Taking the Guesswork
Out of Meter Replacement

In recent years, water and gas utilities worldwide have been making significant investments in battery-powered wireless AMR networks to achieve long-term benefits, including reduced labor costs associated with visual meter reading, faster and more reliable billing cycles and enhanced data capture and communications capabilities.

By Charles Sternau

Translating these potential benefits into bottom-line results requires thorough due diligence on the part of utility managers, who must ensure that the optimal hardware, software and power management systems have been specified across the AMR/AMI network. A key aspect of this due diligence process is to ensure that the power management system being specified provides long-term reliability with minimal maintenance expenses.

An important issue that needs to be addressed involves accurately gauging the projected service life of these systems. Utility managers want to avoid mass changeouts as batteries reach the end of their service lives; the ensuing costs associated with a rapid system-wide battery change could defeat the cost-saving value proposition behind establishing the AMR network in the first place.

New long-life lithium batteries allow for an end-of-life indication

Service Life Quandary

To illustrate the importance of advanced planning to battery changeouts, consider an article that appeared in *The Republican* newspaper entitled "Good Water Meters Are Being Replaced." The article chronicled how the Water and Sewer Commission (WSC) of Springfield, Mass., installed approximately 44,000 AMR meters just a few years ago, but is now starting to replace approximately 4,000 water meters per year at a projected total cost of $9.2 million.

Aware that it could not properly manage the physical changeout of all 44,000 meters at one time, the WSC decided to initiate a planned, proactive meter installation program using its own labor force. The move appeared wasteful to some, but not to the commissioners, who envisioned a rapid system-wide changeout of AMR meters as leading to potential "chaos."

The quandary that the Springfield WSC found itself in may have been avoided if the group had access to reliable data regarding the operational status of the batteries as they approach the end of their service lives. The answer to this challenge involves a new generation of long-life lithium batteries that offers the potential for an "end-of-life" indication. These solutions provide adequate warning when a primary lithium battery is starting to lose its charge to maximize the service life of the battery and ensure continuous service through scheduled battery replacement.

Battery Fix

Developed by Tadiran, PulsesPlus lithium thionyl chloride batteries are typically used in applications where battery replacement or recharging is impossible, difficult to access or not cost-effective to routinely service, such as water meter pits. PulsesPlus batteries employ the same lithium thionyl chloride chemistry that has been utilized for generations in AMR applications.

PulsesPlus batteries are unique in that they combine a bobbin-type Li/SOCL2 cell with a high-rate, low-impedance hybrid layer capacitor (HLC) that stores and releases high current pulses to power AMR meter transmitter units (MTUs). In order to make these devices last for decades on the original battery, they must be specially designed to conserve energy, with the MTU programmed to operate in multiple modes. These include a sleep or standby mode where power consumption is nil or at a low background current; a measurement or interrogation mode where the unit requires a few hundred milliamps of energy; and a transmission mode that requires high current pulses for a period of seconds or longer before returning to sleep or standby status.

The batteries deliver a wide operating temperature (-40°C to 85°C). With an annual self-discharge of less than 1% per year, these batteries are capable of providing 20 or more years of maintenance-free service life without replacement.

Engineers at Tadiran sought to differentiate the Pulses Plus battery cells from other lithium thionyl chloride batteries by integrating a more predictable way of measuring end of life. Typical lithium thionyl chloride cells operate at very stable voltage over their entire operating life, with no drop in voltage to indicate the battery state of charge, providing no evidence that the battery is losing its charge.

By contrast, PulsesPlus batteries offer the potential for end-of-life indication, coming in two distinct families: a 3.6-v system with a 5% end-of-life indication when the battery has used up 95% of its capacity, and a 3.9-v system with a 10% end-of-life indication when the battery has used up 90% of its capacity.

Water Utility Benefits

AMR meters equipped with PulsesPlus batteries can be programmed to interpret and communicate an end-of-life indication through the AMI network, providing utility managers with notification approximately one to two years before a battery reaches its end of life. This information permits the AMR meter to operate for longer periods between battery replacements, thus reducing long-term maintenance costs and improving system reliability.

Use of this new battery technology enables water utilities to maximize battery life for up to 20 years or more. In the past, system-wide changeouts were often scheduled after as little as 10 years (or less, in the case of Springfield) in order to avoid system downtime, which could disrupt billing procedures that hinder cash flow and result in unscheduled maintenance calls.

Had the Springfield WSC required that its AMR units contain batteries that allow for an end-of-life indication, it could have realized higher ROI while gaining greater reassurance regarding the long-term reliability of its AMR/AMI network. WWD

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