federal permits that may be required for their individual project. It also provides insight into developing large-scale projects in Hawaii by describing the siting challenges unique to Hawaii, including the Hawaii environmental review process (Chapter 343, Hawaii Revised Statutes), local cultural and archeological resources, endangered species and habitats in Hawaii, overlaying zoning districts, importance of community engagement, and more.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: sophisticated developers seeking comprehensive guidance on impacts and permitting requirements unique to renewable energy projects in Hawaii; start-up companies who need to know all permits required for a project without retaining a consultant; homeowners who need information on their solar installation permits; permitting agencies who are interested in other agency processes; policymakers and citizens who want a better understanding of permitting requirements and project impacts.

- **Challenges/Issues Addressed:** Project impacts are most effectively and efficiently mitigated during the early project siting and design phase. The Guide supports smart project design location as the only resource that discusses project impacts, mitigation strategies, and regulatory requirements specific to Hawaii's environment and renewable energy industry.
- **Impact:** HSEO does not have analytics tracking the number of times the Guide has been accessed online. Feedback from local consultants specializing in the development of renewable energy projects in Hawaii indicates the Guide is most useful during initial project due diligence.

Permit Briefs (Briefs)

Complementing the Guide, the Briefs provide processing and general information on over 160 individual county, state, and federal permits required for renewable energy projects in Hawaii; including permit process steps, estimated timelines and costs, agency contacts, relevant laws and references, and best practices to most effectively navigate the process. HSEO works with the relevant county, state, and federal agencies to update the Briefs consistent with current agency practices, policies, and procedures.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: sophisticated developers who need information or need to apply for one particular permit or process; start-up companies who need to know all permits required for a project without retaining a consultant; homeowners who need information on their solar installation permits; permitting agencies who are interested in other agency processes; policymakers and citizens who want a better understanding of cross-jurisdictional permitting regimes.
- **Challenges/Issues Addressed:** Understanding the process steps and timelines for individual permits is key to project planning and financing. The Briefs support the development of a realistic permit plan and timeline, which can be used in investment packages, dealings with utilities, workforce, and equipment providers.
- **Impact:** HSEO does not have analytics tracking the number of times the Briefs have been accessed online. Feedback from local consultants specializing in the development of renewable energy projects in Hawaii indicates the Briefs are useful during initial project due diligence and when seeking individual permits.

With additional funding from USDOE to reduce project 'soft costs,' HSEO is upgrading the Project Permitting Assistance and Resources with assistance from Tetra Tech, a firm with experience in renewable energy facility permitting and development in Hawaii. In December 2014, HSEO will start publishing and more actively promoting these updates resources.

Hawaii Department of Health e-Permitting Portal (e-Permitting) (<https://eha-cloud.doh.hawaii.gov/epermit/>) e-Permitting is an online permitting platform launched by DOH in the spring of 2012 that enables the electronic submission and processing of DOH Environmental Health Administration (EHA) permits. In May 2010, DBEDT and DOH executed a Memorandum of Agreement to develop an online permitting tool. This partnership allowed DOH to retain software developer Windsor Solutions to develop an online permit processing tool that empowers DOH staff and provides the regulated community sought-after transparency into the processing of their individual permits. DOH can now electronically

develop, control, and manage many administrative and permitting forms issued by DOH-EHA, including the necessary permit (application) modifications in response to changing state and federal requirements. Permit applicants can now track their application through to issuance, and instantaneously and directly interact with DOH staff processing their permit(s).

Given the numerous permits under DOH-EHA jurisdiction required for renewable energy facilities in Hawaii, enhancing DOH-EHA's ability to process and manage a high volume of permits will facilitate renewable energy development in Hawaii for years to come. e-Permitting has been implemented in other states and can serve as a model for other Hawaii agencies considering electronic permit filing and management. e-Permitting was awarded a 2013 Excellence in Technology Award from the State of Hawaii Office of Information Management and Technology under the "Digital Government: Government to Business" category.

- **Tool Usage:** This tool is most applicable to developers and consultants who need information or need to apply for one particular DOH-EHA permit or process.
- **Challenges/Issues Addressed:** Electronic filing and processing provided by e-Permitting addresses numerous challenges: (a) increased efficiency in permit filing, processing, and file management – benefits external users and DOH staff; (b) increased transparency into the permit process; and, (c) electronic fee acceptance and deposit.
- **Impact:** Since its launch, 2,066 applications (\$726,916 in processing fees) have been received electronically. Of these, 1,713 applications completed. According to DOH, e-Permitting also reduces staff time processing permits and has reduced average permit processing times.

Self-Help Energy Suite (<http://energy.hawaii.gov/developer-investor>)

The Self-Help Energy Suite (Suite) hosts HSEO's innovative and interactive online permitting tools which promote effective project design and location and includes the following resources:

Renewable Energy Permitting Wizard (Permitting Wizard)

(<http://wizard.hawaiiicleanenergyinitiative.org/>) The Permitting Wizard helps those proposing renewable energy projects in Hawaii identify and understand the county, state, and federal permits required for their individual project regardless of technology type (wind, solar, geothermal, wave, bioenergy, waste-to-energy, etc.). Users are asked a series of questions relating to their project(s) and their answers prompt the Permitting Wizard to identify the permits required. To compare projects, users can run numerous scenarios to determine how project design or location changes impact the permits required.

The Wizard serves as a model for a similar "wizard" currently being developed by the National Renewable Energy Laboratory (NREL) and is considered a case study in effective means of permit facilitation by the National Association of State Energy Officials. In addition to receiving favorable review by USDOE, the Permitting Wizard was awarded a 2013 Excellence in Technology Award from the State of Hawaii Office of Information Management and Technology under the "Cross-Boundary Collaboration and Partnerships" category.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: sophisticated developers who need information on the permits required for their projects; start-up companies who need to know all permits required for a project without retaining a

consultant; homeowners who need information on their solar installation permits; permitting agencies who are interested in other agency processes; policymakers and citizens who want a better understanding of cross-jurisdictional permitting regimes.

- **Challenges/Issues Addressed:** Project impacts are most effectively and efficiently mitigated during the project siting and design phase. The Permitting Wizard supports smart project design location by enabling users to immediately and remotely identify the permits required for specific projects. Users can also compare the permitting requirements for the same project at different sites.
- **Impact:** In 2014, 36 users registered and created an account for the Permitting Wizard from various renewable energy sectors – developers, investors, regulatory agencies, and consultants. This does not account for all the non-registered users. Starting in November 2014, HSEO will be able to track the number of visits to the upgraded Permitting Wizard website. The Permitting Wizard has garnered positive feedback from the United States Department of Defense (USDOD), local permitting agencies, local consultants, and other users.

With funding from USDOE (SunShot Grant), HSEO is in the process of updating the functionality, appearance, and permit content of the Wizard. The revamped “Wizard 2.0” is scheduled to be released in December 2014.

EnerGIS Mapping Tool (EnerGIS) (<http://energy.hawaii.gov/resources/renewable-energis-map>) EnerGIS provides renewable energy resource and site information for specific Hawaii locations, enabling developers to conduct high level site due diligence remotely and instantly. Using this tool, developers can generate a list of potential sites for development consideration to support their own project siting efforts and in some cases alleviate the need for third-party assistance identifying and locating suitable project sites. EnerGIS allows a lay user to identify the important attributes related to siting and permitting – such as zoning, critical habitat, slope, and rainfall – for specific land parcels throughout the State of Hawaii. Maps can also be created to show certain resources, such as solar irradiance and wind power density, statewide, allowing the user to refine his or her search to areas with high resource potential. Although this mapping application has functionality which is similar to applications launched by other agencies for other purposes, EnerGIS is the only mapping application focused on presenting information about renewable energy resources development in Hawaii.

A product of the partnership between HSEO, the Hawaii Office of Planning (OP), and developer BEI Consulting, EnerGIS uses existing geographic information systems (GIS) data and system operations managed by OP. EnerGIS was awarded a 2013 Excellence in Technology Award from the State of Hawaii Office of Information Management and Technology under the “Fast Track Solutions” category. HSEO and OP are now contracting for upgrades to the functionality and usability of EnerGIS, with upgrades scheduled to be completed by June 2015.

- **Tool Usage:** This tool has a wide ranging audience and applicability, including: -large scale renewable energy developers can remotely find and assess suitable sites for their projects; landowners can gauge the potential for renewable energy developments on their lands; policy makers can better understand the geographic distribution and potential of renewable resources; and, the general public can obtain information relating to clean energy project siting.

- **Challenges/Issues Addressed:** EnerGIS helps to address the challenge of finding a site with suitable attributes – island, terrain, resource potential – for a given renewable energy project and technology. It also supports individual site assessments, which contributes to both site-specific and system-wide grid planning.
- **Net Impact:** From January 1, 2014 to November 3, 2014, EnerGIS recorded 4,541 sessions from 1,388 users; including users located in the United States, Germany, Canada, Japan, United Kingdom, India, Switzerland, China, Italy, and South Korea. These numbers demonstrate interest in EnerGIS from the development community and its ability to support remote site identification. EnerGIS saves HSEO and OP considerable time, as HSEO specialists can quickly create customized maps to review the attributes of proposed projects without relying on OP’s GIS technicians’ expertise and availability.

Hawaii Renewable Energy Projects Directory (Directory)

(<https://energy.ehawaii.gov/epd/public/energy-projects-map.html>) The interactive Directory is an online listing to find and learn about existing and proposed renewable energy projects in Hawaii. The Directory lists projects statewide, showcasing the variety of renewable energy resources that are being harnessed to move us closer to reaching our overall clean energy goal. The Directory is updated periodically by HSEO based on publically available information from a variety of sources on each identified renewable energy project.

- **Tool Usage:** Identifying existing and proposed projects helps local regulatory agencies better understand the cumulative landscape of renewable energy projects in Hawaii, and informs local communities of projects planned in their area to facilitate community involvement prior to project construction. It also demonstrates Hawaii’s market potential to prospective investors and developers.
- **Challenges/Issues Addressed:** The Directory is the only public repository identifying both existing and proposed renewable energy projects statewide.
- **Impact:** From January 1, 2014 to November 3, 2014, the Projects Directory website recorded 3,603 sessions from 2,502 users, including users located in the United States, Germany, Japan, United Kingdom, France, Poland, China, Italy, and South Korea. These numbers demonstrate international interest in the development of renewable energy projects in Hawaii

Programmatic Environmental Review

On December 14, 2010, the U.S. Department of Energy (USDOE) issued a Notice of Intent (NOI) to prepare a Programmatic Environmental Impact Statement (PEIS), with the State of Hawaii (represented by the Hawaii State Energy Office) as a joint lead, on the wind phase of the Hawai‘i Interisland Renewable Energy Program (HIREP) (75 FR 77859). That NOI referred to the PEIS as the “HIREP: Wind PEIS.” HIREP narrowly considered wind and undersea transmission technologies between Oahu and Maui County. In response to public scoping comments, as well as regulatory and policy developments since the scoping meetings, USDOE and HSEO decided to broaden the scope of the PEIS to include a wider range of clean energy activities and technologies with the potential for near-term development or application in Hawaii. USDOE also assumed the lead for the PEIS under the federal National Environmental Policy Act (NEPA). Accordingly, the project was renamed the “Hawaii Clean Energy PEIS.”

The Draft PEIS was presented for public comment in the second quarter of 2014. Public meetings were held statewide. Stakeholders and the general public were invited to submit comments on the draft document orally at the meetings, in writing and electronically. After responses are prepared to the comments, the PEIS will be released in final form in late 2014 or early 2015.

- **Tool Usage:** The PEIS will be useful as a reference document for the state, county, and federal government agencies and private project developers when project-specific environmental documents are prepared. The PEIS will further serve as guidance the USDOE can use in making decisions about future USDOE funding and other actions to support Hawaii in achieving its HCEI objectives.
- **Challenges/Issues Addressed:** The PEIS serves two of our State energy policy principles, namely, diversifying our energy portfolio and helping to balance technical, economic, environmental and cultural considerations.
- **Impact:** Upon finalization and public release of the PEIS, it will serve as a valuable reference tool across the private and public sector to more readily identify project-specific environmental impacts and associated mitigations and best practices; this should ultimately translate into more timely and effective project development. Furthermore, the PEIS could be used to support future funding decisions by USDOE to support HCEI.

Planned Initiative: Electronic Permitting

HSEO plans to maintain its focus on developing high impact solutions and tools to facilitate the permitting of renewable energy projects in Hawaii.

Specific near-term high impact solutions in HSEO's permit facilitation plan include the development and implementation of electronic/online permitting and asset management systems in partnership with selected state agencies. HSEO has identified specific state agencies key to renewable energy project permitting in Hawaii (i.e., Department of Land and Natural Resources or DLNR) and is in the process of executing a contract for the development of an electronic permit system for select DLNR divisions involved in the regulation of renewable energy developments.

Introduction

This report is respectfully submitted by the Department of Business, Economic Development and Tourism (DBEDT), pursuant to Act 73, Session Laws of Hawaii 2010. The sections to follow focus on reporting to the Legislature the following requested information:

1. The status and progress of clean energy initiatives funded by the Energy Security Special Fund (ESSF) and targeted markets;
2. The State Energy Office (HSEO) budgeted spending plan; and
3. An analysis of the Environmental Response, Energy, and Food Security Tax (EREFST) allocation.

Overview

Hawaii's progress in clean energy is in large part a result of many of the program initiatives and staffing funded through the Legislature, ESSF, and federal grants. This report provides an accounting of the progress achieved through the State's allocation and investment of ESSF funding through the EREFST.

In FY13, \$8,972,432 was spent on HCEI, of which \$3,407,295, or 38% of the total was funded by the ESSF.

In FY14, \$6,074,862 was spent on HCEI, of which \$4,604,056 or 76% of the total was funded by the ESSF. The HSEO obligated over 80% of its ESSF allocation.

This rate of obligated ESSF funds is anticipated to be higher in fiscal year 2015 with the filling of a number of position vacancies.

