2009

ONTARIO MARKET OUTLOOK

ieso

Power to Ontario. On Demand.

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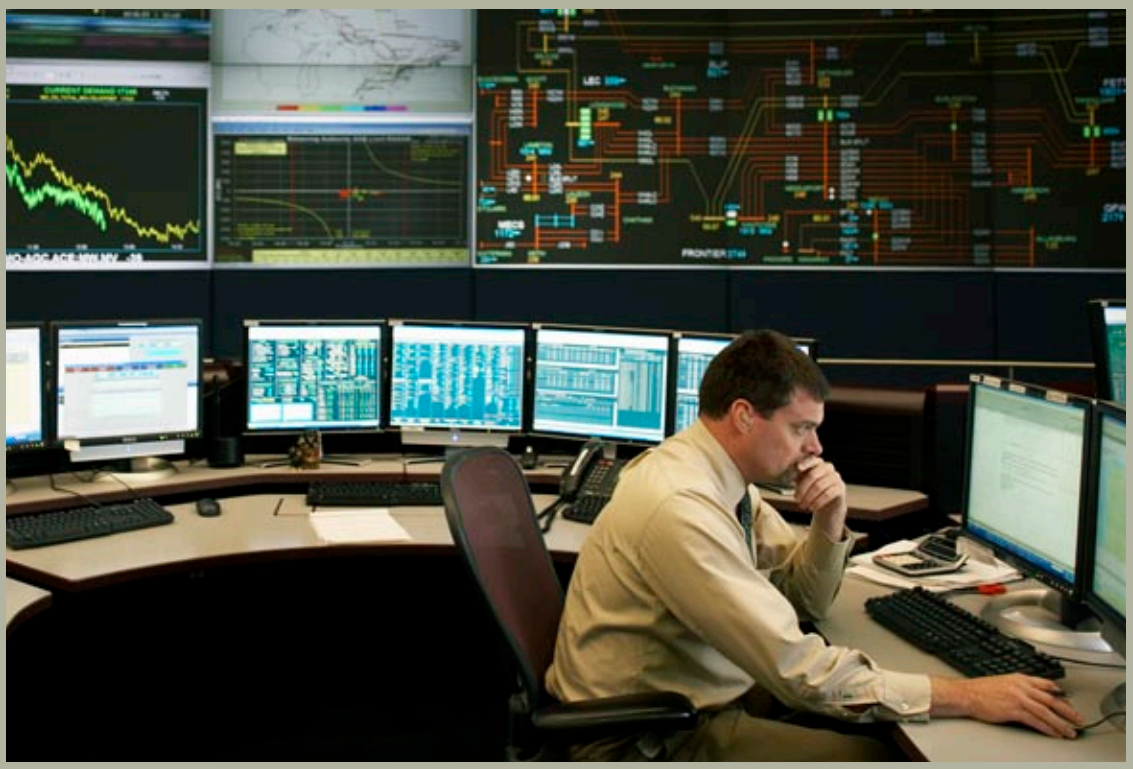


IESO Control Room

The Ontario Market Outlook is produced by the Independent Electricity System Operator (IESO) to report on the current state of Ontario's wholesale electricity market and identify opportunities and challenges for its continued development.

The IESO operates and settles a $10.5 billion market that brings together almost 300 buyers and sellers of electricity. Every five minutes, the IESO balances the supply and demand for electricity across the province and establishes a market clearing price that reflects the cost of providing energy to Ontario consumers.

MESSAGE FROM THE PRESIDENT AND CEO

Paul Murphy

Ontario's electricity system is dynamic, pioneering and in the midst of significant transformation.

New generation and transmission projects are coming online and providing significant improvements to reliability. Demand response and conservation are becoming active forces in the electricity sector, and new opportunities are driving greater participation on almost all consumer levels. Technology is opening doors to more sophisticated options for electricity management.

And other major challenges are being addressed: the phase-out of coal-fired production is on track for completion in 2014; upgrades to the transmission system have been identified; decisions concerning the replacement of retiring nuclear generation capacity are being taken; and new large-scale renewable energy projects are coming online, with more on the way.

Supporting these transformations is the Ontario wholesale electricity market, which brings together supply and demand to guide better energy use and production decisions.

In Ontario, the electricity market provides a broadly-based, impartial and cost effective means to support the operation of our electricity system. It ensures an efficient dispatch of resources; accommodates a diversity of supply sources; and promotes demand response. It provides a yardstick with which to measure the relative value of any decision related to the production or consumption in the electricity sector.

