

UNIVERSITY OF HAWAI‘I SYSTEM ANNUAL REPORT



REPORT TO THE 2009 LEGISLATURE

ANNUAL REPORT FROM THE
HAWAI‘I NATURAL ENERGY INSTITUTE

HRS 304A-1891

November 2008

Report to the 2009 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 Recommendation for Proposed Legislation, required in accordance with HRS 304A-1891 (Act 253, SLH 2007).

SUMMARY: Section 304A-1891 passed by the Hawaii State Legislature in 2007 established the Hawai'i Natural Energy Institute (HNEI) in statute, defined duties of the director and institute, and required an annual report to the legislature on its activities, expenditures, contracts developed, advances in technologies, coordination with state agencies and programs, and recommendations for proposed legislature. A summary of HNEI activities is appended.

Summary of Activities, 2008
Hawai'i Natural Energy Institute
School of Ocean and Earth Science and Technology
University of Hawai'i at Mānoa

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Staffing:	Permanent Faculty (FTE)	9
	Other permanent staff (APT)	3
	Temporary Faculty	11
	Other temporary staff (APT, RCUH)	8
	Training (a)	33

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

Summary of Activities and Contracts: Since 2001, the Hawai'i Natural Energy Institute (HNEI) has experienced significant growth in its extramural funding from under \$2 million per year to over \$5 million per year. HNEI is a nationally acknowledged leader in research activities in areas such as hydrogen, fuel cells, biofuels and ocean resources. More recently HNEI has undertaken a pivotal role within the State, consistent with its mandate from the legislature to reduce dependence on fossil fuels while contributing to the development of advanced energy technologies and systems aimed at finding solutions to energy shortage problems. While continuing efforts directed toward development of renewable energy and ocean resource technologies, HNEI has also implemented several major public/private partnerships to deploy and demonstrate renewable energy systems to meet Hawai'i's energy needs. HNEI has also initiated two major efforts directed toward solving the technical issues associated with very high penetration of renewable energy technologies onto the grid. Although funded outside the Hawai'i Clean Energy Initiative (HCEI), these efforts do provide substantial support to the HCEI goals and programs.

A very brief synopsis of select HNEI activities follows:

Hawai'i Distributed Energy Resource Technologies for Energy Security: This program, managed by HNEI and conducted in partnership with GE Global Research, HECO, MECO and HELCO, addresses technical issues associated with increased penetration of intermittent renewable and distributed energy technologies in the electrical grid. Analytic models developed under this program are being used to identify near-term energy-transforming projects for implementation. To date, models have been developed and validated for the Big Island and for Maui. Scenarios for modification of the Big Island energy system have been analyzed using these models and results have been presented to the U.S. Department of Energy (USDOE) and the utilities. Ongoing efforts include development of models for O'ahu and Kauai, and additional scenario evaluation.

This program also includes the deployment and testing of emerging distributed energy technologies.

Hawai'i Hydrogen Power Park: With funding from U.S.DOE and from the state's Hydrogen Capital Investment Special Fund through DBEDT, HNEI is the implementing partner for the installation of a hydrogen fueling station on the Big Island at Hawai'i Volcanoes National Park (HAVO). HNEI has worked with HAVO to secure separate funding from the US Department of Transportation to develop hydrogen-fueled plug-in hybrid electric vehicle (PHEV) shuttle buses for use at the park. DOE is also providing an IC-engine-powered hydrogen vehicle. Current funding, approximately \$3.3 million, is expected to be sufficient for installation of the fueling station, development of two PHEV shuttles, and 3 years of operation for all 3 shuttle buses.

Maui Smart Grid: This newly awarded, competitively-won project was received by HNEI on October 1st, 2008. Our partners include General Electric, MECO, HECO, and First Wind, among others. This is a 4-year, \$14 million project designed to demonstrate reduction of peak electricity demand by at least 15% through the use of advanced smart grid and demand-side-management technologies. Additionally, the project is intended to assist MECO to provide reliable and stable electricity with increased percentages of as-available renewable resources. This project was formally started October 17, 2008.

Energy Analysis for Renewable Portfolio Standards: As called for by ACT 95, passed by the 2004 Hawai'i State Legislature, HNEI, under contract to the Hawai'i Public Utilities Commission (PUC) is providing technical evaluations to the PUC to assess the current renewable portfolio standards. HNEI produced a draft final report providing the analysis of the state utilities' ability to meet the 2010 Renewable Portfolio Standard goal of 10%. The PUC was briefed on this report in September 2008 and the draft final report submitted to the PUC in October 2008. HNEI is scheduled to provide information to the PUC by the end of the year for determining how additional efforts can be made to enhance renewable portfolio standards.