DBEDT Reporting Pursuant to Act 73(10)

The Legislature in passing Act 73(10), determined that it is in the best interest of Hawaii's people to build the capacity needed to become self-sufficient in energy and food needs and to protect the health and function of the environment. Further, that Hawaii has all the necessary assets to significantly improve the State's energy and food sustainability and independence over the next twenty years if appropriate personnel resources and funding are judiciously used. To succeed, the State must ensure a long-term strategy, which is well-resourced, coordinated, and focused.

The Act specifies that DBEDT shall:

1. Report the status and progress of new and existing clean energy initiatives, which includes:
 - a. The spending plan of HCEI;
 - b. All expenditures of the ESSF moneys; and
 - c. The targeted markets of the expenditures, including:
 - Reasons for selecting those markets,
 - The persons to be served,
 - Specific objectives of the program, and
 - Program expenditures, including measurable outcomes.
2. Study and analyze the EREFST to include:
 - a. Its amount and allocation; and
 - b. Its effectiveness in accomplishing the goals and objectives of the Act.

State Energy Policy Directives

Hawaii's energy policy commitment and objectives are to make cost-effective long-term investments in clean energy productivity and management for the purpose of promoting Hawaii's energy security. This supports the achievement of the HCEI goals to enable an integrated system based on clean energy resources. Key policy directives:

1. To diversify the State's energy portfolio;
2. Connect the islands through integrated, modernized grids;

3. Balance technical, economic, environmental and cultural considerations;
4. Leverage Hawaii's position as a clean energy test bed; and
5. Allow the market to pick winners.

HCEI Program Objectives

HCEI was established to guide the State's transition to a clean energy economy. Its objectives, as established by the Act, are to design, implement, and administer activities, to include:

1. Strategic partnerships for the research, development, testing, deployment, and permitting of clean and renewable technologies;
2. Engineering and economic evaluations of Hawaii's potential for near-term project opportunities for the State's renewable energy resources;
3. Electric grid reliability and security projects that will enable the integration of a substantial increase of electricity from renewable-energy resources;
4. A statewide clean energy public education and outreach plan to be developed in coordination with Hawaii's institutions of public education;
5. Promotion of Hawaii's clean and renewable resources to potential partners and investors; and
6. A plan, to be implemented from 2011 to 2030, to transition the State and each county to a clean energy economy.

These objectives were then used to refine an HCEI roadmap in which the overall mission of HSEO is to:

1. Deploy clean energy infrastructure as a catalyst for economic growth;
2. Facilitate innovation sector development; and
3. Enhance energy security advancement.

To achieve this mission HSEO is undertaking the following tasks:

1. Facilitating implementation of the clean energy objectives articulated in the HCEI road map and concentrating on immediate and near-term opportunities to accelerate renewable energy and energy efficiency deployment:
 - a. Meeting 15% Renewable Portfolio Standard (RPS) target for 2015,
 - b. Meeting 2015 Energy Efficiency Portfolio Standard (EEPS) target to be set by the PUC, and
 - c. Displacing 50 million gallons per year of oil in the transportation sector by 2015;
2. Growing Hawaii's clean energy innovation sector; and
3. Facilitating development of key infrastructure to harness Hawaii's rich portfolio of renewables.

HCEI 2.0 is intended to address the new ecosystem requiring grid modernization and interconnections, and bridging conventional to renewable energy sources with transitional

fuels. As well as, the growing demands for energy efficiencies, and high impact innovative programs that advance the progress towards Hawaii’s energy goals.

I. Status & Progress of Clean Energy Initiatives

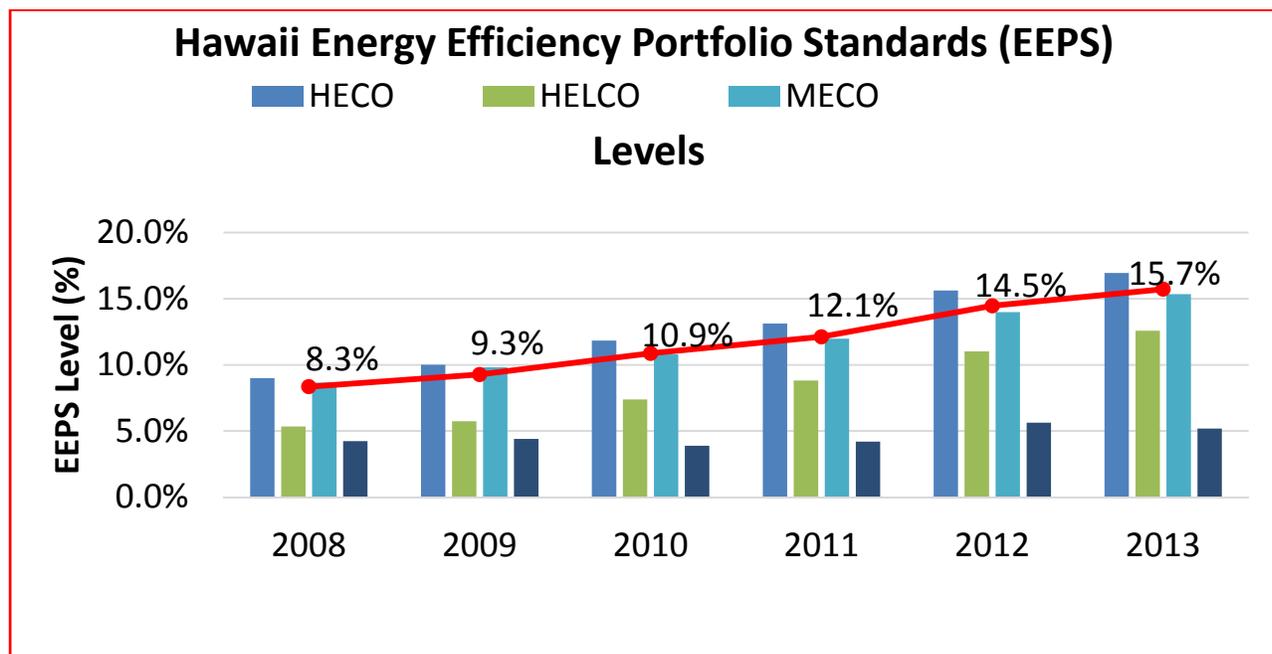
Key progress indicators and accomplishments for FY13 under HCEI are as follows:

Energy Efficiency Demand Reductions

Hawaii’s overall goal for energy efficiency is to meet the Energy Efficiency Portfolio Standard (EEPS) by reducing electricity demands by 30% by 2030. To meet this goal, the State continues to:

1. Align the State’s efficiency regulatory policy framework with clean energy goals;
2. Support the retrofitting of existing residential and commercial buildings;
3. Strengthen new construction policies and building codes;
4. More than double energy efficiency within State and County buildings by implementing additional energy savings performance contracting with the private sector; and
5. Identifying non-building related energy efficiency measures.

As a result of energy efficiency measures to date, Hawaii has already made great strides toward its 30% energy efficiency goal. The chart shows that for 2013 Hawaii, achieved a statewide EEPS level of 15.7%.



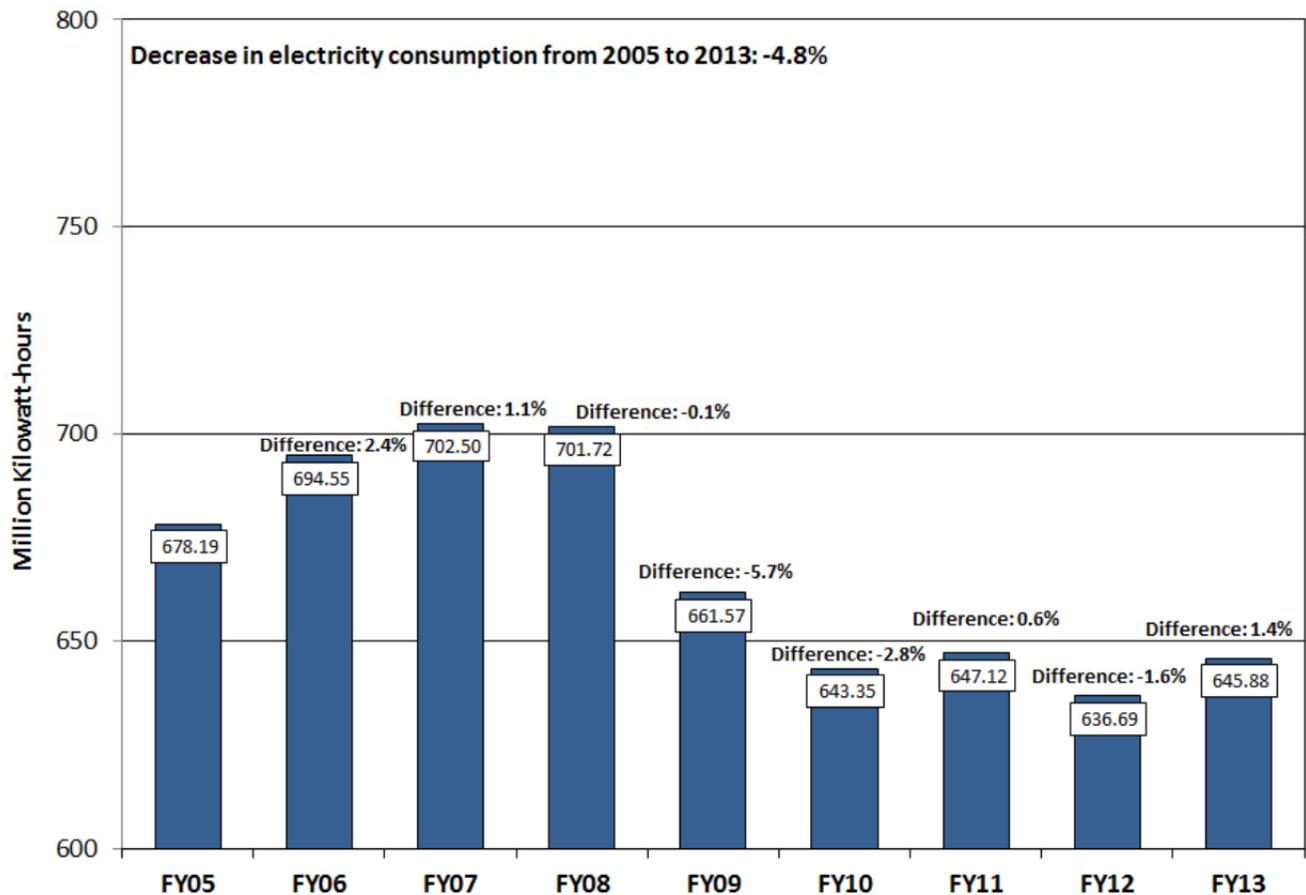
Source: *Renewable Portfolio Standards Status Reports, 2008-2013* (Hawaii Public Utilities Commission)

*Kauai Island Utility Cooperative (KIUC) RPS and EEPS not included for 2013.

State initiatives through the “Lead By Example” program are conserving energy and reducing energy consumption within government buildings, in vehicle fleet usage, and through personnel practices. Retrofitting existing buildings for energy efficiency and modifying operations

strategies were the primary contributors to reducing electrical consumption and cost, but progress also was made in green building design, environmentally preferable purchasing,

transportation and the adoption of renewable energy. Substantial progress has been made through this program, since its inception in 2006. State agency consumption in 2013 is 4.8% below the 2005 baseline levels, as depicted in the following chart; a savings of 32 million kWh.



Source: *Renewable Portfolio Standards Status Reports, 2008-2013* (Hawaii Public Utilities Commission)

*Kauai Island Utility Cooperative (KIUC) RPS and EEPS not included for 2013.

Renewable Energy Development

Each year, Hawaii advances toward its clean energy goals set by HCEI. Renewable energy development is moving forward and an increasing amount of locally produced renewable energy is being utilized throughout the Islands.

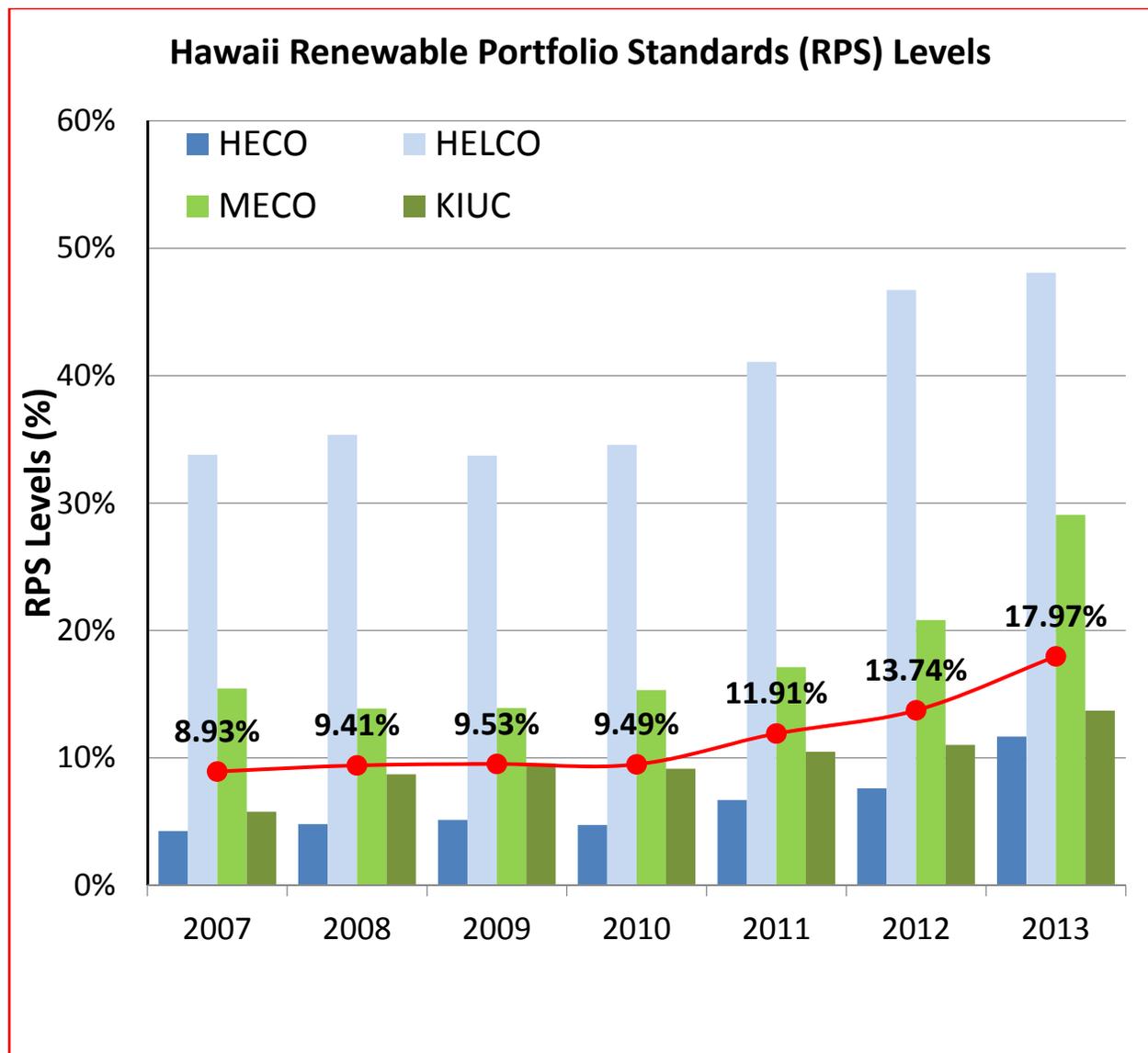
- Renewable energy generation in Hawaii continues to grow from approximately 14% in 2012 to 18% in 2013.
- Renewable resource potential, statewide, is greater than current electricity demand. However, since electricity must be used, transmitted, or stored at the instant it is produced, practical use of most renewable resources is constrained by time and location of production.

