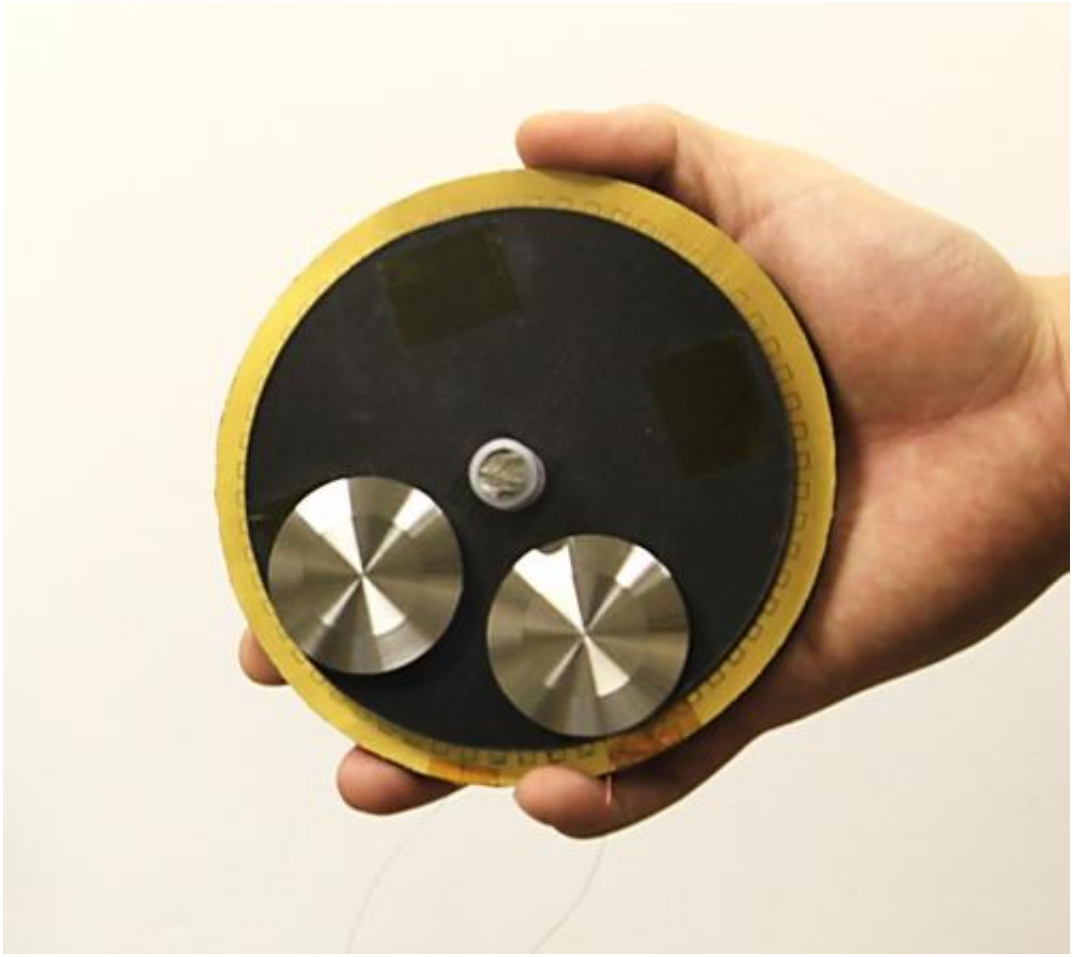
'Tribo-electric,' the buzzword of the future?

March 4 2014, by Richard Ingham



A hand-held triboelectric generator for harvesting energy from human motions. Credit: Drs. Guang Zhu and Zhong Lin Wang, Beijing Institute of Nanoenergy and Nanosystems and Georgia Tech

Out at sea, gentle waves provide power for thousands of homes. In

cities, dancefloor moves generate electricity for nightclubs. In the countryside, hikers use leg power to recharge their phones.

