LPWAN Networks Ideally Suited for Gas and Water Metering

Gas and water utilities globally seek smart meters for conservation and loss reduction, requiring them to be long-lasting, reliable, and efficient.

Read this e-book to learn:

- Why LPWAN network technologies, particularly NB-IoT/CAT-M1 and LoRaWAN® make excellent choices to optimize coverage, prevent downtime, and increase operational efficiencies.

- How to extend the service life of battery-powered water and gas meters and reduce operating costs.

- Ways to minimize impact of drive-by collection by truck rolls.

- Strategies to streamline water and gas bill disputes and improve customer information to prevent resource leakages or abnormal consumption.

- How to simplify development and deployment of meter device management systems while ensuring security, reliability, support for key metering standards, and scalability.

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The Future of Water and Gas Utilities

Today's water and gas utilities are facing unprecedented challenges. With water and energy conservation a major global concern, coupled with rising operating costs, aging infrastructure, increasing demand from growing population, changing customer expectations, and heavy government regulations, modern utilities have much at stake. In fact, industry experts[1] cite multiple major challenges facing water and gas utilities today.

FIVE OF THEM LISTED AS BELOW:

1. Efficient metering and consumption billing

2. Reduction of non-revenue water (NRW) such as due to apparent and physical losses like wrong operations, theft and leaks

3. Improving customer service

4. Asset and workforce management

5. Customer privacy and critical infrastructure security

To mitigate these challenges, modern utilities must adopt new approaches that enable them to provide a safe, steady, efficient, and affordable supply of water and gas resources in a rapidly changing world.

[1] 10 Challenges of Water Utilities | TWRI (tamu.edu); 5 Energy Utilities Industry Challenges in 2022 | Getac

Smart Meters and the Digitization of the Modern Utility

In many parts of the globe, water and gas utilities are demanding ever more from the legacy but aging infrastructure. While sufficient in the past, it is no longer able to meet today's challenges. The solution lies in fully digitizing traditional utility practices, including planning and designing for asset longevity. Careful investment is needed to avoid risk and dependencies on technology that changes too fast or is locked in proprietary systems.

Metering, of course, is a key area where the industry benefits from digital transformation. Traditional meters often degrade in accuracy over time due to mechanical wear, leading to inefficiencies—such as increased operating costs, revenue loss, and customer dissatisfaction.

The new breed of ultrasonic metering technology is replacing the mechanical part in volumetric metering. This has entered the market in Western countries where meters increasingly use embedded electronic with digital displays for higher reliability and tampering protection. The adoption of Advanced Metering Infrastructure (AMI) with wireless communication chipset or module embedded in the electronic design is nowadays considered as superior design for smart meters. The addition of cost-effective microelectromechanical (MEM) sensors for temperature and pressure measurement enhances the total value. In some models, adding an electronic valve allows remote shut-off the distribution of water or gas for better safety and remote management of subscription. Fully digitized, the smart meter can provide utilities with unprecedented insights, control, precision, and more intelligent data.

The cornerstone of these smart meters is connectivity, allowing them to relay frequent information to controlling utilities. With this data, utilities can proactively respond to conditions and issues as they arise, such as reporting alarms for possible tampering, leaks, and abnormal usage patterns, thereby dramatically reducing operational inefficiencies and losses.

How Smart Metering Solves the Modern Utility Challenges

Taking another look at the major challenges facing today's utilities, the responding solutions and benefits of smart metering make a compelling argument for immediate adoption:

| UTILITY CHALLENGE	RESPONDING SMART METER SOLUTION
Efficient metering and consumption billing	**Accurate metering:** Deploying different types of measuring technology on all meters equipped with intelligent communication modules.
Reduction of non-revenue water (NRW)	**Improved revenue:** Leakage and theft detection/reduction, proactive monitoring to pinpoint small leaks before significant damage is caused. Reduction of physical losses.
Improved customer service	**Customer satisfaction:** Better customer experience with greater billing accuracy and no service supply interruptions.
Asset and workforce management	**Operational excellence:** Better maintenance, faster repairs, and improved asset management.
Customer privacy and critical infrastructure security	**Security:** End-to-end security from meter-to-meter device management (MDM) platform.

