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Going deep: Ocean to power grid, recharge fuel cells

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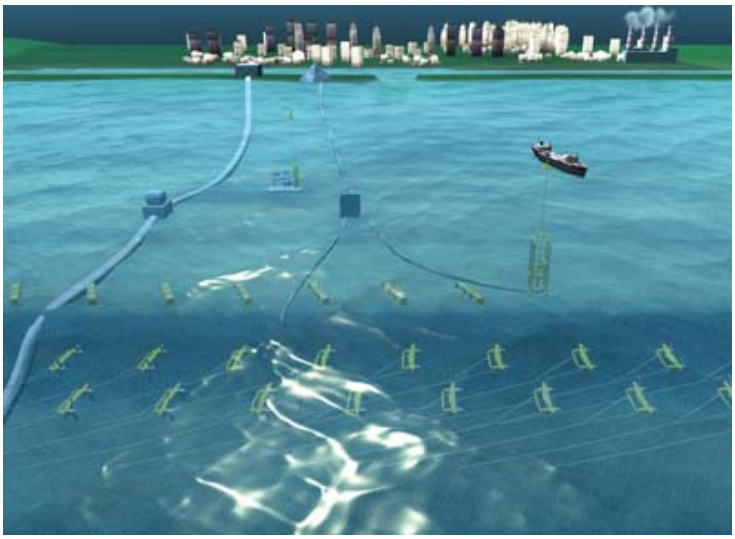
PORTLAND, Ore. — Harnessing ocean power to generate electricity, hydrogen to fuel cars and heat exchangers to cool buildings is the aim of a $13.75 million effort at Florida Atlantic University's Center for Ocean Energy Technology.

The Center has already built a fleet of acoustic doppler current-profiler platforms to be anchored later this year off Florida's Atlantic coast. By 2009, the Center hopes to have permanent mooring sites picked for underwater adaptations of wind turbines. The ocean turbines would be mated to on-shore hydrogen storage facilities that could recharge fuel cells and generate electricity. The moorings will also house pumping facilities to pipe frigid deep ocean water coming from the Arctic Circle into buildings' heat exchangers for cooling.

"The Gulf Stream works 365 days a year, allowing electricity generated from its current to be available 24/7, compared with solar or wind resources. Plus there is a the possibility of using the thermal difference between the warm waters nearer the surface, and the very cold water at the bottom which comes from the Arctic Circle," said Sue Skemp, COET's executive director.



Artist's rendering shows ocean energy scheme off Florida's Atlantic coast designed to generate electricity, hydrogen and cooling.

The Center's original $5 million seed funding came from the Florida Technology, Research and Scholarship Board. Earlier this year, the Florida legislature selected COET to collaborate with four other Florida universities in the Florida Energy Systems Consortium.

Greater resources are being committed to harnessing ocean power. The Energy Department recently revived funding for ocean power research, and is seeking proposals for assessing the potential of harnessing ocean power. Contracts are

expected to be awarded by 2009.

COET has also signed agreements with Heriot-Watt University (Edinburgh, Scotland) and the University Edinburgh to collaborate on ocean energy research.

Ocean turbines would be installed where currents are naturally funneled in areas like underwater canyons or between underwater mountains. By redesigning wind turbines, the Center hopes to stimulate their adaptation for use in ocean currents. According to Skemp, the ocean is full of geological features capable of generating electricity from ocean currents.

"There are a number of sites around the world where extracting energy from the ocean current is potentially viable," said Skemp. For instance, "about 20 percent of the Gulf Stream is entrained between the Florida coast and the Bahamas. There, the topography of the ocean shelf acts like a funnel, guiding the current."

Added Skemp: "We are taking a systems approach--not just what is funded, but looking at the bigger picture." That includes "research that needs to be pursued both in the power plant system but also in the environment and the ecology and the resource itself, the Gulf Stream."

Because the electricity generated by ocean floor turbines will be produced at a relatively constant rate, the Florida Energy Systems Consortium will also evaluate methods for storing energy generated at night as hydrogen. It will use electrolysis to split water into hydrogen and oxygen. The hydrogen could then be used to recharge auto fuel cells as well as to generate electricity for the grid during times of peak energy demand.

The project will also seek to harvest chilly waters at the bottom of the Gulf Stream, similar to a project already underway in Hawaii, Skemp said. Electrical generators in Hawaii currently harness geothermal gradients inside lava tubes. Researchers there also have experience piping cold water ashore from the ocean depths for use in heat exchangers used to cool buildings.

The first Florida project starting later this summer, will establish temporary moorings 13 to 15 miles offshore for acoustic doppler current-profilers used to evaluate how much the Gulf Stream wanders. The fleet of acoustic sensors will evaluate specific sites for energy-generation potential, as well as to catalog the local ecology and evaluate the environmental impact of an underwater power plant.

The U.S. Minerals Management Service is expected to grant leases for offshore sites near Fort Lauderdale later this summer. The current-profiler platforms are expected to begin delivering data about the suitability of specific sites for permanent moorings by the end of 2008.

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