The market has also introduced an unprecedented level of transparency into the day-to-day operations of the electricity sector. Market prices, generator availability and output levels, intertie flows and other market information are available through the click of a mouse. This transparency has increased awareness about the challenges faced by our industry and has enhanced the public accountability of all players in the system to address them.

Evolution, as a process, is about finding ways to overcome or adapt to emerging challenges and seize on opportunities for improved performance. Here, four key challenge areas for future market development and market evolution are identified:

- providing incentives for investment in new generation,
- leveraging consumer buying power through increased integration of the demand side and demand management technologies into the market,
- addressing interjurisdiction seams issues and fostering more efficient regional trade, and
- identifying options to use the market to achieve our environmental objectives.

In the preparation of this report, the IESO commissioned four independently authored companion papers. These papers explore each issue, discussing the extent to which other jurisdictions are dealing with these concerns and what they have done to address them. Highlights from these papers are also included in this OMO.

Market evolution involves determining, with the support of stakeholders, what change is needed. It requires careful thought, broad agreement and time to accommodate change. I hope our discussion here helps further our industry's work to meet the needs of the people and businesses we serve.

I invite you to join us in this important discussion.

Paul Murphy
President and CEO
Independent Electricity System Operator

SECTION ONE: THE ONTARIO EXPERIENCE

Ontario's hybrid market offers the dynamics of competitive pricing with the stability of central procurement.

In Ontario today, the IESO-administered wholesale market operates around the clock, gathering bids and offers to supply and dispatching resources efficiently. Wholesale prices created through the market are then tempered by contract guarantees and fixed prices provided to a majority of generators in the province.

This hybrid structure emerged in response to the challenges facing Ontario's electricity sector: the need to replace aging infrastructure; continued growth in demand; and the overarching drive to increase environmental sustainability.

Over the last couple of years, Ontario's longer-term reliability picture has become clearer. Generation, transmission and demand-side initiatives have been identified and are on track to address immediate areas of concern. The phase-out of coal is scheduled to be complete by 2014, with a clear process underway for ensuring its reliable replacement with cleaner sources of supply.

Already, many of the coal replacement projects contracted are coming into service. In its most recent Ontario Reliability Outlook, the IESO reported that almost 3,300 MW of new gas-fired generation is expected to come online within three years – all procured through the Ontario Power Authority. OPA contracts to procure these capacity resources are – in varying degrees – based on market outcomes.

Throughout this process of renewal, the wholesale market has continued to create price signals that in some way touch all consumers in the province. Increasing numbers of consumers are paying the wholesale price of electricity. And, over the next few years, low-volume consumers will be moving to time-of-use rates, a pricing regime more reflective of market patterns.

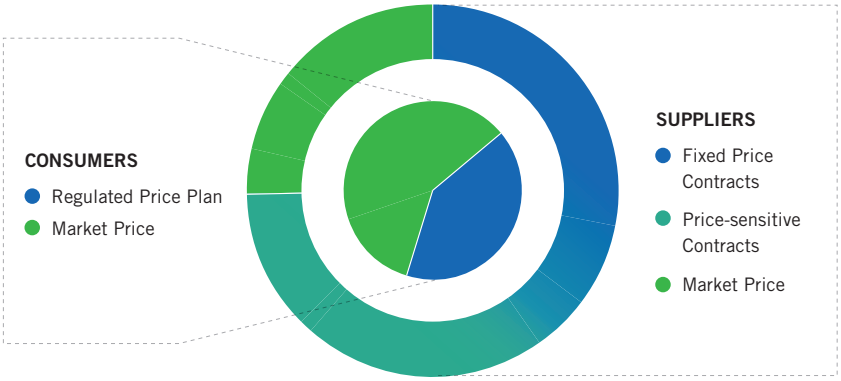
Evolution within a Changing Environment

This process of change will only accelerate. Decisions taken over the last few years are now in the process of being implemented. Change will be sweeping and will take place on many levels, for example:

- The OPA has been tasked with creating a 20 year Integrated Power System Plan that will reshape the generation mix to include greater levels of conservation and renewables.

Figure 1:
Ontario's Hybrid Electricity Market

In the current hybrid structure, market forces play an important role in influencing consumption and production decisions. Almost 60 per cent of load consumed in the province is paid for at the hourly market price, while 60 per cent of electricity is produced in response to some sort of market signal. The price customers pay is determined by the Hourly Ontario Energy Price set in the market which is subsequently adjusted to take into account the various types of contract prices paid to certain generators. Generators offer into the market and are paid the market price. Those with contracts receive fixed prices, monthly revenue guarantees, or guaranteed floor prices.



