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Testimony
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Subcommittee on Water and Power

Hearing on "S. 1419, the Marine and Hydrokinetic Renewable Energy Act of 2013"

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Senator Landrieu and members of the Subcommittee, it is my pleasure and honor to appear before you today to discuss the importance of S. 1419, the Marine and Hydrokinetic Renewable Energy Act of 2013. First, I offer my congratulations to you, Senator Landrieu, for your ascension to committee chair. I also want to thank my Senator from Oregon, Ron Wyden, as well as Senator Murkowski, along with their staffs, for the excellent work on S. 1419 and long time support of efforts to create a marine hydrokinetic (MHK) industry in the United States. Finally, I would also like to express my appreciation for the members of the Department of Energy's Water Power team who are integral to the success of our projects.

I am a professor of Mechanical Engineering at Oregon State University and Director of the Northwest National Marine Renewable Energy Center (NNMREC). Prior to this appointment, I served as the Head of the School of Mechanical, Industrial, and Manufacturing Engineering at Oregon State University. Previous to that, I was the Program Manager for Dynamics and Control at the Air Force Office of Scientific Research. I have served on the US Air Force Scientific Advisory Board, and I currently serve on the board of the Oregon Wave Energy Trust.

The United States is blessed with abundant MHK renewable resources from ocean waves and currents. For the continental United States, the potential MHK resource, dominated primarily by ocean waves, is estimated between 13 and 19 percent of current electricity demand. DOE estimates that Oregon, Washington and California can meet up to twenty percent of their electricity requirements from wave energy convertors, and Alaska and Hawaii can meet nearly all of their power loads from MHK technologies. Clearly, this is a potential renewable energy resource worthy of additional investments by the U.S. Federal Government.

NNMREC is a competitively designated U.S. Department of Energy (DOE) Center with the mission of advancing understanding of MHK technologies. NNMREC, a collaboration between Oregon State University and the University of Washington, was established in 2008 through a competitive DOE Water Power Program Funding Opportunity Announcement. Our programmatic strength derives from our integrated research, development and testing activities, collaborating with private sector industry partners and the national laboratories. NNMREC has historically focused on wave and tidal current energy technologies, and has expanded into off-shore wind. NNMREC serves as a "one stop shop" for technology developers; federal, state and local regulatory and resource agencies; and community stakeholders interested in marine energy. We are developing the workforce for this emerging renewable energy sector, and have placed more than twenty graduates in industrial positions since 2009.

NNMREC has developed world-class test facilities, under the "brand" Pacific Marine Energy Center (PMEC). In 2012, NNMREC established the PMEC North Energy Test Site (PMEC-NETS), a non-grid connected facility in Newport, Oregon, and tested the WET-NZ wave energy converter. With support from DOE and other non-federal sources of cost match, NNMREC is now developing the PMEC South Energy Test Site (PMEC-SETS) to

serve as the United States' utility scale grid connected test facility. At this facility, we will test commercial scale wave energy converters and arrays.

Our faculty and students have also supported scaled wave energy converter testing in our wave tank facilities at OSU's Hinsdale Wave Research Lab, in Puget Sound and in Lake Washington, as well as utility scale tidal current energy projects. Since inception, NNMREC has tested seven different devices in its scaled laboratory facilities at OSU, and three wave energy devices in open water environments. Device developers rely on our testing facilities to prove and advance their technologies.

NNMREC has become globally recognized for research, development and testing in marine renewable energy. Faculty and students collaborate with developers on specific device related projects. To give you a picture of our collaboration with industry, I will focus on one example. In 2004, Greenlight Energy, a wind developer, visited OSU with interest in starting a wave energy company, spring-boarding off licensing OSU's intellectual property. They formed Columbia Power Technologies (CPT), based in Corvallis, Oregon. In 2007, Columbia Power and Oregon State University worked together to develop SeaBeav I, a prototype point absorber wave energy device with a novel direct-drive linear generator. This work was continued in 2008 with Navy and Columbia Power funding, and culminated in the successful ocean testing of the L10 point absorber device. Based on the lessons learned from the successful testing, Columbia Power determined a direct-drive rotary generator design was more appropriate than the linear design for utility scale conversion.

