

**SB 1364**



# NATURAL ENERGY LABORATORY OF HAWAII AUTHORITY

*An Authority of the State of Hawaii attached to the Department of Business, Economic Development & Tourism*

Statement of  
**Gregory P. Barbour**  
**Executive Director**  
Natural Energy Laboratory of Hawaii Authority  
before the  
**COMMITTEE ON ENERGY AND ENVIRONMENT**  
and  
**COMMITTEE ON ECONOMIC DEVELOPMENT AND TECHNOLOGY**

Monday, February 9, 2015  
2:45 pm  
State Capitol, Conference Room 016

in consideration of  
**SB 1364**  
**RELATING TO ECONOMIC DEVELOPMENT.**

The Natural Energy Laboratory of Hawaii Authority (NELHA) is pleased to comment on S.B. 1364 which would fund ocean thermal energy conversion (OTEC) projects in the State. This measure would assist NELHA in expanding an existing OTEC project and attracting a new OTEC project to our technology park in Kailua-Kona. In addition, to creating highly sought after STEM related sustainable engineering jobs and less use of carbon based energy it has the potential to attract up to \$50 million in outside investment to the State.

The State of Hawaii has invested a considerable amount of funds at NELHA over the past 40 years. Much of this funding was used to develop the most extensive seawater delivery system in the world, and as such, we are well positioned to further OTEC research and development. It is also important to point out that this has been a wise investment and the economic impact is well over \$100 million annually with annual State tax revenues generated in the \$5 million range.

There is currently one OTEC research and demonstration facility at NELHA. Makai Ocean Engineering, a world leader in OTEC development, operates this facility. They are currently in the process of installing a 100kW turbine that will be the only grid connected OTEC facility in the world. However, this facility will only operate intermittently due to the high cost of pumping seawater with our current system. We have worked with MOE and believe that this facility could generate power on a 24/7 basis with a few engineering improvements to our seawater system.

In addition, we have been working with Makai Ocean Engineering and developed a draft MOU with Japanese interests to work together to develop a 1MW OTEC facility.

Earlier this year, the NELHA Board of Directors approved a draft Memorandum of Understanding (MOU) between Makai Ocean Engineering, Inc., IHI Corporation, Japan Marine United Corporation, Kobe Steel Ltd., Yokogawa Electric Corporation, Xenosys Inc., Saga University and NELHA for cooperation on the planning, design, financing, and construction of an experimental one (1) megawatt OTEC facility.

If this project is developed in Hawaii it has the potential to attract up to \$50 million in new investment to the State. We believe that adding high-capacity pumps to our existing system will greatly facilitate our efforts to attract this new investment to Hawaii and leverage our existing assets.

We support this bill provided that its passage does not replace or adversely impact priorities indicated in our Executive Budget.

Thank you for the opportunity to offer these comments.



# LIFE OF THE LAND

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COMMITTEE ON ENERGY AND ENVIRONMENT  
Senator Mike Gabbard, Chair  
Senator Josh Green, Vice Chair

COMMITTEE ON ECONOMIC DEVELOPMENT AND TECHNOLOGY  
Senator Glenn Wakai, Chair  
Senator Sam Slom, Vice Chair

DATE: Monday, February 09, 2015  
TIME: 2:45 p.m.  
PLACE: Conference Room 016

Re: SB 1364 RELATING TO ECONOMIC DEVELOPMENT.

Aloha Chairs Gabbard and Wakai, Vice Chairs Green and Slom, and Members of the Committees

Life of the Land is Hawai`i's own energy, environmental and community action group advocating for the people and `aina for 45 years. Our mission is to preserve and protect the life of the land through sound energy and land use policies and to promote open government through research, education, advocacy and, when necessary, litigation.

SB 1364 appropriates \$5,000,000 of taxpayer funds for the Department of Business, Economic Development and Tourism (DBEDT) for the development of ocean thermal energy conversion projects in Hawaii.

The money should not be spent.

But if the money is authorized it should be sent to the Hawaii National Marine Renewable Energy Center (HINMREC) at the Hawaii Natural Energy Institute (HNEI), a research unit of the School of Ocean and Earth Science and Technology, University of Hawai'i at Manoa. HINMREC is currently researching Ocean Thermal Energy Conversion (OTEC).

## **Life of the Land has strong credentials regarding Ocean Thermal Energy Conversion (OTEC).**

Life of the Land was a strong supporter of Ocean Thermal Energy Conversion (OTEC) since about 1980.

Life of the Land presented expert witness testimony on OTEC in a Public Utilities Commission docket. The experts testified at the PUC Evidentiary Hearing.