- By 2010, smart meters will have been installed in every home and small business in the province. Time-of-use pricing plans are being implemented to encourage conservation and demand management efforts.
- Ontario's strong trade relationships with markets in neighbouring jurisdictions continue to create opportunities to look for ways of ensuring that these markets work better together.
- There is a growing awareness of the impact that the electricity industry has on the environment, both in Ontario and around the world. It is expected that over the next several years many jurisdictions, including Ontario, will begin to implement carbon-tax or carbon-trading policies, or perhaps alternative incentive mechanisms to achieve their environmental goals.
- There is also, however, a sense that the electricity sector offers options to reduce the environmental impact of other sectors. Plug-in electric cars show how fuel-switching can address climate change concerns.
- Technological change is opening up new possibilities for consumers – whether they offer opportunities to reduce consumption or even generate electricity in the home through wind turbines or solar panels. These technologies can have a significant and rapid impact on the system affecting reliability, pricing and efficiency.

Ontario's electricity system will be more diverse, comprising many more players with many more sources of supply and demand operating within an increasingly decentralized environment. The benefits of this new approach are many, but the challenges of managing this new paradigm should not be underestimated.

The hybrid model was designed to push the province forward to address its immediate needs. As new procurement, demand response and technological change start to take hold, the hybrid model may need to adapt to better co-ordinate all the divergent elements in an efficient and effective way. More importantly however, it will need to leverage the new opportunities for consumers and buyers to make better choices in their energy production and consumption decisions.

SECTION TWO: WHY MARKETS MATTER

As electricity systems become more diverse and more inclusive, the wholesale spot market becomes a co-ordinating force – using price signals to trigger efficient production and consumption decisions.

Markets will play a critical role in accommodating Ontario's new supply mix. Price signals communicate the supply/demand situation to the entire system in the clearest possible way. In an increasingly diverse and diffuse sector, price provides a common thread that binds all the divergent players together.

As Ontario's electricity market evolves to support industry transformation, it will promote innovation, cost reductions and more efficient price signals.

Across North America, industry analysts have identified some of the most important accomplishments that wholesale markets have achieved over the last decade: [1]

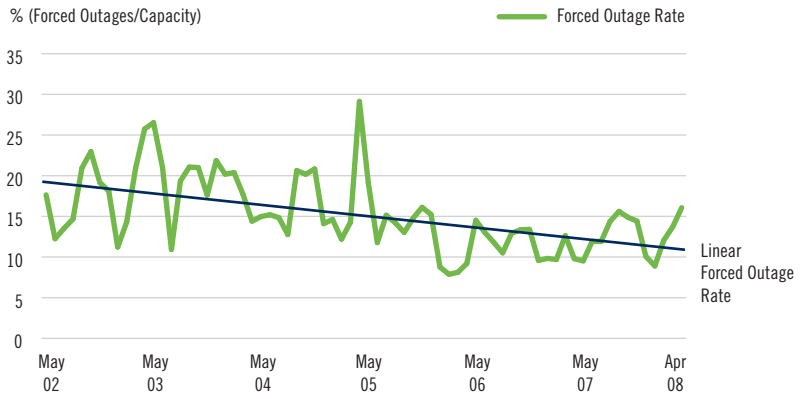
- Wholesale markets for energy and ancillary services (such as operating reserve) are highly transparent, support more efficient generator dispatch, and encourage the development of new generating capacity by independent suppliers.
- For the most part, wholesale market prices reflect the marginal cost of generating electricity, including the costs of congestion and losses. When supply is extremely tight, however, prices are too low to provide an effective signal. Accurate 'scarcity' prices are the foundation for stimulating robust demand-side response programs and for providing attractive incentives to consumers to use electricity wisely.
- Generating unit availability has improved considerably. This increase in availability can put a downward pressure on price and help avoid costly new generation.
- Both non-fuel operating costs and fuel-based operating costs (heat rates) for generators have declined.
- Open access to transmission networks, fair and efficient transmission service prices, market incentives, and coordination agreements between system operators have expanded the scope of interjurisdictional trading. As a result, more consumers have greater access to the least-cost generators available within a broader geographic area.

[1] Conclusions drawn from prepared remarks of MIT Economist Paul Joskow at the FERC Technical Conference on Wholesale Electricity Markets, February 2007.

Figure 2:
Improved Generator Reliability

The Ontario market has contributed to improved generator availability. As reported in the most recent Market Surveillance Panel report, forced outage rates for coal, nuclear and gas facilities have dropped over the last five years. This has had the effect of adding an additional 500 MW of capacity to the system – at no additional cost.

Competition in the marketplace incents generators to provide the maximum possible output to the market by reducing outages.



