Using AMI for Outage Notification at PECO*

By Glenn Pritchard, PECO Energy, and Jeff Evans, Enspiria Solutions Inc.

Outage management process improvement is one of the most sought-after benefits of implementing an advanced metering infrastructure (AMI) solution, according to a recent Chartwell AMI report. To realize AMI-related outage-management benefits, a utility must integrate the AMI system with its outage management system (OMS), as PECO recently accomplished.

BENEFITS OF AMI OUTAGE MANAGEMENT INFORMATION

Both operational (quantifiable) and strategic (nonquantifiable) benefits can be realized from AMI outage management information. Operational benefits include avoided truck-rolls, improved restoration efficiency and avoided overloads. AMI can also lead to strategic benefits such as increased customer satisfaction and improved reliability. PECO realized several benefits when it implemented an AMR solution and provided a data flow to its OMS.

In 1999, PECO began its AMR journey by signing a 15-year contract with Cellnet (now part of Landis+Gyr) to provide a turnkey-managed service for meter reading. The contract called for installation of a hierarchical radio frequency (RF) fixed AMR network throughout PECO's service territory and automation of approximately 1.7 million electric meters. Each meter is minimally responsible for delivering daily meter readings, tamper and outage messages—including last-gasp outage notifications—and power-up power-restoration messages. Additional functionality includes the ability to perform on-demand meter-reading requests, limited interval data capabilities and other advanced metering data.

This contract was primarily structured around providing data to support the meter-to-cash billing process. Additional potential benefits such as outage management, however, were accounted for in the original contract. Many of the benefits could not be realized until the deployment was nearly complete. This is particularly salient for a successful outage-management implementation where large contiguous blocks of automated meters are required to ensure adequate coverage.

FUNCTIONALITY REALIZED

As the deployment effort completed, PECO began addressing three primary opportunities for additional benefits. They included on-demand meter readings for power status, automatic outage notification and power-restoration confirmation. The project was initiated with the goals of reducing system Customer Average Interruption Duration Index (CAIDI) by two to four minutes and saving $400,000 in operations expenses.

PECO used a phased functional approach to integrate its newly deployed AMI solution and its Intergraph OMS. The first step involved developing and implementing a process to ping the network and meters to determine an individual customer's power status. The next step was delivering an automatic outage-notification system to enhance the outage-identification process. And, finally, PECO integrated the power restoration functionality into the existing outage-management process.

Each step took between six months and a year to successfully develop, implement and verify the expected functionality. The key obstacle in the effort was change management—it is imperative to involve all potentially affected organizations during an integration such as this.

*Published in the April 2009 issue of Utility Automation & Engineering T&D Magazine

Pinging application development and integration started with a field trial of a single meter ping tool that was designed to identify a customer's current power state. PECO initially used this tool in conjunction with a customer contact call. In this case, the dispatch office was responsible for pinging a customer's meter each time a power-status customer call was placed. Those involved initially disliked this concept and thought it to be extra work; however, dispatchers quickly gained confidence in the meter ping results and the tool became widely accepted.

With the individual meter ping tool's success, the project team developed several additional tools to improve the application's effectiveness and deliver more information to the user. The next tool the team developed was a batch ping tool that created the means to ping multiple customers with a single request. The team found this tool to be helpful when assessing larger outages.

They then further optimized the batch ping tool to enable ping by transformer, fuse or across an entire circuit. These tools are particularly helpful for determining the true extent of an outage and to effectively dispatch the properly skilled crew the first time.

As with the individual customer pinging tool, the dispatch office and emergency response organizations quickly accepted each of the pinging applications. Their success led to the tools' automation. Now, each single customer outage event that has not been dispatched or assigned to a larger event within the first 20 minutes after being received is automatically pinged by the OMS. Depending on the ping's result, the event is either automatically cancelled and the interactive voice-recognition (IVR) system sends an automated customer notification, or the event is escalated into a larger outage such as a primary transformer event. This automatic process has been active continuously since it was installed in 2005.

