

# EE0007899 – Enabling Cost Effective Electricity from Ocean Waves: PacWave



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# Project Overview

## Project Summary

- PacWave South is an open ocean, fully energetic, utility scale grid-connected facility for testing wave energy capture, conversion, and long-distance transmission of electric power. PacWave South is pre-permitted for most types of Wave Energy Converters and monitoring technology. PacWave South design consists of four offshore test berths, each connected to independent onshore conditioning and monitoring infrastructure via four 5MW-capable subsea cables. PacWave will provide accreditation of power performance, power quality, mechanical load measurements, acoustics, and mooring systems.

## Intended Outcomes

- PacWave is intended to be the final testing step prior to commercialization for utility and/or commercial scale WEC technology.
- Construction is planned to be complete in 2024.
- Full baseline and post-construction monitoring will be complete in 2024.
- PacWave anticipates hosting blue economy, monitoring and mooring study clients in 2024.
- PacWave anticipates providing grid-connected testing capability in 2024 or 2025.

## Project Information

### Principal Investigator(s)

- Burke Hales, OSU, Chief Scientist
- Justin Klure, PEV, Project Manager

### Project Partners/Subs

National Renewable Energy Lab (NREL); European Marine Energy Centre (EMEC); BPA; Central Lincoln PUD; Williwaw Engineering; HDR; HT Harvey; 3U Technologies; Stoel Rives; DEA Engineering; HGE Architects; Jacobs Engineering; The HDD Co.

### Project Status

Ongoing

### Project Duration

- Project Start Date: 1 May 2017
- Project End Date: 31 July 2023 (construction)

### Total Costed (FY19–FY21)

\$15.98M

# Project Objectives: Relevance

## Relevance to Program Goals:

- PacWave will provide one of the most-capable testing facilities in the world, and the only facility of its capacity in the Americas. Primarily by:
  - **Reducing Barriers to Testing**
    - PacWave's pre-permitted status allows developers more direct regulatory approval
    - Oregon's wave climate provides rigorous testing of production capability and seaworthiness.
- PacWave will additionally support:
  - **Foundational R&D** – for mooring systems; acoustic monitoring systems; advanced power conditioning for transmission and grid compatibility; component testing; advanced controls R&D; materials testing.
  - **Tech-specific design & validation** - for power grid-compatibility; PTO optimization; WEC design and testing; WEC IOM; IEC standards development.

# Project Objectives: Approach

## Approach:

- Fully energetic ocean site
- Four, independent berths
- High power transmission capability
- Grid integration
- Pre-permitting of WEC and monitoring technology allows for direct site access and streamlined USDOE NEPA process.
- Detailed site characterization and WEC monitoring
- Partner-supported accreditation

# Project Objectives: Expected Outputs and Intended Outcomes

## Outputs:

- Construction of globally-superior test facility.
- Attainment of accreditation capabilities.

## Outcomes:

- Completion of first full-scale grid-connected WEC testing facility.
- Awarding accreditation to WEC developers.
- Demonstration of feasibility of WEC production of municipal scale power.

## FY 2019

Submission of draft license applications.

Submission of full Technical Design Review to WPTO.

## FY 2020

Final license/lease submissions

Underground construction contracts awarded.

Underground construction start.

Cable design-build RFP developed.

## FY 2021

Cable RFP released.

Permitting lessons-learned document completed; near-publication mid-FY22.

Seaward underground construction complete early FY22.

Underground construction complete and Park restored, mid-FY22

# Project Budget

Total Project Budget – Award Information		
DOE	Cost-share	Total
\$64,000K	\$12,500k	\$75,500K

FY19	FY20	FY21	Total Actual Costs FY19–FY21
<b>Costed</b>	<b>Costed</b>	<b>Costed</b>	<b>Total Costed</b>
\$5,279K	\$3,412K	\$7.294K	\$15,985K

- Original project was modified with \$26M federal allocation in FY20
- Extension of BP2 to 31 July 2023 added ~\$3M.
- Project budget was based on preliminary information. Capability increases, design improvements, inflation, raw materials price increases, global instability, regional market restrictions have caused budget growth.
- Significant contribution (~\$7M) to cost match from State of Oregon; Murdock Foundation, private donors, in addition to OSU match.

# End-User Engagement and Dissemination

- FOA 2080 and 2415 engagement
  - PacWave will work with DOE awardees to ensure successful testing campaigns. Several industry/academic clients selected for in-water work at PacWave
  - Continued outreach and engagement with local stakeholders and agencies
  - OSU follows strict policy regarding DEI in contracting and procurement procedures.
- Results of survey/monitoring work publicly available. As-built documentation will be made available publicly.
- Permitting lessons-learned document nearing publication



# Performance: Accomplishments and Progress

- Completion of permitting process
  - First-ever licensing of a WEC test facility in N American waters
  - Successful interagency collaborative process
- Completion of underground construction
  - Four world-record length beach-landing HDD bore and conduit constructed.
  - Terrestrial HDD bore completed under sensitive wetland.
- Identification of cable procurement and installation pathway.

# Future Work

- Cable Procurement and Installation (P&I)
  - Working to secure design-build partner for P&I. Summer of '22
  - Final marine survey in late '22/early '23
  - Cable order planned for '22
- Utility Connection and Monitoring Facility
  - RFP to be released summer of '22.
  - Planned construction start in late '22/early '23
- Operations (BP3)
  - Organizational/business model under development
  - Need to secure operation funds

# Q&A