Fuel cells in cell phone rescue

The commercially available PEM fuel cell with an integrated fuel reformer is an increasingly popular choice in the wireless telecoms industry as a backup power source for extended run power outages or for remote sites.

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

According to the US Energy Information Administration, there were 149 major disturbances in grid delivery of electricity in 2008 caused by hurricanes, earthquakes, thunderstorms, ice/snow storms, high winds and more. The EIA reported 36 such outages in the first quarter of 2009 alone. These 2009 outages lasted anything from a little over 1 hour to approximately 16 days, with the great majority lasting from a couple of hours to two days. In anticipation of these grid outages, most wireless telecom sites have backup power systems – conventionally consisting of valve-regulated lead acid (VRLA) battery strings and/or gensets.

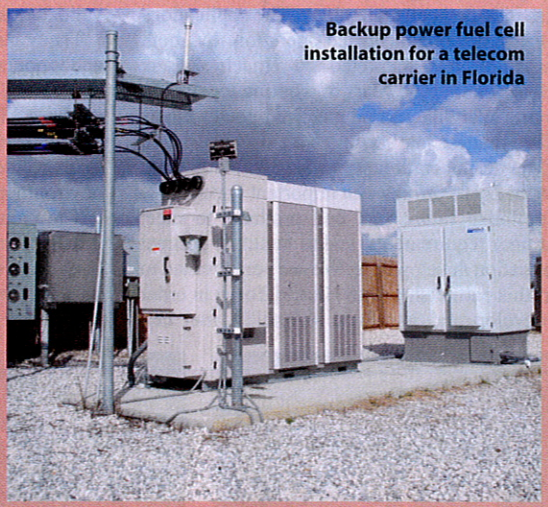
These traditional solutions aren't always appropriate for sites requiring extended run times (days rather than hours), and they don't always work effectively. A battery string can be expected to provide anything from 1 to 4 hours of backup power, but battery functionality is affected by age, temperature, deterioration of charge during down time, and corrosion. In addition, there are environmental problems with the disposal of batteries. A diesel or propane generator – on its own or in combination with batteries – provides longer backup. A generator's run time 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 downside of generators is that they are noisy, produce noxious emissions, and, since they have several moving parts, they need a lot of maintenance and lubrication.

Alternative

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 combines a fuel gas (such as hydrogen) with oxygen and produces electricity through an electrochemical, usually high temperature catalytic, reaction. The principle was discovered by Welsh lawyer-turned-scientist William Robert Grove in 1838, but it wasn't until the mid 20th century that the design and building of fuel cells with commercial potential was explored.

Hurricane proof and low emissions too

A major telecom carrier in Florida wanted an extended run reliable backup power solution for cell sites that were in locations subjected to severe weather conditions such as hurricanes and thunderstorms. They also wanted systems that would provide backup power to the cellular network during times of power outage from the electric grid. Systems were installed outdoor on a concrete pad next to the base transceiver station and integrated with the existing power system. These installions at wireless base stations, replacing diesel or propane generators, have lowered the exhaust emissions produced during electric grid outages and backup power operation.



Backup power fuel cell installation for a telecom carrier in Florida

There several types of fuel cell commercially available today but the most appropriate for use with wireless telecoms sites is the PEM (proton exchange membrane) type. They are compact, durable, reliable, quiet, and operate at peak efficiency in a wide range of climates (-40°C to +50°C) and adverse weather conditions. In addition, they have few moving parts (thus needing minimal maintenance), come in sizes ranging from 250 W to 250 kW, can readily adjust output to meet shifting power demands and offer a high energy density. Also, this variety of cell is fast starting and can begin delivering electricity within seconds of activation.

The typical run time for one of today's fuel cells operating on 6 bottles of hydrogen (one bottle contains 7392 litres of hydrogen) is 10 hours at 5 kW of output power, but longer run times can be achieved by hot-swapping new bottles, although the process takes up storage space and would not be feasible at remote sites.

Employing a fuel reformer extends run time by days. A reformer takes a liquid hydrocarbon/water fuel and extracts high purity hydrogen.

Load bearing

The kind of fuel cell systems with integrated fuel reformer and fuel tank supplied by Idatech contain a small battery string, which, when the grid power fails at for example a wireless telecom site, takes over the load for a couple of minutes while the fuel reformer starts up. On production of hydrogen the fuel cell begins powering the site's load. Idatech supplies HydroPlus liquid fuel, a mix of water and 62% by weight methanol. The reformer recycles waste heat from the reforming process and returns it to the reformer's reactor chamber where it supplies the heat to vaporise the liquid methanol/water fuel, adding to the efficiency of the unit.

This system solves the problem of onsite on-demand electricity during power outages, and yields immediate savings in footprint, weight, regulatory setbacks owing to clear space requirements, simplified refuelling and, most importantly, extended run times.

One 55-gallon tank of methanol/water fuel with a fuel reformer can produce 48 hours at 5 kW output power, while it takes 30 cylinders of hydrogen to produce the same amount. But the fuel tank and reformer have a 72% smaller footprint and are 67% lighter.

Fuel cell backup in practice

A fuel reformer integrated with a fuel cell is being used as extended run backup power for a remote cell tower owned by Telefónica Móviles, a leading wireless telecom service provider in Spain. The tower, located north of Madrid, had suffered repeated power outages. An ageing power recovery system consisting of a large bank of batteries proved difficult and costly to maintain and Telefónica Móviles wanted to find a more reliable, autonomous, low-emission solution. They chose a fuel cell with an integrated fuel reformer that came with a 55 gallon tank of methanol/water fuel, that, in combination with the fuel reformer, supports the tower's 2 kW load for over four days without the need for refuelling.

A solution that brought instant results occurred at a site run by Telstra. This is Australia's leading telecommunications company, providing over 9.2 million fixed line services and 9.7 million mobile services with 5.2 million 3G customers. To ensure that its cell towers operate reliably with no disruption in service Telstra decided to test alternative power sources and chose IdaTech's ElectraGen™ XTi Fuel Cell System to reduce the number of battery strings and diesel generators at its sites. Within 24 hours of installation at the first site, a power failure occurred and the fuel cell system responded, generating one and a half hours of backup power. MPS