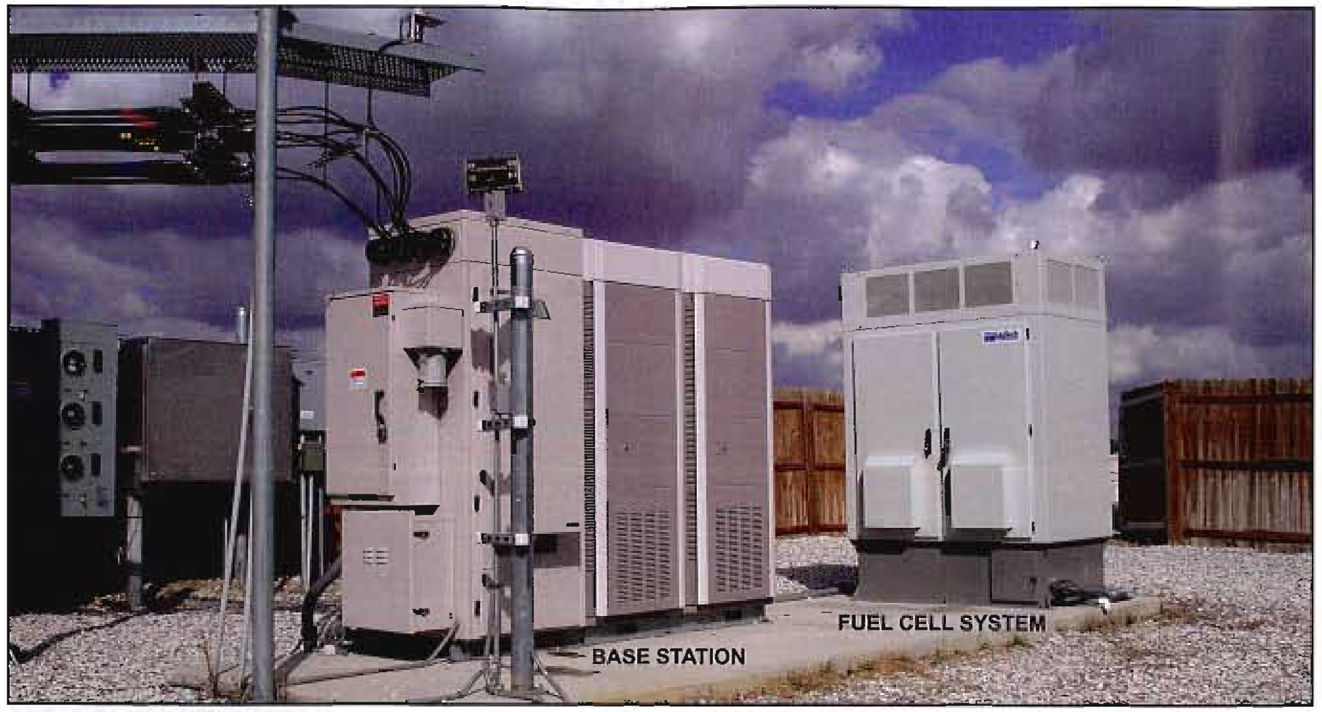
Use Fuel Cell Systems for Reliable Backup Power

Proton exchange membrane (PEM) fuel cells offer a reliable backup power source for remote cell sites or for extended-run power outages wherever they may occur.

By James Kerr

In today's 24/7/365 communications-on-demand world, businesses, individuals, emergency systems such as TETRA, and governments rely on their instant access to voice, data, video or all three through their wireless devices to be able to function effectively. In order to provide customers with instant communications anywhere in the world, wireless telecom companies have to construct and maintain cell phone towers and radio relay stations, sometimes in remote areas where the electrical power grid's reliability is marginal. Despite grid outages, telecommunications engineers must keep these sites operating without interruption to retain customer loyalty and to avoid the high cost and potentially life-threatening situations that may arise from a wireless communications failure.

In anticipation of these grid outages, most wireless telecom sites have backup power systems that traditionally have consisted of valve-regulated lead-acid (VRLA) battery strings, gensets or a combination of the two. These traditional solutions are not always appropriate for sites requiring extended runtimes (days versus hours), and they do not always work effectively. A battery string can be expected to provide anywhere from one to four hours of backup power, but battery functionality is negatively affected by age, temperature, deterioration of charge during down time and



Use Fuel Cell Systems for Reliable Backup Power

Proton exchange membrane (PEM) fuel cells offer a reliable backup power source for remote cell sites or for extended-run power outages wherever they may occur.

