

Pacific Marine Energy Center
South Energy Test Site (PMEC-SETS)

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February 14-17, 2017

PMEC-SETS: The Northwest National Marine Renewable Energy Center (NNMREC) is developing PMEC-SETS, a grid-connected test facility, to evaluate utility-scale wave energy converter (WEC) performance, environmental interactions, and survivability. Intended to be the first of its kind in the United States, PMEC-SETS will help support the development and deployment of innovative marine and hydrokinetic (MHK) systems that have the potential to be cost competitive with other forms of electricity generation.

The Challenge: Permitting, designing, and planning for a grid-connected, pre-permitted, open-ocean, WEC test facility located on the Outer Continental Shelf has not previously been undertaken in the United States.

Core Partners: **Oregon State University** – overall project management and task execution and oversight; **Pacific Energy Ventures** – direct regulatory strategy development and outreach; **University of Washington** – costing tasks and environmental monitoring.

Nine additional team members come from national labs, industry, and international organizations.

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- Conduct R&D for innovative MHK systems & components
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- Support research focused on retiring or mitigating environmental risks and reducing costs
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- Exchange of data information and expertise

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The Impact

- **TARGET:** P MEC-SETS offered as a fully pre-permitted test facility, with environmental monitoring that will retire risk and reduce cost. Leverage best global deployment practices.
- As a result, the industry will experience reduced costs and time to permits and licenses and incur lower monitoring and deployment costs throughout project life.
- **Project endpoint:** Federal Energy Regulatory Commission (FERC) Draft License Application completed for fully permitted test facility

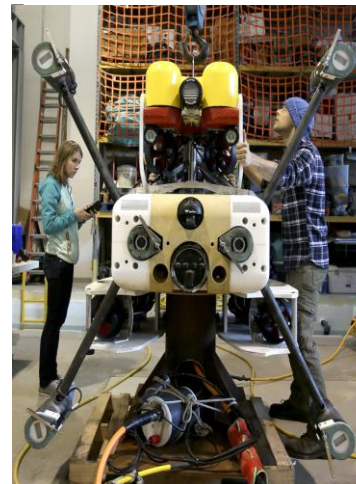


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The Impact

- **TARGET:** develop a robust workforce supporting MHK technologies; develop MHK value chain.
- **Potential Impact:** provide suite of technical contractors and prospective employees to support industry needs for MHK research and development.
- **Project endpoint:** group of informed technical experts to complete P MEC-SETS if project is selected to move forward.

