

# Wireless Utilities

Wireless networks offer reliable, secure connectivity for utilities that provide essential services such as electricity, water, and gas. With improvements in technology and increased spectrum availability, utilities have more options for delivery and can improve the way assets connect to critical infrastructure.

It's an ongoing journey. As demand for improved safety, resiliency, and automation continues to grow, smart networks connecting analytics, IoT sensors, workers, and devices are increasingly critical. As municipalities deploy innovations like electric vehicle charging infrastructure and distributed energy resources (DER) assets and expand broadband services within communities, they are evolving their utility requirements to include modern, ubiquitous wireless communications.

New technologies, increased spectrum availability, and the broadening of supplier ecosystems offer new opportunities to deploy wireless networks and leverage emerging broadband and narrowband systems. With its continued development, cellular 4G LTE technology offers a standards-based solution that can accommodate growth over time, but 4G LTE is only one option among many.

Figuring out whether to leverage existing commercial infrastructure or a dedicated private wireless network is not a one-size-fits-all choice. The answer may be influenced by the existing wireless infrastructure in a service territory, the type of utility (municipality, cooperative, or investor-owned), and the size of the service territory.

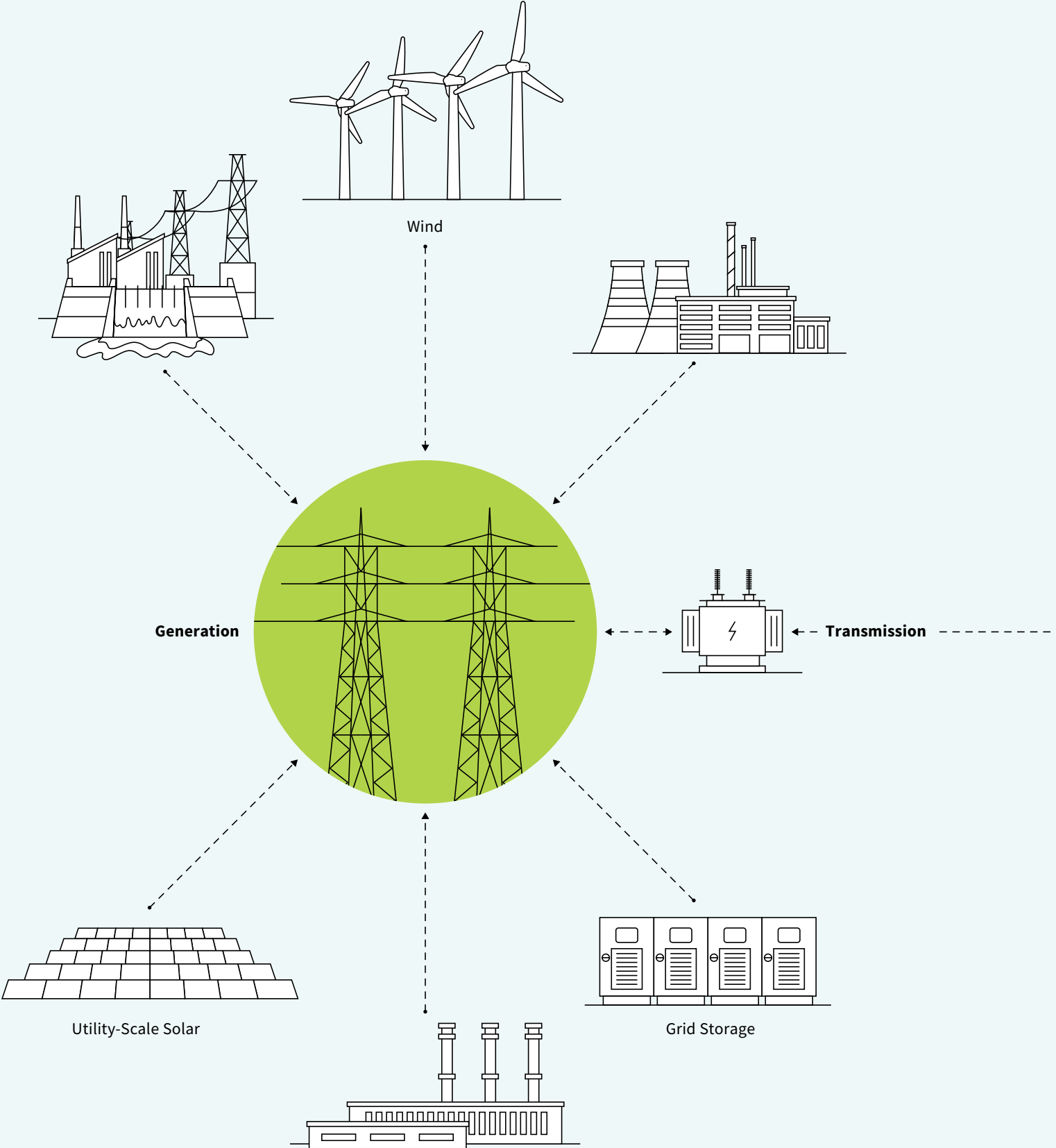
## Wireless Utilities: Ideas and Inspiration

