

Optimizing Communication Networks in Renewable Energy Markets with Wireless Technologies

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Introduction

As alternative energy sources, such as wind and solar, become an increasingly compelling solution for power generation, utilities operators are looking for new ways to maximize their investment in communication networks while ensuring reliable, secure data transmission across them. There are a variety of communication options, including data radios, fiber-optic cable, cell phones, and satellite modems.

The same wireless technologies used in many utility applications, such as distribution automation, are available to renewable energy plants. With wind turbines and solar power generation, systems can often benefit from the cost savings of wireless versus fiber optic cable. While fiber is both an expensive and time-consuming process to install, wireless technologies are easily deployed, dependable solutions. Wireless technologies can support all types of solar power generation models, from the solar troughs, dishes, tracking photovoltaic and heliostats, delivering information directly to the user's desktop.

Data radios provide proven, reliable data transmission and advantages where:

- The system owner wants to control the communications
- Cell phone coverage is inconsistent or non-existent
- Communication security is a priority
- Budgets require efficient communications investment.

In other words, data radios offer wind and solar power generation facility developers and operators a viable solution for meeting their communication network's requirements while also cutting costs. As the industry continues its fast-paced growth, the need to

identify ways to lower infrastructure costs, improve time-to-market and increase performance with reliable, easily installed networks is no longer a wish, but, a requirement.

Reliable and Effective Communication as a Key Success Component for Renewable Energy Power Operators

As the renewable energy market continues to make strides in the power industry, operations and maintenance (O&M) providers are looking for economical ways to manage their systems. To do this most efficiently, some sort of communication system is required. Today, solar and wind power generation plants have economical systems that ensure reliable, secure data transmission from remote locations. The wireless networks need to be easily maintained, with the ability to handle the amount of data transmission required. Many O&M providers in the solar and wind industries are beginning to discover that there are several other options.

Wired versus Wireless Solutions

The class of wireless radios that are industrially hardened and proven to be reliable in the harshest environments are commonly deployed daily in mission critical industrial applications and life-or-death applications in the military. These radios may offer the most effective, economical solution, when compared to other options. For example, when compared with fiber, wireless systems are relatively easy to install. In the event that a buried cable is damaged to the extent that it requires repair or replacement, the costs can be very high. Wireless systems are relatively maintenance-free and, if maintenance does become necessary, they are easily maintained. Once installed, top class wireless systems rarely need any type of service. If, for some reason, maintenance is required, the best systems provide information regarding a pending maintenance concern and the location or type of maintenance required can easily be detected remotely. So, operators only send someone out for service if/when they need it, thereby saving time and money. If engineered and installed correctly, wireless systems will last maintenance-free for years. At least one of the top class wireless manufacturers provides backwards compatible

solutions throughout its family of products. That, too, saves on maintenance concerns as well as stocking and replacement costs.

Finally, wired options are priced by the foot. With wireless data radios, the pricing covers ranges expressed in terms of miles. For instance, a pair of top class serial radios will likely communicate reliably across 60-mile links with line-of-sight designs.

Communication Systems and Options – Pros and Cons

Today, solar or wind utilities operators have a number of different options they can employ for their communications needs. The major ones include:

Wireless Data Radios –The top industrially hardened class of proprietary protocol wireless radios systems are quite easy to install, require minimal labor, don't require any trenching or expensive equipment. In addition, users can obtain real-time data fast. Users can be operational quickly and don't have to wait until some sort of network typology is complete. Once a remote radio and a master radio are installed, users can monitor these points right away. Although these radios are reliable, they often are more expensive than standards-based radios because these radios provide the range, throughput options and reliability found only in this class of offering.

ZigBee –A somewhat inexpensive, standards-based wireless solution. Zigbee offers a self-healing mesh network. However, these products also have a direct sequence protocol that is susceptible to interference, especially when compared with proprietary protocol systems. The range is extremely short in comparison to others and as the users add repeaters to lengthen the range, the throughput degrades quickly – and the “perceived” low cost goes up. At 230 Kbps, the throughput without repeaters is acceptable in many applications. However, to achieve the self-healing networks, repeaters are required and as stated above, as repeaters are added, throughput decreases.

Wired - Copper, fiber and an Ethernet cable are some of the options available as wired solutions. Each of these types of cable will have limitations as to how far the signal can be sent before you encounter line loss. And, wired solutions typically require more money and more time to install. What are the advantages to wired solutions? If implemented correctly, wired solutions provide secure, reliable data communications. The main issues operators will face with wire are the cost of materials and installation. Time to install is also an issue especially when compared with data radios.

