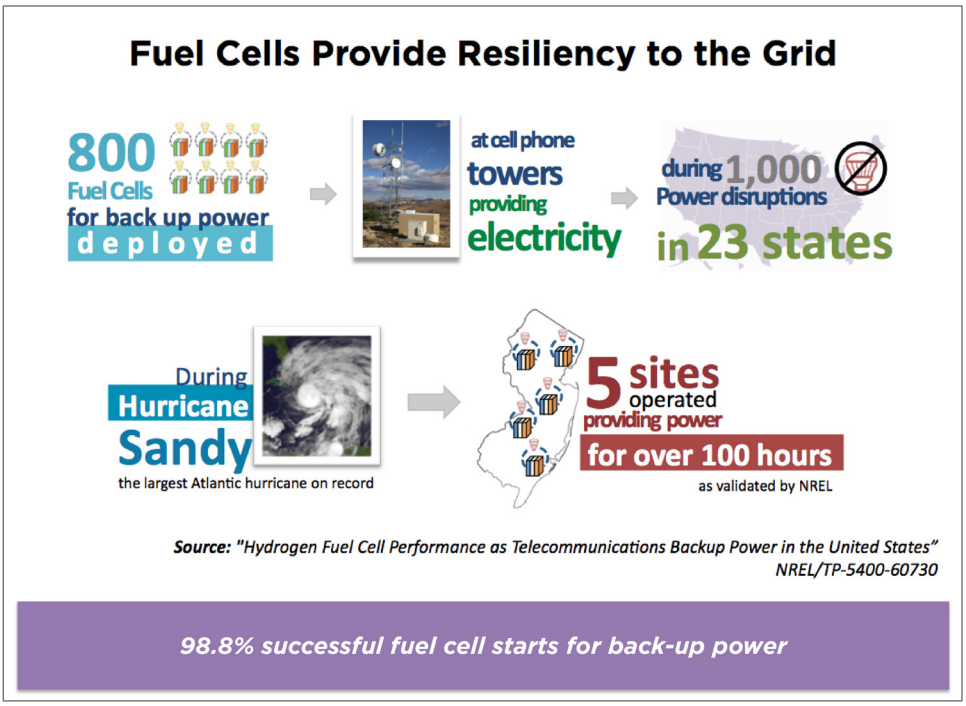
Fuel Cells Powering Critical Infrastructure in Disasters

The United States' power grid is 99.97% reliable, but when it fails, it is both disruptive and costly. Hurricanes, tornados, thunderstorms and other weather events—not to mention human error, animals, and mechanical failure—can knock out power and communications infrastructure that cost Americans at least $150 billion in economic losses each year.

Recognizing the vulnerabilities of grid dependency, organizations are looking at fuel cells as an attractive option for reliable backup power. After Superstorm Sandy slammed the Caribbean and the East Coast, fuel cells provided emergency backup power to at least 100 telecommunications towers in both the Bahamas and the Northeast United States. During Hurricane Irene in 2011, ReliOn fuel cells kicked on at 56 Sprint cell towers, and Doosan fuel cells maintained power at both a storm shelter at South Windsor High School and a Whole Foods location in Connecticut.

Telecommunications

Today, more than a third of U.S. households rely solely on wireless communication devices, putting ever more pressure on mobile networks to function during emergencies. Storms can be particularly disruptive to critical communications systems used by first responders, 911 operators, emergency crews, and the general public. Superstorm Sandy knocked out 25 percent of cell sites in the 10-state area it affected, causing cell phone outages in more than 150 counties. After the summer 2012 "derecho" thunderstorm knocked out power all over the Washington, D.C. area, 2.3 million people lost access to 911 services for four days, partially due to backup diesel generator failures at Verizon facilities.[1]



A number of large mobile service providers, including Metro PCS, AT&T, Sprint, and others have installed fuel cell systems at more than 5,500 cell towers nationwide.[2]

Grocery and Retail Stores

Grocery stores can suffer big losses in spoiled produce and other perishables if grid power is lost for an extended time. Several supermarket chains, including Whole Foods, Safeway, Stop & Shop, Albertson's, Star Market, and Price Chopper, have invested in fuel cell backup systems at some of their new stores, hoping to mitigate the financial impact of losing power.

