



Fuel Cell Systems in Telecom Applications

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Ballard Fuel Cell Systems



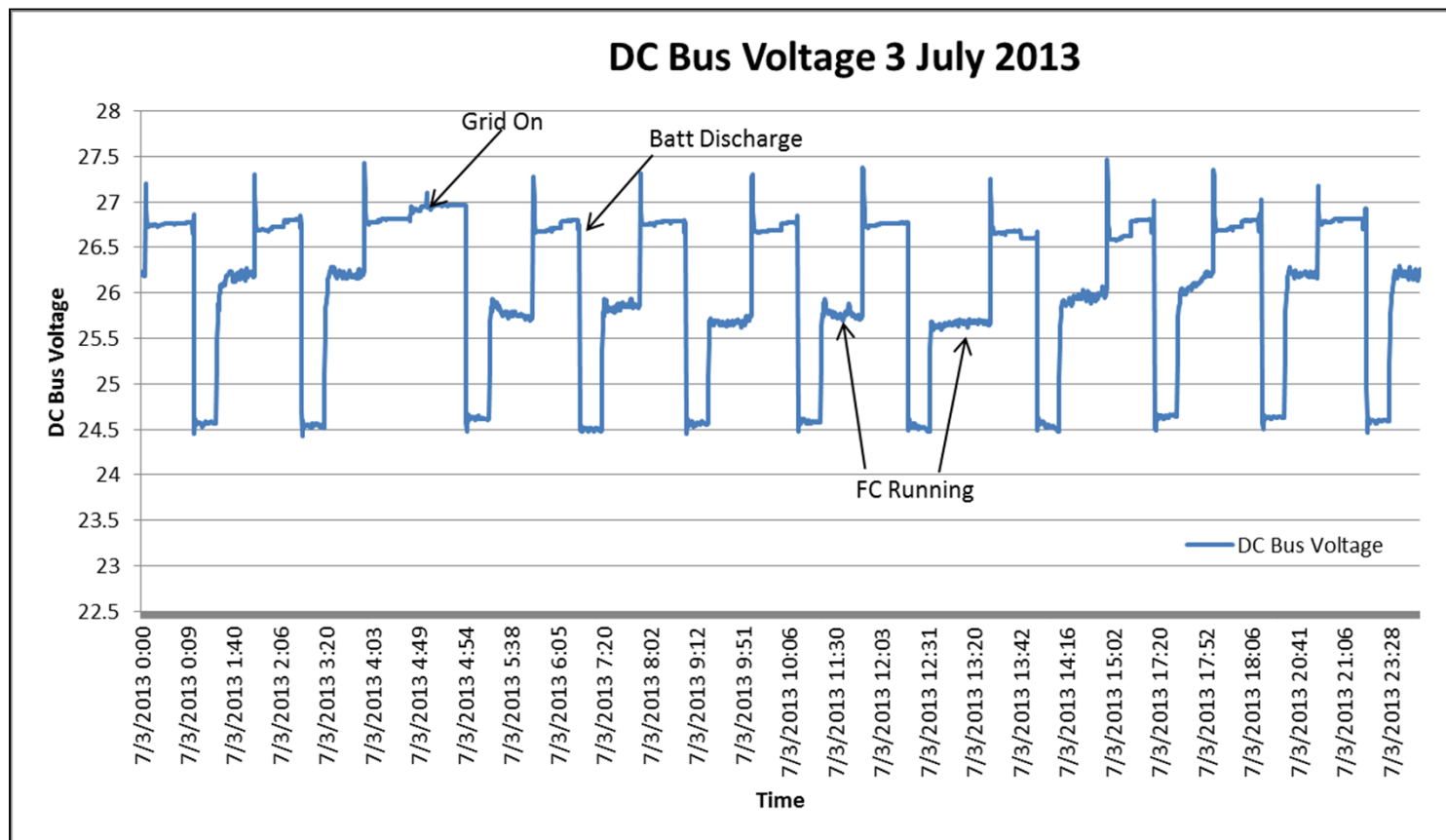
Practical Aspects of a Fuel Cell System in Telecom

- Fuel cell systems generate DC power and are typically connected to the site DC bus.
- Fuel cell systems follow the load. They can be configured to charge batteries or provide power only to the load.
- They have user-settable start/stop voltages.
- They can be remotely monitored and controlled.



Practical Aspects of a Fuel Cell System in Telecom

- Backup Power – site with unreliable grid.





Economics of Fuel Cells in Telecom Applications

- Typically, batteries are used where only a few hours of backup power are required.
- Systems fuelled by compressed hydrogen are economical to about 8 or 10 hours of backup.
- Liquid-fuelled systems offer extended duration backup protection.
- Logistics management of liquid fuel is typically easier during a grid outage.



Installation of Fuel Cells

- Rack-mountable and dedicated cabinets.
- Indoor and outdoor options.
- Rooftops – systems are lightweight.
- Residential & business areas – quiet systems.
- Environmentally-sensitive areas – low/zero harmful emissions, safe fuels.
- Commercial systems shipping now: Ballard, Dantherm, ReliOn, Alteryg, etc. – thousands already shipped.



