

Pacific Gas and Electric WaveConnect Project

Federal Energy Regulatory Commission

CA State Lands Commission

Scoping/Technical Meeting

Eureka, California

June 9, 2010



PG&E WaveConnect Team

● PG&E

- **Robert Blair, Manager, Renewable Development**
- **Annette Faraglia, FERC Legal Counsel**
- **Ian Caliendo, State Agency Relations**
- **Brendan Dooher, PhD, Senior Mechanical Engineer**
- **Ed Cheslak, PhD, Senior Consulting Scientist**
- **Gina Morimoto, Aquatic Biologist**
- **Mike Gunby, Principal Land Planner**

● Consultants

- **Robert Booth, Development Consultant & Project Lead**
- **Bill Toman, Senior Program Manager (CH2M Hill)**
- **Doug Davy, PhD, Environmental Project Manager (CH2M Hill)**
- **Rick Williams, Engineer (SAIC)**
- **Anna West, Outreach and Facilitation (Kearns & West)**



PG&E WaveConnect Overview

- **Objective to provide testing and demonstration platform WEC devices**
 - Aid incubation of this new technology
 - Lead to commercial, utility-scale projects for PG&E
- **Funding for Permitting Feasibility and Engineering only**
 - DOE grant and CPUC authorization
- **Funding for Construction Phase uncertain**
- **Originally 2 locations identified – Humboldt and Mendocino**
 - Good wave resource and access to PG&E grid
 - Mendocino eliminated due to inadequate harbor characteristics
 - Central Coast site under investigation as potential second site
- **Humboldt as Lead Project Site**
 - Located 3 nm offshore of Eureka, California (Humboldt County)
 - 45 meter of water
- **FERC Draft Pilot License Application submitted March 2010**
- **Final Pilot License Application by February 2011**



WaveConnect Overview

- **PG&E will test up to four different wave technologies**
 - Total of 5 MW
 - Target 5 to 10 years operation (construction and removal additional)
- **Anticipate Hybrid structure**
 - Infrastructure owned & operated by PG&E
 - WEC devices owned & operated by manufacturers/sponsors
- **PG&E infrastructure (subsea cables, interconnect)**
 - 4 separate bays each with independent cable runs and power conditioning
- **PG&E has completed a WEC Request for Information (RFI)**
 - In process of selecting 3-4 WEC suppliers. Negotiations underway
- **Operation expected in 2014-2016**

