

**State of Hawaii – Hawaii State Energy Office**

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**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 2013**

## Executive Summary

The Hawaii State Energy Office (SEO) is growing Hawaii's clean energy economy through the Hawaii Clean Energy Initiative (HCEI), the state's blueprint for energy independence. Established in 2008, HCEI is a groundbreaking partnership between the State of Hawaii, the US Department of Energy (USDOE), the military and the private sector. HCEI was established as a State policy, through Act 73, Session Laws of Hawaii in 2010. Through HCEI, the State plans to transform Hawaii's economy from one that is dependent on fossil fuels to a leader in renewable energy and energy efficiency within a single generation.

By 2030, Hawaii must:

- Reduce energy consumption by 30%
- Increase electrical generation from renewable resources by 40%
- Reduce the use of petroleum for ground transportation by 70%

Under the leadership of Governor Neil Abercrombie, SEO works to make sustainability a reality for Hawaii and drives energy innovation by aligning policies among government agencies and the private sector. SEO also provides the framework and tools to attract energy developers and potential investors.

Clean energy development continues to transform Hawaii into a clean energy leader.<sup>1</sup> The State is positioned well to meet, and potentially exceed, its interim clean energy goal for 2015. In 2012, the State's electric generation was 13.7 percent from renewables accompanied by energy savings of 14.5 percent from energy efficiency.<sup>2</sup>

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

EREFST has provided an innovative funding mechanism that uses moneys from barrels of oil to fund achievement of Hawaii's clean energy and food-secure future. However, EREFST is set to sunset at the end of FY15, which will leave uncertainty in the funding of many of our State's clean energy and food security initiatives and may put the achievement of our State's long-term goals of energy and food self-sufficiency at risk.

Achieving our long-term goals as articulated in Act 73(10) will require further commitment, and the necessary means to leverage State, Federal and other investments in energy efficiency, renewable energy, innovation, and policy and planning.

### 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. SEO efficiency programs focus on delivery of cost-effective investments.

<sup>1</sup> *Energy- Democratizing the Electricity System: How Archaic Utility Rules Stall Local Solar*, infographic by the Institute for Local Self-Reliance, August 8, 2012.

<sup>2</sup> Source: Hawaii Public Utilities Commission

To date, SEO has provided technical assistance to State and County agencies resulting in \$171 million in energy performance contracting investments. In 2013, Hawaii retained its top national ranking for energy performance contracting per capita with an investment of \$132.25/capita, resulting in a second 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 implements State efficiency measures in our own buildings, we are finding much success in the efficiency sector. As of 2012, electricity consumption in the State and private sector achieved a 14.47% reduction, nearly halfway to our Energy Efficiency Portfolio Standard (EEPS) of 30% by the year 2030. As of June 2013, SEO 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 next two years.

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

Our island state's abundance of diverse, natural resources and its unique geographic location make for an ideal proving ground for clean energy solutions in the Asia-Pacific region. During the last 18 months alone, the following projects came on-line:

- Auwahi Wind Farm
- Big Island Biodiesel
- H-POWER Expansion
- Kaheawa Wind Power 2
- Kalaeloa Solar Power II
- Kapolei Sustainable Energy Park
- MP2 Solar Project
- Off-Grid Agricultural Pumping Wind Project
- Pearl City Peninsula Solar Energy Facility
- Port Allen Solar Facility
- Puna Geothermal Expansion
- UOP Integrated Bio-Refinery Pilot Project

This clean energy investment is paying off:

- In 2012, Hawaii generated 13.74% of its energy from renewable resources,
- Hawaii is on track to achieve the Renewable Portfolio Standard (RPS) goal of 15% in 2015, and
- Hawaii ranks as a leading state for 2012 solar installations in multiple national reports.

### **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 turns stimulates our economic growth. To help drive this energy evolution, SEO is also leading with innovation, creating programs and bold policy

solutions that will help make clean energy more accessible for Hawaii. For example:

- With the passage of SB1087 by the Legislature, and the signing of Act 211 by Governor Abercrombie in 2013, SEO is establishing a groundbreaking financing program, the Green Energy Market Securitization (GEMS) program. GEMS is an innovative specialized financing structure that employs securitization techniques, typically used by the industrial sector, in order to bring low cost capital for consumers to invest in green infrastructure. In its initial launch, SEO plans to provide financing to support underserved markets such as lower income households, renters and non-profits; thus, promoting the democratization of solar.

SEO also works as a catalyst by providing a suite of self-help tools and roadmaps to assist energy developers and attract international investment. For example:

- SEO launched an improved website whereby users are able to analyze renewable energy potential of sites statewide via the “Renewable EnerGIS.” ([energy.hawaii.gov/resources/renewable-energis-map](http://energy.hawaii.gov/resources/renewable-energis-map))
- Launched a Renewable Energy Permitting Wizard that helps proposed projects understand the permits required for projects ([wizard.hawaiiicleanenergyinitiative.org](http://wizard.hawaiiicleanenergyinitiative.org)); and
- The State launched a new mobile app designed to help drivers locate electric vehicle (EV) charging stations statewide. The free “EV Stations Hawaii” app is available for Apple and Android smartphones and mobile devices.

## **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 (SEO) 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, funded by a combination of federal grants and the ESSF. ESSF spending for FY13 amounted to \$3,407,295, or 38% of total HCEI expenditures.

In FY13, SEO obligated over 97% of its budgeted ESSF allocation. Eighty-one per cent (81%) of the amount obligated was needed to cover SEO personnel costs. Other obligations and expenditures included special fund assessments, grants-in-aid to economic development agencies, and expenditures in advance of reimbursement from the federal government under grants and agreements.

In FY14, ESSF funding is supporting a substantially larger portion of project and staffing costs due to the expiration of federal American Recovery and Reinvestment Act (ARRA) funding. This loss has caused total federal funding in support of the State's energy programs to be significantly less.

In FY15, the legislative authorization for the EREFST and ESSF will expire, creating uncertainty for the continued funding of clean energy and food security initiatives.

## **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 SEO 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 SEO 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.

