CASE STUDY

Northlands Park—Edmonton, Alberta, Canada

SEL Protection and Communications Capabilities Integral to Power System Upgrade at Alberta's Dynamic Northlands Park

A hub of sports, gaming, business, and entertainment action in Western Canada, the ongoing upgrade of Northlands Park's power infrastructure requires complex orchestration and precise timing. This includes off-site simulation of digital monitoring and protection systems from Schweitzer Engineering Laboratories, Inc. to avoid interruption of park events.

Edmonton, Alberta, Canada—What do the Rolling Stones, Edmonton Oilers, championship rodeo, and thoroughbred racing have in common? They are just a few of the attractions that take place at Northlands Park in Edmonton, Alberta, Canada, the expansive sports, entertainment, and exhibit complex that also features a broad array of tradeshows, banquets, gaming, and many other activities throughout the year.

It is precisely because Northlands Park is such an eventful place that upgrading the electrical power infrastructure requires a complex orchestration of power scheme and backup design, simulation, installation, and testing—all coordinated to accommodate a long-term development plan without interrupting a brisk schedule of events.

The 166-acre Northlands Park site, a hub of sports, gaming, business, and entertainment in Western Canada, is home to three of Edmonton's largest events: Capital EX, Farmfair International, and Canadian Finals Rodeo. The park's Rexall Place hosts Edmonton Oilers hockey, concerts, and other major events. Including the site's other major facilities, Northlands AgriCom, Northlands Spectrum, and a horseracing track, events at Northlands generate more than $342 million annually and support another $888 million in economic activity.

Figure 1—An aerial view of Northlands Park in Edmonton, Alberta, Canada. The 166-acre park site is a hub of sports, gaming, business, and entertainment. Northlands Park is home to three of Edmonton's largest events: Capital EX, Farmfair International, and Canadian Finals Rodeo.

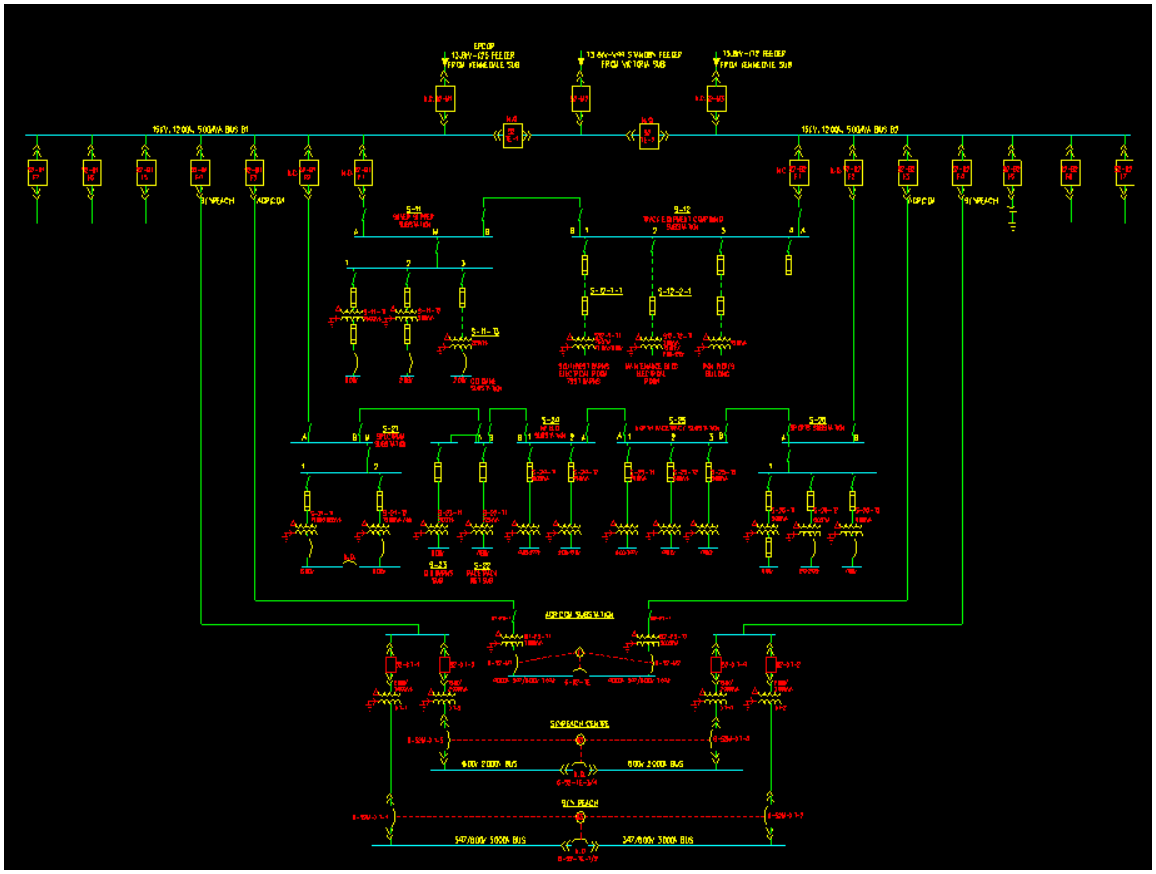

Figure 2—Shown above is a human-machine interface (HMI) screen depicting the Northlands Park electrical system with three incoming utility feeders: one main dedicated, one standby dedicated, and one a shared feeder with another utility customer. Each is protected by an SEL-351S Protection and Breaker Control Relay.