Life of the Land wrote a lengthy position paper on how OTEC could provide most of the energy for Hawai`i while offering excellent educational opportunities and scientific advancement.<sup>1</sup>

Life of the Land's Executive Director was quoted in New York Times on OTEC, made a OTEC cameo appearance in *Les énergies du changement - Artisans Du Changement*,<sup>2</sup> was the only invited guest to the "Ocean Thermal Energy Conversion (OTEC) Workshop: Assessing Potential Physical, Chemical and Biological Impacts and Risks<sup>3</sup>," was a participant in the "Marine and Hydrokinetic (MHK) Environmental Risk Evaluation" webinar sponsored by the Pacific Northwest National Laboratory (2010), and was the producer and host of several videos with OTEC experts ranging from Dr. Luis Vega, Reb Bellinger, David Robichaux, Dr. Hans Krock to Dr. Ted Johnson.

## **The allocation should not be made**

Ocean Thermal Energy Conversion was thought up by Jules Verne in the 1800s, tested by Cuba in the 1920s and proven in Hawai`i in both on-shore and off-shore projects at the Natural Energy Laboratory of Hawaii Authority (NELHA).

Office of Technology Assessment (OTA) was an office of the United States Congress from 1972 to 1995. In 1978 they wrote, "No technological or scientific breakthroughs are needed for OTEC to become a commercial reality."

Both O`ahu and Hawai`i Island could provide all of the energy needed for electricity and transportation from off-shore OTEC facilities.

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<sup>1</sup> Life of the Land's 237-page "Energy Independence for Hawai`i (2030): An Integrated Approach to Economic Revitalization in a Culturally and Environmentally Sensitive Way" by Henry Curtis (February 25, 2011)

<sup>2</sup> Christophe Granger, Lato Sensu productions. (French, Canadian 2011).

<sup>3</sup> Coastal Response Research Center, University of New Hampshire, and NOAA, (2010)

The stumbling block was the cost. Today, a 100-200 MW system is needed in order to produce baseload renewable energy in the 25-30 cents per kilowatt-hour range. The system would cost a billion dollars to build. Building a small “pilot project” would result in prohibitively high electric rates.

The largest U.S. company involved in OTEC was Lockheed Martin. They were working with the military, Makai Ocean Engineering, HECO and others to install a system off Pearl Harbor. But following the 2008 economic melt-down, Lockheed Martin decided to go after stimulus research money and patents instead of taking any actual action.

Another stumbling block was the federal regulatory process.

The Department of Energy terminated their ocean energy program circa 1981. Federal agency efforts to beef up their ocean energy programs re OTEC are a recent phenomenon.

In the last few years Section 316(b) of the Clean Water Act (CWA) has been strengthened in dealing with cooling water intake structures. While the major focus was inland and coastal water intake, and offshore OTEC was not specifically mentioned, the cold and warm water OTEC intake pipes would be a magnitude higher than those for more traditional energy facilities such as coal, petroleum and nuclear.

In addition, OTEC would need to meet National Pollutant Discharge Elimination System (NPDES) permit requirements under Sections 402 and 403. Thus many people believed that the most likely first commercial OTEC facility will be built in the Caribbean or the Far East.

The last few years have not been good for the prospects of OTEC. The collapsing price of solar and wind with the promise of low-cost storage offer a distributed solution instead of another centralized facility.

While an ocean-based OTEC facility might have less environmental impacts than a land-based fossil fuel plant, it clearly cannot compete against rooftop solar and basement batteries.

Mahalo

Henry Curtis  
Executive Director



# MAKAI OCEAN ENGINEERING, INC.

P.O. BOX 1206 KAILUA, OAHU, HAWAII 96734 USA

Written Statement of Duke Hartman, Vice President, Makai Ocean Engineering, Inc.  
before the  
**SENATE COMMITTEE ON ECONOMIC DEVELOPMENT & TECHNOLOGY**  
**And**  
**SENATE COMMITTEE ON ENERGY & ENVIRONMENT**

Monday, February 09, 2015  
2:45 PM

State Capitol, Conference Room 016  
In consideration of

**SB 1364, RELATING TO TECHNOLOGY**

TO: Honorable Chair Glenn Wakai, Honorable Vice-Chair Sam Slom and Members of the EDT Committee, Honorable Chair Mike Gabbard, and Honorable Vice-Chair Josh Green.

FROM: Duke Hartman, Vice President, Makai Ocean Engineering, Inc.

RE: Testimony in Support of SB1364

Thank you for the opportunity to submit testimony in **STRONG SUPPORT** of **SB 1364**.

Ocean Thermal Energy Conversion (OTEC) is a renewable energy technology that uses warm surface seawater and deep cold seawater to generate electricity.

OTEC is stable or baseload power, meaning that it is supplied 24 hours a day, 365 days a year. OTEC is not intermittent power, like solar photovoltaics or wind, and thus does not require an energy storage system in order to replace the existing dirty coal and oil-fired plants that currently provide stable power.

In addition, Hawaii's electrical grid has a growing problem of grid stability, due to the high penetration of intermittent power renewables. OTEC can act as a complement to intermittent renewables by acting as a 'load following' power plant. OTEC can adjust its power output rapidly in response to drops in power output from a wind farm or solar array, for example when a large cloud suddenly decreases the power output of a solar farm. Thus OTEC can help to stabilize the grid, and enable an increase of the high penetration of intermittent renewables (solar and wind) on to our island grid.