- In 2013, a total of 18,316 distributed renewable energy systems with a total capacity of 115 MWs were installed statewide. Since 2006, net energy metering (NEM) system installations have increased rapidly and there are currently a total of 40,717 systems installed, representing 253.5MW of total capacity.

Hawaii's goal is to generate 40% clean energy by 2030, by undertaking the following activities:

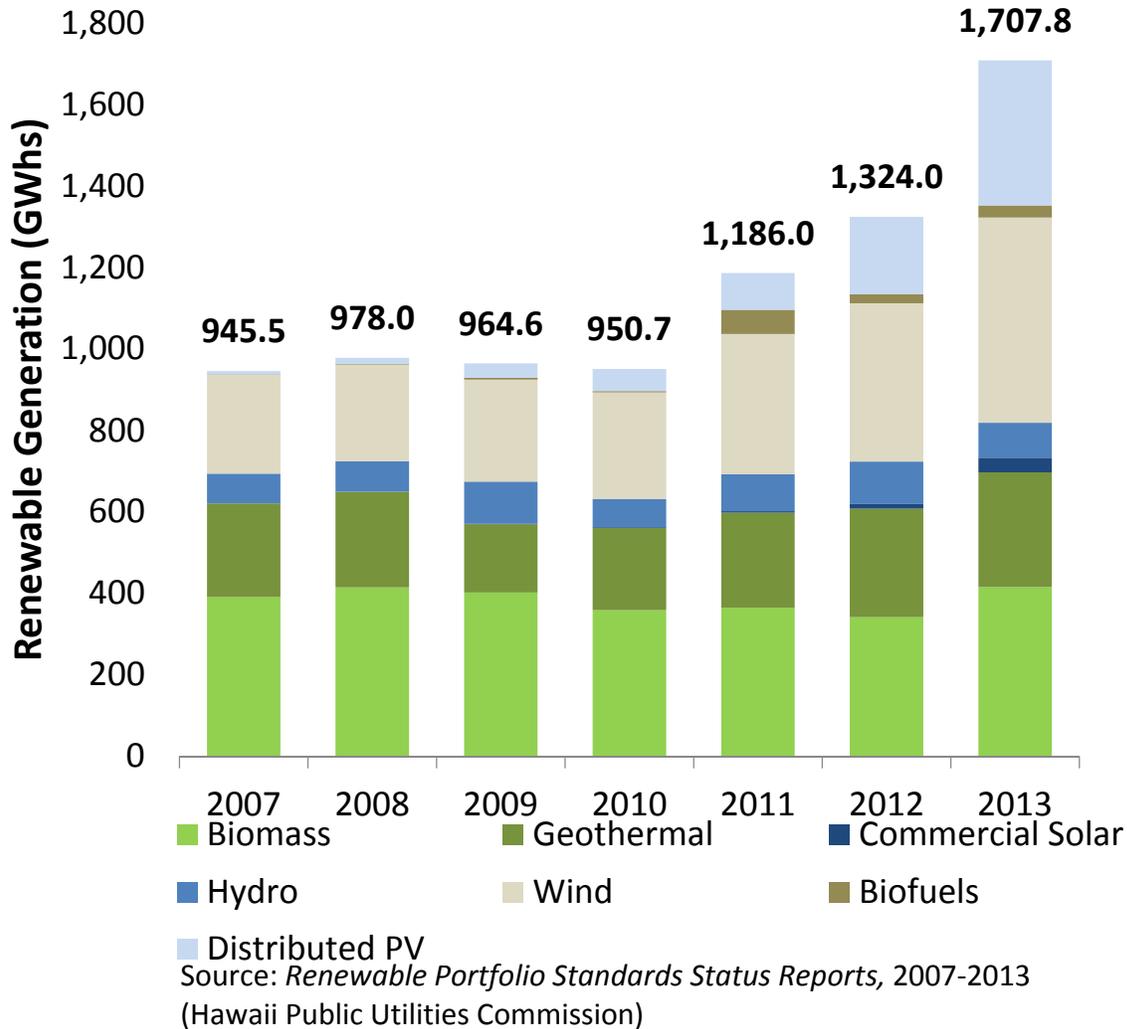
1. Aligning government regulations and policies with clean energy goals;
2. Facilitating processes for developing renewable energy;
3. Assisting in the deployment of impactful renewable generation and grid infrastructure; and
4. Exploring next generation technologies and new applications of existing technologies.

As a result of renewable energy increases to date, Hawaii has effectively surpassed its interim 2015 RPS goal of 15%. The following chart shows that in 2013, Hawaii achieved a Statewide RPS level of 17.97%.



Source: *Renewable Portfolio Standards Status Reports, 2007-2013* (Hawaii Public Utilities Commission)

Hawaii Renewable Energy Generation by Resource



Source: *Renewable Portfolio Standards Status Reports, 2007-2013* (Hawaii Public Utilities Commission)

*Kauai Island Utility Cooperative (KIUC) RPS and EEPS not included for 2013.

Green Jobs, Innovation, and Economic Growth

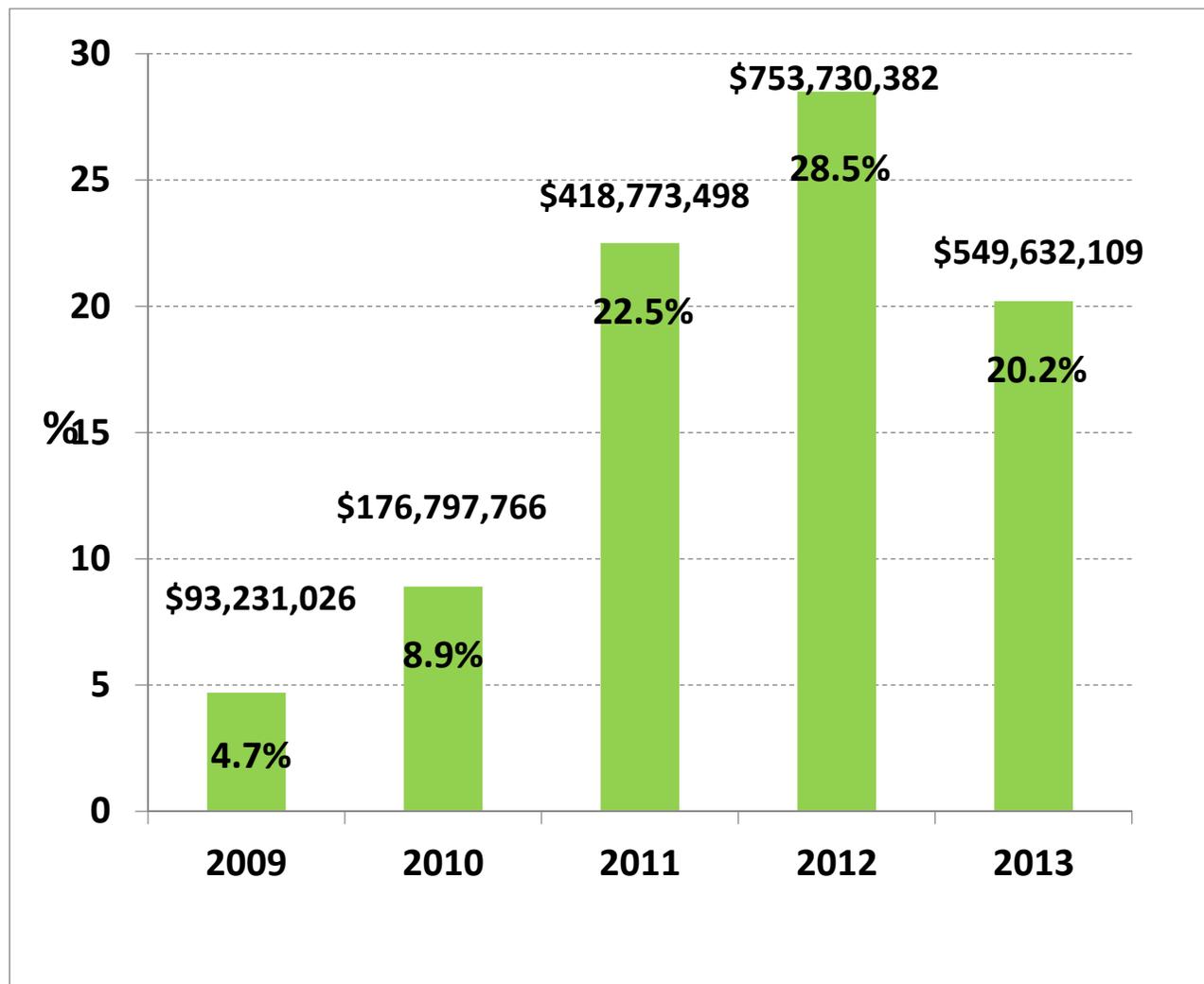
Hawaii ranked No. 3 among the top 10 states for clean energy job postings in 2013, and was also among the top 10 in the fourth quarter of last year, according to a report by nonpartisan business group Environmental Entrepreneurs (E2). Also, according to a Brookings 'Metropolitan Policy Program' fact sheet, Hawaii's 11,113 clean jobs in 2010 earned an estimated median wage of \$42,235 compared to \$38,615 for all jobs in Hawaii.

In 2013, solar-related projects accounted for 20.2% of all construction expenditures in the State (see chart on the next page), providing a much needed stimulus to the construction industry. However, due to high solar penetration of electrical circuits in parts of Hawaii, a curtailment in

interconnection to the utility grid in these areas have dampened the pace and progress of solar implementation.

Solar-Related Construction Expenditures

Value of solar projects as % of total building permit value



Source: Research & Economic Analysis Division, DBEDT

HSEO is undertaking initiatives that provide sustainable and innovative strategies to address market issues to enable reducing Hawaii's dependence on imported oil. The intent is to expand, attract, and develop a critical mass of test-bed energy innovations which will advance clean energy solutions, bridge financial barriers, develop alternatives to transportation usage, add new clean energy infrastructure, and provide tools to foster development.

State and County Performance Contracting

Energy savings performance contracting enables more energy efficient operations, creates jobs, and avoids carbon emissions. These contracts are agreements between a building owner (or facilities manager) and a private energy services company (ESCO) that uses future energy and

water savings to pay for and maintain energy efficiency improvements. See the chart on the following page on energy performance contracts.

Hawaii’s energy savings for performance contracting over 20 years (1.16 billion kWh) is equivalent to powering an estimated 156,995 households for one year. In 2013, Hawaii’s performance contracting program drove more than \$171 million in energy efficiency investments, the highest per capita investment of any state, according to the Energy Services Coalition. The performance contracting program, housed in HSEO and pending availability of funding, offers technical assistance to state and county agencies with their performance contracting projects.

HAWAI‘I STATE AND COUNTY ENERGY PERFORMANCE CONTRACTS			
AGENCY		CONTRACT AMOUNT (\$)	ESTIMATED SAVINGS OVER LIFE OF CONTRACT (\$)
UH-Hilo	1996	\$6,402,695	\$14,630,066
County of Hawai‘i	1997-2006	\$2,215,546	\$8,157,880
County of Kauai	1998-2006	\$525,965	\$1,205,990
C&C of Honolulu	2001-2005	\$11,900,205	\$36,066,761
HHSC	2001-2005	\$22,542,969	\$55,766,365
Judiciary	2003	\$1,474,406	\$9,785,036
DAGS Phase I	2009	\$33,902,962	\$56,149,562
PSD	2011	\$25,511,264	\$46,000,000
UHCC	2011	\$32,802,838	\$90,064,000
C&C Honolulu	2013	\$16,000,000	\$34,000,000
DAGS Phase II	2013	\$17,400.00	\$28,000,000
DOT	2013	\$150,000,000	\$518,025,760
	TOTAL	\$320,678,850	\$897,851,420

Source: DBEDT – Hawaii State Energy Office

Innovative Solutions To Overcome Financial Barriers

Hawaii's Green Energy Market Securitization (GEMS) Program is a high impact strategy to deploy clean energy infrastructure and technologies, which will further contribute to achieving Hawaii's statutory 70% clean energy goals by 2030. It is intended to expand the market reach for clean energy technologies to underserved segments desiring participation in implementing clean energy improvements. The GEMS Program is established in law by Act 211, Session Laws of Hawaii 2013, which also provides a funding mechanism for the Program in the form of bond issuance authority to DBEDT. GEMS fund deployment can be categorized into three products: unleveraged debt, leveraged debt, and credit enhancements, to be deployed through existing market channels such as local banks, solar developers and solar installers. Some of the GEMS products may be repaid as a line item on the consumer's electric utility bill, also known as on-bill repayment.

