CASE STUDY

Barrie Hydro, an Electric Power Distributor—Barrie, Ontario

Relays and Communications Processors Help Energize Barrie Hydro Expansion, Automation, and Transition to Open Market

Updated Barrie Hydro power distribution system combines advanced protection with flexible automation to expand its service area while improving distribution cost savings, reliability, and safety in a newly deregulated marketplace.

Barrie, ON—Barrie Hydro Distribution, Inc., the distributor of residential and industrial power to the City of Barrie and other communities throughout Simcoe County, Ontario, has based its post-deregulation distribution upgrade strategy on an innovative combination of protection, data communications, and automation.

In response to the Provincial Government's 1998 Energy Competition Act, which deregulated and completely restructured electric power generation, transmission, and distribution throughout Ontario, Barrie Hydro has, itself, restructured and reorganized to use advanced technologies and methods for the delivery of reliable, high-quality electricity and customer services. In the process, Barrie Hydro expects to provide highly competitive rates as well as reasonable returns to shareholders.

Ontario's "Open Market" mandate essentially requires that its electric utilities perform with the utmost reliability and quality of service. In the case of Barrie Hydro, it has also presented the opportunity and challenge of taking on some neighboring rural distribution companies, making it Ontario's 12th largest utility, with approximately 62,000 customers.

Barrie Hydro purchases electricity from the transmission grid of Hydro One Networks, Inc., the area's major power transmitter. Hydro One Networks transmits power over 230 kV or 115 kV lines to transformer stations, where the power is stepped down to 44 kV and distributed (also known as "subtransmission") to customers such as Barrie Hydro. Barrie Hydro's customers are served from 41 substations throughout its market area. Summer system peak load on the system is 250 MW.

Figure 1—In response to 1998 Energy Competition Act, Barrie Hydro had the opportunity and challenge to provide reliable, high-quality electricity and customer services. This led to a project to improve the protection, data collection, and automation of the distribution system that began in 2000. Shown above is one of the four new substations built to provide important communications and automation capabilities.

"Our program to improve the protection, data collection, and automation of our system began in 2000 with a project to build four new substations," explains Doug Fairchild, Engineering Planner at Barrie Hydro. "It had been awhile since we built a substation, and we didn't have firmly established

construction standards at the time. We had successfully used arc-proof, metal-clad switchgear with, typically, a four-feeder substation, so we decided to go that way for the new substations. However, we had some unfortunate prior experience with electronic relays, so we went to the market to look at different technologies and see what everyone else was using. We decided to use microprocessor-based relays, which our investigations showed were highly reliable and could provide important communications and automation capabilities."

Barrie Hydro standardized on the Schweitzer Engineering Laboratories, Inc. (SEL) product line, supplied by Pro-Tech Power Sales, Inc. in St. Catharine's, Ontario, with SEL-351A Relays for feeder protection, SEL-351-7 Relays for the main incoming breaker, and the SEL-2030 Communications Processor as the central data collector. Larger stations may also have an SEL-387-5 Relay for differential protection.

"SEL products had been gaining momentum in Ontario, and the buzz was out there," says Fairchild. "People from Barrie Hydro visited some utilities that were using SEL products, and they got a very positive rating. Also, the Schweitzer ten-year warranty and short turnaround times are excellent, and they always seem to have specialists available for help if you need it. So, all that was a plus. Of course, the SEL relays easily met our protection needs."

"At the same time, we wanted to choose a relay with an IED [Intelligent Electronic Device] that could be the start of a SCADA [Supervisory Control and Data Acquisition] system for us. So, the SEL relays really made sense," Fairchild says. The SCADA automation system that Barrie Hydro purchased was an IED-based solution from Quindar Products Ltd. (now Survalent Technology), in Mississauga, Ontario, in November 2001. Barrie Hydro also chose a consultant who served as the systems integrator and purchased the SCADA equipment.

Figure 2—"We had successfully used arc-proof, metal-clad switchgear with, typically, a four-feeder substation… We decided to use microprocessor-based relays, which our investigations showed were highly reliable and could provide important communications and automation capabilities," explains Doug Fairchild, Planning Engineer at Barrie Hydro.

Through the SCADA system, Barrie Hydro collects standard analog values, such as voltages, currents, watts, and vars. Power factor and VA are calculated locally at the SCADA master station.

"We use the SEL-2030 Communications Processor to function as a 'data concentrator' to the attached IEDs," Fairchild explains. "We have no RTUs in our station, which is out of the ordinary around Ontario. A simple serial connection is made from each IED to the SEL-2030. The SEL-2030 is easily programmed with the required DNP mapping. This information is then brought back to the SCADA master. Back at the SCADA master, the operators have access to the individual LED targets of each relay. They are displayed on a replicated picture that looks like the front face of the actual relay. So, when there is an event, a fault in the system, it's just like being right at the station; all the LEDs light up to tell you if it's a 50 element or a 51 time overcurrent and what phase it's on. We're also working on bringing back the distance-to-fault and fault magnitude for each individual station feeder. This information, along with the phasing targets, will allow our personnel to pinpoint power outages much quicker and, with any luck, get the lights back on faster."

Fairchild finds that the capabilities of the new system to remotely control substations (20 currently) provide a number of benefits.