## I. Status & Progress of Clean Energy Initiatives

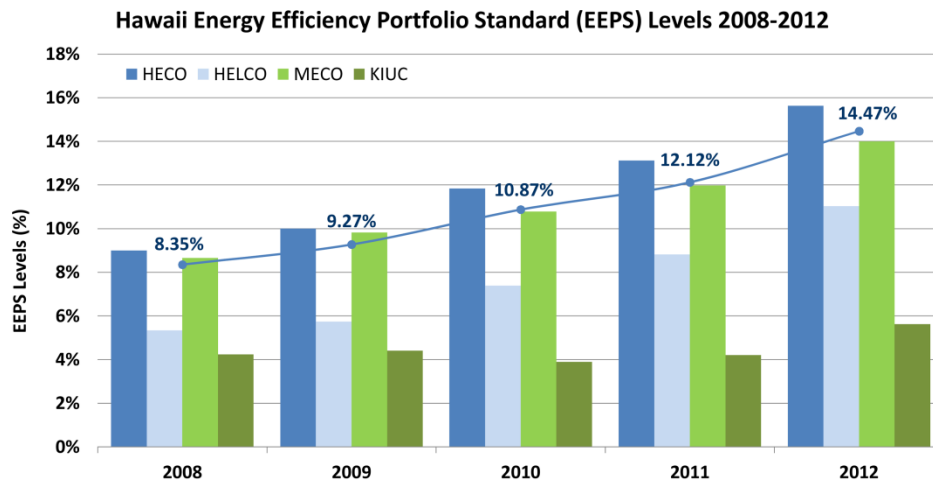
Key progress indicators and accomplishments for FY13 under HCEI are as follows:

### 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.

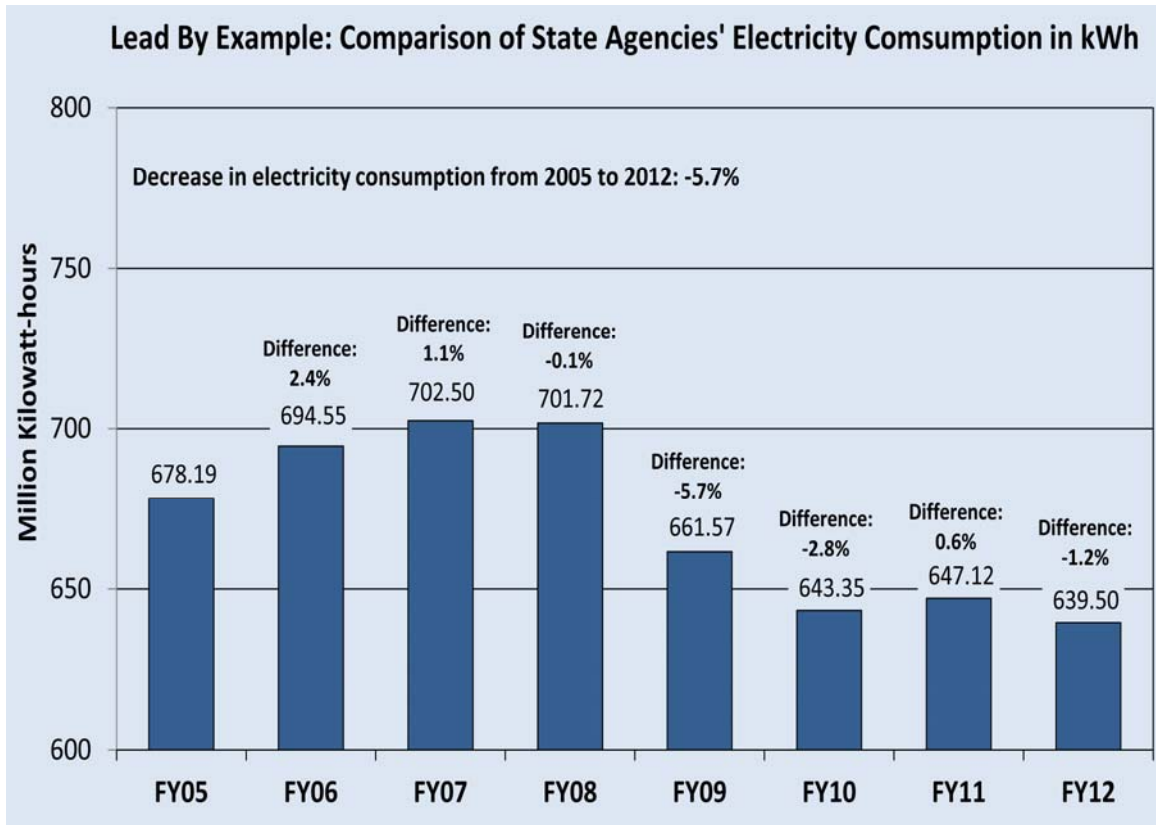
As a result of energy efficiency measures to date, Hawaii has already made great strides toward its 30% energy efficiency goal. The chart shows that for 2012 Hawaii, achieved a statewide EEPS level of 14.47%.



Source: Renewable Portfolio Standards Status Reports, 2008-2012 (Hawaii Public Utilities Commission)

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. See chart on the next page:





## 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.

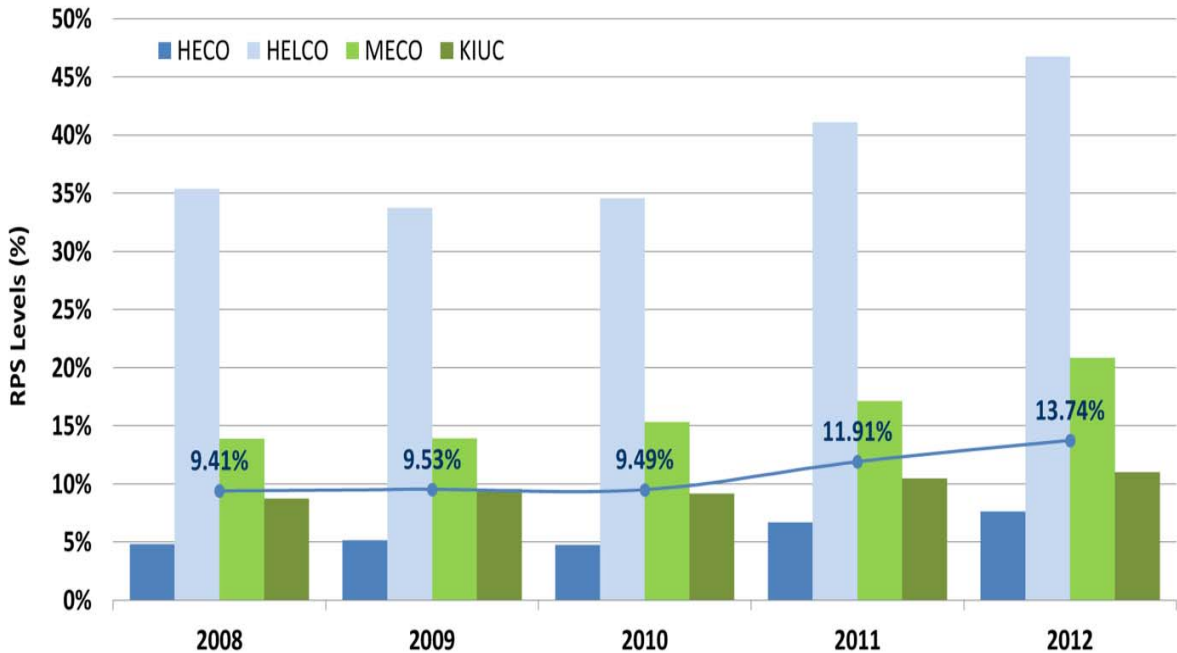
- Renewable energy generation in Hawaii continues to grow from 9.4% in 2008 to 13.74% in 2012.
- Renewable resource potential, statewide, is greater than current electricity demand. However, since electricity must be used, transmitted, or stored at the instant it is produced, practical use of most renewable resources is constrained by time and location of production.
- In 2012, a total of 12,561 distributed renewable energy systems with a total capacity of 79 MWs were installed statewide. Since 2006, net energy metering (NEM) system installations have increased rapidly and there are currently a total of 22,404 systems installed, representing 138MW of total capacity. (See chart on page 13.)

