accident that takes out a distribution line could also take out the meter reading system. “We are training our people such that, when they are responding to this type of accident, they don’t forget about potential damage to the meter reading system,” said Craig.

REPLACEMENT STRATEGIES

While smart meters may not need a lot of maintenance and repair, other than dealing with a small percentage of meters that fail right away and then subsequently monitoring battery life, there is another issue to consider—replacement cycles. How often should smart meters be replaced systemwide?

When computers gained popularity in the 1980s, they had the capability of lasting several years, and this continues to be the case today. However, it wasn’t long before users began replacing their computers every couple of years, as new advancements in technology made newer models significantly more appealing.

Will the same thing happen with smart meters? It is unlikely. While most smart meters have a possible life of 20 years, and change-out may become appealing for technology reasons after five to seven years, most experts believe that utilities will more than likely replace meters every 10 to 15 years, taking advantage of new technologies at that time.

With the technology that exists today, Mario Natividad, president of Applied Metering Technologies, doesn’t think there is a lot that can be added in the near future that would cause utilities to want to upgrade to newer technologies. “Most of the important features are already in place, such as remote disconnect and outage detection,” he said. “In addition, if there are some new technologies, many of these may be able to be added by software upgrades to the whole system rather than replacing the meters themselves.”

After 15 years, though, Natividad believes that utilities will want to look at replacing their meters, at that point taking advantage of new features that might be available at the time.

PG&E has thought about long-term replacement strategies, especially on the gas side. “Gas meters have 20-year batteries,” said Craig. “We haven’t been through 20 years to see if they will last this long. However, our current plan is to do a proactive 15-year replacement. At that time, if a better technology exists, we may upgrade to the new technology, rather than just replacing the batteries on the existing modules.”

SDG&E has also thought about this. “We have selected a very flexible technology solution,” said Reguly. “However, we are constantly monitoring the marketplace and looking at major technology advancements. If the benefits were to outweigh the costs, we would change course in order to deliver the best service to our customers and operations.”

Rather than the way people replace computers with the newest models every year or two, SCE’s De Martini believes meter replacement cycles will be more like those with major home appliances. “Homeowners usually only replace these every seven to 10 years, so manufacturers have aligned their product development cycles to these cycle times,” he concluded.

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VISION STRATEGY REALITY

Smarter ways to manage risk

+ INTELLIGENT VIEWPOINTS

By Mary Ann Stewart

RISK MANAGEMENT

In this article, Mary Ann Stewart walks through efforts that may not scream “smart grid,” but do build a smarter grid and more intelligent utility. Louis Rana of Con Edison focuses on the vision and strategy and Don Cortez focuses on the reality of risk management.

WE ARE INTRODUCING A REGULAR COLUMN FOCUSED ON THE INSIGHTS of utility leaders regarding the development of technology to serve the emerging intelligent utility. In this issue, Louis Rana discusses the adoption of incremental technology innovations that are helping Con Edison minimize risk to the grid as well as to its customers. Don Cortez reflects on CenterPoint Energy’s recent experience restoring power after Hurricane Ike and how this has increased his advocacy for the development of smart grid capabilities.

PLANNING FOR THE UNTHINKABLE

Louis Rana is president and chief operating officer of Con Edison, which provides electric, gas and steam service to New York City and most of Westchester County. Given the history and current stresses involved in providing power to this service area,

Mobile stray voltage detector (SVD)

Con Edison has devoted a great deal of thought to risks to operations.

"We look at the operation regarding major risks and ask how severe are these risks? We assess areas of risk through brainstorming. What could happen? What has happened here and in other locations? It's important to list all of the risks and their potential impact if the event were to occur, plus how to minimize that impact," said Rana. "Our greatest concern is with risks with high impact even if there is low probability of occurrence. We have to be ready to negate, or at least minimize, these risks to better serve our customers."