"There are two major challenges involved with this project," said Clive Collar, power systems specialist and project manager. "First of all, we're using existing, old-technology [electro-mechanical] gear in the process of upgrading a system with state-of-the-art technologies, including Schweitzer [Engineering Laboratories, Inc.] relays and communications processors. Secondly, we have to plan installation so as to not interfere with the schedule of events at busy facilities such as Rexall Place…over a two- to five-year period."

The power system upgrades comprise the first two phases of a five-stage, ten-year development plan prepared by Collar. The first phase, installed and commissioned, involved modernizing the incoming power system and expanding its capacity to accommodate the future addition of facilities. The second phase, also installed and commissioned, involved the upgrade of equipment feeding the park's various facilities, a fiber-optic-based SCADA system, and digital monitoring and metering equipment.

"The ten-year plan calls for a fully redundant system," Collar said, "to ensure reliability. So everything on the power system will be mirror imaged in double-ended substations, dual primary feeder cables to major load centers, and so on.

"We've had to do a lot of system switching from one bus to another in

order to add a third incoming [15 kV] feeder to the main substation," Collar added. "This is a shared-load feeder, a standby that is limited to a maximum incoming load of 5 MVA. The system now incorporates three incoming utility feeders: one main dedicated, one standby dedicated, and the third a shared feeder with another customer. We've incorporated SEL-351S [Protection and Breaker Control] Relays to alarm in the operating center when the third feeder approaches 4 MVA. So now we have two main buses on two main feeders with a standby in between. And then we have a distribution bus farther down the system, which will have 15 kV breakers with SEL relays."

Fourteen feeders will go out to various Northlands Park sites. SEL relays will be the standard protection devices, with the incoming feeders protected by SEL-351S Relays and the outgoing feeder buses protected by SEL-351A Distribution Protection Relays. The SEL-351S Relays are also used to provide an automatic transfer scheme between the three incoming feeders.

"In terms of protection, the scheme is fairly straightforward," Collar said. "We're using overcurrent time and instantaneous features within the Schweitzer relays. In some cases, because we've got breakers on the same bus and want to coordinate one with the other, we're providing the restraint signals between two relays, one upstream and the other downstream. We're stopping the upstream relay from operating under short-circuit conditions until the downstream relay has cleared the fault, which is a delay of about 8–10 cycles that we've introduced into the scheme."

