

CASE STUDY

ENWIN Powerlines an Electric Power Distributor—Windsor, Ontario

Relays Provide Critical Automation and Communications Features for Windsor Substation Upgrade and Auto Plant Transformer Stations

Automation upgrade of ENWIN Powerlines' aging substations was aimed at improving system reliability and control. The installation of SEL digital relays and other equipment produced some unexpected benefits, including saving on manpower resources and maintenance costs while improving on safety.

Windsor, ON—ENWIN Powerlines, Ltd., the organization responsible for the distribution of electric power in Windsor, Ontario, Canada, has undertaken a major substation automation initiative that will improve service and reduce maintenance costs. The project is designed to overcome the shortcomings of an outdated 4 kV municipal system plus aging substations located throughout this birthplace of Canada's automotive industry.

“The project involves 24 substations located in neighborhoods throughout the city, operating at two different voltage levels,” explains Kevin Damphouse, SCADA Manager for ENWIN Powerlines, whose department is heavily involved in planning and implementation. “We have two power systems in the city—4 kV and 27.6 kV—and we're beginning to phase out the 4 kV system. The higher priority is the substation upgrade. Some of those structures are 60 years old and need refitting to meet power system requirements for added reliability, protection, and control.”

A key part of the substation project involves replacement of electromechanical protective relays, some of which are 40–50 years old.



Figure 1—The planning department of ENWIN Powerlines has updated and upgraded its 27.6 kV substations to meet the rigorous requirements for added reliability, protection, and control of the electric power system.

Among other deficiencies, those relays are not fully reliable (occasionally miss trips), are not SCADA capable, necessitate high maintenance costs, and are labor-intensive, tying up vital human resources. Also, on-hand replacement

parts are becoming scarce, and many parts are no longer available from the supplier.

ENWIN Powerlines has specified that the replacement relays will be digital, relatively inexpensive, have SCADA communications capability, plus provide the ability to monitor and control breakers and reclosers, have spare inputs for station security as well as substation battery monitoring, and be simple enough to install quickly.

The relay selected for the upgrade project is the SEL-551 Overcurrent/Reclosing Relay (67 units, total) from Schweitzer Engineering Laboratories, Inc. (SEL), Pullman, WA. The SEL-551 is a microprocessor-based, multishot reclosing relay with sequence coordination, phase, ground, and negative-sequence overcurrent protection, plus monitoring, communications, reporting, and control features. This makes the SEL-551 ideal for utility and industrial applications, including distribution feeders, distribution buses, and transformer banks.



Figure 2—The SEL-551 Overcurrent/Reclosing Relay is a microprocessor-based, multi-shot reclosing relay with sequence coordination. The SEL-551 is used in many utility and industrial applications, including distribution feeders, distribution buses, and transformer banks.

“We had been using SEL equipment since 1999, and we felt confident that this was the right solution, from the right supplier, at the right price,” says

Damphouse. “The SEL-551 Relay speaks Modbus[®] through an RS-485 communications port, and each IED can function as an RTU for further communications capabilities. These features provided the benefits we were looking for, but there were also some unexpected features that produced amazing fringe benefits.” In addition to the operational features of the protective relay, ENWIN Utilities reduced its future relay repair/maintenance costs with electronic microprocessor-based protection products because of the reduction of the frequency of calibration, maintenance requirements, and the relay’s self check feature.

Prior to the installation of the SEL-551 Relays, the ENWIN Powerlines substations had used thermal-demand ammeters. Many of these old ammeters were not especially accurate and had no graduation marks between 0 and 100 A on the meter scale. Significantly, those readings were used by the planners to calculate present and future loads and transfers.

Using the accurate metering information in the SEL-551 allowed planners to know exactly what load transfers were actually being made, which enabled them to eliminate some processes and to bypass and remove stations earlier than planned. “In some cases, when we put the SEL-551 Relay in our substations, we found that we had actually only something like 7 A per phase on a feeder. So, we’d typically transfer that little bit of load to another feeder,” Damphouse says. “In the process, we’ve shut down three substations and saved on a few replacement relays. Plus, this procedure will help us to eventually decommission our 4 kV substations earlier than planned.”