Hawai'i Energy and Environmental Technology Initiative (HEET): This program, funded by the Office of Naval Research (ONR), is focused on the development and testing of fuel cells and seabed methane hydrates. A key activity under HEET was the development of the Hawai'i Fuel Cell Test Facility (HFCTF) located on HECO property on Cooke Street. In addition to ONR, additional funding is provided by the USDOE, National Renewable Energy Laboratory, Arkema Inc., United Technologies Corporation, and Defense Advanced Research Projects Agency. Work at the HFCTF includes substantial efforts to characterize effects of contaminants in hydrogen fuels, with the ultimate objective to assist in development of hydrogen fuels standards to accelerate acceptance of fuel cells.

Hawai'i National Marine Renewable Energy Center: In October 2008, in response to a competitively-submitted bid, HNEI was selected by the USDOE to establish one of two National Marine Renewable Energy Centers. This award will provide approximately \$1 million per year for up to five years to conduct renewable energy R&D of technologies

that harness the power of waves and ocean thermal energy conversion. The local utilities and industrial partners are expected to provide an additional \$1 million per year of in-kind cost sharing.

Solar Initiatives: HNEI is the primary subcontractor to MVSystems, a mainland solar energy company, for development of technology for the solar production of hydrogen. HNEI has critical patents in this field and is currently negotiating with industry for licensing and further development. HNEI is also providing technical support, data acquisition, and analysis services to the Hawai‘i Department of Education for the installation of \$5 million in solar systems on selected schools. HNEI is also working with USDOE and ONR to conduct additional resource assessments and testing of emerging solar technologies.

The Flash Carbonization™ process: Within its technology development efforts, HNEI has developed a patented process for the rapid and efficient production of charcoal from biomass. Charcoal is a renewable replacement for coal, which 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 seeking permits to enable the commercial operation of the technology in Hawaii.

Algal Bio-Oils for Biodiesel Production: Under its technology development efforts, HNEI is working with various industry partners to contribute to the development of technology for the biological production of oils. HNEI efforts focus on the production of biodiesel from waste streams and downstream separation processes which will be essential for cost-effective production of algal oils.

Expenditures: General Funds \$ 1,273,644
Tuition and Fees S Funds \$ 84,168
Research and Training Revolving \$ 278,441
Extramural Awards \$ 5,300,000

All funds are expended in support of research and training activities described above. To date, in 2008, HNEI has been awarded more than \$2.7 million and has ongoing negotiations for more than \$2 million in additional awards. No funds specific to HB1003 HD3 SD1 CD1 SLH 2007 have been expended by HNEI.

Contracts Developed: Neither the 2007 or the 2008 legislature appropriated funds into the Energy Systems Development Special Fund, thus no contracts specific to HB1003 HD3 SD1 CD1 SLH 2007 were developed. HNEI has contracted support services from various partners under other federally funded programs, as summarized above.

Advances in Technology: 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 2008 which involve strong collaboration/coordination with DBEDT include the following:

- ***Hawai'i Hydrogen Power Park:*** The hydrogen power park is funded in part by USDOE and in part by the Hydrogen Capital Investment Fund through DBEDT. HNEI is the implementing partner and works closely with DBEDT in the execution of this project.
- ***Utility Scale Clean Energy Capacity Project:*** HNEI provided substantive assistance to DBEDT in the development of this recent award from USDOE. It is anticipated that HNEI will play a substantial role in this effort which is just getting underway.
- ***EPACT 355:*** HNEI received supplemental funds from USDOE via DBEDT to conduct an assessment of the economic effect of various energy scenarios on the state's refinery operations. This report, required by Section 355 of the U.S. Energy Policy Act of 2005, was delivered to DBEDT and to USDOE in the third quarter of 2007.
- ***National Marine Renewable Energy Test Center:*** DBEDT is a cost-share partner in the recently awarded National Marine Renewable Energy Test Center. HNEI anticipates working closely with DBEDT to attract technology providers to the state to participate in this project.
- HNEI is currently engaged with the PUC in conducting an assessment of the technical and non-technical barriers to meeting the state's renewable portfolio standards. Information from this project will be used by the PUC to evaluate and, as appropriate, adjust the standards for future years.

- HNEI has initiated discussions with DBEDT to simplify contractual arrangements between the two organizations. Such an agreement would position HNEI to further assist DBEDT in effectively serving the State in the analysis and coordination of energy-related R&D.

Recommendations for Proposed Legislation: Generally, HNEI does not initiate legislation, but HNEI is a member of, and works closely with, the Hawai‘i Energy Policy Forum to review legislative initiatives in the energy area. However, HNEI does recommend funding the Energy Systems Development Special Fund as originally proposed. As high oil prices continue to pressure the consumer and energy providers, this fund would accelerate the acceptance and deployment of pre-commercial energy and energy-efficiency technologies expected to have near-term impact on Hawai‘i’s energy infrastructure.