

ENVIRONMENTAL EFFECTS METADATA SURVEY FORM

Name of person updating the form

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Date submitted

May 22, 2013

Project name: Wave Energy Technology – New Zealand Multi-Mode Wave Energy Converter Advancement Project (Oregon)

Planned

In Operation

Completed

Project description:

Project Developer: Northwest Energy Innovations

Technology Developer: Wave Energy Technology – New Zealand

Technology type: Point absorber like WEC (non-axisymmetric)

Resource (wave, tidal): Wave

Project scale (test site, prototype, array, commercial): 1:2 prototype

Installed capacity (MW): 20 kW

Project Website: <http://www.nwenergyinnovations.com/>

Launch Date: September 2010

Additional Description: An object immersed in a wave field is subjected to complex motions – heave (up and down), surge (back and forth) and pitch (a rolling motion). Most devices extract only a small proportion of the total energy of a passing wave. The WET-NZ device is a point absorber that has been designed to extract as much energy as possible from all types of motion. The device is floating but the majority of it is submerged so that as much of it as possible interacts directly with the passing waves. There are three main components:

- The power pod, which contains all the power conversion equipment
- The hull, which is flooded with seawater to add mass to the system
- The float, which pivots about a single axle between the hull and the power pod at the waterline

Because of the mass, the hull does not move vertically to track the wave profile, but can still capture surge and pitch motions. This allows the float to be excited by both vertical and horizontal motions of the waves and to rotate about the pivot, thereby creating relative motion

between the two parts. By opposing this differential movement, work can be done and energy extracted.

The hull is approximately 18 meters long and 3.5 meters wide. Nominal wet mass (flooded) is approximately 50 tonnes and displacement volume is around 95% (i.e. the structure is almost fully immersed – the water line is nominally at the axle center). The float weighs approximately 4 tonnes with a displacement volume of 50%.

Location: The project site is a 1-square nautical mile area at the Northwest National Marine Renewable Energy Center (NNMREC) wave energy test site. It is located offshore of Yaquina Head, Oregon, between Newport (and Yaquina Bay) to the south and Otter Rock (a coastal landmark) to the north. The project site is approximately 1.8 to 2.7 miles offshore, and is closest landward to the Yaquina Head Marine Garden. Water depths at this location are approximately 115 to 180 feet.

The test site is currently in Phase 1 of its development, which involves establishing a mobile berth at which developers like WET-NZ can test and analyze their wave converters. It is a ‘mobile’ testing berth because devices are connected to a nearby floating instrumental buoy, called the Ocean Sentinel, instead of being connected to the electrical grid onshore. In addition to load dissipation, the Ocean Sentinel monitored and recorded performance and environmental data transmitted from the WET-NZ device, which was the first device deployed at the site.

Coordinates (please use Mercator): 44.690°, -124.134°

Process status: Fabrication of a second-generation half-scale device has been funded by the US Department of Energy. The device was tested off the coast of Oregon, US at NNMREC’s wave energy site for six weeks from August to October 2012, after which it was recovered before weather conditions deteriorated and the stormy season set in. Summer metocean conditions at the test site were characterized by moderate swell, morning fog, afternoon sunshine, and sea breeze. Typical wave heights during these months were 0.5 to 3 m with periods of 5 to 11 seconds – ideal for testing.

Licensing information (brief description): The project required authorization from Oregon Department of State Lands (DSL) and the Army Corps of Engineers (ACOE) for device deployment, in addition to National Environmental Policy Act (NEPA) compliance determination from USDOE. The DSL and Corp permits were obtained early August 2012. As both NNMREC and WET-NZ were using federal funding, the DOE prepared an environmental assessment for the project and released it for public consultation (this period closed on 18 July 2012).

There are no local (City of Newport or Lincoln County) biological resource laws or regulation specific to the project site. Appropriate federal regulations include:

- Endangered Species Act (16 U.S.C. 1533(c))
- Migratory Bird Act (16 U.S.C., Section 703, Supp. I, 1989)
- Magnuson-Stevens Fishery Conservation and management Act (16 US.C. § 1801-1884)

- Marine Mammal Protection Act

Appropriate state regulations include:

- Oregon Endangered Species Act (Oregon Revised Statutes [ORS] 496.171 to 496.192 and 498.026)
- Oregon State Water Quality Regulations (OAR 340-41 ODEQ)

Key Environmental issues: The following measures address the impacts of the Proposed Project on biological resources:

- Any WEC device that was tested in other waters prior to shipment to the project site will undergo purging of contained water, cleaning, and drying to prevent the spread of invasive species.
- Umbilical cables will have at least single armor to reduce electromagnetic fields (EMFs).
- The umbilical cable connection on the WEC devices and Ocean Sentinel will be constructed of steel or other metal to discourage chewing, gnawing, or pecking and prevent electrocution by marine life.
- The connection node on the power cable will be filled with biodegradable seed-based oil.
- The Ocean Sentinel will be constructed with National Marine Fisheries Service (NMFS)-approved passive deterrents, such as bull rails and netting, to prevent its use as a marine mammal haulout.
- The Ocean Sentinel will use only TBT-free and copper-free antifouling paints and coatings, and NNMREC will require that all WEC devices to be tested as part of the Proposed Project use only TBT-free antifouling paints and coatings.
- All vessels engaged in activities to suppose the Proposed Project will comply with NMFS marine mammal viewing guides.

