



Connected Utility Deployments: From Strategy to Reality

Your workshop discussion guide



A message from the CTIA Smart Cities Team

Congratulations on taking the next step in your smart utilities journey!

We're here to help. This workbook contains resources our team and member companies have created and compiled as a great starting point, including highlights from our Wireless Maturity Model assessment tool, an introduction to CTIA Certification™, real-world examples of smart utilities use cases and helpful resources for smart utility deployments, from initial strategies to RFPs.

We hope you find it useful for gaining insight into “wireless readiness” for smart utilities projects, guidance into the certification process (and why it's so important), and a picture of what's possible. Please don't hesitate to reach out to us with any questions, or if we can be of assistance.

**Looking forward to working together,
connecting solution strategies with
deployment realities.**

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More Helpful Resources at Town Square

Visit smartcities.ctia.org for even more resources and guidance, including our collaborative, educational series of Playbooks.



About CTIA

CTIA represents the U.S. wireless communications industry and companies throughout the mobile ecosystem. Our members provide the wireless networks, devices, equipment, and solutions that make smart cities possible. This includes the connectivity solutions behind smart utility deployments.

CTIA members are also drivers of 5G, the next generation of wireless. As advanced networks roll out across the nation, 5G will allow up to 100 times more simultaneous connections, up to 100 times faster connectivity, and lower latency, which is key for innovations like intelligent transportation systems.

Due to the tremendous amount of private investment necessary to bring advanced networks to life, collaboration between industry and the public sector is paramount. As we look ahead to the exciting possibilities of smart cities technologies, CTIA is committed to helping communities of all sizes become the cities of the future.

Acknowledgments

This guide was created in collaboration with:

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Assessing Wireless Readiness

Which smart utilities solutions could your organization deploy to better serve customers? How about 5G-enabled leak and outage alerts or interactive apps to help residents?

CTIA Wireless Maturity Model

One big challenge in turning smart utilities visions into reality is knowing where to start, particularly in terms of wireless services and technology.

The CTIA Wireless Maturity Model is here to help, yielding insight into the status quo and where to focus next. Compiled by wireless and technology experts and based on data from smart cities projects nationwide, it takes a look at:

- + Wireless technologies and systems currently in place
- + The infrastructure and deployments needed to move forward
- + Ways to ensure resilience, security, and equity along the way

Why it's useful

Whether you are assessing your entire community or the areas focused on transportation, public services, or utilities, the Wireless Maturity Model assessment can help identify your wireless readiness and next steps towards a more connected tomorrow.

You can:

- + Gain insights on your city's technology strengths, challenges, and opportunities
- + Evaluate your city's current data communications, connectivity access, infrastructure, security, resilience, and equity

- + Identify the physical assets and infrastructure needed to deploy and maintain smart cities solutions
- + Determine ongoing next steps to achieve your smart cities goals

How it works

Information entered into a detailed online questionnaire yields an overall maturity score for wireless connectivity and the ability to deliver, operate, and maintain smart utilities solutions.

YESTERDAY Your wireless-readiness is less advanced than what's currently available in the marketplace, positioning your community to gain the most from advanced wireless investment.

TODAY Your community is right on track in terms of wireless infrastructure and adoption, with even more opportunities ahead for wireless-enabled efficiencies and impact.

TOMORROW Congratulations—you're a leader in this field! Advanced wireless solutions and new use cases are rolling out every day for your community to consider for continued growth.

Multiple-choice questions related to natural gas, water and wastewater, and electricity services feed into this overall maturity score, as well as individual scores for each sector.

What infrastructure is in place to support electric service delivery?

- Distribution transmission assets are managed and controlled wirelessly using microwave and SCADA technologies. Close proximity point-to-point radio may be used to support AMR.
- Electrical grid assets are managed using RF mesh based AMI, LTE cellular point-to-point and point-to-multipoint radio.
- Electrical grid assets are managed using next-generation cellular technologies including CAT-M1, NB IoT and 5G.
- Not applicable

How is wireless connectivity leveraged for the utility's communication system?

- The utility uses SCADA, telemetry, microwave and polling technologies for monitoring and control of electrical network system assets.
- 4G LTE enables telemetry at lower latencies, higher bandwidths and higher throughputs to support near real-time situational awareness across the utility's territory.
- 5G and other advanced communication technologies enable IoT edge applications. They may incorporate local energy markets that are inclusive of independent power producers, energy aggregators and prosumers.
- Not applicable

How is wireless data used to support electric utility assets and service delivery devices?

- Power quality measurements and data collection are manual, requiring physical, walk-by or drive-by meter reads. Substations and other critical infrastructure centers have wireless monitoring and some remote operational control.
- AMI is incorporated throughout the community leveraging wireless mesh networks. Energy Management System (EMS) and Distribution Management System (DMS) operators remotely operate the grid using wireless communications.
- AMI is ubiquitous throughout the community. EMS, DMS (or Advanced DMS) and Distribution Automation (DA) use high-speed wireless communication to enable analytics to optimize grid operations. This includes the use of non-utility-owned renewables, energy storage and controllable loads.
- Not applicable

How is due diligence managed for access controls, information security and physical security?

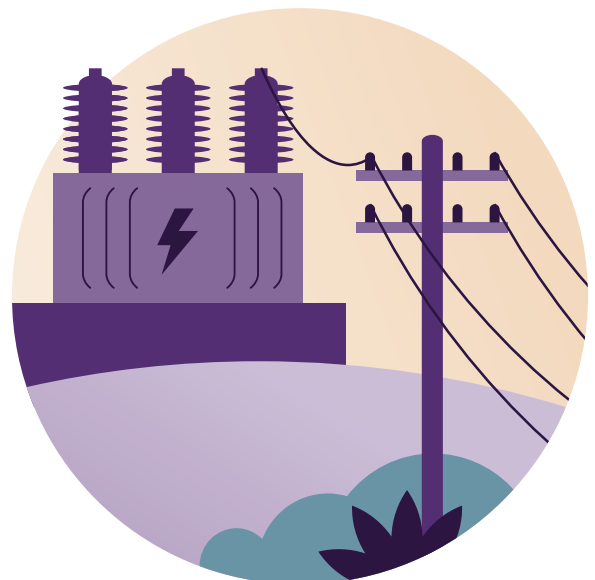
- Critical assets have been identified, as well as the criticality and sensitivity of the information each asset accesses, processes, stores or transmits.
- Critical assets have been assigned risk and impact metrics, with tailored and appropriate controls and mitigation schemes.
- A comprehensive risk management program, in accordance with NIST publications, is used for categorizing critical assets, selecting and implementing security controls and mitigation schemes, and continuously monitoring processes.
- Not applicable

What wireless technologies and processes are in place to help the utility withstand and recover from an unplanned electrical service disruption?

- The utility has prioritized its communication system recovery process and dispatches crews to address issues when they are manually identified and reported.
- The utility monitors its communications networks using analytics to detect anomalies or disruptions in communication systems. Wireless AMI systems are alerted by "last gasp" meter messages to report outages of service delivery to the control room and customers in real time.
- The utility leverages integrated tools and systems such as predictive analytics, AMI and automated workflow—including work orders and dispatch processes to minimize disruptions and to shorten time to recovery. When disruptions occur, DA systems perform automated switching to isolate faults and restore service to the maximum number of customers.
- Not applicable

How does wireless technology help electric service providers deliver service to all community members?

- Electric service providers wirelessly manage customer programs that incentivize the use of demand response controllable load devices, such as smart thermostats, water heaters and pool pumps.
- Electric service providers wirelessly manage customer programs that incentivize distributed power generation, energy storage capacity and electric vehicles.
- Electric service providers wirelessly manage customer programs that are available to all community members.
- Not applicable



What natural gas infrastructure exists within your city or community?

- Many analog manual systems still exist, with SCADA systems used to poll and control key transmission and distribution assets.
- Emergency shut-off valves are automated, with some use of wireless technologies (including 4G LTE connectivity and/or mesh networks) and the majority of key assets instrumented and controlled through centralized SCADA systems. Digital instruments, including meters, provide real-time data and some situational awareness.
- Wireless leak identification sensors and predictive analytics catch issues before they occur, reducing greenhouse gas emissions and increasing efficiency and safety. Automated equipment manages shut-off valves and gas compression equipment. Wireless digital instruments, including meters, provide real-time data and system-wide situational awareness.
- Not applicable

How are natural gas assets and service delivery equipment operated and maintained?

- Customer metering is measured by manual reads; as wireless connectivity is not available to perform automated meter reading (AMR). Compressor stations and gate stations use SCADA polling systems to report to control room operators (CRO), who manually manage equipment to maximize efficiency and safety.
- Customer metering is through AMR or advanced metering infrastructure (AMI) using wireless mesh, point-to-point or tower-based networks. Compressor stations and gate stations maximize efficiency and safety through automated equipment and local control solutions.
- IoT technologies automatically report customer metering data to the cloud for rich, system-wide situational awareness. Wireless technologies enable predictive analytics, and automated control systems maximize safety and efficiency, reporting outages and supply failures and automatically creating maintenance work orders and customer notifications when power delivery issues arise.
- Not applicable

What is the natural gas communication system availability and latency?