With the smart meter, utilities can envision a bold new future of the possibilities that will provide a rich balance of conservation, operational savings, and improved customer satisfaction.
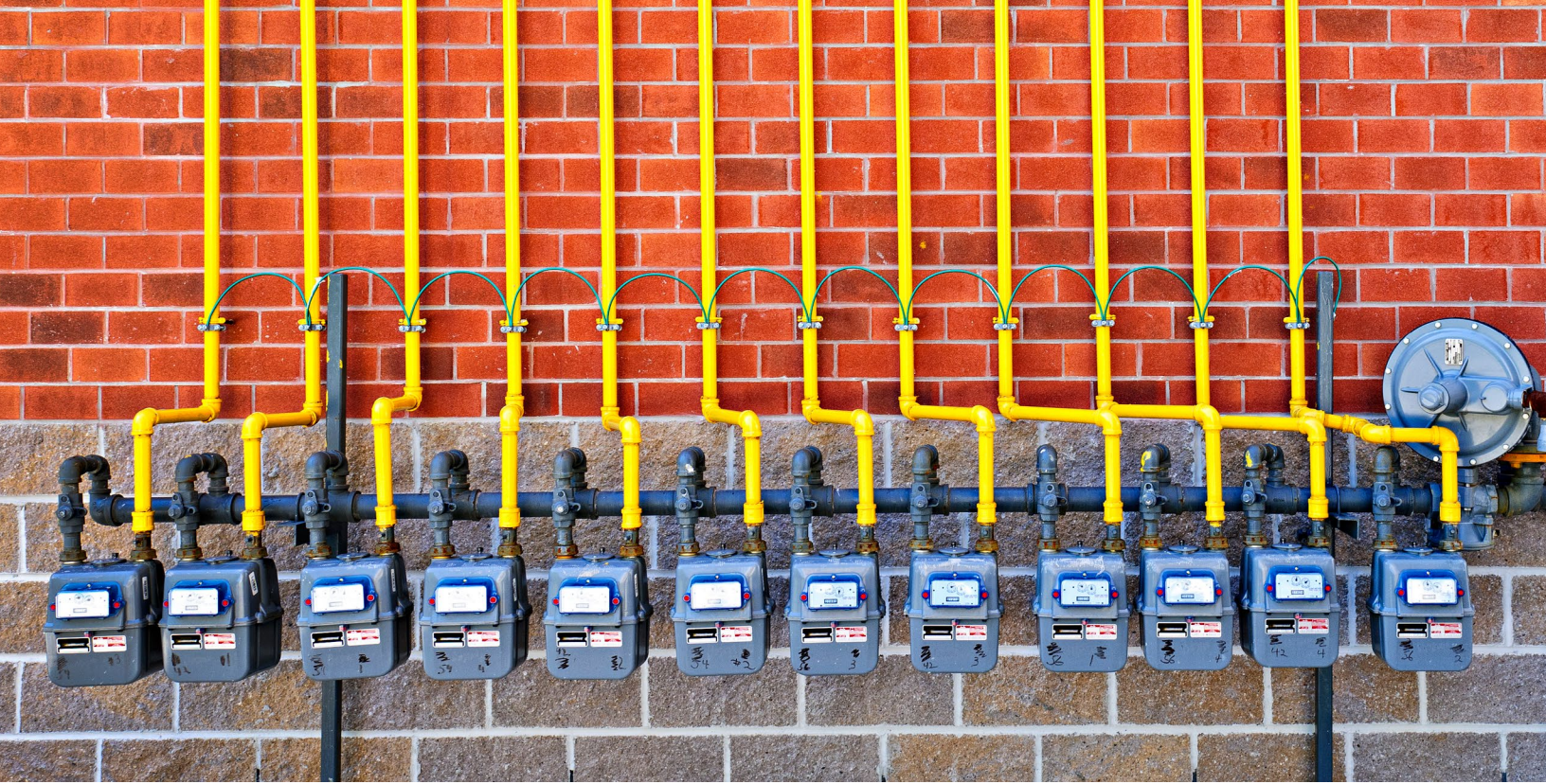
Future of Water and Gas Utility

Clean and affordable water or gas.

Water or gas conservation, reduction of non-revenue.

Benefit of new business models: Software-as-a-Service (SaaS), Metering as a service, etc.

