

# Status of Ocean Energy Projects in Hawai'i

BOEM Hawaii OCS Renewable Energy Task Force

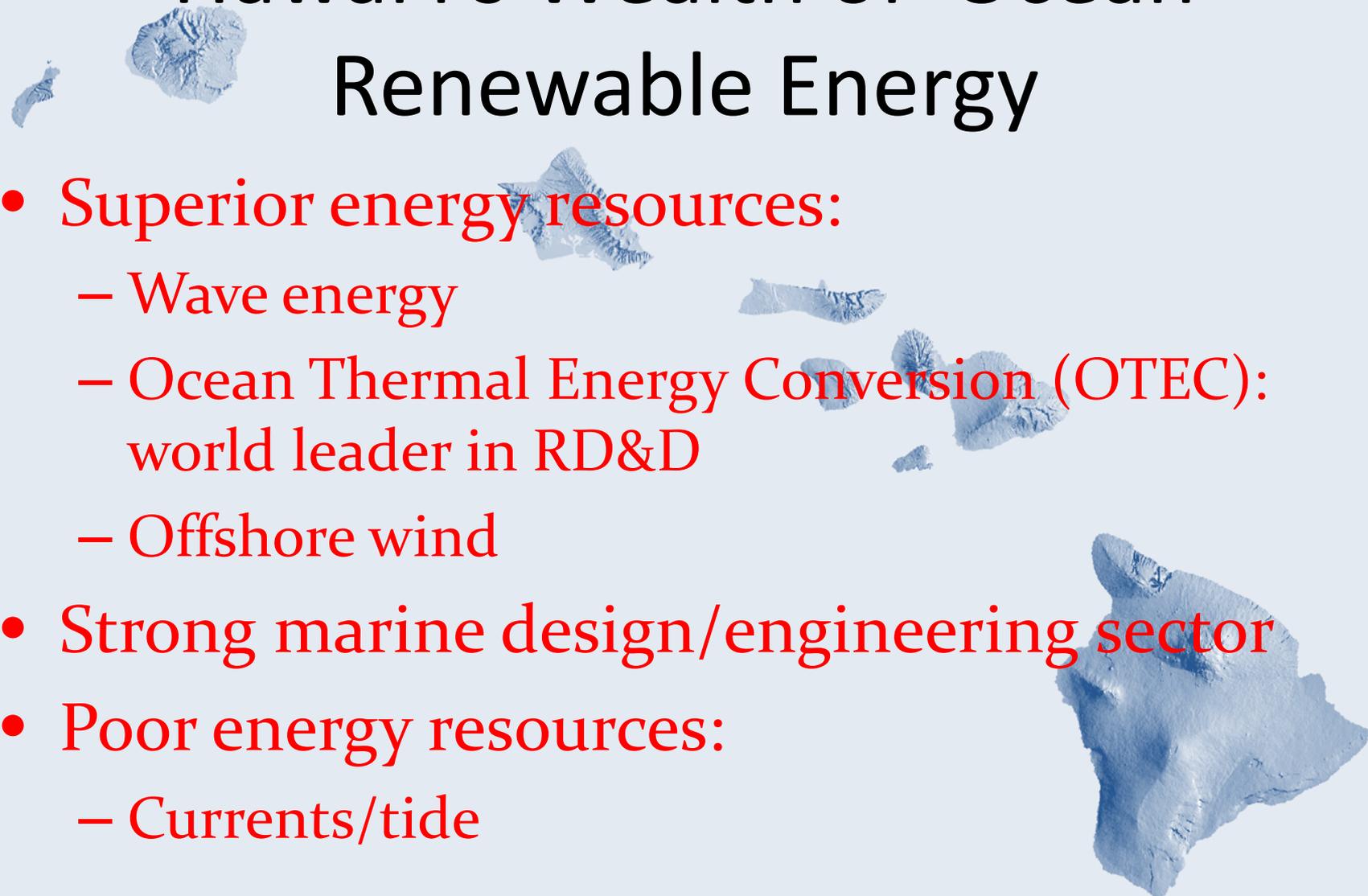