- SCADA telemetry microwave and polling technologies monitor and control critical compressor station and gate station system assets.
- The majority of the gas operator's territory is connected with 4G LTE.
- The majority of the gas operator's territory is connected with 5G technology.
- Not applicable

To what degree does the natural gas provider exercise due diligence in managing access controls, information security and physical security for its critical assets?

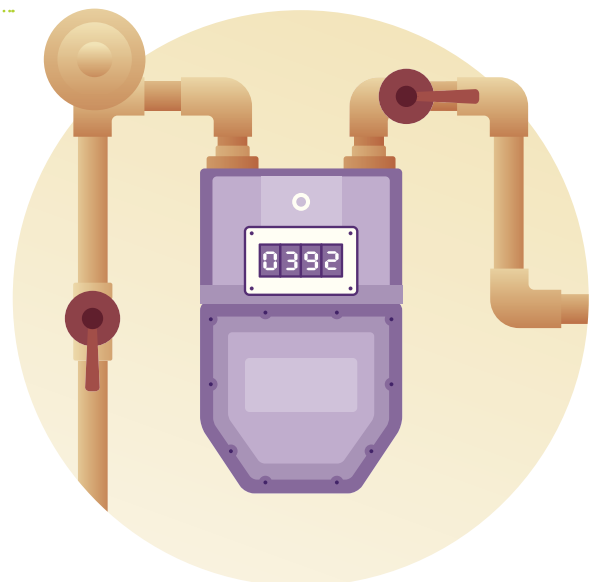
- The natural gas provider has identified its critical assets and determined the criticality and sensitivity of the information each asset will access, process, store or transmit.
- The natural gas provider has determined the risks and impact levels associated with its critical assets and has designated tailored controls and mitigation schemes commensurate with the assigned risk.
- The natural gas provider has established a comprehensive risk management program, in accordance with NIST standards, for categorizing critical assets, selecting and implementing security controls and mitigation schemes that meet mission and business needs, continuously assessing control effectiveness, authorizing the systems for operation and continuously monitoring the systems.
- Not applicable

In the event of an unplanned gas outage, what tools and processes are in place for identifying, communicating and recovering quickly from the outage?

- The natural gas provider has prioritized its communication system recovery process. It dispatches crews when issues are manually identified and reported to a central office.
- The natural gas provider uses data analytics to monitor its communications networks for anomalies or outages. Mesh network AMI systems locate outages, and “last gasp” meter messages alert subscribers. Situational awareness systems, meter systems and workforce management systems are not yet fully integrated.
- The natural gas provider leverages wireless technologies, integrated tools and systems such as predictive analytics, AMI and automated work order and dispatch workflows to minimize outages and shorten time to recovery. Situational awareness systems, meter systems and workforce management systems are integrated.
- Not applicable

How does wireless technology help gas providers deliver service to all community members?

- Wireless technologies are not widely leveraged to help deliver natural gas service.
- Wireless technologies enable operational efficiencies, improving natural gas service delivery to high-volume customers.
- Wireless technologies are used ubiquitously for natural gas service delivery, specifically for low latency monitoring, AMI, command and control, and overall situational awareness.
- Not applicable



What wireless communications infrastructure exists to accommodate water and wastewater management?

- The use of wireless sensors is limited, but Automated Meter Reading (AMR) is used. SCADA systems are used to poll and control pump stations and intake points.
 - AMI that leverages mesh networking technology is widely adopted throughout the service territory. Wireless meters and sensors provide real-time data and improved situational awareness.
 - AMI is ubiquitous throughout the service territory. Wide use of wireless sensors supports real-time detection and AI-enabled predictive analytics.
 - Not applicable
-

How does wireless connectivity impact water and wastewater management?

- Manual or wireless AMR is performed via walk-by or drive-by on a monthly or quarterly basis.
 - AMI provides daily or hourly meter readings. Some wireless sensors are available to provide near real-time metrology and alarms for volume, flow, flood levels, etc.
 - AMI and sensors provide real-time situational awareness and historic data to identify, predict and take appropriate actions on water and wastewater events.
 - Not applicable
-

How is wireless data used to support water management?

- Customer metering is measured manually or by near-field wireless meter reading. Tank and pump station measurements and basic alarms use Supervisory Control and Data Acquisition (SCADA) communications for remote monitoring.
- Meter reads are performed using Advanced Metering Infrastructure (AMI) via mesh wireless networks using some fiber or cellular connectivity to backhaul data to an operation center. Water towers, pump stations, leak detectors and other sensors are wirelessly connected to help manage water quality, pressure and flow.
- Customer metering data is automatically reported to the cloud using key data points and wireless connectivity at pump stations and water intake points—providing robust, system-wide situational awareness as well as data on water consumption and quality.
- Not applicable

How is due diligence managed for access controls, information security and physical security?

- Critical assets have been identified, as well as the criticality and sensitivity of the information each asset accesses, processes, stores or transmits.
- Critical assets have been assigned risk and impact metrics, with tailored and appropriate controls and mitigation schemes.
- A comprehensive risk management program, in accordance with NIST publications, is used for categorizing critical assets, selecting and implementing security controls and mitigation schemes, and continuously monitoring processes.
- Not applicable

What wireless technologies and processes are in place to withstand and recover from an unplanned water disruption?

- Service disruptions are reported manually. The water provider has prioritized its recovery process and dispatches crews to address issues as reported.
- The water provider monitors its systems using analytics to detect anomalies or outages. Mesh network AMI systems use "last gasp" meter messages. Some automated outage reporting to the control system and subscribers is available. Situational awareness systems, meter systems and workforce management systems are deployed, though not fully integrated.
- The water provider leverages integrated tools and predictive analytics (weather, performance and usage data) using AMI and automated workforce management processes to facilitate rapid recovery.
- Not applicable

How does wireless technology help the utility deliver service to all community members?

- Wireless communications services are not used to monitor assurance of clean water and wastewater.
- Some wireless communication sensors monitor clean water and waste water services for some populations within the community.
- Wireless communication sensors are deployed throughout the community to ensure clean water and wastewater services are equally available to all community members.
- Not Applicable



You'll also get scores in six key wireless capability areas: data communications, connectivity access, infrastructure, resilience, security, and equity.

Data communications

From water usage to power outages to infrastructure in need of repair, valuable information exists across every aspect of a utility's operations. Wireless networks help utilities leverage it in real time for safety, efficiency, and customer service.

This score defines the data currently available across your utility operations and community via wireless networks. It also shows how wireless technology currently supports data for electric, natural gas, and water services.

Use Case Examples

[A New Communication Path for Digital Fault Recorder Data \(pg. 27\)](#)

Connectivity access

This score assesses the availability of wireless networks and systems for electric, water, and natural gas services.

Wireless networks provide the backbone of smart utilities operations, enabling smart grids, remote monitoring, integrated troubleshooting and repair systems, and more.

Use Case Examples

[Improving Services with a Multipurpose Network \(pg. 43\)](#)



Infrastructure

This score represents the ability of your community's wireless infrastructure to make connections, process traffic, and respond in a timely manner.

Every minute counts when it comes to delivering safe, reliable water and power. Addressing outages is critical to quality of life. Detecting leaks can save millions for a water utility or be a matter of life and death in the case of natural gas services.

Effective response in such scenarios depends on availability and latency. Availability, or uptime, represents a network's ability to make connections, process traffic, and respond to user requests. Latency is the reaction time of a connection, or how quickly a device gets a response after a request has been sent out.

Use Case Examples

[EV Charging Infrastructure \(pg. 46\)](#)

Resilience

This score represents the wireless tools and processes you currently have in place to withstand and recover quickly from service disruptions and outages. Like security, resilience is essential for maintaining safe, dependable water, electric, and natural gas services.

Use Case Examples

[FirstNet Deployable Resiliency Solutions \(pg. 49\)](#)

Security

This score represents the wireless communication protocols and physical security measures your community has in place for privacy and security.

While more data and new technologies expand what's possible for water, electricity, and natural gas services, some innovations can open utilities up to risk. How secure are utility assets from damage or compromise? When collecting data like customer meter or energy usage information, what measures are in place to safeguard privacy? How do investments in wireless security help safeguard utility services?

Use Case Examples

[Power Substation Monitoring \(pg. 28\)](#)

[Drone-Powered Water Tank Inspections \(pg. 37\)](#)

Equity

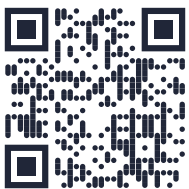
This score represents the wireless tools, provisions, and systems your community has in place right now to support the more equitable delivery of water, wastewater, electricity, and natural gas services. It also gauges your current ability to ensure the smart utilities solutions you develop will serve your community equitably.

Use Case Examples

[Reliability Infrastructure for Economic Development \(pg. 48\)](#)

[Delivering 5G with Dual-Use Streetlight Poles \(pg. 42\)](#)

Take the next step.



Now it's your turn. Discover your own unique wireless maturity score by scanning the QR code to access the online assessment.

Certification

Learn about industry certification programs and why they're so important for smart utility deployments.

Since 1991, CTIA Certification™ programs have set the standard for devices, test labs, technicians, and repair facilities and played a crucial role in advancing the wireless industry.