On June 6, 2014, DBEDT filed applications with the PUC to seek regulatory approval of GEMS. The PUC filings established dockets for a Financing Order (2014-0134) to issue up to \$150 million in green infrastructure bonds, and institute a fee to secure the bonds. The second filing, a Program Order (2014-0135) creates a green infrastructure loan program that would use bond proceeds to provide alternative low-cost financing for eligible clean energy technologies. The PUC will determine whether loan repayments are to be made through a customers' electric bill.

Proceeds from the bond issuance will be placed in a Green Infrastructure Special Fund that can be used alone or in combination with private capital to provide financing to consumers through "deployment partners," such as local financial institutions, solar financiers and energy lenders. Consumers will be able to repay the loans over time with the savings on their electric bills. DBEDT will oversee the program until a Green Infrastructure Authority is created to take over the administrative duties. The fund initially will be used to support the installation of solar PV systems, and will later be expanded to cover a variety of eligible clean energy technologies, energy storage, smart modules, monitoring devices and other technology to support the interconnection of PV systems to the grid.

On September 4, 2014, the PUC approved the GEMS financing order, and on September 30, 2014 it approved the GEMS program order.

Recommitment To Transportation Goals

HCEI 2.0, the next phase of the Hawaii Clean Energy Initiative involves a recommitment to transportation goals in order to confront the new challenge of going beyond 40 percent clean energy by 2030.

Transportation accounts for more than 60 percent of the energy consumed in Hawaii, and while air transportation uses the largest portion — nearly 40 percent — ground transportation via trucks, buses, and cars consume roughly 20 percent.

The overall goal for the transportation sector is to reduce the consumption of petroleum in ground transportation by 70% (or approximately 385 million gallons per year) by 2030. One way to achieve this goal is by helping Hawaii residents mitigate the energy use by ground transportation, and thereby help Hawaii to achieve its clean energy goals.

Hawaii’s leaders and stakeholders view the adoption and widespread deployment of EVs as a key approach towards the reduction of our fossil fuel dependency through the alternative use of clean energy generated electricity for transportation.

On June 15, 2013, a \$30 million collaborative demonstration project between Japan and Hawaii was launched that aims to improve the integration of renewable energy resources into Maui’s Smart Grid and prepare our electric system for efficient adoption of all-electric vehicles.

Hawaii’s drivers have enthusiastically adopted EVs as their mode of transportation. The chart on the next page shows the number of registered EVs in the four counties, as well as the number of publicly available charging stations statewide.

ELECTRIC VEHICLES AND CHARGING STATIONS IN HAWAII (AS OF JULY 2014)		
ISLAND	ELECTRIC VEHICLES	CHARGING STATIONS
Oahu	2002	257
Maui	493	74
Hawai‘i	133	46
Kauai	87	32
Statewide	2715	405

In July 2014, the number of passenger EVs in the state was 2,715, an increase of 1,008 vehicles (59.1%) from the same month last year, and an increase of 110 vehicles (4.2%) from June 2014.

*Registered passenger EVs which include plug in hybrid and neighborhood EVs.

**Charging stations reflect the number of ports or charging cords/plugs which can service one EV

Source: Department of Business, Economic Development & Tourism, 2014

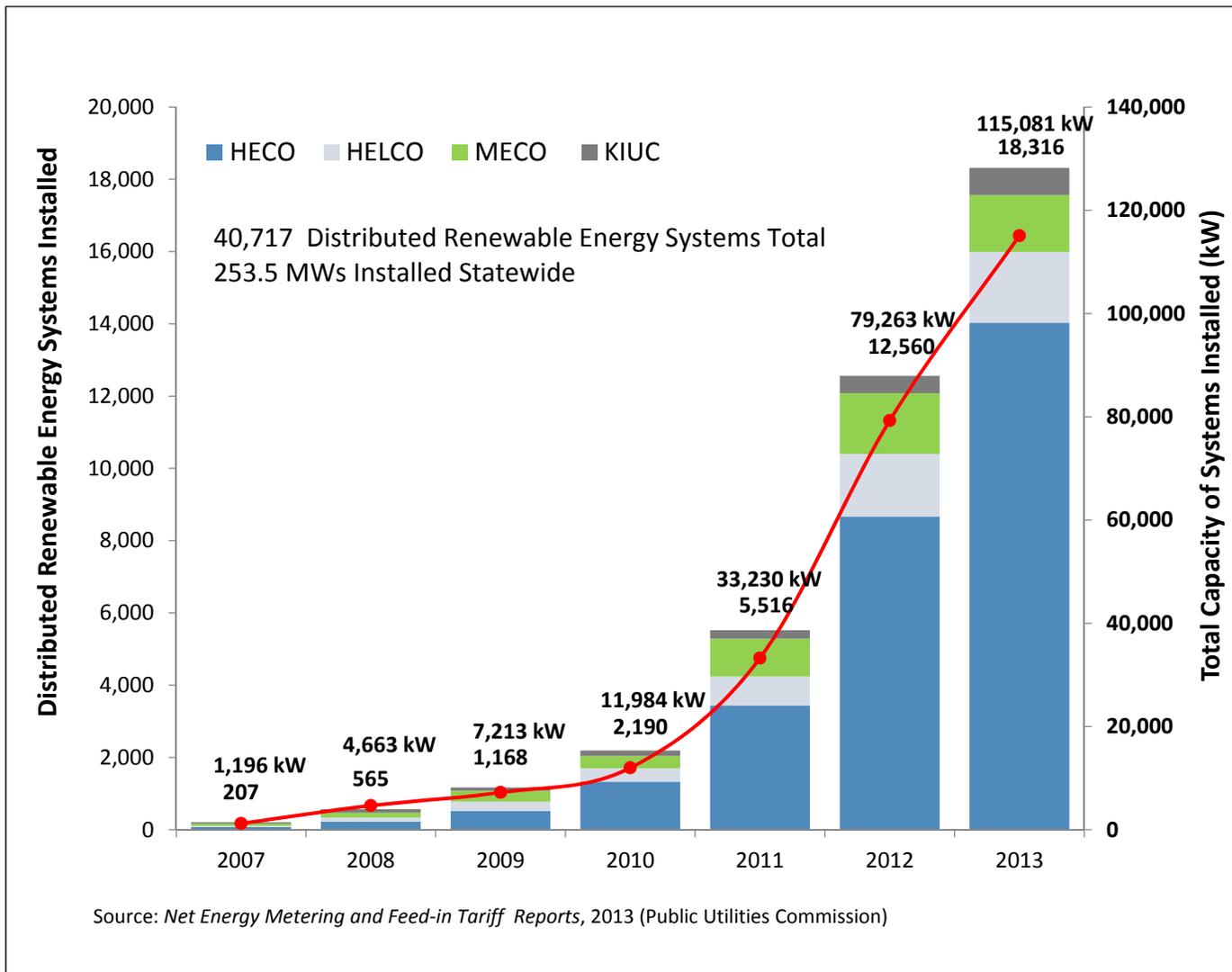
Distributed Renewable Energy Infrastructure

Hawaii’s electric utilities and consumers statewide are taking a “proactive approach” to activating more distributed energy systems onto the electric grid. In 2013, there were a total of 18,316 NEM systems installed statewide with a total capacity of over 115 MWs. See the chart on the following page.

Specifically, HSEO funded (through the U.S. Department of Energy SunShot Initiative grant) the study on the progress of the innovative Proactive Approach developed by Hawaiian Electric Company (HECO). The purpose of the study is to enhance the utilities’ functions of interconnection, and transmission and distribution planning in order to anticipate and plan for

higher penetration levels of Distributed Generation (DG) solar energy. The results could lead to faster, more efficient and cheaper evaluation of interconnection requests from renewable energy developers and homeowners wanting to install solar energy while remaining connected to the power grid. The Proactive Approach was recommended by the Hawaii Reliability Standards Working Group (RSWG), PV Sub-Group, which was convened to develop policy and technical recommendations to the PUC that will facilitate the increased use of renewable energy in the islands without compromising grid reliability.

The results of the Proactive Approach study were presented to both the RSWG PV Sub-Group as well as to the SunShot Initiative peer review team. They said, “This initiative is very important, not only for the benefits it can deliver to Hawaii, but also for the benefits it can deliver to the rest of the country. Since Hawaii is facing grid integration challenges before most other states, the work it does to improve interconnection processes and standards and to resolve reliability challenges as renewable energy penetration levels increase could be shared with other states and utilities in the future. Therefore, the potential impact of this initiative is very significant, assuming the results can be effectively disseminated and applied in other states. Engagement with many local stakeholders from industry, utility, and PUCs are strengths. Understanding the impact of high-penetration solar is a key step in the continued expansion of solar on the grid.”



II. State Energy Office – Budgeted Spending

HSEO is supported primarily by its Energy Security Special Fund (ESSF), established under section 201-12.8, HRS. The ESSF receives 15 cents of the Environmental Response, Energy, and Food Security Tax on each barrel of petroleum product sold by a distributor to any retail dealer or end user of petroleum product, other than a refiner. Act 107, SLH 2014 extended the allocation of revenues collected from the tax to the ESSF, from June 30, 2015, to June 30, 2030. Since fiscal year 2011, the ESSF revenues have been approximately \$3.9M per fiscal year.

Federal funding from the U.S. Department of Energy (USDOE) and other federal agencies supplements the State Energy Office's ESSF funding. Following the expiration of American Recovery and Reinvestment Act (ARRA) funding in September 2013, and Energy Efficiency and Conservation Block Grant funds expiring in November 2014; the State Energy Office has been pursuing other federal funding opportunities. The USDOE's State Energy Program provides an annual formula allocation of approximately \$280K. The current portfolio of federal grants supporting the State's energy program is detailed in the chart on the next page:

Hawaii State Energy Office - Federal Grants				
FUNDING AGENCY	AWARD TITLE	AWARD AMOUNT	GRANT OBJECTIVE	PARTNERS
USDOE - NETL	Hawaii Renewable Energy Grid Project	\$500,000	To establish a regulatory and policy framework that will enable and accelerate the integration of utility scale renewable energy using innovative demand side management, storage, smart grid, plus transmission and delivery technologies for the grid infrastructure of Hawaii. Term: Oct 2008 - Mar 2014.	University of Hawaii - Hawaii Natural Energy Institute
USDOE - NETL	Recovery Act: State Energy Program for State of Hawaii	\$25,930,000	To design and carry out the Hawaii State Energy Office's energy efficiency and renewable energy programs, including administration, community outreach, high performance buildings, loan loss reserve program, renewable energy, and transportation energy transformation. Term: Apr 2009 - Mar 2014.	Various
USDOE - EERE	Recovery Act: State of Hawaii Energy Efficiency & Conservation Block Grant	\$9,593,500	To implement the Hawaii State Energy Office's Energy Efficiency & Conservation Strategy in order to reduce fossil fuel emissions; reduce total energy use of the eligible entities; and improve energy efficiency in the building sector, the transportation sector, and other appropriate sectors, along with creating jobs. Term: Sep 2009 - Nov 2014.	Various
USDOE - EERE	Hawaii's Clean Energy Transformation and Grid Connection	\$705,000	To reduce market barriers and costs of greater renewable energy penetration under HCEI by providing technical assistance on regulatory, financial, and utility solutions, particularly focused on adoption of a variety of grid reliability and interconnection standards and by developing streamlined permitting processes and online tools. Term: Sep 2011 - Aug 2014.	Duncan, Weinberg, Genzer & Pembroke Hawaii Information Consortium HECO

USDOE - EERE	State Energy Program Special Projects - Hydrogen Power Park	\$1,650,000	To conduct engineering and economic validation of pre-commercial hydrogen technologies. Term: Oct 2002 - Dec 2014.	University of Hawaii - Hawaii Natural Energy Institute
<u>USDOE</u> - <u>EERE</u>	State Energy Program (SEP) Formula (2010, 2011, 2012, 2013, 2014)	\$ 1,212,899	To design and carry out the Hawaii State Energy Office's energy efficiency and renewable energy programs. Term: Jul 2010 - Jun 2015.	Various
USDA - Rural Development	Hawaii Energy Audit Program for Eligible Rural Small Businesses and Farmers in Oahu, Maui, and Hawaii	\$100,000	To prepare Investment Grade Energy Audits (IGA) for rural small businesses and farmers. Term: Feb 2012 - Feb 2015.	GDS Associates Hawaii Energy County of Maui County of Hawaii
USDOE - EERE	Advancing Energy Efficiency in Hawaii Public Facilities	\$350,000	To strengthen, enhance, and expand the State's existing energy efficiency program by using Energy Star Portfolio Manager (PM) to benchmark appropriate State Executive Branch facilities and use the results to encourage state agencies to bundle facilities to pursue energy efficiency through energy savings performance contracts or other financing mechanisms. Term: Sep 2012 - Sep 2015.	Hawaii Public Benefits Fee Administrator (Leidos) Hawaii Dept. of Accounting & General Services - Public Works Division Hawaii Energy
USEPA	Hawaii Growing Green Intern Development and Pollution Prevention Project	\$50,000.00	To establish an intern program that leverages the support and expertise of partners across the state with the purpose of expanding the Hawaii Green Business Program and Lead By Example Resource Efficiency Checklist Program, which focus on waste reduction, pollution prevention, and resource conservation. Term: Oct 2013 - Sep 2015.	Hawaii DOH, C&C Honolulu, Honolulu Board of Water Supply, C&C Honolulu - Refuse Division, The Chamber of Commerce of Hawaii

In fiscal year 2014, the State Energy Office, in partnership with the High Technology Development Corporation (HTDC), entered into an agreement with the Research Corporation of the University of Hawaii, for the benefit of the Hawaii Natural Energy Institute's Hawaii Energy Sustainability Program and the Energy Systems Development Fund. Under the agreement, \$1.195M will support energy priority projects. The projects will contribute to Hawaii's most important economic enterprise, developing a clean energy economy for Hawaii. Together, HTDC and the State Energy Office will provide a catalyst that enables the development of clean energy business, projects, and growth of new jobs for Hawaii.

