

# Fuel Cells and Utility Telecommunications: Focus on Reliability

Whether a utility communications network is used for Supervisory Control and Data Acquisition (SCADA) systems, monitoring or radio communications, the robust and resilient nature of the network is paramount. Recent natural disasters have provided a demonstration of the importance of communication to utilities. To have a resilient network, the power critical communications equipment must also provide reliability and resilience.

One tool in the quest for ever-increasing power reliability is the fuel cell. Fuel cells have been commercially available to communication networks for a decade, with a number of suppliers providing products globally. Within early adopters, fuel cell usage has progressed from early trials to larger rollouts providing backup power to several hundred sites in a single network. Globally, fuel cell adoption numbers several thousand installations.

Pacific Gas & Electric (PG&E), based in California, is one of several utilities using fuel cells to provide backup to their communications equipment. J.D. van Wyhe, IT product specialist for Pacific Gas & Electric, emphasized, "This equipment has to work all the time. It can't go down. Ever."

## Fuel Cell Power Solutions

Before discussing how a fuel cell complements a utility telecom network, we first must understand how it operates. A fuel cell is a dc power generator that converts the chemical energy of a fuel (hydrogen, natural gas, methane, methanol, etc.) and an oxidant (air or oxygen) directly into electricity. While there are many fuel cell technologies available, the most common and practical technology for small to medium-sized standby power is the proton exchange membrane (PEM) fuel cell that generates electricity through an electrochemical reaction using hydrogen and oxygen. This process happens without combustion. A fuel cell operates electrochemically through the use of an electrolyte, like a battery,

but it does not run down or require recharging. It is similar to a generator in that it operates as long as the fuel is supplied; unlike an internal combustion generator, however, it is simple, quiet

and clean with few moving parts. Because fuel cell systems are load-following, fuel consumption depends on the load, and equipment operating at relatively low loads can see a significant extension of runtime when powered by this technology.

Criteria for selecting a fuel cell backup system for a specific application include power requirements, frequency and duration of outages, response time to the site, environmental restrictions and serviceability requirements. Fuel cells can and are being used as the sole backup power solution in many critical applications; they can, however, also be used as an added layer of protection for a site using incumbent solutions. This concept is analogous to a layered network security architecture where each layer of security—e.g. firewalls, intrusion detection devices, etc.—add to the overall network protection. Fuel cells offer rack-mounting options within an equipment shelter as well as environmentally-hardened outdoor cabinets for flexibility to meet network design parameters.

Most fuel cells being used for backup power range from 50 watts to some 20 kilowatts. Based on available technology, customer sites can be provisioned with fuel for hundreds of hours of runtime. Refueling allows the system to run continuously as long as needed during extended outages. For sites with these relatively low power loads and outages lasting from hours to days, fuel cells can be the backup power source of choice.

## Fueling Options

Intrinsic to fuel cells is the need for fuel to operate. PEM fuel cells use hydrogen as



the fuel to supply electricity and there are options for fueling. Traditionally, fuel cells have used hydrogen cylinders to store fuel (packaged gas). The refueling of hydrogen cylinders is accomplished by a vehicle transporting full cylinders to the site and exchanging them for the empty cylinders. Though labor-intensive, this remains the option of choice for many locations.

A second option is bulk hydrogen refueling. Network operators and fuel cell manufacturers have worked with global hydrogen suppliers, initially in the US, to establish a refueling model similar to the diesel/propane model. In this model, the cylinders remain on site and are filled on site by the refueling truck. This development has broadened the market for fuel cells to address higher capacity installations and sites requiring extended run times of several days.

A third option for providing hydrogen for fuel cells is the fuel reformer. The reformer takes a hydrogen-rich carbon-based fuel, such as methanol mixed with water and, using heat and catalyst, separates the hydrogen from that fuel to deliver it to the fuel cell. Because these fuels tend to be liquid, energy density is better than with gaseous hydrogen, allowing for more runtime to be stored on site in a smaller space. Reformers, however, introduce additional cost and complexity to the fuel cell system and can reduce the reliability of the system as a whole. Because hydrocarbon fuels are not simple hydrogen, they also emit pollutants during the reforming process. In locations where hydrogen is not readily available or is priced too high, a reformer may be the fueling option of choice.

## Integrating a Fuel Cell Into a Network

One of the attributes of a fuel cell that makes it appealing for deployment in utility telecom environments is that a fuel cell produces dc power. This makes it similar to a standby rectifier source because the power provided from the fuel cell can be directly connected to the site's dc power bus.

In an outage situation, the fuel cell automatically turns on, providing dc power formerly provided by the rectifiers. This means fuel cells can function for long reserve times as a standby power source in customer applications. Fuel cell systems are intended to operate in parallel and augment the traditional dc power system components.

Fuel cells can easily be added to an existing network or can be designed into a new network location. They can also be combined with solar and/or wind power to provide a clean hybrid power solution. With hot and cold weather design features, many fuel cells are capable of serving loads in a variety of geographical locations.



## Putting it Into Practice: PG&E

PG&E incorporated in California in 1905 and is one of the largest combination natural gas and electric utilities in the US. There are some 20,000 employees who carry out PG&E's primary business—the transmission and delivery of energy. The company provides natural gas and electric service to some 15 million people throughout a 70,000-square-mile service area in northern and central California.

As a provider of electricity and natural gas to some 40 percent of Californians and one in 20 Americans, PG&E is taking a leadership role in various parts of its business, including delivering some of the nation's cleanest electric power, bringing more renewable energy to customers, and supporting customers through an array of customer energy solutions that include energy efficiency, demand response, and solar programs and incentives.

PG&E's use of fuel cells to provide backup power at some 20 of its critical radio and SCADA sites began as a response to a problem. PG&E has some 300 standby emergency generators that automatically power up during outages to keep company assets such as radio and fiber optic equipment operational. Most

of them are powered by propane or diesel fuel. They emit pollutants, are noisy and can be unreliable.

"Maintaining generators is expensive," van Wyhe said. "We spend a lot of time and money sending people to remote generators to check the oil, change the plugs and repair the breakdowns, which happen frequently because little-used engines deteriorate over time."

When one of the generators failed as winter was approaching, van Wyhe's

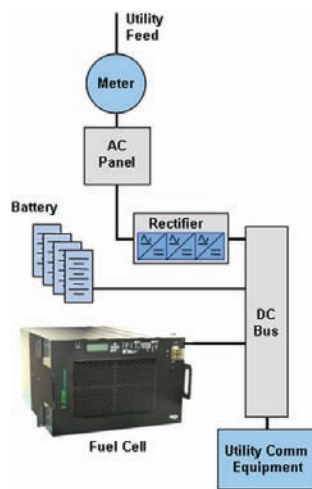
team decided to use the site to pilot a fuel cell system.

"We'd been kicking around the idea of fuel cells for awhile," van Wyhe said. "This was a perfect spot for a fuel cell pilot."

With little time to waste, the team was able to procure and install a ReliOn fuel cell system in less than 60 days.

Since that first fuel cell, PG&E has chosen to replace aging generators with fuel cells at more of its sites.

"The combination of high reliability, lower maintenance and no emissions has given fuel cells a place at our critical locations," van Wyhe said. "What the neighbors think is cool is the peace and quiet now that they don't have generators roaring to life in the middle of the night."



## Conclusion

The issue of reliability is critical for utility networks. When a high level of reliability can be provided by a product that also meets sustainability goals, a win-win scenario develops. Fuel cells meet both those goals and offer a compelling solution for site hardening at critical locations. **UP**

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