

THE ELECTRICITY exchange



Power to Ontario.
On Demand.

A Grid with Smarts

Electricity industry stakeholders explore potential of the smart grid concept

Ask Don Tench to identify one of the most significant changes underway today in Ontario's electricity sector, and he'll respond unequivocally: consumer engagement.

Tench, Director of Market Evolution for Ontario's Independent Electricity System Operator (IESO), said consumers will play an increasingly important role in the management and operation of Ontario's grid. "Increasing demand-side participation in the market is a priority," he said, "and it is one of the drivers of a smart grid."

In general, the expression "smart grid" refers to a fully integrated system that uses two-way communications to monitor and optimize the operation of the interconnected elements of the power system – from the generator through the transmission and distribution systems to end-use consumers and their appliances. This integration has already begun in Ontario as local distribution companies join the province's Smart Metering Initiative.

The goal of a smart grid is to

use advanced information and communications technologies to increase grid efficiency, reliability and flexibility. As various aspects are implemented, they will support increased market efficiency through customer empowerment; seamless integration of distributed generation; improved asset optimization, which frees up investment capital; value-added energy services offered to consumers; and improved power quality coupled with reduced system congestion, which will satisfy industrial and commercial users.

"The smart grid is a dynamic, fluid concept that's always evolving," said David Collie, President and CEO of Burlington Hydro, a local distribution company (LDC) that has already

made considerable progress towards automating its network. "You can't sit and wait for the final, perfect solution – there isn't one. As a company, we chose instead to embrace these new technologies, and make the most of them."

It's difficult to predict exactly how the electricity grid will look in 20 years, but one thing is certain: the smart grid will bear relatively little resemblance to today's grid. The biggest



Courtesy Hydro One

Hydro One crews inspect a new transmission line, deep beneath the streets of Toronto – one of two major projects that will improve system reliability in the city. (Story, Page 4)

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From the Desk of
Howard Wetston
 Chair of the Ontario Energy Board

Part of a series of commentaries from leaders in Ontario's electricity sector.

A growing concern in the energy industry today is that the current transmission system may not be able to accommodate the electricity load expected to be produced from renewable sources such as wind and hydro.

The Ontario Power Authority (OPA) currently has more than 1,300 MW of generation from renewable sources under contract that are expected to connect at the transmission level. Another 1,275 MW is coming online through the Renewable Energy Standard Offer Program. In response to an Ontario government directive, the OPA has also launched a process to contract an additional 2,000 MW of renewable generation resources to be in service by 2015.

Much of this renewable capacity would operate intermittently and at a relatively low capacity factor, and may be located some distance from the existing transmission grid. As a result, connection costs could be a significant component of the total cost of power from these facilities.

One of the Ontario Energy Board's (OEB) key roles is to identify what regulation and what processes will allow for the development of infrastructure that will facilitate the Government's energy policy preferences – in a cost effective manner. For example, are the appropriate rules in place to attract investment? Does the Board need to change the way we allocate the costs

of those connections? Do the existing codes still work for these types of resources?

One area addressed in our codes is who is responsible for paying for connection of generation. Our current regulatory framework is premised on the idea that competing generators make siting decisions based on a business analysis that includes the costs to connect to the transmission system. Our cost responsibility rules were developed under that presumption and are supposed to enhance the economic efficiency of a competitive electricity system.

However, the nature of the Ontario market has changed. We now have a hybrid market where there is a policy mandate to increase the share of renewable generation. The OPA has identified clusters of renewable generation that require an expansion of the transmission system to access. Under these conditions, the effectiveness of our current connection cost responsibility policies is less clear.

To help answer those questions,

the Board has launched a review of cost responsibility with respect to transmission connections. We will review the current policies and assess the extent which they encourage or frustrate the achievement of objectives related to renewable energy. We will examine our codes and look at how we allocate the wholesale transmission rate costs to the network, transformation and connection pools. We will also look at potential changes to the Transmission System Code and, if necessary, the structure of pooled transmission rates.

The goal of creating cleaner, renewable generation also affects the distribution system. The 1,275 MW of distributed generation under the Renewable Energy Standard Offer Program represents over 300 generation projects that will be connecting directly to distribution systems. That's why we will also be reviewing cost responsibility for distribution connections.

