

# NREL's Water Power Software Makes a Splash

Highlights in  
Research and Development

Open-source software provides essential modeling and simulation help in water power research and development.

Researchers at the National Renewable Energy Laboratory's (NREL) National Wind Technology Center are continuing their work on the Wave Energy Converter SIMulator (WEC-Sim), a free, open-source software modeling tool being jointly developed by NREL and Sandia National Laboratories. WEC-Sim promises to help level the playing field in the wave energy converter (WEC) industry.

WEC-Sim allows users to simulate the power performance, dynamics, and other aspects of WEC devices that transform the kinetic energy from waves into electricity. WEC devices have the potential to produce an enormous amount of electricity from one of our nation's largest renewable energy resources—its oceans and rivers. The Electric Power Research Institute report *The Mapping and Assessment of the United States Ocean Wave Energy Resource* estimates that more than 1,000 terawatts of electricity could be generated from U.S. wave resources.

Modeling, design, and simulation tools are essential to the successful development of WECs. However, commercial WEC modeling software tools are closed source; as such, the source code cannot be modified for device-specific modeling needs. In contrast, WEC-Sim is a free, open-source modeling tool that is flexible enough to be modified to meet the rapidly evolving needs of the WEC industry. It models the power generation performance and dynamic loads of WEC designs and supports the development of new WEC devices by optimizing designs to minimize cost of energy.

Even though it is still in development, WEC-Sim's capability has already been demonstrated. In 2014, NREL researchers used WEC-Sim—in conjunction with NREL's FAST modeling software—in the Competition on Hydrodynamic Modeling of a Rigid Body held at the 33rd International Conference on Ocean, Offshore and Arctic Engineering. NREL researchers performed very well in relation to competitors; the full results will be released in June 2015.

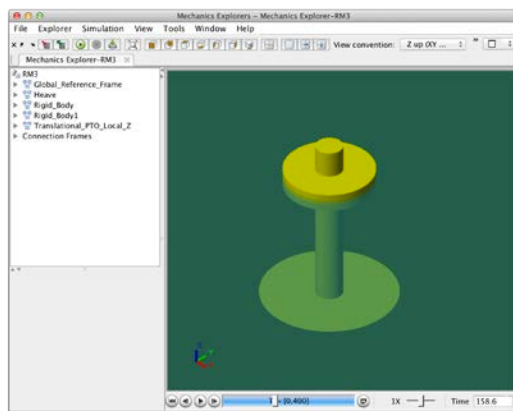
Version 1.1 of WEC-Sim was released in April 2015.

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**References:** EPRI (2011). *Mapping and Assessment of the United States Ocean Wave Energy Resource*. Palo Alto, CA: Electric Power Research Institute. Accessed May 15, 2015: <http://energy.gov/sites/prod/files/2013/12/15/mappingandassessment.pdf>.

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The WEC-Sim simulation environment showing the simulation of a point absorber WEC device. Image by Michael Lawson, NREL

## Key Research Results

### Achievement

NREL researchers have created software that can simulate wave energy converter devices.

### Key Result

The NREL software, WEC-Sim, outperformed others in a water power device modeling competition.

### Potential Impact

By providing high-quality simulations, WEC-Sim may help the nascent marine and hydrokinetic device industry innovate better designs in less time and at lower cost.

**NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.**

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