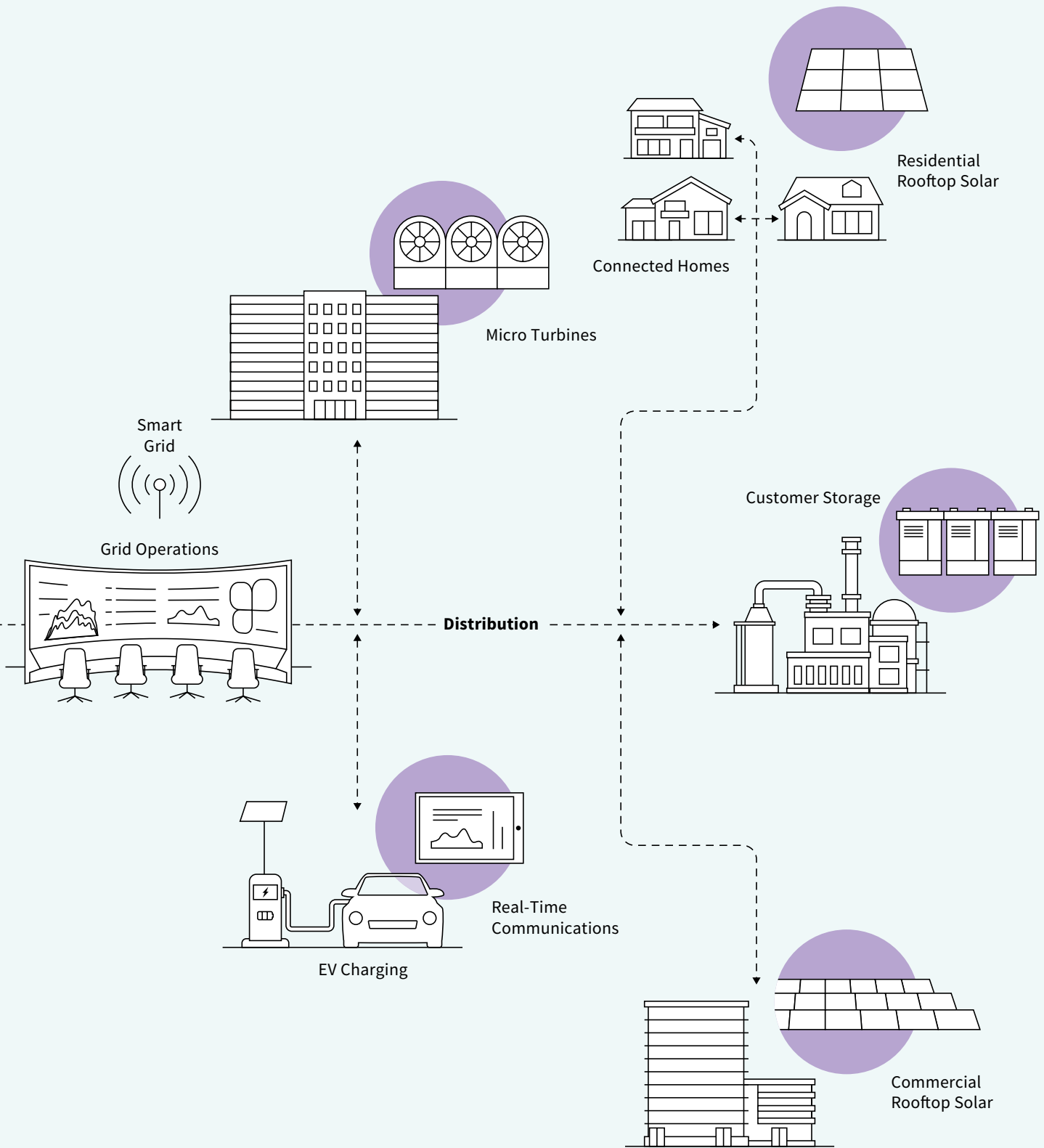
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Municipalities are using wireless networks in their operations in many ways, including:

- + Generation
- + Supervisory control and data acquisition (SCADA)
- + Advanced metering infrastructure (AMI)
- + Microgrid monitoring, coordination, and control
- + Transmission and distribution automation
- + Customer-behind-the-meter asset utility integration
- + Demand response and flexibility programs
- + Home area networking
- + Electric vehicle charging infrastructure
- + Remote terminal units
- + Field force communications and automation
- + Video surveillance and physical security
- + Falling wire and wildfire mitigation
- + Sensors for weather, lines, phasor measurement units, etc.
- + Substation automation
- + Grid-scale distributed energy resource integration (e.g., renewables, batteries)
- + Secure facilities inspections using UAS
- + Energy market participation

# The Integrated Grid





Wireless utility use cases represent a trend towards more integrated grids connecting generation, transmission, distribution, and consumers. These solutions go beyond metering to encompass two-way power flow and coordination and control activities, connecting grids with assets that might not have been accessible to a utility before.