March 7, 2012

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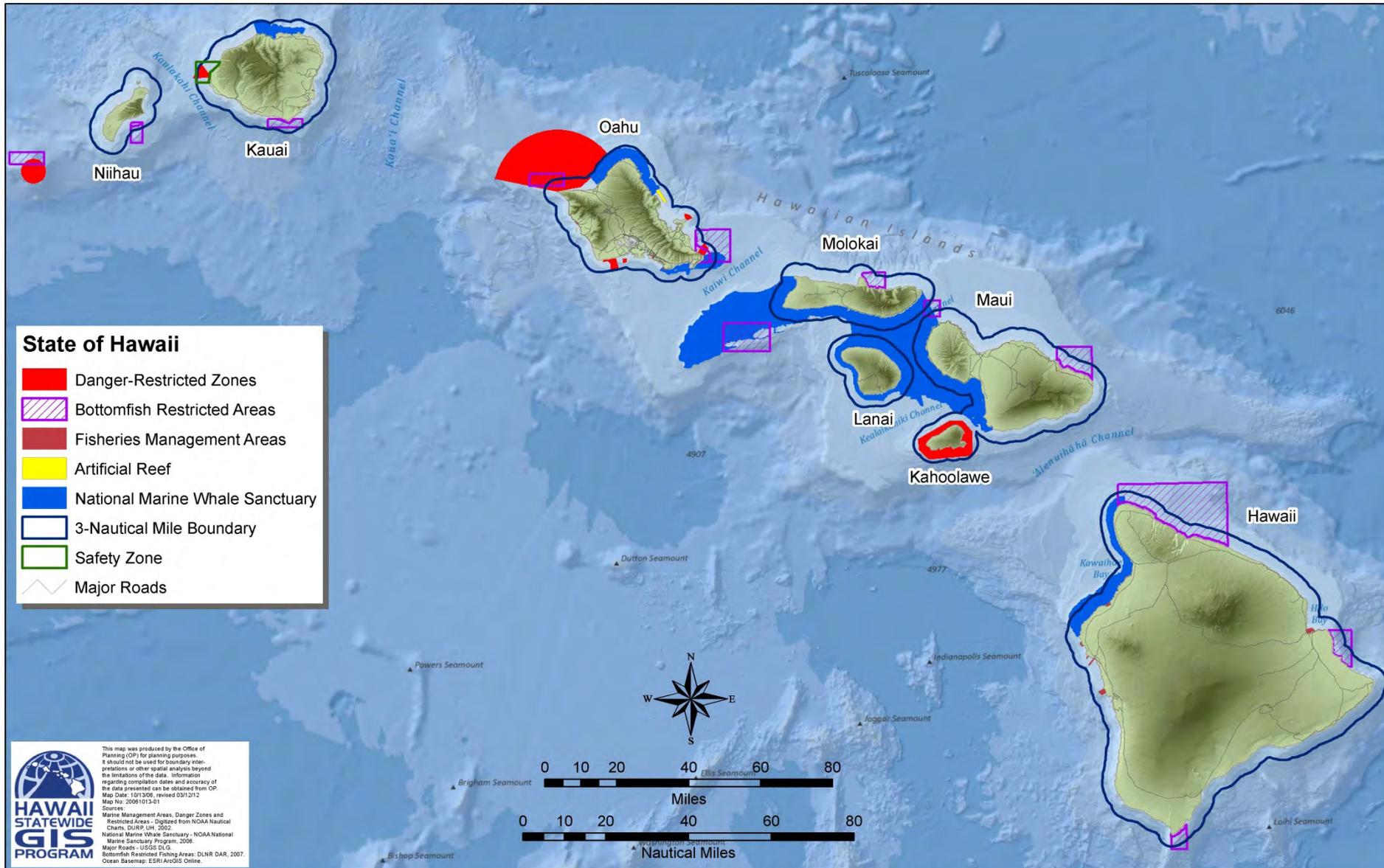


