



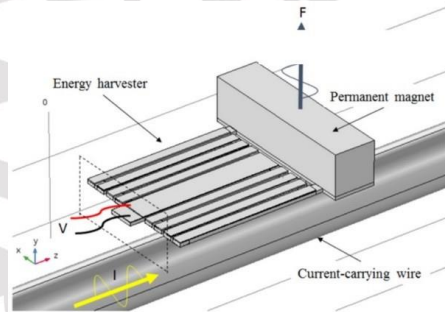
DELIVER

Energy More Intelligently

BUILDINGS | CARBON CAPTURE AND STORAGE | FUEL CELLS | NUCLEAR | POLICY | PLANNING
 RENEWABLES | **SMART GRID** | STORAGE | SUSTAINABLE MOBILITY | SUSTAINABILITY ANALYSES

SELF-POWERED SENSORS COULD HELP AVOID BLACKOUTS

Armaghan Salehian, David Nairn, Lan Wei, H  l  ne Deb  da, Egon Fernandes, Blake Martin, Isabel Rua, and Sid Zarabi



sensors with batteries would require replacing the batteries every couple of years — an expensive proposition when you consider the labour involved.

That makes the idea of self-powered sensors very attractive. Once installed, they would keep working, year after year, without human intervention.

Now, WISE researchers have developed the technology to make that possible. A team led by Prof. Armaghan Salehian (Director of Waterloo’s Energy Harvesting and Vibrations Lab), Prof. David Nairn and Prof. Lan Wei (Electrical & Computer Engineering), have designed a system that takes advantage of the alternating magnetic fields created by the A/C electricity that flows through power lines.

As the magnetic field alternates, a magnet within the device moves accordingly. In the process, it presses on the surrounding piezoelectric material, which generates current when it is compressed. Bingo: electricity.

The researchers fabricated the energy harvester using screen-printing technology, laying down a layer of piezoelectric lead zirconate titanate in a symmetrical “meandering” design to minimize twisting and bending and therefore maximize power output.

The resulting microelectromechanical system (MEMS) measures just 12.7 mm by 14.7 mm. But as the investigators proved, it boasts more power density than any similar MEMS device.

Now, Profs. Salehian, Nairn, Wei and their team are working to integrate this technology with power conditioning and wireless communications circuitry, all on a single chip. If they succeed, self-powered sensors could soon be monitoring the health of our power grid.

Researchers: *Armaghan Salehian, David Nairn, Lan Wei, H  l  ne Deb  da, Egon Fernandes, Blake Martin, Isabel Rua, and Sid Zarabi.*

Partners: *Cisco Systems, University of Bordeaux*

Source: Fernandes, E., Martin, B., Rua, I., Zarabi, S., Deb  da, H., **Nairn, D., Wei, L., & Salehian, A.** (2018). Design, fabrication, and testing of a low frequency MEMS piezoelectromagnetic energy harvester. *Smart Materials and Structures*, 27(3), Article No. 035017.