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Tapping tidal energy: the wave of the future

By Sandi Doughton

Seattle Times science reporter

The future of clean power in the Northwest may look like the 75-foot-tall yellow buoy now bobbing like a cork in the waves off the Oregon coast.

Or maybe it will more closely resemble a gargantuan red snake, riding the swells and capturing their energy. It might even take the form of underwater sails rigged to tap the power of the tides.

Each design is a horse in the race to wring kilowatts from the restless motion of the sea — and make money doing it. Several of the contenders will be tested in the waters off Washington and Oregon in the coming months and years, as inventors and entrepreneurs jockey for dominance in a field so new some compare it to aviation in the era of the Wright brothers.

"It's the Kitty Hawk days for tidal energy," said Craig Collar, of the Snohomish County Public Utility District, which already has permits for trial runs in several Puget Sound straits famed for their rushing tides.

Technologies to harness the up-and-down rhythm of waves are equally nascent.

Over Labor Day weekend, a Canadian company deployed the first wave-energy buoy on the West Coast, anchoring it about 2 ½ miles off Newport,



FINAVERA RENEWABLES INC.

Finavera Renewables' wave-energy converter is lowered into water at the Port of Newport in Oregon. The system uses the heaving motion of the ocean to drive a piston and force seawater through a turbine.

Information

Pelamis: www.oceanpd.com/default.html

Finavera Renewables: www.finavera.com

OSU wave-energy program: <http://eecs.oregonstate.edu/wesrf>

Tidal Sails: www.tidalsails.com/businessidea.html

Ore. Researchers from Oregon State University plan to deploy a different type of buoy in the same part of the Pacific Ocean this week.

The Corvallis-based college, already the country's top academic center for wave-power research, also is building a national wave-energy research and demonstration facility off the coast and an indoor lab to simulate ocean conditions.

Companies that use the demonstration facility will be able to deploy their devices in ocean "berths" equipped with moorings and instruments to measure power output and collect other data, said OSU engineering professor Annette von Jouanne.

"We want to advance wave-energy technology, encourage companies to demonstrate their devices and ... promote Oregon as an optimal location," she said.

There's little doubt the Northwest is prime territory for hydrokinetics — the newest twist on hydropower. Snohomish County estimates tides in the seven Puget Sound sites the utility is studying could generate enough power for 70,000 homes.

Energy from the ocean could provide up to 10 percent of the nation's electricity, according to an analysis by the Electric Power Research Institute.

Winds that blow from the west and the vast expanse of the Pacific Ocean create some of the world's best conditions for ocean power off the West Coast, said von Jouanne. Waves big enough to generate power occur 80 percent to 90 percent of the time. Most wind farms can crank out power less than half the time.

The Northwest also offers a potential market, with both Oregon and Washington requiring utilities to add clean, renewable power to reduce greenhouse-gas emissions.

But potential won't become reality until the technologies mature, von Jouanne said.

"Wave energy is starting off where wind energy started about 20 years ago," she said.

Early wind-turbine designs ranged from giant eggbeaters to blades that pointed straight up, before studies endorsed the three-blade versions most common now.

Similarly, ocean-power systems now come in a staggering array of shapes, sizes and configurations.

Collar, who just visited several European companies, estimates about 40 different systems are on the shelf or under development for tidal-energy conversion. Most are essentially underwater windmills, but one version has fins that flap like a tuna's. A Norwegian group is promoting the underwater-sail system.

"I've been wondering how the heck those things work," Collar said.

The wave-power buoy deployed last month off Newport by Finavera Renewables uses the heaving motion of the ocean to drive a piston and force seawater through a turbine, said Kevin Banister, vice president of development.

The test buoy will be in the water until the end of October, gathering data on the system's efficiency.

In cooperation with the Makah Nation, Finavera also hopes to put four buoys in a bay on Washington's northwest corner by 2009 — and begin generating power shortly thereafter.

"We think our design is simple and easy to maintain," Banister said. "But clearly people with other approaches think those are the right way to go."

A Scottish company plans to deploy an array of its snakelike Pelamis wave-energy converters off the coast of Portugal this year. Each 12-foot-in-diameter, 500-foot-long unit is made up of articulated pontoons that drive hydraulic motors as they move up and down.

The buoy that von Jouanne and her students will test this month takes a completely different approach. The outer shell of the buoy is equipped with magnets. A metal coil inside is held stationary by a tether to the bottom. As the magnets bob up and down with the waves, they induce an electrical current in the coil. It's a simple system with few parts to break or fix — which is key for buoys that would have to function in harsh ocean conditions.

"I'm constantly surprised by how many ideas there are," Banister said. "There will be some sorting over the next few years and the better ideas — this is a bad pun — will float to the surface."

In the meantime, competing companies are keeping the details of their designs under wraps. Collar, the Snohomish utility official, had to sign secrecy agreements at every stop on his European tour.

Whatever technology wins out, von Jouanne said the first "wave parks" will probably be located one to three miles offshore. Power would be delivered to shore via cables on the sea floor. Von Jouanne estimates it would take an array of buoys spread over a few square miles to generate 50 megawatts, enough to power about 30,000 homes.

Faced with a flood of interest and varied designs, regulators are scrambling to prepare rules for ocean-power pilot projects. The Federal Energy Regulatory Commission has received nearly 20 applications for test permits in Washington and Oregon. The agency hosted a conference in Portland last week on a plan to speed up reviews.

OSU also is convening a meeting this month to discuss the environmental impacts of wave parks — another area where many questions must be answered before any aquatic power plants go into operation, von Jouanne said.

"We have to make sure all the concerns are on the table, so we can move forward in a responsible way."

Sandi Doughton: 206-464-2491 or sdoughton@seattletimes.com

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