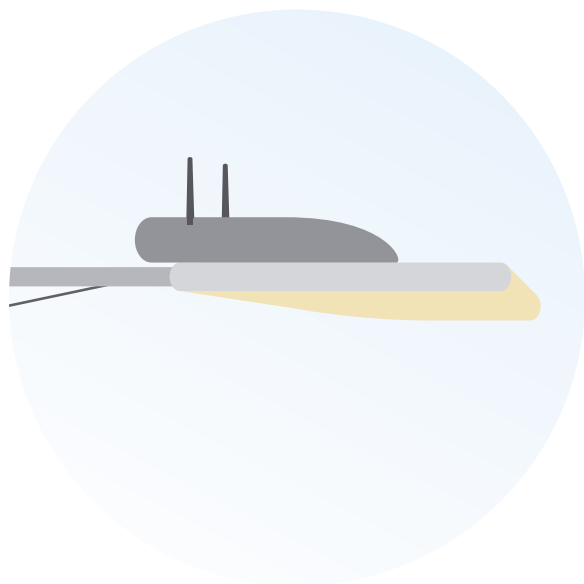
These world-class programs, standards, and best practices are developed and maintained by the 100-plus companies throughout the wireless industry who participate in CTIA Certification Program Working Groups. Devices are tested to conformance, interoperability, and performance standards at over 100 third-party [Authorized Test Labs](#) around the world.

We continuously customize our certification programs to address the needs of sectors who use connected infrastructure, and connected utilities projects are becoming a big business that's getting larger by the day. The [IoT-in-utilities market](#) is expected to grow from \$47.8 billion in 2023 to \$53.49 billion in 2024. As this growth continues, it's vital to ensure trusted devices throughout the utility industry, for both the companies manufacturing them and for those procuring them.

The IoT Network Certified™ Program

IoT Network Certified™ is the baseline certification for IoT devices operating on cellular networks. Drawing on proven standards and specifically crafted for the needs of these devices, it is the first program of its kind for verifying the readiness of devices to connect to cellular IoT networks.

The program provides a simple and affordable pathway for devices to demonstrate compliance with network operator requirements. By designing around a pre-certified wireless module, manufacturers can take advantage of the rigorous testing and certification already done on that module. Additional testing is therefore minimal and consists of checking module integration within the device and its RF performance.



The IoT Network Certified for Smart Connected Infrastructure™ Program

The IoT Network Certified for Smart Connected Infrastructure™ program incorporates additional utility IoT device and cybersecurity testing, which are key to bolstering the robust and secure critical infrastructure network demanded by utilities and device vendors.

Utility IoT device testing:

- + Ensures successful deployment of the device on the cellular network used by the utility
- + Accelerates acceptance by a utility by testing the device on commercial network infrastructure
- + Can identify issues that may not be found on an instrument-based simulation testbed

Cybersecurity testing:

- + Minimizes potential for disruption, intrusion, or data theft
- + Assures utilities of device data security through robust pre-testing
- + Accelerates the deployment process, as devices that have undergone rigorous security testing may be accepted faster by utility's cybersecurity team

CTIA Certification developed this program together with Ericsson's Device and Application Verification Services (EDAVS) team, a leading technology partner for the utility industry in mission-critical LTE networks across the globe.

Developed specifically for utilities with a growing number of cellular-connected IoT devices, the IoT Network Certified for Smart Connected Infrastructure program addresses the increasing demand for advanced IoT deployments by creating a set of standards to ensure the security and reliability of these devices.

Many use cases require broadband IoT connectivity, which is typically provided by Cat 1, Cat 4, or higher-category LTE modems. These modems are either embedded directly into a utility grid device or integrated into an LTE gateway router connected via ethernet to multiple utility grid devices. Other use cases can be served by LPWA, NB-IoT, and LTE-M radio technologies. These use cases typically involve low-cost devices with long battery life, devices deployed in massive numbers, and very low data usage. The certification test scope can be selected based on device type and intended use (e.g., sensor, meter, camera, etc.).

With grid modernization programs leading utility innovation, cellular-enabled IoT devices and apps are increasingly common. The IoT Network Certified for Smart Connected Infrastructure program establishes the industry benchmark for these interconnected products as utilities increasingly demand third-party validation of network compatibility.

Multiple benefits for utilities and manufacturers

Speed: The IoT Network Certified for Smart Connected Infrastructure certification process is rapid, so device vendors and utility companies do not have to wait extended periods of time to ensure their mission-critical devices and networks are equipped for live network deployments.

Cybersecurity: By utilizing the IoT Network Certified for Smart Connected Infrastructure program, device manufacturers can verify that a device can operate successfully on critical infrastructure and present certified devices to utility service providers. Testing is rigorous and conducted by a CTIA Certification Authorized Test Lab.

Comprehensiveness: Advanced network testing includes scopes such as Fixed Broadband LTE, LTE-M, and NB-IoT.

Cost-effectiveness: Because utility device testing occurs at the 4G/5G Ericsson test lab and is operated by Ericsson engineers and employees, device vendors and manufacturers can consolidate testing and streamline costs.

To get a device [IoT Network Certified for Smart Connected Infrastructure](#):

1. **Save time** by designing the device around one of the many modules already [certified for IoT applications](#).
2. **Verify** whether your device requires any additional operator-specific testing for your target markets.
3. **Comply** with government regulations in target markets.
4. **Begin** the certification process by submitting a request to the CTIA Certification database. Here you will select an authorized test lab to determine the testing appropriate for your device, coordinate the testing, and provide the test results.
5. **Pay** the certification fee and lab testing fee.
6. **Receive confirmation** of certification from CTIA once all requirements are met. You can then download the IoT Network Certified logo and certificate.

Next Steps & Resources

Standards-based cybersecurity testing should be an ongoing priority for any network a utility uses: private or commercial 4G LTE, 5G, and beyond.

The [CTIA IoT Cybersecurity Certification Test Plan](#), an integral part of utility IoT device certification, protects consumers and wireless infrastructure while also creating a more secure foundation for smart cities, connected cars, and other IoT applications. It draws from widely recognized NIST (National Institute of Standards and Technology) and ETSI (European Telecommunications Standards Institute) security standards.

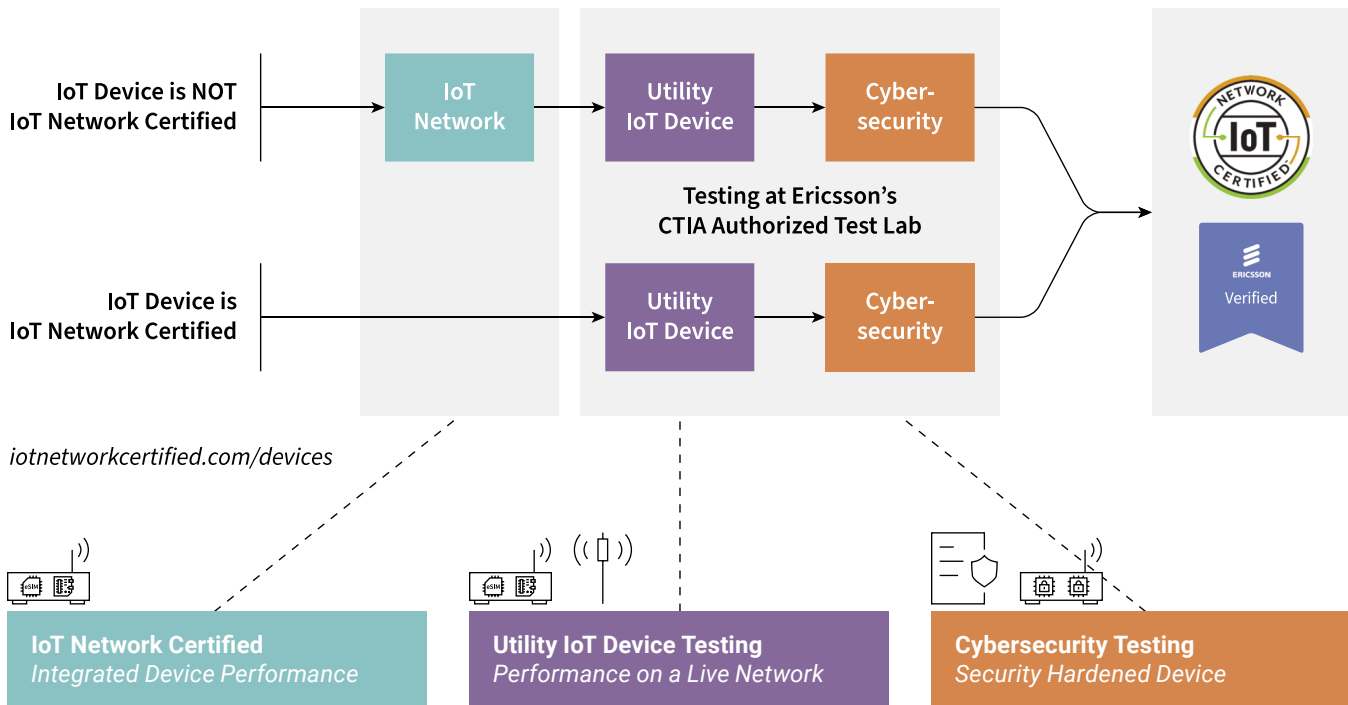
Refer to these helpful industry resources before your next deployment:

- + When choosing devices for utility network deployment, check the [Certified Devices](#) Directory to see which devices have been certified.