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.

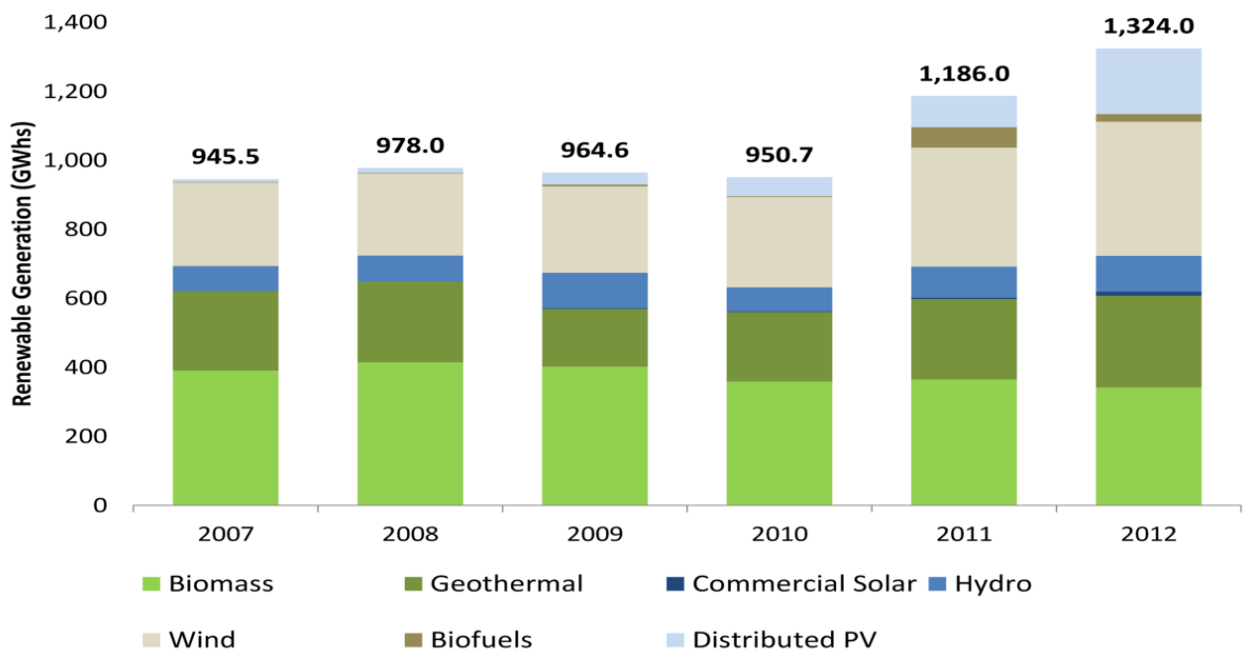
As a result of renewable energy increases to date, Hawaii is positioned well towards its interim 2015 RPS goal of 15%. The following chart shows that in 2012, Hawaii achieved a Statewide RPS level of 13.7%.

### Hawaii Renewable Portfolio Standard (RPS) Levels 2008-2012



Source: Renewable Portfolio Standards Status Reports, 2008-2012 (Hawaii Public Utilities Commission)

### HAWAII RENEWABLE ENERGY GENERATION BY RESOURCE



Source: Renewable Portfolio Standards Status Reports, 2007-2012 (Hawaii Public Utilities Commission)

### Green Jobs, Innovation, and Economic Growth

Hawaii’s pursuit of energy independence is contributing to Hawaii’s economy with more than 11,000 green jobs statewide, this job growth is helping to offset job losses in the traditional construction sector. Construction jobs from solar in 2012 represented more than one-quarter of

construction expenditures in that year, providing a stimulus to the construction industry and jobs.

SEO 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 bridge financial barriers, develop alternatives to transportation usage, add new clean energy infrastructure, and provide tools to advance clean energy solutions.

Energy savings performance contracting also 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. The State of Hawaii is ranked #1 in the nation by the Energy Services Coalition in energy savings performance contracts (ESPC) investment per capita as a result of state agency performance contracts with investments of over \$171 million.

See the two charts on the following page on energy savings performance contracts.

<b>Hawaii Energy Performance Contracts 1996-2012*</b>				
<i>In 2011 Dollars</i>	<i>\$ Investment</i>	<i>Job Years Created</i>	<i>Source Energy Saved</i>	<i>Tons Carbon Avoided</i>
UH Hilo	\$ 11,294,900	123	93,725	1,610
County of Hawaii	\$ 2,931,756	32	24,328	418
County of Kauai	\$ 904,102	10	7,502	129
HHSC	\$ 32,618,201	355	270,666	4,649
C&C Honolulu	\$ 28,580,591	311	237,162	4,074
Hawaii State Judiciary	\$ 2,115,702	23	17,556	302
DAGS	\$ 34,521,672	375	286,461	4,920
PSD	\$ 25,511,264	277	211,692	3,636
UH Community Colleges	\$ 32,802,838	357	272,198	4,675
<b>TOTALS</b>	<b>\$ 171,281,027*</b>	<b>1,862**</b>	<b>1,421,290**</b>	<b>24,413**</b>

\* Source: 1996-2012 data from the Department of Business, Economic Development, and Tourism