It is an alluring goal of clean, reliable power free from geo-political risks—and scientists in the United States said Tuesday it lies within reach, thanks to a smart way to harvest energy called tribo-electricity.

Researchers at the Georgia Institute of Technology said they had built a simple prototype device that converts stop-start movement into power.

Waves, walking and dancing—even rainfall, computer keys or urban traffic—could one day be harnessed to drive sensors, mobile gadgets or even electricity plants, they contend.

Zhong Lin Wang, a professor of materials science and engineering, described the invention a "breakthrough."

"Our technology can be used for large-scale energy harvesting, so that the energy we have wasted for centuries will be useful," he told AFP by email.

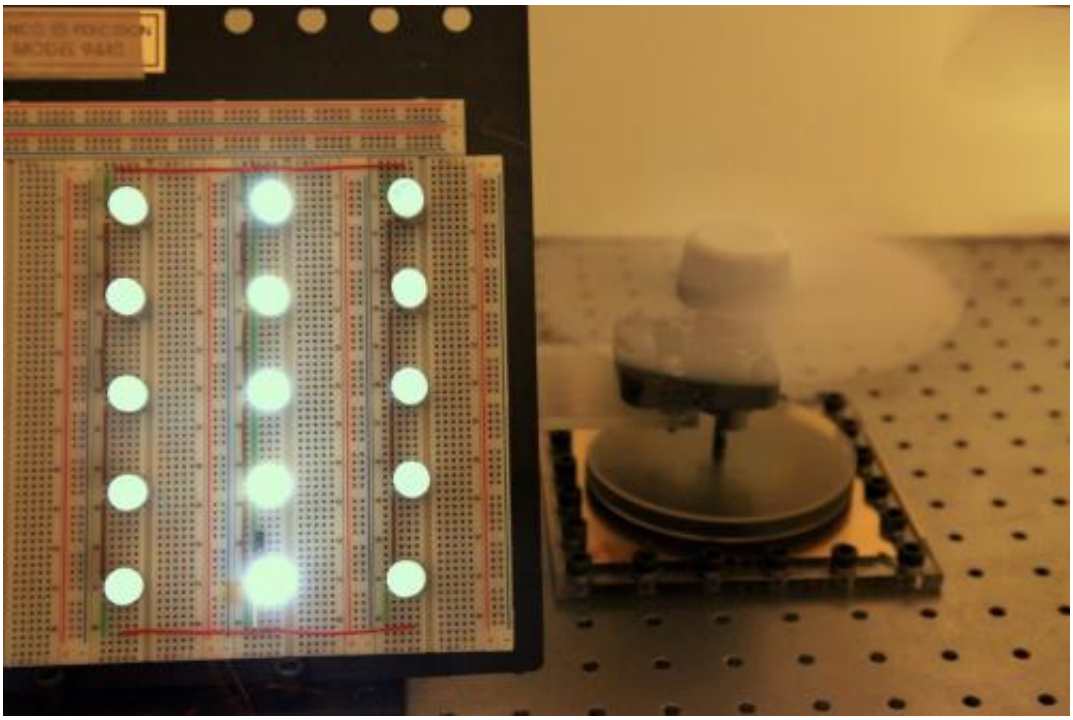
"Tribo-electric" is a modern term with ancient roots—from the Greek word for "rub."

Its electricity is created from friction between two substances causing a charge of electrons to be transferred from one to the other.

It commonly happens, for instance, when plastic-soled shoes are in contact with a nylon carpet, causing the snap of static discharge when one's hand touches a metal doorknob.

Because tribo-electric is so unpredictable, it has been generally shunned as a power source.

The preferred method has been magnetic induction—a turbine driven by nuclear- or fossil-powered steam or water.



Powering spot lights through harvesting energy from air flow by the triboelectric generator. Credit: Drs. Guang Zhu and Zhong Lin Wang, Beijing Institute of Nanoenergy and Nanosystems and Georgia Tech

But, in a new study published in the journal *Nature Communications*, Wang's team said they had overcome key hurdles to converting a haphazardly-generated electrical charge into current.