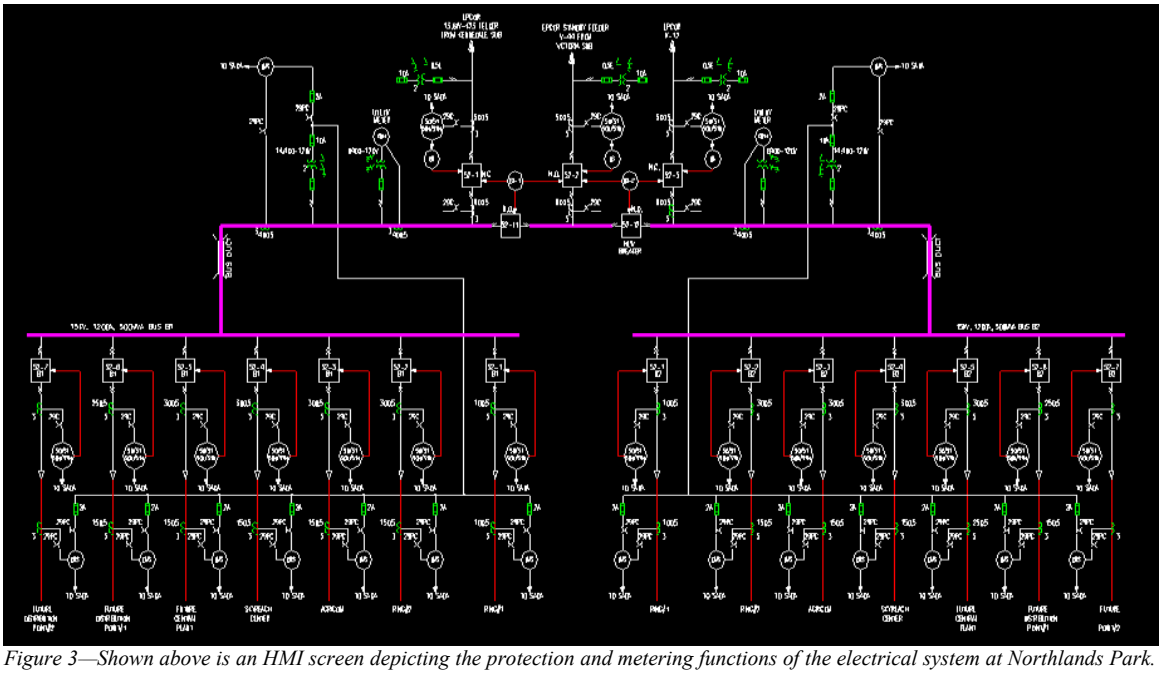

Figure 3—Shown above is an HMI screen depicting the protection and metering functions of the electrical system at Northlands Park. The SEL-351S Relays installed on the three incoming utility feeds also provide protection as well as an autotransfer scheme. The 14 feeders shown are dedicated to various Northlands Park sites, and each feeder is protected by an SEL-351A Distribution Protection Relay.

One problem the project team faced with the system's physical installation was the frequency of activities at the site. For example, the Edmonton Oilers hockey team plays at Rexall Place throughout the long NHL season. "We have the difficulty of scheduling the isolation of the buses and the installation of the new relays and doors in such a way that they have two feeders going to Rexall Place," Collar explained. "So the difficulty has been getting enough work done and then leaving enough time to get the bus back on and energized. Then after a game, we have to de-energize the bus again. We must do enough between games to make sure that we're always in a situation that we can put two feeders into the facility."

Figure 4—The SEL-351S Protection and Breaker Control Relay comes with standard options and includes eight outputs, six inputs, conventional terminal blocks, and ACSELERATOR® QuickSet SEL-5030 Software.

The project team, working with SEL distributor PowerNet Measurement & Control, Ltd., Calgary, and an independent programming consultant, also developed a special break-before-make transfer scheme for the three incoming feeders. "We're using the SEL-351S Relays for that and communicating between the relays using Schweitzer's MIRRORED BITS® technology, which saves on hardware requirements," Collar said. "But the transfer is only in one direction. If we lose one of the incoming feeders, it automatically transfers to the standby, but blocks future operation of the other feeder from transferring. The system remains fixed until somebody goes and resets everything. So it's an automatic transfer-manual reset system."

In combination with the power system development, Northlands Park is installing a 96-strand fiber-optic trunk cable, which will be picked up by various agencies and buildings at the park. The power system will have a dedicated 24-strand fiber-optic cable, which is expandable to 48 strands (within the 96 strands).

As basic building blocks of the SCADA system, Northlands Park installed four SEL-2030 Communications Processors. "We have fiber-optic links between every SEL-351 Relay in the main substation, which are then fed through multimode fiber cables into a central computer," Collar said. "We have installed HMI graphic screens on the system. They are able to communicate with the SEL equipment to obtain energy readings throughout the system."

A slave CPU with HMI in the electrical superintendent's office allows the superintendent to have fingertip control of the complete system. "The supervisor can check their switching orders when they do switching operations," Collar said. "They can place the grounds layout on the screen to mimic where they have safety grounds. They can place safety clearances on the screen where they're issuing permits for people to work on the system. They can check their switching orders and then recheck them when work clearances are surrendered. So this whole communications system is intertwined with the physical operation of the [electrical] system."

Switchgear for the Northlands Park project is provided by Global Switchgear Corporation, Edmonton, which works

closely with the engineers. “You never know what you’re going to come up against in an upgrade project,” Collar said, “so we work closely with Global, which would be far more difficult if our supplier were not local. We’re setting up doors and dummy breakers in Global’s shop so that we can put the system through its paces before we go anywhere near the switchgear. The reason I want to do it that way is because if we start installing breakers and other equipment and the doors, and then experience problems when we test them on-site, that would be a major difficulty because we’re talking about feeders under load. So we’re going to have a day of acceptance of the transfer scheme with the local utility, which will give us an opportunity to make sure the system will do what we say it will do. It will also enable us to make sure there are no bugs in the software before putting the system into operation.”

Northlands Park is interfacing the SEL protective relays, monitoring, and communications equipment with PML metering equipment into the HMI to monitor energy consumption, electrical system reliability, and associated costs. Citech software and DYMEC transceivers are used to implement communications on the system’s energy side.

