

Innovative Load at Halton Hills



The Electricity On-Demand Pilot Project is part of Halton Hills Hydro's Conservation and Demand Management Plan (Photo courtesy of Halton Hills Hydro)

Finding innovative solutions to better manage electricity usage in peak periods is the idea behind a unique load shifting pilot project at Halton Hills Hydro (HHH).

Ontario has experienced record demand in recent years and local distributors are finding that load shifting programs are an effective way to take the strain off the electricity grid in peak periods. At HHH they're finding that load shifting supports a culture of conservation and demand management by providing tangible cost savings and by relieving peaking stress on existing infrastructure.

The concept behind the 'Electricity On-Demand' pilot project is a simple one. Batteries are charged with power, most typically overnight, when electricity is cheaper and more abundant. Then, as prices and demand soar (most often in afternoon peak periods), the batteries release the stored electricity back through the system and to customers.

At the heart of 'The Electricity On-Demand' pilot project are ZEBRA batteries, which employ advanced sodium-nickel-chloride electrochemistry. The Swiss-made batteries are cost-effective, tolerant to, and operate

safely in cold and hot extremes, require no maintenance, and have a working life of 5 to 10 years. Just as importantly, the batteries are environmentally friendly, and do not pose the kind of challenges associated with the storage and recycling of lead-acid batteries (nothing goes to landfill). Impressively, Halton Hills Hydro has set an efficiency threshold of 80% for the system, which is significantly higher than any other energy storage system.

The system for the project was designed and installed by BET Services of Mississauga. The complete pilot installation includes five batteries, five charging units, an inverter, a multiple battery server, power management unit, computer control system, and a connection to the local power grid.

The system is designed to load shift 80 to 120 kWh on a daily basis at a pre-determined time. HHH has purchased five 20 kWh batteries and monitors the daily charging and discharging of the batteries with software created by Angus GeoSolutions of Georgetown. The software is capable of calculating the most cost-efficient times when battery units are charged and discharged.

It's a made in Ontario solution that has a number of potential applications, including among others, providing energy storage for wind generation. The load shifting system would reduce availability restrictions currently associated with wind energy.

The design, review, construction, testing, installation and commissioning for the pilot occurred between January and August 2006, and received final approval from the Electricity Safety Authority (ESA) in August 2006. The project went live at the utility that same month.

HHH believes that everyone can benefit from 'Electricity Storage'.

For customers: significant energy cost savings; stable technology with low maintenance costs; extra power at high-demand periods; and, reduced risk of brown-outs and blackouts

For the government: free up grid electricity during high-demand hours; reduces the need for expansion of power generation and delivery infrastructure; overall drop in electricity prices, due to reduced demand during peak hours; and, a 'Made in Ontario' solution.

For the Environment: Non-polluting, zero emission alternative; and, reduced need for coal-fired generation during peak hours

One of the roadblocks facing the expansion and adoption of the technology is securing a supply of the batteries themselves. Currently, a manufacturer in Switzerland produces only 2,000 ZEBRA batteries each year. Halton Hills Hydro is looking at obtaining licencing to the technology and finding investors to establish a manufacturing arm here in North America.

ON-DEMAND:

Shifting Pilot Project Hydro

Testing the system has found that the CDM benefit of load-shifting approximately 80 kWh of load per weekday off peak has been accomplished. Additionally, efficiency, safety and environmental targets have all been met, or exceeded.

In moving forward, Halton Hills Hydro continues its long-term performance monitoring and its work on the potential for further efficiency improvements. HHH operational staff will receive training on the system and there will be a tie-in to the Independent Electricity System Operator's (IESO) 3-hour ahead price in order to maximize financial returns. Additionally, HHH affiliate, Southwestern Energy Inc., is beginning work on the creation of two marketable systems: a one MWh block for commercial/industrial clients and a 30 to 50 kWh block for residential customers.

The load shifting project is part of Halton Hills Hydro's Conservation and Demand Management (CDM) Plan approved by the Ontario Energy Board (OEB). The program was launched in the summer of 2006. The LDC Tomorrow Fund and the Ontario Power Authority are contributing partners in the pilot.



Halton Hills Hydro has purchased five 20 kWh ZEBRA batteries which are cost-effective, environmentally friendly and require no maintenance. (Photo courtesy of Halton Hills Hydro)



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Zebra Battery Technical Features

The advanced ZEBRA battery technology offers new levels of capability, performance, safety and cost-effectiveness.

Performance, Flexibility and Range

Over a one-hour discharge, the ZEBRA module can deliver double the energy provided by the lead-acid cell. ZEBRA batteries can be rapidly discharged if necessary to meet short duration peaks - a distinct advantage over other battery technologies. The technology can be packaged to accommodate almost any battery application and can be configured to fit into the available battery compartment. To meet specific requirements, modules are available in configurations ranging from 24V to 1000V and 2 to 50 kWh.

Description

Key active ingredients are sodium chloride and nickel. Inside a safe-to-touch vacuum-insulated battery casing, cells of about 100 watt hours have an established operating temperature range of 250 to 350 degrees C, which can be supported by electrical resistance heaters. Shelf life is indefinite, and independent of the state of charge.

General Benefits

ZEBRA battery installations are in the region of 66% lighter than the equivalent energy storage in lead acid batteries. This saving allows designers to utilize additional weight flexibility. ZEBRA modules do not require topping-up, agitation or direct battery cooling, reducing the need for costly ancillary equipment. The sealed 'zero-emission' units are cooled indirectly by battery compartment air. Conditioning charges and discharges are not required. With advantages such as long life, zero battery maintenance and high reliability, ZEBRA can potentially deliver a significant through-life cost effectiveness improvement when compared to lead-acid installations.