

LINDA LINGLE  
GOVERNOR OF HAWAII



**STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

**Testimony of  
LAURA H. THIELEN  
Chairperson**

**Before the House Committees on  
ENERGY & ENVIRONMENTAL PROTECTION  
and  
WATER, LAND & OCEAN RESOURCES**

**Thursday, February 12, 2009  
9:35 AM**

**State Capitol, Conference Room 325**

**In consideration of  
HOUSE BILL 285  
RELATING TO RENEWABLE ENERGY**

House Bill 285 directs the Department of Land and Natural Resources (Department), the Department of Business, Economic Development, and Tourism, and the Public Utilities Commission to provide any necessary assistance and expedite any request for any permits or other approvals required the Hawaii Natural Energy Institute at the University of Hawaii's school of Ocean and Science Technology, and to assist in identifying and designating one or more renewable energy zones in waters not more than three miles from Oahu for wave energy converter platforms. Notwithstanding any law or rule to the contrary, and personnel and fiscal resources permitting, the Department supports this measure.

The establishment of geographic areas proven viable for commercial application in the conversion of wave energy into renewable energy through this Bill would reduce research and development costs for potential developers utilizing such technology and shorten the due diligence effort. Also, investors and lenders of project financing funds would find renewable energy developments projects within the established zones more attractive financing opportunities.

LAURA H. THIELEN  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL V. TSUJI  
FIRST DEPUTY

KEN C. KAWAHARA  
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
BUREAU OF CONVEYANCES  
COMMISSION ON WATER RESOURCE MANAGEMENT  
CONSERVATION AND COASTAL LANDS  
CONSERVATION AND RESOURCES ENFORCEMENT  
ENGINEERING  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATEPARKS

Bill No. 285

Support Y N

Date 2/11/09

Time 1:57p

Cat AF AS AX B C

Type 1 2 WI

**thielen2-Lauren**

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**From:** Rep. Cynthia Thielen  
**Sent:** Monday, February 09, 2009 12:44 PM  
**To:** 'Theodore E Liu'; 'Theodore Peck'; 'Richard Rocheleau'  
**Cc:** thielen2-Lauren  
**Subject:** FW: Written Testimony in Support of House Bill 285  
**Attachments:** HI - Ocean Wave Energy 02-09.doc

Ted,  
Sid Chao is ready to spend substantial money, and we want it to be in Hawaii. Please read his testimony in support of HB 285.  
Aloha,  
Cynthia

Representative Cynthia Thielen  
Assistant Minority Leader  
50th Representative District (Kailua/Kaneohe Bay)  
Office: 808.586.6480  
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Bill No. HB 285  
Support  Y  N  
Date 2/10  
Time 1215  
Cat AF AS AX  E  
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-----Original Message-----  
From: Pete Janda [mailto:peter.janda@ciis.com]  
Sent: Monday, February 09, 2009 12:38 PM  
To: EEPtestimony; WLOtestimony  
Cc: scchao@ciis.com; Rep. Cynthia Thielen; peterjanda@hotmail.com  
Subject: Written Testimony in Support of House Bill 285

Ms. Morita and Mr. Ito,

Please find attached to this e-mail SG2 Americas' written testimony supporting House Bill 285. The cover page should contain all relevant identifying information, but please let me know if there is anything else you need to duly consider our views on the Bill. Thank you.

Regards,

Peter Janda  
Vice President of Business Development  
CIIS LLC, parent company of SG2 Americas LLC

OCEAN WAVE ENERGY DEVELOPMENT  
A Need for Regulatory and Infrastructural Enablement

SG2 Americas LLC,  
a subsidiary of CIIS LLC

Though decades old, ocean wave energy technology does not yet have the critical mindshare among the electorate and its representatives to enjoy a robust regulatory framework, a streamlined permitting process and support infrastructure in both the private and public sectors. The ocean wave energy industry has mostly itself to blame for the status quo, with historically low fossil fuel prices sharing the balance of culpability. Economically viable, technologically sound, mass-produced, durable solutions for harvesting ocean wave energy have not yet been introduced, but the industry is presently on the verge of crossing a tipping point beyond which market adoption of next-generation products may easily surpass that of photovoltaic and wind energy technologies.

Fundamental factors rather than vested interests drive such optimism for market adoption:

- Unprecedented addressable geographies for wave energy harvesting
- Waves have highest energy densities among known non-fossil, non-nuclear fuel sources
- Wave technology maturing from prototype to factory-ready
- Global plateauing of crude oil extraction capacity
- Electrification of vehicle propulsion systems
- Energy diversification away from geopolitically unstable / unfriendly regions
- Worldwide attention to emissions of pollutants and greenhouse gases

SG2 Americas (the “Company”) is at the forefront of introducing to the marketplace robust, inexpensive solutions for harvesting ocean wave energy. The Company’s G-series point absorbers are small, sealed buoys that convert kinetic energy in waves to useful electricity. They can be deployed individually or scale up in arrays to generate as much power as municipalities or states require. The Company continues to deliver on schedule the new models on its product roadmap, with each successive G-series model having higher power output than its predecessor.

