CASE STUDY

# Power the Future with Biofuel Cells

KEYSIGHT

## Organization

- BeFC – innovator of bio-enzymatic fuel cells

## Challenges

- Creating a robust R&D lab to meet their current measurement needs
- Kick-starting their industrial development of biofuel cells

## Solutions

- MXR054A mixed-signal oscilloscope
- CX3324A device current waveform analyzer
- N6705C DC power analyzer
- B2901BL precision source / measure unit
- E36312A triple-output power supply
- M9615A PXIe five-channel precision source / measure unit

## Results

- Test throughput increased by four times and enabled independent and multi-DUT test triggering
- Won global technology awards and industry recognition for their innovative biofuel cell solution

Electronic integration continues to increase in all things, including disposable medical devices and wearables. Many devices are battery operated, using button or coin cell power sources. These power sources can be difficult to collect and recycle, and are often toxic, causing soil contamination and water pollution.

This is a growing concern as IoT goes mainstream, not only in healthcare but also in industrial applications such as asset tracking and Industry 4.0.

# Challenges

BeFC's two key business challenges focused on increasing their R&D laboratory capabilities and kick-starting the industrial development of their biofuel cells.

A key objective was to equip their electronics team with industry best-in-class benchtop instruments to accelerate the prototyping phase of their flexible printed circuit boards. The tools must be able to perform low-power measurements with a high time-base resolution.

BeFC also needed a cost-effective multichannel instrument capable of performing electrochemical measurements to further engineer their paper biofuel cells.

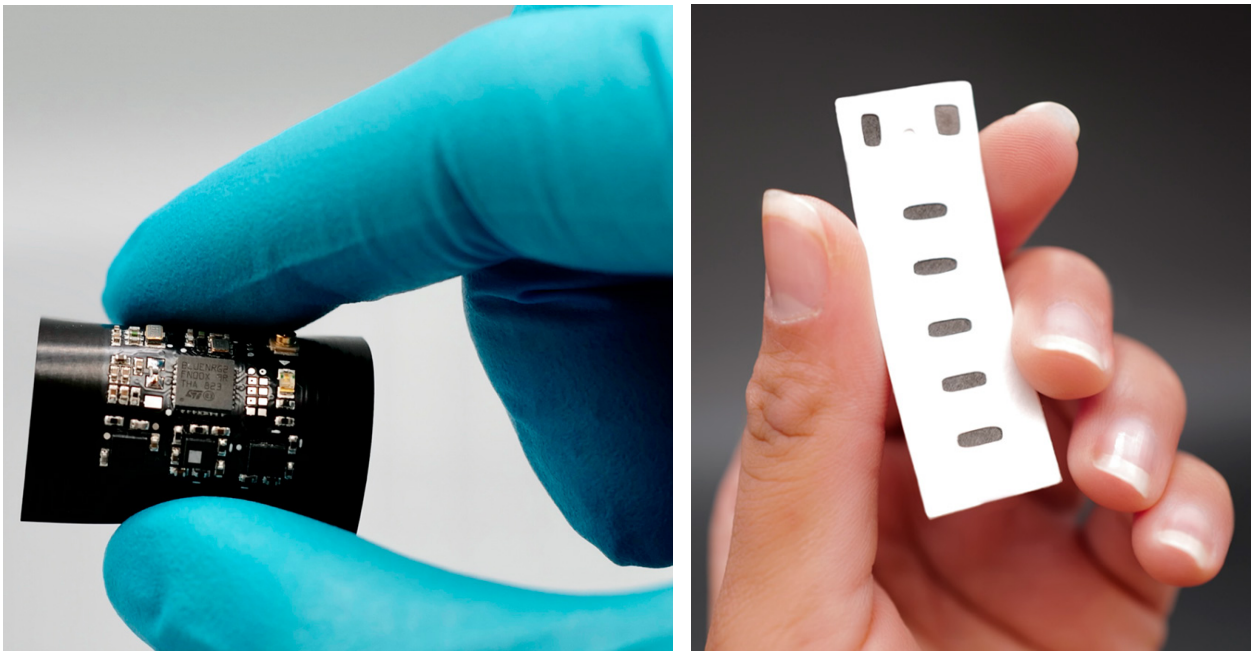

**Figure 1.** BeFC's flexible printed circuit board (left) and paper biofuel cell (right)

# Solutions

Keysight worked with BeFC to implement multiple hardware and software solutions to help them fulfill their current business goals. Integrating the multiple solutions gave BeFC valuable insights to better understand the biofuel cells' behavior and characteristics.

The Keysight M9614A PXIe 5-channel precision source / measure unit combined with the Keysight M9005A PXIe chassis gave BeFC 25 independent measurement channels to use for their electrochemical testing.

These platforms met the test needs of BeFC by enabling higher channel density and fast throughput in a compact and affordable package. Figure 2 shows BeFC performing independent testing of multiple fuel cells in parallel.