Installation of Fuel Cells





Fuel Cell Installations





Bahamas, 2013 – Hurricane Sandy

- 17 ElectraGen™ ME Systems operated.
- Provided more than 700 hours / 1.2MW-hours of backup.
- Protected 50% of cell service on New Providence Island.
- Abaco Island lost 28 of 30 cell sites; the 2 that operated were protected by ElectraGen™ ME fuel cell systems.



Additional materials

May 15, 2013

Hurricane Sandy and Commercially Tested Fuel Cell Backup Power Solutions WEBINAR

Hosted by
Eric Denhoff, CEO
Canadian Hydrogen and Fuel Cell Association

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PUTTING FUEL CELLS TO WORK

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ElectraGen

Superstorm Sandy: Fuel Cell Design for Disaster Recovery vs. Backup Power

Reli On
Fuel Cells Simply Powerful

Benefits of Fuel Cell Solutions for Backup Power Needs in Telecom

For telecom service providers, extended, prolonged power outages can be devastating. Telecom service providers based on Ballard's proprietary fuel cell technology offer improved network reliability, long life-cycle, environmental and economic improvements over traditional technology.

Advantages

- Fuel cells have no moving parts, no combustion, no noise, no pollution, no maintenance, no fuel storage and no hazardous waste.
- Fuel cells have a long life cycle (up to 20 years) and are designed for 24/7 operation.
- Fuel cells are highly efficient (up to 60% efficiency) and generate clean power.
- Fuel cells are highly reliable (up to 99.999% uptime) and are designed for 24/7 operation.
- Fuel cells are highly secure (no fuel storage and no hazardous waste).

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FUEL CELLS
www.fuelcells.org

When the Grid Fails: Fuel cells power critical infrastructure in disasters

The United States' power grid is 99.99% reliable. But when it fails, it is both painful and costly. Hurricanes, tornadoes, 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 \$160 billion in economic losses each year.¹

Recognizing the vulnerabilities of grid dependence, organizations are looking at fuel cells as an attractive option for critical backup power. After Superstorm Sandy devastated the Caribbean and the East Coast, fuel cells provided emergency backup power to at least 100 telecom communications towers in both the Bahamas and the Northeast United States. During Hurricane Irene in 2011, Ballard fuel cells kicked in at 56 Sprint cell towers, and Claridge Power Fuel Cells maintained power at both a storm shelter at South Windsor High School and a Whole Foods location in Connecticut.

Diesel generators and battery backup systems still provide the vast majority of emergency backup power.

Altery's Freedom Power Provide Reliable Telecom After Hurricane Sandy

16 NOV 2012

Altery has announced that the only wireless telecommunications tower sites that remained in operation during the power outages that followed hurricane Sandy were those powered by its Freedom Power fuel cell systems.

Hurricane Sandy knocked out power to an estimated 8.1 million people and several major telecom carriers claimed it may take weeks to restore service to some markets. Altery's customers reported that numerous became inoperable due to loss of power, rapid depletion of failure of diesel generators to start. Wireless customers power systems were still able to make calls and contact emergency power cuts.

Eric Mettler, Altery's President and CEO said "We are proud source still running after such a devastating storm. It is great to provide continuous communications capability. The power infrastructure have far surpassed the reliability of the power generators. Our fuel cells are the new and superior solution wind, solar, batteries, and generators, at lower cost. They advantage for telecom carriers, earning them extreme customer loyalty."

Green Power for Mobile

Fuel Cell Systems for Base Stations: Deep Dive Study

An exploration of the current and future potential of fuel cell systems to provide green power for the telecoms industry

By Mark Crouch

Using fuel cells in... uninterruptible power supply

Background

Events such as Hurricane Katrina in 2005 have focused attention on the availability and reliability of tele-communications services worldwide. Both wireless and wireline communications are expanding globally, so the provision of reliable, economical power is vital. Terrestrial Trunked Radio (TETRA) networks in use by emergency services, military personnel and government agencies require total system reliability during emergencies, when loss of communication would exacerbate an already critical situation. The rapid expansion of cellular networks in countries without more traditional land-based telephone systems is also demanding the provision of reliable power supplies and this market is one of the fastest growing worldwide. The choice of backup power technology for telecommunications therefore has a direct impact on the everyday life of people around the world.

Traditional solutions have included generators and batteries, but issues of maintenance, noise, pollution, size, inefficient running, remote monitoring difficulties and operation under extreme conditions all pose problems for these technologies. This has led to interest in fuel cell technology for this application, and fuel cell backup power units are now being installed in a number of countries.

KEY BENEFITS

- Operation is continuous as long as fuel is available
- Unlike batteries, temperature does not directly affect fuel cell performance

GSMA Green Power for Mobile | **Fuel Cell Systems for Base Stations: Deep Dive Study**