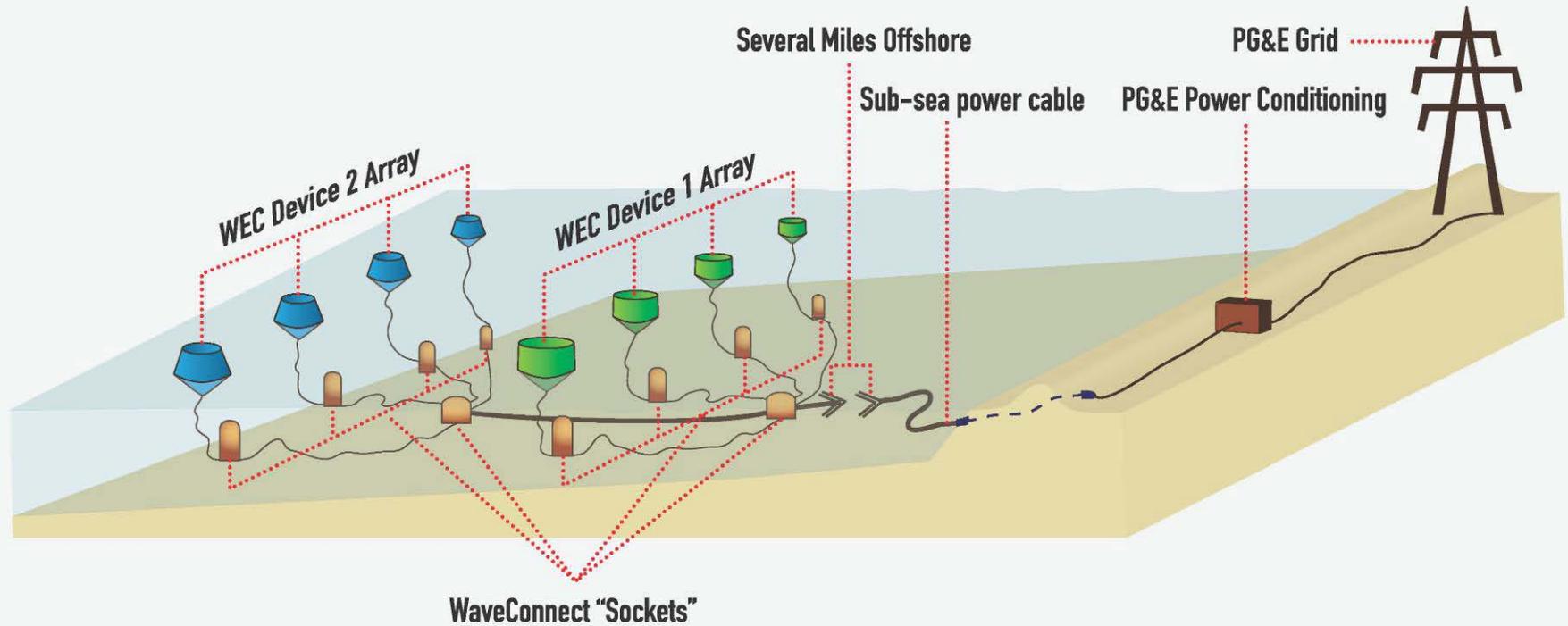


WaveConnect Project Description

- **Four arrays of WEC devices**
- **PG&E Assets**
 - Interconnection to PG&E Fairhaven substation (12kV)
 - Gen Tie (and switch gear as necessary)
 - Conditioning Devices (depending in final agreement)
 - Subsea Cable
 - 5 cables, one for each array and one spare
 - 9 miles to site in application, approx 3 to 4 miles to new site
- **Wave Energy Conversion (WEC) Device Owners' Assets**
 - WEC devices (max 30 devices in 4 arrays)
 - Mooring cables and anchors for devices
 - Conditioning Devices (depending on final selection)
- **Environmental monitoring buoys**
 - Up to 6 environmental
 - Up to 6 markers