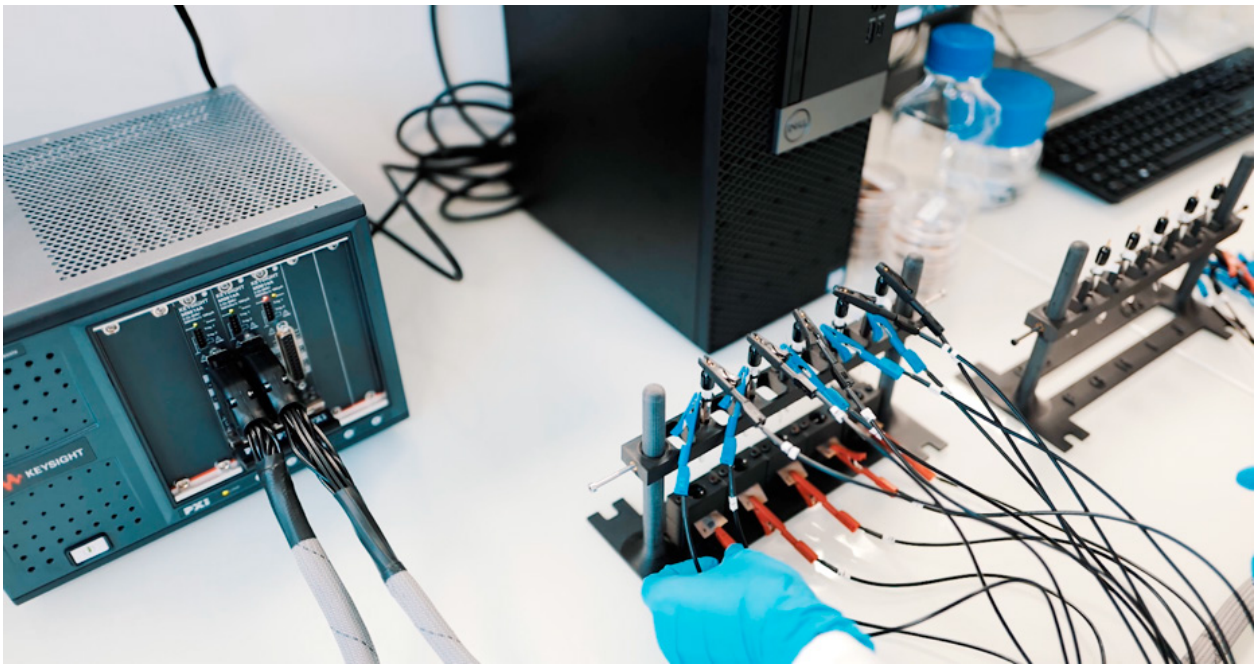


**Figure 2.** Multichannel testing of BeFC's fuel cells with Keysight's PXIe SMUs

# Results

Keysight's PXIe solution and dedicated software have enabled BeFC to quadruple their test throughput while providing independent testing triggered at any time. These capabilities enable R&D to conduct different experiments in parallel.

Keysight's engineering experts worked with the BeFC team to help fast track their R&D efforts enabling them to win the following awards and recognition:

- EDF Pulse Start-Up at EDF Electric Days — 1st place
- MEDICA Internet of Medical Things Techpreneurs 2020 — 1st place
- 10,000 Start-ups to Change the World — 1st place
- EBV IoT Hero challenge at the 12th Innovation World Cup Series — 1st place
- CES 2021 Innovation Awards Honoree
- Solar Impulse label: part of the 1000 solutions to fight climate change
- UNWTO Sustainable Development Goal Startup Competition – winner of SDG7: clean & affordable energy

> The long acquisition time of the MXR054A has allowed us to capture events that could have otherwise been missed. The touchscreen interface is intuitive. The integrated protocol decoder has also been a huge timesaver.
>
> Alban Thierry, BeFC electronic engineer

> We have been using the N6705C DC power analyzer in order to simulate and measure the effect of various load cycles.
>
> Dr. Aleksandrs Sergejevs, BeFC technical manager

> The Keysight PXIe multichannel platform has provided us with an affordable and efficient system for electrochemical measurements with the ability to rapidly screen novel raw materials while improving the half cells of the bio fuel cells.
>
> Lisa Guildbaud, BeFC R&D engineer

# Learn More

- BeFC – Bio-enzymatic Fuel Cells
- Electrochemistry 3-Electrode Measurement Workflows for Li-Ion Cells and Sensors Using the Keysight B2900 surface mount unit (SMU)
- M9615A PXIe Five-Channel Precision Source / Measure Unit
- CX3300 Series Device Current Waveform Analyzers
- N6705C DC Power Analyzer, Modular, 600 W, 4 Slots

For more information on Keysight Technologies' products, applications, or services, please visit: www.keysight.com

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