As the State Energy Office looks toward the next fiscal biennium (FB 15-17), an increased allocation of the Environmental Response, Energy, and Food Security Tax will be proposed for the ESSF. Hawaii's aggressive goals and roadmap to achieve 70% clean energy by 2030 demand this commitment of funding and support.

New and on-going clean energy initiatives are now primarily funded by the Environmental Response, Energy, and Food Security Tax (EREFST) moneys through the Energy Security Special Fund (ESSF), or by awards from federal formula or competitive grants. The obligated and planned investments utilizing ESSF funds are shown in the following chart.

Energy Security Special Fund Expenditures

Expenditures and encumbrances for FY14 and planned investments for FY15 are:

ENERGY SECURITY SPECIAL FUND - OBLIGATED & PLANNED INVESTMENTS		
INITIATIVE	FY14 OBLIGATED	FY15 BUDGETED
Hawaii State Energy Office - Personnel Costs	3,188,606	3,649,525
Hawaii Refinery Task Force Support	255,000	
Energy Education / Outreach - State Energy Office	15,045	18,000
Program Support - State Energy Office	195,207	206,780
Expert Witness-Related Technical Support	450,000	
Energy Efficient High Performance Buildings	1,860	35,000
Database Information, Databooks and Reports	39,935	50,000
Special Fund Assessments	195,248	210,000
Network Assessment	32,406	45,000
Program Support – Green Energy Market Securitization	178,600	150,000
Information Digitization	10,000	
Energy Innovation – Energy Excelerator		500,000
Renewable Energy Related On-line Permitting Tools		75,000
Technical Assistance - Advance Renewable Energy Projects		475,000
Subject Matter Expertise in Docket Activities		250,000
Renewable Energy Alternative Transportation and Fuels Support		75,000
Alternative Transportation and Fuels Adoption		50,000
High Performance Buildings		100,000
TOTAL	\$4,561,907	\$5,889,305

The initiatives in the above spend plan reflect both HCEI program goals and areas targeted for achievement. Associated projects currently encumbered under contract are highlighted based on target market, method of funding, reason for selection, persons served, program objectives, amount encumbered, and measurable outcome in **Attachment 1**.

HCEI-FY14 Expenditures

In fiscal year 2014, \$6,074,862 was spent on HCEI, of which \$4,604,056 or 76% was funded by the ESSF. The HSEO obligated over 80% of its ESSF allocation. This rate is anticipated to be higher in fiscal year 2015 with the filling of a number of position vacancies.

Sending for HCEI utilizing all currently available sources of funding for the State Energy Program is shown below:

DBEDT STRATEGIC INDUSTRIES DIVISION: REVENUE AND EXPENSES			
For the Fiscal Years Ending June 30, 2014 and 2015			
Description	MOF	FY 2014	FY 2015
Personnel	B	3,697,990	3,649,525
Other Operating Expenses	B	1,996,315	52,989,780
Total	B	5,694,305	56,639,305
Personnel	N	-	-
Other Operating Expenses	N	1,750,000	1,750,000
Total	N	1,750,000	1,750,000
Personnel	P	50,000	-
Other Operating Expenses	P	1,495,000	1,514,192
Total	P	1,545,000	1,514,192
Personnel	V	51,535	-
Other Operating Expenses	V	100,000	320,000
Total	V	151,535	320,000
TOTAL ALLOCATION		9,140,840	60,223,497

Funding sources:

Method of Funding: B - Special Funds (Energy Security Special Funds)

Method of Funding: N - Federal Funds

Method of Funding: P - Other Federal Funds

Method of Funding: V - Federal Stimulus Funds

* Includes \$50M for the Hawaii Green Infrastructure Special Fund

III. EREFST Tax Analysis

The amount and allocation of the EREFST as articulated in Act 73(10) is detailed in the following chart:

	Current
Environmental Response, Energy, and Food Security Tax	\$ 1.05
Environmental response fund	0.05
Energy security special fund	0.15
Energy systems development special fund	0.10
Agricultural development and food security special fund	0.15
Total	\$ 0.45
Balance to general fund	0.60

Under the Act three new funds were established in 2010:

- 1 **Energy Security Special Fund** – to be expended by DBEDT
- 2 **Energy Systems Development Special Fund** – to be expended by HNEI³
- 3 **Agricultural Development and Food Security Special Fund** – to be expended by HDOA⁴

The allowable activities for funding from each fund (specified within the Act) are as follows:

a. **Energy Security Special Fund**

- Subject to appropriation, moneys from the fund may be expended by DBEDT for the following purposes and used for no other purposes, except:
 - To support HCEI and the Energy Division, including staffing positions;
 - To fund, to the extent possible, the Greenhouse Gas Emissions Reduction Task Force, climate change task force, grant-in-aids (§42F) to the economic development boards and economic development agencies of each county to meet the stated objectives of HCEI.

b. **Energy Systems Development Special Fund**

- Obtaining matching funds from federal and private sources for research, development, and demonstration of renewable energy sources;
- Awarding contracts or grants to develop and deploy technologies that will reduce Hawaii's dependence on imported energy resources and imported oil. Projects may be commissioned that:
 - Balance the risk, benefits, and time horizons of the investment to ensure tangible benefits to the Hawaii consumer, with priority given to short- term technology development;
 - Emphasize innovative and renewable energy supply and energy efficient end use technologies focusing on environmental attributes, reliability, and affordability;

³ HNEI – Hawaii Natural Energy Institute of the University of Hawaii

⁴ HDOA – Hawaii Department of Agriculture

- Enhance transmission and distribution capabilities of renewable energy supply for electricity;
- Enhance reliability and storage capabilities of renewable energy for electricity;
- Ensure that research, deployment, and demonstration efforts build on existing programs and resources and are not duplicated;
- Address critical technical and scientific barriers to achieving energy self-sufficiency by reducing dependence on imported oil and imported energy resources;
- Ensure that technology used and developed for renewable energy production and distribution will be commercially viable; and
- Give priority to resources that are indigenous and unique to Hawaii; and
- Managing the portfolio of projects commissioned under this subsection.

c. **Agricultural Development and Food Security Special Fund**

- Subject to appropriation, Ag Dev & Food Security Special Fund can fund:
 - Grants to farmers for agricultural production or processing activity;
 - Acquisition of real property for agricultural production or processing activity;
 - Improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity;
 - Purchase of equipment necessary for agricultural production or processing activity;
 - Research on and testing of agricultural products and markets;
 - Funding of agricultural inspector positions within the department of agriculture;
 - Promotion and marketing of agricultural products grown or raised in the state; and
 - Any other activity intended to increase agricultural production or processing that may lead to reduced importation of food, fodder, or feed from outside the state.

The program’s (DBEDT, HNEI, HDOA) effectiveness in accomplishing the goals and objectives of the Act are as follows:

Energy Security Special Fund

HSEO has made significant and tangible progress towards achieving Hawaii’s clean energy goals through HCEI, as evidenced by its national recognition, but we remain vigilant to adjusting and evolving in order to achieve Hawaii’s 2030 clean energy goals.

HSEO is essentially dependent upon the ESSF to enable retaining the capacity, staff resources, and project funding to continue critical initiatives. This reliance on ESSF funds is documented by its obligations for FY14 in the chart on page 18.

An accounting of expenditures (obligations) in FY14 from the ESSF follows:

- a. In-line with the intent of the Act, HSEO funded staff positions within the Division (\$3,188,606). Remaining funds were expended in support of HSEO program activities (\$1,373,301).
- b. One HSEO program activity provided support to a task force evaluating Hawaii's refineries (\$255,000).
- c. Another program activity acquired technical support for DBEDT in PUC docket hearings (\$450,000).
- d. Program funds also were used to support the GEMS program (\$178,600).
- e. Other expenses incurred included statutory special fund assessments (\$195,248), and network expenses (\$32,406).

Energy Systems Development Special Fund

See HNEI attached report, **Attachment 2**.

Agricultural Development and Food Security Special Fund

The Department of Agriculture in FY 14 expended approximately \$3.9 million from the Agricultural Development and Food Security Fund on initiatives targeting food self-sufficiency and security. These activities and programs are summarized in the following table.

HEDTF DOA Expenditure – Encumbrance Update

CATEGORY	PURPOSE	ACTIVITIES AND PROJECTS	EXPENDITURES
Irrigation Operations	Improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity	Irrigation personnel and operating expenses	\$ 344,639
Research	The conduct of research on and testing of agricultural products and markets	Anthurium Research; DNA Bar Coding	\$ 435,000
Marketing and Promotion	Promotion of marketing of agricultural products grown or raised in the state	"Buy Local it Matters" Multimedia Campaign; Logistics Workshop; Eat Local in Schools; Papaya Promotion in Asian Markets; Seal of Quality Campaign	\$ 520,000
Agricultural Support	Activities intended to increase agricultural production or processing and may lead to reduced importation of food, fodder or feed from outside of the State.	Invasive Species Response; Pesticides Database; Planner Position; Neighbor Island Support; Fire Ant Control; Galbraith Water Transmission, Biodigester, Kulani Agricultural Complex	\$ 2,605,489

EREFST ALLOCATION:

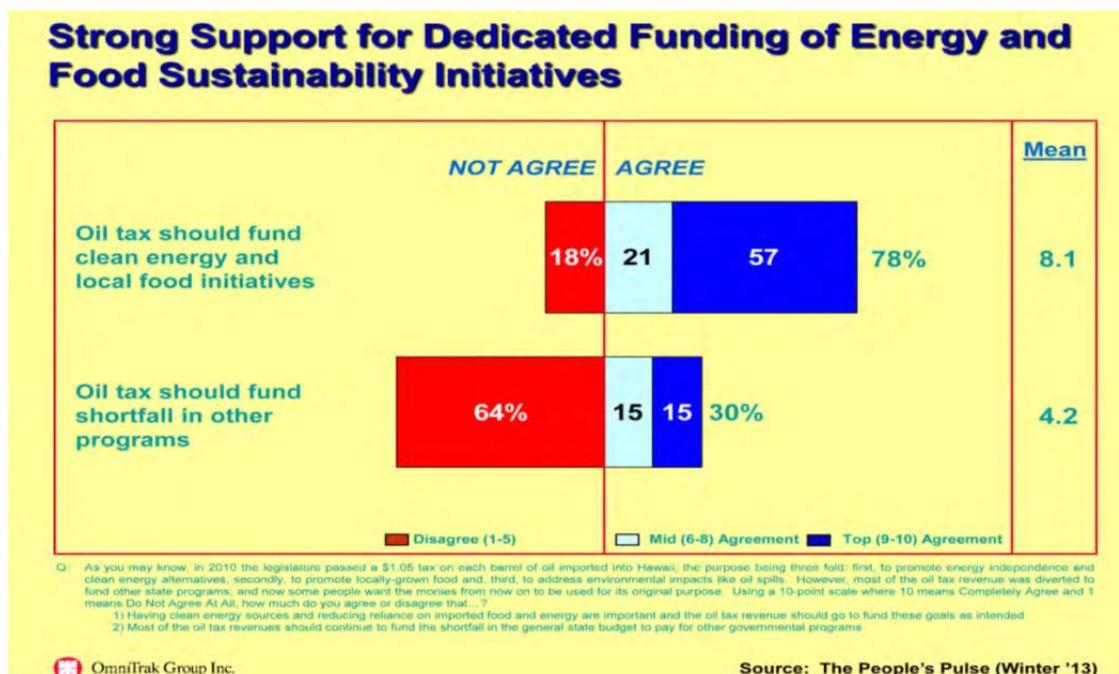
- **Public Opinion** – In December 2012, public opinion was surveyed statewide on the issue of dedicated funding of energy and food sustainability initiatives. There was strong public support to return the barrel tax revenues to its original intended purposes. This survey by OmniTrak Group Inc. showed that 78% of Hawaii residents agreed that the barrel tax funds should be restored for the intended purposes of improving energy and food self-sufficiency. The question posed and the response results follow below:

Question – In 2010 the legislature passed a \$1.05 tax on each barrel of oil imported into Hawaii, the purpose being threefold:

- FIRST, to promote energy independence and clean energy alternatives,
- SECOND, to promote locally grown food, and
- THIRD, to address environmental impacts like oil spills. However, most of the oil tax revenue was diverted to fund other state programs; and now some people want the monies from now on to be used for its original purpose.

Using a 10-point scale where 10 means Completely Agree and 1 means Do Not Agree At All, how much do you agree or disagree that...

- Having clean energy sources and reducing reliance on imported food and energy are important and the oil tax revenue should go to fund these goals as intended; and
- Most of the oil tax revenue should continue to fund shortfalls in the general state budget to pay for other governmental programs.



- **UHERO_Hawaii Free Press – February 13, 2014 stated:** “While in theory it [barrel tax] serves to discourage fossil fuels (internalizing the negative externality), its major impact has been as a funding source for energy and food security initiatives.Providing support for HCEI and the Greenhouse Gas Emissions Reduction Task Force, as well as instrumental research conducted by the Hawai‘i Natural Energy Institute (HNEI) are just several examples of how the barrel tax has contributed to advancing the State’s energy goals.”