- + Explore the [CTIA Certification Utility IoT Device Test Plan](#), which details CTIA Certification Program test requirements specific to utility IoT devices.
- + Explore the [CTIA IoT Cybersecurity Certification Test Plan](#), which establishes an industry baseline for device security on wireless networks.
- + Ericsson's CTIA Certification Authorized Test Lab supports the Utility IoT Device Test Plan and the IoT Cybersecurity Test Plan.

Other things to consider include full end-to-end security to protect information, infrastructure, users, and devices from threats and authorization protocols for maintaining data integrity and confidentiality. Healthy cybersecurity practices leverage robust controls to avoid congestion and effectively prioritize data according to your mission and needs.

Device-Testing Scenarios and Paths to IoT Network Certified for Smart Connected Infrastructure™



A cybersecurity blueprint

When implementing cybersecurity protocols and working toward cybersecurity goals, consider a cybersecurity blueprint with the following elements:

- 1. Both defense-in-depth and Zero Trust security:**
 Traditional defense in depth security protects the internal network and perimeter. Zero Trust security augments and complements it by building security into all components: users, devices, applications, data, and the network itself.
- 2. Traffic separation and asset isolation:**
 Separating different traffic types, like Operations Administration and Maintenance (OAM) and Radio Access Network (RAN), enables protection of more sensitive traffic with more stringent security policies and security levels. Security gateways and firewalls play an important role in traffic separation, as do the virtual routers in the cellular core.
- 3. Encryption to protect data in transit and at rest:**
 Use methods such as Advanced Encryption Standard (AES), Transport Layer Security (TLS), Internet Protocol Security (IPsec), and Datagram Transport Layer Security (DTLS) to protect nodes and control plane traffic and the user plane payload. The network's externally facing Surface Gateway interface (SGi) will require a firewall to give the user plane advanced security. Make sure mobile devices only talk with required applications.
- 4. Holistic security management:** This is essential to ensure network security and privacy from end to end, especially as smart utilities solutions increasingly involve virtualization, automation, and the Internet of Things. Be sure to encrypt all protocols.
- 5. An identity and access management system:**
 Use access controls, identity administration, and user provisioning to authenticate and authorize network users and roles.
- 6. System-verified network security:** As security threats and attacks on end-to-end networks escalate, utilities will need to strengthen the protection of critical network assets, services, and data in transit and be prepared to mitigate risk for each network area potentially under attack. Ensure quick, effective action by testing these solutions in a range of scenarios.
- 7. Secure solutions and operations:** CTIA recommends that utilities align their security blueprint with the specifications of the Third-Generation Partnership Project (3GPP), which unites seven telecommunications standards development organizations and has policies and procedures in place for secure equipment, deployment, and management.
- 8. Supply chain security:** Leverage best-in-class practices to comply with governmental and customer requirements and maintain trust in an evolving geopolitical landscape.

Performance Metrics for Cellular IoT devices

LPWA 4G

	NB-IoT	LTE-M	Broadband 4G
Battery Life	Up to 10 years	Up to 10 years	Use case dependent
Uplink Peak Throughput/UE	~151 kbps	~1,119 kbps	UE category dependent
Downlink Peak Throughput/UE	~118 kbps	~500 kbps	UE category dependent
Cell Range	Up to 120 km	Up to 100 km	Up to 200 km

Use Cases: Seeing What's Possible

Read on for examples of smart utility deployments in action, powered by wireless technologies and cellular networks. They're just a sample from our extensive collection—you can find even more at smartcities.ctia.org.

A New Communication Path for Digital Fault Recorder Data

Virginia

SCENARIO

Utilities need data to know if electrical faults and other events threaten their power systems and when and where to send field crews for diagnosis and repairs. Dominion Energy Virginia uses high-resolution voltage and current measurements from digital fault recorders (DFRs) and traveling wave systems (TWS) to collect this information.

Data flows over optical fiber networks at substation sites where possible. But last-mile optical fiber isn't always available—and can't be economically justified—through some areas of Dominion's territory, like the mountainous terrain in the west.

SOLUTION

Dominion's solution: Use cellular 4G LTE modems to connect with DFRs, TWS, power relays, and substation clocks, for real-time responses to emergency events and data analysis afterwards.

For continuously streaming data and large data sets, Dominion recommends a faster 5G wireless network. This captures data and achieves the low latency needed for testing synchrophasor systems.

To maximize bandwidth requirements for telecom utility circuits at substations, the team explored vendor upgrades to 100 MB and integrated its control center to a Software-Defined Wide Area Network (SDWAN).

RESULTS

With the new solution, Dominion is now able to access field measurements and verify equipment status without sending technicians on site. Dominion discovered that cellular modems are often a cheaper solution than installing new fiber for smaller bandwidth, low-data applications. What's more, the low-cost model of cellular modems enables multiple modems and networks within the same site—effectively making bandwidth extensible and giving multiple groups the ability to independently manage their own traffic.



Power Substation Monitoring

Syracuse, NY

SCENARIO

Today over 1.6 million small drones are registered with the Federal Aviation Administration. With this increase in drone activity, having greater awareness of the airspace near critical infrastructure, such as power substations and transmission lines, is key.

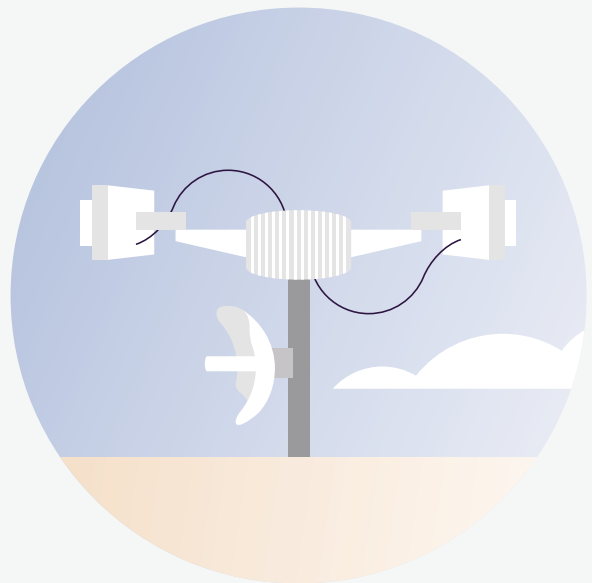
SOLUTION

With help from C&S Companies, Hidden Level is deploying a network of sensors to provide real-time location data of drone activity in Syracuse. Sensors installed on rooftops and cell towers collect data so that drone activity can be correlated geographically to power substations and transmission lines. This enables the utility company to understand the density and frequency of drone operations near critical equipment, alert authorities of issues and understand drone activity in the area.

RESULTS

Hidden Level's drone project has provided real-time alerts for security and law enforcement teams and generated historical reports for assessing the infrastructure most likely to be affected by drone activity.

The local government now has backup data on drone behavior near critical infrastructure, and utility providers who use their own drones for inspections can ensure that no one else is operating in the same airspace at the same time.



Transforming Direct Transfer Trip

New England

SCENARIO

Bringing new power sources like renewables into the grid depends on highly reliable communications between all system components. This is particularly important—and challenging—for the direct transfer trip (DTT) technology used on distribution networks.

To safely incorporate renewables into its power mix, Eversource Energy needed a communication solution that was secure, operationally efficient, and able to support multiple cellular carrier networks.

SOLUTION

Eversource developed a solution with SEL's real-time automation controller and Sierra Wireless' AirLink® MG90 cellular gateway. This combination provides the situational awareness and reliability necessary for safe integration of alternative energy resources through a DTT application.

The AirLink® MG90 enables two cellular carrier connections in each router. When a connection cannot be established on the primary network, the MG90 automatically and transparently switches to the secondary cellular network, then switches back in real time as soon as the primary cellular connection is reestablished.

RESULT

Eversource has applied the solution to several sites and uses it to bring in energy providers like Holiday Hill Community Wind. Power from the Holiday Hill's three massive turbine blades is projected to eventually supply twenty percent of Russell, Massachusetts' energy resources.



Starting a Smart Cities Journey with the Zhaga-D4i Industry Standard

New York

SCENARIO

With smart sensors and connected lighting infrastructure, cities and utilities can improve services, safety, and security while benefiting from more efficient planning and operations, significant energy savings, cost reductions, and enhanced potential for sustainability.

Yet engaging with this digital revolution and using IoT data is easier said than done. When and how can utilities and cities opt in, especially smaller ones with fewer resources, like Mount Vernon, New York?

SOLUTION

The Zhaga Consortium created an industry standard to help. Zhaga D4i enables streetlights to become the backbone of a smart city, for safety, maintenance, public services, sustainability, and data collection. Sensor Ready streetlights leverage the Zhaga D4i standard for a plug-and-play way to extend streetlight infrastructure over cellular networks.

Mount Vernon began its smart cities journey by upgrading its streetlights to 4000 Sensor Ready LED streetlights and connected lighting controls. The city's streetlights were already sensor-ready, which allowed Mount Vernon to install the sensors easily and securely on the luminaires with a simple twist-lock mechanism. The city then added Signify's Zhaga D4i-certified Outdoor Multisensors—which deliver data on motion detection, ambient noise, and temperature—to a subset of the streetlights.