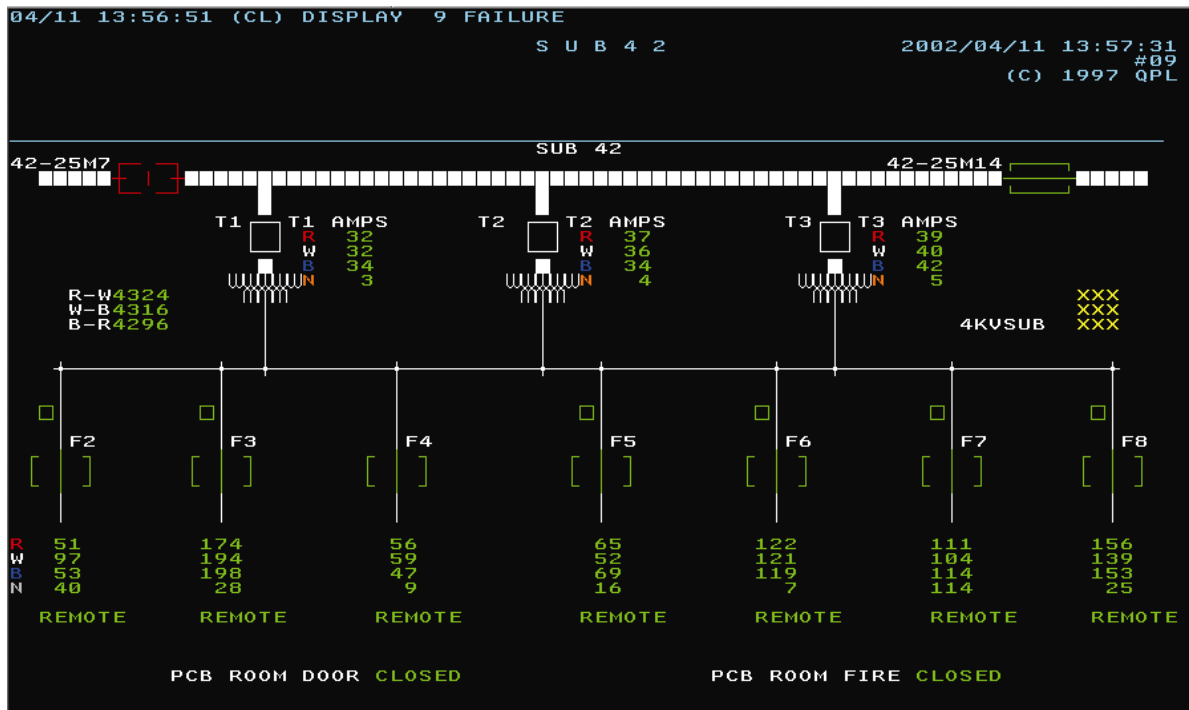


Figure 3—Shown above is a screen capture of the Sub 42 SCADA station layout. By using the integration features of the SEL products, SCADA system operations are optimized.

The SEL-551 also has full oscillographic, sequence of event, and event reporting capability. Damphouse says ENWIN Powerlines also put new SEL-551 Relays on some 27.6 kV substations, with the main purpose of capturing new data and validating trip times. “With the older relays, it took three to four cycles for faults to detect. Now the relay hits super-fast, within one cycle.”

In another automation tactic, ENWIN Powerlines has created an innovative radio communications scheme that eliminates the need for service personnel to access substations, thereby saving manpower and improving on safety and response time in inclement weather.

“Some of our substations have Joslyn reclosers with SEL-351J Relays. The recloser will normally be operated through the SCADA system,” Damphouse ex-

plains. “But we’ve decided to hook up FreeWave wireless radio modems to one of the relay ports so that a technician can communicate with it by laptop. Now if a part of town goes dark, we dispatch a line crew and, when they arrive at the substation, they remain in their service truck and connect via laptop through the FreeWave radio to the SEL-351. Through communications they download the event and targeting files to the laptop and then proceed to the fault as indicated—without leaving their trucks. Not only does this improve dramatically on response time and manpower, it also widens the margin of safety and helps eliminate personnel exposure to foul weather.”

Using the FreeWave radio modems, ENWIN Powerlines crews can perform oscillography downloads, relay changes, configuration checks and so on—as if they were hooked up to the equipment

on a shop bench. The improved efficiency in fault location also makes it safer for citizens and vehicular travelers on the streets, because there is far less time needed for bucket trucks, surrounded by safety cones, to block streets and sidewalks.

