

# Five Key Reasons to Replace Diesel with Hydrogen Fuel Cells at Wireless Base Stations

By Sandra Saatoff

Some 4,000 U.S. cell sites have been converted to fuel cell backup power. For many wireless carriers, the use of fuel cells makes sense economically, operationally and environmentally.

Telecom operators first installed hydrogen fuel cells back in 2003 as a replacement for diesel generators at wireless base stations and outside plant (OSP) sites. Since then, hydrogen and fuel cell technology and solutions for the management of stationary backup and disaster-recovery power have advanced dramatically through new innovations by fuel cell manufacturers and closer collaboration with customers and industry partners.

The stationary fuel cell market has grown from a small number of installations to approximately 4,000 sites across 46 U.S. states and additional sites in 34 countries on five continents. In fact, every major domestic telecom carrier uses hydrogen fuel cells somewhere in their network. However, the vast majority of global carrier sites still use carbon-emitting diesel-based backup power.

The good news is that more operators are seeking to move away from their low-efficiency, polluting diesel gensets and toward disaster recovery power that helps reduce capital expenditures and operating costs at ground level, rooftop, central office and remote facilities, while also being cleaner.

Fuel cells offer an efficient, reliable and environmentally friendly power

alternative, leading more telecom carriers to view hydrogen fuel cells as the preferred backup power solution at wireless base stations and outside plants.

There are five key reasons hydrogen fuel cells make sense as the replacement for diesel:

- Flexibility
- Reliability
- Smaller size
- Cost-effectiveness
- Environmentally clean

Let's take a deeper look at these five major benefits of hydrogen fuel cells in the management of backup and recovery power for wireless base stations and outside plant sites.

## Flexibility

Hydrogen fuel cells are flexible. The models generally used for telecom base stations are housed inside environmentally hardened cabinets and come in various power outputs ranging from 200 watts to 10 kilowatts. Customers are able to purchase the initial power level they need and add to it if power requirements change, often without affecting the footprint of the solution. For example, a customer may purchase a cabinet sized for 10 kilowatts, but only populate it with

7.5 kilowatts of power generation, choosing to save the capital expense until the capacity is needed in the future.

Hydrogen storage solutions are also available in varying sizes, so customers may purchase the amount of runtime specified by their companies for any given site. Improvements in hydrogen availability have made hydrogen as easy to deliver as diesel for many locations.

Planners may determine that a critical location should store 72 hours of runtime fuel, whereas a noncritical base station may only need eight hours of runtime. Because each company has different policies and each location is defined by geographic, environmental and customer-focused differences, it is important to have the flexibility offered by fuel cells to customize the power solution.

## Reliability

Many times, when extreme weather knocks out grid power, the public has been dismayed by their inability to use mobile devices because the cell tower serving them is also down. In such a case, it's likely that the diesel generator failed to serve the equipment load. There are a number of reasons

something like this might happen, but lack of equipment maintenance is a big one.

Diesel generators of the size routinely used at telecommunication outside plant sites have a reliability rating of 88.4 percent, according to the paper “Survey of Reliability and Availability Information for Power Distribution, Power Generation and HVAC Components for Commercial, Industrial and Utility Installations” by Hale and Arno, presented at the IEEE Industrial and Commercial Power Systems Technical Confer-

ence in 2005. The generator system includes not only the diesel generator, but also the generator battery and automatic transfer switch. Reliability seems to be highly related to whether the system has received proper ongoing maintenance, which includes quarterly checks of several different systems by a person visiting the site.

Fuel cell reliability has been third-party tested at up to 99.6 percent. Because fuel cells have almost no moving parts, an annual air filter check is the only on-site mainte-

nance required. Automated health checks are performed monthly by the fuel cell in order to maintain optimal performance capability when called upon to cover an outage. And hydrogen fuel has an indefinite shelf life, so customers need not be concerned about fuel stability as they would be with diesel.

### **Smaller Size**

A typical base station includes a communications shelter that sits on a concrete pad and then a second concrete pad where the diesel



Plug Power's one-pad, space-saving integrated OSP solution.

generator sits. It may also contain an external fuel tank in a third location and multiple cabinets housing communications equipment that isn't inside the original shelter. All of this space is generally leased by the tower owner, when the tower owner is not the carrier. The more space used, the higher the annual lease fees.

The flexibility of fuel cells has allowed some manufacturers to develop a one-pad solution, an integrated, outside plant cabinet housing the complete DC plant, fuel cell backup power and fuel and customer communications equipment. For sites with lower power requirements or limited site space, the option saves up to 87 percent footprint compared with a traditional configuration while also decreasing the amount of time needed to construct the site.

### Cost-effectiveness

Fuel cell manufacturers have made significant gains in both technology and cost reduction. For many site power profiles, fuel cells compete favorably against diesel generators on a capital cost basis, without tax credits. With federal tax incentives, for carriers able to take advantage of them, fuel cells are a clear cost-winner in many more cases. When the maintenance savings for fuel cells is taken into consideration, the total cost of ownership advantage over the lifetime of the backup power solution falls firmly in the fuel cell category.

### Environmentally Clean

A fuel cell is a DC power source that

works by using hydrogen fuel and oxygen from the air. As we know from our basic science classes in high school, hydrogen and oxygen want to combine to form water. A special membrane inside the fuel cell borrows the hydrogen electron in order to produce electricity and then gives it back to the hydrogen molecule, which joins with the oxygen on the other side of the membrane to make water. This zero-emission power production offers corporations a tool for lowering their network emissions and carbon footprints.

There are currently more than 205,000 cell towers in the United States, but for comparison's sake, let's look at just the 4,000 (or so) sites that have been converted to fuel cell backup power. Four thousand telecom sites using 25-kilowatt diesel generators meeting the Environmental Protection Agency's stringent tier 4 emissions standards being used for one week of backup power per year emit an incredible amount of pollution — enough pollution to represent 5,400 vehicles driving back and forth to work, activities and vacations for an entire year.

Carriers using fuel cell backup power at the 4,000 sites over a five-year period have the following effect:

- They make a 100 percent reduction in greenhouse gas emissions over internal combustion generators, preventing almost 139,000 tons of carbon dioxide and 509 tons of carbon monoxide from entering the atmosphere.
- They prevent 435 tons of smog-causing pollution called nitro-

gen oxide from entering our air compared with carriers using diesel generators.

- They keep 2.77 tons of the respiratory irritant and haze-causing particulate matter out of the air because these telecom customers use fuel cells instead of combustion generators.

The use of hydrogen fuel cells helps companies make progress in their corporate sustainability goals. Fuel cells actually check several boxes for carriers. For the environmental department, the clean operation shows customers that the carrier is working to care for our environment. For the engineering department, the flexibility, space savings and cost parity help them do their job, providing communications access in sometimes challenging geographic locations. For the operations team, the reliability and low maintenance of fuel cells increase the productivity of their staff, thereby decreasing the ongoing cost of each site, enabling tight budgets to stretch further.

It's time to take another look at hydrogen fuel cells at telecommunication sites, because reliable power is about solutions that make sense economically, operationally and environmentally.

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