\*\* Source: ENERGY SERVICES COALITION, *Race to the Top*, December 2, 2013

<b>National Energy Services Performance Contracting Rankings*</b>						
<b>State</b>	<b>Population</b>	<b>Performance Contracting</b>	<b>Dollars per Capita</b>	<b>Job Years Created</b>	<b>Source energy Saved</b>	<b>Tons Carbon Avoided</b>
<b>Hawaii</b>	1,295,178	\$ 171,281,027.00	\$132.25	1,862	1,421,290	24,413
<b>Ohio</b>	11,536,504	\$1,252,683,627.00	\$108.58	13,616	10,394,769	178,551
<b>Kansas</b>	2,853,118	\$278,951,861	\$97.77	3,032	2,314,742	39,760
<b>Mississippi</b>	2,967,297	\$260,725,503	\$87.87	2,834	2,163,500	37,162
<b>Idaho</b>	1,567,582	\$129,000,000	\$82.29	1,402	1,070,442	18,387
<b>Massachusetts</b>	6,547,629	\$457,696,106	\$69.90	4,975	3,797,962	65,238
* ENERGY SERVICES COALITION – <i>Race to the Top</i> , December 2, 2013						

### **Innovative Solutions To Overcome Financial Barriers**

On June 27, 2013, Gov. Neil Abercrombie signed into law Act 211, which establishes a green infrastructure financing program. Named GEMS, or Green Energy Market Securitization, the innovative financing model is designed to make clean energy improvements, such as solar photovoltaic installations in its initial deployment, affordable and accessible for Hawaii’s consumers, including expanding the market to expand reach to underserved markets such as low- and moderate-income homeowners, renters and nonprofits. It aims to address the financial barriers of investing in and installing energy cost-savings devices by working with the market to provide solutions for consumers to invest in clean energy and save on their electricity bills.

### **Develop Alternatives To Transportation Usage**

A primary goal in clean transportation is to explore alternatives, which will reduce the consumption of petroleum in ground transportation. To reduce Hawaii’s consumption of petroleum within the transportation sector, SEO is looking at plug-in electric vehicles (EV) as well as other alternative transportation solutions to address the challenges of building a clean transportation future. 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.

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

### Number of Publicly Available EV Chargers Installed

Electric Vehicles and Charging Stations in Hawaii		
Island	Electric Vehicles EVs *	Charging Stations **
Oahu	1307	240
Maui	254	39
Hawaii	97	46
Kauai	49	34
<b>Statewide</b>	<b>1,707</b>	<b>359</b>

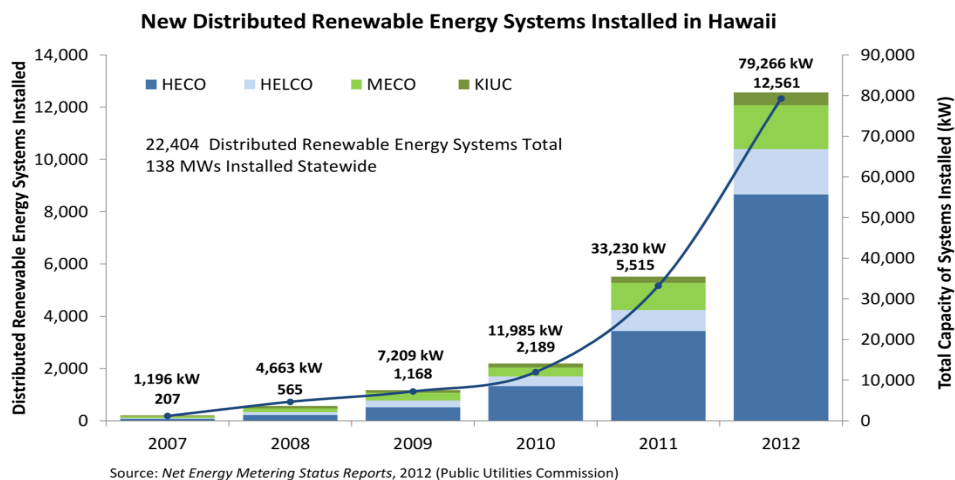
\* Registered passenger EVs which includes Plug in Hybrid and Neighborhood Electric Vehicles

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

Source: Department of Business, Economic Development & Tourism, 2013

### 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 2012, there were a total of 12,561 NEM systems installed statewide with a total capacity of over 79 MWs. See the chart on the following page.



### Provide Tools To Advance Clean Energy Solutions

SEO has developed a suite of self-help tools for developers, investors, and consumers; which are detailed below:

**1. Renewable Energy Permitting Wizard**  
[wizard.hawaii-cleanenergyinitiative.org](http://wizard.hawaii-cleanenergyinitiative.org)

The Permitting Wizard helps developers and investors understand what county, state and federal permits may be required for their renewable energy projects in

Hawaii. Based on responses to questions about the proposed project, the Permitting Wizard provides a list of required permits and typical timeframes.

**2. Renewable EnerGIS Map**

**[energy.hawaii.gov/resources/renewable-energis-map](http://energy.hawaii.gov/resources/renewable-energis-map)**

This Geographic Information Systems (GIS) Map supports innovation by helping landowners, developers and policy makers determine the renewable energy potential for specific Hawaii locations. While site surveys are recommended to determine actual attributes, the EnerGIS will help with preliminary site decisions. GIS files are based on publicly available data from the State of Hawaii Office of Planning.

**3. Hawaii Renewable Energy Projects Directory**

**[energy.ehawaii.gov/epd/public/energy-projects-map.html](http://energy.ehawaii.gov/epd/public/energy-projects-map.html)**

Want to know where innovation is happening in Hawaii? The Directory lists renewable energy projects statewide, showcasing the variety of renewable energy resources that are being harnessed to move us closer to our overall clean energy goals. It also indicates projects by island, specific location, type of resource and production capacity. Each project lists its status, whether it is active/ongoing or in the planning stage, as well as the name of developer and project description.

**4. EV Stations Hawaii Mobile Application**

Access to information of publicly available charging stations statewide is available at your fingertips via your Apple or Android smartphone. “EV Stations Hawaii” is a free app that provides maps and driving directions to the closest charging station in your area, so you’ll never run out of “juice.” Created by the Hawaii State Energy Office, the Hawaii Information Consortium and Honolulu Clean Cities, the app uses the State’s open data to provide a service to consumers. Changing the way we get around in Hawaii is vital in helping us reach our clean transportation goals.