In executing on its roadmap, SG2 Americas has thus far been able to test its buoys in California’s and Hawaii’s offshore waters without incurring regulatory or infrastructure-related delays thanks, in part, to the relatively compact sizes of its products; for example, the latest G3 unit is approximately nine feet tall and weighs about 300 lbs. However, by the end of next year, the Company intends to ocean test an array of G5 units that will comprise approximately three times the mass of their G3 predecessors. Such ocean tests will require buoys to reside in water for several days while occupying 2,500 ft<sup>2</sup> of ocean “real estate” or more.

To complete G5 array testing, SG2 Americas has budgeted approximately USD\$10M for marine engineering services and array testing expenses. Another USD\$3M is slated for capital expenditures entailing leasehold improvements and marine vehicle procurement. It must be noted that these estimates, especially the capital expenditures, assume little or no pre-existing physical infrastructure that the Company could leverage in its efforts. In an era of constrained budgets, when shareholders demand management do more with less, SG2 Americas will soon have to evaluate all its options for establishing a base of testing operations and minimizing costs.

The state of Hawai'i is currently a top choice for the Company, yet additional help with permitting, testing facilities, incumbent energy company involvement and marine docking infrastructure would go a long way in supporting the Company's decision to establish a presence in Hawai'i. Comprehensive site selection criteria include:

- Diversity of ocean conditions
- Access to ocean testing sites
- Established power producers interested in alternate sources of energy (for third-party validation of the Company's solutions)
- Presence of requisite engineering services providers
- Availability of land-based testing equipment
- Warehouse / marine dock facilities
- Tax regime
- Cost of business operations (e.g., labor, rent, insurance)

In addition to the ~USD\$13M in direct, testing outlays, SG2 Americas expects to incur routine expenses associated with a presence in a particular geography: accounting services, legal services, public relations services, facility leases and utilities. The Company is in the process of deciding on a test facility's location.

SG2 Americas can benefit meaningfully from a regulatory environment that offers an established, streamlined permitting process for ocean tests and a physical infrastructure dedicated to marine activities. It would be surprising if other wave energy competitors did not frame their product testing and / or development decisions similarly to the Company's, so any municipality,

state or nation that enables the wave energy industry to more easily cross the tipping point will almost certainly reap significant inflows of outside investments dedicated to the advancement of wave energy technologies.

Please feel free to contact SG2 Americas should any additional questions arise or any clarification is needed. Like other emerging, high-potential industries in the past, the wave energy ecosystem and its success depend on collaboration between the private and public sectors, and SG2 Americas would like to offer its insights and resources to the extent possible.

Kind Regards,

Dr. Sidney Chao

CEO, CIIS LLC

scchao@ciis.com

Peter Janda

Vice President of Business Development, CIIS LLC

peter.janda@ciis.com

Representative Hermina Morita, Chair  
Committee on Energy and Environmental Protection

Representative Ken Ito, Chair  
Committee on Water, Land and Ocean Resources

SG2 Americas LLC, a subsidiary of CIIS LLC  
February 9, 2009

Support of House Bill 285, relating to the designation of renewable energy zones in Oahu's  
offshore ocean waters

Bill No. HB 285

Support  Y  N

Date 2/10

Time 1215

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Type  1  2 WI



06 February 2009

Representative Hermina Morita (Chair, EEP).

Representative Ken Ito (Chair, WLO).

Joint committee on Energy and Environmental Protection (EEP) and the committee on Water, Land, and Ocean Resources (WLO).

### **Support for House Bill No. 285 - Renewable Energy Related**

Following meetings with Representative Thielen in London and subsequent email correspondence, I write with my views on the proposed Hawaiian Bill concerning the wave energy development.

I have been involved with marine energy development (and associated economic development) in the UK for some 3 years now. I have been actively involved in the Wave Hub project in the UK, particularly the economic development aspects of marine energy.

Whilst I am unable to comment on the specific context of Hawaii, I feel I am able to make some general comments about wave energy development and the potential for associated economic development.

### **The UK development route and experience**

Wave energy is still in its infancy with the centre of development currently being the UK. The UK also has an imperative to move to low Carbon forms of generation, has a very good wave energy climate and a desire to be at the centre of a new industry. There is already a publicly supported ladder of development facilities; the National Centre of Renewable Energy (NaREC) for tank testing of devices, The European Marine and Energy Centre (EMEC) for the testing of single devices and shortly (2010) Wave Hub for the testing of multiple devices in arrays. In addition there is significant research funding and incentives for industry.

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MEM (UK) Limited Cleaveland House 1 Cleaveland Rise East Ogwell Newton Abbot Devon TQ12 6FF

These ingredients combined have created an environment conducive to development. The UK sees economic development a key factor when considering public sector investment in marine energy.

### **Hawaiian Development**

Recent moves in the United States to award wave energy funding to the Hawaiian University will I have no doubt help stimulate interest in the sector and development. However, if economic development is desired, a broad development strategy is needed combining knowledge development, unfettered access to a wave resource and knowledge transfer activity to ensure commercial development.

Whilst I am not knowledgeable about the Hawaiian economic context, there are significant opportunities to enhance economic development through the development of a marine energy industry if the fundamental strategic elements are provided. The development and transfer of knowledge into the commercial sector can deliver high value knowledge based services into the developing world wave energy marketplace. In my view the bill being proposed, bringing together economic development institutions with the knowledge development functions and the utility, alongside access to the wave resource, are key catalysts for development of the sector.