Perhaps the best example of the benefit of fuel cells to grocery stores came during Hurricane Irene, when a Whole Foods in Glastonbury, Connecticut, the first grocery store to install a fuel cell for stationary power, was able to keep its coolers running with its 200 kW fuel cell. Whole Foods now has four stores nationwide powered by fuel cells.

Hospitals

Backup power is critical in hospitals, where patients' lives could be threatened if power is lost for life support, operating rooms, and medicine refrigeration. During the aftermath of Hurricane Katrina, generators failed or ran out of fuel at four hospitals, necessitating extraordinarily difficult evacuation efforts via boat and helicopter.

A report by the Urban Institute[3] on hospitals' challenges during Katrina called the generator failures "one of the most striking and disappointing parts of the post-Katrina experience." During Hurricane Sandy, several hospitals were forced to evacuate patients due to malfunctioning backup generators. St. Francis Hospital in Hartford, Connecticut, has installed two 400kW fuel cells for stationary power.

Shelters

South Windsor High School in Connecticut, a designated emergency shelter, is equipped with a 200 kW fuel cell, which is usually tasked with decreasing the school's draw on grid power and heating air and water. During Winter Storm Alfred in 2011, the fuel cell

kept the high school running for nine days as the facility provided shelter, food, and hot showers to 400-600 area residents.

Police/Fire Stations

For more than a decade, the New York City Central Park Precinct has had a 200 kW fuel cell installed. The police station was the only building in the area to retain power during the massive blackout that hit the Northeast in 2003. The fuel cell system also saved the police station $200,000 in capital costs by avoiding the installation of power line extensions.

Gas Stations

After Hurricane Sandy, finding an open gasoline station in New Jersey was a challenge, as the few gas stations with power had to serve millions trying to get fuel for their backup generators and cars. Fuel cell backup power at gas stations could prevent the long lines and gas rationing that typically follows hurricanes.

Data Centers

Like wireless networks, data centers require an uninterrupted supply of high-quality electricity. A study by the Aberdeen Group[4] estimated that companies lose an average of $138,000 for every hour their data center is offline, and companies with more than 1,000 employees lose an average of $1.1M per year.

Residential

In Japan, micro-CHP (combined heat and power) fuel cell systems have become increasingly popular since the tsunami, and roughly 150,000 have been installed to date. The European Enefield project plans to install 1,000 residential micro-CHP units across Europe this year. Residential fuel cell backup power systems could help consumers become grid-independent in the future, as next generation technologies offer the ability to operate without any grid power whatsoever.

Grid Backup

To help bolster the power grid and prevent power outages, utility companies are beginning to deploy megawatt-scale fuel cells at electric power stations. This also helps energy companies meet clean energy requirements imposed by Renewable Portfolio Standards (RPS)—a regulation in place in many states (and countries) requiring energy companies to acquire a certain percentage of their electricity from renewable sources. Several large-scale installations are already operating at utilities in several states, including a 14.9 MW Dominion fuel cell power park in Bridgeport, Connecticut, and 30 MW installed at two Delmarva Power substations in Delaware. In addition, some states in the northeastern U.S. are funding microgrids, to ensure reliable power during storms or other outages. In Connecticut, several microgrids include fuel cells to provide power for emergency shelters, first responders, seniors, and public works facilities.

As global population and economic production grows, demand for power is beginning to outstrip existing grid capacity, leading to 15 percent longer outages and 43 percent higher electricity costs.[5] Fuel cells help reduce grid dependency and mitigate financial losses from power outages while keeping critical infrastructure up and running. No longer an environmentalist's pipe dream, the reliability, scalability, and versatility of fuel cells are saving money for companies in a variety of industries, and making dependable access to emissions-free power a reality.

For More Information

More information on the Fuel Cell Technologies Office is available at http://www.hydrogenandfuelcells.energy.gov.

References and Notes

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