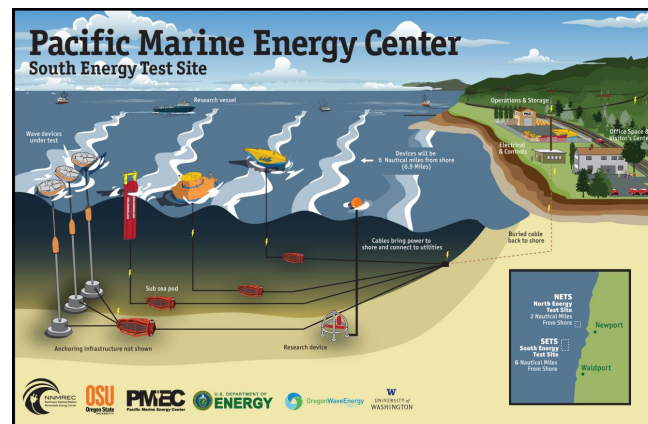


Crosscutting Approaches

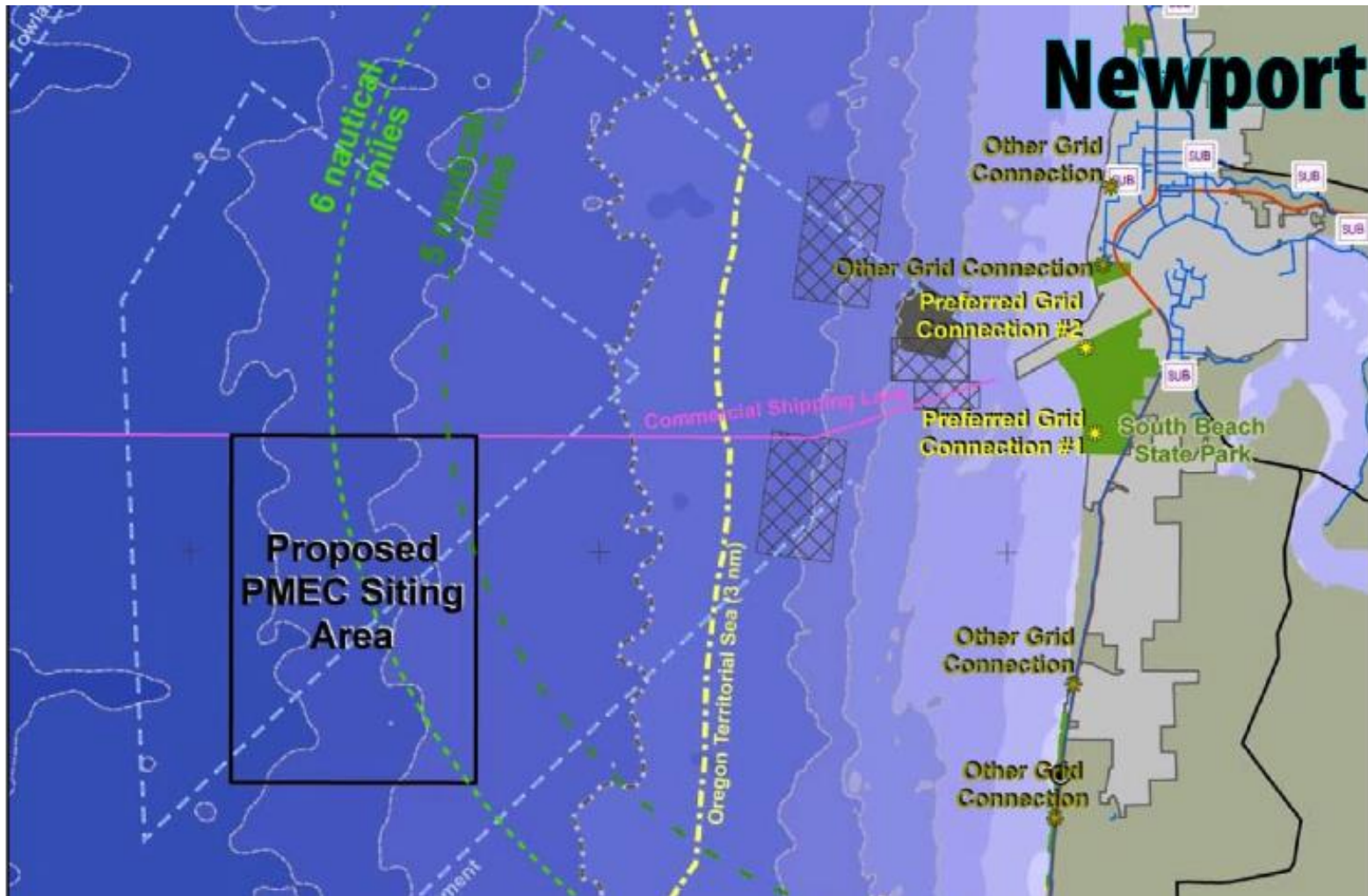
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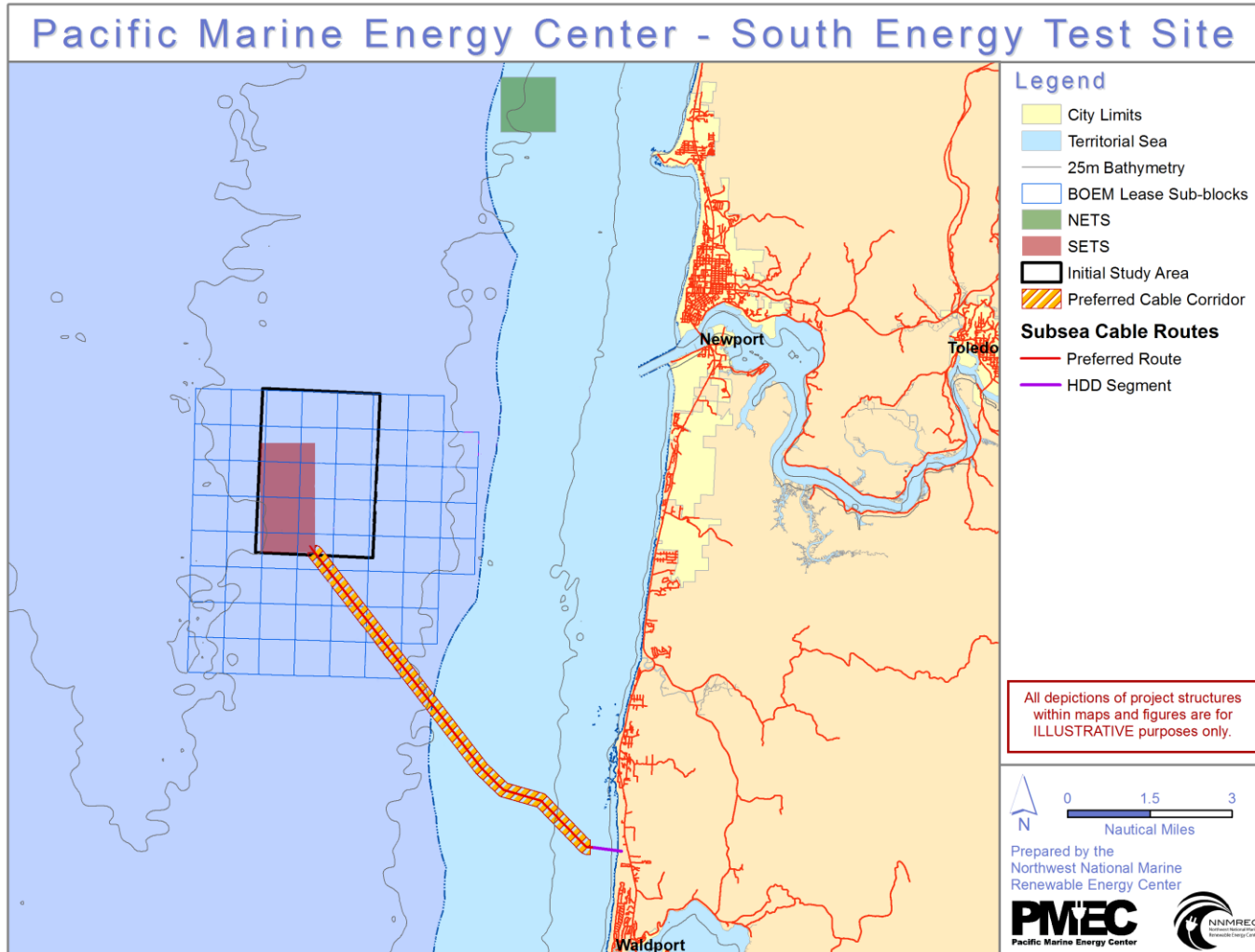
- **TARGET:** teaming with global leaders, develop a grid-connected test facility for up to 20 utility scale WECs, up to 20MW, within four berths.
- **Potential Impact:** provide the only U.S. site for utility-scale WEC array demonstration and development.
- **Project endpoint:** FERC Draft License Application Submitted; All facility predesigns completed.