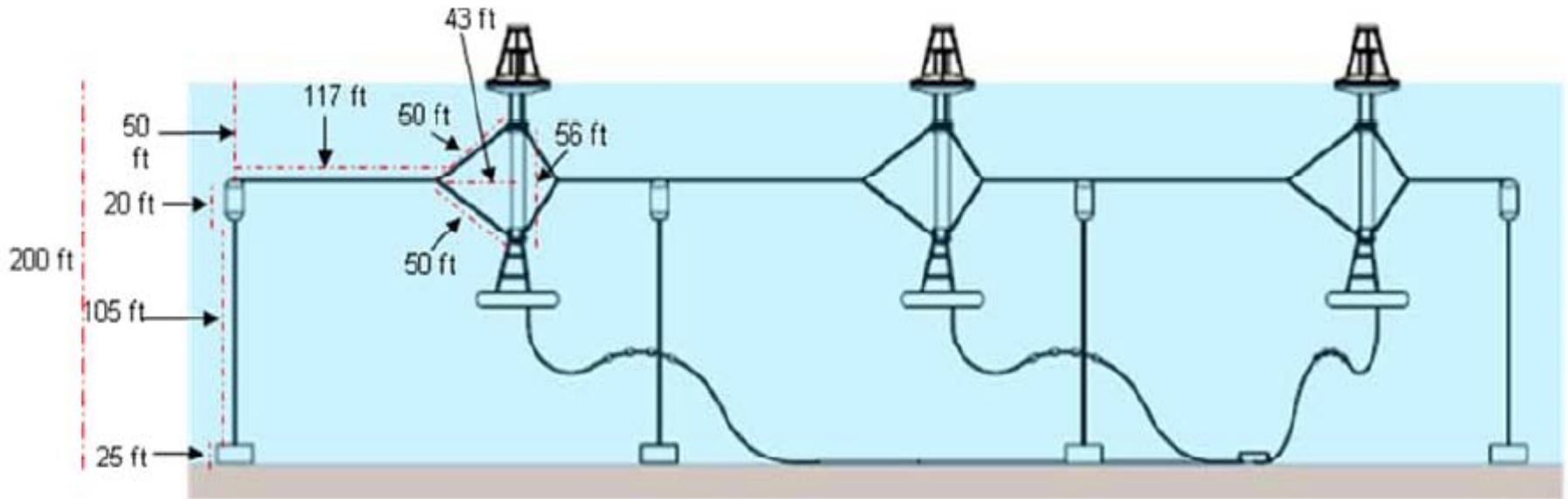


Humboldt WaveConnect Project Description



Wave energy conversion (WEC) devices capture the ocean's energy. The energy is transmitted through an undersea cable to land, where the energy is conditioned and fed to the electric grid.

Typical small, low KW mooring



WaveConnect Location

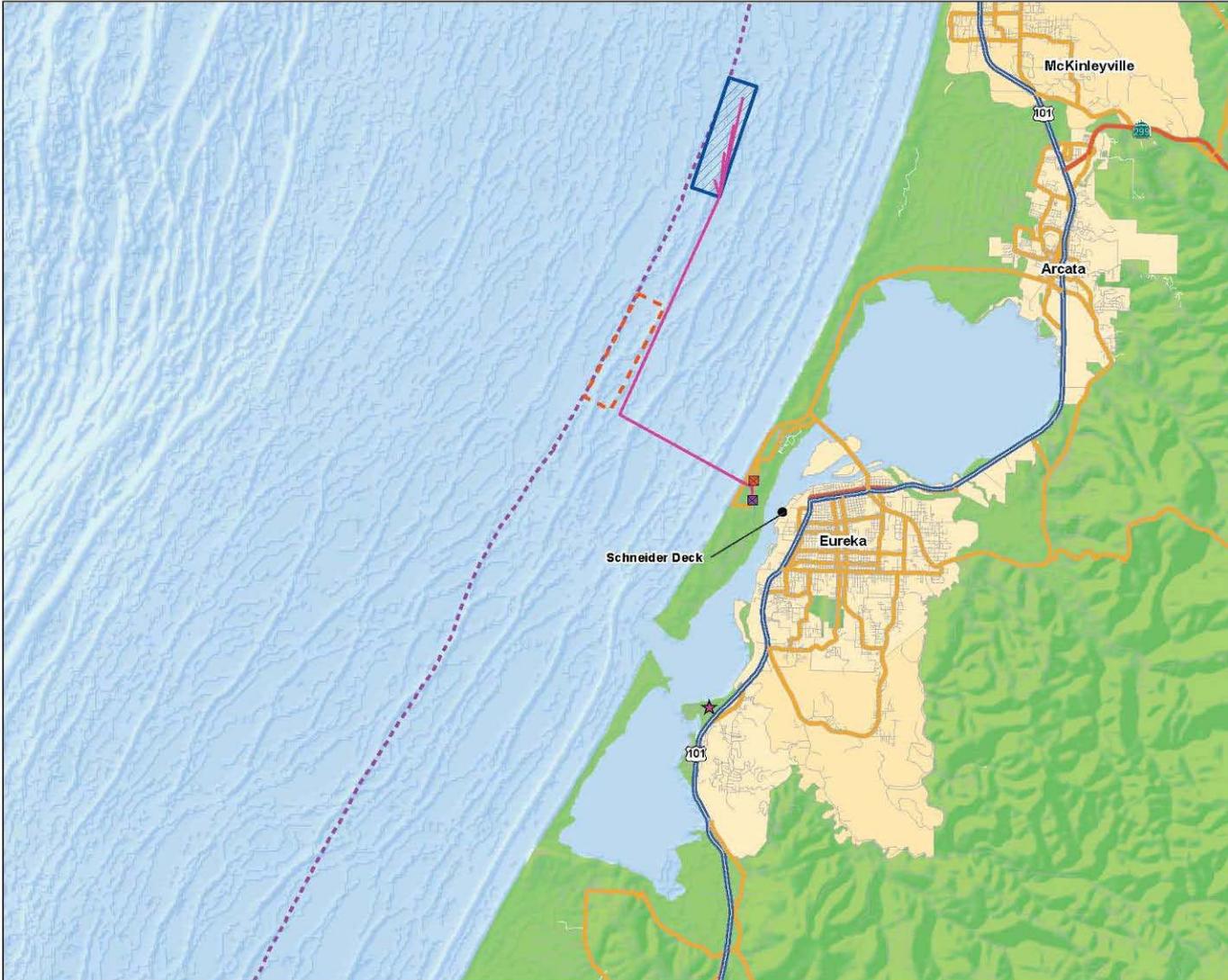
- **DPLA proposal is to locate approximately 2.5 to 3 nautical miles offshore Manila on the Samoa Peninsula of Humboldt Bay**
- **Surface and subsurface area approximately 1 sq nm**
 - 2 nm north-south by 1/2 nm east-west
- **On shore facilities at HBMWD property next to New Nave Base Road**
- **Transmission interconnection at Fairhaven substation**