- Significant progress is being made in deploying well-designed demand-side programs to reduce the need for new generating capacity, to help meet reliability criteria efficiently, and to use the existing fleet of generating plants more efficiently.
- Wholesale markets are well adapted to getting the most out of cap-and-trade programs to control emissions. These markets have also provided outstanding economic and administrative infrastructure to support the renewable energy portfolio standards adopted by many U.S. jurisdictions.

Market Evolution at the IESO

While the benefits of markets are clear, jurisdictions around the world continue to confront the complex and challenging task of improving markets to deliver these benefits. Since its inception, the IESO has engaged market participants and other stakeholders in a program of continuing improvement.

In its first five years of operation, the IESO implemented a number of market improvements such as Multi-Interval Optimization which worked to improve the dispatch process, as well as develop demand response programs such as the Transitional Demand Response Program. These initiatives only represent first steps.

In 2007, the IESO initiated a study to assess how its day-ahead planning mechanisms might be amended to support anticipated changes in Ontario's electricity sector. The assessment addressed both current and future challenges, including: how to most efficiently integrate and optimize Ontario's changing generation fleet; and how to enable opportunities to better manage demand response and utilize smart meter technology. A range of options were put forward such as enhancements to the current Day-Ahead Commitment Process, the implementation of an Energy Forward Market and the development of an unconstrained day-ahead market.

The IESO applied cost-benefit analysis to help identify which of the options would result in the highest net benefits to the province as a whole relative to the current Day-Ahead Commitment Process (DACP). Following extensive consultation with stakeholders, the IESO Board considered the proposed options and recommended that the IESO start implementing the common elements of the three day-ahead mechanisms under consideration.

As a result, by 2010 the IESO will launch an Enhanced Day-Ahead Commitment Process (EDAC) that will schedule generation based on a unit's availability and costs over a 24-hour period, instead of an hour-to-hour basis. To do this, generators will need to submit three-part bids that separate out energy, ramp-up and minimum run-time costs, so that the IESO can better allocate resources throughout the day. This will provide the least-cost outcome for the entire day, rather than for 24 individual hours.

Like the DACP, the EDAC will continue to offer financial commitments to scheduled imports. Unlike the DACP, exports will have the ability to bid and be scheduled in the EDAC. EDAC is one step toward integrating Ontario's new supply mix as it can better accommodate the changing characteristics of a post-coal fleet.

The IESO is also currently looking at enhancing its dispatch methodologies to improve the reliability and capability of existing resources and accommodate the different operating characteristics of new generation coming online. Options under consideration include increasing the frequency of intertie schedules to closer align these transactions with real-time dispatch signals to domestic generators.

Market Evolution: A Checklist

As the IESO and its partners continue to work to improve the function of the market, they need to ensure that market evolution initiatives advance the following priorities:

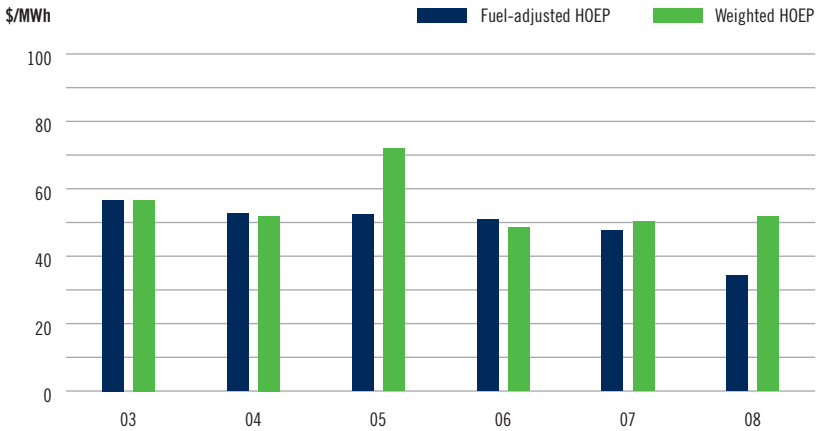
Transparent and predictable price signals: The province needs two sets of price signals: short-term (or real-time) prices; and longer-term forward prices. Real-time price signals that accurately reflect the marginal cost of dispatch (or the marginal value of consumption) drive efficiency and reliability in the short-term. Long-term price signals are needed to encourage efficient investments, both in generation and in conservation/demand management technologies, and to provide resource adequacy.

Increased buyer involvement in the market: Successful markets need active participation from both the demand and supply side of the market. Efficiency in electricity markets will increase when buyers can adequately react to price changes in the market. Allowing buyers the opportunity to react to pricing signals (demand response) in the market can promote efficient long-run investment, diminish price spikes, lower price volatility and reduce customers' bills and environmental footprints. More direct buyer involvement in the market will also provide reliability benefits and reduce the need for the IESO to intervene in the market to manage reliability.