Our starting point



Our project goal



This project consists of 10 tasks with 23 sub-tasks and 30 milestones/deliverables, requiring multiple technical approaches, which are summarized below:

- Conduct a detailed desktop characterization of the P MEC-SETS ocean study area with site-specific conditions relevant to the ocean facility design
- Assess the logistical infrastructure needs for device testing and availability to accommodate the test article preparation
- Build on its ongoing outreach and permitting efforts to coordinate with agencies and stakeholders through the Collaborative Work Group (CWG) and the regulatory process
- Develop preliminary building design alternatives and identify the preferred alternative
- Conduct a Cable Routing Desktop Study to generate alternative cable routes
- Submit an application for grid interconnection to Bonneville Power Administration, in collaboration with Central Lincoln People's Utility District
- Develop a grid model for connection of P MEC-SETS
- Assess the feasibility of design alternatives for business and operations facilities
- Develop a set of best management practices and protocols for deployment, operations, and removal; post-installation monitoring plans; and adaptive management plans

- Develop comprehensive and actionable preliminary costs and schedule for construction of P MEC-SETS
- Develop potential operations and maintenance plans, cost categories, and operating assumptions
- Assess business models/service models and develop fee structure(s) that would enable full cost recovery
- Work with the regulatory CWG to complete the necessary regulatory filings.
- Conduct a series of surveys at potential terrestrial sites and along the terrestrial cable route to finalize the location of terrestrial project components and nearshore cable routes
- Analyze developments within the Port of Newport and Port of Toledo, and how potential future developments in these and other nearby ports will further strengthen the region's ability to meet the logistics and infrastructure needs of P MEC-SETS
- Provide current information on infrastructure and capabilities of regional ports (e.g. controlling depths, availability and capacity of cranes and travel lifts, distances to P MEC-SETS) that will provide critical support for WEC testing.