"We have the ability to open and close the breakers, as well as the ability to enable and disable the reclose on the breakers, and bring back various transformer information, such as fan current, so that we can monitor when transformer fans engage and disengage," he says. "We also monitor the winding temperature and oil temperature of the transformer, as well as rapid pressure status. We monitor station batteries, station smoke detectors, station entry contacts, and sump pump activity in stations where we have oil containment."

Figure 3—Shown above are SEL-351A Relays for feeder protection, SEL-351-7 Relays for the main incoming breaker, and the SEL-2030 Communications Processor as the central data collector. Larger stations may also have an SEL-387-5 Relay for differential protection.

An important aspect of Barrie Hydro's updated protection and automation scheme is its ability to manage data communications with local and remote stations via a hybrid network of licensed radio, unlicensed radio, and fiber-optic cable.

"There were economic considerations in the choice of radio or bringing fiber to each station," Fairchild explains. "We use a 9600-baud licensed system in Barrie. In the outlying areas, we use a combination of fiber and spread-spectrum radio." The unlicensed radio network is composed of MDS (Microwave Data Systems) equipment that is highly accepted in SCADA radio system applications.

Although considered an ongoing program, the initial Barrie Hydro automation project was developed for a five-year period, with 2005 as the target date for completion. Phase I included updating the protection and automating nine substations within the City of Barrie. Phase II, completed in 2002, included installing fiber-optic cable and a spread-spectrum radio network between the control room in Barrie and four substations at neighboring Bradford-West Gwillimbury. Phase III involved installing a fiber cable to the community of Alliston for communications with the three substations there. Most recently, Barrie Hydro has included data acquisition of its wholesale boundary metering points.

"There are very substantial cost savings involved," Fairchild says. "We'd often dispatch crews to do the remote holdoffs. Virtually eliminating that need alone is a huge cost savings. And the safety factor—not having to send our crews into the substations—is a substantial benefit. For example, in a substation not long ago we had a breaker fail due to an internal bus fault in the switchgear, which was not arc-proof, and there was a dangerous explosion. With our new relays and communications, our personnel can control the substation without entering the site."

Fairchild is enthusiastic about the savings realized through the use of the Ethernet-IP radios for several rural substations. "The radios come with two serial ports and one Ethernet port. This allows us to do our DNP poling out of Port 16 of the backs of the SEL-2030 Communications Processor. Plus, we also have another connection on the SEL-2030 that I set up as just a remote port. This allows a telnet connection. Now, right from my desktop, I can run SEL-5010 [Relay Assistant Software] and SEL-5020 [Settings Assistant Software] just as if I were right in front of the relay. I can use this software to make relay settings changes; I can download event records and oscillographic reports. Not only is this convenient, but there is a huge cost savings in not having to travel 30 to 60 minutes each way to get this information. That's been a major selling feature, to eventually change out our old radios at the City of Barrie from our original Phase I program, to install

Ethernet-IP technology that allows us to get more of the information out of the Schweitzer relays."

Fairchild says Barrie Hydro makes use of all of the available programs, including ACSELERATOR® QuickSet™ software, to program its relays, maintain settings, and manage the data concentrator settings on the SEL-2030. "All of the mapping for our SCADA system is done through the SEL-5020 software. The SEL-5010 Relay Assistant is an excellent database tool for keeping track of all the settings," he adds.

"The whole program has really evolved for us as a utility" says Fairchild. "With the new relays and SCADA systems, we have all this information at our fingertips. Once everyone realized what these relays and SCADA system are doing for us, that really drove interest in the continuation of the automation project and to carry on with upgrading the rest of our substations."

# # #

About Barrie Hydro Distribution, Inc.

In October 2000, Barrie Hydro was incorporated under the Ontario Business Corporations Act, with the City of Barrie as the sole shareholder. At the time of incorporation, Barrie Hydro also acquired the electric utilities of the towns of Penetanguishene, Bradford, Alliston, Beeton, Tottenham, and Thornton. Serving over 62,000 customers in these communities, Barrie Hydro is now the 12th largest utility in the Province of Ontario. For more information, contact Barrie Hydro at 55 Patterson Road, P.O. Box 7000, Barrie, Ontario L4M 4V8; phone: (705) 722-7222; fax (administration): (705) 722-6159; email: mail@barriehydro.com; or visit the website: www.barriehydro.com.

About Pro-Tech Power Sales, Inc.

Serving the utility, industrial, government, and OEM markets, Pro-Tech Power Sales is dedicated to the highest level of customer service, and is committed to a continuous process of providing technical support and implementing new equipment and technology to serve our customers. With headquarters in Roseville, Minnesota, Pro-Tech Power has sales offices in Ontario and Québec. Contact Pro-Tech Power Sales, Inc. in Roseville, MN at: (651) 633-0573; Quebec Office: (514) 761-3906; Ontario Office: (905) 646-2234; or visit their website at: www.pro-techpower.com.

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.

SCHWEITZER ENGINEERING LABORATORIES, INC.
2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Tel: 509.332.1890 • Fax: 509.332.7990
www.selinc.com • www.selindustrial.com
Email: marketing@selindustrial.com

LCS0009