Because PECO had already successfully implemented an OMS solution and an IVR system, the AMI/OMS project team concluded that it would be most effective to leverage the existing outage- management processes. In this case, the AMI last-gasp outage notifications were integrated into the outage process in the same fashion as a customer call.

While the last-gasp messages are tightly integrated into the automatic outage process, the power-up messages are used in a stand-alone process. Each power-up message is received and stored in a dedicated database. The database is queried nightly to compare the field reported restoration times with the times recorded by the AMI solution. A daily report is produced and the dispatch office overnight supervisor is responsible for analyzing the report. If he or she identifies significant discrepancies, corrections are made to the outage record to reflect the accurate times.

The true power of the automatic outage-notification processes became evident as PECO began to recognize outages before receiving customer calls. In many cases, the AMI system identifies the outage, a crew is dispatched and the power is restored without any customer calls. This scenario plays out often, especially in residential neighborhoods during midday and late at night when customers are not at home or are asleep.

The AMI/OMS integration has also been beneficial during storms and emergency events. For example, during the July 2006 "Summer Slam" event, nearly 400,000 customers lost power when a severe band of thunderstorms swept across the PECO service territory. The AMI/OMS automated processes cancelled more than 750 events where there was power available at the customers' meter. Likewise, automated processes escalated nearly 1,200 events from single customer events to primary events. The overall benefits were reinforced by direct feedback from the field forces, who

reported that the dispatch office was more effective than usual because few, if any, jobs were "OK on arrival."

In each case, each phase of integration produced compelling results. PECO exceeded its original project goals of two to four minutes of CAIDI savings and $400,000 of operational savings in the implementation's first year.

The pinging processes single handedly improved PECO's outage-management processes. They are responsible for validating and confirming tens of thousands of outages annually. On average, the automatic processes cancelled an average of 7,500 events annually where there was power at the meter. They also annually escalated an average of 3,000 outages into primary events to ensure the properly skilled and equipped crew could resolve the event on the first visit.

The outage-notification and the restoration-confirmation processes accounted for three to five minutes of annual system CAIDI reduction from quicker recognition of outage events and more accurate reporting of the outages' actual durations.

POTENTIAL FOR SAIFI IMPROVEMENTS

Opportunities to leverage and gain benefit from the AMI-OMS integrations continue to emerge. What PECO originally thought to be noise and extraneous outage messages communicated by the AMI system are now suspected to be precursor messages that are advance notice of failures. PECO is actively studying these messages to develop an algorithm or process that will be able to predict failures before they occur. This will potentially translate into a System Average Interruption Duration Index (SAIFI) benefit by reducing the overall number of outages.

In addition to the precursor analysis, PECO is evaluating means to enhance proposed reliability analysis processes through the use of AMI outage data. By analyzing the raw, unfiltered last-gasp and power-up messages, it is believed that a better view of a circuit's performance may be created and improved reliability may be realized.

While PECO has seen real quantifiable and strategic outage- management benefits from its AMI implementation, other utilities should exercise caution when considering these benefits.

Many current-generation AMI technologies have not been deployed and field-tested in volume. Most AMI technology vendors are proposing their latest technologies for which outage notification and restoration functionality have not been proven in volume. Utilities should ensure that adequate field acceptance testing and contractual provisions exist to ensure realization of AMI outage-management functionality and benefits.

Ultimately, a utility should expect reliability matrices such as CAIDI and SAIDI to improve. But in the short term, reliability indices may show performance degradation. Proactive outage notifications will result in more timely awareness of outages and the possibility that the duration (SAIDI/CAIDI) clock may start sooner than before. Outage management functionality, however, will help utilities operate more efficiently and result in more accurate restoration time reporting.

ABOUT THE AUTHORS

Jeff Evans is an executive consultant with Enspiria Solutions. Glenn Pritchard is a consulting engineer with PECO.