Results:

- **2014 Legislative Session** – the Hawaii Legislature and the Governor approved Act 107(14), to enable the barrel tax to function as a resource strategy that is now aligned with the State’s 2030 clean energy goals to continue progress and plan development for clean energy infrastructure in Hawaii. This measure further provides support for the Departments of Agriculture and Health to respectively undertake food self-sufficiency and equip for an environmental response. And, the Legislature restored funding to the Energy Systems Development Special Fund, which had been repealed on June 30, 2012. See the chart below:

	Allocation as provided in Act 73, SLH 2010	Allocation as of July 1, 2012 and 2013	Restored Allocation as of July 1, 2014
“BARREL TAX”	\$ 1.05	\$ 1.05	\$ 1.05
• Environmental Response Revolving Fund	\$ 0.05	\$ 0.05	\$ 0.05
• Energy Security Special Fund	\$ 0.15	\$ 0.15	\$ 0.15
• Energy Systems Development Special Fund	\$ 0.10	----	\$ 0.10
• Agricultural Development and Food Security Special Fund	\$ 0.15	\$ 0.15	\$ 0.15
TOTAL ALLOCATED TO ENERGY, FOOD SECURITY & ENVIRONMENTAL RESPONSE	\$ 0.45	\$ 0.35	\$ 0.45
BALANCE TO GENERAL FUND	\$ 0.60	\$ 0.70	\$ 0.60

- **2015 Legislative Session** – In the upcoming 2015 Legislative Session, a proposal to restore the barrel tax funds to their intended purposes of improving energy, food self-sufficiency, and environmental response is a measure in the Governor’s Legislative Package.

Conclusion:

The EREFST serves as a self-sufficient fossil fuelled based mechanism to fund clean energy solutions to Hawaii’s addiction to oil, through the Hawaii Clean Energy Initiative.

The State has made substantive progress on its HCEI goals that have been funded through EREFST, with tangible results that are improving our environment, our economy, and our way of life. Uncertainty in leveraging sufficient funding for future programs may unnecessarily interrupt the progress that Hawaii has seen. Therefore it is critical that we have a commensurate funding commitment to the goals identified in Act 73(10).

Progressive funding from the EREFST for HCEI, food security initiatives is imperative, towards developing solutions to complex technological challenges. EREFST progressive funding will enable program initiatives to provide positive contributions to economic development and jobs, and advance and achieve the State’s energy and food security goals and targeted timetable to achieve energy and food sustainability and independence.

ATTACHMENT 1. HCEI FEDERAL AND ESSF FUNDED INITIATIVES

Target Market	Method of Funding*	Reason For Selection	Persons Served	Program Objectives	Encumbered	Measurable Outcome
Electric Grid	N	Establish Regulatory and Policy Framework to Accelerate Integration of Utility-scale Renewable Energy	State, Utility, and Consumers	Hawaii Renewable Energy Grid Project	\$360,000.00	Progress towards RPS objective. In progress.
Hydrogen	P	Transportation Energy Diversification	State & Developers	Hawaii Hydrogen Power Parks Project	\$1,200,000.00	Progress towards TRANSPORTATION objective. In progress. Fueling facility dedication pending.
Regulatory	N, B	State Energy Planning, Regulatory Policy, and Energy Goals	Energy Program & Decision-makers	Expert Witness technical support services for potential and actual litigation of legal matters involving the State, its agencies, and its officers and employees, including administrative quasi-judicial proceedings	\$700,000.00	Assistance in pursuit of HCEI GOALS. Contingency activity.
Interisland Cable	V, B	Interconnecting the islands via electric transmission cable would provide increased energy security and system efficiencies and enable the islands to have backup power	Energy Program & Decision-makers	Technical assistance for cable research & development.	\$1,200,000.00	Progress towards RPS objective. In progress.
Energy Efficiency	B (MOF, B funds are to be reimbursed by N funds for this contract)	Energy savings potential and provide investment grade documentation to banks for energy-efficient investment.	Small businesses, and farms	Energy Audits for Rural Small Businesses and Farms Project	\$133,334.00	Progress towards EEPS and RPS objectives. In progress.
HCEI Goals	B	Analysis of potential activities	Energy Program & Decision-makers	Hawaii Renewable Energy Support	\$250,000.00	Progress towards RPS objective. In progress.
Electric Grid	P	Grid regulatory and policy strategies for utility-scale energy self-reliance.	State, Utility, and Consumers	Hawaii Renewable Energy Grid Project	\$380,000.00	Progress towards RPS objective. In progress.
Electric Grid	P	Proactive approach with the utility on 3 circuits to test and identify grid interconnection issues and mitigation measures.	State, Utility, and Consumers	Hawaii Grid Cluster Evaluation project (SunShot grant)	\$446,446.68	Progress towards RPS objective. In progress.
Under-served market segments	B	Provides low-cost financing to enable consumers in under-served markets to invest in clean energy installations.	Energy program and consumers	Project management services and Special Legal Counsel for the administration of the for Hawaii Green Infrastructure Market Securitization (GEMS) loan program.	\$1,443,100.00	Progress towards RPS objective. In progress.
Transportation	N	Next phase of HCEI in reducing the consumption of petroleum in ground transportation.	Energy Program & Decision-makers	Analysis of HCEI transportation data and plans, evaluation of options, tactics, and tools for implementation	\$100,000.00	Progress towards TRANSPORTATION objective.
Energy Efficiency	P, N	Continuing the advancement of energy-efficient measures in public buildings.	State and County government agencies	Technical assistance to state and local gov for energy code analysis & adoption, energy savings performance contracting and advancing energy efficiency measures in Hawaii public facilities	\$570,000.00	Progress towards EEPS objectives. In progress.
Energy Program	B	Facilitate government and public understanding of energy policies and programs.	Energy Program	Provide specialized public relations and marketing support services to DBEDT's Hawaii State Energy Office	\$200,000.00	Assistance in pursuit of HCEI GOALS.
Fuels	B	Assess the potential impacts to changes in Hawaii's refining capacity and to provide recommendations involving a future fuels ecosystem.	Energy Program & Decision-makers	Provide assessment, analysis, and recommendations for the Hawaii Refinery Project	\$350,000.00	Progress towards TRANSPORTATION objective.

ATTACHMENT 2

UNIVERSITY OF HAWAI‘I SYSTEM ANNUAL REPORT



**REPORT TO THE 2015
LEGISLATURE**

**ANNUAL REPORT FROM THE HAWAI'I
NATURAL ENERGY INSTITUTE**

HRS 304A-1891

November 2014

Report to the 2015 Legislature

Annual Report on
The Hawai'i Natural Energy Institute

HRS 304A-1891

**Hawai'i Natural Energy Institute (HNEI) School of Ocean
and Earth Science and Technology
UH Mānoa**

SUBJECT: Annual Report on Activities, Expenditures, Contracts Developed, Advances in Technologies, Work in Coordination with State Agencies and Programs, and Recommendations for Proposed Legislation, required in accordance with HRS 304A-1891 (Act 253, SLH 2007).

NOTE: Sections 304A-1893, 1894, and 2169, HRS, were repealed on June 30, 2013. While, the Energy Systems Development Special Fund (ESDSF) was not in place during the period this report covers (July 1, 2013 – June 30, 2014), activities already initiated or contracted did continue. The ESDSF was re-established by Act 107, Session Laws Hawaii 2014, effective July 1, 2014.

SUMMARY:

The Hawaii Natural Energy Institute (HNEI) was established in 1974 to coordinate and undertake the development of natural energy sources for Hawaii. In the past decade, HNEI has substantially increased its funding base. During this time, HNEI has also developed significant partnerships with local and national industry addressing integration of renewable energy technologies onto the grid, an issue of critical importance to the State. In 2007, the State Legislature established HNEI in statute (ACT 253) and expanded its mandate to explicitly include coordination with state and federal agencies; and the demonstration and deployment of efficient end use technologies including those that address peak electric demand issues.

HNEI Mission (from ACT 253)

To coordinate and undertake the development of Hawaii's abundant natural energy sources, in order to:

- Diminish Hawaii's dependence on imported fossil fuels;
- Meet the state's increasing energy demands with little or no environmental degradation;
- Contribute to the technology base for finding solutions to the national and global energy shortage;
- Coordinate with state and federal agencies; and,
- Demonstrate and deploy efficient end use technologies, including those that address peak electric demand issues.

In executing its mission, HNEI has assumed a pivotal role within the state to reduce Hawaii's dependence on fossil fuels, serving as the implementing organization for several large, high-visibility public-private partnerships to develop, deploy and demonstrate renewable energy systems. HNEI works closely with federal funding agencies, industry, the State Energy Office, our State legislators, and our Congressional delegation; regularly participating in high level coordination meetings.

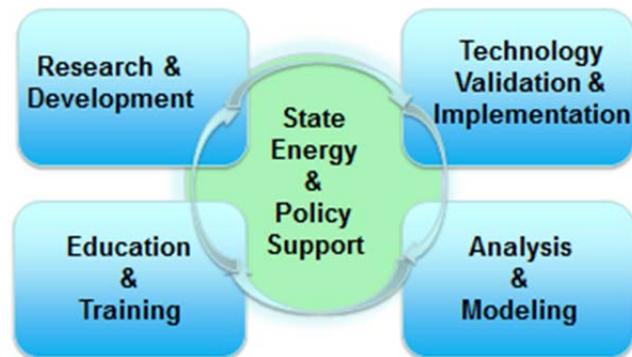
HNEI supports the State's "Hawaii Clean Energy Initiative" (HCEI), to achieve the goal of 70 percent clean energy by 2030, serving as a critical bridge between State and Federal initiatives. For example, HNEI serves as the implementing research partner for the Asia Pacific Technology and Education Program funded by the Office of Naval Research ("ONR"). HNEI also manages the USDOE Hawaii National Marine Renewable Energy Center to facilitate the advancement of ocean energy technologies, and leads many technology development/validation efforts as described below.

While HNEI's plays a significant role in the development and management of public-private partnerships and supporting analysis for state energy policy, we have also maintained our strong core research effort. Today, HNEI conducts programs in the areas of Alternative Fuels; Renewable Power Generation Technologies; Energy Efficiency; Electrochemical Power Systems; and Grid Integrated Energy Systems.

HNEI staff are predominantly non-tenure track faculty and full time research staff, allowing greater flexibility in realigning research efforts. Along with the multidisciplinary education and extensive experience of HNEI's staff, HNEI can consistently align its efforts with the changing objectives of the State of Hawaii, the US DOE and DOD. For example, Grid Integrated Energy Systems, the area with the most significant amounts of federal and state funding today were not part of HNEI's portfolio just a few years ago. HNEI's sustainability activities remain well aligned with the State's energy goals and with the University's Strategic Plan.

The energy needs of the state and the nation are both urgent and complex. Solutions are often capital intensive with long lead times and have the risk of unintended consequences. Development of technology, strategies and policies that will have significant positive impact on the state energy mix requires the integration of analysis, research, engineering, economics, and policy.... and more. It requires people from a wide range of disciplines and from different types of organizations to work together. HNEI operates in this manner.

HNEI's activities can be grouped into five core functions; Research & Development, Technical Validation & Implementation, Analysis & Modeling, Education & Training, and State Energy & Policy Support. As illustrated in the schematic, these functions are inter-related, and overlap by design, in order to maximize collaboration and leverage resources.



Act 253 also established the Energy Systems Development Special Fund (ESDSF) and directed that it be managed by HNEI, but it went unfunded until 2010, when ACT 73 established a barrel tax and authorized that 10 cents of the tax on each barrel be deposited into the ESDSF. UH/HNEI access to those funds was delayed until June 2011. That fall, in collaboration with the State Energy Coordinator, HNEI developed an expenditure plan to maximize the value of these funds to meet near term needs and opportunities within the state. HNEI initiated actions on all but one of the original items. In 2012 and 2013, HNEI, again in collaboration with DBEDT, expanded the project portfolio to include additional high priority projects. The attached report summarizes HNEI's current research activities for the past year and provides a summary of the expenditure for the remaining funds provided under ACT 73, before the repeal of the ESDSF.

Summary of Activities, 2014
Hawai'i Natural Energy Institute
School of Ocean and Earth Science and
Technology
University of Hawai'i at Mānoa

Director: Richard E. Rocheleau

Staffing:	Permanent Faculty (FTE)	8
	Other permanent staff (APT)	3
	Temporary Faculty	24
	Other temporary staff (APT, RCUH)	17
	Training (a)	40

(a) Includes post-doctoral fellows, graduate and undergraduate students, and visiting scientists.

SUMMARY OF CONTRACTS AND ACTIVITIES: Between 2001 and 2007, the Hawai'i Natural Energy Institute (HNEI) experienced substantial growth in its extramural funding from under \$2 million per year to over \$5 million per year. Due to new or expanded programs in ocean energy, hydrogen, smart grids, and interest by the Office of Naval Research (ONR) to utilize Hawai'i as a site for alternative energy testing in the Pacific region, HNEI has seen a dramatic increase in extramural funding since then from \$5.7 million in 2007, to over \$17 million for 2013 and 2014 (based on 3 year rolling averages).

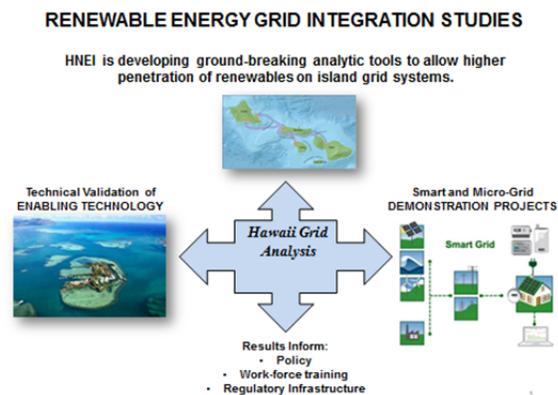
HNEI is a nationally acknowledged research leader with major activities in areas such as hydrogen and fuel cells, biofuels, ocean resources, and grid integration. While continuing to conduct basic and applied research, HNEI has, in accordance with HRS 304A-1891, also undertaken a pivotal role within the state to reduce dependence on fossil fuels including identification, evaluation, and testing of advanced energy technologies and systems aimed at reducing Hawai'i's dependence on fossil fuels. HNEI serves as the implementing and/or managing partner for several major public/private partnerships to deploy and demonstrate renewable energy systems to meet Hawai'i's energy needs. These efforts support the goals of the Hawai'i Clean Energy Initiative (HCEI).