Cell Phone/Satellite – Cell phone and satellite technologies have many similar attributes. They both are public systems and, therefore, not controlled by the plant owner. Carrier-based systems, such as these, include monthly fees, that add to the

overall cost of ownership, making it even more costly over time. Notoriously, cell phone-based systems do not have a history for being backwards compatible. Replacing old technology with new technology can be very costly. What are the advantages? Sometimes these systems can reach extreme or remote locations where it is not feasible to lay fiber or even deploy a full wireless communication network. This is especially true in the case of satellite systems.

Hybrid Communications as Yet Another Option

None of the systems described above solve all problems in all situations. Hybrid networks – a blend of different technologies – are often important to consider especially in the wind power generation markets. Wind installations can be very remote. In such situations, there are benefits to implementing a system that uses data radios from location to location with a satellite modem at a site data concentrator. Hybrid networks also might include a mix of fiber, data radios, satellite or cell phone-based technologies. A hybrid system can be a more cost-effective and effective solution for remote networks through lower hardware unit costs, fewer points requiring monthly fee-based satellite or cell connection modems, and lower power-consuming technologies.

A specific example might be a wind farm located in an isolated region with 10 turbines. Land line access does not exist, cell coverage is not present though satellite coverage is present. A viable, hybrid solution would include data radios on each turbine communicating to one “master station” turbine. With those radios, there can be reliable communications with no monthly fees and backwards compatibility. At the master station, a master radio is wired to a satellite modem that uplinks data to and from the wind farm. This system eliminates the monthly fees for nine of the 10 towers.

Proven Benefits of Using Industrially Hardened Wireless Radios

Top class data radio communication systems – composed of industrially hardened radios – offer several advantages that some of the other options do not. This class of radio has been proven in communication-intensive industries, such as military, oil and gas, and electric power. The leading companies offering data radios stand by their products with training, tech support, warranties and experience. These attributes arm O&M providers with the confidence required for managing their communication system. Proprietary data

radios are offered at a variety of speeds, interface protocols and security. They are offered with varieties of form factors available to match the needs of the user.

Range or link distance is another advantage in the top class of radios. Some types have proven to communicate over 60 miles line-of-sight. Others, such as standards-based radios, offer a range that is more accurately characterized in hundreds of feet. The top class technologies are used successfully in extremely harsh conditions with high vibration, such as robotics, unmanned aerial vehicles in the military, and farm vehicles, proving in the field that they can effectively communicate in all types of environments, including the challenges presented by wind turbines. Data radios even have proven effective and reliable in high-speed racing environments – such as Formula One car and motorcycle races.

Sample Renewable Market Applications for Wireless Communications

Wireless radios can be used for a variety of options in the renewable energy markets, including:

Orientation and Positioning	Operations & Maintenance
Tracking Controls	Condition Monitoring
Status Updates	Met Tower Communications
Telemetry	Emergency Messaging (especially weather changes)
SCADA	Alarms from the remote points
Temperature Monitoring	E-Stop
Pressure Monitoring	Perimeter security
Performance reporting	And, more....

Conclusion

Each of the applications that can be performed using data radios in solar and wind power generation plants are conducted today in many thousands of other market applications. These radios are relied upon in mission critical monitoring, controlling and data

acquisition situations in the harshest weather and RF conditions. Radios are used on natural gas wells in every climate imaginable. They are used reliably in baking high heat and in the freezing cold in Antarctica, for example. The top class of radios is used in urban situations, plant situations and rural situations. Again, the top class of radios is known to perform with comparable reliability to the wired alternatives and, all at a fraction of the cost.

The advances of wireless technology in the renewable energy power markets on both an industrial and commercial scale are anticipated to increase. The costs, reliability, reporting and more are driving operators to consider alternatives to wired solutions. The experience mentioned above of operators in many, many industries around the world are evidence that data radios are a very viable alternative. Wireless data radio technologies provide a long-range, reliable and affordable solution to providers. A wireless system can potentially save a company millions of dollars of installation fees and the technologies have been proven in the field over and over again in many different industries. Not all radios are created equal. Top class radios have proven, industrially hardened equipment and the flexibility to perform in almost any situation. Any manufacturer who has a solid product offering is likely willing to provide operators with test equipment to prove the technology before they buy it. It is easy to use, quick to install, reliable and low risk. When ROI is a key in determining the best communications solution, the benefits of top class data radios should be part of every decision process.

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Colin Lippincott has been with FreeWave Technologies, Inc. (www.freewave.com) for seven years. In his current position, general manager of energy markets, he works primarily with solar, wind and smart grid technologies to advance remote automation, condition monitoring, positioning and SCADA success with affordable wireless systems and unmatched reliability. Prior to FreeWave, he served in various management and operations roles with several companies since graduating from the University of Colorado with a Master's in Business Administration.