CASE STUDY

ARX Engineering—Calgary, Alberta, Canada

Automatic Transfer Scheme Retrofit Ensures Reliable Power in Calgary High-Rises

The critical use of power in large commercial facilities makes continuous electric power extremely important. In order to provide a more reliable utility supply, the power system often employs redundant utility sources via a transfer scheme that switches from a preferred to an alternate source in the event of a power upset.

Assurance that transfers between power sources are automatic and reliable has become increasingly vital due to increased concentration of sensitive electric-powered equipment on tenant premises as well as the dependency of sophisticated building infrastructures on uninterrupted power. A continuous power supply relates to health and safety issues, computer and process loads, and comfort requirements such as HVAC and lighting.

With the increased demand for electricity combined with the aging infrastructure of the electric power grid, disturbances such as voltage spikes and sags and severe weather conditions are continually increasing the probability that large buildings will incur the need to transfer between power supplies at increasing intervals. When the transfer does not occur within a few seconds or automatically, both building and tenant operations could be interrupted, quite possibly exposing building owners to extensive liabilities.

"Such outages are extremely impactful, as the building tenants usually have to be evacuated for the duration of the outage," says Roland Davidson, R.E.T., Operations Manager at ARX Engineering, Calgary (Alberta, Canada). "In extreme cases, it could be inherently precarious for building occupants if the emergency power systems were to fail. With elevators not operating, they must navigate through dark halls and stairwells without the help of emergency lighting to vacate the building."

Figure 1—Typical high-rise building in Calgary, Alberta, Canada. In case of emergency conditions or power outages, all occupants must be evacuated.

The increased frequency of power transfer scheme failures can be attributed to the age of the equipment in these large commercial buildings and the use of archaic technologies that are inadequate for today's power system requirements. These designs incorporate devices such as electromechanical relays

and pneumatic timers known to have a limited service life cycle, which have been supplanted by more advanced microprocessor-based devices.

Reaching a More Reliable Solution

The management of ARX Engineering has always prided itself in being on the leading edge with the evolution of new technologies that offer more robust protection as well as other advanced performance characteristics. Since 1982, ARX and its predecessor Magna IV Engineering Ltd. have been providing electrical engineering, equipment maintenance, and commissioning services to the utility, industrial, commercial, and institutional sectors.

ARX Engineering works with building management and external resources to achieve high performance building infrastructure management. Maintaining an efficient infrastructure—including electrical power systems—is quite significant, because a typical building life cycle is 30% to build and 70% to manage, operate, and maintain over the life of the property (e.g., $300,000,000 to build and $700,000,000 to operate).

Over the years, ARX Engineering Ltd. has identified and repaired failures to these systems. However, within a one-year period, at least three major facilities in Calgary experienced a failure of the utility source where power was not automatically restored via the alternate source. These events all resulted in building evacuations.

"Rather than continue to repair these problematic systems, ARX was determined to design a new modern protection and control scheme," explains Davidson. "The goal was a solution that would not only improve reliability but also enhance the performance of the system."

With the backing of Brookfield Property Management and Oxford Properties, ARX was commissioned to design a retrofit transfer scheme that would improve reliability, meet the current utility requirements, provide enhanced protection features, and provide feedback to the building operators.

After consultation with Schweitzer Engineering Laboratories, Inc. (SEL) based in Pullman, Washington, the design was undertaken, utilizing a powerful and flexible microprocessor-controlled protective relay, the SEL-351 Directional Overcurrent and Reclosing Relay. The SEL-351 Relay is widely used at utilities and substations around the world because of its extensive monitoring, protection, communications, and automation features.

Figure 2—The SEL-351 Relay is used on the main breakers, which utilize the relay's extensive monitoring, protection, communications, and automation features.

"At one facility, we utilized two SEL-351 Relays on each of the main breakers plus four SEL-551C Overcurrent/Reclosing Relays on the feeder breakers," Davidson says. "The scheme is a 25 kV preferred source with a hot alternate. Many of the major office towers in downtown Calgary are serviced by a 25 kV network with the preferred feed in one building being the alternate in an adjacent building. Upon the failure of one of the 25 kV feeds, the affected buildings will transfer automatically to their alternate source. The local utility (ENMAX) will then restore the buildings back to their original state after the problem is corrected under a defined procedure."

Figure 3—The SEL-551C Relay is used to control the feeder breakers.

Figure 4—This transfer scheme project replaced electromechanical relays and pneumatic timers, which are known to have a limited life cycle (a and b). The new microprocessor-based protective relays provide more functionality and increased reliability (c and d).

Comprehensive System Features

Transfer scheme design parameters include a selectable preferred source, automated and synchronized transfer to a second source in case of a power sag or other disturbance, and remote alarm notification to the building engineering staff should there be a loss of the standby (secondary) source. Overcurrent protection and lockout features are standard functions of the SEL-351 Relay and are incorporated into the overall design.

"Other features of the SEL-351 Relay have provided tremendous benefit in reporting and troubleshooting," says Davidson. "Event reports, communications, load profiling, ease of installation, flexible programmable logic, and enhanced protection features have considerably improved the reliability of this system for the property owners."

With the successful installation of this system at five facilities within the Calgary marketplace, the building owners have seen the benefits of the installation in that they have not experienced any malfunctions and have renewed confidence in the event of a problem with the alternate supply. An unforeseen benefit is that they now are aware when the utility transfers them onto the alternate source without notification, and they are aware if there is a problem with the utility alternate source.

(a) (b)

Figure 5—This transfer scheme project replaced the old electromechanical assembly (a) with programmable transfer scheme logic for "preferred" and "alternate" utility sources and includes built-in control interlocks to help ensure personnel safety (b).

A New Focus on Commercial Facilities

A past winner of the BOMA (Building Owners and Managers Association) Service Excellence Award, ARX Engineering has been nominated for the BOMA Innovations Award for the Calgary area because of these new automated transfer schemes and related equipment recently installed in several of the city's high-rise office buildings.

From the outset, the management of ARX Engineering Ltd. recognized that complex electrical distribution systems existed in major commercial facilities and were essentially being ignored by the industry. As the market place has become more competitive, proactive building owners have challenged ARX Engineering Ltd. to find innovative solutions to enhance the reliability of the power supply at these facilities.

"Commercial power systems like those found in high-rise buildings can now enjoy the same benefits of high-speed digital protection and control that electric utilities have enjoyed for decades," says Erik Newman, Vice President of Sales and Customer Service at SEL. "The use of older electromechanical technology for protection of the building's power system can now be updated with digital technology built by SEL. Commercial customers will enjoy the benefits of safe, reliable, and economical power while gaining additional information about the status of the power system that was not available from the older technology. As ARX Engineering has demonstrated, the sky is the limit!"

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About ARX Engineering Ltd.

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About SEL

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. SEL also provides complete, customized systems. 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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