A brief synopsis of select HNEI activities follows:

Hawai'i Energy Sustainability Program (HESP): HESP is a continuation of the Distributed Energy Resource Technologies for Energy Security program initiated in 2006. Under this program, managed by HNEI and conducted in partnership with GE Global Research, the Hawaiian Electric Company (HECO), Maui Electric Company

(MECO) and the Hawai'i Electric Light Company (HELCO), HNEI has established a research and assessment program in integrated energy and systems analysis of electricity technologies. Through this program, HNEI conducts essential research in areas of relevance to Hawaii and abroad including analysis and modeling of isolated grid systems with high amounts of renewable energy resources, power distribution and microgrid systems, and advanced power system monitoring, intelligent control, communications and enabling technologies. HNEI's program is focused on identifying technically-sound cost effective solutions and practical strategies that energy generators and grid operators can implement to deliver commercially viable renewable energy to achieve reduced dependence on oil and other fossil fuel resources. Major activities under this program and its predecessor, the Hawai'i Distributed Energy Resource Technologies for Energy Security program have included:

Oahu Wind Integration Study (2008 - 2010) – Utilizing a variety of modeling and grid simulation tools, this study evaluated the technical feasibility and economic viability of operational strategies, improvements to existing infrastructure, and new technologies to enable high penetrations of renewable energy in Hawaii. A viable strategy was developed integrate up to 500 MW of wind and 100 MW of solar energy on the isolated Oahu power grid.



Hawaii Solar Integration Study (2010 - 2012): The Hawaii Solar Integration Study (HSIS) built upon the knowledge gained in the Oahu Wind Integration Study (OWIS). The study examined very high penetration scenarios of solar and wind energy – up to 760 MW of distributed and utility scale solar PV and 300 MW of wind resources for Oahu, and up to 45 MW of distributed and utility scale solar PV and 72 MW of wind on Maui. Focused on the operational impact on the Oahu and Maui bulk power systems, the HSIS evaluated reserve strategies, impacts on thermal unit commitment and dispatch, utilization of energy storage, renewable energy curtailment, and other aspects of grid reliability, operations and costs.

Oahu – Maui County Grid Interconnection (Stage 2) Study (2012 – 2013): In partnership with Hawaiian Electric Company, HNEI managed the Stage 2 Study, which built upon the work of both the OWIS and HSIS to examine the value proposition of prospective grid interconnection of the power systems on Oahu to those in Maui county (Maui, Lanai and Molokai) via submarine power cables, advanced control systems and operational strategies. The study, completed in May 2013, found a variety of benefits that grid interconnections could potentially provide, and recommended further research to compare the incremental value of potential interconnections with modified utility

operating practices. This work is being performed in the Renewable Portfolio Standards Study described below.

Oahu EV Charging Study (2012 – 2013): Leveraging the validated models of the Oahu power grid refined in the OWIS and HSIS, this study's primary objectives were to quantify the impact of electric vehicle charging on Oahu grid operations and to explore how different control techniques to manage EV charging profiles might further enhance the integration of wind and solar resources (e.g., by reducing curtailment and/or providing a new source of reserves). This study was prepared for DBEDT's Strategic Industries Division and was published as part of DBEDT's larger Hawaii Renewable Energy Grid Project Report for the USDOE that was delivered in 2014.

Renewable Portfolio Standards Study (2013-present): For this study, HNEI has contracted with GE to build upon the work done in the OWIS, HSIS, and Stage-2 studies to evaluate and assess the likelihood of compliance with the State RPS requirements. The study has modeled costs and economics as well as the technical implications of various scenarios to help identify promising approaches to meeting the 2020 RPS mandate. The analyses compare the value of grid-tied, and generation-tied undersea island interconnections with island independent systems. The analyses also include the impacts of using liquefied natural gas for electricity production, of modified utility operating practices and reserve requirements, and the use of ancillary services such as demand response and battery energy storage systems. The goal of the study is to provide insight on the economic and technical implications of the approaches analyzed to inform decision makers that need to implement plans to achieve the RPS objectives. The final report will be delivered by the first quarter of 2015.

Liquefied Natural Gas Study (2012): In response to a request from the state, HNEI retained FACTs Inc. to evaluate the potential importation of liquefied natural gas (LNG) to Hawaii. The study (1) assessed the potential demand for LNG in Hawaii, (2) evaluated the costs and benefits of LNG compared to other fossil fuels, (3) identified the potential impacts of LNG on Hawaii's economy and Hawaii's energy future, and (4) identified and assessed regulatory policies and practices that may be necessary or appropriate for Hawaii to consider for the importation of LNG. The final report was delivered in December, 2012 and HNEI used approximately \$150,000 from this program to fund the study. In a separate body of work, HECO contracted for studies to assess the technical feasibility of various import facility options and infrastructure requirements, and to assess different LNG supply options, including potential sources, pricing, security, and contracting options. Together the HNEI and HECO studies should begin to provide a foundation to assist in planning and decision making as the importation and use of LNG in Hawaii is considered.

In addition to the technical studies, HNEI has committed resources from the Energy Systems Development Special Fund to support the Hawaii Clean Energy Programmatic EIS efforts. This work is closely coordinated with the State Energy Office and the USDOE, and is cofunded by the the Energy Systems Development Special Fund. This project is described in the section on the ESDSF.

Hawai'i Hydrogen Program: Since 2003, HNEI has developed funding from various federal, state, and private sources to deploy hydrogen infrastructure at multiple sites on O'ahu and the Big Island in support of both DOD and civilian transportation projects. These efforts, summarized in the following subsections, are budgeted at over \$ 8 million including approximately \$1,000,000 from the Energy Systems Development Special Fund to support a local bus service in the Hilo-Puna area on the Big Island.

Hydrogen Energy System as a Grid Management Tool: This joint USDOE-DOD-HNEI project is intended to test and evaluate the dynamic operation of an electrolyzer to demonstrate its potential to provide frequency control in support of additional renewable generation, and to provide fuel for two transportation demonstration projects. The intended site at Puna Geothermal Ventures has been delayed due to continuing delays in executing a Memorandum of Agreement with PGV, and most recently the lava flow threatening Pahoia and the main access road. Due to the continuing delays the project will conduct initial system dynamic testing at the Powertech Labs facilities in Vancouver, Canada. This is planned for six months completing in mid-2015. At that time the system will be delivered to Hawaii and installed at another site. Negotiations are ongoing to site it at the NELHA facility in Kona. It is expected to be fully operational by the end of 2015. The total budget is approximately \$5 million.

Hydrogen Fueling Tube Trailers: HNEI is also assisting with the purchase of two (2) hydrogen transport trailers to support multiple fueling sites from one production site. Current plans are to support refueling at Hawaii Volcanoes National Park and the Island of Hawaii Mass Transportation Agency. The trailers carry over 100 kilograms of hydrogen at a pressure of 450 bar (6,600 psi). The trailers support the development of critical hydrogen delivery infrastructure on the Island of Hawaii. The trailers were completed in May 2014 and will be delivered in mid-2015 with the hydrogen energy system equipment.

Marine Corps Base (MCB) Hawai'i Hydrogen Fueling Station at Kaneohe Bay: The Office of Naval Research (ONR) has leased and deployed five General Motors (GM) Equinox Fuel Cell Electric Vehicles (FCEVs) at MCB to enable the US Navy/Marine Corps to conduct technical evaluations and gain experience in the operation of FCEVs utilizing direct hydrogen fuel. HNEI has signed an MOA with MCB Hawaii to provide rapid high-pressure refueling infrastructure in support of this work. The station has been commissioned and successfully fueled its first vehicle on November 19th, 2014. Vehicle fill times are under 5 minutes.

Maui Smart Grid: This very significant HNEI-led USDOE demonstration project was formally started on October 17, 2008, with partners that include General Electric, MECO, HECO, Sentech, and First Wind, among others. This \$15 million project is intended to demonstrate reduction of peak electricity demand by at least 15% through the use of advanced smart grid and demand-side-management technologies, and to assist MECO in providing reliable and stable

electricity with increasing percentages of as-available renewable resources. The equipment was installed, and the demonstration is being conducted through 2014. A final report on this work will be completed by December 2014. HNEI is also serving as one of the Hawai'i implementing organizations for the recently announced NEDO Smart Grid Initiative, also located on the south side of Maui.

DOE Smart PV Inverter Project. In a project that closely supported the Maui Smart Grid efforts, an HNEI-led team won a new project under the USDOE Sunshine Program to develop and demonstrate new “smart grid-enabled” PV inverters. This project, announced in September 2011, was intended to facilitate higher penetrations of solar PV systems by mitigating the utility operations issues resulting from variability of PV systems. HNEI used \$400,000 from the Energy Systems Development Special Fund to meet a critical funding shortfall and to insure efforts to secure the federal funding. Project partners include Fronius, which is supplying the advanced PV inverters, and Silver Spring Networks, which will integrate them into the smart grid network they developed. Maui Electric Company, Hawaiian Electric Company, and Pepco Holdings Inc. are the utility partners supporting the live demonstrations on their utility grids.

Under the USDOE funding the HNEI team completed development of the technology and purchased hardware for deployment and testing. Due to changes in the DOE program, testing of this hardware on the Maui grid is now supported by the Office of Naval Research.

Asia-Pacific Research Initiative for Sustainable Energy Systems: The APRISES initiative, formerly named the Hawai'i Energy and Environmental Technologies Initiative (HEET) was initiated in 2001 with funding from the Office of Naval Research (ONR), focused on the development and testing of fuel cells and seabed methane hydrates has been expanded to include biofuels and to support testing of critical heat exchanger technology in support of Ocean Thermal Energy Conversion (OTEC). More recently the program was again expanded to include deployment and testing of net energy neutral buildings, testing of grid scale Li-ion high power batteries for grid support, and support of various hydrogen infrastructure projects on the islands. In 2013 HNEI was awarded an additional \$15 million to continue the current activities and further expand to include testing and evaluation of renewable generation and power system controls for smart and micro-grid applications. This program has provided substantial support for various smart and microgrid research activities with ongoing efforts on Molokai, Coconut Island, at the UH Manoa campus, and various projects on Maui.

Hawai'i National Marine Renewable Energy Center (HINMREC): In March 2009, USDOE executed a five-year agreement with UH - HNEI to establish a new Center to facilitate the development and implementation of commercial wave energy converters (WECs) and to assist the private sector in developing Ocean Thermal Energy

Conversion (OTEC) systems for use in Hawai'i and around the world. The HINMREC has established industry-driven partnerships between WECs and OTEC developers, utility companies, engineering and environmental support companies, university researchers, federal and state government agencies, and other non-government organizations (NGOs). The HINMREC coordinates engineering and science efforts to address industry needs and leverage U.S. Department of Defense (DOD) interest in Hawai'i energy projects. The USDOE awarded multiple year funding (2008-2015) to HINMREC of approximately \$8 million.

This USDOE funding and an additional \$9 million contributed by the Naval Facilities Engineering Command (NAVFAC) in 2014, through the University of Hawaii's Applied Research Laboratory, is being used to support testing activities at the United States' first grid-connected wave energy test site (WETS) at Marine Corps Base Hawaii. The site is now fully permitted with three births at different depths, expected to be functional by February 2015. HNEI is working with NAVFAC and USDOE to support the WETS efforts in three key areas: 1) independent WEC device performance analysis; 2) environmental impact monitoring; and 3) ongoing measurements and analyses of device acoustic signature, device and cabling electromagnetic fields (EMF) and changes in device/mooring-induced sediment transport, seawater chemistry, and ecological environment.

Solar Initiatives:

HNEI is also working with USDOE and ONR to conduct high-fidelity resource assessments and testing of emerging solar technologies. The objectives are to characterize emerging photovoltaic (PV) technologies, to understand the performance of PV in differing environments, and to collect information to evaluate the effects of high PV generation on the grid. Multiple test sites became operational in 2012. Additional test sites are being developed.

The Flash Carbonization™ process: Under this technology development effort, HNEI is scaling-up a UH patented process invented at the Institute for the rapid and efficient production of charcoal from biomass. Charcoal is the renewable replacement for coal that is burned in Hawai'i for power generation and is the biggest contributor to global warming. To assist licensees of our patents, HNEI is now developing emissions control technology that will facilitate the permitting process so that the technology can be operated in Hawai'i and on the Mainland. HNEI also is exploring the use of this technology to produce charcoal from Honolulu sewage sludge, and the production of charcoal to replace coke used to reduce silica to silicon for the manufacture of photovoltaic cells. The latter work is funded by the National Science Foundation and involves collaboration with the Dow Corning Corporation.

Fuel Cell and Battery Testing: HNEI researchers conduct testing and modeling to develop advanced battery system diagnostic and prognostic technology to further understanding of the performance of advanced batteries for use in electric vehicles and renewable energy storage applications. Funding sources include the US

Department of Energy EERE Office and the Office of Naval Research. HNEI has recently initiated a major effort to conduct testing to better predict the lifetime of grid-scale battery energy storage technologies.

EXPENDITURES: General Funds \$ 1,234,022
Tuition and Fees S Funds \$ 41,948
Research and Training Revolving \$ 388,235
Extramural Awards \$ 17,338,181

All of these funds support the research and training activities described above. We anticipate 2015 extramural funding levels to be comparable to those from 2014. The rate of expenditure is expected to be similar to that of 2014.

CONTRACTS DEVELOPED: HNEI has developed many subcontracts under its existing extramural federal funding. Contracts using the Energy Systems Development Special Fund are described in the section below on the specific projects funded by ESDSF. HNEI coordinated and planned for ESDSF expenditures with the State Energy Coordinator.

ADVANCES IN TECHNOLOGY: HNEI continues to conduct research to advance renewable energy technologies and system integration. HNEI has patent applications and/or patents in the areas of battery charging, conversion of biomass to charcoal, solar production of hydrogen, novel filtration for operation of fuel cells in harsh environments, and conversion of waste streams to valuable bioplastics in the processing of ethanol. Licensing discussions are ongoing in all of these areas.

