Sustaining the University of British Columbia's Critical Energy Needs

CASE STUDY

The University of British Columbia (UBC) conducts a myriad of operations involving daily classes, research, housing, athletic facilities, and conferences. There are over 35,000 students, 14,000 employees, and 10,000 on-campus residents. All these areas depend on a reliable source of power.

But uninterrupted electricity is a complex proposition. UBC spends $8.6 million per year on power, making it BC Hydro's largest non-industrial customer. UBC Utilities, a division of UBC, is responsible for maintaining the electricity, heat, water, gas, and sanitary services for the entire campus.

UBC Utilities recently realized that they needed an automated system to manage campus-wide energy use, improve problem response, and increase reliability.

ION®

Application: University

System:
- ***ION 7700 meters***
- ***ION 7330 meters***
- ***ION 7300 meters***
- ***3720 ACM meters***
- ***PEGASYS® software***

Benefits:
- Increased reliability
- Fast problem response
- Improved system design
- Revenue accuracy
- Simple integration
- Expandability

Seeking Solutions

One of UBC's critical energy areas is the TRIUMF physics lab, which houses the world's largest cyclotron for generating subatomic particles. Sensitive equipment runs 24 hours a day year-round, including a proton treatment facility for eye tumors.

If anything is interrupted by a power disturbance, researchers may have to repeat months of costly work. "Our most common power disturbances," explains Utilities Electrical Engineering Assistant, Russell Dobie, "are line-to-ground faults, or short circuits, caused by trees falling onto power lines. The faults produce voltage or current sags," which damage or shut down equipment. The associated computer crashes lead to lost or corrupted data.

"Ground faults also induce faults on adjacent feeders," explains Dobie, "causing tripping of the 12.5 kV distribution feeders in underground ducts and manhole systems." Dobie and his co-workers wanted to improve their responsiveness to these problems by more accurately pinpointing the origins of the faults. This required comprehensive waveform analysis to reveal which feeder tripped first.

They also wanted to design the distribution system to avoid repeat occurrences and operate more efficiently. For this, they needed historical records about the causes, duration, and frequency of outages originating both inside UBC's jurisdiction and outside by BC Hydro.

Russell Dobie, Electrical Engineering Assistant, studies a voltage sag on a PEGASYS workstation.

POWER MEASUREMENT

System Installation

To satisfy those needs, UBC Utilities chose a monitoring solution from Power Measurement, primarily due to its high resolution and sampling rate for waveform recording. It would also modernize their alarm scheme to a more complete set of conditions, and provide the revenue accuracy required to expand metering into individual buildings.

Karim Hirji, Manager, Electrical Utilities, observes, "Initially, we installed 3720 ACMs and now we're introducing the next generation ION 7700s, ION 7300s, and ION 7330s. We currently have around 50 meters, and are installing another 25 per year for the next five years in different campus buildings."

Meters have been placed in the main substation on incoming 69 kV transmission lines, on the two main transformers, and on twelve 12.5 kV distribution feeders. The meters monitor consumption, demand, power quality, billing, and equipment status. Further metering in the smaller unit substations at each campus building is planned.

PEGASYS software manages the networked meters. It provides uninterrupted processing of alarm and control signals, as well as analysis tools. At the main substation, a PEGASYS server and the meters are connected through RS-232 and RS-485 links. From there, the server communicates across campus to three workstations at the UBC Utilities office via Ethernet 10BaseT and RADSL modem links.

Improved Responsiveness and Design

The new power quality analysis tools have helped UBC Utilities identify the sources and most appropriate corrective actions for numerous power disturbances.

Dobie has configured alarms for over- and under-voltages, transformer temperatures and pressures, and cooling fan overloads. The meters are also set up for shadow protection on relays.

If an alarm occurs, the engineers and electricians instantly see it at their desktops, or receive notice of it via pager. They can then make decisions on how to fix the problem in just a few minutes.

In addition, with extensive energy profiling and historic records, the electrical utilities group has been able to design a more robust, efficient power distribution system.

"We can view voltage and current waveforms, study voltage sags and harmonic distortion, capture transients, and plot data on CBEMA curves," says Dobie. Multi-cycle waveform recording is triggered by combinations of setpoints.

Minimum and maximum values are stored to trend system capacities. Real, reactive, and apparent power is monitored, along with per-feeder and campus-wide power factors. The meters also verify loads during feeder transfers and switching.

Stan Takenaka (left), Utilities Electrician, and **Richard Hugli**, Utilities Head Electrician, check installation of meters

Teamwork with BC Hydro

"UBC is the first site in British Columbia where there's a common link between the power provider's information system and the customer's," Dobie remarks. UBC and BC Hydro jointly purchased two ION 7700 revenue meters for the two lines feeding the main substation.

Now, UBC and BC Hydro perform bill verification and power quality analysis with the same data. As a result, UBC was able to save over $70,000 from an outage-related billing error.

Further Applications

In the near future, UBC Utilities and another division, Plant Operations, will collaborate on cost allocation and load shedding as part of their cost control initiatives. Using shared PEGASYS data, Plant Operations will determine which loads may be cycled on and off, and what boundaries can be set for allocating energy costs.

For More Information...

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