Figure 3:
Fuel-Adjusted Prices Reflect Downward Trend

This figure shows the Hourly Ontario Energy Price compared to the fuel-adjusted wholesale price. Over the years, this adjusted price has trended downwards. This shows that demand is being met at a lower overall cost, producing efficiency gains for the province.

*The IESO constructed its fuel price index using actual production shares from nuclear, coal and gas units and actual uranium, coal and gas prices.



New hedging mechanisms for consumers and suppliers: Electricity market outcomes can vary – which leads to price and quantity risks for customers and suppliers. Both sides need options for managing these risks, should they want them. Typically, these hedging mechanisms involve a portfolio management strategy with various financial and physical instruments.

Additional revenue opportunities outside of the spot market: Relying on the spot market alone is generally viewed as too risky an approach to encourage investments in new supply and conservation and demand management technologies.

The Issues:

The following pages in the OMO contain summaries and analysis of four issues that, from the IESO's perspective, merit further investigation. These summaries are not designed to set out a course of action, but to initiate the discussion of what needs to happen next, now that Ontario's immediate supply needs are being addressed. Copies of the papers can be found on the IESO web site at www.ieso.ca/publications.

The Electricity Market and the Smart Grid

The forces driving market evolution are much the same as those driving the development of smart grids – the need to meet aggressive conservation and demand management targets, integrate more diverse and dispersed generation sources and make more efficient use of electricity infrastructure.

Smart grids use two-way communication systems to monitor and automatically optimize the operation of the elements of the power system – from the generator through the high-voltage network and distribution system, to end-use consumers and their thermostats, appliances and other household devices. They use advanced technologies to integrate transmission and distribution networks as well as accommodate distributed generation and demand response efforts.

Smart grids will accommodate greater levels of local generation and the more effective use of transmission and distribution infrastructure, alleviating in part some congestion issues.

In many ways, smart grids don't make sense without a price signal to drive consumption and production decisions. For example, home automation systems that control residential energy use aren't meaningful without a price signal to respond to. Plug-in cars can only make a positive impact on the system if consumers choose to charge up during lower-priced periods.

In many ways, Ontario is well positioned to become a leader in smart grid technologies. A number of utilities are already employing some of the "self-healing" aspects of smart grids, which can identify and correct faults on the system before they escalate. And as all Ontarians receive smart meters in their homes and move to time-of-use rates, the province will have a solid foundation of consumers who have the technological capability to respond to variable prices, and who are increasingly changing their behaviour to respond to pricing signals.

This need to develop smart grid technologies is being accelerated by the growth in renewable and distributed generation. These facilities are typically smaller – and intermittent – requiring the system operator to gain a better view of generation activity in distribution service areas. This will provide the IESO with a better understanding of the provincial demand/supply situation and contribute to a more accurate price signal.

To this end, the IESO is leading an industry dialogue on a smart grid vision for Ontario. The Ontario Smart Grid Forum will issue a final report by early 2009, identifying benefits that will arise from smart grid investments and what needs to be done to enable implementation.

SECTION THREE: THE CHALLENGES

Generation Investment: Creating Market Incentives

One of the greatest concerns about the current wholesale spot market is its inability to attract new investment without external incentives. Markets around the world are struggling with what is often described as the 'missing money' problem – where the competitive energy and ancillary spot markets do not provide enough revenues to cover both variable and fixed operating costs for some existing generation types and for needed future generation investment.

At its most basic level, the missing money problem arises when market prices are not allowed to rise sufficiently to trigger a consumer response that would define true capacity needs. This typically occurs at times of shortage conditions, when generation supply is scarce and reliability programs or administrative actions are used to balance demand and supply.

These programs or actions either dampen price increases or establish prices administratively via price caps that are well below the true value of the energy to consumers. As a result, they reduce energy market revenues to below what is needed to cover the variable and fixed operating costs of existing generation plants and the investment costs of new ones.

Indeed, a circular chain of events starts to emerge. Reliability programs or administrative actions, while maintaining electricity service can dampen prices, which in turn fails to stimulate a consumer response to reduce energy use. Capacity needs have to be defined by demand, but if demand fails to exercise much influence in the market, the market won't stimulate the required levels of capacity investments.

The unconstrained pricing system in Ontario may also be a contributing factor to the lack of investment in generation in constrained areas of the province. These are areas where generation is regularly 'constrained-on' to run when their offered costs are higher than the uniform Ontario price. While the wholesale market offers 'constrained-on' payments to generators that operate in these circumstances, the payments typically represent the variable operating costs and do not cover the fixed costs of operation.