Mount Vernon's solution uses LTE-M technology and a standardized smart interface with industry-recognized LED drivers and outdoor luminaries, cellular controllers and communication nodes, and sensors.

In addition:

- + Smart street light control nodes, certified to D4i Type A for multi-master control capability, work with Type B-certified sensors.
- + Control nodes plug into the NEMA socket, and sensors plug into the Zhaga socket Book 18 interface.
- + When certified nodes and sensors are attached to a luminaire, Mount Vernon can transport the sensor data into the cloud and remotely configure sensing functions.

RESULTS

Smarter street lighting with sensors has helped Mount Vernon “go above and beyond to make our city the best it can be,” according to Mayor Shawyn Patterson Howard.

The solution delivers:

- + Noise detection for reinforcing city ordinances
- + Environmental data for city planning and communications related to extreme heat and cold
- + Motion detection to trigger the optimal street lighting for pedestrians and drivers
- + The ability to easily set lighting schedules for different neighborhoods
- + Data for quick response to outages or other lighting issue

Spotting Line Disruptions without Disrupting Power

Eastern Kansas/Western Missouri

SCENARIO

Evergy's service territory includes many rural areas where trees grow into power lines and cause problems. To indicate where tree growth needs a maintenance crew to trim it, the utility has installed thousands of TripSaver reclosers.

But often when these reclosers operate, there is no communications link back to the utility letting them know the event occurred. Repeated operation of the recloser signals that there is a vegetation management issue on that circuit that the utility is unaware of, exposing the utility to more frequent power outages in these areas and leaving Evergy in the dark about where and when issues needed attention.

SOLUTION

Evergy partnered with Ubicquia for a solution. The utility deployed the company's Ubicell lighting control nodes onto lighting fixtures near TripSaver reclosers, leveraging existing LTE networks for the essential connectivity piece.

The Ubicells, equipped with onboard GPS for location awareness and high-accuracy functionality, proved a cost-effective way of detecting and reporting brief power disturbances. Ubicells placed behind non-communicating reclosers improved circuit visibility, allowing Evergy to become aware of voltage and power fluctuations in real time.

RESULTS

This solution has proven promising for future deployments. Because the system uses existing LTE networks, Ubicells can be placed on streetlights or local area/security fixtures such as barn lights on customer properties, anywhere in the service territory. Ubicells can also be programmed to differentiate between momentary and full power outages.

Evergy is using the data these nodes collect to optimize the deployment of its field crews. This further increases grid resiliency while lowering operation and maintenance costs.



Getting Ahead of Transformer Damage and Repairs

South Florida

SCENARIO

With high lightning and storm activity putting equipment like circuits and transformers at risk, Florida Power & Light (FP&L) operates in one of the most challenging environments in the country. How could the utility more effectively spot problems, conduct repairs, and make its grid more resilient—without spending more on operations and maintenance?

SOLUTION

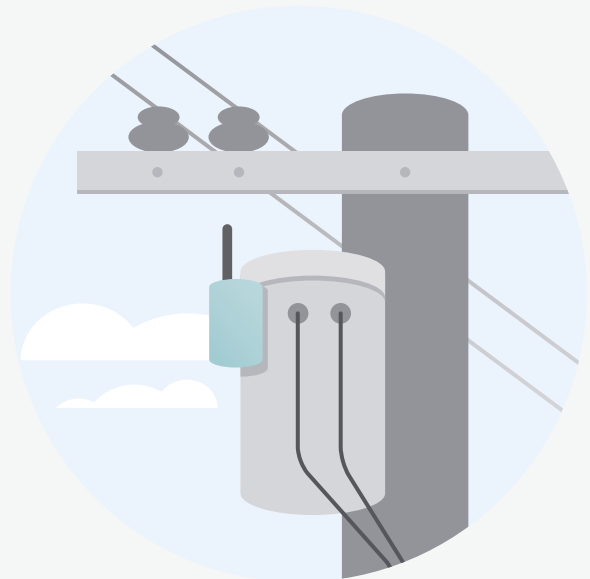
The answer: retrofitting transformers with new technology to monitor their condition in real time. This gives FP&L the ability to proactively address circuit-level electrical issues driving many maintenance and repair tickets.

FP&L partnered with Ubicquia to develop GPS-equipped wireless sensors. Mounted onto existing pole and pad-mounted distribution transformers, these sensors report location, electrical and mechanical information, and oil pressure and temperature readings every few minutes via an LTE network, providing immediate alerts when a threshold is breached.

RESULTS

Data from the 5,000-plus sensors FP&L has installed to date has provided much insight into both distressed transformers and the root causes of transformer failure. The sensors show true transformer utilization and load on specific parts of the grid. They also notify the utility of actual voltages and the current delivered to customers, to verify that both are within proper limits.

Looking ahead, FP&L plans to deploy sensors that measure primary circuit currents and sensors for larger three-phase transformers that serve critical customer loads. The utility is also working with Ubicquia to create alarms for early signs of dielectric breakdown within the transformer in order to identify damaged transformers needing replacement before they fall and cause customer outages.



Remote Monitoring that Reduces Leaks and CO2 Emissions

Nationwide

SCENARIO

More than 2.6 million miles of oil and gas pipelines crisscross the United States. As oil and gas companies transition to less emission-intensive energy sources, they must monitor and maintain these pipes to address safety concerns and limit leaks. In fact, the Pipeline and Hazardous Materials Safety Administration (PHMSA) requires pipeline inspections every two months.

But inspection points are typically five to 10 miles apart, and the actual driving distance between them can be much longer. Even for just a few onsite inspections a day, the hours, fuel costs, GHG emissions, and environmental impact add up.

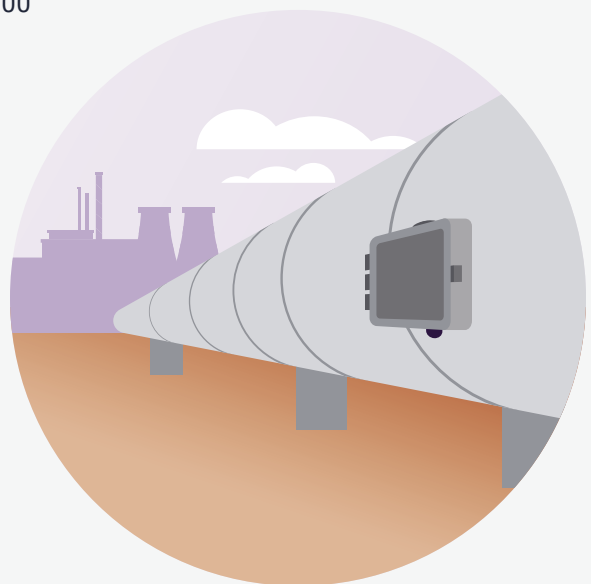
SOLUTION

OmniMetrix has found a more efficient—and energy-efficient—way. This provider of critical asset management services uses an AT&T Internet of Things (IoT) remote monitoring solution to help customers monitor the condition of their steel pipelines. This system both reduces the GHG emissions associated with inspectors driving from site to site and collects detailed, timely information about pipeline health, helping companies reduce leakages.

RESULTS

Across multiple pipeline companies and thousands of sensors, the AT&T IoT solution not only reduced inspection travel time, labor, and fuel costs, remote monitoring shrunk fuel usage by around 22,000 gallons of gas a year— equivalent to almost 200 metric tons of CO₂e.

The solution team noted that it is currently very difficult to collect data on methane emissions, as many factors impact the reduction of these emissions from pipeline infrastructure.



Smart Water Data, Delivered

Columbia, SC

SCENARIO

The City of Columbia and Columbia Water—driven by the core values of accountability, transparency, and integrity—were looking for a way to enhance the customer service experience for 400,000 water and wastewater customers.

SOLUTION

Columbia Water partnered with Badger Meter to replace touch-read meters with a cellular AMI solution across its entire 320 square mile service area.

These Recordall® Disc Series and E-Series® Ultrasonic meters, coupled with ORION® Cellular LTE-M endpoints, deliver data at 15-minute intervals to a BEACON® Advanced Metering Analytics (AMA) solution. Customized dashboards deliver system-wide information to desktops and devices. Alerts proactively monitor exceptions, and automatic software updates maintain accuracy.

Through the EyeOnWater® mobile app, consumers can monitor their water usage patterns and set consumption and leak alerts. Data from across the system, from digital water meters to utility billing centers, helps improve meter-reading efficiency and billing accuracy. The solution leverages existing cellular networks throughout, which eliminates the city needing to maintain its own communications infrastructure.

The system is easy to upgrade and expand as service demands change. Delivery over cellular networks helps ensure that water systems remain online, safe, and secure.



“The Badger Meter technology allowed us to deliver an AMI solution quickly and responsively, as well as cost-effectively,”

said Carmen Flemming, senior program analyst, program management office, Columbia Water.

