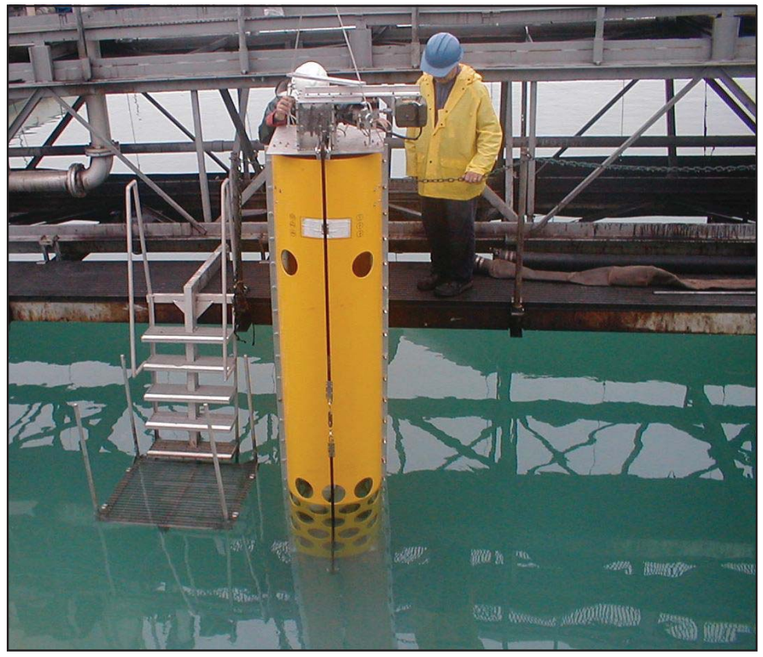
*** Special Show Issue - RETECH 2011, Washington, D.C. ****

Wave Energy Prototype Withstands the Marine Environment

In 2002 Able Technologies, LLC of Englewood, New Jersey received a patent for their design of a wave energy device that can produce clean and renewable energy. After seven years of research and development that included bench-scale modeling, architectural blueprints for siting, and a scale-model built for wave tanks, Stanley and Linda Rutta brought their device to Ohmsett for a week in November 2009 to test in realistic marine environment.

The Electricity Generating Wave Pipe (EGWaP) is a point absorber wave device that is fixed to the bottom of the ocean floor.



The Electricity Generating Wave Pipe (EGWaP) was placed in the water fitted with probes and sensors that measured the energy output of the device. Waves were introduced to determine its ability to produce energy, as well as its ability to withstand the marine environment.

As waves pass over the device, the kinetic energy of the isolated vertical movement of the water is converted to power. This in turn may be converted to electricity.

"It is simple, but elegant. It's a very efficient way to make electricity," said Linda Rutta, President, Able Technologies, LLC.

In the Ohmsett test tank, the 12-foot cylindrical prototype was placed in the water fitted with probes and sensors that measured the energy output of the device. Waves were introduced to determine its ability to produce energy, as well as its ability to withstand the marine environment.

"The tank configuration was perfect and it proved to be a positive experience. It tuned to the waves beautifully and the output performance was very good," said Rutta. "This test was immensely important. It showed us that we can work with models but without the waves, we can not determine how it would perform."

Rutta believes that the tests performed on the Electricity Generating Wave Pipe provided encouraging and very helpful data relating to output and performance. "Now that we have the test and credibility behind us, we look forward to more successes."

Able Technologies, LLC has applied for a small business grant from the Department of Energy, so that they can move forward with the development of the Electricity Generating Wave Pipe. "We need the funding to analyze the data from this test and customize a scale-up version to put into the ocean to see what it will do," said Rutta. "Once the device is commercialized it is a very clean and renewable form of energy."

Oil Spill Response Research & Renewable Energy Facility

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MHK Testing Protocols Being Developed

In an ongoing project between the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) and the Department of Energy's National Renewable Energy Laboratory (NREL), the Ohmsett staff is developing a set of standard operating procedures to provide guidance in the testing and scale-up of Marine Hydrokinetic (MHK) devices. The result will be a detailed set of interim protocols based on existing experience and methodologies previously developed in wind energy conversion device testing at NREL, and marine testing in test tank environments at Ohmsett. Efforts will be made to leverage existing protocols from the European Marine Energy Center, University College Cork, Det Norske Veritas, Germanischer Lloyd and others, as guidance.