Alarms to enable efficient leak detection, meet increasing compliance, regulation, and prevent revenue loss.

Real-time usage data to the backend system enabled by LPWAN, smart water meters and metering platforms.

New technology (ultrasonic) for static meter unaffected by wear and tear to maintain its accuracy throughout its entire lifetime.

LPWAN Networks are the Cornerstone for Connectivity of Smart Meters

The most important consideration for deploying smart meters is the connectivity technology used to communicate with the cloud. To enable digitization benefits with data collection, devices must be able to transmit signals several times a day over long distances, typically over several kilometers. This automatically rules out short-range radio technologies such as Wi-Fi or Bluetooth. In addition, gas and water utilities demand smart meter batteries that last 10 to 20 years depending on local regulation or market rules. It is estimated that on average the communication modem inside the smart meter consumes almost 30-40% of the entire meter power budget, and therefore careful consideration needs to be given to the network used. By default, this rules out high-power, long-range radios such as 4G/LTE, and 5G. Utilities are increasingly looking to low-power wide-area networks (LPWAN) for solutions. The two most successful LPWAN networks deployed for gas and water metering, according to Omdia research are LoRaWAN® and NB-IoT/ CAT-M1. The key reasons for their success include:

1. **OPEN LPWAN TECHNOLOGY ENABLING A BROADER AVAILABILITY OF PUBLIC NETWORKS AND THE FLEXIBILITY TO BUILD A PRIVATE NETWORK SCALING COVERAGE ON DEMAND**

   Public networks are critical for the decision of a massive and national deployment of smart meters. Operator value is to ensure a good level of SLA from end-to-end, enabling installed meters to connect quickly to the existing network, be provisioned, and start transmitting data. Open LPWAN technology based on a standard is preferred over proprietary technology, which locks utilities into a limited number of vendors. Both NB-IoT & LoRaWAN are formally standardized within well-established and recognized standards bodies. LoRaWAN standard is recognized by ITU-T and supported by the LoRa Alliance®, while NB-IoT is a 3GPP standard. This openness enables utilities to choose various network models, ensuring flexibility in investments and the ability to shift operators.

2. BROAD AVAILABILITY OF GAS AND WATER METERS WITH LPWAN RADIOS

Equally important is the availability of OEM devices with LPWAN radios. This ensures that utilities can select from various suppliers with different features and multi-source meters for supply chain security. Many utilities express the need to have at least two or three viable OEM suppliers to choose from.

3. GUARANTEED INTEROPERABILITY AND COMPLIANCE TO KEY METERING STANDARD

Ensuring that different devices are interoperable with different networks is yet another critical factor in choosing the right connectivity. Without interoperability, utilities face challenges in varying geographic locations and must maintain flexibility in deploying different meter brands. Interoperability gives utilities peace of mind, knowing that regardless of the vendor chosen, it can be connected to the network. For LoRaWAN®, the support of key metering standards such as Device Language Message Specification (DLMS), with the communication profile for LPWAN defined in the IEC 62056-8-12, and M-Bus, with the Adaptation layer defined by Order Management System (OMS) association and LoRa Alliance® in the EN13757-8, are mandatory requirements for many utilities. NB-IoT/CAT-1M, and DLMS can be supported natively via IPv6 profile.

4. HEALTHY AND VIBRANT ECOSYSTEM OF NON-METER DEVICES

An additional consideration for utilities in the choice of connectivity is the availability of connecting ancillary non-meter devices. For example, utilities will need more and more detection capabilities for better safety and resource conservation. Adoption of water and gas leak detectors associated with smart valves to shut-off water and gas helps reduce risk and cost. For better water management, utilities want to connect other sensors like fill level combined with water pressure sensors to optimize use of energy in pumping clean water in reservoirs. Many different probe sensors exist and can be dispatched to control the water quality all along the distribution network.

These are just a few Internet of Things (IoT) use cases which can help increase operational efficiencies, requiring a strong vibrant ecosystem of device makers that build devices with the same network technology used for meters to ensure interoperability and simplicity of management for the utility.

NB-IoT

- NB-IoT is a Global System for Mobile Communications (GSMA) standard and enjoys broad adoption and deployment by carriers globally.