## II. State Energy Office – Budgeted Spending

SEO energy projects in the fiscal biennium 2011-2013 were primarily supported by federal funds for program initiatives. However, State Energy Program American Recovery and Reinvestment Act funds expired in September 2013, and Energy Efficiency and Conservation Block Grant funds will expire in November 2014. The current portfolio of federal grants supporting the State’s energy program is detailed in the chart below:

Hawaii State Energy Office - Federal Grants				
FUNDING AGENCY	AWARD TITLE	AWARD AMOUNT	GRANT OBJECTIVE	PARTNERS
USDOE - NETL	Recovery Act: Energy Assurance Planning - State of Hawaii	\$318,196	To strengthen and expand State and local government energy assurance planning and resilience efforts by incorporating response actions for new energy portfolios and Smart Grid applications; to create jobs; and to build in-house State and local government energy assurance expertise. Term: Aug 2009 - Mar 2013.	Science Applications International Corp
USEPA	Hawaii Green Intern Development and Pollution Prevention Project	\$74,000	To train and deploy student interns to promote Pollution Prevention, Resource Conservation, Waste Minimization by enrolling businesses, hotels and governmental office in the Green Business Program and Green Government Challenge and providing them with technical assistance. Term: Oct 2010 - Jun 2013.	Hawaiian Electric Company Hawaii Pacific University Chamber of Commerce of Hawaii Hawaii Dept. of Health City & County of Honolulu Rebuild Hawaii
USDOE (sub-award)	Clean Cities Community Readiness & Planning for Evs and Charging Infrastructure	\$16,000	To create a sustainable implementation plan for EV deployment and charging infrastructure in Maui County with applications to other neighbor islands and the State of Hawaii. Term: Oct 2011 - Sep 2013.	University of Hawaii Maui College
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 - Sep 2013.	Various
<b>ON-GOING</b>				
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
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 - 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	State Energy Program (SEP) Formula (2010, 2011, 2012, 2013)	\$929,849	To design and carry out the Hawaii State Energy Office's energy efficiency and renewable energy programs. Term: Jul 2010 - Jun 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 Hawaiian Electric Company
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 2014.	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 (SAIC/RW Beck) Hawaii Dept. of Accounting & General Services - Public Works Division Hawaii Energy
USEPA	Hawaii Growing Green Intern Development and Pollution Prevention Project	\$50,000	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 Dept. of Health City and County of Honolulu - Honolulu Board of Water Supply City and County of Honolulu - Refuse Division The Chamber of Commerce of Hawaii

## HCEI-FY13 Expenditures

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

<b>DBEDT STRATEGIC INDUSTRIES DIVISION: REVENUE AND EXPENSES</b>			
<b>SOURCE</b>	<b>REVENUES</b>	<b>EXPENDITURES</b>	
		<b>PERSONNEL</b>	<b>OPERATING EXPENSES (e.g., Travel, Equipment, Supplies, Contracts)</b>
<b>Energy Security Special Fund *</b>	\$ 3,998,323.71	\$ 2,585,630.14	\$ 821,664.58
USDOE State Energy Program Formula Grant	\$ 99,595.79	\$ -	\$ 254,667.35
USDOE State Energy Program Recovery Act Grant	\$ 3,641,800.90	\$ 547,365.43	\$ 3,210,290.19
USDOE Energy Efficiency Recovery Act Grant	\$ 204,814.58	\$ 163,150.49	\$ 44,593.19
USDOE Energy Assurance Planning Recovery Act Grant	\$ 96,388.43	\$ -	\$ 96,388.43
USEPA Cooperative Agreement	\$ 21,975.94	\$ -	\$ 21,975.94
USDOE HI Renewable Energy Grid Project Grant	\$ 202,897.65	\$ 62,233.17	\$ 140,663.33
USDOE Hydrogen Power Park Grant	\$ 770,000.00	\$ -	\$ 770,000.00
USDOE Hawaii's Clean Energy Transformation and Grid Connection Grant	\$ 212,989.99	\$ -	\$ 212,989.99
USDOE Advancing Energy Efficiency in Hawaii Public Buildings Grant	\$ 9,050.22	\$ -	\$ 9,050.22
USDOE Clean Cities Grant	\$ 4,226.63	\$ -	\$ 4,226.63
PVE - Stripper Well Funds	\$ 43.24	\$ -	\$ -
PVE - Exxon Funds	\$ 1,310.75	\$ -	\$ -
PVE - Chevron Funds	\$ 589.91	\$ -	\$ -
NGA Clean Energy States Grant	\$ -	\$ -	\$ 1,185.91
General Fund Aerospace	\$ -	\$ -	\$ 20,000.00
<b>TOTAL</b>	<b>\$ 9,264,007.74</b>	<b>\$ 3,358,379.23</b>	<b>\$ 5,614,052.76</b>
* ESSF revenue from Environmental Response, Energy, and Food Security Tax: \$3,884,268			

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 on the following chart.

### Energy Security Special Fund Expenditures

Expenditures and encumbrances for FY13 and planned investments for FY14 are provided below:

ENERGY SECURITY SPECIAL FUND - OBLIGATED & PLANNED INVESTMENTS		
INITIATIVE	FY13 OBLIGATED	FY14 BUDGETED
Hawaii State Energy Office - Personnel Costs	2,545,583	3,697,990
Hawaii Refinery Task Force Support	95,000	255,000
Energy Education / Outreach - State Energy Office	28,642	22,000
Program Portfolio and Data Repository - State Energy Office		40,000
Program Support - State Energy Office	115,767	214,315
Expert Witness-Related Technical Support		225,000
Renewable Energy Support Project (PEIS)		100,000
Build & Buy Green Conference		35,000
Energy Assurance Plan		35,000
Database Information, Databooks and Reports		65,000
Special Fund Assessments	177,990	210,000
Network Assessment		45,000
Energy Audits for Rural Small Businesses and Farms	133,334	
Grants-in-Aid to Economic Dev Agencies	52,673	
<b>TOTAL</b>	<b>3,148,990</b>	<b>4,944,305</b>

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**.

### III. EREFST Tax Analysis

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

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

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 HNEI<sup>3</sup>
- 3 **Agricultural Development and Food Security Special Fund** – to be expended by HDOA<sup>4</sup>

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;

<sup>3</sup> HNEI – Hawaii Natural Energy Institute of the University of Hawaii

<sup>4</sup> HDOA – Hawaii Department of Agriculture

- Emphasize innovative and renewable energy supply and energy efficient end use technologies focusing on environmental attributes, reliability, and affordability;
- 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**

SEO has made significant and tangible progress towards achieving Hawaii's clean energy goals through HCEI, as evidenced by its national recognition, but we must remain committed to adjust and evolve in order to achieve Hawaii's 2030 clean energy goals.

SEO is currently managing the impact and expiration of \$37 million in federal funds from the American Recovery and Reinvestment Act. It is now primarily dependent upon the ESSF to enable retaining the capacity, staff resources, and project funding to continue critical initiatives. This progressive reliance on ESSF funds is documented by its obligations for FY13 and FY14 in the chart on page 15. The large disparity in the loss of federal funds (\$37 million) and the funds received from the ESSF, within the fiscal year (\$3.5 million) has caused difficult choices in the budgeting of energy program initiatives and in the decision to fill vacancies.