Market Mechanisms to Stimulate Investment

There are potentially a number of mechanisms to incent generation. In their paper "Market Incentives for Generation Investment," Scott Harvey and Scott Travers explore the various options that wholesale markets can offer in order to ensure sufficient generation to meet long-term demand needs:

Reliability Must Run (RMR) Contracts: Some jurisdictions (including Ontario) have chosen to sign contracts with generators who would otherwise shut down due to low market revenues. These contracts, while maintaining reliability, can act as a disincentive to lower-cost providers who could offer alternatives to displace the incumbent supplier. In practice, RMR contracts only work to retain existing facilities, and not attract new ones.

Capacity Markets: Capacity markets contract capacity needs through an auction process. In these scenarios, Load Serving Entities (LSEs) representing consumers, act as the buyer contracting the capacity – whether it be through new generation or demand response.

Experience in the United States has shown that to work, capacity markets need to reflect locational deficiencies and cover a long enough timeframe in which capacity can enter or exit the market in order to be effective. And while capacity markets can contract capacity, it does not necessarily follow that the contracted generation will be available when it's needed.

A capacity market does not resolve the underlying cause of the missing money problem – that is, dampened prices during shortage conditions. If real-time prices aren't high enough during shortages to cover the marginal costs of a peaking plant that has been contracted through the capacity market, it won't run.

South of the border, a number of independent system operators have been refining capacity market models with the long-term effectiveness of these markets still to be determined.

Long-Term Forward Contracts: Since 2005, the OPA, acting as a surrogate LSE for Ontario in this regard, has been procuring through contracts to ensure capacity growth in the province. These contracts provide top-up payments in excess of the revenues earned in the wholesale spot market.

This approach has been extremely successful in addressing reliability needs while to a large extent, maintaining the integrity of the market-based approach to electricity dispatch. There are, however, a number of potential limitations to this model.

It can be difficult to design completely efficient performance incentives in the contracts to encourage efficient use of generation resources in the real-time markets.

Both capacity markets and long-term forward contracts do not resolve the underlying cause for the lack of investment. If reliability programs or administrative actions continue to dampen prices during shortages, prices will be prevented from rising to sufficient levels to trigger a consumer demand response that would define true capacity needs. As a result, the central procurement agency is required to contract for additional capacity to supply the higher levels of demand.

In addition, because spot energy and ancillary service revenues remain below the level needed to sustain new investment, they are also too low to provide efficient incentives for existing capacity to remain in operation. This can mean additional costs through RMR contracts are required.

Spot Market Scarcity Pricing: One option could be to remove any limits on the market price, or setting limits at a relatively high level, to encourage prices to rise during shortage conditions. The prospect of high prices during capacity shortages stimulates new investment in generation. It also induces consumers who cannot reduce consumption in response to high prices, to enter into forward contracts with existing or new generation to hedge themselves against high prices. This forward contracting

provides a further stimulus for new investment as it allows both the consumers and suppliers to share the risk of the investment. A further advantage of this approach is that it would encourage consumers who are able to reduce consumption in response to high prices to do so, which would reduce the need for investment in peaking capacity.

A limitation of this approach is that it is unclear if the commitment to high prices during shortage conditions will be credible to consumers and investors.

In Ontario, the maximum market clearing price is set at $2,000/MWh, but the unconstrained Hourly Ontario Energy Price (HOEP) has rarely exceeded $500/MWh, suggesting that scarcity pricing alone may not address provincial capacity needs.

Options for Ontario

Steps to evolve the Ontario market would help stimulate new private investment and transfer some of the burden of the investment costs and risks away from the OPA and Ontario ratepayers.

For example, to encourage more investment in constrained areas of the province where investment is needed most, the current uniform pricing system could continue to calculate a uniform price for Ontario consumers but be based on a weighted average of the prices at different locations in the province used for settling generators.

In this model, generators in constrained areas would receive the price that better reflects the capacity costs for that area. Generators in areas where there is an excess of capacity relative to demand would receive a lower price. Under this option, there would also be a reduction in consumer uplift costs as there would be little need for congestion payments to generators. And consumers across Ontario would still pay the same price, no matter where they lived in the province.

As industry stakeholders start to explore a longer-term vision for the management of the electricity system, there are a wide number of options that warrant further consideration. And while the OPA's procurements have been essential to ensure reliability, increasing the market's ability to attract generation investment will be a critical component of an efficient and sustainable electricity sector for the future.