The expansion of renewable generation requires that the OEB, as regulator, take the initiative. Our goal is to ensure that the right regulatory policies are in place at the right time. ●

IESO's Backup Operations Centre Ready on Short Notice

In February, IESO Control Room crews successfully ran the IESO's real time operations for an extended period of time from its new Backup Operations Centre. The centre is also home to the IESO's Emergency Response and Crisis Management Support teams.

The test exercise is an important part of meeting and testing the IESO's obligations under its business continuity plan. It also satisfies the North American Electric



Reliability Corporation's requirement that system operators have a fully functional backup control centre and that it be tested on a regular basis. ●

A GRID WITH SMARTS...*Continued from page 1*

difference lies in new functionalities resulting from improved information and communications technologies. The smart grid is built on a decentralized, digital model. It will have the capacity to identify and repair faults before they cascade. It will allow a broad range of consumers to become fully engaged participants in market operations. And it will have at its core the two-way flow of information among appliances, control devices, LDCs, grid operators and other stakeholders.

As the interface between the retail customer and the technology, LDCs are on the front lines of this evolution. "I fully expect customer satisfaction will increase as the smart grid rolls out," said Norm Fraser, Chief Operating Officer of Hydro Ottawa. "Customers will see improved power quality and reliability, quicker response and restoration, a more responsive utility, and greater opportunity to manage their consumption."

The smart grid will create opportunities for all kinds of businesses and industries, including monitoring and measurement technologies; smart appliances; building automation and controls; broadband communications networks; training to support development of new skills; software applications and tools; and demand response aggregators.

The technological dimension will pose unique challenges, but according to consultant Marion Fraser, President of Toronto-based Fraser & Company, vendors appear willing to work cooperatively. "With so many smart grid options, interoperability of system components is vital," she said. "Some manufacturers were initially resistant to the idea of open systems but they've recognized that the industry as a whole needs a critical mass in order to grow."

Implementing a smart grid in Ontario will pose unique challenges. A steep learning curve is perhaps the biggest challenge, but Fraser contends the electricity sector stands to learn from

other sectors – telecommunications, for instance – that have successfully automated some of their critical processes. Along with purely technological problems like integrating new and old interfaces, implementers may also face financial, regulatory and communications challenges.

Earlier this spring, the IESO announced the formation of the Ontario Smart Grid Forum, a broad-based industry working group focused on developing a vision for a provincial smart grid that will provide consumers with more efficient, responsive and cost-effective electricity service. "Ontario needs to make innovation a watchword in our province's energy sector," said David McFadden, Chair of the Ontario Centres of Excellence Inc., and Chair of the National Energy and Infrastructure Industry Group of Gowling LaFleur Henderson LLP. "If we're successful, it will create exciting business opportunities and jobs for tens of thousands of Ontarians."

From the system and market operator's point of view, these improvements mean improved system reliability and a more efficient market place. A smart grid will also effectively bridge the gap between the wholesale and retail markets, allowing retail consumers to play a key role in the operation of the wholesale market. It would also provide better price signals to all electricity consumers. And better price signals mean better consumption decisions by empowered, informed users.

"The transformation in Ontario's electricity sector, combined with advances in information technology, creates a unique opportunity for the development of a smart grid," said Paul Murphy, President and CEO of the IESO. "This forum builds on the provincial Smart Metering Initiative to install smart meters in all homes and businesses by 2010 and complements the renewal taking place in Ontario's transmission and generation sectors." ●

Putting Technology to Good Use

A Burlington Hydro project has been recognized as the 2008 Electrical Engineering Project of the Year by the Halton Engineering Committee in association with the Ontario Society of Professional Engineers.

The first of its kind in Ontario, this innovative "IntelliTEAM" system comprises advanced switches, radio frequency communications and rapid, fibre-enabled connectivity to automatically restore power in the critical load areas of downtown Burlington.

The Joseph Brant Hospital, the main water and wastewater treatment facilities, the Canadian Coast Guard and other mission-critical services are all served by the new system, which monitors and pre-empts issues, isolates faults and re-routes power – all without human intervention.

