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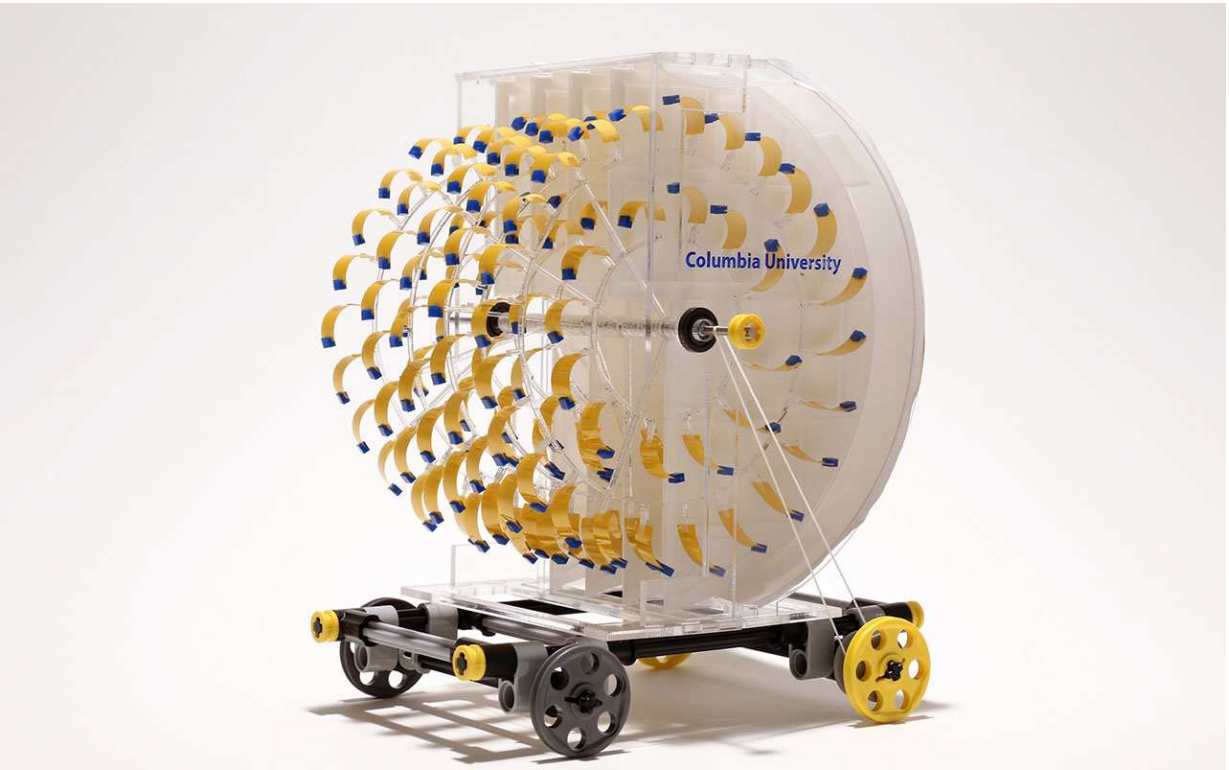
Energy from evaporating water could rival wind and solar



Evaporation engine prototypes use materials that expand and contract like muscles
Xi Chen

By **Michael Le Page**

A vast source of renewable energy has been sitting under our noses. Evaporating water could supply enormous volumes of clean electricity, if we can only harness it.

Evaporation is the process by which liquids turn into gases, generally when they are heated up. Every day, vast amounts of water evaporate from lakes and rivers, powered by heat energy from the sun. The scale of this energy is considerable.

Water that evaporates from existing lakes and dams in the US – excluding the Great Lakes – could provide up to 2.85 billion megawatt hours of electricity per year, according to Ozgur Sahin of Columbia University and colleagues. That is the equivalent of two-thirds of US electricity generation in 2015. In 15 of the 47 US states studied, the potential power exceeds demand.

Covering freshwater bodies with engines that harness evaporation would halve water lost in this way, the team says. In seven US states, this would save more water than the entire state consumes. But the calculations assume that all the water is covered – which we would not want to do.

Evaporation engines could also be put in other areas, from irrigated fields and greenhouses to sheltered bays, says Sahin.

But first an evaporation engine needs to be built. Sahin's team has created several miniature prototypes.

The prototypes are all based on materials that shrink as they dry, such as tape coated with bacterial spores. The spores curl as they dry, shortening the tape. "They work like a muscle," says Sahin. "They can push and pull with a lot of force."

To avoid being repeatedly soaked in water and becoming contaminated with dirt and chemicals, the prototypes exploit changes in humidity.

In one version, the "muscle" sits just above the water. When shutters above it are closed, the humidity rises and the material expands. That opens the shutters, allowing the material to dry out and shrink, and so on.

Such evaporation engines can run at night as well as day. Normally, there would be less evaporation at night, but blocking evaporation during the day stores energy in the form of warm water. "At night you take advantage of this power," says Sahin. "This is a great advantage."

Engine problems

Others agree that the potential is huge. The issue is harnessing it.

"The question is whether there is any practical way to capture that energy," says Ken Caldeira of the Carnegie Institution for Science in Stanford, California. He doubts it is possible to efficiently convert evaporation energy into electrical energy.

What's more, developing evaporation engines to the point where they can be mass-produced is a huge task, and one that few groups are working on.

The technology would also have to compete directly with solar panels, as it is increasingly common for floating solar farms to be placed on reservoirs. But evaporation engines could be made from cheap biological materials that are easier to dispose of than solar panels, says Sahin.

If the technology does take off in a big way, it could affect local weather by reducing evaporation. But it will only make a difference if an area of 250,000 square kilometres is covered, the team calculates. At large scales, all forms of energy production, from wind to nuclear, can affect weather and climate.

Besides, in a world of increasingly extreme rainfall, reducing evaporation could be desirable in some places.

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Article amended on 28 September 2017

We have corrected the amount of megawatt hours of electricity that could be provided from water evaporation from lakes and reservoirs in the US

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