## Telecommunications Considerations

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As utility use cases are unique, so are the telecommunications characteristics required for deployment. Here are things to consider in your connectivity infrastructure, based on specific areas of wireless utility operations.

**Generation:** Use cases include remote access, monitoring, and control; bi-directional site communications; asset management; instrumentation like remote metering; optimization in areas like economics, carbon emissions, and equipment efficiency; SCADA telemetry; and reach-to-merchant telemetry. These all require highly available, reliable, resilient, and secure telecommunications services. Some use cases may require low latency communications.

**Transmission and distribution:** When implementing SCADA, PMUs, and teleprotection and securing communications between grid assets, substations, and control centers, look for low latency and latency asymmetry and high availability, reliability, resilience, and network route redundancy. Some use cases may require high bandwidth. This will depend on data

volume requirements and the number of utility- and customer-owned assets.

**Substation automation (SA):** Look for a secure network with high bandwidth and low latency that enables real-time control of SA devices and system coordination, as well as expandability for additional device automation, systems automation, and future utility provisioning of new customer services. Physical access security should also be a consideration.

**Control room network operations:** Systems operations and energy management systems with distribution management, distribution energy resource management, SCADA, and GIS technologies require network redundancy for high availability, resilience, reliability, and security and may require high bandwidth, low latency communications. Physical access security should also be a consideration.

**Security:** Indoor and outdoor video surveillance ground-based radar perimeter monitoring solutions require high network availability, reliability, and resilience. These characteristics are needed to support physical access controls, monitors, and alarms and to store, send, or stream HD video and data analytics.

**AMI, distribution automation, grid instrumentation, and distributed energy resources (DER):** Look for large service area coverage, flexibility, and expandability, as well as the ability to integrate EV charging assets and support AMI and DER management gateways, utility head-end systems, third-party cloud system communications, and utility, merchant, and customer renewable generation sites.

## Systems That Bring Smart Utilities Solutions to Life

**Advanced metering infrastructure (AMI)** systems support the management of power quality, energy resilience, home energy, and renewable energy. They connect with meters to schedule usage reads throughout the day, provide consumption and quality data, report outages, and remotely connect and disconnect meters. These systems are typically deployed via RF mesh networks (using unlicensed bands) or fixed wireless networks (using licensed bands or direct cellular connectivity to the end point). The need for RF mesh and fixed wireless networks to leverage distribution automation or feeder automation can challenge the low or bi-directional latency required for some distribution automation functions. Densification of collectors on the cellular take-out point is recommended for RF mesh deployment.

**Supervisory control and data acquisition (SCADA)** is the primary system for sending and receiving status and control signals and is responsible for connecting grid assets to the utility control room. SCADA is typically coupled with a distribution management system or energy management system to relay system modeling and real-time system feedback.

To lower environmental impact and increase energy stability, **distributed energy resources (DER)** systems bring together the small, grid-connected or distribution system-connected devices that generate and store electricity. This enables the collection of energy from many sources: distributed generation, renewables, electric vehicles, flexible loads, and energy storage systems.

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## Private LTE Telecommunications

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4G LTE is a viable communications approach for many utility use cases, depending on the type of community being served (city, suburb, or rural), the availability and capabilities of commercial carrier systems, budget, and security, bandwidth, and latency requirements. Utilities also have the choice of deploying private wireless LTE for connectivity.

It's important to understand the infrastructure, capabilities, and limitations of commercially available wireless networks and private LTE networks, for example:

+ **The technology platform:** Both commercially available wireless and private LTE networks are based on 3GPP standards of LTE, a proven

technology. Commercially available networks are in the process of implementing 5G. Private LTE networks don't have the broad spectrum available to support 5G. As DER penetration grows—and with it the need for higher bandwidth, lower latency communications—this may change.

+ **Reliability:** Both commercial and private networks are built using similar RAN equipment, with similar expectations for equipment performance. Power redundancy standards at commercial carriers are determined by consumer economics, while utilities are sometimes able to make additional investments into the uptime of their critical infrastructure.