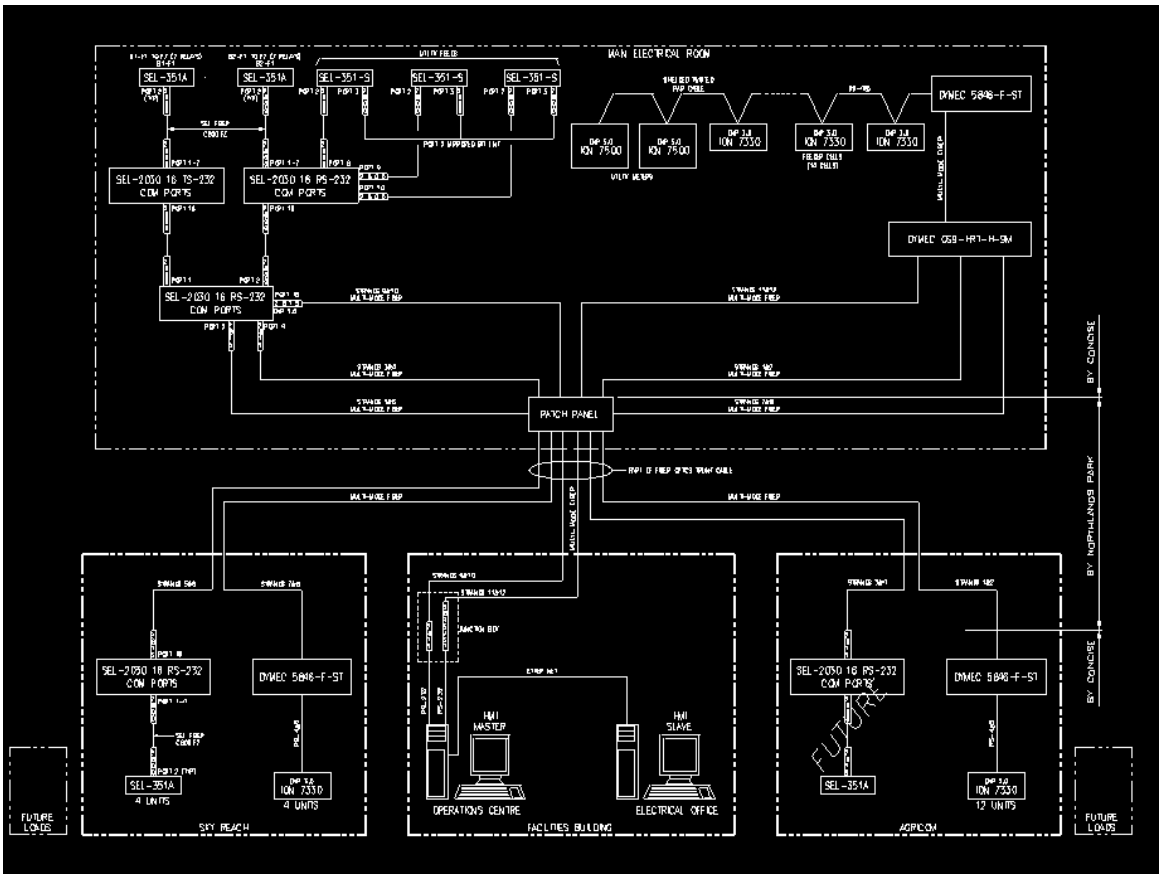

Figure 5—Shown above is a representation of the Northlands Park power monitoring and control system communications diagram, including SEL-2030 Communications Processors, SEL relays, fiber-optic links, metering points, and computer workstations.

Collar recommended SEL for protection, communications, and monitoring because of its technologies and affordability. He added that he is also impressed that SEL has become a standard among many utilities. "The local power company (EPCOR) has standardized on SEL equipment. I also came across a lot of SEL systems when I was involved with a project for [West] Kootenay Power in British Columbia. So I have a lot of regard for Schweitzer and their products."

In particular, the SEL-351S Relay provides combinations of functions, including protection, monitoring, control, fault locating, and automation in a single, compact package. In addition to the ten front-panel buttons, SEL-351S Relay users can add independently operated breaker/trip-control switches and status lamps that are functional even when the relay is out of service. This allows utilities and substations to minimize construction costs for breaker-control panels by eliminating the need to add switches. Direct-programmed operations such as reclosing are accessible from the relay front panel, enabling instant lockout for safety if a crew is working on a line when the relay trips. Programmable operator controls help users meet specific application requirements, such as enabling/disabling underfrequency load-shedding schemes and changing relay settings groups.

The following individuals and companies were involved in the project:

- **Northlands Park**: Mark Weisner, Garth Graham, Rick Seriadak, Davis Edwards
- **Project Manager**: Clive Collar, P.Eng., power systems specialist, Calgary, Alberta
- **Commissioning Manager**: John Van Hooydonk, commissioning specialist, Edmonton, Alberta
- **Utility Company**: EPCOR, Edmonton, Alberta
- **Manufacturers and Reps**: PowerNet Measurement & Control, Ltd., Calgary, Alberta; Global Switchgear Corporation, Edmonton, Alberta

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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-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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