A reputable private-public consortium from Japan is currently expressing strong interest in investing in an Ocean Thermal Energy Conversion (OTEC) power plant. The OTEC plant would produce 1-megawatt of electrical power, making it 10x larger than the current world's largest OTEC plant. The electricity revenues would sustain operations, as the plant would be primarily dedicated to research and development of OTEC technologies.

The OTEC plant would have a capital cost of about \$30 million to build, plus several million to operate over its life of 10+ years.

The OTEC plant capital cost will likely be funded mostly by agencies of the Japanese central government. There are two sites being considered for the project: 1) Kailua-Kona, Hawaii and 2) Kume island, Okinawa, Japan

Hawaii is in competition with Okinawa to be selected as the project site. Both sides recognize the economic boon for their regions in the form of highly skilled STEM jobs, the generation of stable renewable power for the grid, a world's first in ocean energy, the generation of valuable technology / intellectual property, and the ability to attract follow-on projects to the region.

Therefore, in order to attract to Hawaii the significant investment represented by this OTEC plant, we encourage you to pass **SB1364**, which would enable the state to match a small portion of the funding coming from Japan if Hawaii is selected as the location for the project. The Hawaii state funds would be highly leveraged, for example on the order of 6:1 to 10:1. This will serve to encourage the Japanese consortium to select Hawaii as the project location.

This project would enhance and further Hawaii's 40-years of leadership in the area of OTEC research and development. OTEC has recently brought over \$18 million dollars in federal funding and has providing stable, baseload power to the micro-grid at the Natural Energy Lab (NELHA). In addition, OTEC has attracted global attention for Hawaii as a renewable energy test bed, and one dozen permanent, high paying, highly skilled energy/technology jobs into the State of Hawaii since 2009 alone.

This is why we **STRONGLY SUPPORT SB1364**, which would provide the state matching funds for a large investment in diversifying the state's renewable portfolio. Not only would this funding be highly leveraged with funding coming from Japan (6:1 to 10:1), but it would help to stabilize the Big Island grid, and enable our tech industry to compete and win more Federal and international monies for technology development, and would provide highly-skilled technology and energy jobs for our keiki here at home.

Again, thank you for the opportunity to testify.

Sincerely,

Duke Hartman



Written Statement of **SUPPORT**  
Before the  
**COMMITTEE ON ECONOMIC DEVELOPMENT & TECHNOLOGY**  
February 9, 2015  
2:45 p.m.  
State Capitol, Conference Room 016  
In Support of  
**SB1364 RELATING TO ECONOMIC DEVELOPMENT**

TO: Honorable Chair Glenn Wakai, Vice-Chair Sam Slom and Members of the Committee  
FROM: Gérard Nihous, Ph.D., Associate Professor, Dept. of Ocean and Resources Engineering, University of Hawaii  
RE: Testimony in Support of SB1364

Thank you for the opportunity to submit testimony in **STRONG SUPPORT** of **SB1364**.

Since moving to Hawaii in 1987, I have been actively involved in research activities related to Ocean Thermal Energy Conversion (OTEC), and have been teaching a graduate-level engineering course at UH Manoa about marine renewable energy technologies since 2008.

I believe that the State of Hawaii is uniquely positioned to reap future benefits from this abundant, renewable ocean energy resource, even though OTEC development into a mature, commercial technology still necessitates the building and operation of meaningful pilot systems.

The OTEC technology is essentially tropical, as it uses warm ocean surface water in addition to cold deep ocean water, which means that direct stakeholders are located in tropical regions. In my opinion, this has historically been a funding handicap, although one generally not acknowledged. It is therefore imperative that our State shows a continued – or renewed commitment to advance the OTEC state-of-the-art to further progress accomplished in the 1980s and 1990s, when NELHA was conceived, and landmarks though limited OTEC R&D programs placed Hawaii at the forefront of OTEC research worldwide.

Our State is blessed with extraordinary renewable energy resources, each with their advantages, drawbacks and different levels of market readiness. It would be wrong to ignore the significant potential of any of these resources (wind, solar, wave, OTEC, biomass) to advocate a single technology.

A couple of facts stand out about OTEC, however. It is the only renewable technology, with the exception of geothermal, that is by design capable of providing firm baseload power (essentially, on a 24/7 basis): no clouds, no lack of wind, no lack of waves etc. The thermal difference in the tropical ocean water column is permanent (and only small seasonal fluctuations occur). Also, OTEC has the potential to be strictly based offshore, in deep waters, with no demand on limited land and no interference with shallow reef ecosystems, or heavily used near-shore facilities.

In the short term, sustaining local projects that involve science, engineering and construction jobs is good policy. OTEC research projects, in addition, would inspire and motivate on a path to energy independence, well beyond the confines of the existing Hawaii Clean Energy Initiative.

The long-term economic benefits of an indigenous, renewable and sustainable energy production technology like OTEC for the remote islands of our State cannot be overstated, and steps to ensure that OTEC will play a key role in the future energy mix of Hawaii should be taken.

It is nothing short of a generational investment.