



**SMART-GRID  
STRATEGY**

# Why Wireless?

Radio waves  
deliver flexibility  
and security.

**BY WILLIAM ATKINSON**

Photo courtesy of Arcadian Networks

**I**n recent months, much of the smart-grid buzz has involved a newer technology being introduced into the mix—wireless.

According to Eric Miller, a senior vice president for wireless technology vendor Trilliant, the reason for the new-found popularity of wireless smart grid is that it addresses many of the communications challenges utilities face related to geography, bandwidth, performance, and upgradability.

In addition, wireless technology already is available. “There’s a tremendous amount of investment globally in wireless communication for other applications that you can leverage and work off,” he says. “You don’t have to pay to invent wireless.”

### **Wireless in Action**

One utility already moving in this direction is Connecticut Light & Power (CL&P). The company is using wireless smart grid technology as part of a pilot program, among the largest customer-focused pilots of its kind in North America to date. This summer, 3,000 CL&P customers are taking part in the utility’s Plan-It Wise Energy program, a voluntary rate program to test residential, commercial, and industrial customers’ interest in, and response to, time-based energy rates and smart meters. Smart meters will measure customers’ electricity usage in one-hour intervals. The system will collect and transmit information about customer electricity usage to the utility, and then back to the customer, via a two-way wireless network.

“We felt that wireless, using radio signals, would be the most cost-effective approach,” explains Jessica Brahaney Cain, program director at CL&P. “We already own several radio towers, so we were able to leverage that existing asset.”

Another utility expressing interest is Hawaiian Electric, which provides electricity to 95 percent of Hawaii’s residents. It’s involved in a pilot project using the FlexNet wireless smart-grid system from Sensus Metering Systems. To date, the technology has been tested for two years, with thousands of smart meters in a variety of settings, terrains and environments on Oahu. Between 2009 and 2015, the company expects to transition 430,000 residential and commercial customers to FlexNet smart meters. Nineteen tower network sites throughout Oahu, Maui, and Hawaii will provide two-way secure radio frequency (RF) network coverage.

The system provides the utility with two-way communications with the meters, to enable on-demand reads, remote connect and disconnect services, notifications of outages and restoration, and remote firmware upgrades. It also will support new pricing and demand-response (DR) initiatives that help customers manage their electricity use.

“We see wireless smart grid as a way to improve service to our customers,” says Darren Pai, a spokesperson for the utility. “It provides customers with more options and control, as well

as cost-saving rates based on time-of-use. It also will help us manage our system better.”

### **Beyond Meters**

While wireless smart-grid technology seems to be making its first inroads at the meter, the potential is significantly greater. In fact, most of the smart grid is well suited to wireless.

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*—Jessica Brahaney Cain,  
Connecticut Light & Power*

higher level grid devices are of equal, if not greater, importance in the drive for overall grid efficiency. Utilities are looking at deploying thousands of smart-grid devices throughout the network, in addition to metering.” Most of these devices can use wireless communications platforms—such as the narrowband PCS spectrum the company uses in its FullMAX broadband system, which provides utilities with their own private wide-area communications network for command and control of smart-grid devices.

Ed Solar, CEO of Arcadian Networks, agrees that meters are only scratching the surface of wireless potential. The company provides last-mile wireless-carrier services to utilities and energy companies. “Wireless smart grid isn’t just limited to metering and distribution automation,” he says. “It covers a lot more, such as demand response, asset management, substation automation, and feeder optimization.” In addition, according to Solar, it can go beyond fixed voice and fixed data, to include mobile voice and mobile data. In this way, wireless communications can expand beyond just tying devices together, to tying the entire enterprise together. As such, Solar says utilities shouldn’t take a fenced-in approach to wireless smart grid.

“If you apply it from generation through distribution, the

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grid becomes much more intelligent,” he suggests. Three years ago, for example, Arcadian Networks helped G&T cooperative, Great River Energy, build the first large-scale wireless smart-grid infrastructure in the nation. Part of this involved wireless surveillance of video monitoring at substations. “We all talk about the same challenges in this industry—geography and the need to manage highly dispersed assets, aging communications systems, security and cost,” stated David Saggau, Great River Energy’s CEO. The wireless-network approach allowed the utility to bring “an improved service level to customers throughout our service area.”

### Private or Public?

Probably the biggest question these days related to wireless smart grid is whether the wireless technology should be private (owned by the utility) or public (using existing wireless carriers).

One company offering technology for use with the latter is Cooper Power Systems, which recently entered into an agreement with AT&T to jointly market and sell Cooper’s smart-grid sensor devices that are certified on AT&T’s wireless data network. “This allows utilities to receive real-time system performance data to operate their electric grids, reduce the need for on-site inspections, and identify and solve problems that could cause outages or increase system energy losses,” explains Tom Pitstick, vice president and general manager of energy automation solutions for Cooper.

One device that is part of the arrangement is OutageAdvisor, which transmits the location and other detailed information about fault conditions in real-time over AT&T’s wireless network. The technology is designed to increase grid reliability and reduce the time and cost associated with traditional methods of identifying and repairing grid problems. The other device is VARAdvisor, which monitors the status of fuses on distribution capacitor banks and notifies the utility of a fuse failure, so it can identify the cause of the failure, replace the fuse, and get the capacitor bank back on-line.