- It is a great technology for smart metering applications which require very low transmission volumes and are disconnected from power sources, especially in water and gas metering applications.

- It is also a "resilient" connectivity technology, i.e. has a higher tolerance for connectivity loss and re-attachment especially when the meters are in hard-to-reach places.

- For most applications, with batteries and electronics deployed into the application, they last over 10 years, amortizing metering asset investments over a long period.

- When reading meters, transmitting that information, and doing some edge processing, NB-IoT optimizes power usage from a battery, especially in water and gas meters, while leveraging resilient connectivity.

CAT-M1

- CAT-M1 is also a GSMA standard with broad coverage globally.

- When a smart metering application requires more data transmitted at greater frequency intervals, CAT-M1 may be a suitable solution.

- When a meter needs to report continuous level and flow measurements with more edge processing and data transmission, CAT-M1 may offer additional advantages, such as near-real-time leak detection or blocked flow condition monitoring.

Power management is crucial for both NB-IoT and CAT-M1. If a meter relies on batteries, they may lose capacity in 7-10 years. Smart meters can be architected to leverage energy-harvesting technologies to mitigate power management concerns when the smart meter needs to be deployed and serve a useful life of 15-20 years.

LoRaWAN®

A MAC layer LPWAN protocol specification defined and managed by the LoRa Alliance® as well as recognized as a global standard by the International Telecommunication Union (ITU) since 2022. LoRaWAN is an excellent choice for Advanced Metering Infrastructure (AMI) network systems to not only connect smart meters and streetlights for utilities, but also provide connectivity for a host of other IoT devices in smart city and asset tracking verticals around the globe. LoRaWAN uses the PHY layer based on the LoRa® modulation from Semtech. Several suppliers provide either LoRa transceiver chips or LoRaWAN modules. Since Semtech first entered the market more than a decade ago, the RF properties of the LoRa Spread Spectrum modulation quickly outpaced the legacy use of Frequency Shift Keying (FSK) modulation, commonly used in meter reading collection systems. The innate ability of a LoRa radio to demodulate a signal down to 20dB below the noise floor gives it an instant advantage over traditional and legacy FSK-based systems. This higher link-budget that a LoRa radio offers over FSK radios benefits LoRa-connected smart meters and other IoT devices. With longer range and higher sensitivity, LoRa lowers the overall cost of ownership of a fixed network solution.

LOWER POWER

By transmitting at lower power levels over the same distance as comparable FSK-connected smart meters, LoRa®-based metering solutions can last 10 to 20 years on the same battery, thereby lowering the total cost of ownership.

THE LoRa Alliance® AND ITS ECOSYSTEM

Since its creation, the LoRa Alliance has grown into an ecosystem of more than 400 members worldwide, comprising device makers, gateway OEMs, chip and module suppliers, public network operators, solutions providers and IoT platform providers. Its members include many metering OEMs with certified LoRaWAN® devices, including available ones for smart water and smart gas.

In Europe and the Middle East, 100+ OEMs have LoRaWAN solutions for water and around 20 for gas. In North America, the market preference is to use Meter Interface Units (MIUs) that connect water and gas meters with a wired cable. These MIUs are available from Diehl Metering, GWF, Mueller, Neptune, Vision Metering, Zenner USA and Axioma or Wasion for an embedded ultrasonic smart water meter or Mesura for an embedded ultrasonic smart gas meter. According to Omdia research LPWAN 2023 Market report, "LoRa and narrowband Internet of Things (NB-IoT) continue to account for the greatest volume in the low power wide area network (LPWAN) market: NB-IoT and LoRa together dominate the LPWAN market, with over 87% of the connections worldwide." The graph below shows the adoption of connectivity for smart meters in the Americas and EMEA.