Since its introduction three years ago, outages have virtually been eliminated in the Burlington core, and city-wide the system has resulted in a 20 percent improvement in the duration of outages. Overall reliability has improved by 40 percent.



Burlington Hydro's Chief Operating Officer Gerry Smallegange (left) and Chief Operator Ken Miller with the distributor's 2008 Engineering Project of the Year Award.

The \$3-million, multi-year project will be rolled out, feeder by feeder, as more switches are deployed on the city's distribution network. However, operational benefits resulting from avoided labour costs and productivity gains have been pegged at \$400,000 per year.

"We made a strategic decision to invest in automation," said David Collie, President and CEO of Burlington Hydro. "Through systems like this, LDCs can enjoy significant efficiency gains and support their customers' need for a reliable source of electricity." ●

Toronto Transmission & Generation Projects Improve System Reliability

Since 1983, Toronto has had to import all of its electricity along two transmission lines that are frequently operating at close to their maximum limits, especially during the summer months. But now, both Hydro One and Portlands Energy Centre (PEC) have projects that will improve system stability and reliability in time for this year's summer peak demands.

As in any electricity system, the goal is always to maintain and balance the flow of electricity both into and within large urban areas like Toronto. PEC, a combined cycle generating station, and Hydro One's recently constructed underground transmission line link between two downtown transformer stations, will help relieve stresses experienced at local transformer stations brought on by summer peak demands.

PEC, a partnership between Ontario Power Generation and Transcanada Energy, is located in south east Toronto. The plant is expected to operate primarily during peak demand periods with the first 340 megawatts (MW) of its total capacity available by June 1 and the final 210 MW by 2009. It's enough power in total to supply about 500,000 homes on an average day.

"We're very proud to be ready when we promised," said Curtis Mahoney, PEC's General Manager. "Our contractor, SNC, and the many workers on the project all did a fantastic job and since many were from the Toronto area, they took extra pride in building a vital part of the city's future."

PEC will have a "high efficiency factor", meaning that it will maximize its production of electricity from every unit of fuel used. The station's high efficiency factor also translates into lower fuel usage and as a result, lower emissions.

Closer to downtown, Hydro One was engaged in its own project that would improve power delivery reliability to Toronto Hydro. As office workers,

retailers and condo owners went about their daily business, a special boring machine was at work 30 meters below them, carving out a 2.1 kilometre-long stretch of shale bedrock between the St. Lawrence Market and the CBC Building to form a tunnel three metres in diameter.

The tunnel is now home to a new 230 kilovolt transmission circuit that



Courtesy Portlands Energy Centre

Portlands Energy Centre will generate power for Toronto primarily during peak demand periods

joins Hydro One's John and Esplanade transformer stations (TS) giving Toronto Hydro increased operating flexibility and transfer capability. The circuit also provides overload relief for circuits between Hydro One's Leaside and Cherrywood TS. Without this relief, the facilities were expected to become overloaded by this summer.

Laura Formusa, Hydro One's President and CEO, said Hydro One is pleased and satisfied with the way the tunnel was built. "We were able to conduct our work with minimal excavation at street level and with little disturbance or interruption to car and pedestrian traffic," Formusa said.

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What Was Said...

"Running today's digital society through yesterday's grid is like running the Internet through a switchboard."

Energy Future Coalition Website,
Washington, DC

"We must aim to make our manufacturers the most efficient, or else we simply won't have any manufacturing in Ontario"

Adam White, President,
Association of Major Power Consumers
Speech at APPRO Conference

"What is really needed to facilitate distributed generation, or DG, is to convert a system which was designed to distribute power into one which gathers it. Since the distribution system has been developed on the basis of customer density, it should not be surprising that it is deficient in some areas that are relatively rich in DG resources."