Colin Cornish

Managing Director  
Marine Energy Matters

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Ph: 916-977 3970 Email: mirko@re-vision.net

Representative Hermina Morita (Chair, EEP)  
Representative Ken Ito (Chair, WLO)

Monday, February 9<sup>th</sup>, 2009

Support of House Bill 285, Relating to Wave Energy Conversion

Dear Representatives,

Re vision consulting LLC, is actively involved in the evaluation of the technical and economic viability of emerging renewable energy sources, including ocean wave energy conversion for a wide range of domestic and international government entities and electric utilities. As part of our studies and active R&D programs, we carried out feasibility studies in many of the coastal regions in the US, including Hawaii. We strongly support the establishment of a marine renewable energy test center on the island of Oahu, because the results of many independent studies<sup>1</sup> shows that Hawaii is uniquely positioned to become a leader in this emerging technology sector. This in turn will create local jobs in science, engineering, construction, operation and maintenance.

The technical potential to provide electricity from wave energy accounts for a significant portion of today's electric consumption on the Hawaiian islands. Initial studies suggest that given sufficient deployment scale, these technologies will be commercially competitive with other forms of renewable power generation. However, significant technical, economic, environmental and regulatory barriers remain to be addressed in order to allow this emerging industry to move forward with commercial development. The experience related to ocean energy is limited to a few prototype and early commercial adopter installations and provides a limited understanding of the economic, operational, environmental and regulatory issues. It will be critical for the success of this industry to gain a full understanding of all lifecycle-related issues over the coming years to pave the way for larger scale commercial deployments. Such understanding can only be gained in a practical way from the deployment of demonstration and early commercial adopter systems. As such, the collaborative efforts to establish a test-bed on Oahu is critically important to the long-term success of this industry in Hawaii. It will further develop a market pull and attract

<sup>1</sup> Independent site, performance, cost and economic assessments, were carried out by EPRI. A number of reports are available for download from [www.epri.com/oceanenergy](http://www.epri.com/oceanenergy)

Bill No. HB 285  
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many of the leading wave power device developers to address the unique challenges present in the development of the Hawaiian wave energy resource.

At present, a majority of the energy demand on the Hawaiian islands is being met by imported fossil fuels. The reliance on a largely non-diversified fossil-fuel based energy supply portfolio, puts the State's economy at the mercy of price volatility and the longer term global supply shortage of fossil fuels. This global supply shortage brought about by the increasing energy needs of emerging economies such as China as well as dwindling oil reserves, will drive energy prices higher in the long-term, putting the Hawaiian economy at risk. This reliance on fossil fuels also creates a negative trade balance, undermining the local economy and exporting jobs, instead of keeping money in the local economy and creating jobs for the construction, operation and maintenance of renewable generation facilities.

Most of the Hawaiian islands are abundant in other sources of renewable energy, including biomass, geothermal, solar and wind. However, Oahu consumes 80% of the total energy within the islands and has only limited access to many of these resources. Wave energy is one of the few resources, that could meet a significant portion of the islands needs in the long-term and the development of this resource is one of the best insurance policies against rising oil prices and for the long-term health of the local economy. In this light, we urge the committee to pass the House Bill 285 and actively engage in harnessing the immense power of the ocean in a responsible, safe and environmentally friendly manner. Thank you for this opportunity to testify.

Sincerely,

A handwritten signature in black ink, appearing to be 'M. Previsic', with several horizontal lines drawn through it for emphasis.

Mirko Previsic

President

**Rep. Cynthia Thielen**

**From:** Karen Wright [Karen.Wright@southwestrda.org.uk]  
**Sent:** Monday, February 09, 2009 6:46 AM  
**To:** EEPtestimony; WLOtestimony  
**Cc:** Rep. Cynthia Thielen  
**Subject:** Support for House Bill 285: Renewable Energy; Wave Energy

**Bill No.** HB285  
**Support**  N  
**Date** 2/10  
**Time** 1215  
**Cat** AF AS AX  B C  
**Type**  1 2 WI

Representative Hermina Morita, Chair, EEP  
 Representative Ken Ito, Chair, WLO  
 Committee on Energy and Environmental Protection (EEP)  
 Committee on Water, Land, and Ocean Resources (WLO)

Nick Harrington, Head of Marine Energy  
 South West of England Regional Development Agency  
 Tel: +44 (0)1752 234830 e-mail: nick.harrington@southwestrda.org.uk

Support for House Bill 285: Renewable Energy; Wave Energy

I am the Head of Marine Energy at the South West of England Regional Development Agency, United Kingdom, and also General Manager of the Wave Hub Project [www.wavehub.co.uk](http://www.wavehub.co.uk). I am testifying in support of the above proposal.

Generating electricity from the waves is still a young industry. The worldwide potential is enormous, but there is still a long way to go before this can be realised. The devices that generate the power need to show that they can operate reliably and economically in a range of different wave climates. Just as important is understanding what effects they will have on the marine environment and thereby gaining acceptance from environmental stakeholder groups. Therefore, development of a wave energy test site in Hawaii would be a valuable addition to the small portfolio of such sites across the world. The wave and weather conditions will differ from those in Europe, as will the marine ecology and the existing patterns of fishing, commercial shipping and other uses. The site will therefore give you an opportunity of building expertise in the operation and maintenance of the devices and in monitoring of environmental impact as well as developing knowledge of how to integrate this power with existing distribution systems.