# Hawai'i's Wealth of Ocean Renewable Energy



- Superior energy resources:
  - Wave energy
  - Ocean Thermal Energy Conversion (OTEC): world leader in RD&D
  - Offshore wind
- Strong marine design/engineering sector
- Poor energy resources:
  - Currents/tide

# Hawai'i's Oceans Are Used for Many Purposes





Niihau

Kauai

Kane'ohē Bay



Pa'uwela Point



Oahu



Makai Pier

Molokai



Maui



Lanai



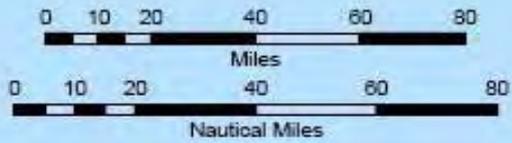
Kahoolawe



Hawaii



Natural Energy Laboratory



Some sites of interest

# Hawai'i National Marine Renewable Energy Center



## Wave Demonstrations:

- Ocean Power Technologies
- Oceanlinx

# Ocean Power Technologies (OPT)

- US Navy R&D project
- 3 PowerBuoys since 2004
- Currently, 1 40-kW Buoy
- Grid-connected Sept. 2010
- Marine Corps Base Hawai‘i, Kane‘ohe, Oahu
- Environmental Assessment: FONSI (Finding of no significant impact)