WaveConnect Project Modifications

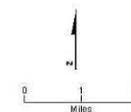
- **Term**
 - 5 years in current application
 - For economic reasons considering a longer term
- **Number of devices**
 - 30 in application but could be as few as 12
 - Depends on WEC negotiations and selection
- **Location**
 - Move site to southern end of investigation area
 - As discussed with fishermen and other stakeholders

Humboldt WaveConnect Project Location



HUMBOLDT WAVECONNECT WAVECONNECT PROJECT HUMBOLDT COUNTY, CALIFORNIA

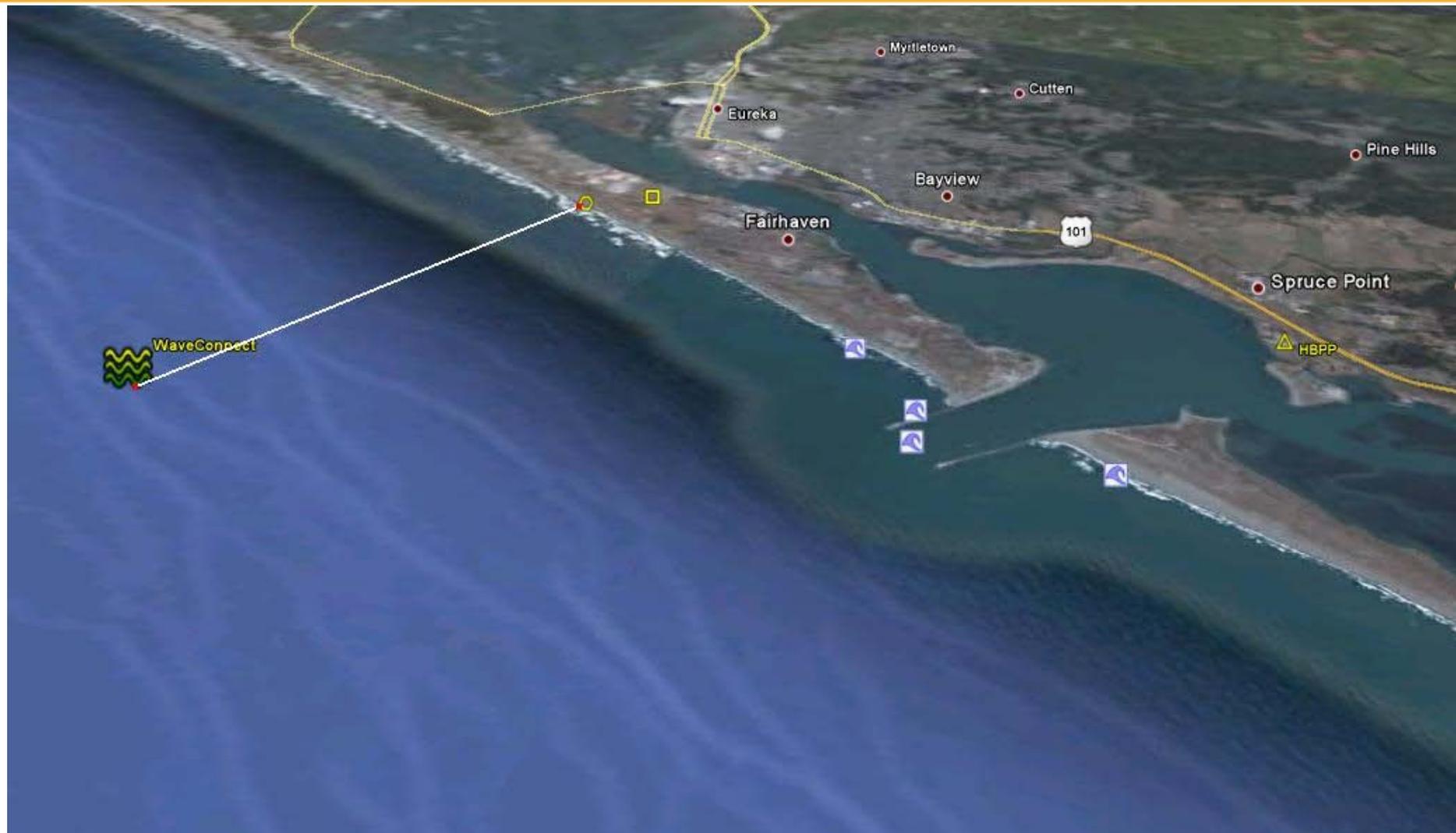
The preliminary permit allows PG&E to conduct studies only. It does not allow for construction, exclusion, or any physical disturbance. If the project is permitted for construction at a later date, the project footprint would be significantly smaller than this preliminary permit study area.