An accounting of expenditures (obligations) in FY13 from the ESSF follows:

- a. In-line with the intent of the Act, SEO funded staff positions within the Division (\$2,545,583). The fund also provided SEO program support and energy education/outreach of its activities (\$115,767 and \$28,642 respectively).
- b. SEO provided grants to the Hawaii and Kauai county economic development agencies to meet the stated objectives of HCEI and continue an on-going relationship to develop and implement appropriate energy measures (\$52,673).
- c. The fund also covered grant expenditures in advance of reimbursement from the U.S. Department of Agriculture to conduct energy audits for rural small businesses and farms (\$133,334).
- d. Lastly, statutory special fund assessments for administrative and central service expenses (\$177,990).

**Energy Systems Development Special Fund**

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

**Agricultural Development and Food Security Special Fund**

The Department of Agriculture in FY 13 expended approximately \$2.6 million from the Agricultural Development and Food Security Fund on programs and activities that will help the State reach its goal of food self-sufficiency and security. The activities and programs are summarized in the following table.

**HEDTF DOA Expenditure – Encumbrance Update**

<b>CATEGORY</b>	<b>PURPOSE</b>	<b>ACTIVITIES AND PROJECTS</b>	<b>EXPENDITURES</b>
Irrigation Operations	Improvement of real property, irrigation systems, and transportation networks necessary to promote agricultural production or processing activity	Irrigation personnel and operating expenses	\$ 509,000
Research	The conduct of	Biofuel Research; Anthurium	\$ 250,000

	research on and testing of agricultural products and markets	Research; Foliage Germplasm Research	
Marketing and Promotion	Promotion of marketing of agricultural products grown or raised in the state	"Buy Local it Matters" Multimedia Campaign; Logistics Workshop; Philadelphia Flower Show; Papaya Promotion in Asian Markets; Cashew Project	\$ 302,000
Agricultural Support	Activities that intended to increase agricultural production or processing that may lead to reduced importation of food, fodder or feed from outside of the State.	Feedmill project; Foreign Exploration for Biocontrol Agents; Coffee Berry Borer Research; Insectary Repair; Planner Position; Neighbor Island Support; Fire Ant Control; Food Security Research; Food Safety Research	\$ 1,563,000

## 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 survey by OmniTrak sampled 700 adult residents December 3 - 7, 2012 via phone interviews. The question posed and the response results follow below:

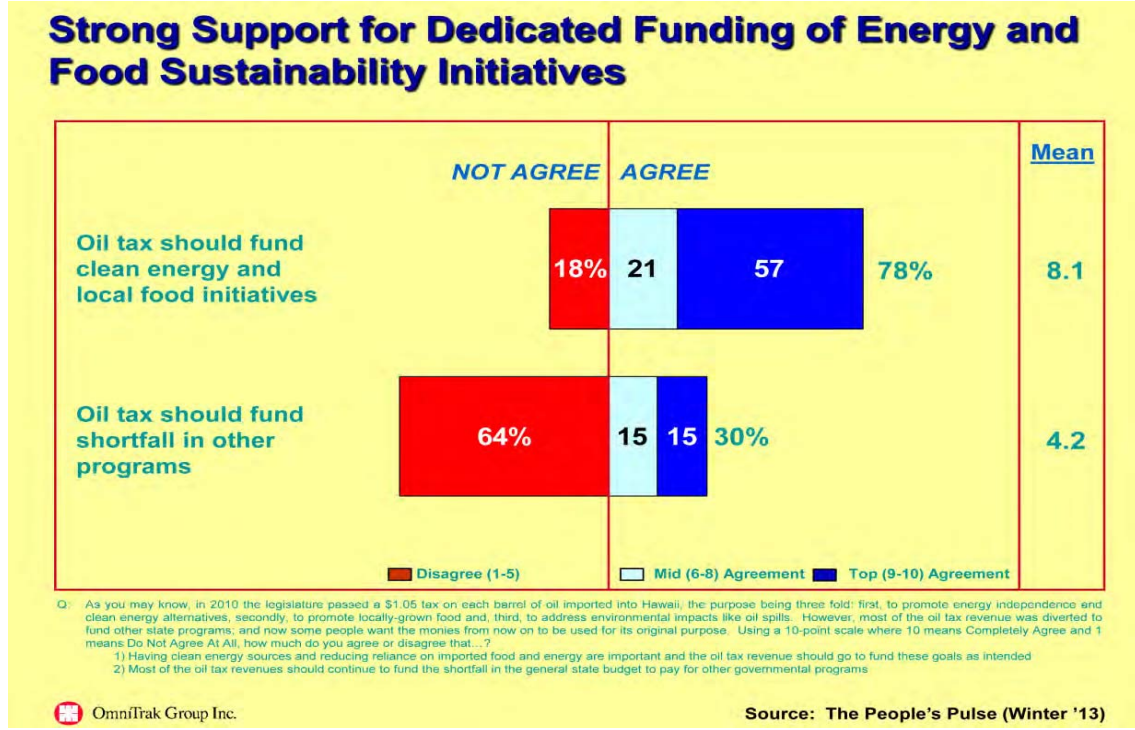
**Question** – In 2010 the legislature passed a \$1.05 tax on each barrel of oil imported into Hawaii, the purpose being threefold:

- 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.

**Results:**



- **2013 Legislative Session** – The departments proposed reallocating revenues that were being diverted to the general fund back to food and energy self-sufficiency. Out of the \$1.05 “barrel tax,” 60 cents was going to the general funds. Of that 60 cents, it was proposed that 27.5 cents be reallocated to each of the Energy Security Special Fund and the Agricultural Development Special Fund, with the remaining 5 cents being reallocated to the Environmental Response Revolving Fund. In addition, there was a proposal to extend the Energy Systems Development Special Fund beyond June 30, 2013. However, these proposals were unsuccessful and the current EREFST allocation now has less allocated to food and energy security.

