

U.S. Department of Energy

Wind and Water Power Program



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U.S. Department of Energy Water Power Program

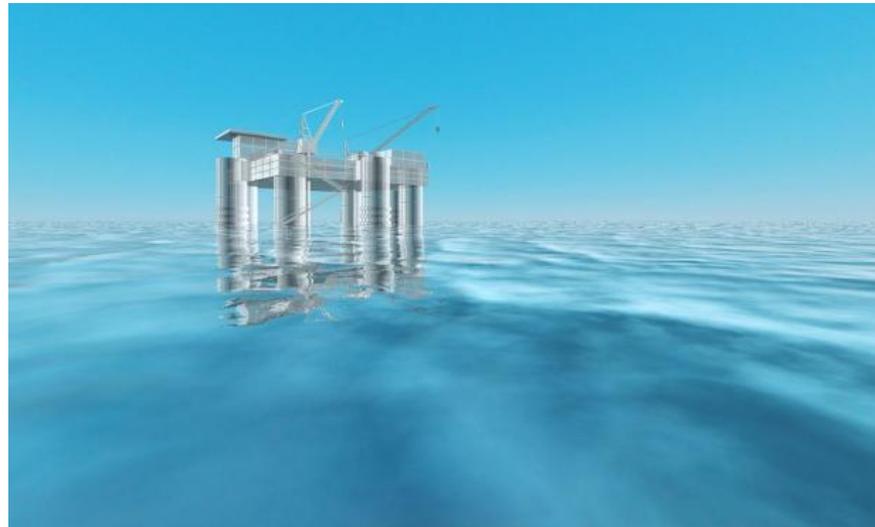
U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Develop and employ novel technologies, improved operational procedures, and rigorous analysis to assess the potential extractable energy from domestic rivers, estuaries and ocean waters and help industry harness this renewable, emissions-free resource through environmentally sustainable and cost-effective electric generation.

- Current DOE OTEC Research Efforts
 - Technology Development
 - Resource Assessment
 - Environmental Effects
- DOE Responsibilities under the OTEC Act



DOE had an active OTEC program through the 1980's.

Current research efforts more limited but include:

- **Design and Modeling of Open Cycle OTEC Plant**

Makai Ocean Engineering is developing a conceptual design and model of an offshore 100MW Mist Lift Open Cycle OTEC plant to determine economic benefits, risks, and R&D requirements (SBIR funding).

- **Advanced Composite Cold Water Pipe**

Lockheed will validate a significantly lower-cost and high reliability technique for manufacture and installation of coldwater pipes critical to OTEC in order to help create a more cost-effective and durable OTEC system.

- **Design Optimization of Modular OTEC Heat Exchangers**

University of Maryland, in conjunction with Lockheed Martin, is working to develop conceptual design and performance prediction methodologies (SBIR funding).

- **OTEC Cables**

Makai Ocean Engineering is working to optimize conceptual cable specifications, installation plans, costs, and feasibility (SBIR funding).

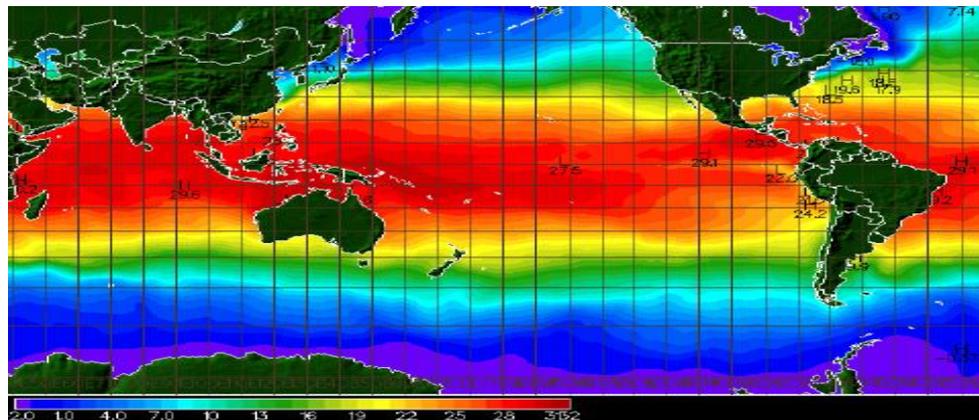
- **OTEC Life Cycle Cost Analysis**

Lockheed Martin, and partners, working to refine OTEC cost estimates.



Program Supported Detailed Resource Assessments

- Lockheed Martin, in conjunction with Florida Atlantic University's Center for Ocean Energy Technology, University of Hawaii's Hawaii Natural Energy Institute, and the National Renewable Energy Laboratory, complete in FY 2011
- Working to Develop a Ocean Thermal Extractable Energy visualization tool
 - Will estimate maximum practicably extractable energy from the global and domestic U.S. ocean thermal resource
 - ID areas viable for OTEC and Cold Seawater Based Air Conditioning
 - Will culminate in a publically-available web based GIS tool



Project Title: The Potential Impacts of OTEC Intakes on Aquatic Organisms at an OTEC Site under Development on Kauai, HI

PI: Stephen Oney, OCEES International

Partners: Alden Research Labs and Tenera Environmental

Funding Level: \$594,961

Objectives: Provide the baseline biological data required to determine the potential impacts of OTEC intakes on aquatic organisms on the island of Kauai.