By James Kerr

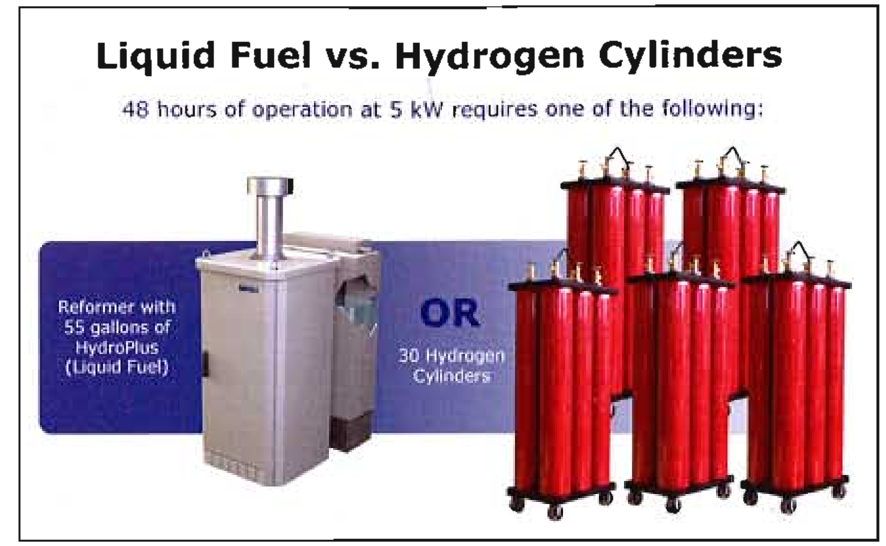
In today's 24/7/365 communications-on-demand world, businesses, individuals, emergency systems such as TETRA, and governments rely on their instant access to voice, data, video or all three through their wireless devices to be able to function effectively. In order to provide customers with instant communications anywhere in the world, wireless telecom companies have to construct and maintain cell phone towers and radio relay stations, sometimes in remote areas where the electrical power grid's reliability is marginal. Despite grid outages, telecommunications engineers must keep these sites operating without interruption to retain customer loyalty and to avoid the high cost and potentially life-threatening situations that may arise from a wireless communications failure.

In anticipation of these grid outages, most wireless telecom sites have backup power systems that traditionally have consisted of valve-regulated lead-acid (VRLA) battery strings, gensets or a combination of the two. These traditional solutions are not always appropriate for sites requiring extended runtimes (days versus hours), and they do not always work effectively. A battery string can be expected to provide anywhere from one to four hours of backup power, but battery functionality is negatively affected by age, temperature, deterioration of charge during down time and corrosion. In addition, there are environmental problems with battery disposal.

A diesel or propane generator — on its own or in combination with batteries — provides longer backup. A generator's runtime is based on how much fuel is available for the generator and how much power is needed to replace the electricity lost from the grid outage. The problem with generators is that they are noisy, produce noxious emissions, and, because they have several moving parts, they need a lot of maintenance, repair and lubrication.