# OPT at MCBH, Kāneʻohe, Oʻahu



Buoy #1  
2004-2005



Buoy #2  
June 2007

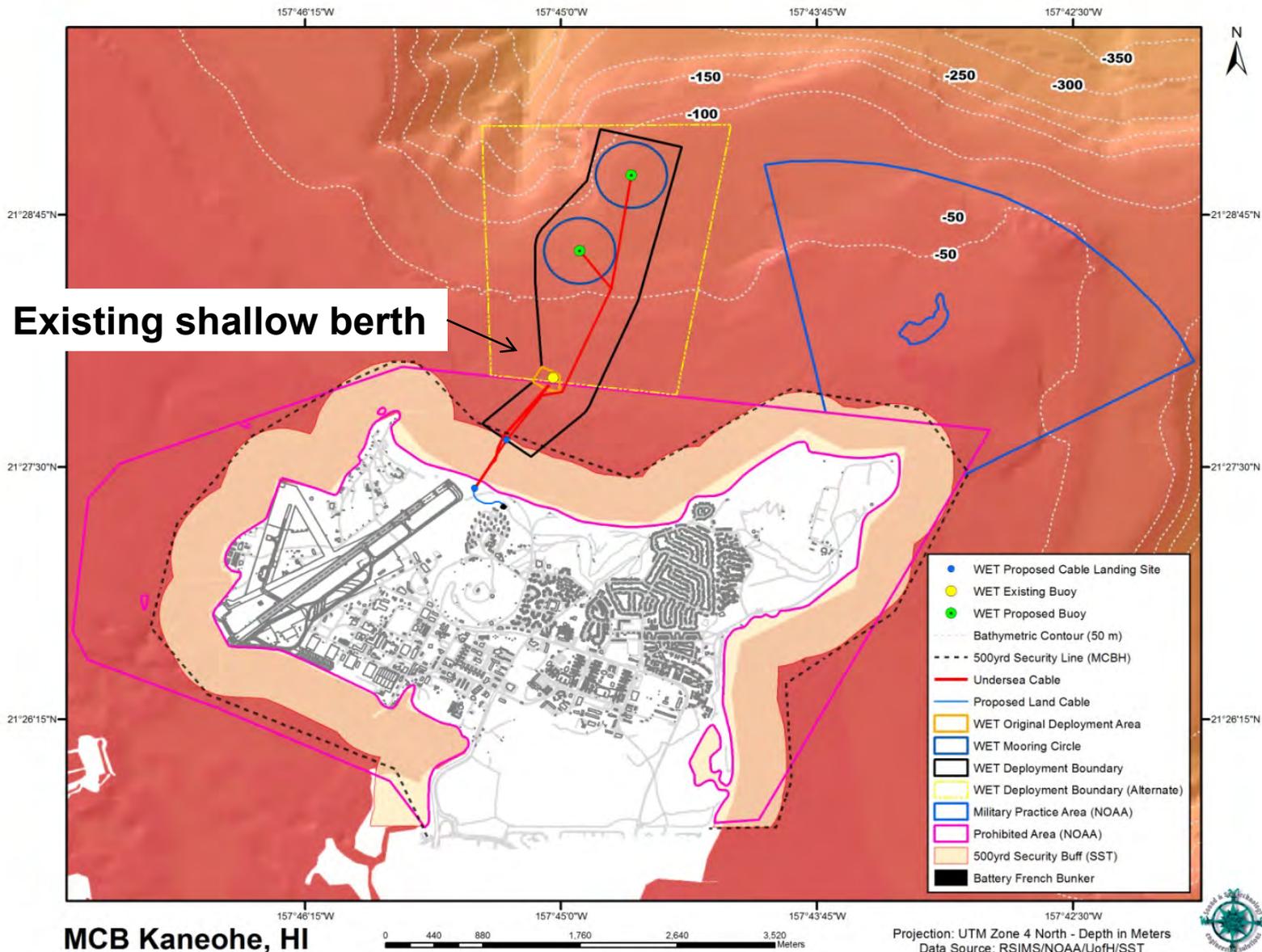


Buoy #3  
11/08, 12/09 -

# PowerBuoy Deployment



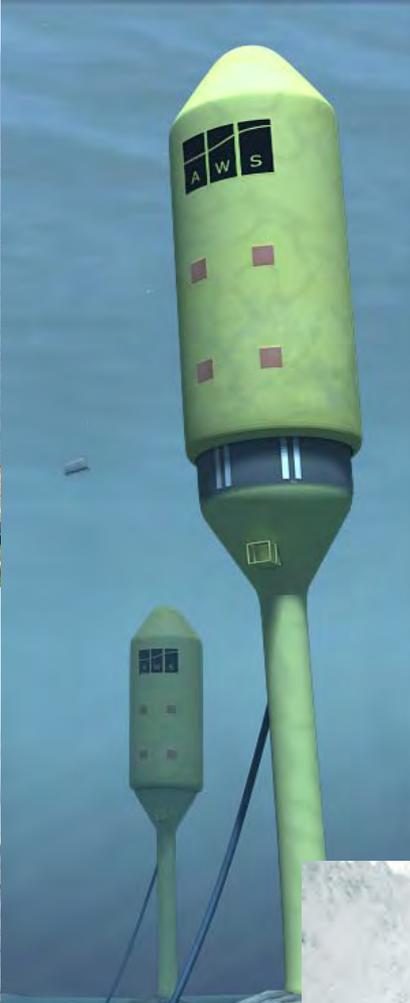
# Proposed Kane'ohe WETS



# Oceanlinx: Pa'uwela Point, Maui

- Proposed 500-kW OWC demo
- At-sea tests in Australia
- Privately funded
- FERC preliminary permit application recently rescinded
- HINMREC assisting with environmental studies