Another significant benefit to the maintenance personnel, via the SEL-551 Relay installation is that it can be configured to remotely control the enable/disable feature of the feeder recloser or breaker during a holdoff (dead line tag) situation. Normal process is to go to the station and “disable” the auto-reclose, go to the work site to complete the task, then return to “enable” auto-reclose at the end of the work, which could be as simple as lifting a dead branch off a line or routine tree trimming.

“Our transition counters show that we’ve taken thousands of holdoffs without a failure to the auto-reclose controls,” Damphouse says. “That’s many trips in a truck that service personnel didn’t have to make. In fact, holdoffs can be managed via the FreeWave system of data radios so that contractors, such as tree trimmers who request a holdoff in work areas, can get it with the flip of a remote switch—even before they get to where they’re working.”

ENWIN has made good use of the SEL-551 Relay’s remote control access features. Due to the age of the system that was upgraded, Damphouse emphasizes the importance of the safety factor. “Imagine yourself standing in front of a 60-year-old circuit breaker while you close it. Suppose that the lineman has fixed the fault, but there’s another one. With the new relays and the ability to have SCADA controls, the line crew

calls our base operator and they simply close the breaker through the SCADA system. If the breaker pops, nobody will be in front of it. Restoration times are also improved. Instead of a lineman having to drive to a substation to close a breaker after they have fixed a fault event, they simply call over the radio and ask the operator to close it for them. If it holds, then everything is working fine, and customers are back on line much faster because they don’t have to wait 20 minutes for a repairman to drive to the substation to restore the breaker. Everyone wins and the efficiency of restoration is greatly improved!”



Figure 4—Overloads were not known for weeks with the “old system,” now overload status is instantly recognizable using the relay’s visual alarms. The installation of SEL-551 Relays economizes on space and improves functionality for seven feeders.

The SEL-551 Relay has many metering features to take advantage of. Tripping, multifunction programming, and over-current set points can be used for alarms. Damphouse adds that, with the old system, overloads weren’t known for weeks. With the new SEL-551 Relays installed, overload status is now instantly recognized via relay alarms. Also, power quality can be dramatically increased due to immediate knowledge of power values and decreased switching time.

Installation of the SEL relays was simplified due to all required wiring being available from the front panel at the old relay location. Mounting was accomplished using aluminum plates that covered existing holes with cutouts for relays and PML digital meters.



Figure 5—Rear view of the compact installation of protective relays for seven feeders. Simple wiring and control I/O are readily accessible.

ENWIN Powerlines also installed three major 115 kV transformer stations for the Windsor area's largest automotive customers, Ford, General Motors, and DaimlerChrysler. Ford operates a casting plant with big induction furnaces and a foundry; the DaimlerChrysler plant is a mini van assembly facility; the GM plant produces automatic transmissions. "These new feeders are dedicated to those customers, who are major power customers, and very large investors in the economy of Windsor," explains Damphouse.

He adds that in all three cases, the transformer stations were built around SEL equipment, including SEL-351 Direc-

tional Overcurrent and Reclosing Relays, SEL-387 Current Differential and Overcurrent Transformer Relays, SEL-587 Current Differential Transformer Relays, SEL-551 Overcurrent/Reclosing Relays, and SEL-2030 Communications Processors. Timing for all events is synchronized to the SEL-2030 from an Arbiter GPS clock. Substation signals inside the building are transported using SEL fiber-to-serial transceivers and fiber-optic connections, which eliminate ground potential rise issues with all cables carrying data.

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About ENWIN Powerlines, Ltd.

ENWIN Powerlines, Ltd., Windsor's electric power distribution company, is responsible for the distribution of electricity as well as the service and maintenance of the municipality of Windsor's powerline infrastructure. For additional information, contact ENWIN Powerlines at: (519) 251-7300 or visit www.enwin.com/html/power.html

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About SEL

Schweitzer Engineering Laboratories, Inc. (SEL) has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2000-certified company serves the electric power industry worldwide through the design, manufacture, supply,

and support of products and services for power system protection, control, and monitoring. For more information, contact SEL, 2350 NE Hopkins Court, Pullman, WA 99163-5603; phone: (509) 332-1890; fax: (509) 332-7990; email: info@selinc.com; website: www.selinc.com.

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