# The microgrid that uses and stores renewable energy

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**A new design of mobile power generator can run off renewable energy and also store excess energy for use later. Relying on hydrogen fuel cell technology to supplement the supply, Elemental Energy's $H_2$IPO™ system can provide power, 24/7. Designing a system like this demands reliability, so alongside a hydrogen fuel cell from Toyota, Elemental Energy has partnered with Bürkert to play a key role in hydrogen flow management.**

Across southern Africa, tourism is big business. However, the remote locations of safari lodges and an unstable power grid present a challenge, but this is where a $H_2$IPO - pronounced hippo - comes in. Developed by Elemental Energy, the system is an intelligent, self-contained microgrid that provides reliable and green power, 24/7. Not only can it generate power from a renewable source, it can also store renewable energy for later use, ideal for a lodge located in the middle of the bush.

The uninterruptable power supply microgrid integrates energy inputs from the conventional power grid, alongside renewable energy sources including wind and solar. Supporting this system is a hybrid battery and hydrogen fuel cell system. $H_2$IPO can generate power from its renewable sources, while excess energy is stored in batteries or converted into hydrogen through electrolysis which can then be stored to power the hydrogen fuel cell.

**Firm power, 24/7**

Whether relying on the grid, wind or solar, batteries or hydrogen, the result is 100% power uptime, and the system is available in power generation ratings ranging from 100 kW (kilowatt) up to 1 MW (megawatt). The system's intelligence can also manage the input priority dependent on source availability.

"Renewable power has daily and seasonal fluctuations," says Caroline Allsop, head of operations at Elemental Energy. "On a bright, windy day, there's often more energy than you can actually use and a lot of that ends up wasted. On the contrary, when you have extended periods of cloud cover or little to no wind, you find yourself without enough. This is where our $H_2$IPO comes into it. It balances out these fluctuations by storing the surplus energy in batteries and hydrogen and using this to provide power during times of energy deficit, ensuring a continuous and reliable power supply. Unlike batteries designed for shorter duration (days) energy storage, hydrogen can be stored for weeks or months, making it ideal for storing summer solar energy for winter use or ensuring grid stability during prolonged periods of low renewable output."

The flexibility of the system means that $H_2$IPO can provide power generation virtually anywhere in the world, from the Arctic Circle, through to the deserts of the Middle East. From EV Charging to mining, construction sites to data centres, site setup is simple and easy to deploy. Its compact footprint gives the system the mobility to be transported just about anywhere and Elemental's own storage trailers are towable by pickup, allowing them easy access to every site. The skid-mounted $H_2$IPO system is housed within custom containers, measuring between 2m and 6m long depending on the output capacity, while the hydrogen can be stored and transported in purpose-built trailers.

**Reliability is essential**

To achieve the reliability required for the system, it was essential for the design to rely on trusted technology. $H_2$IPO uses Toyota's high-performance fuel cells, and to

control hydrogen flow, Elemental Energy partnered with flow control specialist, Bürkert.

When handling hydrogen, safety is paramount, so the system uses Bürkert's Type 6440 shut-off valves to create an impenetrable barrier when closing the hydrogen supply, with a pair of valves integrated to achieve double redundancy. To increase pressure resistance and leak-tightness, the valve's stopper and core guide tube are welded together. Moreover, the cartridge and flange connections, plus solenoids with IP6K9K automotive-grade plugs, are optimised for hydrogen compatibility and fuel cell use.

To ensure safety and long life, the coils are moulded with chemically resistant epoxy. This approach to valve sealing is also used on Bürkert's Type 6013 plunger valve, integrated to clear the system of accumulated water and residual hydrogen, enabling a safe system shutdown.

"We have a team of experienced engineers who have worked with Burkert in previous roles involving hydrogen and have experienced their reliability for over 10 years," says Caroline. "Secondly, Burkert has a very good reputation of producing high-quality valves and we have experienced that first hand."

**Custom manifold**

In addition to the safety and resilience of the valve designs, a significant advantage to Elemental Energy's development was Bürkert's custom manifold for the hydrogen storage trailer. In addition to the shut-off valves and plunger valve, the manifold system integrates a pressure transmitter and a manual pressure relief valve, connecting the hydrogen supply with composite cylinders.

Where reliable power supply is essential, the advantage of the manifold is rapid maintenance in the event of a fault. Although the system is leak tested prior to

shipping, if any leaks were to develop, the manifold unit can be rapidly removed and replaced in the field. This is a significantly faster approach compared to checking and replacing each connector in turn when all valves and components are installed on a single pipe.

**Towards real zero power**

While a pilot project involved providing 24/7 power to a safari lodge in South Africa, the demand for subsequent applications have centred around Europe. Although facing less extreme conditions, sectors such as construction, driven by the net-zero agenda, have seen strong benefits in a system that can speed up the energy transition in a fast-to-implement, cost-effective package. $H_2$IPO can be used to replace diesel generators and potentially take over demands placed on the grid.

Beyond net zero, the capability of Elemental Energy's technology to push towards 'real zero power', where the generation and use of electricity produces no greenhouse gas emissions at all, has opened the potential to supply large installations that demand a reliable power source, such as hospitals, data centres, and EV charging stations.

"Our ultimate aim is to replace the need for diesel in power generation, and the projects already installed are showing how this could be achieved," says Caroline. "For the system to work long term, it's vital that we can depend on partners like Bürkert to give us the reliability we need."

**Image captions:**


**Image 1:** The self-contained microgrid provides reliable and green power for remote locations.


**Image 2:** Bürkert's valves and custom manifold are used to manage hydrogen delivery on the storage trailer**.**


**Image 3:** The technology has the potential to provide a reliable power source for EV charging stations.

**About Bürkert**

Bürkert Fluid Control Systems is one of the leading manufacturers of control and measuring systems for fluids and gases. The products have a wide variety of applications and are used within food & beverage, pharmaceutical and water industries as well as in medical engineering and space technology. The company employs over 3,500 people and has a comprehensive network of branches in 36 countries world-wide."

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