Wave and Hydrokinetics Interest Group
1st Meeting of 2009/2010 Year:
With a Focus on wave Energy

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EPRI EPRI Ocean Energy Leader
Marine Wave Energy Interest Group

- Bill Toman, PG&E WaveConnect Project Manager is Chairman

- Agenda

  8:30-9:00 USA Project Status: PG&E WaveConnect, OPT Reedsport and Coos Bay and beyond, Oceanlinx Maui and beyond

  9:15-10:00 Wave Economics: 2005 EPRI Study, 2009 DOE Project, any OPT input

  10:00-10:45 Grid I/C and Integration: BPA I/C Standards, SAIC Wave Forecasting, EPRI Distribution System Simulator (DSS) Screening Applet for Evaluation Impacts of Distributed Renewable Energy Projects

  10:45-11:30 Regulatory: Project developers compare notes on regulatory experiences

  11:30- noon Anyone who wants to stay for discussion
The State of Wave Energy

• Installed Offshore Wave Capacity (as of 6/30/09) - < 1 MW worldwide
• EPRI estimates a U.S. cum capacity of ~200 MW by 2015 and 10,000 MW by 2025 (assumes regulatory and political barriers are overcome)
• Wave Energy Conversion (WEC) Technology Readiness
  – WEC is an emerging technology.
  – About a half dozen full-scale prototype WEC devices have been demonstrated at sea over the past five years and
  – another dozen sub-scale prototypes have also been demonstrated at sea over the past five years.
• Economic Status: The first U.S. commercial wave plant project in Reedsport, OR, was made possible through public support, private investment, and state incentives.
• The first U.S. wave power purchase agreement was rejected by the California Public Utility Commission in late 2008.
• The first U.S. wave power plant license issued by FERC for the 1-MW Makah Bay, WA project was surrendered by Finavera
Wave Power Environmental and Regulatory Status

• Environmental Impact
  – Proper care in siting, installation, operation, and decommissioning may enable ocean wave energy technology to be one of the more environmentally benign electricity generation technologies
  – Pilot demonstration testing needed
  – Adaptive management required

• Regulatory Status
  – Wave power plant projects are being permitted in Europe
  – The time, cost and complexity of the U.S. regulatory process can be difficult for wave power project developers
  – The Federal Energy Regulatory Commission (FERC) has primary jurisdiction for licensing ocean wave energy under the Federal Power Act (FPA), both in state waters and on the outer continental shelf (OCS).
  – FERC issues preliminary permots for projects in state seabed lands but not on OCS
  – Mineral Management Service (MMS) leases Federal lands on the OCS. MMS lease rules for alternative energy on the OCS were issued in April 2009.
  – There currently are no leases for wave plants on the OCS nor are there any applications for leases for wave plants on the OCS.
Government Support and Trends to Watch

• Government Support of Wave Energy
  – European governments (particularly in the UK, Ireland, Portugal and Denmark) as well as those in Japan, New Zealand, and Australia, support the development and deployment of WEC technology and are now providing subsidies to stimulate a commercial market.
  – The U.S. DOE initiated a Waterpower R&D Program in FY 2008 with a Congressionally mandated $10 million which was followed by another Congressionally mandated level of funding for FY 2009 of $40 million.
  – The Murkowski/Inslee Marine Renewable Energy Promotion Act of 2009 would authorize as much as $250 million a year (up from the current authorization limit of $50 million per year)

• Trends to Watch
  – Getting economical power from ocean waves will be difficult and will require the very best engineering skills.
  – Communication outreach and negotiation skills for resolving conflict of sea space issues will be required.
  – More demonstration projects and early commercialization projects, including multi-megawatt “wave farms,” are expected to be deployed over the next decade in Europe, South America, and Australia (and the US if regulatory and political obstacles are overcome).
Exciting WEC Device Highlights over the Past Year

• Columbia Power Technology (CPT) deployed and tested a 10-kW wave energy buoy that uses a prototype linear generator 2.5 miles off Newport Oregon over five days in September 2008.

• Stanford Research Institute (SRI) demonstrated a novel Electroactive Polymer Artificial Muscle (EPAM) technology wave-powered generator in the ocean near Santa Cruz, California on December 8, 2008.

• Aquamarine Power Oyster deployed at EMEC in summer 2009

• Pelamis WavePower P2 being built for EON and will be deployed at EMEC
Exciting Wave Project Highlights over the past Year

• PG&E WaveConnect – CPUC approved $4.8M and DOE grants $1.2M to get the Permitting and Design Phase underway
• Oceanlinx applied for preliminary permit for Maui Hawaii Project -
• UK Wave Hub
• Orecon Portugal
• And one not so exciting development - Pelamis Aquadouce project stuck at dockside

Courtesy: Orecon Limited
U.S. Wave Power Plant Preliminary Permit Locations

Issued Construction and Operation License

Issued and Valid Preliminary Permit

Pending Preliminary Permit
Conclusions

• Considerable potential exists for generating electrical power from wave energy off the coast of the United States and many other places in the world.
• In the U.S., the prime locations (i.e., those with a good wave climate, port infrastructure, coastal grid infrastructure) are:
  – Northern California and Hawaii – excellent wave energy climate, good coastal grid infrastructure, good ports, and high electricity prices.
  – Oregon – excellent wave energy climate, good coastal grid infrastructure, good ports, but low electricity prices.
  – Washington – excellent wave energy climate, poor coastal grid infrastructure (the load is in the Seattle area and there is no transmission infrastructure to get power across the Olympic peninsula), good ports, but low electricity prices.
  – Alaska – excellent wave energy climate, poor coastal grid infrastructure (the relatively small load is in the Anchorage, Fairbanks, and Juneau areas and there is no transmission infrastructure to get power there), good ports, and high electricity prices.
• The recoverable potential to provide electricity from wave energy resources is estimated by EPRI to be about 6.5% of today’s electric consumption in the United States (250 TWH per year)b.
• The experience related to ocean energy is limited to a few prototype installations and provides a limited understanding of economic, operational, environmental, and regulatory issues.
• Such understanding can only be gained in a practical way from the deployment of demonstration and early commercial adopter systems.
• Early commercial adopter systems will not only address technology related issues, but will also provide confidence to regulators, the general public and investors. Both market push (R&D) and market pull mechanisms (economic incentives to encourage deployment) will be required to successfully move this technology sector forward and develop the capacity to harness wave energy from the ocean.
Reports from the US Project Developers

Bill Toman – PG&E

From OPT – Reedsport and Coos Bay Projects

Roger Bedard for Tom Denniss – Oceanlinx Maui Project

Sonoma County Water Agency

Tillamook County

Douglas County

Greenwave Mendocino and San Luis Obispo

Gray’s Harbor

SARA Catalina Island