DV2010 Tier 2 Distribution Automation Solution Placed in Service at BC Hydro

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A unique and exciting Distribution Automation (DA) project was successfully commissioned and placed into service on March 31, 2006, reports Helen Iosfin, Distribution Planning Manager of BC Hydro. This project will dramatically improve the reliability of supply to a shopping center in West Vancouver, BC, Canada.

DV2010

The project was initiated as a result of BC Hydro's membership in the Distribution Vision 2010 LLC (DV2010) research consortium. This consortium of progressive utilities formed in 2001 is developing new products that will help member utilities provide options to customers who require superior reliability levels. Ralph Zucker, Director of Asset Investment & Reliability, spearheaded BC Hydro's membership in DV2010 in 2002, together with five other utilities, AEP EmTech, LLC; Alliant Energy Corporation; Oklahoma Gas & Electric; Public Service Electric & Gas; and Wisconsin Energy Corporation. Under the leadership of Mr. Robert Huber, the consortium recently expanded membership size from six to nine utilities, to include Long Island Power Authority (LIPA), Salt River Project (SRP) and FirstEnergy. The goal of the consortium is to lead the development of DA products which can be deployed by member utilities by the year 2010 in order to provide and maximize the benefits of improved reliability to customers. This approach leverages products and shared experience without the overhead burden of intellectual property rights often associated with Research and Development.

The DV2010 advanced DA is currently based on four tiers of automation, including autonomous protection, distributed automation logic, substation local area control, and regional wide area controls. Each tier provides independent automation features. DA systems can be designed with one or all tiers of automation to customize the system performance and optimize customer reliability.

Two DV2010 pilot projects were successfully completed recently. The first pilot, constructed by We Energies in New Berlin, Wisconsin, demonstrates high-speed PeerComm™ communication-based feeder reconfiguration and restoration through a combination of high-speed PeerComm communications and distributed control (Tier 3 and future Tier 4) functionality. The second pilot, constructed by BC Hydro at Vancouver, BC, Canada, demonstrates networked feeders with distributed protection (Tier 2) functionality.

Russ Dobie (Project Manager) and Helen Iosfin (Distribution Planning Manager) inspect a Loop Tap Switch.

BC Hydro Pilot Site Selection

The DV2010 pilot project at BC Hydro is aimed to provide a modular solution for reliable supply service to critical commercial and industrial customer loads in urban and suburban areas, such as shopping centers and industry development zones. It is also aimed to provide one reliablity option to supply future Vancouver 2010 Winter Olympics venues. The shopping center venue was selected for the following reasons: applicability to other shopping center-type loads in urban settings, relatively short feeders and a compact system, manageable fault levels, and demonstrated need for reliability improvement.

The shopping center, with a peak load of 5.0 MVA, was formerly served by two 12.5 kV feeders, with each feeder source supplied from a separate substation. If an outage occurs on either feeder, or if supply is lost at either substation source, a manual switching scheme is used to transfer the load to the remaining feeder. Therefore, each feeder has some dedicated firm reserve capacity, and normally open tie switches are situated at strategic points between the two feeders. Despite these provisions, the shopping center experienced a significant vegetation-related outage in early December 2002 when coincident outages occurred on both supply feeders.

Network Feeder Solutions

The concept demonstrated by the new DV2010 pilot system is "networked feeders."

A conventional distribution system supplies loads radially, and for urban feeders there are a number of normally open tie switches between feeders which provide alternative supply sources when one of the feeder circuit breakers trips, usually due to weather, trees or equipment failure. This results in customer outages of varying duration while the fault is located and isolated.

Manual operation of tie switches may be required to restore supply from adjacent feeders.

Using the new system, the critical customer loads are supplied from two feeders from neighboring substations that are normally tied together continuously. Two pad-mounted Loop Tap Switches (LTSs) and a sophisticated ProView™ software-based protection and PeerComm telecommunications scheme are at the heart of the system. When either of the feeders experiences a fault, fault interrupters inside the LTSs quickly isolate the critical customers from the fault and the load remains continuously supplied from the alternate feeder. Instead of experiencing an outage, the critical customers only experience a brief voltage dip while the fault is cleared in three to five cycles.

