Advanced Metering Without the AMI

By Doug Staker, Itron

Including its surrounding area, the population of Tucson, Ariz., recently exceeded one million people. With its burgeoning population comes demand for affordable housing and subsequent development. Jim Taylor, engineering superintendent for Tucson Electric Power (TEP), has witnessed this growth firsthand. His involvement in ensuring new homes have access to electricity and are metered accurately gives him a front row seat to Tucson’s rapid development.

To manage strong growth for large service territories like TEPs, it can be advantageous for utilities to shift load from peak periods to off-peak. Taylor and his team have found that time-based, or time-of-use (TOU), rate structures, are ideal for this, allowing TEP to charge its customers different rates for consumption at different times of the day, based on differing underlying costs. To this end, TEP and other investor-owned utilities (IOUs) in the state have worked with the Arizona Corporation Commission (ACC) to expand their individual TOU programs.

For this strategy to succeed at TEP, the utility invests its time and resources in expanding the number of customers who use TOU rates. Ideally, such programs provide customers with tools to manage their energy consumption and costs, while increasing the overall efficiency of the electric system on both the demand and supply sides.

From AMI to TOU

At one point, TEP considered implementing an advanced metering infrastructure (AMI) system with two-way communication to every meter to support TOU rates. To implement AMI, however, the utility would have had to replace every meter in its service territory. Comparing this expense to the cost of the automated meter reading (AMR) solution TEP was already deploying, AMI was not feasible without endorsement or regulatory assistance for rate recovery. Additionally, it would have stranded all the AMR equipment already deployed.

Another alternative was to install additional AMR meters that support TOU rate structures, and read them with handheld computers. The additional meters and cost to collect the extra register reads made this option cost prohibitive as well.
These expenditures were deterrents to the strategic implementation of a widespread TOU program. This, combined with TEP’s innovative spirit, led Taylor and his team to begin work with Itron in early 2007 to implement a “smart network” that meets TEP’s core requirements for advanced metering at a substantially lower cost than a new AMI system.

Taylor’s team envisioned a solution that would collect the interval data required for TOU programs while utilizing TEP’s existing deployment of AMR meters. They sought a technology that would allow them to build in redundancy from the meter to the collection engine with exceptional system reliability, energy diversion notification and also help improve TEP’s outage response. They also sought an answer to the high costs and efficiency issues associated with off cycle reads. Itron’s ChoiceConnect fixed network in combination with Itron Enterprise Edition meter data management (IEE MDM) software, satisfied these requirements.

The Benefits

Today, TEP’s fixed network technology is using wireless communication to automate interval data collection from its meters. It relies on the IEE MDM to aggregate the intervals for TOU rates and serve the data up to the utility’s customer information system (CIS). It also provides positive outage and restoration notification to improve outage response and grid reliability.

To achieve network reliability while also optimizing data backhaul costs, TEP has pioneered an approach that takes advantage of the flexibility that the neighborhood collector provides. Within a separate box, adjacent to the collector, TEP mounts three items: an Ethernet router, a WiFi radio and a cellular modem. All three of the devices are Ethernet-enabled and are connected to the Internet protocol (IP)-addressed collector via an Ethernet port off the router.

The utility’s IT department took innovation to another level by installing several configuration settings on the router that enable either backhaul method to use the same IP address for both the WiFi and cellular connection when active. This way the fixed network headend software always knows the correct IP address for the collector, helping to maintain its security settings. It also has the logic to switch paths if the primary WiFi connection is down for some reason.

To gather the data, the AMR meters’ radio-based endpoints transmit consumption, interval and meter tamper data at regular intervals to the network of collectors. Repeaters are used to fill holes and add redundancy in endpoint-to-collector coverage, further optimizing the cost effectiveness of the network.

TEP also employed its considerable expertise in solar technology to power collectors and accompanying communications located where power is too costly or does not exist. Solar panels
satisfy 100 percent of the power requirements at these locations, including seven-day battery backup capabilities.

The Stats
To date, TEP and Itron’s collaboration on the project has resulted in 30,000 meters being read every 10 minutes at 100 percent reliability by the fixed network. The fixed network infrastructure continues to be deployed strategically across the TEP service territory.

“We have developed a modular approach to the siting of collectors and repeaters to achieve our desired redundancy. This allows us to seamlessly expand the system using our existing distribution operation and construction processes and procedures,” said Taylor.

TEP is in the final stages of its implementation of IEE MDM. Once the MDM integration to its fixed network and CIS is complete, the utility will be able to implement the aggregation of billing determinants for TOU rates based on interval data from a single AMR-enabled meter. This way, TEP will utilize a lower cost AMR meter to provide AMI functionality and automation of additional settlement processes for commercial and industrial (C&I) and transport contract customers. This results in a solution for mass market and C&I customers without any stranded investments and a surgical implementation approach that is less capital dollar intensive. IEE MDM will ultimately house interval data for all meters in its service territory, thus, interval data can be leveraged for use with other business functions such as load research, energy diversion, forecasting and planning.

Other functionality inherent to AMI systems—primarily load limiting remote connect/disconnect—did not meet the utility’s cost-benefit analysis. “The extra expense of providing this capability for every customer is not warranted since a large percentage of our customers never require a connect or disconnect of service,” said Taylor.

In terms of overall expense, TEP’s solution provides the most critical AMI functionality it was seeking—interval data, on-demand reads and outage detection—at less cost than a new AMI system.

Not only were the benefits attractive to the TEP team, they also caught the attention of its regulatory commission. The ACC has incorporated “smart networking” as an alternative to the “smart metering” initiative, and has recommended that other IOUs look into a similar strategy for their TOU programs. TEP realized that to fulfill some utility business cases, AMI is an apt choice. But, for TEP and many other utilities, a field-proven fixed network solution can meet current and future challenges at a reasonable cost today. <<

Doug Staker is vice president for ChoiceConnect fixed network product marketing at Itron. Staker’s responsibilities include setting the strategic direction for the company’s fixed network solutions. Contact him at doug.staker@itron.com.