- 1) **Study baseline species composition**
- 2) **Site-specific intake assessment to determine optional warm water intake technology**
- 3) **Review potential impacts of cold water intake**



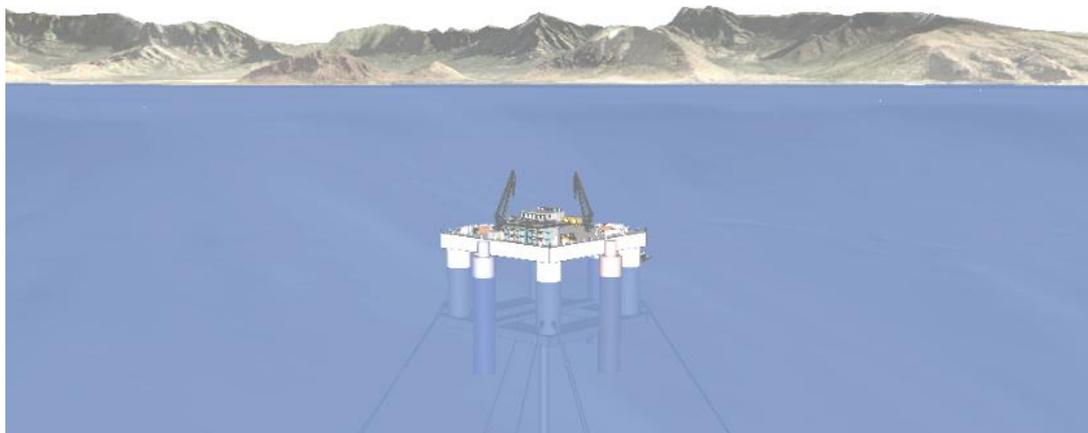
National Marine Renewable Energy Center of Hawaii:

- The University of Hawaii in Honolulu, HI, established a center to facilitate the development and implementation of commercial wave energy systems in their state and to assist the private sector in moving **ocean thermal energy conversion systems beyond proof-of-concept to pre-commercialization, long-term testing.**



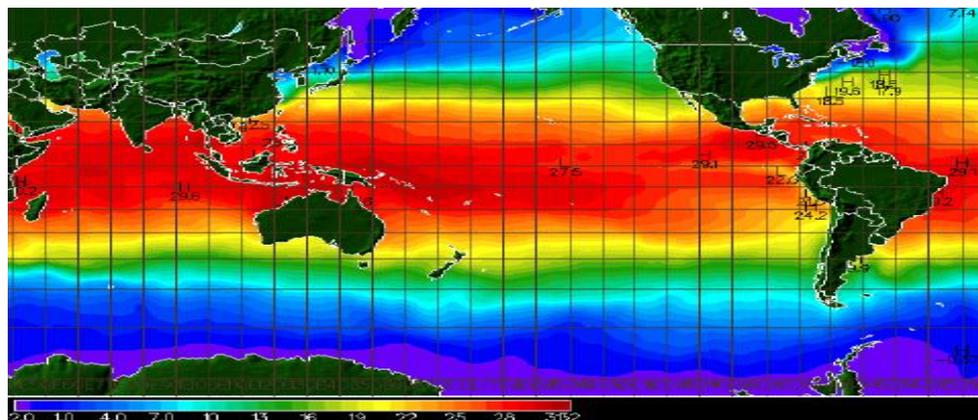
DOE Responsibilities Under the OTEC Act (1980)

- Gives the Secretary of Energy authority to approve OTEC demonstration projects
- Unique role for DOE – mainly an R&D institution
- DOE is working closely with NOAA to develop an approval process for demonstration projects but has not finalized a process yet
- DOE has yet to receive any OTEC demonstration project applications



Thank You

- OTEC represents the most significant global water power resource and one of the largest renewable energy resources available.
 - Very conservative estimates place the practically available resource at 3-5 TW, greater than projected global electric power consumption in 2025 (projected at 2.7 TW)¹.
- Ocean thermal systems provide stable and predictable power output, and are thus ideally suited for baseload applications.
 - Nearshore ocean thermal resources are often concentrated in areas where electricity prices are highest and power is generated from the most polluting sources (esp. diesel). In the US, prime OTEC resource locations include Hawaii, Florida, and many military bases.
 - Offshore resources are even more extensive, and will be harnessed and exported by the country that develops the best technologies first.



¹ Nihous, "A Preliminary Assessment of Ocean Thermal Energy Resources," ASME, 2007.