Source: Omdia LPWAN Market report 2023
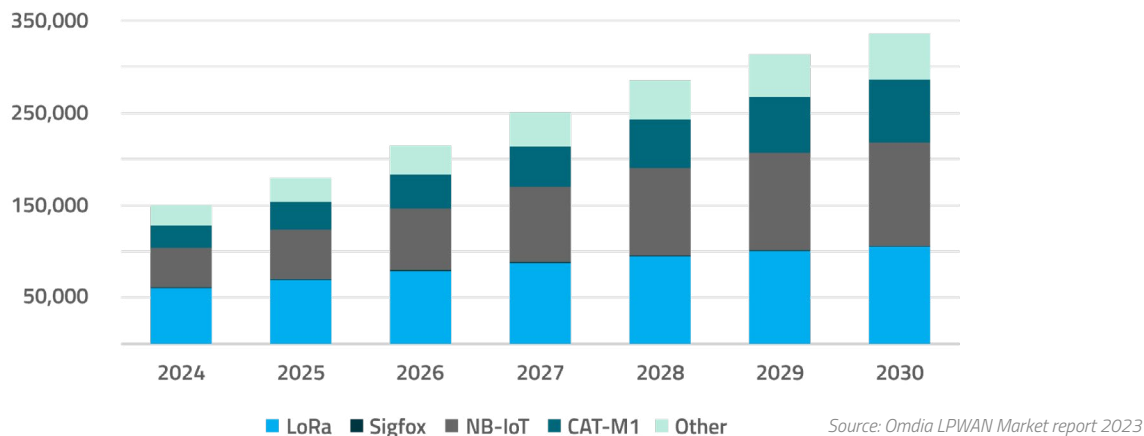
Hybrid networks: Good news, you don't have to choose between LoRaWAN and NB-IoT/CAT-M1

Due to the success of both NB-IoT/CAT-M1 and LoRaWAN, both are viable choices for deploying smart meters. In fact, many utilities, such as Italgas[2], are choosing to deploy a new generation of smart gas meters with embedded dual connectivity for NB-IoT and LoRaWAN. This makes sense for two reasons: public networks for both technologies are still rolling out in many locations but don't yet offer ubiquitous coverage; dual connectivity provides a backup link. One advantage of LoRaWAN networks is their ease of deployment almost anywhere, plus the availability of relays, which extend coverage for a minimized cost. Utilities that choose to deploy dual connectivity are building a long-term strategy to benefit from public networks where available and connect all meters via private networks if the public coverage is spotty.

[2] Italgas unveils Nimbus, the World's smartest 'H2 Ready' Smart Meter at Enlit in Paris - Italgas

Don't Forget the Cloud

In addition to the device and network, the third main building block that needs to be sourced and integrated as part of a smart meter deployment is the cloud.

This is where your data will be orchestrated, and where you will deliver, manage, monitor, and service your devices to ensure they are operating as desired as part of your Meter Device Management (MDM). A MDM service plays a crucial role in managing smart meter data. Key functions include:

1. **Centralized Data Storage and Management:**
   MDM systems collect, monitor, and manage data from smart meters and devices

2. **Validation, Estimation, and Editing (VEE):**
   MDM validates and processes meter data, ensuring accuracy and consistency

3. **Workflow Management:**
   It handles data workflows, including processing, aggregation, and distribution

4. **Billing Register, Calculation, and Export:**
   MDM supports billing processes by calculating usage and exporting data for accurate billing

These capabilities enable utilities to efficiently handle the vast amount of data generated by smart meters, contributing to a reliable meter management system.

Conclusion

Deployment of smart connected meters is clearly not a question of if, but when. With utilities struggling to effectively manage demand to meet consumption, it is becoming imperative to have frequent data on resource utilization, allowing utilities to proactively react to ensure smooth supply of gas and water resources to customers. However, capital expenditures must be weighed against operational, a major concern being the potential of having to do a truck roll in order to change a battery in a field, or change out a component in a meter, or, in the worst case, having to swap out the meter itself due to a technology sunset. This is why utilities are very crisp in outlining requirements for longevity of meters and networks to last up to 20 years. LoRaWAN® and NB-IoT are two essential networking technologies which are ideally suited to enable utilities to achieve this goal. Their inherent low-power consumption lends itself to long battery life, enabling meter vendors to incorporate suitable batteries which are small enough to fit inside the meter. Both technologies are formal industry standards and have been deployed by multiple network operators across the globe, enabling economies of scale which are ripe for deployment.

Make a new LPWAN Smart Meter

(LoRa®/NB-IoT/LTE-M)

Find LPWAN Connectivity Services

(LoRaWAN/Cellular Connectivity)

Find an Existing LPWAN Meter

Chat with us to learn more and get your questions answered on **LPWAN Smart Meters**

SEMTECH

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