COORDINATION WITH STATE AGENCIES: HNEI works closely with DBEDT and other agencies on a variety of renewable energy projects and continues to seek new opportunities and means to do so. Projects initiated or ongoing in 2014 which involve strong collaboration/coordination with DBEDT include the following:

- o ***Hawai'i Hydrogen Power Park:*** The hydrogen power park is funded in part by USDOE and in part by the Hydrogen Investment Capital Special Fund through DBEDT. HNEI is the implementing partner and works closely with DBEDT in the execution of this project.
- o ***Hawai'i Hydrogen Plan:*** HNEI, via Kolohala Ventures developed the State Hydrogen Plan as called for as part of the Hydrogen Investment Capital Special Fund.
- o ***Marine Corps Base (MCB) Hawai'i Hydrogen Fueling Station at Kaneohe Bay:*** HNEI leveraged the State of Hawai'i investment in the Hawai'i Hydrogen Power Project to develop the fast-fill high pressure fueling station at MCB Hawai'i, in support of the deployment of the ONR/GM Equinox fuel cell

vehicles. HNEI continues to work closely with HCATT, DBEDT and the state legislature to attract national and international partners to support the roll-out of fuel cell electric vehicles in Hawaii.

- o **Utility Scale Clean Energy Capacity Project:** HNEI provided substantive assistance to DBEDT in the development of this award from the USDOE and recently assisted DBEDT in evaluating the impact of electric vehicles on the O'ahu grid system.
- o **National Marine Renewable Energy Center:** HNEI is working closely with DBEDT to attract technology providers to the state to participate in this project and to provide assistance in the permitting process.
- o **Hawaii Clean Energy Programmatic Environmental Impact Statement (PEIS):** HNEI is closely coordinating the PEIS effort with the Hawaii State Energy Office and the USDOE. The PEIS will provide federal and local agencies, policymakers, and developers with information and guidance they can use to make decisions about actions that will support achieving HCEI goals.
- o **Hawaii Public Utilities Commission support:** HNEI has been coordinating with the PUC on developing assumptions and scenarios for the RPS Study (described in the ESDSF section below) to support their need for independent modeling and analysis of utility systems and their capabilities, constraints and planning needs.
- o **Hawaii State Energy Office Support:** HNEI is working with the Hawaii State Energy Office in DBEDT to support programs in energy efficiency, renewable energy, test bed development, and energy education and outreach.

RECOMMENDATIONS FOR PROPOSED LEGISLATION: Generally, HNEI does not initiate legislation, but is a member of the Hawai'i Energy Policy Forum and works closely with this group to review legislative initiatives in the energy area. Via federal funds and the ESDSF, HNEI also financially supports the University of Hawai'i's Hawai'i Energy Policy Forum for outreach and analysis efforts.

ENERGY SYSTEMS DEVELOPMENT SPECIAL FUND

As described above, the Energy Systems Development Special Fund was established in 2007 under ACT 273 but went unfunded until 2010, when, under ACT 73, the Hawai'i Legislature established a barrel tax and authorized that 10 cents of the tax on each barrel of oil be deposited into the Fund. Due to account issues, UH/HNEI was unable to access these funds until June 2011. Between June 2011 and June 30, 2013, HNEI received a total of \$7,173,639 in funding. HNEI worked in collaboration with the State Energy Coordinator to develop an expenditure plan to maximize value of these funds to

meet near term needs and opportunities within the state; and maximize leveraging of federal dollars. As noted previously, Sections 304A-1893, 1894, and 2169, HRS, were repealed on June 30, 2013, and re-established on July 1, 2014. Thus, the Energy Systems Development Special Fund (ESDSF) did not exist and received no barrel tax funding for fiscal year 2014. HNEI is currently coordinating with DBEDT to plan the expenditure of new funds which have begun to accrue.

Below is a description and update of the programs and projects supported by money committed from the Fund prior to its repeal, totaling approximately \$7,000,000.

Geothermal Resource Assessment: (\$400,000) The US DOE has funded a project led by the University of Hawai'i to validate a new geophysical inversion and analysis procedure to map the subsurface structure of the geothermal resource and lower exploration costs. DOE funding was approximately \$1 million over two years with additional cost share from industry partners. HNEI committed \$400,000 from the Fund to purchase the relevant equipment and support one scientist to conduct the analysis to insure that the equipment and know-how developed under this effort will be available for additional resource studies with near-term target areas on both the Big Island and Maui. This work, initiated in Spring 2012 will also allow site exploration on the Island of Maui.

Geothermal Strategic Development Study (\$115,000) HNEI contracted with the Pacific International Center for High Technology Research (PICHTR) to assess the current environment for geothermal development in the state, including the level of industry interest, and the identification of state and county agency needs to adequately perform the functions necessary for anticipated geothermal development. From this information PICHTR prepared a geothermal strategic development plan that will help agencies be prepared for the complex planning, assessment, regulatory, and permitting activities required. This plan, which can serve as a guide to DBEDT and other state agencies (e.g. DOH and DLNR) involved in geothermal development, was completed in December 2012.

Smart Inverter Deployment: (\$400,000) This US DOE funded project led by the University of Hawai'i, was intended to develop and commercialize smart grid-enabled PV inverters to mitigate grid reliability impacts of high penetrations of PV systems. This project was part of the ongoing smart grid demonstration projects on Maui. HNEI obligated \$400,000 from the Fund to match partner cost share. This cost share from the Fund resulted in an initial federal award of \$1.5 million with an additional \$4.5 million that was awarded upon successful demonstration of the go/no-go deliverables in early 2013. Due to recent changes to the DOE program, deployment and demonstration of this technology will be funded via a grant to HNEI from ONR.

Hydrogen for Grid Management: (\$500,000) In 2011 HNEI was awarded \$ 1.7 million by the Naval Research Laboratory (funds provided to NRL by US DOE) to demonstrate the use of electrolyzer technology to simultaneously produce hydrogen for fuel and for grid management. This program leveraged other investment from the US Department of Energy, the Hawai'i Hydrogen Capital investment Fund, and in-kind cost

share from Puna Geothermal Venture and County of Hawai'i Mass Transit Agency. The hydrogen system, originally intended to be located near PGV, has been delayed due to continuing delays in executing a Memorandum of Agreement with PGV, and most recently the lava flow threatening Pahoehoe and the main access road. Due to the continuing delays the project will conduct initial system dynamic testing at the Powertech Labs facilities in Vancouver, Canada, after which it will be delivered to Hawaii and installed on the Big Island. Negotiations are underway for siting at the NELHA facility in Kona. It is expected to be fully operational by the end of 2015. HNEI also contracted with the Hawaii Center for Advanced Transportation Technologies (HCATT) to procure a bus and convert it to operate on advanced fuel cells to for use in the county. Approximately \$500,000 from the ESDSF was committed for this work.

Hydrogen Fueling Tube Trailers (\$555,000) ESDSF money was used to purchase two (2) hydrogen transport trailers to support multiple fueling sites from one production site. Current plans are to support refueling at Hawaii Volcanoes National Park and the Island of Hawaii Mass Transportation Agency. The trailers carry over 100 kilograms of hydrogen at a pressure of 450 bar(6,600 psi). The trailers support the development of critical hydrogen delivery infrastructure on the Island of Hawaii. The trailers were completed in May 2014 and will be delivered in mid-2015 with the hydrogen energy system equipment.

Hawai'i Clean Energy Programmatic Environmental Impact Statement:

(\$1,700,000) A Programmatic EIS for the undersea cable was identified by USDOE and DBEDT as the next critical step in planning for the interconnection of the Hawaiian Islands via undersea cable - a critical step to meet HCEI goals. In July 2012, in coordination with the USDOE and DBEDT, HNEI contracted New West Technologies to conduct a Programmatic Environmental Impact Study for alternative scenarios for deployment of undersea electrical cables for interconnection of O'ahu, Maui, and Hawai'i Counties electrical grids. The PEIS is analyzing, at a programmatic level, the potential environmental impacts of clean energy activities and technologies in the following clean energy categories: (1) Energy Efficiency, (2) Distributed Renewables, (3) Utility-Scale Renewables, (4) Alternative Transportation Fuels and Modes, and (5) Electrical Transmission and Distribution (including undersea cables). The State of Hawai'i and the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) are cooperating agencies in preparing this PEIS. The PEIS will provide federal and local agencies and policymakers and energy developers with information and guidance on adhering to all laws and permitting requirements, implementing well-planned best management practices and mitigation measures, and consideration of community and cultural concerns they can use to make decisions about actions that support achieving HCEI goals. The draft PEIS was published in April, 2014, eight public hearings were held on the six major Hawaiian Islands, and the comment period closed in July. The Final PEIS, which will consider and/or address comments received on the draft, is currently being drafted, and is due out in the first quarter of 2015.

The Pacific Asian Center for Entrepreneurship and E-Business: (\$50,000) PACE consists of an integrated set of leading-edge entrepreneurship programs at the

University of Hawaii Shidler College of Business with an innovative curriculum, research projects, and community outreach and involvement with Pacific and Asian entrepreneurs and entrepreneurial ventures. HNEI expended \$50,000 of the Fund to support several PACE fellowships to conduct technical and business analyses of critical energy issues. Support of this program was intended to develop a workforce cross-trained in the business, legal and technical aspects of future energy systems. This effort stopped with the ESDSF sunset and has not been reinitiated.

Hawaii Energy Policy Forum Support, HCEI Metrics (\$350,000). HNEI supports the Hawaii Energy Policy Forum and the Social Science Research Institute at the UH in their efforts to seek smart energy solutions for a clean and sustainable energy future through advocating policies and initiatives and promoting civic action. HNEI also specifically supported the Forum's effort to develop a set of metrics to measure the State's progress toward meeting the Hawaii Clean Energy Initiative's requirements.

Wave Energy Test Site (\$500,000). UH/HNEI through the Hawaii National Marine Renewable Energy Center has been awarded a total of \$ 8 million by USDOE to support wave energy testing at the soon to be completed Wave Energy Test Site (WETS) at MCBH. This \$500,000 cost-share from the fund was critical to receipt of this award.. These funds will support environmental and resource studies supporting the Navy sponsored plug-and-play facility. The Navy has committed approximately \$11 million for infrastructure at the WETS. Combined resources of the Navy, USDOE and the Fund will result in a grid-connected site where developers can test their technology for proof of seaworthiness, functionality, system integrity and technology viability.

Sea Water Air Conditioning Monitoring (\$160,000) Seawater air conditioning has the potential to contribute significantly to the state's energy efficiency goals. HNEI has procured federal funding to develop high-fidelity plume models to assess the impacts of cold water return depth, a factor which has major impact on the capital cost of these projects. HNEI has also procured funding to initiate on-site monitoring before and during operation of the Honolulu SWAC system to assess impacts and validate models. HNEI is using \$160,000 from the barrel tax to conduct the long-term monitoring necessary to validate performance. Depth of discharge has major impact on the overall cost of the SWAC project. This work has the potential to save millions from future projects substantially increasing the likelihood of future SWAC development and resulting fuels savings.

Renewable Portfolio Standards Study (\$850,000) HNEI has contracted with GE to build upon the modeling work done in the OWIS, HSIS, and Stage-2 studies to evaluate and assess the likelihood of compliance with the State RPS requirements. The study, cost shared by US DOE has modeled costs and economics as well as the technical implications of various scenarios to help identify promising approaches to meeting the 2020 RPS mandate. The analyses compare the value of grid-tied, and generation-tied undersea island interconnections with island independent systems. The analyses also include the impacts of using liquefied natural gas for electricity production, of modified

utility operating practices and reserve requirements, and the use of ancillary services such as demand response and battery energy storage systems. The goal of the study is to provide insight on the economic and technical implications of the approaches analyzed to inform decision makers that need to implement plans to achieve the RPS objectives. A final report will be available in the first quarter of 2015.

Hawaii State Energy Office Support (\$1,125,000) HNEI continues working with the Hawaii State Energy Office in DBEDT to support programs for:

- Hawaii Test Bed Development and Energy Education and Outreach
 - Design Planning for Innovation Center for energy system commercialization testing, innovation, advancement, and energy venture acceleration
 - Energy Education and Outreach to generate awareness of Hawaii's clean energy goals and their contribution to economic growth
- Energy Efficiency – Technical Assistance for High Performance Buildings
- Renewable Energy
 - Enhance EnerGIS Renewable Energy Resource Tool
 - Online Self-Help Investor Development Tools
 - Energy Systems Infrastructure Development – infrastructure planning may include LNG, fuels and/or smart grid.

Energy Efficiency Natural Ventilation Research (\$356,000) HNEI is conducting research and demonstration of three areas of energy efficient, emerging technology research that will enable natural ventilation to be integrated into building operation without sacrificing modern expectations of comfort. These technologies will be of interest to public facilities such as schools that are increasingly concerned about educational environments as they relate to student performance. Three areas of research using technologies to be researched for Hawaii-specific application are:

- 1) **Natural Ventilation and Comfort Mitigation:** HNEI is conducting research in collaboration with the UH School of Architecture Environmental Research and Design Laboratory on mitigating comfort in extreme conditions in naturally ventilated spaces. Night flushing, ceiling fans and controls, and the use of individual comfort devices are being assessed for applicability in non-conditioned environments in Hawaii.
- 2) **Radiant Cooled Surfaces:** Radiant panels that can be retrofitted into standard T-bar ceiling grids, wall surfaces or work space cubicles can be used in conjunction with natural ventilation to provide a cooling effect at a much lower energy cost than conventional air conditioning. These are particularly applicable in buildings where natural ventilation provides sufficient airflow for much of the

year, but where comfort is desired or required for the hotter, more humid portions of the year. The cooling benefits derive from an air conditioning compressor sized at a fraction of a standard compressor.

- 3) **Building Modeling and Simulation:** HNEI is conducting predictive modeling research using computational fluid dynamics (CFD) models to understand and validate heat transfer and comfort conditions within naturally ventilated spaces. In combination with building energy simulation tools, CFD can be used to predict the impact of external variables (adjacent structures, orientation, topography) on air movement into a building. Internal CFD models are being used to evaluate air flow within a space, including the effect of ceiling fans and radiant cooling surfaces. Modeling can be used as a predictive tool to determine the impact of comfort mitigating measures being considered by the State for schools and other unconditioned spaces.