

Evaluating the Communications Component of Your Smart Grid Solution



What communications
technologies are in your
utility's five-year plan?

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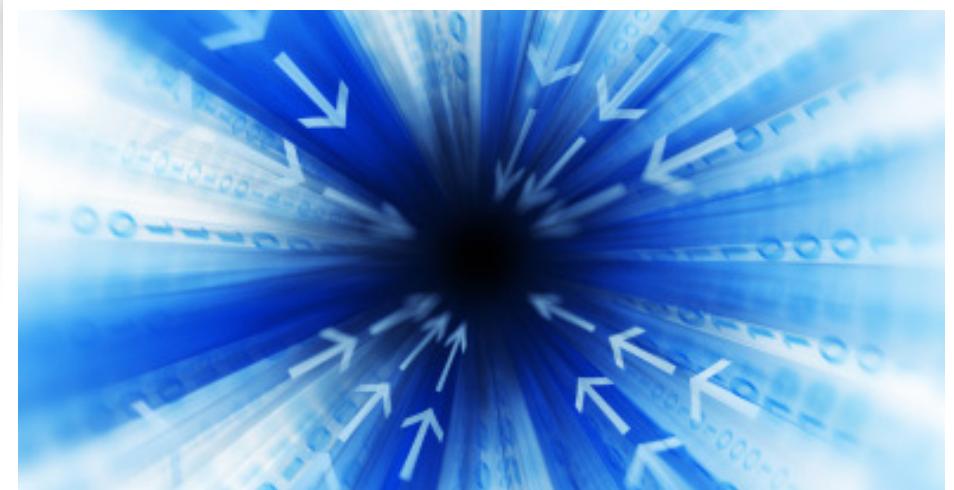


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Evaluating the Communications Component of Your Smart Grid Solution

The true enabler of smart grid, the communications layer provides two-way capabilities for moving data between the utility and endpoints.



Of the physical components comprising smart grid architecture, the communications technology — a collection of communication network components that enable the flow of information throughout the grid — is the most complex.

When it comes to determining the right technology mix for the communications components, there may not be a one-size-fits-all solution or single technology that can meet all the needs of today's smart grid networks. Every utility must consider its unique circumstances, including the existing communications infrastructure available to support connectivity to the smart grid network. Service area terrain, population density, local regulations, and future applications are also important. This white paper will consider several smart grid communications technologies and their respective benefits for various types of utilities and their needs.

The communications technology connects systems and devices for network-side communications. As the true enabler of the smart grid, it provides two-way communication capabilities for moving

data from the utility head-end system to endpoints, while managing how that data is used and secured.

Global Trends in AMI Communications Technologies

Advanced metering infrastructure (AMI) systems use a variety of communications technologies — including radio frequency (RF) mesh, power line carrier (PLC), RF point-to-point and cellular. With multiple communications networks to manage, utilities often look for solutions that support a variety of applications and fully integrate into future operational plans.

According to a recent report by Greentech Media, most U.S. utilities rely on private networks for communications, with many opting to adopt IP-based networking to meet the interoperability challenges of these multiple networks.

Across the globe, technology adoption varies by region. In North America and Europe, RF mesh and PLC are most often deployed, with a greater tendency toward PLC technology in Europe than in the U.S. This is largely because grids in

Europe connect many more homes per transformer than in the U.S. Data sent from the meter over the power line may not have to pass through a transformer to reach a collector, so some PLC technologies used in Europe operate in wider bandwidths. For example, Italy and Sweden — two leaders in AMI deployment — employ PLC technology as the most economical solution in areas with a high population density, whereas the opposite tends to be true in North America.

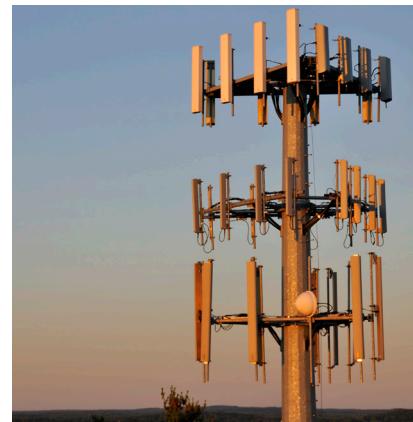
Often, technology choices are driven by local regulations. Many countries, Germany among them, restrict use of RF mesh technologies, as unlicensed frequencies have raised concerns about interference.