RESULTS

With upgrades to over 150,000 services, the changeout project is the largest deployment of cellular AMI at a North American water utility to date. It's also a powerful example of how smart water technologies give utilities access to more information for decision-making and infrastructure management. Improved meter-reading accuracy, for example, has given Columbia Water the ability to:

- + Eliminate estimated bills
- + Reduce truck rolls for meter reading re-checks by 96%
- + Reduce customer complaints regarding water bills
- + Reduce inactive water-consuming accounts by 21%

What's next? According to the solution team, smart water systems shouldn't just address current challenges. The right solution should help a city or utility meet future goals and objectives, too. Today's smart water systems enable utilities to upgrade and expand as they grow and integrate their efforts with other smart systems for efficient city management.

Drone-Powered Water Tank Inspections

Nationwide

SCENARIO

Every three to five years, water tanks receive a comprehensive inspection. Inspection teams take the tank out of service and drain the water to examine the interior for structural integrity, sanitation, safety and security. Between these routine inspections, inspectors use cherry pickers or scaffolding to look for corrosion or coating issues. These methods have many drawbacks: tanks taken out of service, billions of gallons of water lost to spillage, multiple trips to the site and safety concerns for inspectors, to name a few.

SOLUTION

AT&T found a solution: using drones and remotely operated vehicles to capture real-time information on water tank integrity. Such secure IoT connectivity, supported by a video analysis platform, could help utilities keep tanks in service, reduce inspection time and avoid unnecessary risk of injury.

RESULTS

By reducing operational costs and increasing inspection safety today and collecting valuable data for asset maintenance tomorrow, the connected drone-remote operation vehicle solution offers great potential to help utilities save water, energy, time, and money.

**If used on 10 percent of water tanks in the United States,
the estimated benefits are:**

- + 1 billion gallons of **water saved**
- + 2,000 metric tons of **CO₂ avoided**
- + \$12 million in inspection **costs saved**
- + 300,000 out-of-service **hours saved**

Wastewater Flow Monitoring

Miami-Dade County, FL

SCENARIO

Each year, an estimated 40,000 sanitary sewer overflows bring untreated sewage into U.S. homes and natural waterways, threatening water quality and public health. The Miami-Dade County Water and Sewer Department is using technology to assess, rehabilitate and improve its wastewater management process, for fewer overflows and stronger EPA compliance.

SOLUTION

The department worked with Itron and its partner US3 to address these challenges. The resulting flow reduction solution analyzes real-time data from US3's battery-powered wastewater flow sensors over Itron's industrial IoT network, to provide a more accurate and complete view of wastewater flows throughout the basin. This helps utility operators quickly identify and mitigate overflows, to reduce public health risk, minimize water contamination and avoid property damage.

RESULTS

The flow reduction solution has yielded many benefits. For example, automating the reporting process for regulatory compliance reduced truck activity for field surveys by more than 60 percent, increasing operational efficiency and reducing greenhouse gas emissions.

“With enhanced visibility into our operations, this solution equips us to better serve customers. It ensures our sewer collection system meets regulator standards, **it improves our level of service**, and in the future, it will assist us in identifying sewer overflows and mitigating inflow and infiltration into our wastewater collection system.”

– Kevin Lynskey, director of the Miami-Dade County
Water and Sewer Department

Accelerating Streetlight Innovation

Baltimore, MD

SCENARIO

Baltimore Gas & Electric (BGE), an Exelon company, had an ambitious goal: roll out over a quarter million wireless smart lighting nodes to lower the utility's carbon footprint, reduce outage resolution time, enhance operational excellence, and improve service.

BGE aimed to leverage technology throughout: using mobile field apps for deployment and maintenance, detecting outages via wireless networks rather than customer reports, and using data analytics to reduce truck rolls. The mission also involved synchronizing and maintaining data across asset management records, GIS applications, and other back-office systems.

SOLUTION

To accomplish all of this and more, BGE deployed TerraGo's cloud-based streetlight operations platform, integrated with Itron's Streetlight.Vision central management system.

With the TerraGo platform, BGE can continuously track smart nodes as they're installed and commissioned, with full chain of custody. TerraGo inventory management identifies bottlenecks and helps eliminate delays. The utility can also track all warranty and asset records for future maintenance.

BGE crews use the TerraGo mobile app to install and commission wireless network controls on the city's streetlights. Configurable workflows guide crews through smart control installations while capturing and validating essential data related to pole attachments, stop signs, cell phone antennas, and surveillance cameras. These guided workflows enforce quality control, prevent errors, and accelerate installation.

Post-installation, TerraGo performs remote triage on system alarms, dispatches crews, and guides personnel with step-by-step workflows to resolve outages efficiently and correctly the first time.

The solution leverages the existing Itron IIOT wireless network throughout, which will also enable future smart city applications. The system is easy to upgrade and expand as service demands change.



RESULTS

With TerraGo, BGE crews are able to install nodes faster and resolve problems more quickly, accurately, and efficiently. In an optimal scenario, a BGE field crew can fully complete a smart streetlight installation in six minutes or less.

Once wireless controls are deployed, both lights and people work smarter. As just one example, BGE previously diagnosed streetlight problems by sending out a bucket truck and having a crew examine the fixture from the top down, reassigning the repair and rolling another truck as needed. Now the system can discern the nature of the problem in advance and automatically dispatch a crew with the right skills the first time.

Behind the scenes, BGE's smart lighting operations have gone completely paperless, with fully digital, automated operations from planning and installation through inventory management, maintenance, and the creation and assignment of work orders.

Wireless edge devices and mobile field operations apps can transform operations and maintenance, the team noted.

Yet it's important to remember that networked lighting involves more than just screwing dumb photocells on top of existing lights. These wireless cyber assets require a deployment strategy, process control, and cross-platform data management.

Furthermore, as wireless lighting nodes automatically collect valuable data, utilities must commit to the next steps of analyzing, integrating, and using this information.

Smart Lighting Retrofit

Birmingham, AL

SCENARIO

To improve public safety, engage residents and modernize its infrastructure, the city launched Brighter Birmingham. Its goals: retrofit and upgrade seven city parking garages with LED fixtures, upgrade the city's streetlights to LEDs, improve park and architectural lighting throughout the city and upgrade highway lighting to LEDs.

SOLUTION

Implementation began with the parking garage retrofit, identified in an energy audit as the fastest return on investment. The mayor's office worked closely with Philips Lighting, the city council and the parking authority and engaged a local construction company and engineering team. The retrofit used new motion detection sensor technology to improve safety as well as energy savings.

RESULTS

The garage retrofit not only saved money, it contributed to a greater sense of safety and community engagement. Within five days of the first parking deck being completed, garage attendants reported a noticeable increase in utilization. The city financed the retrofits through energy savings and careful use of public funds, eliminating the need for capital expenditures. The contract vehicle can be adjusted to a "lighting as a service" agreement, which would accommodate future technology advancements and yield additional savings and local jobs.

Brighter Birmingham's parking garage retrofits are estimated to save nearly **\$375,000** annually in energy and maintenance costs.

Delivering 5G with Dual-Use Streetlight Poles

Denver, CO

SCENARIO

As communities roll out 5G nationwide, increasing bandwidth and densifying networks were top priorities in Denver, Colorado. Streetlight infrastructure offered an opportunity for increasing network capacity while also collocating small cells and upgrading the city's lighting.

SOLUTION

To help build Denver's 5G network, Xcel Energy selected the Comptek Technologies' CityPole® smart pole for its modularity, flexibility, and track record of hundreds of seamless installations across the metropolitan area with minimal downtime. With a pole-ordering strategy designed to streamline the process and address deployment and delivery challenges, Comptek deployed, engineered, manufactured, and delivered an integrated pole solution within eight weeks of the order.

"We have carefully calibrated with Comptek when the orders are issued, and when the poles are fabricated and delivered to our contractor's bucket," said Tony DiCamillo, small cell project manager for Xcel Energy. "As a result, our contractor is installing between twenty-four and thirty poles per week, which is notable and unheard of."

Xcel Energy and Comptek also communicated with city leaders and residents to address deployment questions or concerns.

RESULT

Xcel Energy has deployed more than 150 dual-use streetlight poles in 2019, an additional 350 in 2020, and over 620 in 2021. The project has expanded statewide to municipalities including Aurora, Boulder, and Grand Junction.

"We couldn't be more pleased with this project and that we were able to deliver a best-in-class, dual-use streetlight product. We're proud of this project's success," Said Ed Bieging, Vice President of Utility Relations, Aero Wireless Group.

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Improving Services with a Multipurpose Network

Chicago, IL

SCENARIO

Smart cities start with smart buildings. To create a more efficient environment for people to live, work and play, Chicago has embraced this concept head-on, seeking out public-private wireless partnerships to digitize operations, streamline transportation and enhance live events at key locations and attractions— connecting the Windy City from the inside out.

SOLUTION

The city launched hyperconnected, converged wireless networks from Boingo Wireless at high-traffic venues: Chicago O'Hare International Airport, Midway International Airport and Soldier Field, home of the NFL's Chicago Bears and the MLS Chicago Fire FC, as well as the Donald E. Stephens Convention Center and the 50-story One North Wacker building.

The end-to-end networks feature 5G over millimeter wave and Wi-Fi. In addition, private LTE, powered by CBRS 3.5 GHz spectrum, offers the city more coverage and capacity, has strong network security and is scalable for private 5G connectivity.