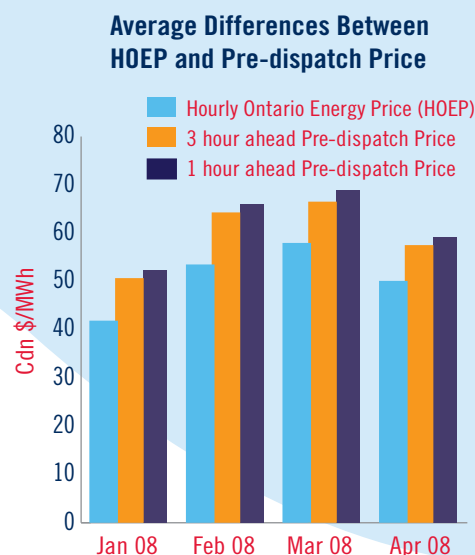
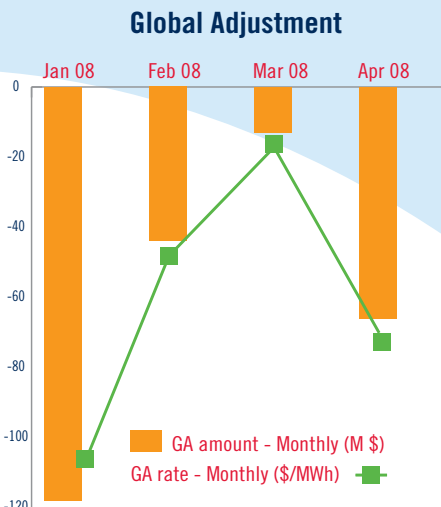
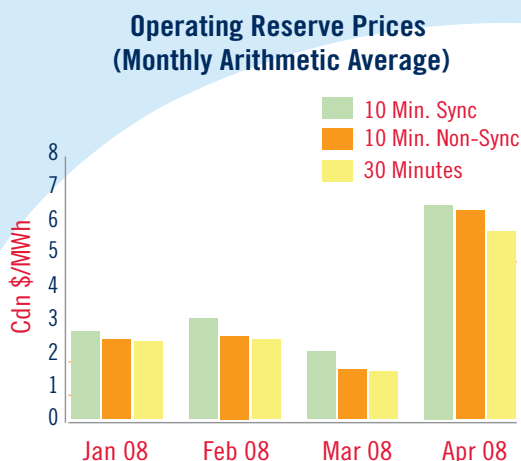
Jan Carr, Chief Executive Officer,
Ontario Power Authority, on distribution
of small-scale local & renewable generation

The Electricity Exchange is a quarterly publication designed to inform IESO customers on topics of broad interest to the electricity industry.

The Electricity Exchange is mailed to subscribers and is also available on the IESO website at www.ieso.ca/ElectricityExchange. Please email your comments, feedback or suggestions to electricity.exchange@ieso.ca or contact the editor, **Doug Barnard at 905-403-6980**.

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The Market at a Glance



Courtesy: Hydro One



Crews remove the boring machine from its exit point at Hydro One's John Street transformer station.

TORONTO TRANSMISSION...

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The boring machine tunneled an average of 12 metres a day (and up to 25) removing a total of 22,000 cubic metres of rock. The machine, with its operating and support crew of 20, was kept on track by laser. At points where the machine had to bend or turn, small shafts were drilled down to the tunnel to transfer above-ground survey points to adjust its course.

Like many complex construction projects, obstacles had to be overcome along the way. The boring machine was required to make two 90 degree

turns during the tunneling operation – a difficult maneuver to accomplish and the machine had to safely bore under both the subway line and the Enwave tunnel below it that brings cooling water up from Lake Ontario. As well, it was very difficult to find room in the city streets to construct suitable entry and exit shafts for the machine.

While the 230kv line was put in service back on December 18, the tunnel is large enough to carry additional cables for any future expansion of the transmission network. Hydro One has scheduled a final inspection for mid-summer. ●

CONSUMER FORUM IESO Hosts Breakfast Series

for Small and Mid-Sized Businesses

Small and mid-sized industrial and commercial consumers with demand greater than 1 MW are invited to provide input on key electricity market initiatives through a Consumer Breakfast Series. The IESO has partnered with several local distribution companies to identify for consumers electricity pricing and reliability issues that may be of interest to them.

Complimentary breakfast events running from 7:30 a.m. to 9:30 a.m. will take place in several communities:

Burlington (June 10, 2008)

Windsor (June 25, 2008)

Whitby (September 16, 2008)

Other events in the series will be scheduled for fall 2008.

