



The ZEBRA battery is a high power, high energy battery that is “an extremely efficient device delivering over 90% of the stored energy as output, depending on how the battery is being used,” says Skidmore. Halton Hills Hydro had set a performance threshold of 80% which is significantly higher than any other energy storage system.

The performance of the ZEBRA battery is significant given the advancement of battery technology over the past 20 years. Skidmore reports they have an energy density is 5 times higher than lead acid batteries and have large cells - up to 500Ah. Most surprisingly, they are made primarily of salt and nickel and are environmentally friendly. Other advantages of the Zebra battery are:

- ◆ Cycle life is better than 1000 cycles
- ◆ They are tolerant of short circuits
- ◆ They are safer than Sodium Sulfur cells
- ◆ Low cost of material
- ◆ Typical cell failure is a short circuit which does not cause complete failure of the battery.

Halton Hills Hydro will be conducting a series of tests with the ZEBRA battery as well as exploring the possibility of importing the manufacturing capability. A report will be completed at the end of the research and shared with all LDCs. For more information on the project, visit [www.mearie.ca](http://www.mearie.ca) and click on the LDC Tomorrow Fund link.

#### **ZEBRA BATTERY: TECHNICAL FEATURES**

The advanced ZEBRA battery technology offers new levels of capability, performance, safety and cost-effectiveness. ZEBRA can potentially provide a solution for the many problems currently experienced around the world with lead-acid battery installations.

##### **Performance, flexibility & range**

As an example of the gains to be made, a ZEBRA module of 0.13m<sup>3</sup> and 195kg outperforms a lead-acid cell of 0.19m<sup>3</sup> and 525kg, at all discharge rates. Over a one-hour discharge, the ZEBRA module can deliver double the energy provided by the lead-acid cell. ZEBRA 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 50kWh.

##### **General benefits**

ZEBRA battery installations are in the region of 50% 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.

##### **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 250-350°C, which can be supported by electrical resistance heaters. Shelf life is indefinite, and independent of the state of charge.

##### **Principle**

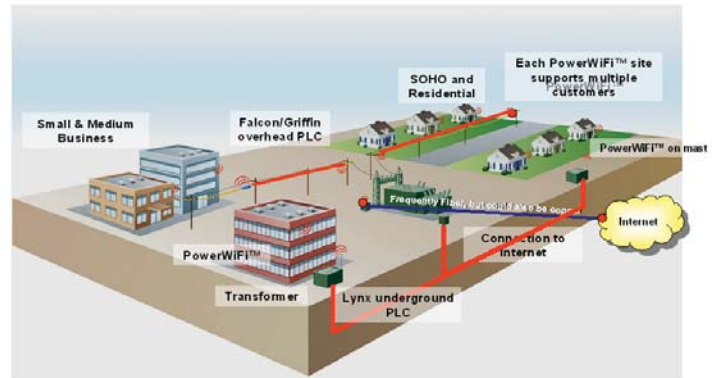
Energy is stored by the transfer of sodium ions through a solid electrolyte of beta-alumina ceramic, leaving a coating of nickel chloride on the nickel powder granules of the positive electrode. A minimum operating temperature is defined by a liquid secondary electrolyte, sodium aluminum tetrachloride. This melts at 155°C, but power output is better at higher temperatures. On cooling to ambient temperature, the cell contents freeze to relatively soft solids, which do not transmit severe mechanical forces to the ceramic electrolyte. There is no restriction on freeze/thaw cycles.

# BroadBand Over Power Line Project - Meter Reading Solutions

Funding Granted to PUC Telecom Inc. (A Subsidiary of PUC Distribution Inc.)

People have been experimenting with building communication networks over power lines since the 1950s. But the technology has never seriously caught on due to its low speed, low functionality and high development cost.

In recent years, new modulation techniques supported by other technological advances have helped “Broadband over Powerline” (BPL) evolve. Most services today are capable of delivering between 512kbps and 3mbps of throughput, which is comparable to most DSL offerings. A few utilities worldwide currently provide high speed internet, Voice over Internet Protocol (VoIP) as well as video capabilities in the range of 12mbps over their power distribution grid, yet overall, this technology has failed to be embraced by the public and private utility companies on a large scale.



(C) 2003 Amperion Inc. CONFIDENTIAL COPYING, TRANSFER AND DISCLOSURE PROHIBITED

PUC Telecom is building an intelligent distribution network by using a combination of wireless technology and existing electrical wires to transmit information from the residential Smart Meter back to the LDC.

As this technology continues to evolve, new opportunities have arisen that were previously not contemplated. In Sault Ste. Marie, PUC Telecom (an affiliate of PUC Distribution Inc.) has embarked on an ambitious project to be the first company in Canada to deploy BPL technology in Canada.

