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Generating renewable energy from ocean and river currents

A device designed to capture and convert energy from ocean and river currents has been developed to provide a source of clean and renewable energy. The designers suggest that energy produced by the device will be cheaper than that from either solar or wind power and offer distinct advantages over standard hydropower technologies.

Unlike other forms of hydropower technologies, such as turbines and water mills, the device, called the VIVACE (vortex induced vibration for aquatic clean energy) converter, can generate electricity from slow moving water, typically found in ocean and river currents. The device is thought to be the first that can harness energy from flows moving slower than 2 knots (about 3.7 km per hour). Most currents are slower than 3 knots. Turbines and water mills need an average of 5 to 7 knots to operate efficiently. In addition, the device can operate in water surges, allowing it to take advantage of faster flows.

The VIVACE converter exploits the turbulent effects of vortices (swirling currents) that form around an obstacle in flowing water. It was partly inspired by the way fish swim. Fish propel themselves forward by generating vortices or by taking advantage of naturally occurring vortices in the turbulent trail of other fish.

The device consists of a cylinder which is placed below the surface of the water, across the direction of current flow. As water flows past the device, it is disturbed and creates vortices which cause oscillations, or vibrations, inside the cylinder. Mechanical energy from these oscillations can be efficiently converted into electrical energy via a generator.

At present, the VIVACE converter is still in prototypical stages. However, were it to be fully scaled-up and developed, the authors suggest that it would hold a number of advantages over other hydropower technologies, including:

- the energy density, or amount of energy that can be harnessed per volume occupied by the VIVACE converter, is greater than other types of wave converters
- it remains below water and does not interfere with shipping
- when installed along coastlines, the value of coastal properties would not be affected as the system is not visible
- as the movements of the system are slow, it should have minimal impact on marine life
- maintenance costs are relatively low
- its structures are tough and able to cope with extreme environmental events

In its simplest form, a VIVACE converter consists of one module. The researchers suggest a number of modules could be combined in a flexible manner to create large-scale configurations, including the development of offshore power plants, potentially producing electricity with an output from a few kilowatts to about 1 gigawatt. Its life-span is predicted to be around 20 years.

Although the installation expenses would be high initially, the costs of electricity generated should be competitive due to low maintenance costs and the wide range of conditions under which the system could operate. It is therefore estimated to be cheaper than both wind and solar power. The researchers estimate that VIVACE energy would cost around US $0.055 (around 0.04 Euros) per kilowatt hour. Wind energy costs around $0.07 (0.05 Euros) per kilowatt hour and solar power costs between US $0.16 and $0.48 (0.12 to 0.36 Euros) per kilowatt hour, depending on the location.

Source: Bernitsas, M.M, Raghavan, K., Ben-Simon, Y., Garcia, E.M.H. (2008) VIVACE (Vortex Induced Vibration for Aquatic Clean Energy): A New Concept in Generation of Clean and Renewable Energy from Fluid Flow. *Journal of Offshore Mechanics and Arctic Engineering*. 131 (1): 011102 (12 pages).

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