RESULTS

By consolidating segregated networking solutions, Chicago can realize cost savings. Meanwhile, converged networks, a mobile edge computing architecture and a strong public-private partnership with Boingo enables the city to reduce traffic congestion, improve safety and enhance the civilian experience.

Now and after COVID-19, the converged networks can support capabilities like biometric sensing, thermal screening and touchless experiences like contactless entry and concessions, giving large venues the foundation to create healthier and safer environments. The private LTE and private 5G connectivity also offer the potential to:

- + **Reduce congestion and prevent accidents at airports** via IoT sensors that allow traffic conditions to be analyzed in real time
- + **Equip stadiums with real-time security** through 5G-powered video surveillance systems that use 4K cameras and biometrics devices
- + **Help commercial real estate enterprises improve efficiencies and decrease operational costs** via private, secure communication

Turning an EV Charger into a Grid Powerhouse

New York

SCENARIO

Fermata Energy's Vehicle-to-Everything (V2X) technology turns electric vehicles (EVs) into battery storage assets, enabling EVs to send energy to a building or the grid and support grid resilience. Brooklyn-based technology accelerator Newlab discovered its power during Hurricane Ida.

At the beginning of the storm, Newlab and Verizon were demoing a Nissan LEAF plugged into Fermata Energy's FE-15 bidirectional charger and managed by the Fermata Energy V2X cloud software. Throughout the rest of the meeting and that night, the Fermata Energy V2X platform managed the energy load of the Newlab building.

This demo spurred further thinking. Utility substations need to be able to respond swiftly to changing grid conditions, especially given the growing density of distributed energy systems and the fleets of EVs connected to them. Applications that involve photovoltaic (PV) smoothing and frequency response require low latency and high reliability between the controls that process decisions and the chargers that execute them.

How would different communications networks affect these functions, including a utility's ability to deliver data in near real time and quickly load-balance and optimize the grid.

SOLUTION

To answer this question, Verizon compared 4G LTE and 5G technology performance on V2X's vehicle-to-building system.

Using one Nissan Leaf EV paired with Fermata Energy's bidirectional charger, the team linked the software with a wavelength Amazon and Verizon product called the EDGE. The goal: see how fast it would communicate with the EV. Instead of using 4G LTE, the team enabled the system with the latest Verizon 5G network.

The team used the Fermata Energy cloud control system to monitor the state of vehicle chargers and the energy load of the building. VPN tunnels over cellular connections link the system to the remote networks containing the chargers and building load meters.

RESULTS

With a normal response time of under 100 milliseconds, the Verizon 5G/AWS Wavelength network pathway outperformed Newlab's existing 4G LTE/datacenter pathway, which reported a normal response time of over 300 milliseconds.

Today the Fermata Energy V2X charger is either charging EVs or powering the Newlab building, with the ability to power 10% of the building's electrical load. Fermata Energy has created utility protocols for its platform and is working closely with utilities to design programs and optimize utility signals for sending energy from EV batteries to buildings.

This technology can also be used for microgrids, compressed versions of the larger electrical grid, and virtual power plants, which are anticipated to become highly valuable resources as hurricanes, wildfires, floods, and other natural disasters impact communities more frequently.

EV Charging Infrastructure

San Francisco, CA

SCENARIO

San Francisco needed a network of charging stations to serve a growing number of electric vehicles.

SOLUTION

Black & Veatch, whose vehicle-charging infrastructure portfolio includes more than 163 MW of capacity in North America, partnered with San Francisco-based Volta Charging to significantly expand Volta's network of free public charging stations in the city. Black & Veatch assisted with engineering, design and permitting. The partnership worked together to obtain dozens of local government permits, address the needs of businesses where stations are located, and consider variable construction requirements at every physical location.

RESULTS

In some cases, new charging stations were brought online in roughly a month. With this project, Volta joins a growing list of industry leaders leveraging Black & Veatch's ability to execute seamlessly on large-scale, geographically dispersed project

Grid Modernization for Improved Safety and Service

US

SCENARIO

An investor-owned utility (IOU) needed to make communication upgrades for critical infrastructure devices across multiple states, including the reclosers that help clear obstructions like tree growth on power lines. These upgrades would be complex to install, and the utility would need to minimize operational downtime throughout. For these reasons, the IOU explored a retrofit approach to grid modernization, with an emphasis on scalability.

SOLUTION

An IoT solution over an AT&T FirstNet cellular network transformed a communication upgrade into total grid modernization. The turnkey solution included design, customized hardware, enclosures, and software, plus maintenance and full project management for the life of project.

RESULTS

The IOU is now able to detect faults in near real time, improving power restoration after outages.

But this was just one of the solution's many benefits. With advanced circuit protection to protect and manage devices across its critical infrastructure, the IOU now had increased visibility and control across its grid.

Operations became more efficient and cost-effective, too. Remote control over the network helped the utility optimize resources, such as using more reclosers and fewer truck rolls to address tree growth.

Throughout, improved communications and control across a multi-state service area enhanced the utility's mission of customer service and public safety.



Reliability Infrastructure for Economic Development

Montgomery, AL

SCENARIO

Alabama Power, the City of Montgomery, Montgomery County and the Montgomery Area Chamber of Commerce aimed to improve alignment and collaboration on smart community projects.

SOLUTION

The four organizations created the Montgomery Smart Community Alliance and made its first priority increasing the reliability of the electric grid. In the Montgomery Area fiber and reliability project, Alabama Power sectionalized segments of distribution power lines to isolate fault locations and improved crew deployments for troubleshooting scenarios. Alabama Power also provided dark fiber connectivity for buildings at the Montgomery Area Chamber of Commerce and used the same fiber to improve the city's public Wi-Fi network.

RESULTS

The Montgomery Area fiber and reliability project increased the overall reliability of the electric grid—reducing outages from unplanned events and weather—while reducing city connectivity costs, enhancing economic development downtown and improving the overall quality of life for residents and visitors alike.

FirstNet Deployable Resiliency Solutions

Nationwide

SCENARIO

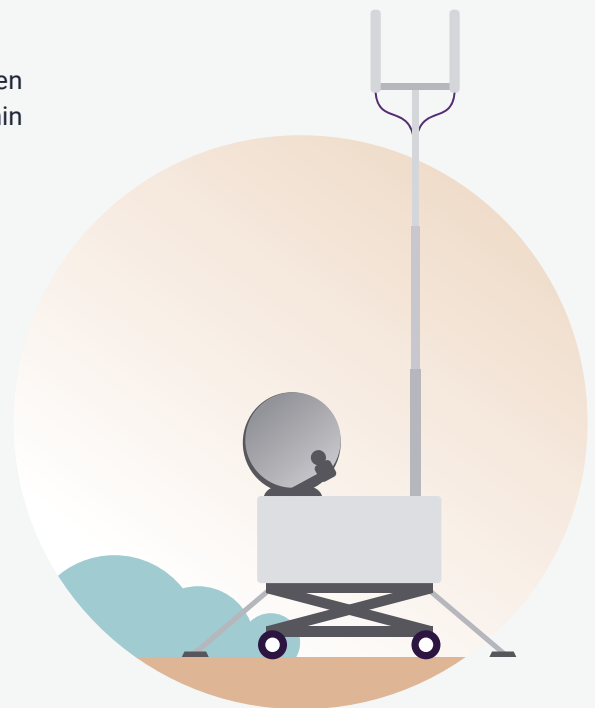
AT&T deployed FirstNet® SatCOLTs (Satellite Cell on Light Trucks) to rural locations to improve first responder and critical worker connectivity. After large wildfires in 2020, however, fire officials and utilities realized a gap in SatCOLT emergency communications: work crews had difficulty accessing voice and data in more rugged territory. Emergency managers, utility operators, line crews, and contractors needed a smaller, more mobile communications system.

SOLUTION

AT&T responded with the FirstNet® Compact Rapid Deployable (CRD™) and Cell-On-Wheels (COW) products. CRD™ is a pre-configured cell tower that generates an area of FirstNet® Cellular and Wi-Fi coverage virtually anytime and anywhere. It supports voice, LTE, data, and IoT communications for emergency response, local citizens, and community engagement.

RESULT

When deployed, the CRD™ becomes operational in just seven minutes. The COW can be deployed by a single person within minutes wherever it is needed and can be transported with a standard Class 2 hitch or by helicopter.



Helpful Tools and Resources

You've seen what's possible with connected utilities innovation. Now start bringing your own projects to life.

Here are a few of the resources CTIA has developed offering guidance on strategy, community collaboration, selecting vendors and navigating the technical details.

Getting Started

Here are some examples of projects to consider:

- Alerts and notifications
- Connected utilities solutions
- Customer-behind-the-meter asset utility integration
- Demand response and flexibility programs
- Electric vehicle charging infrastructure
- Energy market participation
- Falling wire and wildlife mitigation
- Infrastructure inspections
- Integration of renewable energy sources
- Sewer and stormwater overflow management
- Smart lighting
- Smart water
- Security
- Water loss detection
- Water usage tracking
- Wireless utility networks

For further guidance, explore current capabilities and future possibilities related to:

- 4G and 5G
- Advanced metering infrastructure (AMI)
- Artificial intelligence and machine learning
- Automation (substations, field force operations transmission, distribution, etc.)
- Drones
- Dual-use streetlight poles
- Home-area networking
- Microgrid monitoring, coordination, and control solutions
- Sensor networks (for weather, lines, phasor measurement units, etc.)
- Supervisory control and data acquisition (SCADA)
- Wireless utility solutions



Setting Your Project Up for Success

It's important to narrow your scope, prioritize your projects and line up funding sources. This requires a comprehensive evaluation of the following areas:

Past projects

- What smart projects have already been executed?
- What were the results, positive and negative, particularly in the area of data sharing?
- Have technology platforms been launched that serve more than one department or agency?
- How successful were they?