My colleagues and I, and our research partners, wish you well and will be very willing to share our own experiences at any time.

Nick Harrington

N J Harrington  
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2/9/2009

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[www.wavehub.co.uk](http://www.wavehub.co.uk)

 Save a tree... please don't print this e-mail *unless you really need to*

**Rep. Cynthia Thielen**

**From:** Derek Robertson [derek.robertson@wavebob.com]  
**Sent:** Monday, February 09, 2009 12:52 PM  
**To:** EEPtestimony; WLOtestimony  
**Cc:** Rep. Cynthia Thielen; Andrew Parish  
**Subject:** Support of H.B. NO. 285, Relating to Renewable Energy

Representative Hermina Morita , Chair  
Committee on Energy and Environmental Protection (EEP)

Representative Ken Ito, Chair  
Committee on Water, Land, and Ocean Resources (WLO)

Derek Robertson, President  
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www.wavebob.com

Date of Hearing (TBD)

Support of H.B. NO. 285, Relating to Renewable Energy

Wavebob, LLC is a Maryland registered company and serves as the US operation of Wavebob Ltd, an Irish technology firm who specialize in ocean wave energy conversion. We strongly support H.B. NO. 285, Relating to Renewable Energy, which would provide welcome opportunities to locate ocean wave energy demonstration projects in the waters off Oahu.

Following significant investment in R&D and successful at-sea testing (2006), Wavebob has formed valuable strategic relationships to include Chevron and Vattenfall, one of Europe's largest utility companies. In 2008, Wavebob and Vattenfall formed a joint venture for the development of a 250MW commercial wave farm off the west coast of Ireland. European governments have provided a broad range of supports to the marine renewables energy to include R&D funding, capital grants, government led testing opportunities, and feed-in tariffs for generators. These incentives have inspired significant investment in both technology and demonstration projects. This environment contrasts sharply with minimal activity in the US and a regulatory environment which is hostile to marine renewable technology.

Having emerged an industry leader in ocean wave energy conversion, Wavebob established operations in the US as a key component of its commercialization strategy given unique R&D capacity and industry expertise in maritime technology. Our current engineering program

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includes a series of advanced demonstration projects over the next few years, ideally suited to the wave resource, demand, and infrastructure characteristics found in Oahu.

A government sponsored program to support designation of renewable energy zones would provide a significant reduction of project risk, and Wavebob would be keen to pursue demonstration projects at the earliest opportunity. We urge both committees to pass H.B. NO. 285. Thank you for this opportunity to testify.

**Testimony before the  
House Committees on  
  
Energy & Environmental Protection  
and  
And Water, Land & Ocean Resources  
  
H.B. 285 – Relating to Renewable Energy**

Bill No. 285  
Support Y N  
Date 2/11/09  
Time 9:42a  
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Thursday, February 12, 2009  
9:35 am, Conference Room 325

By Arthur Seki  
Director of Technology  
Hawaiian Electric Company, Inc.

Chairs Morita and Ito, Vice Chairs Coffman and Har and members of the Committees:

My name is Arthur Seki—I am the Director of Technology at Hawaiian Electric Company. I am testifying on behalf of Hawaiian Electric Company (HECO) and its subsidiary utilities, Maui Electric Company (MECO) and Hawaii Electric Light Company (HELCO) (hereinafter collectively referred to as HECO).

We support H.B. 285 which directs state agencies (Department of Land & Natural Resources, Department Business, Economic Development & Tourism and Public Utilities Commission) to assist Hawaii Natural Energy Institute (HNEI) in the identification and designation of renewable energy zones for wave energy development. HECO and MECO are industry partners in the HNEI award as a National Marine Renewable Energy Research Center. We look forward to working with HNEI and others towards ocean energy development.

As you may know there are a number of activities related to this bill:

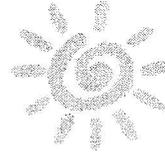
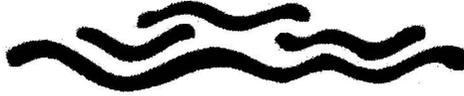
- DBEDT conducted a wave energy resource study using wave buoy data.
- HECO and the Electric Power Research Institute (EPRI) conducted a Hawaii State Offshore Wave Power Plant study. The reports cover harbors, bathymetry, grid locations, competing use, and conceptual design. The weblink to these studies is <http://oceanenergy.epri.com/waveenergy.html>

- HECO and EPRI conducted a Hawaii ocean current resource study. The report summary is being uploaded to our heco.com website.
- Hawaii Energy Policy Forum, Malama Hawaii and HECO sponsored several community meetings to develop an ocean energy guideline to help developers with their projects on Oahu. The weblink to this report is [http://www.hawaiisenergyfuture.com/Images/Ocean\\_Energy.pdf](http://www.hawaiisenergyfuture.com/Images/Ocean_Energy.pdf)

In addition, there are a number of other ocean related activities in Hawaii:

- Ocean Power Technology (New Jersey) continues its wave buoy demonstration project off Kaneohe Marine Corp Base. A third buoy was deployed in June 2007. This demonstration includes an underwater electrical cable installed about 1 mile off Kaneohe Marine Base. HECO engineers provided technical review and support in the interconnection design of this electrical system.
- OceanLinx (Australia) continues their development of a small wave farm off the north shore of Pauwela Point on the northeast coast of Maui.
- Lockheed Martin received a federal grant for ocean thermal energy conversion (OTEC) research development and other companies are developing OTEC projects.