Day-Ahead Forecasts

Consumers and producers of electricity have long been looking for a forecast of electricity prices to help them in making strategic, informed decisions about the next day's operations. In July 2008, the IESO launched a day-ahead price forecast (DAPF).

The DAPF model developed by the IESO uses public information available a day ahead (at approximately 5:00 p.m.) to provide a forecast for the next day's hourly prices, Monday through Friday. This model produces upper and lower price thresholds, which provide a 95 per cent confidence band around the forecast. This is in contrast to the pre-dispatch price which provides a day-ahead view of what the price would be based on offers currently available and which is updated hourly.

Already, analysis of data collected in the first three months of the forecast indicates that the DAPF performed better than the day-ahead pre-dispatch price for the same period. The difference between the DAPF and the real-time price was found to be smaller than the difference between the pre-dispatch price and real-time price.

The DAPF is available on the IESO website at www.ieso.ca/dapf and is published Sunday through Thursday.

Demand Response: Rebalancing the Market

Consider an electricity market where consumers can influence the price much in the same way as generators can. Demand response can deliver obvious environmental and capacity benefits – as well as highly-efficient markets where consumers are no longer just price-takers.

A wholesale electricity market provides the foundation for consumer empowerment. It incents consumers to leverage their buying power to choose when and at what cost they use electricity. In effect, it promotes the development of a vibrant retail sector that organizes energy users to become more effective energy consumers – through demand response.

Demand response can take a number of forms. As a market participant, load has the option of offering Operating Reserve or participating in the real-time market by cutting production when they feel it's no longer economic to continue to consume. There are also a number of demand response programs offered by the IESO and the OPA for individual organizations or aggregators that provide both capacity and/or energy payments for load reductions.

The advantages of integrating consumers more closely into the market are well documented:

Maximizing Capacity: In Ontario, peak demand for electricity is rising faster than total energy consumption. This growth in peak demand necessitates the construction of costly expanded capacity which would be used for only a few hours a year.

Enhanced Reliability: Demand response provides another tool for system operators to maintain reliability during periods of short supply.

Environmental Benefits: Demand response reduces the environmental footprint of the electricity infrastructure.

Price Pressure: Various ISOs throughout North America have experienced scenarios where even small demand reductions of two to five per cent can reduce prices by a half or more.

On a fundamental level, however, demand response has the potential to improve the efficiency of electricity markets. Broader integration of demand in the market would allow customers to more directly communicate the value of electricity to the market and the market scheduling process. This would enable more efficient scheduling of generation resources in the short term, and more efficient investment decisions over the longer term. Markets around the world are evolving to foster greater demand-side participation, envisioning a world where consumers can impact the price, in the same way as generators do today.

Ontario is well on the path to creating a more dynamic consumer base that is sensitive to fluctuating prices. Already, more than half the load within the province is paying the hourly variable price – with all businesses with consumption of more than 250,000 kWh a year paying market rates. This consumer base will grow in 2009 as public sector institutions such as universities, municipalities and hospitals make the transition to market rates.

And while the overall impact of market prices is mitigated in part by the Global Adjustment, they still incent load-shifting. Consumers still need to determine at which point they are better to curtail consumption – and the market price helps them do that.

The impact of variable rates will be felt across all consumer groups with the installation of smart meters and the subsequent implementation of time-of-use prices to all homes and small businesses.

While consumers in Ontario are increasingly exposed to market prices, they don't necessarily have the information, tools, incentives or the interest to take advantage of them.

Demand response technology incorporates the energy monitors, control systems and other high-tech tools that communicate price and demand information and provide the controls that allow consumers to manage their energy use accordingly. These kinds of upfront investments provide the means with which to create a robust demand response sector.

Institutional issues also affect demand-side participation. With the introduction of the OPA's DR3 program in summer 2008, aggregation is just starting to take shape in the Ontario market. There is a long way to go before aggregation becomes an option for a broader range of consumers – issues around security of data, verification and even the length of settlement periods stand in the way. Given the growing interest – and capabilities – to aggregate greater numbers of consumers, movement on these issues will likely accelerate.