Other vendors are banking on the growth of private networks—most notably for security reasons. “Every time you utilize a public network, such as a cellphone network, you’re just opening up the number of points at which there could be an entry into the system,” says Trilliant’s Miller. This, he suggests, increases the number and types of threats. Private wireless networks, on the other hand, are easier to secure because they limit the number of entry points, and benefit from wireless cybersecurity tools created for other industries. “You don’t have to

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—Eric Miller, Trilliant

create it from scratch,” Miller says.

Arcadian Networks also is banking on private network demand, in part because of security concerns, and also because wireless smart-grid applications continue to expand and eventually will exceed the capacity of existing networks to accommo-

date them. “If you’re working with an unlicensed network, you don’t have the ability to manage and control it,” Solar says.

Also, while public wireless networks have expanded dramatically in the past decade, they still might not reach a utility’s entire grid. “Reclosers, voltage regulators, capacitor banks, and substations are typically distributed in difficult-to-reach areas over wide geographies,” Kantor says. “Public wireless networks lack the coverage and quality of service to be an effective solution.” And even where public networks provide adequate coverage, they might not be affordable. “Unlicensed systems can require up to 40 times the infrastructure cost of a licensed solution, dwarfing the cost of obtaining licensed spectrum,” Kantor says. “Maybe for metering, you can use unlicensed wireless. However, for the higher level applications, you need a licensed solution.”

At the same time, however, public wireless networks offer some advantages over private networks. Bandwidth is one example. “I don’t think people yet have come to terms with what »



Photo courtesy of Arcadian Networks

the bandwidth requirements will be in the future,” says David Mohler, vice president and chief technology officer for Duke Energy. “If we are trying to remotely read meters, the bandwidth requirements will probably be fairly low. However, if we plan to deploy an intelligent infrastructure that will allow multiple queries, real-time reporting of energy consumption information, real-time correlation of data, and allow us to use distributed resources and direct load control for reserves or peak shaving, we may need a great deal of bandwidth—maybe not broadband, but certainly more than we will probably be able to get from many of the wireless deployments that we are doing today.”



For instance, in many utilities’ wireless mesh networks, a single data concentrator (radio receiver) serves as many as 5,000 customer premises. However, the maximum bandwidth at the data concentrator might be only 100 kilobits per second (Kbps). “You probably need at least half of this just to manage the network itself,” Mohler says. “I don’t think the remaining bandwidth will be sufficient to do all the things you want to do with that many customers.”

Additionally, he says public networks offer reliability levels that proprietary networks might be hard-pressed to match. “If we own the wireless network, and if a thunderstorm rolls through and takes a bunch of equipment down, our guys have to work hard to get the power back on and also to get the wireless network back on,” he says. “This can take a fairly long time—hours beyond the restoration of power. If we are using a public cellular carrier, and if their network goes down, they will fix it, and they are just as incented as we are to get it back up quickly.”

For Duke’s architecture, Mohler sees fertile ground for development from the central communications collection point—which, for Duke, is located on distribution transformers—into customer premises. The collection point has memory processing, backup power supply, USB ports, a modem, and a number of communications cards. These allow the utility to transmit information from a multitude of devices in the neighborhood area network—*i.e.*, meters and sub-meter devices, reclosers, street lights, capacitor banks, transformers, weather monitoring equipment, and security equipment—to the communications box. For this piece of the smart grid, Mohler says public networks can serve the company’s needs. Toward that end, Duke plans to deploy a SmartSynch product called the Universal Communications Module (UCM) to serve some of its commercial, industrial and residential customer sites. The UCM transmits and receives data over public wireless networks using Internet-based or other open standards, which Mohler says will allow Duke to spot-deploy smart-grid applications, such as load profile and control, power quality monitoring, distribution automation, and stand-by generator control; and to support retail demand response, conservation and real-time pricing programs.

“Ultimately, a portfolio of communications technologies will be required to achieve the kind of communication reliability we want,” Mohler says. “We don’t think any one communication technology will be the solution. In fact, we’ve developed an architecture at Duke that anticipates and is designed to accommodate this kind of portfolio communication.”

### Unwired Future

Whether public or private, over time, the smart grid might become more wireless than wired—if only because wireless is becoming ubiquitous for all types of connectivity, supplanting copper in many situations.

For example, in comparing wireless to power-line carrier (PLC) technology, Trilliant’s Miller points out that with the exception of a few industrial applications, PLC doesn’t have a lot of application outside of the utility industry. “In addition, the quality of the wire can have an impact on the capacity and data quality you can get from PLC technology,” he adds. “In fact, as we see it, PLC technologies are probably below the minimum thresholds of what are required for true smart grid.”

In addition, wireless connectivity provides an easy upgrade path, compared to hard-wired technologies that can be limited by the bandwidth constraints of the wire. Accordingly, the wireless smart grid will continue to develop and evolve, as companies explore various approaches to addressing their particular needs.

“There won’t be many solutions that will be in a shrink-wrapped box that can be shipped as-is,” says Pitstick of Cooper Power Systems. “Every utility network is different and will require a custom solution.” ■