Day in the life of a linemen in a smart grid world

By Louis Szablya

As we move closer to a smarter grid, it becomes apparent that the innovative systems and technologies will touch nearly every utility department and employee. This is the first of a four-part series that explores some of the benefits and impacts the smart grid may have on the people who work for utilities.

From replacing a meter to extending and upgrading feeders and laterals, the utility worker's primary concern is safely getting the job done right, the first time. The future smart grid will enhance the safety, efficiency, and flexibility of a worker's daily job by deploying new technologies and systems integrated into the everyday lives of each of us. Let's follow a one-person line crew, and see how his day would be improved.

8 a.m. Instead of driving to the central loading dock, the lineman walks to his office—the line truck. Overnight, the various systems (asset, order, materials, and workforce management) evaluated the field personnel available, materials, equipment, and locations of the work orders and assigns jobs as appropriate, making sure that each crew has all the tools and necessary materials. In the truck, he logs in to his primary portal, and his customized homepage shows a summary of all the information he needs, including the optimal route for his jobs for that day. The highly secure login also triggers the automatic vehicle location system and associates him with the vehicle so the dispatcher can monitor his location for improved safety.

8:30 a.m. The utility is transferring load from one substation to another, and although much of the switching is done automatically, there is one mid-line manual switch that must be closed before the job can be completed. Looking at the map of switches on his handheld wireless computer, the lineman can connect directly with the distribution management system (DMS) and watch the transfer process in real time. He sees switches change status as the automatic switching procedure executes. When the automated procedure reaches the step where the manual switch must be closed, it stops. In a quick text message exchange the dispatcher confirms that the lineman should close the switch, and he does after completing the safety procedures. He updates the status of the switch on his handheld and sees visual confirmation on the screen. The automated transfer then continues and completes the switching orders. The lineman receives confirmation of completion along with voltage readings that verify that everything is operating correctly. The next job in the optimized route plan appears on his screen.

3:25 p.m. An afternoon thunder storm causes a power outage in a neighborhood two miles away from the lineman's location. By evaluating the various line crews' locations and inventories, the system pings the lineman's handheld computer to notify him that he is the closest crew with the appropriate materials. The lineman accepts the change in plan and heads to the point of need. The system reroutes his afternoon jobs and switches time-critical tasks to other crews to allow him to focus on the outage. Using the computer, he notifies the utility engineer or dispatcher in real time when power is restored, and the utility communicates the restoration to its customers through automated voice response calls, in-home displays, text messages, emails, and proactive social media messages. The lineman's display shows his next work order, and he is on his way again.

By interfacing directly with the smart grid system throughout the day, the lineman's daily tasks become safer and more efficient and provide near real-time communication and feedback on the

electric delivery system to the utility and its customers.

Day in the life of a distribution engineer in a smart grid world

By Louis Szablya

As we move closer to a smarter grid, it becomes apparent that the innovative systems and technologies will touch nearly every position in a utility. In the first of this four-part "Day in the Life" series we explored how a **lineman's job** might benefit from the new capabilities of the smart grid. Today we look at how a distribution engineer's job might be affected.

The distribution engineer's responsibility is to make sure that the distribution system operates safely under a wide variety of conditions and configurations

8:00 a.m. As our engineer arrives at work, she learns via a text message generated from the utility's outage management system that several homes are affected by an unplanned power outage in the problem division. The engineer checks her mobile device to verify that the closest line crew with the right skills and tools has already been dispatched to fix the problem.

8:45 a.m. The line crews run into a problem while trying to restore power as they find a non-standard construction technique at the point of failure. Instead of calling the engineer into the field, they use the video camera on a cell phone to show the engineer the situation. The engineer uses asset management and geographic information system (GIS) information to identify the exact equipment that she is looking at, and works with the lineman to solve the problem.

10:15 a.m. As the line crew works on repairs, our engineer receives real-time field reports on her mobile device. The outage management system sends text messages to the cell phones of customers that have signed up for them, letting them know when service will be restored at their homes.