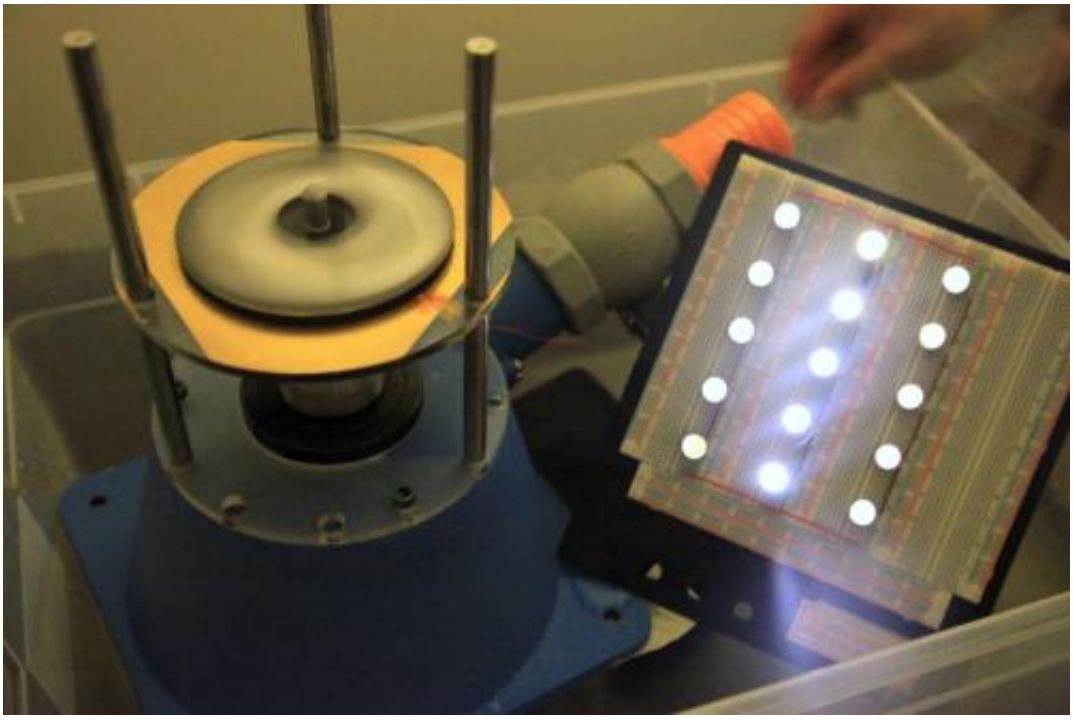
Their prototype comprises a disc about 10 centimetres (four inches) across, designed to show the potential from a small, portable generator moved by ambient energy.

Inside are two circular sheets of material, one an electron "donor" and

the other an electron "receiver," brought together through rotary movement.

If the sheets are separated, one then holds an electrical charge isolated by the gap between them.

Sandwiched between the two discs is a third disc with electrodes, which bridges the gap and helps a small current to flow.



Powering spot lights through harvesting energy from tap water flow by the triboelectric generator. Credit: Drs. Guang Zhu and Zhong Lin Wang, Beijing Institute of Nanoenergy and Nanosystems and Georgia Tech

At a top speed of 3,000 revolutions per minute, the device generated 1.5 watts.

This gave it an energy efficiency of 24 percent, three times greater than piezoelectric, the previously best source of mechanical electricity harvesting—and as efficient as magnetic-induction turbines.

It can run on a gentle wind or tap water, or "random jerky motions," including human movement, to provide the rotation, Wang said.

"As long as there is mechanical action, there is power that can be generated."

The prototype used copper for the rotator and gold for the electrodes in lab tests, but these could easily be substituted for low-cost synthetics, he said.

The team is working on ways to scale up tribo-electric energy for harvesting power from the ocean.

More information: Paper: dx.doi.org/10.1038/ncomms4426