Natural Gas Safety Playbook:

Modernizing Natural Gas AMI and Safety Solutions with LoRaWAN

Gas leak incidents often go unreported, leading to potentially dangerous situations and costly damages. To address this challenge and enhance safety and efficiency, utilities and facility managers are increasingly turning to advanced wireless network technologies and connected devices. Network connected natural gas alarms (NGAs) and other safety solutions are ideal because they support real time monitoring, provide immediate alerts, and can be an important component of automated shut-off capabilities.

This playbook explores how LoRaWAN addresses gas safety by enabling remote monitoring and real-time data collection for enhanced safety measures. From its robust feature set to the low-cost of deploying and maintaining the network and device infrastructure, we will detail how LoRaWAN is revolutionizing natural gas safety and driving utility infrastructure advancements.

Identifying a Business Case

As with any new use of technology, it is important to start with a solid business case. In the natural gas market, the most common use of LoRaWAN today is Advanced Metering Infrastructure (AMI). Utilities have been deploying LoRaWAN enabled AMI systems to automate meter reading and enhance billing services since 2018, proving the capabilities and usefulness of the technology for critical infrastructure applications.

Now, with the commercial availability of LoRaWAN connected natural gas alarms, natural gas safety not only presents a new compelling business case for utilities, but also for residential and commercial property owners of all types, including single family homes, multi dwelling units, restaurants, hospitals, schools, municipal buildings, and more.

With LoRaWAN networks, gas alarms, and automated shut-off capabilities, utilities, municipalities, and property owners can enhance safety protocols, prevent incidents, mitigate environmental risks, and protect their assets – ultimately demonstrating a commitment to the well-being of employees, customers, and the surrounding community.

Understanding the Solution Architecture

At a basic level, the architecture of a LoRaWAN solution for natural gas safety is straightforward and includes sensor-enabled end devices, a wireless network (gateways and network management software), and application software. Think of the solution as "DNA" (Device, Network, Application).

Devices: LoRaWAN end-devices are the battery powered physical endpoints of the LoRaWAN solution where sensing occurs and control is exercised. End devices communicate wirelessly with a network gateway using the LoRaWAN protocol as defined by the LoRa Alliance.

End devices available today support some of the more critical elements of natural gas distribution and safety. These devices include gas meters, methane leak detectors, temperature (fire) sensors, water level and leak sensors to detect water levels near gas appliances, and stand-alone or integrated smart meter shut-off valves.

- What are the key considerations for device selection, gateway placement, and network infrastructure in your gas safety deployment?

- What data do you need to collect and how often?

- Will the devices and network infrastructure be compatible with your existing systems and technologies?

- How many devices will be deployed, and is there a need to add devices in the future – for the same or different use case?

- Can the LoRaWAN network scale to accommodate your application needs and future expansion plans?

- How does the LoRaWAN solution ensure network and device security and the integrity of the data being transmitted?

- What level of technical support and maintenance services does the LoRaWAN network provider offer?

- What collaboration opportunities exist with network and solution providers who can offer tailored solutions and guidance for LoRaWAN-based gas safety implementations?

- Is your network provider an active participant in gas industry organizations and familiar with gas related regulations and laws?

Network: LoRaWAN networks are optimized for low power, wide area wireless connectivity requirements and can be deployed in public, private, and hybrid configurations. Gateways provide connectivity for end-devices, relaying data to and from the Network Server via IP backhaul (cellular is typically used for backhauling to the cloud from the LoRaWAN gateway, but in some cases other backhaul types are used including Ethernet, Wi-Fi, and satellite). In a public or a multitenant network implementation, the LoRaWAN gateway infrastructure is typically owned by Senet who provides LoRaWAN Network as a Service (NaaS) to multiple solution providers, utilities, municipalities, and other tenants. In this case, the network capacity is securely shared among the parties. In a private or dedicated network, all the gateway capacity would be allocated to a single utility or municipality network to which they can connect smart meters and other LoRaWAN end-devices or sensors. In this model, the utility or the municipality (or one of their trust partners) would typically be the owner of the gateways with carrier-grade cloud-based network management services provided by Senet through its Platform as-a-Service (PaaS) offering. In some cases, a mix of both multi-tenant (public) and dedicated (private) gateways might make sense. Senet supports this hybrid approach to delivering LoRaWAN connectivity services as well.