HECO continues to monitor wave energy technologies and will continue to meet with various wave energy developers about projects in Hawaii. Thank you for the opportunity to present this testimony.



# LIFE OF THE LAND

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Phone: 533-3454; E: [henry.lifeoftheland@gmail.com](mailto:henry.lifeoftheland@gmail.com)

Bill No. 285  
Support  Y  N  
Date 2/11/09  
Time 2:20p  
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## COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION

Rep. Hermina M. Morita, Chair  
Rep. Denny Coffman, Vice Chair

## COMMITTEE ON WATER, LAND, & OCEAN RESOURCES

Rep. Ken Ito, Chair  
Rep. Sharon E. Har, Vice Chair

Thursday, February 12, 2009  
9:35 a.m.  
Conference Room 325

HB 285 RELATING TO RENEWABLE ENERGY.

**STRONG SUPPORT**

Aloha Chairs Morita, Ito, Vice Chairs Coffman, Har and Members of the Committees,

My name is Henry Curtis and I am the Executive Director of Life of the Land, Hawai'i's own energy, environmental and community action group advocating for the people and 'aina for almost four decades. 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.

Life of the Land has sponsored ocean and wave energy experts in Hawai'i PUC regulatory hearings and we are the only non-federal intervenor in the first proposed wave farm regulatory action which is currently before the U.S. *Federal Energy Regulatory Commission (FERC) Grays harbor Ocean Energy Company re Penguin Bank, Moloka'i.*

HB 285 directs DLNR, DBEDT, and PUC to assist Hawaii Natural Energy Institute in the identification and designation of one or more renewable energy zones in the waters not more than three miles from Oahu for a wave energy converter platforms.

We strongly support this legislation, HOWEVER, we firmly believe that (1) the PUC is a regulatory body, not an advocacy organization; and (2) there must be a community component. We propose the following amendment:s

(1) Delete references to the PUC;

(2) Delete references to the Hawaii Clean Energy Agreement and the Hawaii Clean Energy Initiative, which are Gubernatorial policy statements and are not law, rules or regulation;

(3) To expedite the process, add a section that HNEI shall work with the public, community groups and ocean users.

Earth Island Institute, founded in 1982 by veteran environmentalist David Brower, reported in their newsletter that "If less than 0.1 percent of the renewable energy within the oceans could be converted into electricity, it would satisfy the present world demand for energy five times over."

See: [www.earthisland.org/eijournal/new\\_articles.cfm?articleID=173&journalID=46](http://www.earthisland.org/eijournal/new_articles.cfm?articleID=173&journalID=46)

The Union of Concerned Scientists, Environmental Defense, and the Natural Resource Defense Council support off-shore renewable energy. They jointly testified before Congress:

"Impacts of offshore renewable energy projects are generally limited to the installation and dismantling of structures that are attached to the seabed. Once in operation, renewable energy projects have minimal impacts and risks compared to oil and gas operations. ... Project-specific reviews and permitting processes should include state environmental and marine resource agencies and governors from affected states. ... Construction of an offshore renewable energy project should be fully subject to existing federal law ... Offshore renewable energy legislation should authorize term-limited leases, rather than easements or rights of way, for eligible offshore energy projects."

See: [www.ucsusa.org/clean\\_energy/clean\\_energy\\_policies/testimony-on-bill-to-amend-the-11-outer-continental-shelf-lands-act-h-793.html](http://www.ucsusa.org/clean_energy/clean_energy_policies/testimony-on-bill-to-amend-the-11-outer-continental-shelf-lands-act-h-793.html)

### **The Ocean Potential**

Life of the Land Expert Witness Dr. Hans Krock (PUC Docket 05-0145):

"It's larger than oil and coal, everything. It is, in fact, the energy source that runs the world's weather system, whole hydrologic cycle. It's 10,000 times as big as human energy use. So it's the largest energy resource in the world. ... That's -- that's the ocean, the tropical ocean. And OTEC, it takes advantage of the same system that runs that world energy, namely, the difference in temperature between the surface layer and your cold area elsewhere. ...

The energy flowing through the surface layer of the tropical ocean is about 10,000 times greater than the energy used by human societies. As such it is the only energy resource on earth that is large enough to replace fossil fuel."

Dr. Hans Krock is Professor Emeritus of Ocean & Resources Engineering at UH and President of OCEES International, Inc. He has a BS in Civil Engineering from Arizona State Univ. in Tempe, MS and Ph.D. in Civil and Environmental Engineering with minors in Chemistry and Chemical Engineering from the University of California at Berkeley.

Dr Krock is a registered Professional Engineer (Civil) in Hawaii, served as PI for numerous research projects at UH for twenty five years covering all aspects of ocean engineering, ocean dynamics, water quality, OTEC, and environmental effects, hold two US Patents related to gas exchange dynamics and open cycle OTEC, received letters of recognition from two Governors of Hawaii, served as visiting professor at two foreign universities, have been recognized as the leading authority on multi-product OTEC systems and OTEC/hydrogen at the World Renewable Energy Congress and by the Chinese Academy of Science.

