Photo courtesy Getty Images

'BEFORE THEY EVEN GET HOME'

AMI AND ADVANCED ANALYTICS HELP CO-OPS PROACTIVELY FIND AND FIX OUTAGES

BY REED KARAIM

Outages are a fact of life at every electric cooperative, and they probably always will be. Storms come through, tree limbs break, cars knock down poles, wild animals short out substations. In a way, some of the big weather events are easiest to deal with. Crews can see them coming and prepare. It's the smaller outages that can catch a co-op by surprise.

Until this year, Platte-Clay Electric Cooperative in Kearney, Missouri, was like many cooperatives. It often didn't learn of these smaller outages until a member called in to say the power was out. This summer, the co-op began using a fault detection and localization (FD&L) system that uses data analytics and visualization to change the game when it comes to spotting outages.

"We're finding a lot of outages a lot quicker," says Jared Wolters, Platte-Clay Electric's manager of engineering.

In fact, initial results indicate the cooperative is now detecting 37 percent of outages before members call to tell them the power's out. Those numbers should improve further, Wolters says, as the algorithms that are part of the analytics improve with feedback from the system's operations.

Platte-Clay Electric already had advanced metering infrastructure (AMI) operating over its power lines through Aclara's TWACS, or two-way asynchronous communications system. The co-op serves 20,000 members stretched across seven counties in the rolling country north of Kansas City, encompassing everything from farms to bedroom communities for the city. With hilly terrain and a density of about seven members per mile, Wolters says, power line communications made the most sense.

Before adopting its new FD&L system, the cooperative pinged meters twice a day to see if they were operating, but that still left hours when outages could go undetected until a member called in. The automated FD&L solution, also from Aclara (NRECA Associate Member; **aclara.com**), pings meters much more frequently based on algorithms that determine when and how often meters should be checked.

The system can locate outages in just over three minutes, and, during restoration, it can ping meters every five seconds to see when they're coming back on-line.

When it detects a meter that's not responding or giving an anomalous reading, the system also begins working to determine the size of the problem.

"Basically, it targets the pocket and grows outward until it finds the extent of the outage, reporting back each meter that's off," Wolters says. "Then that comes back into your outage management system and figures out what devices tripped."

VISUALIZATION TOOLS

Platte-Clay Electric uses Milsoft (NRECA Associate Member; **milsoft.com**) for outage management, and seamless integration was a priority.

"The most important advantage of this FD&L is being

> "Because meter status can be checked without a truck roll, one utility avoided more than 300 'okay-on-arrival' truck rolls during one storm alone."

able to feed information into our outage management system," Wolters says. "Aclara and Milsoft worked together and figured it out, and, basically, the information comes across just the same way data does from our IVR [interactive voice response] system or any other data source."

The co-op's FD&L system provides data visualization tools that allow crews to quickly get an accurate picture of the extent of an outage and which lines, circuits, or meters are affected. The map updates in real time as power is restored. The data also can be fed into a compatible outage management system's visualization and mapping tools, which is how Platte-Clay Electric uses it.

Wolters sees the system playing an important role in both big and small outages.

"You got your clear-blue-sky days where you don't even know the meter is off until the member comes home from work," he says. "Hopefully, now you can get there and fix the problem before they even get home.

"The other extreme is a major storm, and you're doing a lot of [restoration work] and being able to monitor what's going on and determine which meters have been restored and which ones haven't," he continues. "We hope we never have to put it through the test, but that is one of the key benefits we're expecting to get out of the system."

A 2016 study by the U.S. Department of Energy, *Advanced Metering Infrastructure and Customer Systems*, backs up those expectations. The study found that systems like Platte-Clay Electric's that regularly query meters allow utilities to identify outages more quickly and dispatch repair crews more accurately, reducing the time the power is out and the cost of making repairs.

"Because meter status can be checked without a truck roll, one utility avoided more than 300 'okay-on-arrival' truck rolls during one storm alone," the study concluded. Even when the power is out, Wolters adds, the capability the new Platte-Clay Electric system provides to automatically conduct power restoration checking can "free crews up from having to do some of the manual checks," meaning they can get on to the next job more quickly.

MINING THE DATA

Further performance improvements spring from the capability of such systems to identify "nested" outages—a problem hidden by a larger outage which most typically follows a storm that causes widespread damage, the study said. Absent the capabilities of an FD&L system using AMI data, repair crews can believe they have restored power to an area but be unaware of the nested outage until members call to complain their power still hasn't been restored.

The DOE study further noted that visualization capabilities using AMI data allow utilities to get a clearer idea of what might be causing a problem, especially when combined with geographic information system (GIS) mapping overlays that can connect outage patterns to vegetation or other physical features of the service territory.

Data visualization can also enable a utility to provide near real-time information to consumer-members and public officials. Some utilities, the study said, have posted outage maps on their websites that use AMI data to keep the public updated on the process of getting power back on.

David Pinney believes even more sophisticated AMI data analytics and visualization lie ahead.

"There's a huge amount of interest at co-ops in mining that meter data to find anomalies which might point to safety or billing problems," says Pinney, analytics research program manager at NRECA. "There's also growing interest in load disaggregation. Once you know how much of a load is air conditioning, for example, you can use that information to improve your engineering analysis models, and if it looks too small or too large, it might make sense to let the consumer know their system needs a tuneup."

A 2017 report from NRECA's Business & Technology Strategies group, *Application of AMI Data to Anomaly Detection and Dynamic Power Flow Analysis*, further noted: "Cooperatives have the ability to get more value out of their AMI data by analyzing it for anomalies including faults, damaged meters, or energy theft. Finding these problems quickly can help cooperatives save money and maintain high member satisfaction."

The FD&L software solution that Platte-Clay Electric uses operates in the cloud. Pinney says co-ops can handle the computational workload that comes with analyzing the data on site on their own IT systems, but a lot of system vendors are going to hosted services.

Some benefits to hosted services revolve around the economic efficiency that comes with vendors supporting computing hardware in one location rather than at each client's headquarters, Pinney says. Another potential advantage comes with scalability: The resources provided through centralized cloud computing make it easy to handle changing demands for data and analytics.

Wolters also believes the growing sophistication of AMI data analytics and visualization is likely to allow co-ops to improve outage management further in the future. But even as the technology improves, he notes, the goal will remain the same: "catching problems before the member even has to make a call, raising the bar as far as member expectations go, always doing more to improve their service." RE