Applications: The LoRaWAN network server forwards sensor and device data to the head-end system of the utility or to a specific platform/application to which the end device belongs. Applications can include gas leak detection systems, building management systems, analytics platforms, and safety management interfaces that enable quick and targeted interventions during gas-related incidents. These systems make operations leaders more productive and better equipped to do their jobs by providing real-time insights into what is happening and empowering them to make the best decisions to keep customers, occupants, and the community safe.

Benefits and ROI: Driving Improved Gas Safety and More

The value of LoRaWAN gas safety solutions is delivered across several operational areas, including:

Leak Detection: LoRaWAN natural gas alarms provide real-time data on gas leaks, enabling rapid detection and response to mitigate risks. Devices deployed as part of a monitored service provide precise notifications to first responders of location and concentration of gas leaks allowing for safe, quick, and efficient remediation of leaks.

Automatic Gas Shut-Off: LoRaWAN technology can be used to control and monitor remote shut-off valves in gas distribution networks. Integration between automatic shut-off valves and LoRaWAN networks provides utilities 24/7 monitoring with automatic and remote gas shut-off capabilities.

Pressure Monitoring: Pressure sensors enable continuous monitoring of gas line pressure, allowing for early identification of anomalies and proactive maintenance. This helps prevent system failures and can catch potential leaks, ensuring safe operating conditions.

Environmental Monitoring: LoRaWAN sensors can be used to monitor environmental conditions around gas infrastructure, including air quality and meteorological data. This information can be crucial for assessing the impact of gas operations on local ecosystems and communities.

Demand Management: Connected sensors can help manage and optimize gas distribution networks by monitoring consumption patterns and demand fluctuations. This data can aid in load balancing and efficient resource allocation.

Tamper Detection and Asset Monitoring: LoRaWAN sensors can be used for open/close detection, impact, tilt detection and other types of asset and facility monitoring use cases.

Asset and People Tracking: LoRaWAN tracking devices can sense virtually any kind of movement for tracking outdoors, indoors or a combination of both for safety and compliance use cases.

Predictive Maintenance: By continuously monitoring equipment performance and conditions with LoRaWAN sensors, utilities can proactively identify when maintenance is needed, preventing costly equipment failures and optimizing maintenance schedules.

Market Leading Innovation

Senet's technology leadership is increasingly relied on by the utility sector to navigate a complex ecosystem and to deliver unique solutions powered by LoRaWAN. For example, Senet has contributed to a LoRa Alliance Technical Recommendation that utilizes the LoRaWAN specification to create device-to-device communication. This capability enables natural gas alarms to communicate with shut-off valves in the event a leak under wide area network outage conditions such as a natural disaster. A key benefit of this functionality is the timely shutdown of the gas distribution infrastructure in specific locations as opposed to larger regional shutdowns which can result in unnecessary service outages and millions of dollars in costly service restoration.

Elevating Safety Standards in the Natural Gas Industry

The LoRaWAN standard is an open, member driven protocol that has been engineered with extended battery life IoT devices in mind, including smart gas meters and other sensing devices with a typical battery life of 10 to 20 years. SLA-backed service delivery and a long device operation without battery replacement make LoRaWAN ideal for gas infrastructure modernization and safety related projects.

Furthermore, proposed legislation requiring natural gas alarms in homes and commercial buildings is now driving active collaboration between utilities and leading gas technology solution providers. This growing collaboration to deliver state-of-the-art LoRaWAN sensing and alerting systems and valve shut-off capabilities is poised to be a key contributing factor to the mitigation of natural gas dangers and the adverse effects gas leaks have on the environment.