OREGON DEPARTMENT OF ENERGY

Why wave energy is good for Oregon's energy systems

The marine renewable energy community offers economic and energy opportunities for the state of Oregon. Through responsible development and research centers, the state believes that marine energy – particularly wave energy – could be important to Oregon's future. Wave energy generation can support a stable, healthy electric grid, future electricity load growth, sustainability goals and jobs on Oregon's coast.

- **Wave energy will improve our power mix.**

Although the state has made significant strides in clean energy and energy efficiency, there's room for improvement. On average 35 percent of the electric power consumed in Oregon comes from coal and 16 percent from natural gas. Public power, while much less carbon intensive, relies on nuclear power for over 10 percent of its electricity.[1]

As the Boardman coal plant closes by 2020, major power contracts end and electric loads increase over time, utilities will need more power resources. Wave energy could play a vital role as a new available power resource. Wave energy does not contribute to greenhouse gases and can harvest the renewable power of the ocean, providing a resilient and non-emitting electricity resource to Oregon's coast.

- **There is almost no electric generation on the Oregon coast.**

Power in Oregon travels from east to west across the state – from generators located in eastern Washington, eastern Oregon and locations further east. Bonneville Power Administration's transmission lines are the only power lines across the coast range.[2] There is no significant power generation on the coast to bolster those lines. Power must travel a long distance from east of the Cascade Range to serve the Oregon coast. Cross-coast range transmission line outages, such as what occurred in 2007, can severely impair the system.[3]

Local generating resources, like wave energy projects, can safeguard a system against problems such as outages and overloads and preserve a local utility's ability to deliver electricity to its customers.

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[1] "Where does Oregon's power come from?" 2010 Electric Power Mix. http://www.oregon.gov/energy/pages/oregons_electric_power_mix.aspx. Accessed November 6, 2012.

[2] http://transmission.bpa.gov/LanCom/Geographic_Information_Services/maps.cfm

[3] "Customers frustrated about being 'kept in the dark'." http://www.dailyastorian.com/news/customers-frustrated-about-being-kept-in-the-dark/article_62bc5943-289f-51be-92fc-add7930ff9be.html. Accessed November 7, 2012.

- **Wave energy can help relieve a highly constrained coastal grid, a barrier to economic development.**

The coastal grid is highly constrained; it cannot accept large new loads. Currently, it is difficult to attract new industries to the coast without investing in and siting costly electric infrastructure to bring more power from east to west, especially for the southern Oregon coast.[4] Electricity-intensive industries that look to site their businesses on the coast must consider high infrastructure costs.[5] Investment in local wave energy generation can significantly reduce the need to site and construct major new electric transmission system infrastructure.

Wave energy would also support the day-to-day functions of the system. BPA recently invested over $15 million in a voltage booster system near Gold Beach. The BPA investment ensures that high-enough voltage reaches the south coast, to the end of the transmission lines that serve the Brookings-Harbor area.[6] Local generation will improve voltage levels and help support a stable healthy grid, especially on the south coast.

- **Wave energy projects can plug into the local grid systems.**

Most local utilities that serve the Oregon Coast have 115-kV and 69-kV transmission lines and substations. They also have lower voltage distribution lines that could serve as part of the grid interconnection for wave energy projects. Modeled estimates show that the coastal grid could absorb 430 MW of new distributed energy generation without requiring infrastructure upgrades to cross-coast range transmission.[7]

- **For a renewable energy resource, wave energy should be relatively stable and predictable.**

Wave energy should be a predictable and stable generating resource. Oregon's wave climates change seasonally with an energetic climate in the winter and a milder regime in the summer (wind and solar resources vary within a day). The consistency of wave power production offers electric system operators a renewable generation resource with superior forecasting and scheduling characteristics compared to other renewable resources.

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[4] South Oregon Coast Reinforcement, BPA Publication FYI, March 1998.

[5] Project Columbus and Project Parkway, through the Oregon Economic and Community Development Department in 2008, explored bringing large new manufacturing facilities to the Gardiner IP.Mill Industial site.

[6] Rogue Substation Static VAR Compensator (SVC) Project. BPA South Oregon Coast Study Summary 7-13-2010. SW Oregon Coast Reinforcement Project_III.ppt.

[7] J. Khan, D. Leon, A. Moshref, G. Bhuyan. "A Scenario Analysis of the Northwest Electrical System toward Determining the Level of Wave Power that can be Integrated by 2019 in Oregon." Powertech Labs, December 2009. http://www.oregonwave.org/wp-content/uploads/Task-4.2-Integrated-Systems-Analysis.pdf.

- **Wave energy matches well with other renewable resources, especially wind.**

Putting wave energy on the grid improves integration of other renewable resources, in particular wind generation. Research indicates that when pairing wave energy with wind, it reduces the cost of balancing the grid's electric load and generation by 35-45 percent.[8]

- **Wave energy is local generation.**

Wave energy can meet local coastal electricity loads , keeping coastal communities independent from large power plants in eastern Oregon and Washington (hydropower, gas, coal, nuclear, and wind), all of which require many miles of east-west high-voltage transmission lines.

No other energy resource has the same opportunity as wave energy to provide local generation. Currently, the total electric load on the coast of Oregon ranges from 500 to 900 MW.[9] The local load will be the first served by new development.[10]

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[8] Chozas, J. Fernández, H.C. Sørensen and N. E. Helstrup Jensen. (2012) "Economic Benefit of Combining Wave and Wind Power Productions in Day-Ahead Electricity Markets." 4th International Conference on Ocean Energy, Dublin.

[9] Oregon Coastal Loading - Cross-Coast-Range Transmission Lines to Oregon Coast Area, BPA Powerflow Model, Calendar Year 2009, Load Forecast Year 2012.

[10] IEA OES-IA Report on Grid Integration of Wave and Tidal Current Plants, T0331. (March 2011) [Oregon Case Study, pages 136-154]. http://www.ocean-energy-systems.org/library/annex_iii_reports/integrating_wave_and_tidal_current_power_case_studies_through_modelling_and_simulation/