

Going Strong

By Charles Sternau

Designing an AMR system to operate 25-plus years



The use of batteries that offer the potential for 25-plus-year service life can reduce the total cost of ownership, significantly increasing long-term ROI.

In the current economic environment, utility managers need to be increasingly bottom-line focused, viewing an automated meter reading (AMR)/advanced metering infrastructure (AMI) network installation as a valuable long-term investment capable of delivering a significant return on investment (ROI) based on associated labor savings, enhanced data capture and improved customer service. A potential wild card in this equation is expected battery life, which directly increases long-term maintenance costs associated with system-wide battery changeouts.

As the world faces long-term threats to water supplies and natural resources resulting from climate change and population growth, literally every drop of water counts. Use of an AMI network provides water utilities with vital real-time information to effectively monitor water consumption and detect leaks faster and more efficiently.

Upgrading to advanced AMR/AMI technology is especially important for municipalities with aging infrastructure, as old pipes can be responsible for losses of up to 35% or more of municipal water supplies, wasting precious natural resources and costing utilities and their customers millions of dollars per year.

To reduce unnecessary waste, municipalities have been installing AMI technology, which allows them to track water consumption in real time, thus enabling utilities to improve customer service while improving cash flow and the speed and accuracy of billing cycles. AMI networks enable water usage to be monitored multiple times per day, instead of relying on manual meter reading—a labor-intensive process

that provides more sporadic data and fails to take advantage of software programs that can detect silent leaks and “red flag” unusual consumption patterns.

Long Battery Life Matters

In 1984, Aclara introduced battery-powered AMR devices for the utility market, deploying millions of these devices worldwide, each powered by a single Tadiran TL-2100 AA-size lithium thionyl chloride battery. These early AMR devices remain in service, still going strong on their original battery, with laboratory tests confirming that these decades-old batteries have retained nearly 25% of their capacity.

Lithium thionyl chloride cells are preferred for water utility AMR applications because they feature the highest energy density and the highest open-circuit voltage (3.6V) of any battery type. The chemistry is also nonaqueous, enabling a wider temperature range of -55°C to 125°C. Due to a very low annual self-discharge, this chemistry has a potential service life of more than 30 years.

Currently, more than 100 municipalities have installed the Aclara STAR Network, a newer generation system, including New York City, Boston, Kansas City and Washington, D.C., as well as smaller municipalities such as Leesburg, Va., Ann Arbor, Mich., Beverly Hills, Calif., and Corpus Christi, Texas.

Aclara STAR Network wireless fixed-network AMR systems utilize meter transmitter units (MTUs) that provide multiple daily



Comprehensive Solutions

Utility customers demand robust solutions that offer the lowest total cost of ownership.

And while they often do not focus on the system's internal construction, it is important that they specify a system that offers decades of maintenance-free operation without battery replacement.

Furthermore, if the system is designed for use in underground pits, the units need to be enclosed permanently with a watertight seal to avoid moisture infiltration and corrosion problems that can occur with battery holders.

Independent testing has confirmed that lithium thionyl chloride batteries are not created equal. In fact, the performance of a lithium thionyl chloride cell can vary significantly based on numerous factors, including the self-discharge rate, which is governed by the chemical composition of the electrolyte, the manufacturing processes used, as well as mechanical and environmental considerations. Self-discharge can be affected negatively by high levels of impurities in the electrolyte. Extreme temperatures also reduce battery performance by affecting voltage and self-discharge rate. Battery performance can be hindered further by impedance, which results from the internal resistance created by the electrolyte, the anode and the cathode.

Additional features to look for include the use of fully automated manufacturing techniques to deliver unparalleled lot-to-lot consistency, even in large volume production. Product quality needs to be further verified by ISO-9001:2000-certified quality systems,

as well as by fully documented and verifiable test results for parameters such as battery pulse, low-temperature pulses, discharge and repeatability.

Standard lithium thionyl chloride cells operate at very stable voltage over their entire operating life, with no drop in voltage to indicate that the battery is losing its charge. Utility managers can seek reliable data indicating the operational status of the batteries by using Tadiran PulsesPlus cells, which have the ability to handle high-current pulses required for certain data transmissions, as well as the potential for an end-of-life indication.

AMR meters equipped with PulsesPlus batteries can be programmed to interpret and communicate an end-of-life indication through the AMI network, providing notification one to two years before the battery reaches its end of life, thus permitting longer operating time between battery replacements to reduce long-term maintenance costs and improve system reliability.

Batteries are the lifeblood of any wireless sensor. Therefore, it is incumbent upon utility managers to perform proper due diligence when specifying a wireless AMR/AMI network. Requiring the use of batteries that offer the potential for 25-plus years of service life will reduce the total cost of ownership, significantly increase long-term ROI and provide utility managers with greater reassurance regarding the long-term reliability and operational status of their AMR/AMI network. **WWD**

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readings using narrow-band radio frequency to communicate with data collection units strategically positioned on buildings or utility poles located approximately 1 to 2 miles apart.

To extend battery life even further, the MTUs do not require a receiver to listen for a "wake-up" transmission. Instead, a timer initiates data transmission at programmed intervals. Use of one-way transmission also results in a less complex, lower-cost system.

These MTUs are powered by Tadiran TL-4903 "XOL" AA-size lithium thionyl batteries that feature 33% higher capacity (2.4 AH vs. 1.8 AH) and lower self-discharge (less than 1% per year) compared to older model TL-2100 batteries, and they are rated to deliver a 20-plus-year service life.

Factoring in 20- to 25-year battery operating life makes the ROI analysis look more favorable. The typical drive-by or walk-by AMR system offers a maximum service life of five to seven years.

Assuming that the cost of each battery changeout is approximately \$40 per site, a water utility with 5,000 service connections could realize up to \$200,000 in total cost savings over 10 years by eliminating all battery changeouts during that period.