Harnessing The Waves

By John Kosowatz

Image: NREL

The development and rapid deployment of wind and solar energy systems hinges on costs. Decarbonization goals have accelerated as generating costs have dropped, leading to their surge as replacement for fossil-fueled generating stations. One renewable source lags behind: wave energy.

The potential is great as about half of the U.S. population lives within 50 miles of shoreline. But a major challenge to the technology is costs. The National Renewable Energy Laboratory points out that wave energy converters must be designed to be robust enough to withstand large wave loads and difficult seas. Structural costs account for 35 percent to 50 percent of their overall cost.

NREL engineers have developed a new design to reduce structural costs and perhaps quicken their competitiveness. The design is based on variable-geometry components to change their shape, allowing structural loads to be controlled.

Image: NREL

Introducing variable geometry into wave energy designs would add a second control to the system, according to NREL, similar to a wind turbine's blade pitch control. More control would allow the system to be adjusted in a variety of sea conditions.

The conceptual design looks like a series of panels fitted to a foundation. Variability comes from each panel's ability to open and close, the degree depending on sea state, providing ability to control its hydrodynamics. Initial studies looked at rigid pieces that could be opened and closed with mechanical actuators and flexible bags filled with air or water that could inflate or deflate depending on conditions.

NREL also is collaborating with the University of Massachusetts at Amherst on an oscillating surge wave energy converter placed on a raised foundation. NREL believes advances in large-scale additive manufacturing may dramatically reduce the cost of sub-sea foundations.

Here is a look at the EcoWave system that turns ocean and sea waves into electricity.

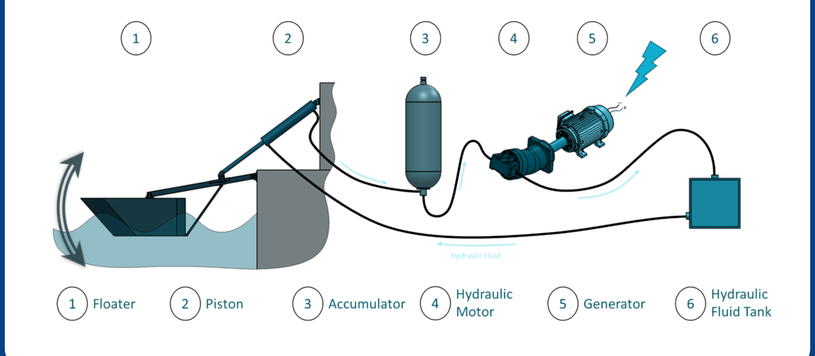

Image: EcoWave

A handful of wave energy projects are operating or being built around the globe. Israel-based Eco Wave Power will build a wave energy project of up to 2 MW for Port Adriano, Spain. Its system uses a series of floaters that compress and decompress hydraulic pistons that transmit hydraulic fluid to accumulators. Pressure is built in the accumulators and rotates a hydraulic motor, and then the generator. After decompression, the fluid flows back into a tank and is reused by the pistons. The system produces electricity from wave heights of 0.5 meters, according to the company.