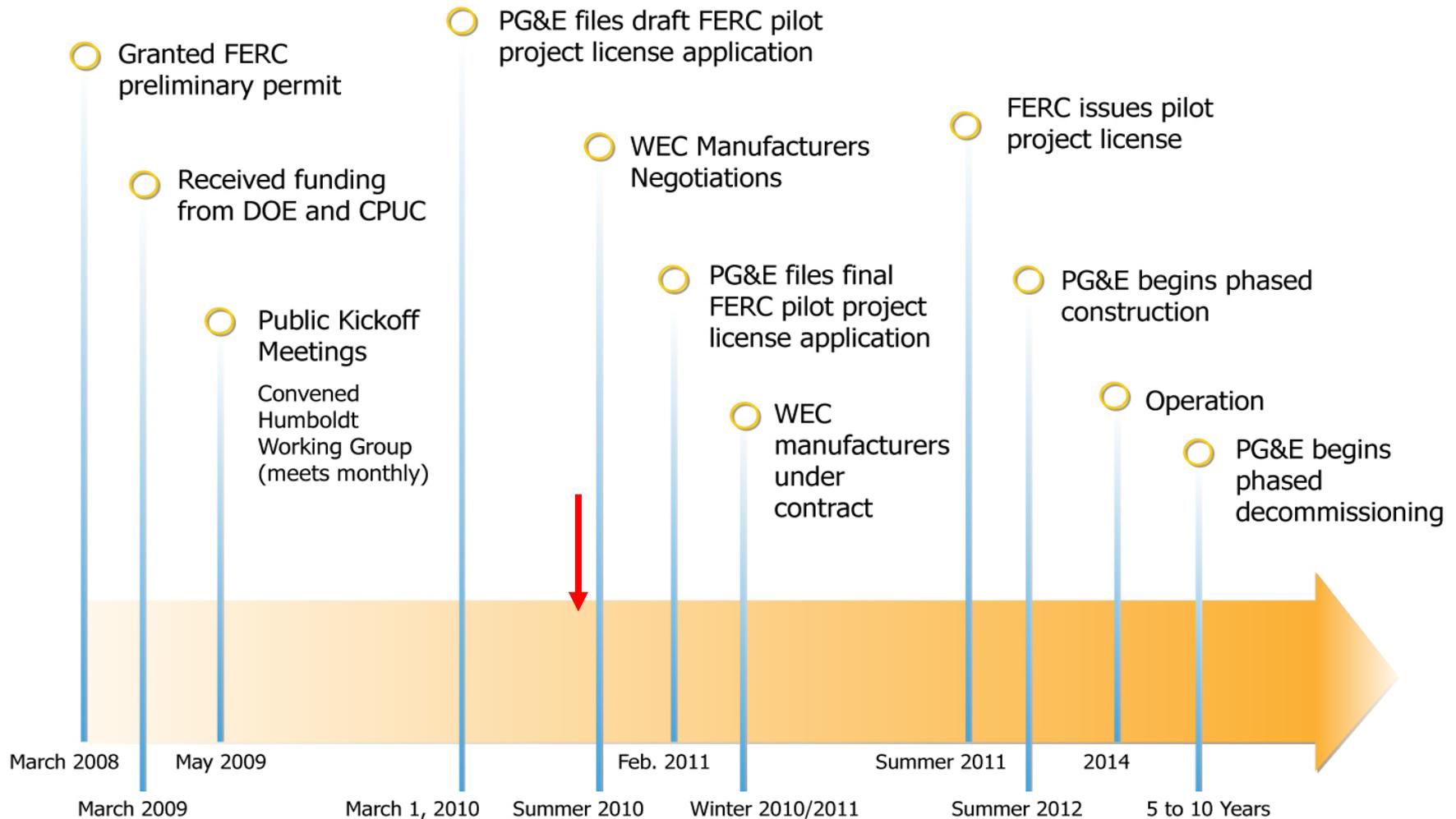
LEGEND

- Fairhaven Substation
- On-Shore Facilities
- ★ Humboldt Bay Generating Station
- Preferred Cable Route (5 cables)
- - - 3 Nautical Mile
- ▨ WEC Deployment Footprint
- - - Alternative Site

