

## Capital Project Stage Gate I: PacWave Energy Test Facility

### BACKGROUND

The PacWave Energy Test Facility (PacWave) project is included in the Ten-Year Capital Forecast and the university has completed the schematic design phase. The following information is provided for consideration by the Finance & Administration Committee to advance this project to the next phase of development, per the [Approval of Capital Projects policy](#).

### PROJECT DESCRIPTION, SCOPE AND PROGRAM

In partnership with the U.S. Department of Energy (DOE), the State of Oregon and other stakeholders, Oregon State University is developing PacWave, a grid-connected, wave energy 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, PacWave will support the development and testing of innovative wave energy systems that have the potential to be cost-competitive with other forms of electricity generation. As the nation's first licensed, grid-connected facility for utility-scale WEC and array testing, PacWave will play an integral role in advancing wave energy from early-stage ocean testing through final demonstration for commercialization, serving as an integrated research center, as well as a training ground for future jobs in the ocean energy industry.

As a grid-connected test facility, PacWave will provide developers of WECs with the opportunity to: optimize WECs and arrays to increase their energy capture; improve their survivability and reliability and decrease their levelized cost of energy; refine deployment, recovery, operations, and maintenance procedures; collect interconnection and grid synchronization data; and gather information about potential environmental effects and economic and social benefits.

As such, the primary purpose of the proposed project is to serve as a facility to allow clients to test full scale WECs, with generation and transmittal of power to the grid being a secondary project purpose. The project has also been designed to specifically support the mission, vision, and goals of the DOE's Office of Energy Efficiency and Renewable Energy Water Power Technologies Office to improve performance, lower costs, and accelerate deployment of innovative technologies for clean, domestic power generation from resources such as waves. Testing conducted at PacWave will advance the development of WEC technologies, and thus further the nation's efforts to reduce its greenhouse gas emissions, diversify its energy supply, provide cost-competitive electricity to key coastal regions, and stimulate revitalization of key sectors of the economy.

The PacWave open ocean test site will be approximately seven miles off the coast to the south of Newport, OR in a location selected by the Newport community and, in particular, by the Fishermen Involved in Natural Energy (FINE) committee. The test site will consist of four individual tests berths over two square nautical miles, each with a separate five-megawatt (MW) subsea cable back to shore. Each berth will be able to accommodate multiple devices for array testing. A fifth power and data cable will supply power to the site for associated environmental monitoring and technology R&D. The total project capacity is 20 MW, with up to 20 devices under test at any one time. PacWave will be licensed by the Federal Energy Regulatory

Commission (FERC) for all currently known device types with an option to amend the license in the future if a new device type is developed.

Power generated at the test site will be transmitted to a cable landing site at Driftwood Beach State Recreation Site in Seal Rock, OR. From there, the power will run to a Utility Connection and Monitoring Facility (UCMF) located on an OSU-owned property on NW Wenger Lane, east of Highway 101 in Seal Rock. At the UCMF, the power will be monitored, conditioned and fed onto the Central Lincoln People’s Utility District distribution system, through which it will power local homes and businesses. Data from the test site will also be monitored, analyzed and disseminated. The UCMF will function as the PacWave data, communications and control center.

The construction and operations of PacWave will be managed by the College of Earth, Ocean, and Atmospheric Sciences (CEOAS). CEOAS has a strong reputation for launching and supporting large infrastructure projects, including the Ocean Observatories Initiative (OOI) and the Regional Class Research Vessel (RCRV) project. CEOAS will build upon its existing collaborations with coastal communities to support the mission of the test facility and advance carbon-free energy technology.

**ESTIMATED TOTAL PROJECT BUDGET, FUNDING AND TIMELINE**

In 2017, OSU was awarded \$35.0M in federal funds from the DOE for design, construction, and operational testing of a full-scale PacWave project, with an expectation of a project budget comprising 80 percent federal and 20 percent non-federal funds. The project was initially estimated by OSU to cost approximately \$50.0M total; however, OSU and the DOE have consistently anticipated that OSU’s development of a detailed design and corresponding budget would result in a need for additional federal funds.

The PacWave team currently estimates the total project costs to be approximately \$82.5M, with cost estimates anticipated to be refined during the design development process. Current estimates for the major cost categories are:

<b>Major Cost Category</b>	<b>Current Cost Estimate</b>	<b>Budget Period</b>
Permitting and Design	\$11.0M	BP1
Construction (UCMF), Cable Procurement and Installation, Monitoring and Construction Phase Operations	\$61.0M	BP2
Accreditation, Testing Phase Operations	\$10.5M	BP3

The PacWave final design and updated cost estimates are currently being evaluated by the DOE. While the final project budget estimate is still being finalized, OSU is currently working with the DOE and Congress to pursue additional funds in the annual federal appropriations process. Additional federal funding is currently being sought for the most significant construction cost — the long-lead procurement of cables — with a waiver of non-federal cost match that considers OSU’s concerns for financial risk and reflects practical limits to OSU’s capacity to secure non-federal funding for infrastructure costs of this nature. The outcome of OSU’s efforts to secure additional appropriated funds is not expected to be final until later this calendar year.