Topics to be covered include market pricing, energy efficiency, conservation, demand response and interval metering. ●

To receive further information or register for any of the breakfasts, please e-mail jane.leckey@ieso.ca.

The Consumer Breakfast Series is part of the IESO's Consumer Forum program. Information about the program can be found at: www.ieso.ca/consumerforum.



Stakeholder engagement is a dialogue between stakeholders and the IESO on initiatives that advance the evolution of Ontario's electricity market and system operations.

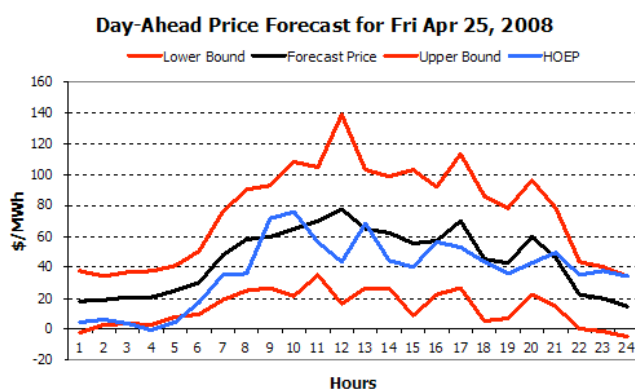
Electricity Market Moves Towards Day-ahead Forecast of Real-time Prices

The IESO's Board of Directors has endorsed recommendations to proceed with the implementation of a day-ahead forecast of real-time prices.

Currently, the IESO operates a real-time market in which electricity prices are determined in five minute intervals. Consumers and producers only learn of real-time price changes as they happen, making it difficult for them to make efficient consumption and production decisions in response to the changes. The volatility of the real-time prices and the lack of advance warning of price changes also create risk for both consumers and producers who want to plan their operations. Advance signals of real-time prices would provide both consumers and small generators with information that would help them manage this risk.

John Witjes, who represents public service consumers on the IESO's Stakeholder Advisory Committee, expressed support for the concept of publishing a day-ahead price forecast of real time prices. "Electricity has a significant impact in the public sectors' overall operating costs," explained Witjes

who is the Engineering Director at Queen's University, responsible for all of the university's energy needs. "Day-ahead forecasting will greatly enhance our ability to effectively manage on-peak costs – the time of the day when most need power."



Upper and lower bounds represent a 95 per cent confidence band around the price forecast. This means there is a 95 percent probability (19 times out of 20) that the Hourly Ontario Energy Price (HOEP) will be between the upper and lower bounds.

In December, the Board endorsed further investigation of the merits of developing a price forecast and a stakeholder engagement plan was initiated for the possible implementation of the day-ahead forecast of real-time prices. The goal was to seek feedback from stakeholders on the expected costs and benefits of a day-ahead forecast

of real-time prices. These topics were discussed with stakeholders at round table meetings in February and March, 2008.

The way in which stakeholders arrived at their endorsement of the day-ahead forecast of real-time prices involved an open dialogue with the IESO. The IESO developed a price forecasting model then presented data from the model in a way they thought would be useful to consumers. Stakeholders saw the model's merits but couldn't really assess how valuable it would be to them based on the data presented. The IESO then came back with more data and comparisons for stakeholders to consider. Once stakeholders reviewed the additional data, they agreed the forecast would be valuable to them.

Since then, progress has been made towards developing a real-time price forecast model which is separate from the IESO's existing pre-dispatch process. The model uses information available day-ahead (at approximately 5:00 pm EST) to provide a forecast for each of the next day's hourly prices. •

EVENTS CALENDAR

June – July 2008

More information on these and other events is available at: www.ieso.ca/events

All events are in the Greater Toronto Area (GTA) unless otherwise noted.

June 4

> Stakeholder Advisory Committee Meeting

June 5

> Market Pricing Working Group

June 10

> IT Standing Committee Meeting

June 10

> Consumer Breakfast Series (Burlington)

June 18

> Intro to Ontario's Physical Market Course

June 19

> Interjurisdictional Energy Trading Course

June 20

> Commercial Reconciliation Course

June 25

> Consumer Breakfast Series (Windsor)

July 16

> Forecasts & Assessments Standing Committee Meeting