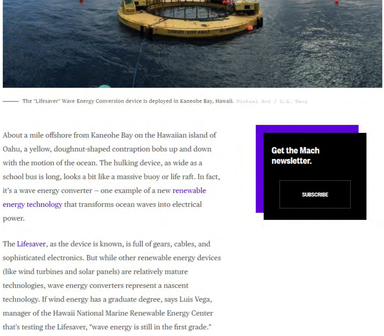
ENVIRONMENT

Why wave power may be the next big thing in green energy

Unlike wind and solar energy, waves are easily forecasted and available 24/7.

by Joseph Bennington-Castro / Nov.24.2017 / 8:38 PM ET



The "Lifesaver" Wave Energy Conversion device is deployed in Kaneohe Bay, Hawaii. Michael Ard / U.S. Navy

About a mile offshore from Kaneohe Bay on the Hawaiian island of Oahu, a yellow, doughnut-shaped contraption bobs up and down with the motion of the ocean. The hulking device, as wide as a school bus is long, looks a bit like a massive buoy or life raft. In fact, it's a wave energy converter – one example of a new renewable energy technology that transforms ocean waves into electrical power.

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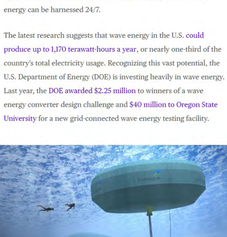
The Lifesaver, as the device is known, is full of gears, cables, and sophisticated electronics. But while other renewable energy devices (like wind turbines and solar panels) are relatively mature technologies, wave energy converters represent a nascent technology. If wind energy has a graduate degree, says Luis Vega, manager of the Hawaii National Marine Renewable Energy Center that's testing the Lifesaver, "wave energy is still in the first grade."

But Vega and other experts see big things for wave energy. If they're right, arrays of wave energy converters moored along coastal regions of the U.S. will be providing power to millions of homes in coming decades.

A THOUSAND VARIATIONS

What these devices will look like – and exactly how they will work – is anybody's guess. The Lifesaver has an onboard electrical generator driven by the up and down motion of cables that stretch from the bottom of the device to the ocean floor.

Other converters resemble large snakes and harness wave energy via hydraulic systems activated by the movement of jointed segments; still others resemble giant underwater metallic balloons and feature pumps that pressurize seawater to power a hydroelectric turbine back on shore. Some operate close to shore and are visible from land, while others operate in deeper waters.



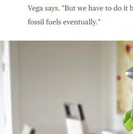
There are more than a thousand different wave converter designs, says Reza Alam, a wave energy researcher at the University of California, Berkeley. Adds Ted Brekken, an energy systems researcher at Oregon State University, "The simple fact is that we're not at a point yet where there's a dominant technological paradigm. It may be that there might not be one."

One thing is clear: Wave energy is a vast, untapped resource that could help reduce our reliance on fossil fuels.

KEY ADVANTAGES

Like solar and wind power, wave power harnesses energy that comes ultimately from the sun. Solar radiation causes air pressure gradients that cause wind, and wind gives its momentum to the ocean surface, producing waves. As Alam puts it, "Wave power is a very dense form of solar power."

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Just how dense? Every square meter of a solar panel receives 0.2 to 0.3 kilowatts of solar energy, Alam says, and every square meter of a wind tower absorbs 2 to 3 kilowatts. Every meter of the California coast receives 30 kilowatts of wave energy.

Wave energy has another advantage over solar and wind. Waves are easy to forecast, Brekken says. And unlike solar, which works only in daylight hours, wave energy can be harnessed 24/7.

The latest research suggests that wave energy in the U.S. could produce up to 1,170 terawatt-hours a year, or nearly one-third of the country's total electricity usage. Recognizing this vast potential, the U.S. Department of Energy (DOE) is investing heavily in wave energy. Last year, the DOE awarded $2.25 million to winners of a wave energy converter design challenge and $40 million to Oregon State University for a new grid-connected wave energy testing facility.

Carnegie's CETO technology captures the up and down movement of buoy to drive a pump which delivers high pressure water to drive an onshore hydro electric turbine . Carnegie Clean Energy

HURDLES ABOUND

Brekken offers a cautious assessment of the real-world potential of wave energy, predicting that it will ultimately contribute about 6 percent of the nation's total electricity production (similar to hydropower).

Such caution stems, in part, from the many engineering hurdles that must be overcome before wave power becomes viable. The marine environment, with all the water, high winds, and violent waves, is tough on even the most robust devices. And deploying and testing wave converters requires vessels and divers, which only add to the cost of deploying the devices.

Given these and other challenges, it may take a decade to develop converters that marry efficiency and economy. "It just depends on how much funding we can put into [developing the technology]," Vega says. "But we have to do it because we are going to run out of fossil fuels eventually."



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