Additionally, Ohmsett and NREL will take advantage of the practical knowledge gained from previous and future MHK test projects at the Ohmsett facility. To add to the knowledge base in this effort, Ohmsett has and will continue to consult with personnel from the Applied Physics Laboratory, University of Washington; Stevens Institute of Technology; the Northwest National Marine Renewable Energy Center; and various members of the commercial MHK community.

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Resolute Marine Energy Tests Second-Generation Wave Energy Converter

Resolute Marine Energy, Inc. (RME) returned to Ohmsett the week of June 6, 2011 with a new wave energy converter (WEC) prototype it is developing that captures energy primarily from the surge motion of ocean waves. The SurgeWEC ™ prototype is a bottom-mounted oscillating wave surge converter, which was designed and built with the help of computer modeling tools developed by RME over the past year.

"The very first step for cost effective development of WEC devices is through the use of computerized simulation tools that can predict WEC performance in a variety of operating conditions," explained Bill Staby, CEO of Resolute. "We designed and built the SurgeWEC prototype using this information and brought it to Ohmsett were we could verify our computer models by running a series of experiments using different wave conditions in Ohmsett's controlled testing environment."

The experiments were designed to investigate the effects of several parameters on the SurgeWEC performance. The half-scale prototype was positioned in the Ohmsett test tank near the underwater viewing windows in order to allow the RME team to clearly see the device and better understand how it was reacting to waves. During the test, the team collected data with instrumentation that was attached to the device to measure its perfor-

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A large crane is used to lower the SurgeWEC into the Ohmsett test tank.

Device Proves to be an Absorber of Wave Energy

Resolute Marine Energy, Inc., based in Boston, Mass., designs and builds wave energy converters (WECs) that harvest clean energy from ocean waves. The company came to Ohmsett in February 2010 to conduct experiments to determine certain performance characteristics of a prototype wave energy converter in Ohmsett's test tank.

The prototype WECs Resolute tested at Ohmsett is based on a patent-pending design that, according to Resolute CEO Bill Staby, may generate electricity at low cost and with minimal ecological impact. In preparation for the full week of tests at Ohmsett, RME staff had to design, build, program, and pre-test the sensing and data acquisition system they used to monitor the WEC buoys while being exposed to waves in the tank.

"With the advanced sensing and data acquisition system we built, we can accurately measure the hydrodynamic response of the device in real time and then use the information we've collected to further-optimize the design." Staby said.

During the test run, various WEC buoys were anchored to the bottom of the tank while a series of cables and pulleys transmitted the wave energy absorbed to dynamometers equipped with sensors mounted on the Main Bridge. Various anchoring configurations were also tested. While the wave maker was generating various wave configurations, power generated by the WEC was run through a load bank and certain parameters were viewed and recorded in an Excel database.

"The tests were very successful and they proved that our WEC is an extremely efficient absorber of wave energy," Staby said. "In addition, our work at Ohmsett will allow us to start assembling base-line data that we will use to derive an accurate estimate of the levelised cost of energy we can expect from this WEC. So far, we're optimistic that this particular design can eventually achieve grid parity - i.e. compete with electricity generated by coal- and natural gas-fired plants."

Funded by the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE), formerly MMS, the tests were observed by staff members of BOEMRE, the Department of Energy and the National Renewable Energy Laboratory (NREL) who have partnered to develop test tank protocols for marine hydrokinetic devices.

"Ohmsett is a terrific facility for the types of experiments we needed to conduct," commented Staby. "The wave maker produces lovely sinusoidal waves that are completely undisturbed as they move down the very long tank," said Staby. "The MAR, Inc. crew was attentive to our needs and we never had to waste time looking for particular parts or supplies…everything was right there! We'll definitely be back for more testing."