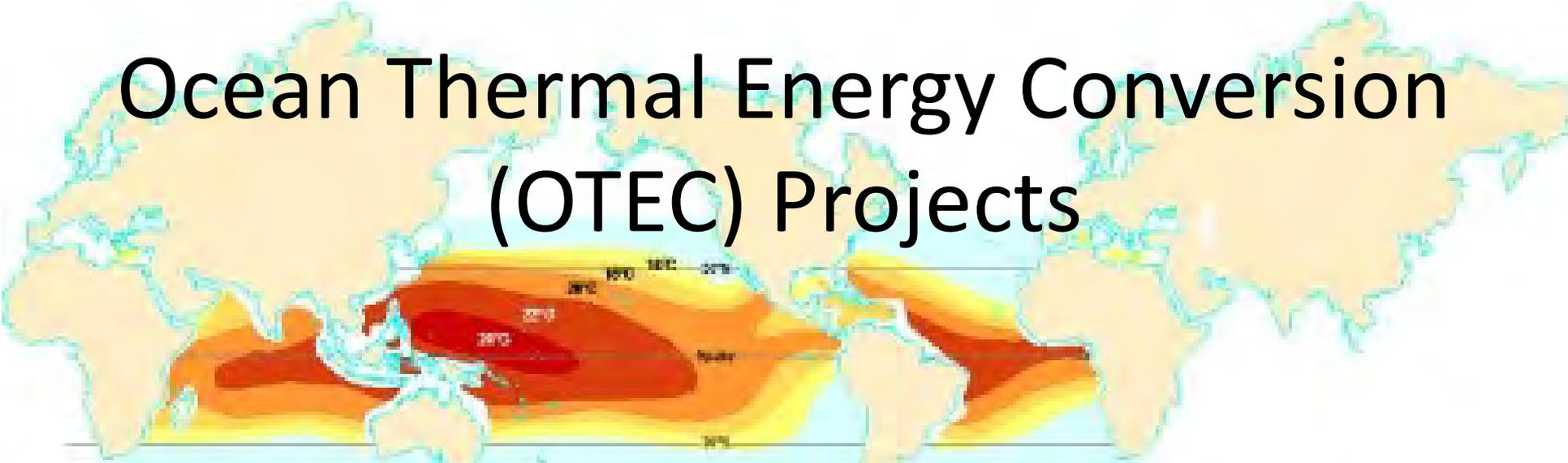




Other companies  
have inquired about  
Hawai'i projects



# Ocean Thermal Energy Conversion (OTEC) Projects

- 
- A world map with a color-coded overlay representing the potential for Ocean Thermal Energy Conversion (OTEC). The map shows high potential (red and orange) in the tropical regions, particularly in the Pacific and Atlantic Oceans. The equator is marked with a horizontal line. The map is centered on the Pacific Ocean, showing the Americas on the left and Asia/Australia on the right.
- Heat Exchanger Test Facility
    - Makai Ocean Engineering & Lockheed Martin
    - @ NELHA (ongoing)
  - OTEC International
    - 1-MW onshore demo @ NELHA
    - Term sheet for 100 MW off Oahu
  - Interest in 5-10 MW offshore pilot
    - Lockheed Martin & Makai Ocean Engineering
    - SW coast of Oahu

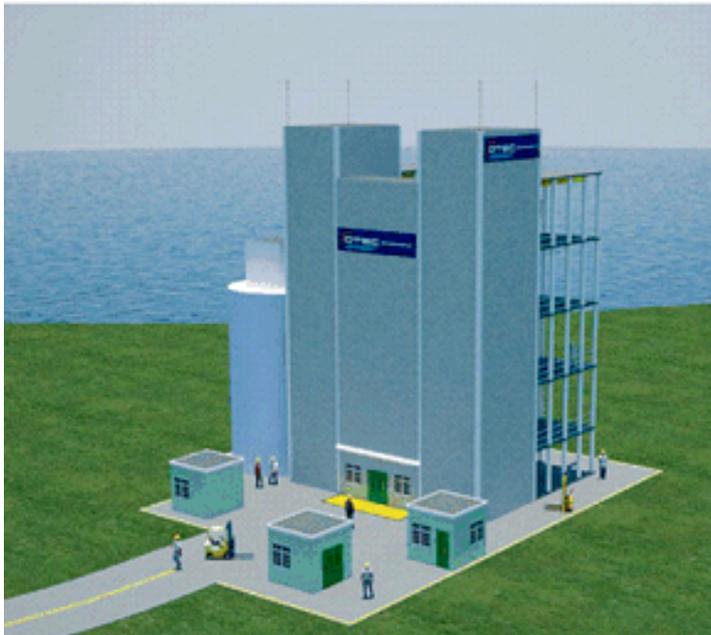
# Natural Energy Laboratory of Hawai'i Authority

