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Ocean currents can power the world, say scientists

A revolutionary device that can harness energy from slow-moving rivers and ocean currents could provide enough power for the entire world, scientists claim.

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Existing technologies require an average current of five or six knots to operate efficiently, while most of the earth's currents are slower than three knots Photo: AP

The technology can generate electricity in water flowing at a rate of less than one knot - about one mile an hour - meaning it could operate on most waterways and sea beds around the globe.

Existing technologies which use water power, relying on the action of waves, tides or faster currents created by dams, are far more limited in where they can be used, and also cause greater obstructions when they are built in rivers or the sea. Turbines and water mills need an average current of five or six knots to operate efficiently, while most of the earth's currents are slower than three knots.

The new device, which has been inspired by the way fish swim, consists of a system of cylinders positioned horizontal to the water flow and attached to springs.

As water flows past, the cylinder creates vortices, which push and pull the cylinder up and down. The mechanical energy in the vibrations is then converted into electricity.

Cylinders arranged over a cubic metre of the sea or river bed in a flow of three knots can produce 51 watts. This is more efficient than similar-sized turbines or wave generators, and the amount of power produced can increase sharply if the flow is faster or if more cylinders are added.

A "field" of cylinders built on the sea bed over a 1km by 1.5km area, and the height of a two-storey house, with a flow of just three knots, could generate enough power for around 100,000 homes. Just a few of the cylinders, stacked in a short ladder, could power an anchored ship or a lighthouse.

Systems could be sited on river beds or suspended in the ocean. The scientists behind the technology, which has been developed in research funded by the US government, say that generating power in this way would potentially cost only around 3.5p per kilowatt hour, compared to about 4.5p for wind energy and between 10p and 31p for solar power. They say the technology would require up to 50 times less ocean acreage than wave power generation.

The system, conceived by scientists at the University of Michigan, is called Vivace, or "vortex-induced vibrations for aquatic clean energy".

Michael Bernitsas, a professor of naval architecture at the university, said it was based on the changes in water speed that are caused when a current flows past an obstruction. Eddies or vortices, formed in the water flow, can move objects up and down or left and right.

"This is a totally new method of extracting energy from water flow," said Mr Bernitsas. "Fish curve their bodies to glide between the vortices shed by the bodies of the fish in front of them. Their muscle power alone could not propel them through the water at the speed they go, so they ride in each other's wake."

Such vibrations, which were first observed 500 years ago by Leonardo DaVinci in the form of "Aeolian Tones", can cause damage to structures built in water, like docks and oil rigs. But Mr Bernitsas added: "We enhance the vibrations and harness this powerful and destructive force in nature.

"If we could harness 0.1 per cent of the energy in the ocean, we could support the energy needs of 15 billion people. In the English Channel, for example, there is a very strong current, so you produce a lot of power."

Because the parts only oscillate slowly, the technology is likely to be less harmful to aquatic wildlife than dams or water turbines. And as the installations can be positioned far below the surface of the sea, there would be less interference with shipping, recreational boat users, fishing and tourism.

The engineers are now deploying a prototype device in the Detroit River, which has a flow of less than two knots. Their work, funded by the US Department of Energy and the US Office of Naval Research, is published in the current issue of the quarterly Journal of Offshore Mechanics and Arctic Engineering.