10:30 a.m. After managing the power restoration, the engineer prepares for a budget and planning meeting she has with management about the problem district. Armed with the detailed data (down to the quarter-hour) from the advanced metering infrastructure (AMI), she evaluates the exact voltage profile and loading of the district's feeders on a per phase basis.

The engineer pulls the actual meter load and voltage data into a distribution analysis package to establish the base case, which is now populated with actual data, not a theoretical starting point. With the updated planning tools and the improved data analytics developed to process the new AMI information, she is able to rapidly determine where there is a need to upgrade conductors or install capacitors, and where it is most urgent. The manager provides an updated population projection for the district, which the engineer uses to estimate load growth, schedule the upgrades, and submit revisions to the capital plan.

3:00 p.m. The engineer receives an urgent automated message that a distribution transformer is overloaded to 300%. She views a geographic representation to determine the location, size, and age of the transformer and reviews the daily distribution transformer reports to identify recent trends related to this transformer's loading characteristics. With these details, the engineer determines that the transformer needs to be replaced, and with the accurate load information from the AMI, she sizes the new transformer very accurately. She creates a work order that is automatically processed through the work management system, which will assign the job to a line crew, who will then replace the transformer during regular business hours.

In the days before these new smart grid resources, the utility would have waited until the

transformer failed and then replaced it—often during evening hours at overtime labor rates—incurring an extended outage for the customers served by the transformer.

By interfacing directly with the smart grid system throughout her day, the engineer makes effective use of the detailed and near real-time data to help daily tasks and the grid itself become more efficient.

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Day in the life of a utility operations manager in a smart grid world

By Louis Szablya

As we move closer to a smarter grid, it becomes apparent that the innovative systems and technologies will touch nearly every person in the utility. This is the last article in this four-part "Day in the Life" series. So far we have explored how the daily activities of a **lineman**, an **engineer**, and a **customer service representative** might benefit from the new capabilities of the smart grid. Today we look at an operations manager.

Operations managers have a difficult job because they are responsible for making sure everything works correctly all the time while working indirectly through others.

7:30 a.m. While riding the metro to work, the manager thinks about a problem that has been bothering her—*Why were the Division 25 distribution statistics the worst of any division in the system?* While still within the mandated limits, outage minutes for some feeders in Division 25 had been slowly creeping up to unacceptable levels over the last two years.

8:02 a.m. In the office, the manager receives an alert on her screen - there is an outage in Division 25 affecting 1,500 customers. The manager switches over to the distribution management system portal to watch how the system is responding in close-to real-time. In two minutes, power has been restored to all but 200 customers.

The manager reviews a root cause analysis report showing the outage statistics for the feeder that just tripped are on the high side but not extreme. It also indicated that there is a higher than normal failure rate of connectors on that feeder.

8:15 a.m. Since all the utility's data are in a coordinated repository, the manager can see the age of field assets and notices that the feeders with the higher outage rates were all constructed in the same year. However, not all feeders constructed that year were having problems even though they were all the same voltage in similar neighborhoods.

10:15 a.m. The manager meets with the distribution engineer and tells him about the correlation between the higher outage rates on some feeders and the age of those feeders. The engineer finds this interesting and mentions that, earlier in the day, a line crew had shown him an odd construction method from the field on one of those feeders.

10:30 a.m. The manager receives a call from the local TV station asking about the recent outage. The manager has all the needed information at hand and is able to give the reporter a full briefing, including how many customers were affected, for how long, and the time it took to repair. The manager also knows exactly what failed since the field report was filed just minutes before, along with notes from engineering on the unusual construction technique.