He has conducted professional engineering work in Hawaii and numerous other islands in the Pacific as well as in Arizona, California, Germany, the Indian Ocean, and the Caribbean. Served as Professor of Ocean Engineering and Director of J.K.K. Look Laboratory of Oceanographic Engineering and Ocean & Resources Engineering Departmental Chair at UH and established OCEES International, Inc.

## **Ocean Thermal Energy Conversion (OTEC)**

"I think there is a clear choice that ought to be made by the American people, and especially U.S. environmentalists; namely, whether they prefer baseload nuclear, baseload fossil, or baseload OTEC."

Dr. Robert Cohen, via email correspondence. I met Dr. Robert Cohen at the Ocean Energy Council's EnergyOcean 2007 conference.

Robert Cohen, received a Ph.D. in Electrical Engineering from Cornell University in 1956. He left his career at NOAA in Boulder, Colorado and joined the staff of the budding U.S. solar energy program in the fall of 1973. His assignment as a program manager was to organize the U.S. ocean energy program. In the fall of 1981 he took early retirement from the federal government, then participated in ocean thermal energy conversion (OTEC) studies as a consultant in the private sector until 1985. That work included a contract to familiarize Alcan International Ltd. with OTEC technology and participation in a conceptual OTEC power plant design study for the Taiwan Power Company. From 1985 to 1990 he was on the staff of the Energy Engineering Board, National Academy of Sciences, engaged in energy policy studies. Since 1991 he is working as a consultant in Boulder, Colorado.

## **Sea Water Air Conditioning**

LOL Expert Witness Dr John Harrison (BLNR Contested Case CDUA OA-2801 -- 2002)

"A Waikiki seawater air conditioning cold water circulation system could reduce Waikiki's entire energy economy by 40%"

Dr. Harrison has a B.A. in biological sciences, with a minor in mechanical engineering from Stanford University in 1974. His doctorate in zoology from the University of Hawaii in 1981. He worked as a post-doctoral marine scientist for the University of California at Berkeley where he administered the U.S. Department of Energy funded ocean thermal energy conversion (OTEC) environmental research program in Hawaii. Dr. Harrison wrote the Ocean Thermal Energy Conversion (OTEC) handbook for the U.S. Department of Energy's solar energy research institute. Dr. Harrison was hired by the United States Department of Commerce, National Marine Fishery Services to write the environmental analysis section of the federal environmental impact statement for the 40-megawatt ocean thermal energy conversion (OTEC) pilot plant that was intended to be installed at Kahe Point adjacent to and in combination with the Hawaiian Electric Kahe Point generating facility. Dr. Harrison has served as the Environmental Coordinator of the University of Hawaii's legislatively-mandated [Act 132, 1970] University of Hawaii Environmental Center since 1987.

As the Environmental Coordinator he has functional responsibilities in review of environmental documentation, review of legislation, coordinating research, providing educational services to both students and to the state and the county and members of the general public and various other academic duties. Dr. Harrison currently serves on the energy income tax credit, energy efficiency policy task force, which is addressing the current energy income tax credit law and is intended to provide a report to the upcoming legislature.

Life of the Land Expert Witness Dr. David Rezachek (PUC Docket 05-0145):

"Well, seawater air conditioning is a very simple process. Basically what you do is you bring up cold seawater from a depth of anywhere from 1600 to 3,000 feet, at which point the temperature is 39 to 45 degrees Fahrenheit. Now, the seawater is brought to a shore-based station where you have heat exchangers. Typically, we use corrosion resistant materials such as titanium, heat exchangers, plate-type heat exchangers that have a low temperature difference across them. Then that cold -- or, actually, the heat is transferred from the chilled water loop that circulates to the

downtown buildings. And then that heat from that loop is transferred to the seawater, raising the temperature slightly."

"We initially started with downtown Honolulu because of the high density of the cooling load and the close proximity to the cold water source. We've also identified Waikiki as a very good area and perhaps better than downtown with respect to the utilization of the pipe. There are other areas such as the airport, Hickam, and Pearl Harbor that could be developed into a system. And as the other areas within Honolulu, say Kakaako and Ko'olina, develop further and have a greater density need -- or cooling need, they -- they would be available or potential candidates for air -- seawater air conditioning."

Dr. Rezachek is Associate Development Director of Honolulu Seawater Air Conditioning, LLC. Dr. Rezachek received his Ph.D. in Ocean Engineering from the University of Hawaii at Manoa in 1991 (Dissertation Title: "Development of a Solar Pond System Design Computer Model"); an M.S. in Mechanical Engineering from the University of Hawaii at Manoa in 1980 (Thesis Title: "Application of Heat Pumps to Residential Water Heating"); a B.S. in Environmental Technology and Urban Systems from Florida International University in 1976; U. S. Navy Nuclear Power School and Nuclear Power Plant Prototype (Nuclear Engineering) 1973; Ensign. U. S. Navy Officer Candidate School 1972; and a B.S. in Chemistry (with distinction) from the University of Minnesota in 1972.

