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C. Guzy

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Fuel Cell Systems in Extended Duration Emergency Backup Power Applications

Christopher Guzy, Ballard Power Systems, Canada

1 Introduction

In this presentation, we will cover how the deployment of clean energy, zero-emission fuel cell backup power modules seamlessly handles extended power interruptions. Fuel cell powered backup power products have:

- Extended runtimes, while delivering a high level of reliability in an affordable package;
- High durability with minimal maintenance;
- Longer lifetime than batteries;
- Fueling flexibility, since reformate-capable fuel cell products permit flexible installation where natural gas or methanol is available.

Various aspects of the business will be reviewed in this presentation, including a market and technology overview, followed by examples and experiences from current deployments along with information regarding the commercialization of Ballard Power Systems' fuel cell technology.

2 Market Overview

There are currently two commercially viable telecom applications where extended duration power solutions are being used: emergency backup power and supplemental power.

Emergency backup power is widely required in areas where the grid is reliable and the requirement for backup power is infrequent. Events such as the Northeast U.S. Blackout of 2003 and the Hurricane Katrina disaster of 2005, led to increased focus on availability and reliability of telecommunications services. A key differentiator of telecom systems, whether wireless or wireline, is the ability to provide continuous, reliable service to customers at all times and, in particular, during extended power outages. The choice of backup power technology has a direct impact on the availability of services to end-users and contributes significantly to a telecommunication company's market success. Deployment of fuel cell systems in this application is a practical alternative to lead-acid batteries for telecom service providers.

Supplemental power solutions are required in regions where the grid is unreliable and the need for power is robust and growing. Fuelled by the transition from an agricultural to an industrial base, newly industrialized countries are experiencing economic growth and rapidly expanding market demand. In many of these countries, however, the lack of widespread and reliable electrical power is a real bottleneck to smooth running and efficient economic activity. Urban areas can, and do, experience frequent power outages of over six hours that interrupt daily life, especially for businesses relying on electricity to power critical devices. Companies in high tech industries, such as telecom network operators, long familiar with the unreliability of grid power, have invested in private distribution generation systems. As a result, diesel

generators and batteries are most often used to provide supplemental power, though each has its own limitations.

3 Technology Overview

At the heart of Ballard's backup power solutions is our FCgenTM-1020ACS fuel cell stack. The FCgenTM-1020ACS is an air-cooled hydrogen fuel cell that has been engineered to incorporate advanced open cathode technology and state of the art self-humidifying membrane electrode assemblies. These features completely eliminate the need for humidification systems and simplify system integration. The result is a simple, low-cost design delivering reliable operation over a wide range of challenging conditions. With no moving parts and high efficiency, the FCgenTM-1020ACS produces clean DC power with a low thermal and acoustic signature. The fuel cell stack can be scaled to meet power requirements from 300W to 3kW.

The next generation of technology that Ballard is introducing is our FCgenTM-1300 fuel cell stack. The FCgenTM-1300 is a reformate-capable liquid-cooled fuel cell that has double the durability, as well as lower cost, than the FCgenTM-1020ACS. The FCgenTM-1300 has been engineered for state of the art high volume manufacturing. It has the ability to provide from 2kW to 11kW of power suitable for use in applications such as supplemental power.

4 Fuel Cell Deployments

Ballard has several deployments of backup and supplemental power solutions in the marketplace. Two examples will be reviewed in this presentation:

- (i) Deployment of fuel cell backup power systems by our partner, Dantherm Power, for use in European TETRA emergency networks, ensuring reliable power-on-demand. This environmentally friendly, fuel cell based backup solution provides mission-critical operations with continuous secure communication across the nationwide SINE network in Denmark, the first network of its kind in the world.
- (ii) Deployment of our partner IdaTech's fuel cell supplemental power modules by ACME TelePower in India, where the rapid growth of telecom networks and poor grid infrastructure create the need for a more reliable and flexible supplemental power solution. Future deployment of natural gas and methanol reformate fuel cell products to support telecommunication networks in India – and other developing economies – will be a major step forward in providing clean continuous power.

5 Field Experiences

Using the above two examples, the presentation will review the technical challenges that we have faced, including environmental factors (such as high altitude operations and air pollutants) as well as cell degradation due to frequent start/stop cycles. Also a challenge was non-operational performance loss (NOPL) in backup power stacks due to the infrequent operation. Strategies to mitigate NOPL had to be developed and will be reviewed. In addition, we will cover the analysis selected field operational data provided by Dantherm and IdaTech/ACME and the path forward for these deployments.

6 Commercialization

We will conclude with a summary of how Ballard is “putting fuel cells to work” by bringing PEM fuel cell costs down, while leveraging the advantages of the technology, including scalability, safe designs, fuel flexibility, fast start-up, and low-temperature operation. Fuel cells are delivering reliability, durability, and efficiency gains...leading to compelling savings relative to incumbent technology and ensuring their place in the future clean energy landscape.