2014: Existing Site Conditions – Due to limited existing data, a geophysical marine survey was added to the project scope. This provided critical bathymetric and sub-bottom data for site selection, cable routing, cable design and cost estimates. This work exceeded the technical target.

2015: Final Test Selection – In late 2012, the Newport Community Site Selection Team identified an area they felt would be a suitable and acceptable location for P MEC-SETS. As part of this project, NNMREC worked closely with agencies, stakeholders, industry experts, developers and potential clients in an effort to down select to the final P MEC-SETS location. This input and data from the marine survey allowed NNMREC to down select P MEC-SETS to a 2 nm² area. This work achieved the technical target.

2016: Permitting – Significant progress has been made with this permitting. In April, 2014 NNMREC embarked upon an extensive collaboration with federal and state agencies, and other stakeholders as part of FERC's Alternative Licensing Process. The majority of the engagement has been through the CWG (nine federal agencies, seven state agencies and 10 other stakeholder groups). This effort will culminate in a Draft License Application that is nearing completion and will likely be submitted to FERC in the first quarter of 2017. This achieved the technical target.

Project Dates				
Phase	Planned		Actual	
	Start	End	Start	End
I	03/01/2014	03/01/2015	03/01/2014	06/01/2015
II	12/01/2015	12/31/2016	12/01/2015	06/30/2017

- Phase I schedule and milestones delayed due to:
 - Towlane relocation with final ocean site selection required approval by crabbers and towboat operators at a meeting in March 2015
 - Delays in external contracting
- Phase II schedule and milestones delayed due to:
 - Four-month National Environmental Policy Act hold on some terrestrial surveys
 - Ongoing permitting process
 - Delays to cultural and geophysical surveys
- There were no Go/No-Go decision points for the P MEC-SETS project

Budget History					
FY2014		FY2015		FY2016	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$3.843k	\$0.328k	\$587.156k	\$339.353k	\$862.649k	\$143.030k

- There were no variances from planned budget
- Project budget expended to date = 73.7%
DOE = 71.7%, Cost-share = 77.7%
- No other funding sources

Partners, Subcontractors, and Collaborators:

Partners:	Oregon State University; Pacific Energy Ventures; and University of Washington*
Subcontractors:	3U Technologies; H.T. Harvey & Associates; HDR Engineering; and Stoel Rives.
National Labs:	National Renewable Energy Laboratory* and Sandia National Laboratories*
International:	University College Cork*
Other:	Oregon Wave Energy Trust* and Sustainable Energy Authority Ireland*

*NOTE: * denotes team members who were only involved in Phase I*

Communications and Technology Transfer:

Newport Public Meeting (2014); OR Ocean Policy Advisory Council (2014); PMEC-SETS Scoping Meeting (2 in 2014); Fishermen Involved in Natural Energy (2 in 2014, 2016); Coastal States Organization Members Meeting (2014); International Marine Renewable Energy Conference (2015, 2016); U.S. Department of Energy (2015); OR Land Conservation & Development Commission (2015); Newport City Council (2016); Ocean Renewable Energy Conference XI (2016).

Additional Collaborative Work Group Meetings (5 in 2014, 2 in 2015, 3 in 2016).

FY17/Current research: The P MEC-SETS project was recently granted a no-cost extension through 06/30/2017 to complete the following milestones/deliverables:

- Conduct geophysical surveys
- Finalize locations of terrestrial project infrastructure
- Conduct cultural survey
- Complete FERC Draft License Application

Proposed future research: In September 2016, NNMREC responded to DOE's Funding Opportunity Announcement (FOA) Number: DE-FOA-0001419. The Topic Area of Interest of the FOA was:

“To support the full-scale testing of MHK wave energy devices, the Water Power Program intends to fund a recipient to build and commission an open-water, grid-connected, fully energetic domestic wave test facility.”

If successful, NNMREC will finalize the design and permitting for P MEC-SETS, and then construct and commission the site.