	Allocation as provided in Act 73, SLH 2010	Allocation as of July 1, 2013
<b>“BARREL TAX”</b>	\$ 1.05	\$ 1.05
• Environmental Response Revolving Fund	\$ 0.05	\$ 0.05
• Energy Security Special Fund	\$ 0.15	\$ 0.15
• Energy Systems Development Special Fund	\$ 0.10	\$ 0.00
• Agricultural Development and Food Security Special Fund	\$ 0.15	\$ 0.15
<b>TOTAL ALLOCATED TO ENERGY AND FOOD SECURITY</b>	\$ 0.45	\$ 0.35
<b>BALANCE TO GENERAL FUND</b>	\$ 0.60	\$ 0.70

## **Conclusion:**

The EREFST has offered an innovative and self-sufficient funding mechanism to leverage one of Hawaii's energy challenges, its addiction to oil, to fund a solution, Hawaii's clean energy and food security initiatives. However, the EREFST and related energy and food security special funds are set to sunset in FY15, if no further legislative action is taken.

Continued funding from the EREFST for HCEI, food security initiatives is imperative, especially to offset the loss of Federal ARRA funding sources. EREFST funding is critical if program initiatives are to continue 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.

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 funding for these programs may unnecessarily interrupt the progress that Hawaii has seen, and it is critical that we have a continued and uninterrupted commitment to the goals identified in Act 73(10) and can leverage a dedicated and sustainable funding source aligned with our long-term State objectives.

## ATTACHMENT 1. HCEI FEDERAL and ESSF FUNDED PROJECTS

1/22/2014

Target Market	Method of Funding*	Reason For Selection	Persons Served	Program Objectives	Encumbered	Measurable Outcome <sup>①</sup>
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	Progress towards RPS objective. In progress.
Hydrogen	N	Transportation Energy Diversification	State & Developers	Hawaii Hydrogen Power Parks Project	\$1,200,000	Progress towards TRANSPORTATION objective. In progress. Fueling facility dedication pending.
Regulatory	N	State Energy Planning, Regulatory Policy, and Energy Goals	Energy Program & Decision-makers	Expert Witness for potential and actual litigation of legal matters involving the State, its agencies, and its officers and employees, including administrative quasi-judicial proceedings	\$400,000	Assistance in pursuit of HCEI GOALS. Contingency activity.
Loan Loss Reserve	V	Innovative Financing for Energy Deployment	Financial institutions, building owners, and general public	Third-party administrator for the Loan Loss Reserve program approved by the U.S. Dept. of Energy	\$296,898	Progress towards EEPS objective. Active.
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.	\$500,000	Progress towards RPS objective. In progress.

\* Methods of funding - N: Federal Funds, V: Federal Stimulus Funds, B: Energy Security Special Funds



## ATTACHMENT 1. HCEI FEDERAL and ESSF FUNDED PROJECTS

1/22/2014

Target Market	Method of Funding*	Reason For Selection	Persons Served	Program Objectives	Encumbered	Measurable Outcome <sup>①</sup>
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	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	Progress towards RPS objective. In progress.

\* Methods of funding - N: Federal Funds, V: Federal Stimulus Funds, B: Energy Security Special Funds

**ATTACHMENT 2**

**UNIVERSITY OF HAWAI'I SYSTEM  
ANNUAL REPORT**



**REPORT TO THE 2014  
LEGISLATURE**

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

**HRS 304A-1891**

**November 2013**

Report to the 2014 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, Its 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. Thus, the Energy Systems Development Special Fund (ESDSF), and the requirements for its periodic evaluation and coordinated plan of action no longer exist.

**SUMMARY:**

The Hawaii Natural Energy Institute (HNEI) was established in 1974 to coordinate and undertake the development of natural energy sources for Hawaii. In 2005, HNEI faculty developed a strategic plan which called for HNEI to be the UH and State focal point for multidisciplinary research and education on the energy supply for Hawaii. In this plan, HNEI proposed to take a leadership role in the development of public-private partnerships on sustainable energy deployment and demonstration projects in Hawaii. The significance of HNEI's contributions to the State was recognized by the Hawaii State Legislature which, in 2007, 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 "Hawai'i Clean Energy Initiative" (HCEI), to achieve the goal of 70 percent clean energy by 2030. We also serve 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"). The Director of HNEI also serves as co-chair of the energy subcommittee for the UH-PACOM Partnership, formalized in 2010.

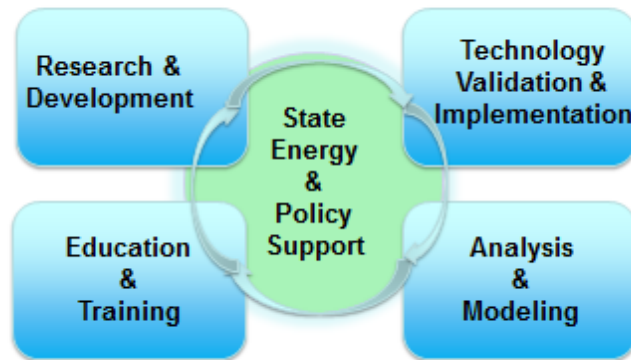
While HNEI's responsibilities go beyond traditional academic research, playing a significant role in public-private partnerships and supporting analysis for state energy policy, we have also maintained our strong core research effort. Today, HNEI conducts programs in the areas of Alternative Fuels; Renewable Power Generation Technologies; Energy Efficiency; Electrochemical Power Systems; and Systems Integration/Energy Security.

HNEI faculty are predominantly non-tenure track, 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, Systems Integration/Energy Security, the area with the most significant amounts of federal and state funding today were not part of HNEI's portfolio at the time our latest strategic plan was developed.

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, 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, 2011**  
**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)	7
	Other permanent staff (APT)	3
	Temporary Faculty	21
	Other temporary staff (APT, RCUH)	12
	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 \$22 million for 2012 and 2013 (based on 3 year rolling averages).

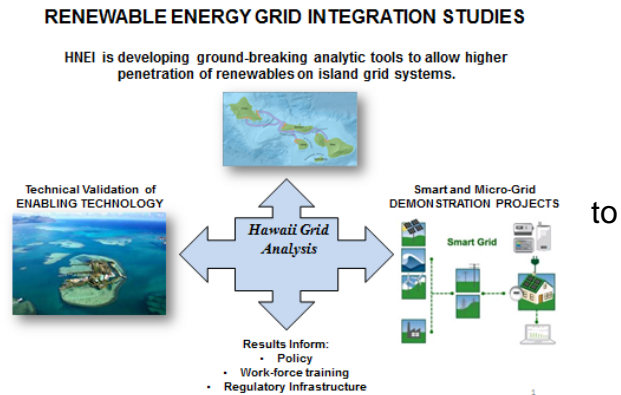
HNEI is a nationally acknowledged research leader with major activities in areas such as hydrogen, fuel cells, biofuels and ocean resources. While continuing to conduct basic and applied research, HNEI has, in accordance with HRS 304A-1891, also undertaken a pivotal role within the state to reduce dependence 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 an 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 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 will be published as part of DBEDT's larger Hawaii Renewable Energy Grid Project Report for the USDOE to be delivered in 2014.