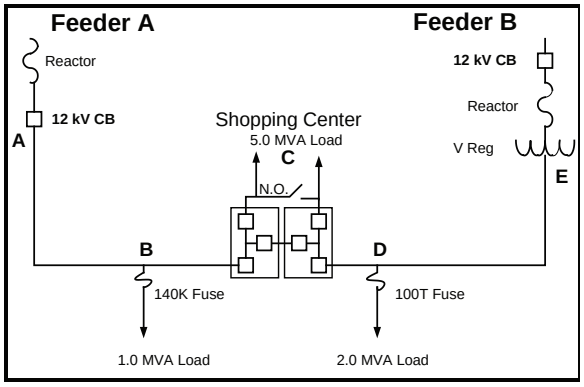

Figure 1. Network feeder supply for the shopping center.

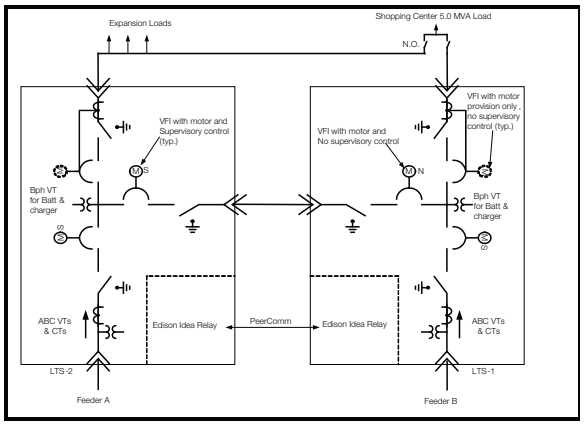

Figure 2. Loop tap switches configuration in BC Hydro DV2010 pilot project.

As the proposed DV2010 networked feeder solution (middle part) shown in **Figure 1**, sufficient spare capacity is retained in the feeders to supply the shopping center load from either feeder. Key components of the protection scheme are feeder relays in the substation feeder Circuit Breaker (CB) positions and two Cooper Power Systems Pad-Mounted Idea Relay-Controlled Vacuum Fault Interrupters (VFI) switchgear assemblies at the shopping center. The switchgear is shown schematically in **Figure 2.** Incoming Vacuum Fault Interrupters (VFI) on each LTS assembly are controlled by Cooper Idea™ relays; these relays use directional elements and PeerComm peer-to-peer communications exchanging critical data such as fault direction, breaker status, permissive trip and trip-blocking information to clear upstream faults on either feeder. The PeerComm communications system exchanging critical system information is able to react to power system disturbances much faster than traditional time overcurrent curves allowing for faster fault isolation, shorter voltage suppression during the fault and faster power restoration to the unfaulted feeder sections. LTS upstream faults are isolated in four to five cycles with the customers only experiencing a partial voltage sag on the networked power system. The Idea relays also provide remote operation, control, indication and telemetry to the Area Control Center. If either LTS is required to be de-energized, load can be safely transferred to the other unit. The LTS design is based on pad-mounted Edison™ Intelligent Switchgear (EIS) units configured with visible break disconnects under oil to provide for cable isolation and worker safety.

Team members celebrate project completion.

Project Milestones

Highlights of the project schedule:

March 2003
Project initiation

April 2003 – April 2004
System study (short circuit, power flow, P&C assessment)

May 2004
Project approval

May 2004 – October 2004
Design and material acquisition

October 2004 – January 2005
Construction

November 2005
Testing and commissioning

March 2006
Completion

The network feeder solution is expected to provide superior supply reliability to this shopping center. Compared to the 3.42 h System Average Interruption Duration Index (SAIDI) for the combined feeders of the shopping center in last four-year average, the SAIDI is anticipated to improve to 0.12 h, while the Average Service Availability Index (ASAI) should improve from 99.94 to 99.99 percent. The experience gained on this project will enable BC Hydro to offer similar levels of service to other commercial customers. ■

Contact Information

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