Mini-fuel cell delivers maximum performance

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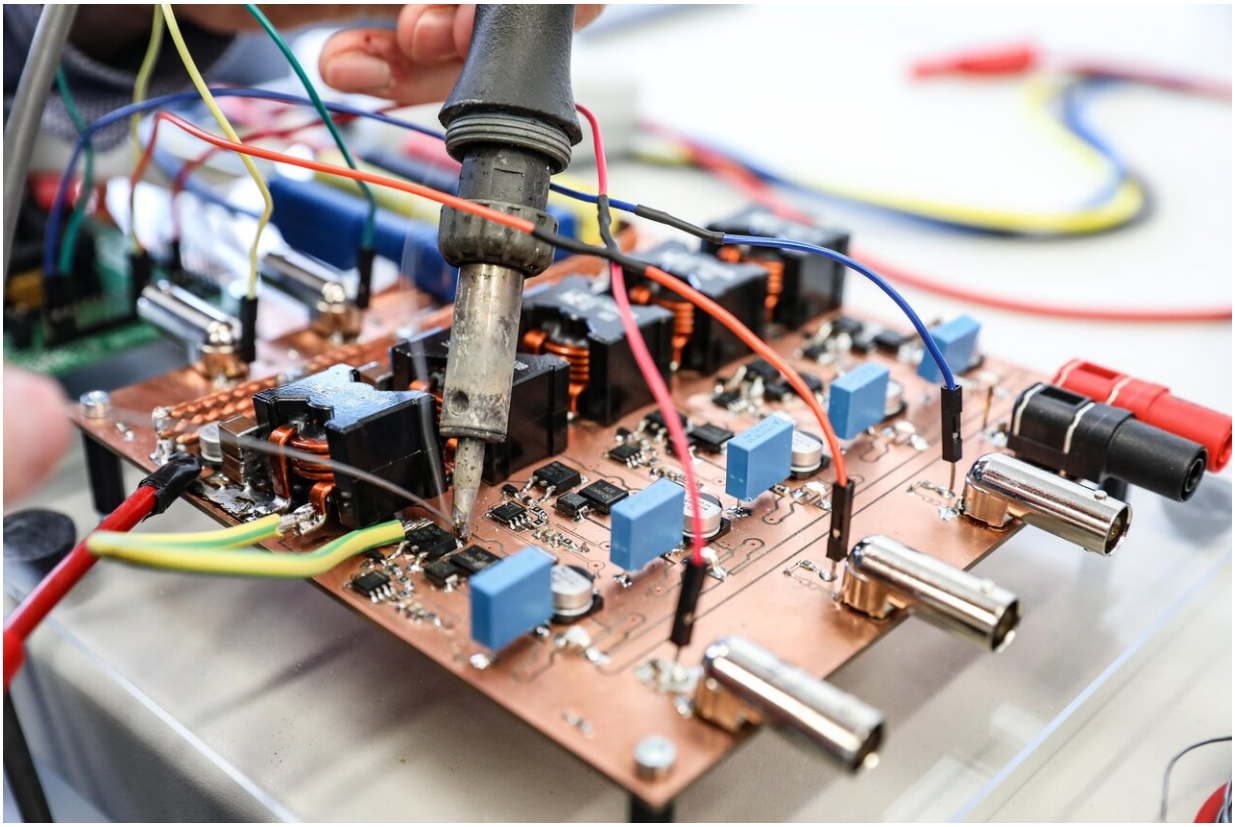

Inergio's battery can fly a delivery drone for several hours. Credit: Alain Herzog

EPFL startup INERGIO has just unveiled a prototype for a lightweight, eco-friendly, high-performance fuel cell that can supply energy in situations where there's no power grid. Its system can be used to run

delivery drones, weather stations, environmental sensors, telecommunication antennae and even campsites.

A slew of applications, ranging from weather stations and mountaintop environmental sensors to remote pipeline surveillance systems, drones and even campsites, would benefit from a compact, long-lasting and eco-friendly power supply. With this in mind, INERGIO—a spin-off based at EPFL's Innovation Park and born out of 15 years of joint research between EPFL and HEIG-VD—has developed a compact fuel cell that is 80% lighter than similar systems on the market. With support from several startup funds, the company has just completed a prototype fuel cell that measures 25 cm long by 14 cm high and wide, and that can generate 25 W of continuous power. The next step for INERGIO will be to test its system with various companies in the Lake Geneva area and develop a pilot production line.

Seven to eight hours of flight time for delivery drones

Fuel cells—including hydrogen fuel cells, which will likely power tomorrow's cars—offer a promising alternative on the path to carbon neutrality. Fuel cells use chemical reactions between a fuel and an oxidizing agent to generate power: the reaction releases electricity, water and heat. INERGIO's prototype employs a solid oxide fuel cell (or SOFC), which offers high fuel-to-electricity conversion yields and doesn't emit pollutants, but operates at extremely high temperatures (650°C). The heat that SOFCs generate usually requires large amounts of insulation, which restricts their use to stationary applications. "After 15 years of laboratory research," says INERGIO CEO Mahmoud Hadad, "our major achievement is that we have confined the high-temperature zone to a small area in the battery's core." This keeps insulation to a minimum and creates a system that is three times lighter while delivering the same yields.

For now, INERGIO's system uses fuels such as butane and natural gas to feed the anode with atmospheric oxygen serving as the oxidizing agent. In addition to electrons, the reaction produces water vapor and a small amount of carbon dioxide. "The big advantage of our system is that butane and propane is available commercially at a low price. In liquid form, it is much lighter and easier to transport than hydrogen," says Mahmoud Hadad. In the future, hydrogen—for now still hard to produce—could also be used as a fuel, making the cell even more efficient and eco-friendly.

When connected to a butane or propane cartridge, the mini-fuel cell's autonomy is up to 20 times greater than that of similar-sized lithium-ion batteries. "For example, we can generate 500 W of power with a 4 kg cell, which would give a delivery drone 7–8 hours of flight time, compared with current flight times of around 60 minutes," says Hadad. INERGIO's system is scalable and can supply between 25 W and 500 W depending on the intended use. In remote locations, such as mountainous regions, it offers a safe, silent power source that is not dependent on weather conditions and can operate on its own for extended periods.

This year, thanks to an Enable grant from EPFL's Vice Presidency for Innovation as well as numerous awards and startup funding, INERGIO plans to develop an all-in-one system that could fit inside a shoebox. That means it could be transported easily or connected to remote monitoring units, and could provide thousands of hours of continuous operation.

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