In 2009 Columbia Power tested a 1:33 scale prototype of their new direct-drive rotary system in collaboration with NNMREC researchers in OSU's Tsunami Wave Basin. This effort expanded the next year with the testing of a 1:15 scale device in the OSU's Large Wave Flume, along with 1:33 scale prototype array testing in the Tsunami Wave Basin, one of the first testing of its kind in the US.

In 2011 Columbia Power worked with NNMREC and OSU researchers to develop and successfully test a 1:7 scale prototype in Puget Sound. This 13 month testing was very successful, and Columbia Power is continuing forward with a full-scale design. In addition, Columbia Power and NNMREC have recently developed active mooring control systems to enable flexible and accelerated wave tank testing.

At all points in their research, development and testing, CPT staff have been actively engaged with NNMREC faculty and students. Over the years OSU has provided CPT with several of our graduating students to fill out their engineering staff, and with several undergraduate student interns. The ongoing collaboration has accelerated research and product development toward grid-scale implementation.

Earlier this week CPT announced that the manufacturing order for its power generator has been issued to Siemens Industry; the generator will be utilized in CPT's full-scale power take-off (PTO) test project. The PTO will be tested on the new 5MW dynamometer at the National Renewable Energy Laboratory. This land-based test allows the safe, rapid and economical simulation of the full range of ocean conditions.

Columbia Power Technologies is just one of the private sector technology developers that NNMREC has supported over the five plus years of its existence, and this example demonstrates how the collaboration between NNMREC, the DOE Water Power Program and the National Labs is working to shorten the time and cost to commercialization for U.S. based MHK companies. Unfortunately, technology development is not the only hurdle facing this industry or these private sector companies.

Much of my time during the last year and a half has been devoted to developing PMEC-SETS which will serve as the first US grid connected testing facility for a variety of utility scale wave energy converters and arrays. This facility is being developed to provide the industry with a premier test site in the United States, analogous to the European Marine Energy Center (EMEC) in Orkney, Scotland that has been operational for 10 years. It has been reported that the existence of EMEC contributes $16 million per year to the local economy and supports hundreds of jobs throughout the research and development supply chain. Members of the European Union have spent almost $1 billion over the past ten years on MHK development and have made this technology a priority. By establishing a comparable testing center in the United States, we can grow a MHK industry that will provide new economic opportunities, high wage jobs and a clean energy source to coastal communities.

Through my efforts to develop PMEC-SETS, I see first hand the challenges that the marine renewables industry faces with respect to funding and regulatory processes to advance their technologies. We have been working on permitting activities for PMEC-SETS for over a year, and have spent approximately $500,000. We anticipate spending another $1 – 1.5M and that it will require at least two more years until we have our permits and licenses in hand. All this cost and effort has been expended to establish a non-commercial testing facility for prototype devices. Clearly, something is not working if this is the best we can do as a government to support the private sector in developing new renewable energy technologies.

The reauthorization of the Department of Energy's Water Power Program through S. 1419 is essential to providing the continued funding that this industry needs at this stage of its development. This is particularly true when you keep in mind that funding from the DOE Water Power Program is the one key mechanism to support U.S. technology developers competing against overseas companies that receive a suite of subsidies. The reality is that most MHK companies are not yet in a position to receive the tax benefits enjoyed by more mature conventional and renewable energy technologies. In addition, the regulatory changes proposed in S. 1419 will provide an avenue for promising new MHK companies and their technologies to advance through the necessary testing stages more quickly. This industry requires targeted investments and permitting efficiencies like those that are included in S. 1419.

These investments and permitting efficiencies are essential to developing the MHK energy sector that has the potential to deliver reliable power to our coastal communities with significant, positive economic impact. NNMREC has received over $10M in funds from DOE to date, and another $10M in non-federal matching funds,

mostly from the States of Oregon and Washington. This bill will enable NNMREC to continue to support developers as illustrated in my example with Columbia Power Technologies.

Ocean energy can play a significant role in our nation's renewable energy portfolio. With the right support, the United States' MHK industry can be competitive internationally. I am pleased to offer my support for S. 1419. I ask this committee to consider the measure and positively refer it to the full Senate for its eventual passage. I will be glad to respond to any questions that you may have about NNMREC's activities or the MHK industry.

Thank you.