Dr. Rezachek won the national Best Energy Education Program (BEEP) award in 1989 for Ka'ahele La (Tour of the Sun) Interscholastic Photovoltaic-Powered Vehicle Competition; was the Project leader for first high school solar car to complete the 1990 World Solar Challenge (a 1,900-mile solar car race from Darwin to Adelaide, Australia) in the second year of the Ka'ahele La (Tour of the Sun) Interscholastic Photovoltaic-Powered Vehicle Competition; and is a registered professional mechanical engineer in the State of Hawaii for more than 21 years (No. 5485)

Dr. Rezachek is the owner and principle at Rezachek & Associates (1993-), an Alternative Energy Specialist at the Hawaii Department of Business, Economic Development and Tourism - Energy (1987-2003), an Assistant Mechanical Engineer in the Sugar Technology and Engineering Department, Hawaiian Sugar Planters' Association (HSPA) (1980-87). Dr. Rezachek has made extensive presentations on SWAC and written numerous articles and reports.

### **Wave Power**

DBEDT's Feasibility of Developing Wave Power as a Renewable Energy Resource for Hawaii (1992): "Waves Power (buoys) could generate all (100%) of the state's electrical needs. As with any project, there are site specific conditions which must be examined. ... Siting a wave energy system is not unlike buying real estate, there are three key issues, location, location, location."

E2I/EPRI Offshore Wave Energy Plant Site Assessment - State of Hawaii (2004): "Oahu. ... Very good energy resources along its northeast coast from Kahuku to Makapuu Points. ... Honolulu is the best port harbor and port infrastructure in the Islands to support device fabrication and assembly. ... A unique opportunity for a wave energy pilot facility exists off the northeast coast of Oahu, just west of the humpback whale marine sanctuary boundary. The unique opportunity is the existence of Makai Ocean Engineering's fully instrumented pier and offices."

### **Oceanlinx Wave Energy System**

Life of the Land Expert Witness Dr. Tom Denniss (PUC Docket 05-0145):

"In principle it is very similar to a Blowhole. It is the air pressure which drives the Energetech turbine. This pressure is increased by utilising the wave height in a chamber to displace and compress the air, driving it past a narrow aperture, at which point the turbine is housed. The turbine work in both directions. This is a vital requirement for wave energy turbines. The device is 35 meters by 30 meters in plan. ...

My estimate for wave energy production in Hawaii (at this stage of the technology) is about 8-10 cents per kWh. Improvements in the technology over the next few years, with accompanying economies of scale of larger plants, would likely see costs at below 5 cents per kWh. Once funding is available, a project could be commissioned within 18 months. ... The only moving part is the turbine, and this is totally isolated from wildlife about 8 meters above the waterline. No marine or avian life can be harmed at all."

Dr. Tom Denniss is Executive Director of Energetech Australia Pty Ltd. Dr. Denniss has a B. Math, B. Sc (1st Class Honours), Dip. Ed., Ph.D (in Mathematics and Oceanography). He is a member of the Global Roundtable on Climate Change (which meets twice per year – recently in Iceland, prior to that in NY); a member of the Communications Committee for the Global Roundtable on Climate Change, and an Expert Reviewer of the United Nation's Intergovernmental Panel on Climate Change Fourth Assessment Report; and an expert reviewer of the United Nation's Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, due out early in 2007. The International Academy of Science recognized the Energetech Wave System as one of the 10 Outstanding Technologies of 2006.

### **Underwater Pipes**

Life of the Land Expert Witness Reb Bellinger (PUC Docket 05-0145):

"We've been involved in just about every major cooling project of this nature done anywhere in the world in the last 20, 25 years. ... We were involved with the Cornell project. We did all the engineering and design for that pipeline. And there is a real paranoid community. I mean, they are fussy about everything. And so their environmental requirements and reviews were intense. And even today they were re -- initially required to maintain a regular monitoring system for potential impacts in -- in that lake. And their system has been operating about six or seven years. And those monitoring systems are still in place, and they have found no adverse impacts at all."

Mr. Reb Bellinger is Vice President of Makai Ocean Engineering. Mr. Bellinger is a former State Representative and current President of the Ka'a'awa Community Association. Mr. Bellinger has worked on installation of ocean pipes from New York to Toronto to Bora Bora over the past twenty years.

### **Hawaii Ocean Energy meetings (2007)**

Life of the Land participated in the HECO conducted ocean energy meetings in the summer of 2007, HECO released the "Ocean Energy Development Guidelines" in July 2007. The preface of the Final Report was written by LOL's Assistant Executive Director.

### **Federal Energy Regulatory Commission (2008-09)**

We are the only Hawaii entity to intervene in the Federal Energy Regulatory Commission (FERC) regulatory docket re the Grays Harbor Ocean Energy Company's proposed wave/wind farm in Penguin Bank located southwest of Moloka'i.

### **Conclusion**

We need to aggressively move past the fossil fuel era. Please pass this bill.

Mahalo,

Henry Curtis

REPRESENTATIVE HERMINA MORITA (CHAIR, EEP),  
REPRESENTATIVE KEN ITO (CHAIR, WLO).