The Resolute prototype wave energy converter was anchored to the bottom of the Ohmsett wave tank while waves were gernerated in various configurations to determine certain performance characteristics of the device.

Resolute Wave Energy Converter

Continued from page 1

mance. They also used sensors, attached to a custom built strut mounted on the Ohmsett main bridge, which measured wave period and height, as well as water particle motions and turbulence.

"We had a wonderful week and collected all the data we needed. The Ohmsett crew was most helpful in enabling these tests," commented Staby. "We were pleased to have visitors from FERC [Federal Energy Regulatory Commission] and DOE [Department Of Energy] to observe the tests so they could become more familiar with these new renewable energy devices that we hope will be deployed in the near future."

The RME team is in the process of compiling and analyzing the data collected during the Ohmsett tests. According to Staby, the next step will be to conduct ocean trials which he said "will be the ultimate test of the commercial viability of this particular device."

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Wave Energy to Electric Power Technology

Float Incorporated is a small, San Diego-based company working on proprietary technology for the operation of large floating platforms typically moored offshore. The generic Float platform, known as a Pneumatically Stabilized Platform (PSP), is composed of multiple open-bottom cylindrical air buoyancy tanks assembled in a rectangular pattern to form a construction module. Air flow is controlled from cylinder to cylinder through manifolds. This airflow helps reduce the magnitude of wave pressures beneath the structure, providing platform motion stability and acts a mechanism for dissipating wave energy.

The Rho-Cee wave energy converter can potentially convert wave energy into electricity.

Float Incorporated designed a wave energy converter (WEC) for use with a PSP that can potentially convert wave energy into electricity very efficiently. During the first week of December 2009, they conducted a WEC study at Ohmsett. The device, known as the "Rho-Cee," is a large, floating oscillating water column (OWC) system. The design's central principle is that its input impedance (pressure / velocity) matches the characteristic impedance of the targeted waves, to ensure maximum energy capture.

The study in the Ohmsett wave tank, funded by the the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE), formerly MMS, was to verify the impedance-matching basis of the Rho-Cee WEC concept and design, and to reveal any discrepancies between performance expectations and observations so that they may be identified, remedied, and subjected to further testing. It also provided a graphic demonstration of the Rho-Cee WEC performance in wave environments.

With the data collected during this study, Float Incorporated was able to gain new insight allowing further advancement of the concept program.

ECO-Auger™ Tidal Energy Device is Put to the Test

In a small workshop in Juno Beach, Fla., Scott Anderson of Smart Product Innovations (SPI) came up with an idea for an environmentally friendly tidal hydrokinetic system that would convert moving water to usable renewable electric energy - the ECO-Auger™ was born. The device is a bi-directional tapered helical auger that does not have to be in a pipe or shroud to concentrate the flow of water. It is designed to glance off or push the debris aside as it rotates.

After successfully testing the theory with 200 live fingerling trout, Anderson built a two-foot model and looked for a test tank where he could test the modified version and record important data.

Anderson heard about the Ohmsett facility from a company he was working with for the hydraulics on the two-foot prototype. He felt that it would be the perfect venue to test the ECO-Auger™. With the ECO-Auger™ loaded onto a trailer, Anderson headed to New Jersey.

The prototype was tested in the Ohmsett wave tank during the last week in September 2009 to determine the torque or power that the unit will generate from 1.5 to 6.0 knot currents.

"We don't fully understand how much energy this unique design could capture, that's why we came here," said Mr. Anderson. "We are recording hydraulic pressure, speed through the water, and RPM of the auger. It is a very simple test. After this test, I may be back to test an alternate version that generates power."

Eventually he wants to go to a four- or six-foot diameter model for the next series of tests. "The power generated with the ECO-Auger™ increases by the square of its diameter. Can you imagine the power that can be generated with a larger, say 12-foot model?"

The goal is to have 10,000 units along the East coast of the U.S. "As long as there is a tidal current, over 1.5 knots, it can be attached to a boat house, a bridge in an inlet."

Anderson applied for a patent on the ECO-Auger™ in November 2008; the patent is still pending.