Sandia National Laboratories

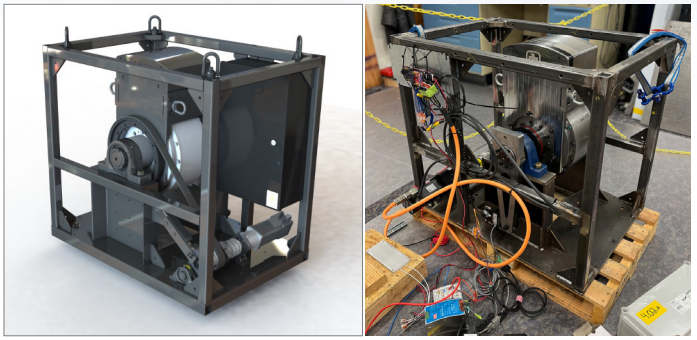
Pioneer Wave Energy Converter (WEC)



The Pioneer Wave Energy Converter (WEC) is a groundbreaking project developed by Sandia National Laboratories to enhance the power supply for the Ocean Observatories Initiative (OOI) Pioneer Array. This innovative bolt-on WEC is designed to provide reliable energy to oceanographic sensors and data telemetry systems, ensuring continuous operation in challenging marine environments.

Key Features:

- **Design and Development:** The WEC was developed through a collaborative effort between Sandia's Hydrodynamic Energy Systems Department and the OOI, with a focus on the creation of a fully enclosed system that minimizes mechanical failure risks and potential ecological impacts.
- **Pitch Resonator Technology:** The WEC features a novel pitch resonator design that harnesses energy from the buoy's natural pitching and rolling motion, ensuring consistent power generation.
- **Integration:** The WEC is designed for plug-and-play installation, allowing for seamless integration with existing Coastal Surface Mooring (CSM) infrastructure without the need for extensive re-engineering.



The left image showcases an initial concept drawing of the Pioneer WEC, while the right image depicts the actual fully constructed and operational WEC that is now powering oceanographic sensors.

Deployment Success:

- **Prototype Installation:** The WEC v1 prototype was constructed at Sandia's New Mexico site and successfully deployed 50 nautical miles off the coast of North Carolina in November 2025.
- **Performance Metrics:** Initial data from the deployment indicates a median power output of 10.2 watts, with an impressive operational uptime of 99% during the first six weeks. This performance validates Sandia's numerical models and demonstrates the WEC's potential as a stable power source for oceanographic research.



OOI Coastal Surface Mooring, with the Sandia-designed Pioneer WEC installed, deployed off the coast of North Carolina as a part of the NSF-funded OOI Pioneer Array. (Credit: Taylor Mankle and Joshua Bauer, National Laboratory of the Rockies)

Future Developments:

- **Next Steps:** The data collected from the v1 prototype will inform the development of a second version (v2), targeted for deployment in 2027. The v2 aims to improve power output by 1.5 to 2 times, enhance longevity, and reduce component costs.
- **Broader Applications:** The WEC technology has the potential to revolutionize energy supply for remote oceanographic systems, improving data collection and operational efficiency while reducing maintenance costs.

Project Team:

The project is led by Sandia's Hydrodynamic Energy Systems Department, with contributions from various departments within Sandia and external collaborators, including the Woods Hole Oceanographic Institution, Johns Hopkins University, Virginia Tech University, and East Carolina University.

Contact Information:

Giorgio Bacelli
Technical Contact
Email: gbacell@sandia.gov

Peter Kobos
Project Manager
Email: phkobos@sandia.gov

U.S. DEPARTMENT of ENERGY | NNSA National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. SAND2026-17208M

Sandia National Laboratories