In the meantime, the DOE is working in good faith with OSU to keep advancing the project while the final design, budget, and efforts to secure the necessary additional federal funding are being finalized.

OSU has secured matching funds per the current grant requirements to provide non-federal cost-match as follows:

- State of Oregon: \$5.4M
- Murdock Foundation: \$740,000
- Small Donations: \$10,000
- OSU: \$3.0M - sourced through continued fundraising, possibly from future returned overhead, or university central funds

Fundraising work is ongoing, with engagements with several potential industry partners and other foundations, including the Oregon Community Foundation, the Moore and Allen Foundations, and the Schmidt Ocean Institute.

In addition to the university approval process, this project must undergo the DOE approval and FERC licensing process as well as the budget, design, and land use permitting processes. Budget Period 1 is the design and licensing phase of the project, which began in May 2017 and ends in October 2019. Budget Period 1 includes the technical design review, currently underway by the DOE. Findings from this review will inform the DOE’s go/no-go process, which is required before Budget Period 2 (the construction phase) can be initiated. The go/no-go decision is expected by the end of 2019.

Assuming a positive go/no-go decision and receipt of all the necessary federal and state authorizations, construction of the terrestrial components of PacWave is currently expected to begin in early 2020. The installation of the subsea cables (the final phase of construction), is currently expected to occur in late summer 2021, and PacWave is currently expected to be operational in the fall of 2021 or spring of 2022.

**IDENTIFICATION OF RISKS AND PROPOSED CONTINGENCY**

The following risks have been identified for the project. In consideration of these risk, the contingencies for design, construction, and owner are 9%, 5%, and 10%, respectively.

<b>Risks</b>	<b>Consequences</b>	<b>Mitigation Strategy</b>
<i>Funding</i>	The PacWave team has estimated that the cost of the project will be substantially higher than the current DOE budget of \$40.0M.	The Senate has released its Fiscal Year (FY) 2020 funding bill for DOE that includes a substantial increase for PacWave. However, if DOE and Congress do not or are unable to provide the additional funds, the following options have been provided to DOE: <ul style="list-style-type: none"> <li>• Operate as non-cabled facility</li> </ul>

		<ul style="list-style-type: none"> <li>• Seek additional private or state funding</li> <li>• Sell the property/facility</li> <li>• Delay operations until funding is secured</li> </ul>
<i>Undiscovered conditions</i>	Site work, directional boring and undersea work carry an inherent risk of the actual construction or conditions being different from archived documents or even explorative inspection and testing. Unexpected conditions could present a risk to final cost, schedule, and/or the quality and scope of the project.	The PacWave team has utilized geotechnical investigative boring and sea floor mapping to anticipate actual conditions as best as possible. The contingencies noted above will be in place to cover unexpected costs.
<i>Labor and materials availability</i>	Availability of resources presents risk to cost, schedule, and possible scope.	This risk is mitigated by the contingencies stated above.
<i>Higher than expected construction market escalation</i>	This risk is based on national/regional economics more than labor availability (above), but these risks are similar and interconnected.	This risk is mitigated by an annual escalation factor of 7%.
<i>Project delay</i>	Funding, land use permitting, FERC licensing, logistical, contractual, or any reason for substantial delays in construction present not only schedule vulnerability, but also subject the project to further escalation in materials and labor costs. Stretching the construction period would likely increase the cost for the contractors to manage the project and pay for general logistics (general conditions).	This risk is mitigated by having a team in place that considers critical activities, appropriate timelines, and measures to avoid and accommodate delays.

**TOTAL COST OF OWNERSHIP**

The contract with the DOE is through Budget Period (BP) 3 which includes two years of operations. Cost to design, construct and operate the test facility is included in the budgets of the three BPs. The disposition of ownership and operations of the test facility at the completion of BP3 is not yet established, though it is expected that operations will continue through the 25 year expected lifespan of the facilities.

In any case, whether OSU operates the facility with an extended contract from DOE, in a partnership with a National Lab or other arrangements, the operations, maintenance, and renewal cost will be self-sustaining from test facility revenues sponsored by the DOE.

**RECOMMENDATION**

Staff recommend that the Finance & Administration Committee approve advancing the PacWave Energy Test Facility project to the next phase of design development. We expect to present the project for Stage Gate II review at the January 2020 Finance and Administration Committee meeting, at which time the decision whether or not to proceed to the next phase will have been made and the DOE budget established.