- USA's premier OTEC research lab
- Open- and closed-cycle demonstrations
- Onshore and at-sea demonstrations
- Net power produced

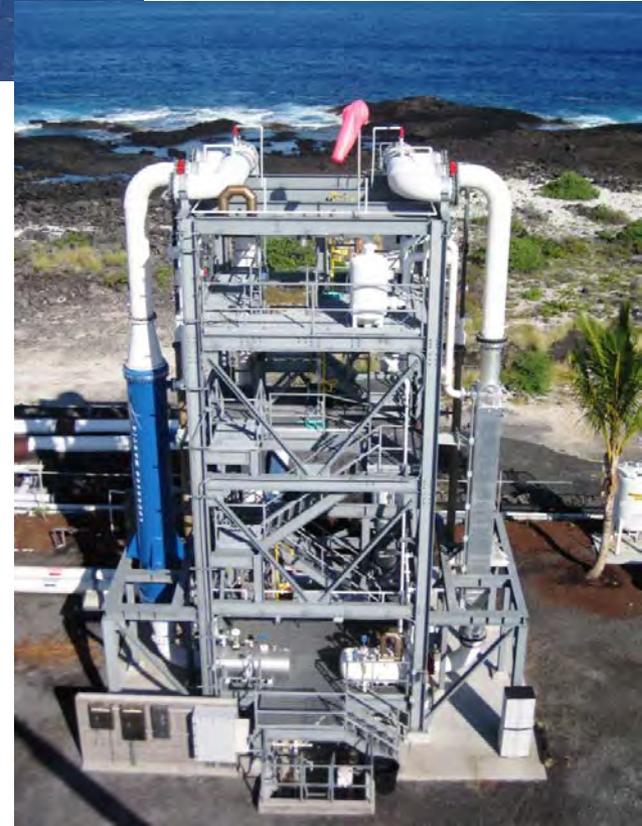




Offshore  
OTEC  
concepts  
←



Onshore  
OTEC  
concept  
←  
and test  
facility  
→

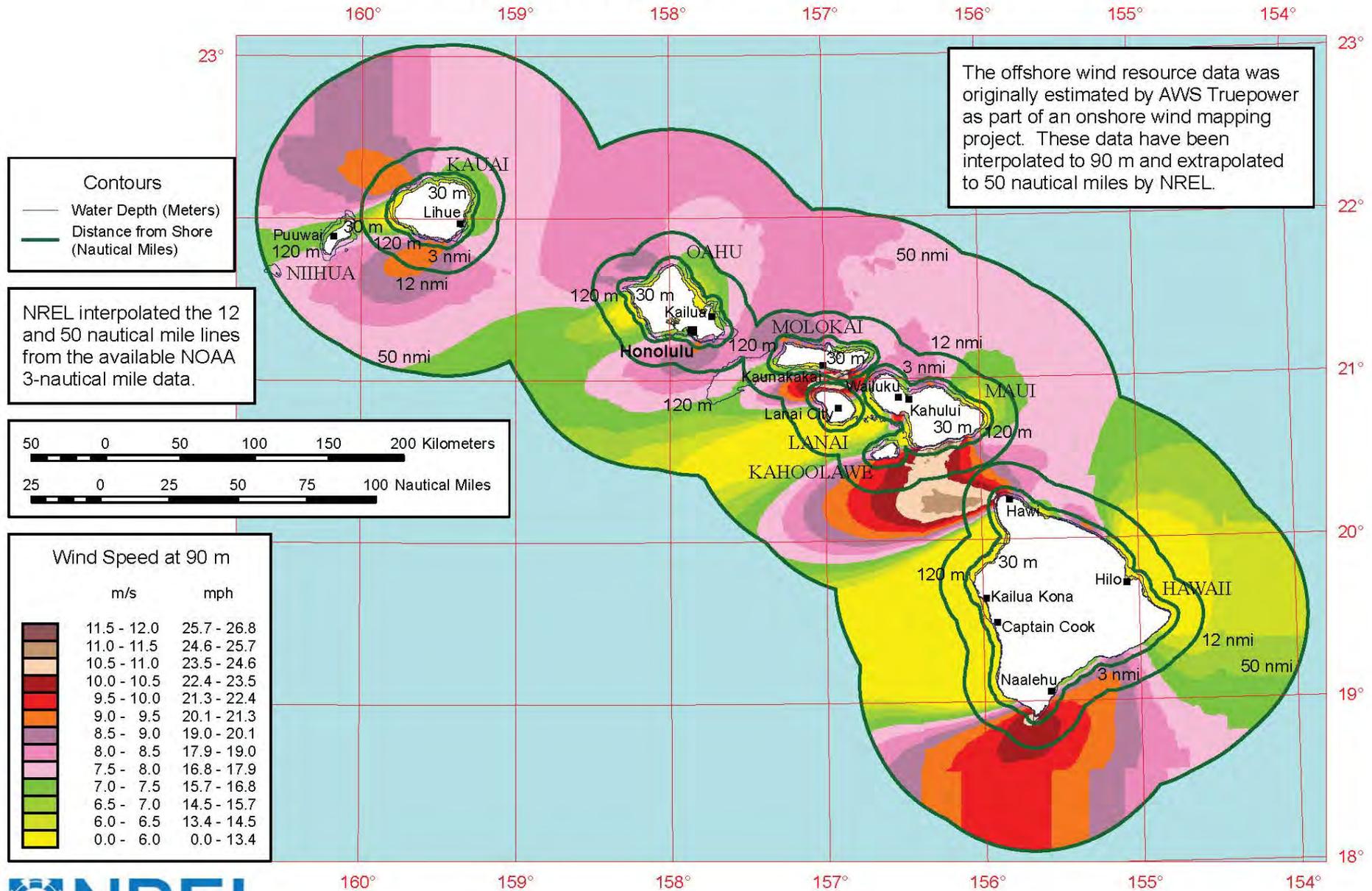


# Offshore Wind

- Several companies exploring opportunities
- May respond to HECO RFP in 2012
- Challenges include bathymetry (steep slopes nearshore)



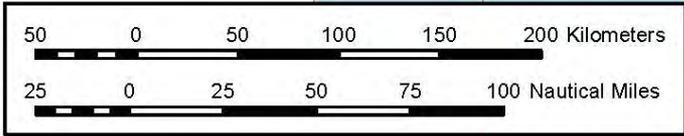
# Hawaii - 90 m Offshore Wind Speed



The offshore wind resource data was originally estimated by AWS Truepower as part of an onshore wind mapping project. These data have been interpolated to 90 m and extrapolated to 50 nautical miles by NREL.

**Contours**  
 — Water Depth (Meters)  
 — Distance from Shore (Nautical Miles)

NREL interpolated the 12 and 50 nautical mile lines from the available NOAA 3-nautical mile data.



**Wind Speed at 90 m**

	m/s	mph
	11.5 - 12.0	25.7 - 26.8
	11.0 - 11.5	24.6 - 25.7
	10.5 - 11.0	23.5 - 24.6
	10.0 - 10.5	22.4 - 23.5
	9.5 - 10.0	21.3 - 22.4
	9.0 - 9.5	20.1 - 21.3
	8.5 - 9.0	19.0 - 20.1
	8.0 - 8.5	17.9 - 19.0
	7.5 - 8.0	16.8 - 17.9
	7.0 - 7.5	15.7 - 16.8
	6.5 - 7.0	14.5 - 15.7
	6.0 - 6.5	13.4 - 14.5
	0.0 - 6.0	0.0 - 13.4

# Ocean Energy Has a Role in Hawai'i's Renewable Portfolio

- Pre-commercial technologies
  - Support RD&D through HINMREC, NELHA
- Facilitating siting
  - permits and other information