CASE STUDY

Reducing Customer Outage Duration at We Energies

Recipient of the 2004 ReliabilityOne™ National Achievement Award for America's most reliable utility, We Energies serves 1.1 million electric customers in Wisconsin and Michigan's Upper Peninsula. The utility's distribution system includes almost 2,000 feeders ranging from 4 kV to 35 kV, with a service territory of over 24,000 square miles. We Energies' system-wide outage frequency performance (SAIFI) historically ranks in the first quartile, while system-wide outage duration performance (SAIDI) historically ranks in the first or second quartile. The customers at We Energies experience fewer outages than the customers at three out of four utilities nationwide.

In the spirit of constant improvement, We Energies identified customer average interruption duration (CAIDI) as a new target. Historically in the lower third or fourth quartiles, CAIDI was 125 minutes in 2003. Results of customer satisfaction surveys and focus groups indicated that reducing outage duration times was key to improving customer satisfaction and perception of the company. We Energies employees were challenged by their CEO to achieve first quartile CAIDI performance while maintaining the historically excellent SAIFI and SAIDI performance. To achieve this goal, We Energies added troubleshooters (both in numbers and shift coverage), implemented a new mobile data dispatch system, effected internal culture changes, and installed SEL LINAM® faulted circuit indicators on feeders with the highest annual customer minutes of interruption.

Figure 1—SEL ERL fault indicators lead utility service personnel to fault locations so they can quickly restore service to customers.

We Energies had limited application experience with faulted circuit indicators (FCI) prior to the 2003 selection and application of electrostatic reset (ERL) fault indicators manufactured by the E. O. Schweitzer Manufacturing Division of Schweitzer Engineering Laboratories, Inc. (SEL). FCIs installed before 2003 were typically applied in small numbers in response to high profile outages or on problematic feeders in an attempt to reduce future fault-finding time. Purchased from several fault indicator manufacturers, these products ranged from the simplest to the most complex units available.

During this phase, We Energies learned several lessons that helped them to successfully apply fault indicators and avoid the pitfalls experienced in the past. We Energies decided to establish a team focused on the successful application of FCIs. This team would develop and implement standards for purchasing, installing, documenting, operating, and mapping, which were lacking in the

company's previous approach. This team also provided training throughout the company so that every employee, from operations to engineering to dispatch, understood the FCI technologies being applied and knew their roles in the new processes. Despite their best efforts in the past to implement the FCIs, We Energies had no way of measuring whether FCIs were impacting their CAIDI; successful FCI operations were not recognized, and unde–sired operations were not investigated.

Figure 2—We Energies installed SEL ERL faulted circuit indicators on feeders with the highest annual customer minutes of interruption.

As a result, the Electric Distribution Controllers (dispatch) and Operating (trouble-shooting) groups eventually lost confidence in fault indicators and reverted to fault locating techniques used prior to FCI installation. They continued to rely on proven techniques, including information phoned in from customers and analyzed by the Computer Aided Distribution Operating System (CADOPS), SCADA substation breaker operation indication, target information from electromechanical relays, and distance-to-fault information from SEL-251 and SEL-351 protective relays. But finding the exact fault location often necessitated a time-consuming patrol of the entire feeder. Without knowing the general fault location, We Energies was not able to isolate and restore portions of the feeder prior to finding the fault. As a result, many customers experienced outage times inconsistent with We Energies' otherwise outstanding service reliability.

Despite the previous bad experience with fault indicators, We Energies Distribution engineers believed that FCIs could provide valuable fault location information that would further the company's ambitious CAIDI improvement goal. The engineers evaluated past fault indicator experiences and problems and developed a clearly defined system for selecting and applying fault indicators that included:

1. The FCI's application would be limited to main line overhead circuits where the greatest CAIDI improvement could be realized.
2. The FCIs must have a proven track record.
3. The FCIs must be self-powered to avoid battery-related end-of-life issues.
4. The FCIs must reset automatically and display only permanent faults.

The distribution engineers wrote a functional device specification with the overall goal of keeping the fault indicator as straightforward as possible. They reviewed several manufacturers' proposals, relevant literature, the results of trial installations, and field experience obtained from other utilities. In the end, the team chose the SEL ERL, an electrostatic reset fault indicator. Trip ratings of 200 A, 400 A, 600 A, 800 A, and 1000 A were chosen based on the system analysis. Then the engineering group worked with the company's electric distribution controllers to document procedures for how to respond to feeder lockouts on feeders equipped with fault indicators.