*Renewable Portfolio Standards Study:* This year 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 will model 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 will compare the value of grid-tied, and generation-tied undersea island interconnections with island independent systems. The analyses will 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.

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 is being closely coordinated with the State Energy Office and the USDOE, and is described in more detail below, in the section on the Energy Systems Development Special Fund.

*Liquefied Natural Gas Study:* 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.

***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:* In a joint USDOE-DOD project HNEI is developing hydrogen production infrastructure at the Puna Geothermal Venture (PGV) electricity production plant on the Island of Hawai'i. The project objectives include 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 PGV hydrogen system has been delayed due to permitting and other agreements but is now expected to be operational by June 2013. The total budget is approximately \$5 million.

*Hydrogen Fueling Tube Trailers:* HNEI is also assisting with the purchase of two (2) hydrogen transport trailers for the supply of hydrogen produced at the PGV geothermal plant to support fuel cell electric shuttle buses operated 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 are under construction and will be delivered in mid-2014.

*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 high pressure refueling infrastructure in support of this work. Completion is expected in first quarter 2014.

***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 has been installed, and the demonstration will be conducted through 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. In addition to general advice, HNEI is leading efforts to coordinate between the two smart grid projects

***DOE Smart PV Inverter Project.*** In a project that closely supports the Maui Smart Grid efforts, an HNEI-led team won a new project to develop and demonstrate new “smart grid-enabled” PV inverters. This project, announced in September 2011, is intended to facilitate higher penetrations of solar PV systems by mitigating the utility operations issues resulting from variability of PV systems.

These new PV inverters will be tested as a part of the ongoing smart grid demonstration projects on Maui and another smart grid pilot project in Oklahoma. 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 Oklahoma Gas and Electric are the utility partners supporting the live demonstrations on their utility grids. HNEI used \$400,000 from the Energy Systems Development Special Fund to meet a critical funding shortfall and to insure timely and successful completion of this effort.

***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, as described above, support of various hydrogen infrastructure projects on the islands. In 2013 we will continue the current activities and with further expansion to include testing and evaluation of renewable generation and power system controls for smart and micro-grid applications.

***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. In 2011, USDOE awarded \$2,333,379 for the second and third years of funding in addition to the first-year federal funding of \$978,048. In 2012, HNEI was awarded an additional \$3 million to support development of a grid-connected wave energy test site at MCBH and to support industry testing at that site.

**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 will be developed in 2013.

**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.

**Electrochemical Power Systems R&D:** Researchers in HNEI's Electrochemical Power Systems Laboratory 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 through the Idaho National Laboratory, and the Air Force Research Laboratory through the Hawai'i Center for Advanced Transportation Technologies.

**EXPENDITURES:** General Funds \$ 1,216,305  
Tuition and Fees S Funds \$ 38,342  
Research and Training Revolving \$ 199,832  
Extramural Awards \$ 22,728,465

All funds were expended in support of research and training activities described above. We anticipate 2014 extramural funding levels to be comparable to those from 2013. The rate of expenditure is expected to be similar to that of 2011.

**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 patents in the areas of battery charging, conversion of biomass to charcoal, solar production of hydrogen, 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 2012 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. This work was completed in 2012.
- o ***Marine Corps Base (MCB) Hawai'i Hydrogen Fueling Station at Kaneohe Bay:*** HNEI is leveraging the State of Hawai'i investment in the Hawai'i Hydrogen Power Project by reallocating the hydrogen production and fueling station from Hawai'i Volcanoes National Park to MCB Hawai'i, in support of the deployment of the ONR/GM Equinox fuel cell vehicles. HNEI has worked closely with DBEDT in coordinating this evolving project. This project is receiving global interest as a result of GM's commitment to target Hawai'i for the first commercial rollout of its FCEV program.
- o ***Utility Scale Clean Energy Capacity Project:*** HNEI provided substantive assistance to DBEDT in the development of this award from the USDOE and was recently awarded funding from DBEDT to evaluate 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.

**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. Thus, the Energy Systems Development Special Fund (ESDSF), and the requirements for its periodic evaluation and coordinated plan of action no longer exist.

Below is a description of the money committed from the Fund, totaling approximately \$7,000,000.

**Geothermal Resource Assessment: (\$400,000)** The US DOE is funding 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 is 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 allow initial 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 is 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)** The US DOE is funding a project led by the University of Hawai'i to develop and commercialize smart grid-enabled PV inverters to mitigate grid reliability impacts of high penetrations of PV systems, and demonstrating these systems at two sites, one on Maui and one on the mainland. This project is 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.

**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 leverages 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. HNEI has 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 underserved Puna area. Approximately \$500,000 from the Fund was committed for this work.

**Hydrogen Fueling Tube Trailers (\$555,000)** ESDSF money was used to purchase two (2) hydrogen transport trailers for the supply of hydrogen produced at the PGV geothermal plant to support fuel cell electric shuttle buses operated 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 are under construction and will be delivered in mid-2014.

**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 both federal and local agencies and policymakers with information and guidance they can

use to make decisions about actions to support achieving HCEI goals. This work has been contracted and is underway.

***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 is intended to develop a workforce cross-trained in the business, legal and technical aspects of future energy systems.

***Hawaii Energy Policy Forum Support, HCEI Metrics (\$350,000)***. HNEI is supporting 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 National Marine Renewable Energy Center has been awarded an additional \$ 4.3 million by USDOE to support of wave energy testing at the to be constructed Wave Energy Test Site (WETS) at MCBH. This \$500,000 cost-share from the fund was critical to receipt of this award and is in addition to . \$3.8 million from the private sector.. These funds will support environmental and resource studies supporting the Navy sponsored plug-and-play facility. Navy has committed approximately \$11 million for infrastructure at the WETS. Combined resources of 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 will use \$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

will model 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 will compare the value of grid-tied, and generation-tied undersea island interconnections with island independent systems. The analyses will 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.

**Hawaii State Energy Office Support (\$1,125,000)** HNEI is 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 two 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. Two technologies to be researched for Hawaii-specific application are:

- 1) **Ceiling Fan Controls:** Ceiling fans are considered to be low energy impact devices that can mitigate heat and humidity with air movement across the skin. HNEI is leveraging its current research initiatives by collaborating with other UH and private partners to develop state-of-the-art controls to solve these issues. This research may also generate IP that will derive revenue, a portion of which would flow back to the State.
- 2) **Radiant Cooled Ceiling:** Radiant panels that can be easily retrofitted into standard T-bar ceiling grids 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.