CalWave xWave Pilot at PacWave

DE-EE0009952

Non-Commercially Sensitive Project Report

Deliverable D7.0.1

CalWave Power Technologies Inc.

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Note: For simplicity, in this document CalWave Power Technologies Inc. is further referred to as CalWave.

1. INTRODUCTION & BP1 OVERVIEW

This report was generated during the Budget Period 1 of the DOE-EERE 'Advancing CalWave's WEC Design for PacWave' grant with project number DE-EE0008951.

The scope of this project is the detailed design, construction, and deployment of CalWave's next-generation submerged pressure differential wave energy converter (WEC), specifically for a two-year deployment at the PacWave South test site.

By completion of BP 1, the following milestones and achievements have been reached:

FULL SYSTEM & CONTROLS CO-OPTIMIZATION:

- Applied advanced optimization techniques to optimize the entire system, including the power take-off (PTO), wave energy converter (WEC), and mooring system, to maximize energy capture and minimize costs.
- Developed and implemented control strategies that adapt to changing wave conditions to improve performance and extend system life.

DATA-DRIVEN/ADAPTIVE CONTROLS:

- Implemented data-driven and adaptive control algorithms that can learn from operational data and adjust control parameters to optimize performance and system survival and extreme conditions.
- Developed self-tuning control systems that can automatically adjust critical performance and operational parameters based on changes in the wave environment or system conditions.

DETAILED PTO, WEC, AND MOORING DESIGN:

- Designed and optimized the PTO system, including the generator, gearbox, and hydraulic or electrical components, to maximize energy capture and efficiency.
- Developed detailed designs for the WEC structure, including the hull, floaters, and mooring system, to withstand harsh offshore conditions and ready for fabrication.
- Ensured installability, maintainability and insurability of all components and subsystems as well as operations throughout the lifecycle of the wave system

IEC/IEEE CONFORMITY ACHIEVED AND ACCREDITED TESTING PLANNED:

- Ensured that the design and construction of the WEC system complies with international standards and guidelines, such as those set by the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE).
- Conducted independent verification and certification of the system to demonstrate compliance with these standards.

2. COMMERCIALIZATION PLANNING

CalWave has followed a variety of partner and customer leads, yielding a large project pipeline and strong prospects for widespread commercialization of the technology post validation at PacWave. Progress at PacWave has been presented at conferences including, but not limited to:

- NREL Growth Forum — April 2022, Denver, CO
- EDF Pulse Awards — March 2023, Paris, France
- MIT Energy Conference — April 2023, Boston, MA
- Demonstrate Deploy Decarbonize 2023 — June 2023, Boston, MA
- Ocean Energy Europe — October 2023, The Hague, Netherlands
- Greentown Labs Climate Tech Summit — November 2023, Houston, TX
- Marine Renewables Canada — December 2023, Ottawa, ON
- Yuquot Regulatory Workshop — February 2024, Victoria, BC
- Waterpower Week 24 — March 2024, Washington, DC

CalWave has announced a few press releases related to commercialization of the technology enabled by the PacWave project:

- CalWave and Launch Alaska sign MOU to advance planning of wave energy projects (April 27, 2022)
- California enacts landmark wave energy legislation (October 18, 2023)
- CalWave selected as technology provider for wave energy project in British Columbia (March 26, 2024)

External entities have also covered CalWave and the team's progress toward the PacWave project and beyond:

- MCJ Collective: Startup Series: CalWave (July 14, 2022)
- Third Derivative: D3 Announces Its First Cohort of 2023 (January 24, 2023)
- White House: Ocean Climate Action Plan (March 2023)
- KQED: California Needs Renewable Energy. Could We Harness the Power of the Ocean? (August 3, 2023)
- UBS advisor podcasts: Green shoots with The Arbor Group (November 15, 2023)
- NBC San Diego: Could ocean waves be a source of energy? A Senate Bill will require a closer look at that (December 13, 2023)
- CBC Vancouver: B.C. First Nation hopes to revive village through wave energy plan

3. PLANS FOR BUDGET PERIOD 2:

The goal for Budget Period 2 is to install and operate the pilot unit at PacWave South connected to the local grid.

Steps conducted to achieve this goal is to complete fabrication of the WEC hull, outfit the system with PTO, electrical and SCADA equipment, and tow the device to site. At site, the device will be connected to

pre-installed anchors and a dynamic umbilical will be connected to the PacWave export cable before commencing operations.

During operations, data from the deployed system will be collected to validate the annual energy output predictions as well as for general WEC operational optimization. An NREL MODAQ system will be installed on the WEC for data collection according to IEC 62600 Technical Specifications.