One example is hurricane risk. A significant hurricane such as a Category 3 or 4 hitting New York City is a major risk. "The probability of this type of storm hitting New York City at a high tide is low. Such an event has not happened in recent history. However, we do have models from the Army Corps of Engineers projecting storm surge levels that could occur," said Rana. "In addition to our normal storm recovery plans, we've begun a multi-year program to prepare for the type of flooding that could occur. When we are replacing equipment in potential flood zone areas, we make sure waterproof equipment is used. These flood zones are also a factor when we build new substations. We install energized equipment above flood levels and we are creating a more resilient system over time."

Are there other flooding issues? "In 1983, we had one substation that had been built below grade. There was a major water main break nearby, which flooded the substation and destroyed it. The result was an electrical outage in the area. Since that time, we have not built any substations underground. Water main breaks still occur, but all of our substations are now above ground," he said.

When the 1983 substation was severely damaged, it was necessary to move customer connections to other substations. "This led to planning that helped when two substations were destroyed following 9/11. It's impossible to completely prevent the loss of a substation, but there can be plans to minimize that possibility. There are also plans for how to serve customers when a substation is no longer available. The 9/11 restoration took three to eight days. Having restoration plans in advance proved very helpful in expediting the process under very trying conditions," said Rana.

Con Edison also has a model for each underground network distribution system that predicts the probability of cascading equipment failures. This model is used to help determine what component should be replaced to minimize the probability of network failure for the lowest cost. It also helps determine the optimum configuration of the network.

"The main issue to be dealt with is cascading failure," said Rana. "Say there are 12 to 25 supply feeders to a network. The network has been designed to be able to lose two feeders without a problem on the hottest day of the year. If three feeders are lost, customers may have low voltage. But with a cascading problem, loss of three feeders leads to loss of a fourth and then a fifth and so on. Therefore, it is important to minimize the chance of this occurrence."

Approximately 80 percent of Con Edison's delivery system is underground. For Manhattan, the system is all underground. The rest of the boroughs and Westchester are a mix of underground and overhead service. Con Edison has 26,000 underground network transformers with primary voltages at 13,000 or 27,000 volts. Loads on these transformers are monitored to determine if anything is overloaded, if there are any blown fuses or if any abnormalities exist. Information is transmitted from each transformer by cables over a power line carrier system into the substation, with no reliance on telephone or other outside circuits. From the substation, the information goes to the control centers, which have the technology to determine if there are real-time problems or if problems would occur at the next contingency. This capability is unique to underground network distribution systems.

Every utility must figure out where to focus its research and development (R&D) efforts. Risk analysis is a way to find the most important areas in which to focus on R&D. A good example of technology for mitigating risk is the use of stray voltage equipment. Con Edison's stray voltage system was developed as a result of a contract to develop the technology with Sarnoff Labs in New Jersey (the former RCA Labs).

"Con Edison has 70,000 miles of 120-volt underground cable. How do we know its state? Every five years manholes and service boxes are inspected. But the majority of the system is conduit, which remains uninspected. A new solution to this problem is use of stray voltage vehicles to pick out abnormalities in cable," said Rana.

The core of Con Edison's stray voltage mitigation initiative is a fleet of 15 mobile stray voltage detectors (SVD). The SVD is a truck-mounted device that employs a three-dimensional antenna to sense unshielded sources of electricity from approximately 20 feet away (*see photo, opposite*). When the SVD sounds an alarm, the operator can rewind video on the onboard laptop that is connected to side-mounted cameras. The operator can then identify potential stray voltage sources by comparing the video to the level of the alarm. The operator then performs manual testing on all objects in the vicinity of the potential stray voltage source to pinpoint the object with stray voltage.