Cellular communications technology is in limited deployment in private utility networks around the world and is more commonly used for commercial metering or data backhaul applications in North America. However, it has found broader applications for residential metering in countries such as Australia.

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Comparing Communications Technologies

In choosing a communications network, it is important to closely examine the most viable options to ensure that today's utility requirements are met and that long-term business goals remain on track.



1 **RF MESH IS THE FRAMEWORK THAT MANY OF TODAY'S AMI DEPLOYMENTS ARE BUILT ON. WITH WIRELESS MESH NETWORKING TECHNOLOGY, METERS AND OTHER DEVICES ROUTE DATA VIA NEARBY DEVICES, CREATING A MESH OF NETWORK COVERAGE.**

PROS

- **It can be distributed regionally.** RF mesh technology can be regionally distributed, so the operator can target specific areas without needing to deploy the entire service territory.
- **It's self-healing.** If one module loses communication with the network, the network automatically finds another path to bring communications back to the head-end system. So, the network operator never needs to worry about the entire network being down.
- **It's self-forming.** The network's intelligence enables the signal to find the optimal route back to the head-end system. This is particularly important in areas with many obstructions, such as mountains or high-rise buildings.

CONS

- **It may require more infrastructure.** RF mesh technology may require more infrastructure than other options, especially in rural areas where meters are more spread out across the service territory.
- **It may raise interference concerns.** Unlicensed frequencies used in RF mesh may raise some concerns about interference. Some countries restrict use of frequencies in the unlicensed spectrum, including RF mesh.

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2 POWER LINE CARRIER (PLC) ENABLES TWO-WAY DATA TRANSMISSION ACROSS POWER LINES. THEY ARE RECEIVING INCREASED ATTENTION FROM UTILITIES INTERESTED IN MAKING A MORE GRADUAL MIGRATION TO SMART GRID BECAUSE THEY CAN LEVERAGE EXISTING POWER LINES AS THE COMMUNICATIONS NETWORK.

PROS

- **It's cost-effective.** PLC can transmit over long distances. In North America, this can be a cost-effective advantage for utilities serving rural environments. Also, because it is a "hard-wired" system, topographical and other physical obstructions do not affect performance.
- **It leverages existing investments.** Because PLC leverages existing infrastructure, the utility owns the communications system and the learning curve may not be as steep.
- **It returns useful grid analytics.** A PLC system uses the distribution network to send signals from the meter to the substation. Signal strength provides the utility with analytics that can help isolate and troubleshoot problems with insulators, transformers and other grid devices.

CONS

- **Potential for network interference.** Utilities with large industrial customers that may introduce noise and harmonics on the power line have found that this noise on the system may affect performance and distort communications.
- **Less bandwidth.** Narrower available bandwidth can impact data capacity and the speed or rate at which data can be accessed in some applications.

3 CELLULAR TECHNOLOGY USES A COMMERCIAL CELLULAR NETWORK TO CONNECT SMART GRID DEVICES. IT IS USED BY MANY UTILITY SMART GRID PROGRAMS FOR COMMERCIAL ACCOUNTS. AUSTRALIA, FOR EXAMPLE, HAS A LARGE-SCALE CELLULAR DEPLOYMENT.

PROS

- **Faster deployments.** Cellular enables long-range communication and can be rolled out quickly using the existing cellular infrastructure.
- **It leverages an existing network maintained by the cellular company.** In most utility service territories, cellular already reaches the majority of customers.
- **It's optimal for targeted applications.** Cellular can be deployed cost-effectively to support small groups of customers, even a single customer.
- **It's proven technology.** In use for more than a decade, cellular technologies are well established, reliable and are continually improved upon — particularly as it relates to security.
- **It's secure.** Because they already provide service to billions of customers worldwide, cellular networks extend the promise of safety and performance to utilities.