1:00 p.m. The manager and engineer meet again to talk about the Division 25 problems. The

engineer reports that the odd construction technique had something to do with the outage. At the time the feeders were built, there was a shortage of a particular standard connector that the line crews preferred to use. Because Division 25 was growing so fast, the inventory of the standard connectors was depleted and an alternate connector was used. Some of the crews were not familiar with the alternative connector's differences and made what they felt were necessary field modifications. This was not documented in the asset management system because the construction had occurred prior to its implementation, and therefore the correlation was difficult to see. However, the purchasing history was available for that time period, and the engineer noticed the increased use of the non-standard connectors in Division 25. The manager asked the engineer to come up with a plan to review all the suspect feeders in Division 25 and determine if the connectors should be replaced.

By having access to the utility's data through a unified interface, the manager is able to perform ad-hoc queries that can provide the incremental information to direct business decisions. This same capability can help a utility identify regions, divisions, or feeders that are operating most efficiently by tying operating performance to revenues and expenses. This new level of business intelligence will allow utility managers and executives to better deploy their limited capital to optimize electric service.

Day in the Life of a Customer Service Rep in a Smart Grid World

By Louis Szablya

As we move closer to a smarter grid, it becomes apparent that its innovative systems and technologies will touch nearly every position in a utility. In the first two articles of this four-part "Day in the Life" series we explored how the jobs of a **lineman** and an **engineer** might benefit from the new capabilities of the smart grid. Today we look at a how a customer service representative's (CSR's) job might be affected.

CSRs are on the front line with the utility customers. Many existing systems provide CSRs with as much data as possible, but a monthly report cannot provide much information.

8:00 a.m. A flood of calls just came in and many others are registering on the interactive voice response system. An alert appears on the CSR's screen stating that there has been a mid-line recloser operation and that 1,500 customers are impacted. "Yes. We are aware of your outage and are working to restore it," the CSR tells the customer. "The system will automatically restore power to all the customers that it possibly can."

8:02 a.m. While the customer is still on the phone, another message scrolls across the screen stating that the automatic reconfiguration is complete and power has been restored to all but 200 customers. The customer on the phone has their power restored, and the CSR sees the customer's status change on the screen.

"Wow, that was quick," the customer says. The CSR explains that the new automatic fault detection, isolation, and restoration system was able to reconfigure the system and restore the power, minimizing the outage duration in most of the affected area.

8:15 a.m. "I am sorry that your power is out," says the CSR to another customer a few calls later. "We have a line crew at the scene investigating what happened and how long

it will take to repair. If you'd like, I can add your cell phone to our text message or voice outage update system, so you will receive informational messages regarding the status of your outage. All I need is your cell phone number and permission to send you these updates. You can turn off updates at anytime online or through your phone." The customer accepts the offer and thanks the CSR for her help.

10:15 a.m. An alert notifies the CSR that all customers now have had their power restored.

1:00 p.m. The CSR receives a call from an irate customer who thinks his new smart meter has caused his bill to double. "Let me take a look at your account," says the CSR. "It looks like you have quite a bit of energy consumption right now. Are you at home?" The customer is at home and assures the CSR that nothing is turned on. The CSR asks if they are on a well to which the customer answers "why yes." The CSR suggests the customer check their well pump. Coached by the CSR the customer identifies that the pump is running but the water pressure stays below the normal range. The CSR urges the customer to have someone check for a leak. The customer comments with appreciation that perhaps that is why it is damp next to the driveway in this dry weather.

3:05 p.m. The CSR receives a message identifying a group of customers who will have a planned power outage. One of the accounts is tagged as having electric powered medical equipment and has not renewed a subscription for text or voice alerts. The CSR calls the customer and determines that the customer is at home and is able to operate on her backup supply for up to 1½ hours. The CSR notifies the line crew that they need to ensure that the outage does not last more than 1 hour, and if it approaches 1½ hours, they must check in with the customer and offer her a portable generator. The crew loads an extra generator on the truck and heads to the site.

This new smart grid world will provide CSRs with never-before-seen information. The customers' records will no longer be limited to 12 meter reads per year and about 12 payments per year. The volume, accuracy and timeliness of information will allow CSRs to help customers solve problems.