PUC Telecom, along with partners PUC Distribution Inc., Amperion Inc., Elster Canada, Olameter, Lantronix are concentrating their efforts initially at enhancing PUC Distribution’s network management capabilities by establishing an integrated two-way link between their electricity distribution substations and residential Smart Meters.

Martin Wyant, project leader for the program, reported “the advantages of using Broadband over Powerline technology to monitor and record statistical and billing data is considerable given the costs associated with adding fibre wire or allocating resources to retrieve Smart Meter data.”

“Our project has successfully demonstrated utilities can, and perhaps should, consider building a multi-purpose telecommunications network that can support their automatic meter reading requirements in a cost-effective manner,” says Wyant. “The cost-per-potential-customer-served is \$121 for BPL network, compared to \$44,242 for the fibre network. While fibre is an excellent product, it is simply not cost-effective to deploy it to all homes and businesses. In fact, most ‘fibre-to-the-home’ or ‘fibre-to-the-curb’ projects have stalled because average customers are simply unable or unwilling to pay the rates required for telecommunications firms to break even.”

PUC Telecom’s solution is unique in the BPL industry, as other BPL developers have traditionally focused their efforts on developing solutions that provide access to customers by placing coupling devices that connect the medium voltage (MV) and low voltage (LV) networks, which enables customers to connect via a BPL modem that is placed in an electrical outlet in their home or business. While MV/LV solutions work, they have to deal with an extra level of complexity with respect to dealing with line transformers.

The solution that Wyant and his team have adopted combines new powerline technology with wireless technology that acts as the “last-mile” solution for broadband delivery. The table below highlights the process of transmitting and receiving signals between existing network and customer location .

<b>Injectors</b>	Receives wireless signal from fibre node / WAP and launches BPL signal
<b>Repeater</b>	Receives BPL signal, decodes, reconstitutes, sends BPL to next Repeater, also send/receive wireless signal to/from users
<b>Extractor</b>	Receives BPL signal, send/receive wireless signal to/from users

Amperion has developed products that can be used to provide BPL on overhead and underground lines. These systems currently provide up to 24 Mbps of delivered throughput per injection point, depending on the line quality and equipment spacing.

This is a standards-based solution that links the power line network to customers via an 802.11b connection on a public wireless spectrum. PowerWiFi provides a broadband solution that is scalable, economical, and safe and which conforms to globally accepted standards. Because BPL technology shares the same wires and poles used to deliver power, and because BPL networks tend to be developed around substations deployed by the local LDCs, there is a unique opportunity to examine how the introduction of the technology can serve to increase a utility's ability to apply greater predictive management to its grid.



The Griffin 1000 MV delivers speeds of up to 24 Mbps of throughput per MV feeder. This allows backhaul and broadband services to both residential and business customers

Broadband Performance Characteristics in Trials
Very low latency (time loss)
Repeatable over extended distances - single segments up to 2000 feet
Up to 24 Mbps throughput

PUC Telecom's deployment of two BPL spurs in Sault Ste. Marie included an industrial park that houses a variety of light manufacturing, industrial service and warehouse firms. The second spur was deployed in an area that is a mix of commercial, residential, restaurants, box stores, hotels and small shops. It was recommended that 13 commercial and 65 residential buildings have their existing meters exchanged for new Smart Meters.

One of the side benefits of this BPL project has been the development of new relationships with a variety of hardware vendors, software and GIS developers says Wyant. Given these firms are already developing 2nd generation equipment and software, future research and development efforts will be focused on the development and/or deployment of utility applications.

To read PUC Telecom's final report on this project, visit [www.mearie.ca](http://www.mearie.ca) and click on the LDC Tomorrow Fund link.

## LDC TOMORROW FUND

The purpose of the LDC Tomorrow Fund is to fund research projects and finance energy innovation and opportunities for Local Electricity Distribution Companies (LDCs) in Ontario. The Fund is designed to support initiatives that enhance the competitiveness and success of LDCs in Ontario. Funding is in the form of non-repayable grants.

Application for funding is open to LDCs, government agencies, academic institutions and others who work in the electricity industry. The MEARIE Group is appointed by the LDC Tomorrow Fund Trustees to act as Fund Manager. Decisions for approval for funding are made by the trustees.

If you need further information, please visit [www.mearie.ca](http://www.mearie.ca) and click on the Financial Solution link. Alternatively, you can contact John Wong of The MEARIE Group at 905-265-5358 or by email at [jwong@mearie.ca](mailto:jwong@mearie.ca).