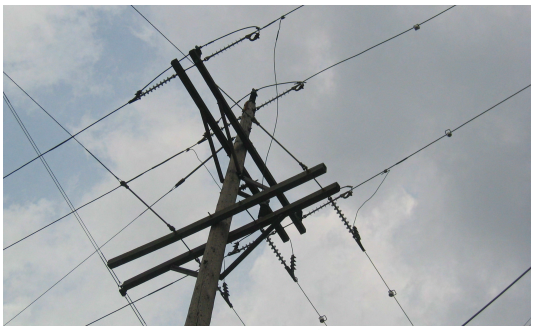

Figure 3—During 2004, 2005, and 2006, We Energies installed SEL ERL fault indicators such that approximately one-third of the company's overall feeders were populated by 2006.

The new procedures marked a major change in philosophy for We Energies; FCI target information would provide the information necessary to restore portions of the feeder prior to finding the exact fault location. This fault isolation/partial circuit restoration solution would decrease outage time for many customers while improving CAIDI. Engineers provided extensive training to troubleshooters on how to install the ERLs and report target information. Based on feedback and observations from the field, We Energies developed a sign for installation at the base of the pole to identify the location of fault indicators. Protection and Reliability technicians specified installation locations and FCI trip levels to ensure coordination with existing overcurrent devices and circuit loading.

Figure 4—We Energies developed blue fault circuit indicator signs for installation at the base of the pole to identify the location of fault indicators.

In the fall of 2003, fault indicator installation became a feature of We Energies' annual "Top Feeder Program," a system for addressing reliability improvement on the 5–10% worst-performing feeders. The program calls for reviewing outages, patrolling feeders, targeting deteriorating equipment for replacement, improving overcurrent and surge protection, and upgrading wildlife guarding and weather hardening. During 2004, 2005, and 2006, We Energies installed fault indicators such that approximately one-third of the company's overall feeders were populated by 2006.

Figure 5—FCI installation orders became part of the company's work management process.

Initially, FCIs were applied at substation cable exit risers, near the feeder midpoint, and at major branches in the feeder. As confidence in the successful use of FCIs increased, We Energies applied additional units at cable dips and at 1/3 and 2/3 points on long feeders. FCI installation orders became part of the company's work management process. Engineering works closely with the company's Mapping and Electric Distribution Control groups to make sure that FCIs are added to the mapping system accurately. The company now includes FCI target information in the Outage Management System along with breaker and fuse operations, allowing it to celebrate successful uses of fault indicators and investigate undesired operations.

By 2005, We Energies achieved its goal of 25% CAIDI reduction. Its customers, who had long benefited from fewer outages than most other American utility customers, have seen outage durations reduced by an average of 30 minutes when an outage does occur.

SEL ERL faulted circuit indicators provided a reliable fault locating solution that allowed We Energies to implement its new philosophy of restoring power to unaffected portions of a system before identifying the exact fault location. Field crews that in the past didn't see FCIs as an important piece of equipment, now do. Today, some of the best testimonials come from the line mechanics, troubleshooters, and electric distribution controllers who rely on fault indicators to lead them to fault locations so they can quickly restore service to customers.

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About We Energies

We Energies serves more than 1.1 million electric customers in Wisconsin and Michigan's Upper Peninsula and more than one million natural gas customers in Wisconsin. We Energies also serves about 2,500 water customers in Milwaukee's northern suburbs and about 500 steam customers in downtown Milwaukee.

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About EOS Manufacturing

EOS Manufacturing's line of high-quality fault indicators and sensors fits well with the SEL mission to make electric power safer, more reliable, and more economical. In turn, the SEL commitment to quality and innovation will help EOS Manufacturing develop new products and better serve our customers. SEL protective relays and recloser controls, coupled with SEL LINAM fault indicators, improve the reliability of electrical distribution systems. For more information about SEL products, locate the SEL representative nearest you by visiting our website at www.eosmfg.com; or contact EOS Manufacturing, phone: (847) 362-8304; fax: (800) 424-0762; mail: 450 Enterprise Way, Lake Zurich, IL 60047.

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