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February 9, 2009

**Committee on Energy and Environmental Protection (EEP) and the Committee on Water,  
Land, and Ocean Resources (WLO).**

**Relating to Renewable Energy - Support of House Bill 285**

We are glad to hear that the Hawaii Natural Energy Institute has recently been selected by the DOE as one of two National Marine Renewable Energy Centers. To expedite the work required to identify and designate one or more renewable energy zones for wave energy converters (WECs) in the vicinity of Oahu and to then obtain necessary permits and approvals needs the support and assistance of key departments and so we are pleased to support this House Bill.

Wave energy conversion technology is still in its early development phase. Testing in real sea conditions is essential to enable the technologies to mature. The application of the early stage technology in Hawaii waters will help to secure local expertise and skills in the marine renewable industry which should result in sustainable jobs. As wave energy technology develops Hawaii is in an ideal position to reduce its dependency on the importing fossil fuels which will both lead to carbon reductions and increased isolation from price fluctuations.

We request that the zones are selected and designated so that they are suitable for all types of WECs including the implementation of breakwaters, nearshore and shoreline wave energy converters.

Copies sent to: [EEPtestimony@capitol.hawaii.gov](mailto:EEPtestimony@capitol.hawaii.gov) , [WLOtestimony@capitol.hawaii.gov](mailto:WLOtestimony@capitol.hawaii.gov) and [repthielen@capitol.hawaii.gov](mailto:repthielen@capitol.hawaii.gov)

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Professor George H Smith  
Scottish and Southern Energy Professor of Renewable Energy  
University of Exeter, UK  
Joint Head of The Peninsula Research Institute for Marine Renewable Energy  
(PRIMaRE)

Contact: School of Geography, Archaeology and Earth Resources

Support for House Bill 285: Renewable Energy; Wave Energy

PRIMaRE (The Peninsula Research Institute for Marine Renewable Energy<sup>1</sup>) is a research collaboration between the Universities of Exeter and Plymouth. It was set up and funded through the efforts of the South West Regional Development Agency to promote the development of marine renewable energy (wave and tidal) in the South West of England. I am writing to provide evidence in support of Bill 285, relating to the designation of a geographic region for the development of marine renewable energy.

Marine renewable energy is now coming to have real potential as a contributor to the generation of 'clean' energy and the reduction of carbon emissions from conventional energy production. From my position within a major research UK/ European research Institute I can confirm the considerable efforts within Europe to establish viable marine technology developments and push towards a practical industrial scale. PRIMaRE was set up in parallel with the proposed Wave Hub development off the North Cornwall coast ([www.wavehub.co.uk](http://www.wavehub.co.uk)). Wave Hub was conceived to take advantage of the wave and tidal resource potential in the south West UK. It is seen as having real potential to help meet the regions targets for carbon reduction and sustainable development. The regional development agency (SWRDA) saw this development also to have great potential to sustain and develop regional businesses and industry. They have estimated it could potentially create some 1,000 jobs with £332 million being generated in the South West region). There have been many and wide ranging estimates of revenue from potential marine renewable energy. The Carbon Trust<sup>1</sup> (a respected UK government funded body) quote a figure for worldwide electricity revenues from wave and tidal stream projects could ultimately be between £60b/year an potential investment of 'over £500 billion'. To achieve this potential I consider the need for large and full-scale testing in a 'real sea' environment a crucial component. It is evident that device developers will be attracted to specified sites with good resource which have some degree of infrastructure support and a supportive regulatory and financial environment. I can now think of at least seven sites in Europe being developed for the development and pre-commercial testing of wave energy and tidal devices and these are already attracting research funding and developers.

PRIMaRE and Wave Hub were developed in parallel to take maximum advantage of the possibilities. The association of high quality research infrastructure with a specific test

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site holds great potential to attract and support incoming developers. Conversely the association of the researchers with an active demonstration sites provides the industrial interaction to drive the research in a practical direction, providing the intellectual seed corn for new developments. An important objective of PRIMaRE is to be a catalyst within the local economy as well as develop internationally competitive research. As such the project has already: (i) provided a further £1million of research income (in addition to the pump priming from SWRDA) (ii) enabled participation in two major international marine renewable energy projects, providing access to these networks to promote the potential for marine RE in SW England (iii) employed a range of scientist/ engineers/ biologist and social scientist on research support for marine RE (approximately 20 new staff to date) (iv) recruited high quality graduate students (some funded by device developers) (v) supported educational development within the Universities (v) provide a series of workshops and business information days for local companies to inform and identify where they may gain advantage within a new industry.

To summarise, I am firmly of the opinion that marine renewables has the potential in the medium term to make a significant contribution to the worlds energy needs and also address the possibly dire consequences of climate change. The potential for industrial development in this new industry is also significant on a world-wide scale. From my experience, I *see the need for sea scale trials and developments as critical*. The potential for academic/ industrial partnership is huge and so I firmly believe that the proposed development in Hawaii could be a significant contributor to the development of the world-wide industry whilst having great potential for the benefit of the Hawaiian economy. I wish you well in your every success in this exciting endeavour!

Yours sincerely



Professor of Renewable Energy  
University of Exeter  
United Kingdom

<sup>1</sup> <http://www.primare.org/>

<sup>2</sup> <http://www.southwestrda.org.uk/>

<sup>3</sup> [http://www.carbontrust.co.uk/technology/technologyaccelerator/marine\\_energy.htm](http://www.carbontrust.co.uk/technology/technologyaccelerator/marine_energy.htm)