NOW HERE'S A SWITCH...STANDARD COMPONENTS HELP HYDRO VAUGHAN DISTRIBUTION BUILD A BETTER RTU

With a peak load of 575 MW, Hydro Vaughan Distribution Inc. (HVDI) serves 70,000 customers in the City of Vaughan, Ontario. A growing customer base has fuelled an increase in load requirements of 10 per cent, per year over the last three years. And, HVDI's recent joint acquisition of the neighboring City of Richmond Hill's hydroelectric system with Markham Hydro Distribution Inc. will further increase these requirements.

Taking energy from the provincial power grid at 230 kV, HVDI's 10,000 distribution transformers stepped down the power to a utilization voltage of 28kV. With a mandate to deliver electricity reliably and profitably to their industrial, commercial and residential customers, HVDI relies on a network of remote terminal units (RTUs) to distribute power over a 110 square kilometer area.

Remotely operated by central control room operators using a supervisory control and data acquisition system (SCADA), the more than 70 RTUs immediately detect network faults and outages, communicating this information real time to the control room over a radio modem. After locating the affected area on his PC-based SCADA software, the control room operator remotely opens switches to isolate the faulted area, and restores power to nearby areas that aren't affected by the fault.

"The ability of our SCADA-controlled RTU network to instantly communicate faults and outages and allow operators to open and close switches with a simple mouse click, allows us to reduce the length of power interruption to many customers," says John Garnish, Superintendent Station Maintenance, Hydro Vaughan Distribution. "We also minimize the area of necessary outage while repairs are being made."

RTU ISOLATING SWITCH MADE WITH STANDARD COMPONENTS MAXIMIZES RELIABILITY, MINIMIZES COST

In the past, dealing with four different RTU manufacturers — each with their own proprietary communication protocol — made HVDI's network of 30 RTUs expensive to maintain. Spare parts were not available and technical support and service were poor. To make matters worse, two of these manufacturers went bankrupt.

Also, control room operators could not assess the type of distribution network faults or pinpoint their location. So they dispatched a repair crew to visually inspect the suspected area for signs of faulted equipment before repairing it. Because the fault took so long to locate, many customers were without power for a considerable length of time.

To minimize costs, ensure a reliable supply of spare parts and maximize their choice of vendors, HVDI decided to build new RTU boxes themselves, using standard industrial components and an open communications protocol that they could buy through an existing distribution channel. And, to remotely locate and assess the type of faults, HVDI decided to create

an intelligent monitoring system with report by exception capability.

The power distribution system's 28 kV SCADAMATE isolating switches, manufactured by S&C Electric Ltd., can be opened and closed, either locally or remotely. This minimizes cycle time while maximizing safety. The current (CT) and

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potential (PT) transformers are built into the switch, thereby eliminating the need for separate transformers and extra wiring.

To remotely identify the type of current faults that occur, the isolating switches communicate current and voltage data to the pole-mounted RTU's Schneider Electric PowerLogic CM4000 circuit monitor.

"The CM4000 is a universal transducer that can be used to read analog and waveform information of any current or potential transformer," explains Garnish. "And it supports boolean logic for detecting alarm conditions."

Another key feature is the CM4000's ability to easily communicate via Modbus, a protocol that facilitates radio modem communication and that can be added to the SCADA system with a standard serial port.

"Because the CM4000 gives us more accurate diagnostics that immediately identify the type of current faults, our line crew knows what faulty equipment to look for before they're dispatched to site," said Garnish.

The Schneider Electric Concept software's XMIT function block reads the CM4000-generated CT/PT current and voltage data over Modbus, and the Momentum PLC transmits the information via radio modem to the central SCADA system. The PLC continuously polls the CM4000 to determine the status and type of current faults, as well as trip data for maintenance purposes. The PLC reports the alarm via radio to the SCADA control room. "This PLC is ideally suited to this RTU application," says Garnish. "It is an off-the-shelf PLC using the standard Modbus protocol. It provides accurate data, and is compact and cost-effective. Moreover, its modular tophats allow us to select the communications protocol and the input type - analog or digital or both."

Not all RTU locations have a clear line of sight path for radio communication to a radio repeater. To solve this problem, HVDI networks several RTUs over a local cable network installed on their RTU poles. One RTU that has a clear line of sight to a radio repeater becomes the radio link of this wired network to the master SCADA station.

With this intelligent monitoring system in place, HVDI SCADA control room operators can now quickly determine the exact location and cause of faults, allowing the line crew to zero in on a smaller segment of the grid to effect field repairs. Moreover, because the control room operators can remotely open the line switches on either side of the fault, customers outside the fault zone have their power restored very quickly.

"This system has dramatically reduced the length of power interruption to our customers," concludes Garnish. "And, underpinning this success is our ability to build our own RTU boxes with standard, interchangeable Schneider Electric components to maximize flexibility and maintainability."

TRANSFORMER STATIONS 2 AND 3

HVDI's PLC-based SCADA system also controls their transformer substations (TS). The local SCADA integrates the protection, control + metering functions, and communicates via telephone line to the central control room.

One of these substations, TS # 3, has two power transformers each rated at 125

MVA that step down the energy from 230 kV to 28kV. To maximize reliability of cooling, pump and tap changer control, the system contains Quantum PLCs running on Concept software, and two workstations running on a Modbus plus redundant communication network with a self-healing fibre optic ring. One of the workstations communicates via telephone line to the SCADA master.

Future plans include replacing TS # 2's existing proprietary RTU with a similar Quantum/Concept/Modbus system that now controls TS # 3.

"Schneider Electric provides outstanding application engineering expertise and technical support," says Garnish. "This ranges from helping us with our in-house RTU design to solving post-installation issues," says Garnish.

An important feature is the Quantum's input/output and sequence of events recording capability, which time stamps control functions. This is crucial to event tracking which, in turn, aids in root cause analysis of trips. "Quantum PLCs and Concept software are industry standards," concludes Garnish. "They are reliable, easily upgradable and serviceable, and are backed up with excellent tech support and spare parts availability. They are key to helping us deliver electric energy reliably and profitably to our customers."

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