Pain points

- What are your community's main pain points related to public services, transportation and utilities?
- Does the pain point affect only one part of your community or does it cross municipal boundaries?
- Which public and private entities does the pain point involve?
- Do you have a relationship with a public or private entity that can be leveraged again?

Processes

- Does a common smart cities vision exist in your community?
- What are your current constraints in procurement—e.g. difficulties collaborating across departments?
- Do you have open policies for data and processes for governance?
- Do you have a marketing plan? Think about how you plan to share updates publicly to raise awareness, increase visibility and build momentum.
- Do you have a modernized infrastructure plan?

People

- Do you have an assigned smart cities champion?
- Do you have relationships with local universities or innovation councils?
- Does your project deliver value across the community or only to a specific segment?

Community Collaboration

Step 1:

Know what you're working with.

- Does the city have any government-owned utilities that service residents?
- How much of the city's infrastructure is leased or shared by utilities?
- What are the modernization/IoT plans for the local utilities?
- What is the current relationship between the city and local utilities?
- Are there regular strategic planning meetings?
- What are the current financial arrangements between the city and utilities?
- What are the plans for future smart grid, distribution network and renewables projects?

Communities and utilities can leverage existing networks of poles and wires and existing rights-of-way to expedite deployment and reduce costs. For instance, utility poles, including light poles, can be used to mount various devices that enable other "smart" services. Partnerships with the wireless industry can provide the connectivity to power smart utility projects like:

- Remote-controlled LED street lighting
- Small cell sites
- Wireless LAN access points
- Audio sensors for gunshot detection
- Cameras for capturing photos of vehicle license plates
- Traffic enforcement
- Tracking systems for stolen vehicles/fugitives/Amber Alerts

Step 2:

Get the technical specifications.

Is end-to-end encryption required?

- If a device is monitoring or controlling the grid or has access to critical information, enhanced end-to-end security features should be considered.
- End-to-end encryption can be built into the configuration as routers are deployed.
- If you are deploying modules/embedded chipsets into equipment like relays, capacitor banks and meter cans, the encryption must be developed and incorporated by the equipment manufacturer.

Are devices protected?

- Devices should be certified for supply chain protection.
- Ask who will have access to devices, from manufacturing to delivery.

How will you ensure system reliability?

- See if you will need a quality-of-service arrangement to ensure prioritization of utility traffic.
- Pay attention to antenna configuration, which is critical to increasing reliability, throughput, and capacity.
- Consider MIMO and cross-polarized antennas where applicable.

Step 3:

Prioritize security.

Security is paramount for reliable, resilient smart utility services. Implementing a cybersecurity plan during the design phase of your project can help keep your smart utility assets safe. Specific to wireless connectivity, smart utility devices should be IoT Network Certified for Smart Connected Infrastructure™—which includes a baseline of cybersecurity screening for your IoT devices being deployed on cellular networks.

Consider certifying devices that transmit over a cellular network, including:

- Gas, electricity, and water meters
- Industrial gateways
- Monitoring and control devices

An Example RFP Checklist

Make sure you have all your technical requirements covered with this checklist as a starting point.

- | | |
|---|--|
| <input type="checkbox"/> Alarms/alerts | Particularly for a utility management, public infrastructure or traffic management project, how does the vendor plan to handle remote monitoring and critical event detection? |
| <input type="checkbox"/> Certifications | What industry standards and certifications (3GPP, IEEE, IoT Network Certified for Smart Connected Infrastructure™, NIST, ETSI, etc.) will your technologies, such as network devices, need to achieve, and how does the vendor plan to address this? Including industry certifications, such as IoT Network Certified for Smart Connected Infrastructure™, as part of your vendor requirements can help establish a standards-based cybersecurity baseline for the cellular network your utility plans to use. |
| <input type="checkbox"/> Cloud infrastructure | If your project will be hosted in the cloud or manage data or handle analytics in the cloud, what cloud services and support does the vendor offer? |
| <input type="checkbox"/> Cybersecurity | How does the vendor plan to protect hardware, software or electronic data from theft, damage, disruption or misdirection of services? This includes achieving cybersecurity certification for devices touching your network and setting a baseline set of cybersecurity standards. |
| <input type="checkbox"/> Data analytics | What processes does the vendor have in place for inspecting, cleansing, transforming and modeling data and relaying it to you? The information that fuels a smart cities project is only as good as your capacity to interpret and respond to it. |
| <input type="checkbox"/> Data ownership | How does the vendor plan to handle possession of and responsibility for information, including data ownership, compliance and access management procedures? |
| <input type="checkbox"/> Data retention | What is the vendor's data retention policy? Does it align with your requirements (e.g., compliance with state and federal regulations), and what kind of plan and personnel will you need to collect and manage the data you need? |
| <input type="checkbox"/> Equipment | What type of equipment does the vendor plan to use to implement your project? Is it compatible with your existing/planned infrastructure, and does it meet your resiliency and sustainability standards? |
| <input type="checkbox"/> Key Performance Indicators (KPIs) | What kind of KPIs will the vendor use to evaluate the success of its service/solution? |

<input type="checkbox"/>	Lifecycle management	How does the vendor manage the product lifecycle—from inception through design, manufacturing and service to disposal/end of life?
<input type="checkbox"/>	Maintenance	What is the vendor's policy for hardware, network and software maintenance and support? Does this include preventive and remedial services? How much does it cost and how will you be charged (e.g., per incident)?
<input type="checkbox"/>	Managed services	If you need to outsource certain processes and functions to augment your internal resources, what managed services does the vendor offer, and how much will they cost?
<input type="checkbox"/>	Metrics	What measures, including and beyond KPIs, does the vendor plan to use to report key behaviors, activities and performance? How frequently will these be reported?
<input type="checkbox"/>	Operations	How does the vendor ensure efficiency and high performance?
<input type="checkbox"/>	Physical infrastructure	How will the vendor help you leverage current infrastructure?
<input type="checkbox"/>	Redundancy	Duplicating or backing up critical components and functions, referred to as redundancy, is key to network reliability and system performance. What redundancy services does the vendor offer?
<input type="checkbox"/>	Reliability	Reliability is a must-have feature for telecommunications networks, especially in public safety projects. How does the vendor plan to ensure reliability?
<input type="checkbox"/>	Support	Help with specific problems is often an ongoing cost. What type of support does the vendor offer, and how much will it cost?
<input type="checkbox"/>	Systems integration	How does the vendor plan to bring together components, subsystems, computing systems and software applications to act as a coordinated whole? What kind of experience does the vendor have in this area, and how will the vendor ensure that systems interact and perform as expected?
<input type="checkbox"/>	Universal design/accessibility	How does the vendor plan to make products and services usable by all individuals and communities? Evaluate the ability of a given technology to enhance access to services.
<input type="checkbox"/>	Use cases	Can the vendor provide examples of previous deployments involving similar technologies, applications and goals?

A Glossary of Common Acronyms

AES	Advanced Encryption Standard	MWh	Megawatt hours
AMA	Advanced metering analytics	OAM	Operations administration and maintenance
AMI	Advanced metering infrastructure	PLC	Programmable logic controller
DER	Distributed energy resource	PMUs	Phasor measurement units
DFR	Digital fault recorder	PQM	Power quality measurements
DNP	Distributed Network Protocol	QoS	Quality of service
DSSE	Distributed system state estimation	RAN	Radio access network
DTLS	Datagram Transport Layer Security	RF	Radio frequency
EMS	Energy management system	SDWAN	Software-Defined Wide Area Network
EV	Electric vehicle	SGi	Surface Gateway Interface
GOOSE	Generic object-oriented substation event	SIM	Subscriber Identity Module
GPS	Global positioning system	SLA	Service-level agreement
IEC	International Electrotechnical Commission	SV	Sampled values
IoT	Internet of Things	TLS	Transport Layer Security
IIoT	Industrial Internet of Things	TVM	Tilt and vibration monitor
IOU	Investor-owned utility	TWS	Traveling wave systems
IPsec	Internet Protocol Security	UPS	Uninterruptable power source
IT/OT	Information technology/Operations technology	VPN	Virtual private network
LAN/WAN	Local Area Network/Wide Area Network	V2X	Vehicle-to-Everything
LEDs	Light-emitting diodes	3GPP	Third Generation Partnership Project
LMR	Land Mobile Radio	4G	Fourth generation of broadband cellular network technology
LPWA	Low-Power Wide-Area	5G	Fifth generation of broadband cellular network technology
LTE	Long Term Evolution		

We hope you find these resources helpful!

Many thanks to CTIA Smart Cities member companies for their contributions.

If you have questions or need more information, please contact the CTIA Smart Cities Team at smartcities@ctia.org or visit Town Square at smartcities.ctia.org to view these resources and more online!

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