Humboldt WaveConnect™ Project Location

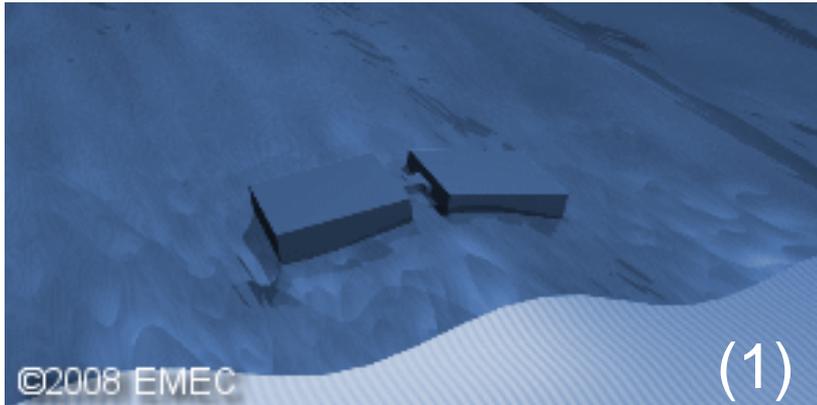


Humboldt WaveConnect Project Timeline

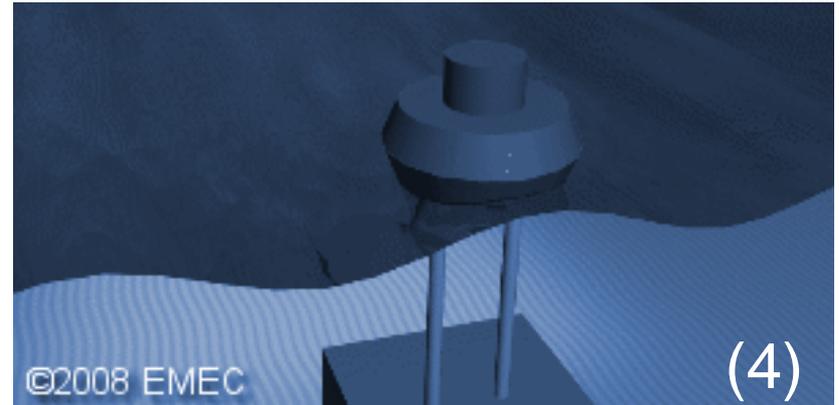


Overview of Technology Types

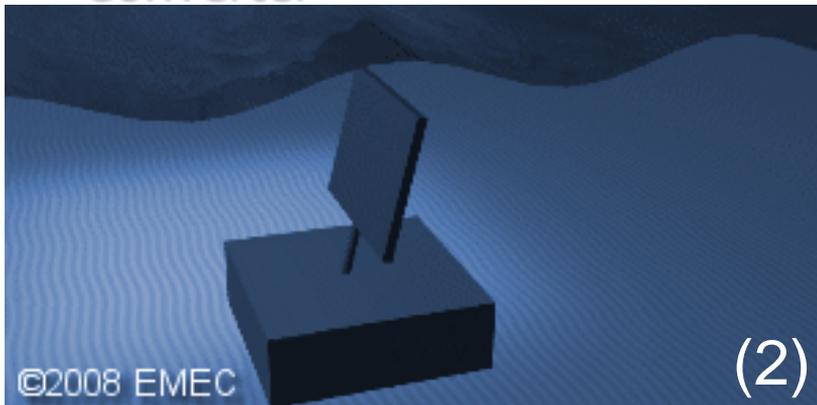
- Attenuator



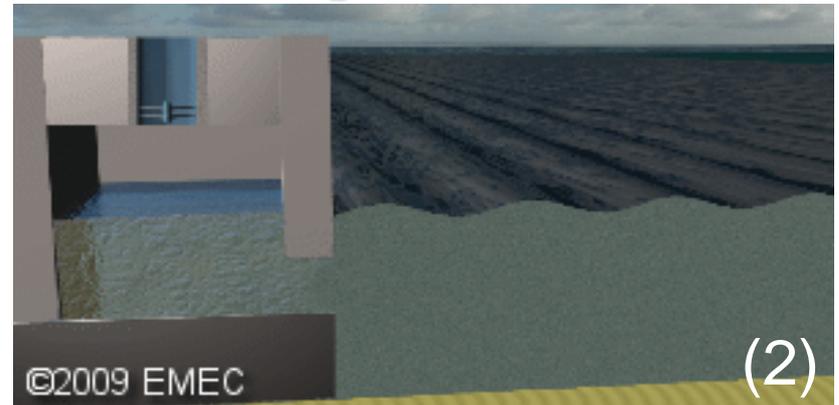
- Point Absorber



- Oscillating Wave Surge Converter



- Oscillating Water Column



WaveConnect RFI Process and Results

- **Sent RFI invitations to 53 manufacturers**
 - Designed to solicit technical, commercial and financial information
- **14 WECs responded**
- **9 under consideration today**
- **Next Steps**
 - Detailed discussions with WECs
 - Financial and risk management capabilities
 - Partnership arrangements
 - RFP vs Bi-lateral negotiations



WaveConnect Project Status

- **Working to address DPLA and related agency questions**
 - Extensive questions/comments- valuable learning process
 - Initial response submitted 5/28/10
 - Revisions to Adaptive Management & Monitoring Plan
- **Evaluating WEC devices and negotiating with suppliers**
- **Finalizing preliminary engineering and costs for infrastructure**
- **FPLA due by February 2011 (or PG&E loses site preference)**



WaveConnect Project Challenges

- **New technology**
 - First full scale grid-interconnected project in US Very few world wide
- **Environmental impacts uncertain**
 - Complexity of environmental issues and permitting
- **Project costs much higher than originally expected**
- **Pilot license is new and untried**
- **Pilot requires project removal if severe unforeseen negative environmental impacts occur**
- **No potential to build out into large project at this site**
- **Short-term license, small scale and high costs result in excessive amortization cost (CPUC approval risk)**
- **Multiple permitting processes (e.g. State Lands CEQA & FERC NEPA, etc)**



WaveConnect Contact Information

**Copy of this presentation and additional
project information available at:
www.pge.com/waveconnect**

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