Energy Storage and National Security: The Challenge of Terrorism and Global Military Operations by Ed Badolato, President, CMS, Inc.

Presented at the DOE Energy Storage Systems Peer Review Conference, Crystal City, VA, November 14, 2001

Recent events involving electric power industry have pointed out the importance of this critical component of the US infrastructure. In the following, we will discuss the series of adverse events over the past several years that have disrupted the supply of power to major segments of the US--California Blackouts, Weather Induced Power Disruptions, the Attack on the World Trade Center--as well as the new storage and reliability requirements of today's military.

Coping with Blackouts and the Terrorist Threat. Learning to cope with electricity shortfalls and blackouts has been a costly reality in California as a string of power disturbances and outages disrupted the lives of millions of people and thousands of businesses. Electric Power Research Institute estimates that power outages and fluctuations already cost the economy up to $50 billion annually in lost production (DOE believes it may be as high as $150 billion annually), and EPRI argues that the US electricity system is in its worst condition since 1965.

Planning for both price spikes and terrorist strikes have presented a dilemma to the utility industry. Both have serious consequences, but the recovery from a price spike usually has less long term damage that the worst case terrorist attack--a coordinated multi site attack that will cripple an entire region for weeks and months. However, with the post 9/11 terrorist threat, the potential for terrorist caused blackouts around the country could be even greater than what we saw in California.

This threat points out that better protection needed for individual companies with mission critical power-related operations will have to rethink their emergency planning to include distributed generation, power storage and improved power quality from the grid.

DOE has recently released a study warning that increased electricity usage and an aging infrastructure were stressing the grid systems to the point of disrupting service, and the report also recommended on site systems as a means to help utilities meet the growing power demand.

The Key Lessons of 9/11 for Distributed Generation and Power Storage. There were four key lessons from the recent terrorist attacks:

First, the NYC priority of restoration for key financial customers had tremendous implications for distributed generation and power storage capabilities as temporary emergency generation was put into place and grid power was restored.

Second, the battery storage systems and power supply situations of the key telecommunications systems must be revisited to look at the new technologies available for power storage and backup.

Third, the post event temporary suspension of maintenance while restoration took place has implications for user power quality and reliability during a crisis.

Fourth, the problems experienced by the power industry with its in house internet communications reflects back on the integration of the power-telecommunications systems and the need for better emergency power systems.

The digitized military is also learning about the cost of "unreliable power." The military's modern electricity network is revealing vulnerabilities that call into question its ability to meet the needs of its new information and network-centric operations. The deployment of large numbers of US military forces into combat zones with their extensive headquarters and field data centers have a requirement to mesh IT with C3I--Information Technology and Command, Control, Communications and Intelligence.

When one looks at the large numbers of communications vans and the forest of antennas that support the modern military field force, it is evident that there are tremendous opportunities for the new high tech power storage and quality systems. The new storage and reliability systems are presently available and ready to replace the Vietnam era generators that are currently in use. The modern military wants and needs dependable real time high quality power to prevent data corruption, data transmission gaps, and a crippling lack of power at crucial times. For example, a costly Predator drone aircraft was lost in flight recently because of a power loss at its ground control station.

Another network-centric system that has been introduced by the Navy and Marines to extend the reach of military forces inland is the Navy's wide-area-relay Network (WARnet). Designed to provide ship-to-shore and unit-to-unit connectivity, WARnet provides a wireless digital communications network to Marine mobile command centers ashore as well as computers carried by individual Marines in combat. As with many new field systems, WARnet has been reported to be prone to spotty network outages.

The fog of war and the chaos that normal combat generates is bad enough without power failures in electronic battlefield support systems and mobile equipment. The new network-centric military is heavily dependent on the transfer of instant information, both up and down the chain. There is no room for delay or failure. When the power system that supports these networks goes down, there are serious consequences.

The potential for localized disruptions and poor quality power reveal a number of weaknesses in the current power systems. The key desired capability is to be able to generate and deliver power at the desired levels of reliability and quality to our forces in the field, as well as to the supporting command and data centers.

The vulnerability of local distribution systems points not merely to the need to spend more on upgrading our power systems, but also the need to introduce systems that enhance the value of small generators that, by producing power within the local system, can lighten logistic loads.

The Powercell solution for providing high quality, uninterruptable power. High quality, uninterruptable distributed power is especially valuable for high tech industries such as computer chip and semiconductor manufacturers, pharmaceuticals, chemicals, and biotechnology, which rely on computerized manufacturing applications, and are vulnerable to even slight power interruptions. The same is true for the network-centric military.

Powercell Corporation of Burlington, Massachusetts, has developed a unique technology to not only store, but manage, power in order to provide quality and reliable electricity. The company's flagship product, called PowerBlock, is an electrochemical storage device that has the ability to not only store significant amounts of power, but also to ensure that customers receive an electrical waveform with a constant magnitude and frequency. PowerBlock provides effective large scale energy management and power quality solutions to meet the urgent needs of the new high tech requirements for national security.

PowerBlock can be used to improve an inter-connection with the power grid or with an emergency power generating unit by placing the PowerBlock system at the end-user's site at the connection to the power grid or generator. It can also maintain reliable, high quality power for an end-user's critical operations through its battery system. For example, grid-supplied electricity can be stored in PowerBlock, ready for instantaneous "zero cycle loss" dispatch should the power grid be interrupted. Typical applications for PowerBlock include data centers, telecom facilities, and "power critical facilities," such as computer chip and semiconductor manufacturers, pharmaceuticals, chemicals, biotechnology centers, hospitals, etc.

The combination of the power grid, a small localized distributed power generation source and a PowerBlock system provides the benefits of quality power for long duration grid failures by allowing peak loads to be served with improved operation economies for the end user. Distributed power applications include power for automated manufacturing and telecommunications facilities, large data centers, "Tech Hotels," and military operations.

Conclusion. At present, communications and power technologies are converging toward what some call an "intelligent" distributed power mini-grid that can respond instantaneously to problems and run more efficiently than current systems. In both the private sector and the military, new power storage and power quality systems can bridge the gap between outages and fluctuations that are so harmful to mission critical operations.