The Evolving Electrical Grid: Why We Need Smart Technology

By German Fernandez, global vertical marketing manager, power transmission and distribution at Belden, Inc.

The seeds of the current smart grid were planted back in the 1980s when electronic control monitoring and metering were introduced. The technological innovations of the 1990s, which included digital control systems, graphical interfaces and software, then made two-way communication in the electrical grid possible. This allowed local grids to grow and eventually become interconnected to boost efficiency and reliability.

Over time, the grid evolved to meet even higher power demands, and the "smart grid" was born. Our modern grid has automated digital communication and can gather and act on real-time data about the behaviors of suppliers and consumers. Now, more than ever before, teams can maximize the throughput of the system and improve overall energy efficiency.

Through sensors connected to the grid and various machines that capture real-time data, the monitoring, analysis and control capabilities that come with the modern grid and bi-directional communication greatly improve the reliability, safety, economics and sustainability of the production and distribution of electricity. Government mandates, coupled with greater industry competition, are spurring a very large investment in the smart grid movement worldwide. In fact, some estimate revenue from smart grid technology will reach $70 billion by 2024.

A smarter grid: How to use wireless communication to improve efficiency

Core to the success of smart grid applications are wireless technologies, which introduce many benefits to engineers working in the power generation and distribution space, including:

- **Remote monitoring:** With 4G communication networks deployed across the grid, utilities can remotely locate, isolate and restore power outages, which increases the stability of the grid.
- **Access to information:** With wireless technologies, teams can gain access to information anytime, anywhere and gain better accessibility by using mobile workforces connected to a company intranet.
- **Reduced costs:** When no fixed deployment infrastructure is needed, it reduces the cost and complexity of network deployments and also provides a greater amount of flexibility and scalability.

Using cellular over a public network combines the benefits of high-penetration frequencies with the already available backbone from the telecom utilities connected to the internet. High-speed data access over cellular communications is great for reaching local assets in remote utility facilities and third-party installations. This cellular technology is used to transfer data in a secure, reliable way, and provide connectivity over a public network to utility substations, energy generation locations, utility offices and secondary transformation centers.

4G is ideal for smart grids because it facilitates two-way communication, remote monitoring and better control of the grid, which lead to greater broadband speeds and quick and easy installation. And by supporting multiple megabits, 4G gives grid operators the ability to not only address the primary meter

communications requirements of the network, but also to leverage a common platform for real property management, mobile workforce connectivity and camera security backhaul.

How to get there: What to look for when choosing wireless

There are a variety of wireless technologies to choose from for substation applications. Typical options include: short-range Wi-Fi or ZigBee, city-range cellular 3G, 4G-WiMax or Radio, long-range via radio microwave, or operator's backbone. It is also important to know whether the team needs a point-to-point, point-to-multipoint or mesh communication. To decide, the type of traffic matters: asymmetric or symmetric traffic may require different technologies.

The multitude of options that are out there can lead to a lot of pressing questions for teams: What technology do we choose for our specific application? What characteristics should this technology have? What will the implications for this wireless component be in this specific environment? What scalability and deployment issues might we face?

It's crucial that the data networks in smart grid applications operate reliably in harsh environments and withstand high electromagnetic interferences (EMI), large temperature variations, shocks, vibrations and dust. This necessity requires special performance features and the utmost network resiliency.

In addition, choosing a robust portfolio of technologies that includes everything from cables, connectors, patch cords and patch panels to wired and wireless switches, routers and firewalls for harsh environments is a great place to start. Look for the following:

- **Compact Ethernet port LTE router** for unlimited network connectivity.
- **Integrated firewalls** for maximum perimeter protection of the network.
- **Dual SIMS** for network redundancy to ensure connectivity availability in case of network failure.
- **GPS for geospatial localization** that allows engineers to check the connection status of each device and ensure network security and availability.

Why we need smart technology

The smart grid is the foundation for the world's goals for energy efficiency and a springboard for transitioning to a low carbon economy. It plays a crucial role in efficiently producing and using electricity in our homes, businesses and public institutions.

As more organizations make commitments to the smart grid, investments in distribution automation devices, metering infrastructure, security and mobile devices will grow. Wireless products will be the most critical technologies of the modern grid because they connect the various devices with important data and help teams make informed decisions about energy efficiency. As the smart grid becomes even more sophisticated and data rates increase to support it, solid wireless communication networks will be crucial for success.

For more information on how to successfully implement wireless communication in smart grid deployments, read this white paper: "Guide to Wireless Communication in Smart Grid Deployments."

Author Photo & Biography

Germán Fernández has 15 years of experience in the electric power industry, specifically pertaining to industrial Ethernet networking and telecommunications technologies.

Fernández is the global vertical marketing manager of power generation, transmission and distribution at Belden. He has managed power projects worldwide as a system integrator and brings a deep understanding of cybersecurity needs for electric power utilities to his role at Belden. He is also a member of the Cigre Working Group D2.40.

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