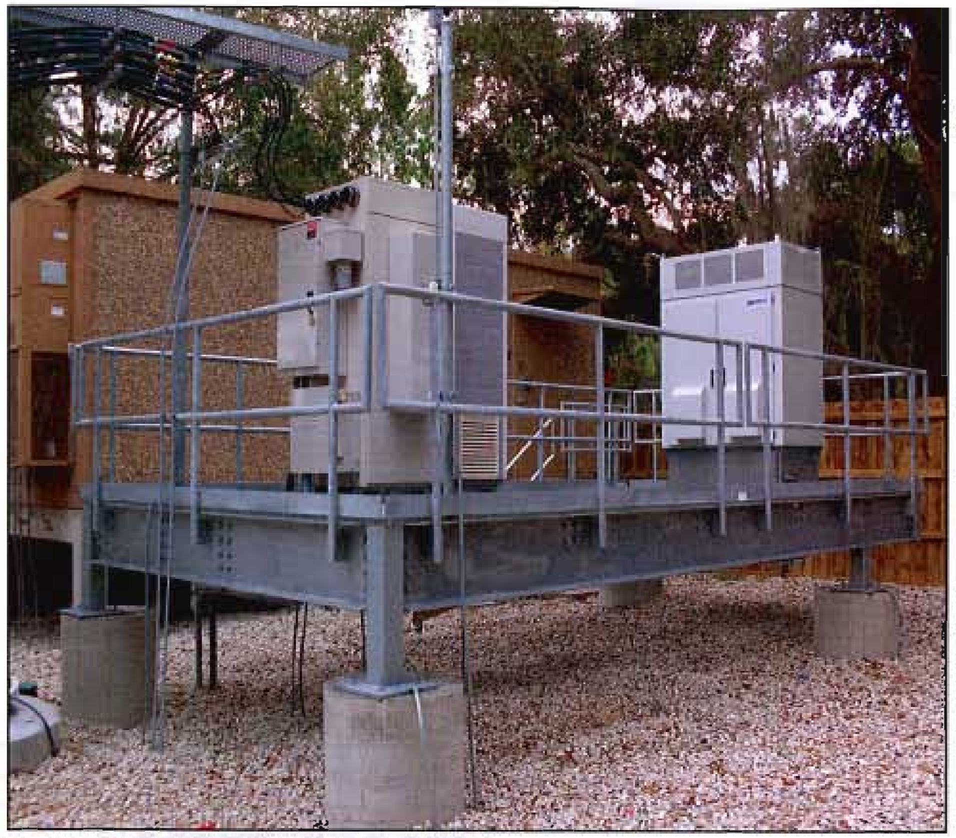
In recent years, an alternative to the traditional backup electric power for telecom installations has become commercially available. It is the fuel cell. A fuel cell produces electricity through an electrochemical reaction.

The science behind fuel cells is not new. It was discovered by Welsh lawyer-turned-scientist William Robert Grove in 1838, but it wasn't until the mid-20th century that designing and building fuel cells with commercial potential was explored.

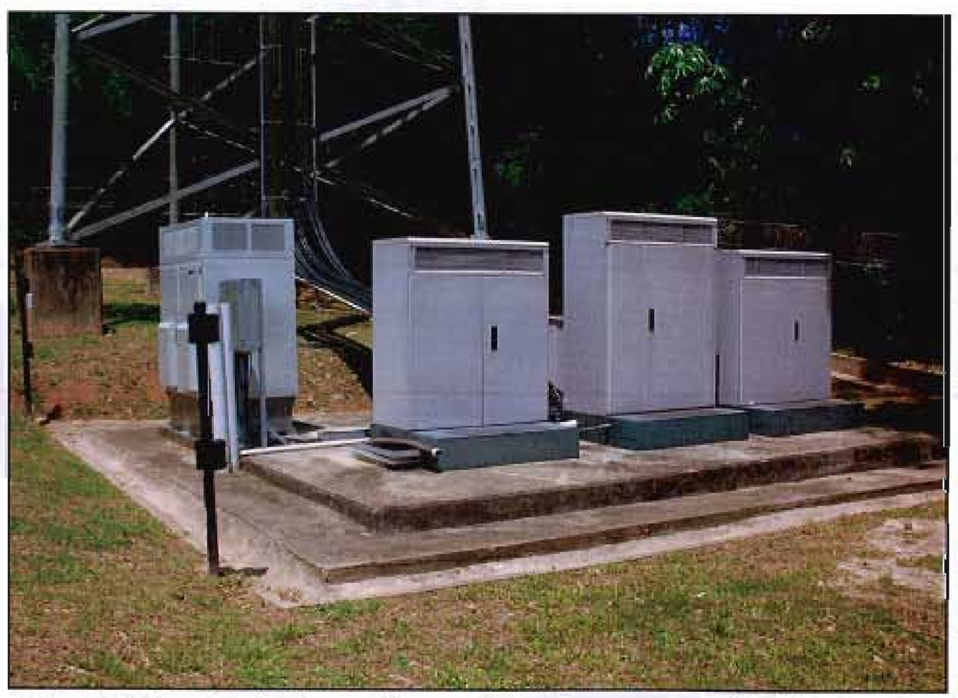


It takes one 55-gallon fuel tank of methanol-water fuel with a fuel reformer to produce 48 hours of 5-kilowatt output power versus 30 T-cylinders of hydrogen to produce the same amount of output power.