Environmental webpage: *link to project official environmental webpage (if available)*

Baseline studies and project effects studies: Wave Energy Technology – Oregon				
General description				
Receptor	Study description including question and/or objective	Design and methods	Results	Status
Nearfield Habitat	Geology and Sediments.	Review of prior studies. Additional sonar scans.	Sediment at the project site similar to much of the Oregon shelf. Predominantly medium-grained sand with little variation. Rocky outcrops are found in some locations, but not at specific project site.	Completed
	Marine	Review of	Marine plants include phytoplankton and	Completed

	Vegetation and Algae.	prior studies.	sessile algae. Bull kelp, <i>Neroeocystis luetkeana</i> , grows subtidally in the area and has special legal status because of its value as a commercial raw material and habitat for protected fish species, but project site water depths preclude bull kelp presence.	
Invertebrates	Zooplankton, Crab Larvae, and Fish Larvae.	Review of prior studies.	Zooplankton dominated by copepods, seasonally distributed. Larvae of Dungeness crab, Cancer magister, are common between January and May. Larvae of Smelts (<i>Osmeridae</i>), English sole (<i>Parophrys vetulus</i>), sandlance (<i>Ammodytes hexapterus</i>), sanddab (<i>Citharichthys sordidus</i>), starry flounder (<i>Platichthys stellatus</i>), and Pacific tomcod (<i>Microgadus proximus</i>) are most abundant between February and July.	Completed
	Benthic Invertebrates.	Review of prior studies. Six sampling stations were located with site and between Newport.	The project site consists of nearly pure sand at 40 m and deeper. The community is dominated by highly mobile organisms adapted to shifting sands. The food web is supported by krill at this location further offshore.	Completed
Fish	Presence of Fish.	Review of prior studies.	English sole, Butter sole, Pacific Sanddab, speckled sanddab, and starry flounder have been observed in sandy bottom areas near the project site. Fish from hard-bottom communities outside project site boundaries may be occasionally found in the site. Pelagic species include Pacific herring, northern anchovy, and Pacific Ocean perch.	Completed
Reptiles	Sea Turtles.	Review of prior studies.	Pacific leatherback sea turtles (<i>Dermochelys coriacea</i>) are common. Green sea turtles and Loggerhead sea turtles (<i>Caretta caretta</i>) have also been known to travel as far north as Alaska.	Completed
Marine Mammals	Presence of Marine Mammals.	Review of prior studies.	Common pinnipeds: Pacific harbor seal (<i>Phoca californianus</i>) and Steller sea lion (<i>Eumetopias jubatus</i>). Common cetaceans: killer whales (<i>Orcinus orca</i>) in April, blue whale (<i>Balaenoptera musculus</i>), finback whale (<i>B. physatus</i>), sie whale (<i>B. borealis</i>), Pacific right whale (<i>Balaena galcialis japonica</i>), Humpback whale (<i>Megaptera novaeanglia</i>), and sperm whale (<i>Physeter catodon</i>).	Completed

Birds	Presence of Marine Birds.	Review of prior studies.	Many birds are seasonally present. Oregon listed threatened species include Western snowy plovers (<i>Charadrius alexandrinus nivosus</i>). Other protected species that may forage near project site include short-tailed albatross (<i>Diomedea albatrus</i>) and marbled murrelet (<i>Brachyramphus marmoratus</i>).	Completed
Reports or Papers	<ul style="list-style-type: none"> • US Department of Energy. (2012). Oregon State University and Northwest National Marine Renewable Energy Center Wave Energy Test Project. (pp. 137). • US Army Corps of Engineers; US Environmental Protection Agency. (2012). Yaquina Bay, Oregon Ocean Dredged Material Disposal Sites Evaluations Study and Environmental Assessment. (pp. 47). 			
Research Projects	N/A			

Monitoring and adaptive management: Wave Energy Technology – Oregon				
General description				
Receptor	Monitoring program description including question and/or objective	Design and methods	Results	Status
Benthic Environment	Benthic Species and Habitat.	Visual Observation and gut analysis to look for changes in: <ul style="list-style-type: none"> • substrate composition; • species composition; • species relative abundance; or • feeding habitats. 	N/A	Underway
Marine Mammals	Prevent pinnipeds haul-out.	Visual observations from surface during all site visits, at least bi-weekly during deployment and grey whale migration season while moorings are in place.	N/A	Underway
Acoustics	Prevent injury from sound pressure levels.	N/A	N/A	Underway
Electromagnetic Fields	Measure any adverse impacts to EMF emissions.	Deployment of an advanced 2nd generation EMF monitoring instrument.	N/A	Underway
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	Environmental Assessment. (pp. 47).
Research Projects	N/A