The vehicles are dispatched throughout the company's service territory year-round and use sensors to detect stray voltage as low as one volt on manhole covers, gratings, service boxes, light poles, neon signs and other structures. The mobile SVDs enable Con Edison to perform multiple scans of geographic areas in a much shorter time frame than manual testing. The vehicles have the advantage of not needing to make direct contact with a structure to test it for stray voltage. In fact, the vehicles have found stray voltage on objects, such as scaffolding, that would not be tested in the manual testing program.

▲ Louis Rana

The manual testing program, involving crews with handheld voltage-detection equipment, surveys 730,000 structures in New York City and Westchester County once a year. The vehicles, however, are able to conduct systemwide surveys far more frequently, with 12 complete surveys of the system to be completed in 2008. In 2007, additional area scans were completed prior to special events such as the New Year's Eve celebration area, the St. Patrick's Day parade route, the Greenwich Village Halloween parade route and the Macy's Thanksgiving Day parade route. The result has been a reduction of shocks to the public and to dogs. As a result of these safety efforts, Con Edison experienced a 78 percent decline in electric shock calls from 2004 to 2007.

WHEN THE UNTHINKABLE HAPPENS

Don Cortez, CenterPoint Energy's vice president of regulated operations technology, recently reflected on lessons learned from restoring power following Hurricane Ike. He's become even more of an advocate for smart grid technology to help identify and isolate trouble areas, allowing the electric grid to automatically reroute power and self heal, resulting in faster restoration.

"Ike was not our first hurricane, but it was the first to take out 2.1 million of our 2.2 million customers in a few hours. We did the best job possible with the technology we had, with 90 to 95 percent of our customers restored within two weeks, even with a distribution system that is mostly manual intensive," Cortez said.

CenterPoint Energy has an emergency operations plan that they've used in the past. "We've had a dashboard system in place as far back as Hurricane Rita. It tracks outages and provides a communication tool for our company. The system puts up red dots when consumers' lights are out," he said. "As Ike progressed, the service area map was mostly covered in red. It made everyone stop and think about the tough restoration time that lay ahead of us."

CenterPoint Energy worked with the U.S. Department of Energy and the Texas governor's office, as well as the city of Houston, to resolve high-priority issues quickly. "We were not an island. A city this size can't lose the ability to deliver water due to lack of power," Cortez said.

A key area in which automation would have proven beneficial was managing the increase from the routine 3,000 field staff to 11,000 staff working the outage. Automation could have improved getting out-of-town workers documented into the system and tracking hotel rooms, food and logistics. Food had to be trucked in from out-of-town to feed staff working the restoration. IT and communications had to expand and contract to accommodate the restoration work.

Staging sites are locations where people show up to work. "Before Ike, we believed that four sites would be sufficient to handle the additional resources, but having only four sites out of which a thousand crews and their trucks were working were not enough. Additional smaller staging sites turned out to be better for the Hurricane Ike recovery," Cortez said.

Consumers today want to know specifically when their power will be back on, and CenterPoint Energy has a Web application that shows restorations by ZIP code. "Even with so many customers in our territory without power, we got so many hits to our Web site that IBM had to come in to provide a bigger Web server. If we didn't know it before, we know now that we're an Internet society. This is another reason to provide advanced metering to get down to the consumer level," he said.

Don Cortez

"Houston reverted back to its neighborhood roots. People went to the neighbors who had a generator to charge cell phones. There were block barbecues. Neighborhoods were really behind our staff and everyone was courteous. All of the infrastructure on which the public normally relies was not functioning for several days. The government handed out ice at stadiums. They would dump bags of ice in your trunk and you'd keep moving through the line. People really realized how much not having electricity affects their world," he said.

CenterPoint Energy has enough wire in the field to circle the equator twice. Trying to find damage from something as small as a tree branch can be time consuming, especially if processes are manual. "All I was thinking about was, how quickly can I apply resources to solve a problem?" Cortez said. "Ike gave us an additional perspective regarding the business case for smart grid that we weren't counting on."

Mary Ann Stewart is a journalist, engineer and researcher focusing on the utility industry.