The type of fuel cell commercially available today and most appropriate for use with wireless telecommunications



An alternative to the traditional backup electric power for telecom installations has become commercially available: the fuel cell. A fuel cell, housed in the cabinet to the right side of the platform, produces electricity through an electrochemical reaction.



With a fuel cell system that has an integrated fuel reformer and a fuel tank (in the cabinet to the left), when the grid power fails at a wireless telecom site, a small battery string takes over the site's load for a couple of minutes while the fuel reformer starts up and produces hydrogen, and then the fuel cell begins powering the site's load (the three base stations in the other cabinets).

sites is the proton exchange membrane (PEM) fuel cell. PEM fuel cells are compact, durable, reliable and quiet, and they operate at peak efficiency in a wide temperature range (–40 degrees C to +50 degrees C) and in adverse weather. In addition, they have few moving parts (thus needing minimal maintenance), they come in sizes ranging from 250 watts to 250 kilowatts, they can readily adjust their electronic output to meet shifting power demands, and they offer a high energy density. Also, fuel cells are fast starting and can begin delivering electricity within seconds of activation.

The typical runtime for one of today's fuel cells operating on 6 bottles of hydrogen (one bottle = 1 T-cylinder, which includes 7,392 liters of hydrogen) is 10 hours at 5 kilowatts of output power. For longer runtimes, additional bottles of hydrogen can be hot-swapped into the hydrogen storage cabinet. However, there can be limitations as to how much extended backup runtime can be achieved by hot-swapping bottles of hydrogen. The extended backup runtime can be limited by the amount of space for storage of additional bottles of hydrogen at a fuel cell installation or by the remoteness of a fuel cell installation, either of which may make hot-swapping unfeasible.

There is a new technology that has already been successfully deployed commercially and that can extend fuel cell backup runtime not by hours, but by days. It is called a fuel reformer. To put it simply, what a fuel reformer does is to take a liquid hydrocarbon/water fuel and extract the highly purified hydrogen so it is readily available for use as fuel in the fuel cell.

A typical example of the effectiveness of the use of a fuel reformer integrated with a fuel cell as a reliable source of extended run backup power for a remote cell tower is the case of Telefónica Móviles, a wireless telecom service provider in Spain. A remote cell tower operated by the company north of Madrid in central Spain suffered repeated power outages. An aging power recovery system consisting of a large bank of batteries proved difficult and costly to maintain. Telefónica Móviles needed to find a reliable, autonomous, low-emission solution for its remote backup power problem. They chose a fuel cell with an integrated fuel reformer that came with a 55-gallon tank of methanol/water fuel. Using the fuel reformer combined with the fuel cell, the 55 gallons of liquid fuel supported Telefónica Móviles' 2,000-watt load at that remote cell tower reliably for more than four days (more than 100 hours of operation) without the need for refueling.

With a fuel cell system that has an integrated fuel reformer and a fuel tank, when the grid power fails at a wireless telecom site, a small battery string takes over the site's load for a couple of minutes while the fuel reformer starts up and produces hydrogen, and then the fuel cell begins powering the site's load. An available system is powered by HydroPlus liquid fuel, a mix of water and methanol (62 percent by weight methanol). The fuel reformer is highly efficient, recycling the waste heat from the fuel reforming process and directing it back to the reformer's combustion chamber where the waste heat takes over as the heat supply to vaporize the liquid methanol-water fuel.

The typical runtime for one of today's fuel cells operating on six bottles of hydrogen is 10 hours at 5 kilowatts of output power.

This system solves the problem of delivering needed onsite, on-demand electricity during power outages, and it yields immediate savings in footprint, weight, regulatory setbacks (clear space requirements), simplified refueling and, most importantly, extended runtimes.

It takes one 55-gallon fuel tank of methanol-water fuel with a fuel reformer to produce 48 hours of 5-kilowatt output power versus 30 T-cylinders of hydrogen to produce the same amount of output power. The fuel tank and reformer create a 72 percent reduction in footprint and a 67 percent reduction in weight over the amount of bottled hydrogen (and number of hot swaps needed) to produce the same 5-kilowatt power output.

The commercially available fuel cell with an integrated fuel reformer and supply of HydroPlus methanol-water fuel is an increasingly popular, highly reliable, and cost-effective backup power source for remote sites and extended-run power outages for the wireless telecom industry. agl

James Kerr is product marketing manager at IdaTech, Bend, Ore. The company sells fuel cell systems with integrated fuel reformers and fuel tanks.