CONS

- **It may require head-end system changes.** In the North American market, most of the widely deployed head-end systems are optimized for either RF (mesh or point-to-point), PLC, or a combination of these. Incorporating a less widely used communications technology, such as cellular, for AMI purposes may require modifications to the head-end solution.
- **It has obsolescence issues.** Cellular networks tend to roll over prior to the useful life of the metering technology, so many operators are concerned about how long a deployed technology will remain viable.
- **It's a network availability issue.** The mission-critical communications that smart grid networks require need nearly 100% network availability. When utilities share public cellular networks, they are often at the mercy of the carrier's priorities in the event of an outage.
- **It can be unreliable.** If a natural disaster impacts the cellular infrastructure, networks may become overburdened.

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4 LICENSED POINT-TO-POINT, FIXED NETWORK TECHNOLOGY ENABLES TOWERS TO TALK DIRECTLY TO ENDPOINTS AND SENSORS.

PROS

- **It requires less infrastructure.** One tower may be used to cover a large geographic territory.
- **It doesn't raise interference issues.** Since it is a licensed network, there are no concerns about other devices interfering with network communications.
- **It's easy to deploy.** Since the network may be deployed from a few towers, even a single tower, there may be less infrastructure required.

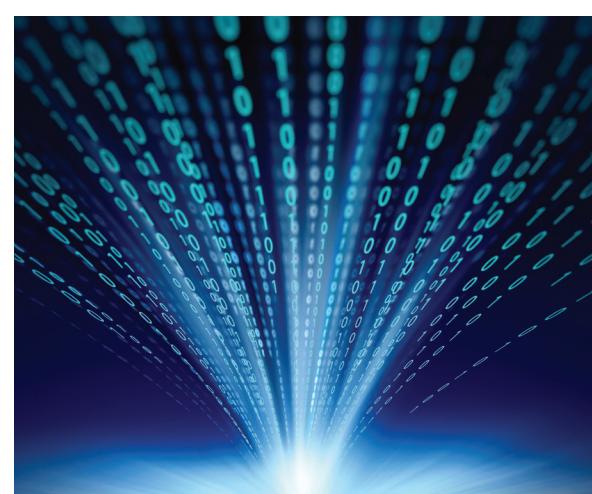
CONS

- **Challenges of securing tower space:** It may require installation or leasing of a tower.
- **It may result in transmission congestion.** The more meters and devices communicating to a single point, the more likely network congestion and bandwidth limitations are.
- **It's not self-healing or self-routing.** Unlike an RF mesh system, which offers many communications pathways, a point-to-point system has no built-in redundancy. So if the base station goes down, communication to thousands of meters may be lost. This can compromise grid performance and reliability.
- **It requires licensing.** Along with a fee, there is limited bandwidth associated with each license. In addition, a second license may be required for distribution automation functions or other advanced grid management applications. Also important to consider: the internal labor required to manage and maintain these licenses.

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Choosing the Right Communications Technology

While there are many network options available, no two deployment scenarios are alike. That is why each utility should carefully analyze the available solutions, as well as internal resources and long-term goals. This will ensure unique needs are addressed for optimum efficiency.



Some of the Questions That Utilities Should Ask When Seeking the Right Technology:

- How quickly do you need information? Do you need real-time response?
- Do you have a commercial customer base with significant data needs?
- Are you looking for the most cost-effective option?
- Do you have plans to implement additional applications, such as distribution automation or other advanced smart grid management applications? If so, when?
- What sort of internal resources are available?
- Do you need a relatively turnkey solution to minimize in-house labor?

There is a wide range of communications technology options and the best fit for your utility will be driven by these and other factors. While choosing the right communications solution for your utility is critical, in many cases, a multi-technology approach will provide the best route for realizing the most value from your smart grid deployment.

In addition to providing solutions that can integrate and support multiple technologies on a single platform, smart grid solution providers like Landis+Gyr play a consultative role, working with you to ensure that your utility migrates to the new technologies at your own pace, while meeting your specific technology and customer requirements every step of the way.

¹ "Trends in Utility Smart Grid Communications Management," Greentech Media: <http://www.ericsson.com/res/docs/2013/trends-in-utility-smart-grid-communications-management.pdf>