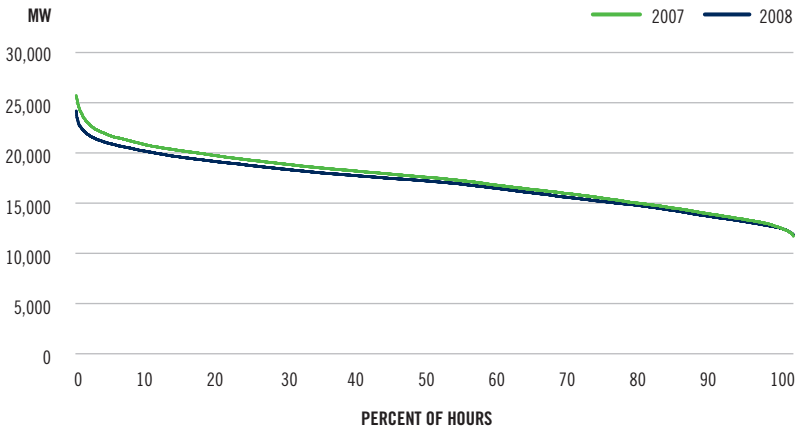
Building the Demand Side of the Market

In his report, "Demand Response in Ontario: Exploring the Issues," Professor Ian Rowlands explores the ways in which markets can address some of these economic, institutional and technical barriers to demand response.

- **Implement Real-Time Pricing/Critical Peak Pricing**. Time-of-use pricing alone doesn't reflect the day-to-day volatility of the market necessary to create a more robust demand response. Critical Peak Pricing, which has been tested in Ontario as part of the smart meter initiative, creates a particularly powerful trigger for demand response efforts.
- **Make new technologies available to help consumers better control their energy use.** For example, real-time energy monitors have the potential to boost residential consumer conservation and load-shifting by showing instantaneously how demand response can pay off.
- **Explore regulatory changes that promote demand response**. Efforts are underway in many jurisdictions to remove key barriers to distribution companies from promoting demand reductions by requiring them in future rate cases to decouple distribution revenue from sales.

Figure 4:
Load Duration Curve

In order to ensure reliability, Ontario requires enough capacity to meet the highest levels of demand. In 2007 however, demand only exceeded 24,000 MW for 62 hours. In 2008, demand reached this same level for just four hours. Flattening this curve would work to create a more competitive and efficient market.



- **Develop smart grid strategies.** Incorporating real-time high-speed communications systems in the management of the power grid turns the definition of traditional electricity system operations upside down. In this paradigm, any consumer with an electric car could instantly become a supplier during peak periods, just by plugging their car battery into the system and injecting power. (see page 8 for more on smart grids).

Options for Ontario

While the dispatch and engagement of generation in the system is well-coordinated, the emerging presence of demand response will require a significant level of adaptation – in price transparency, dispatch, technology and education.

Price transparency: While the real-time market price is easily accessed and a day-ahead price forecast can assist consumers in their consumption decisions, the total costs paid by consumers, including the adjustments made to the market price to incorporate additional costs generated through OPA contracts are not as transparent.

The Global Adjustment which accounts for the additional payments to contracted generators and demand response program participants, Non-Utility Generators, and Ontario Power Generation's baseload generators is issued once a month; however, more granular data would support consumers in making real-time consumption decisions. One option could be the development of a Global Adjustment forecast that could be factored into real-time pricing. This information would help large-volume consumers better evaluate their options when comparing market pricing and their own electricity contracts.

Dispatch signals: Demand response programs have grown considerably over the last two years. From emergency load reduction programs that help the system operator manage reliability when the system is strained, to peaksaver programs that cycle down residential air conditioners, these initiatives work to engage consumers of all types to provide valuable load-shifting and conservation to reduce peak demand.

In order to achieve peak reduction goals, the triggers for a demand response program need to be co-ordinated through a market approach in order to generate the maximum benefits for the consumer (in terms of savings and/or payments) and for the system (increased reliability). The IESO is collaborating with its partners to develop demand response triggers with maximum effect.

Technology and education: Technological advances such as advanced metering technology, residential solar panels and smart meters bring system management to the doorstep of every electricity consumer in Ontario. The provincial government's smart metering initiative and the transition to time-of-use pricing represents a revolution in the way most Ontarians will think about their electricity use – giving them the tools and information to better manage their consumption.

Yet technology on its own won't deliver its promised benefits without a broad understanding of how to use the technologies and the potential they offer. A full engagement of the demand side of the market will require sustained outreach to demonstrate to consumers how their energy use can impact the entire system.

The level of consumer outreach by partners in the industry is at unprecedented levels – communicating the importance of using electricity wisely. For example, the IESO, in partnership with the Ontario Government and local distribution companies, developed a pilot communications program to assist in the transition to time-of-use rates in Newmarket and Milton. These types of efforts are critical for the future of demand response in Ontario.

Interjurisdictional Trade: Smoothing out the Seams

Regional trade – imports and exports between jurisdictions – strengthens reliability and promotes lower average production with associated lower energy costs for consumers.

Trade between jurisdictions is an integral part of electricity markets. Importers and exporters are very sensitive to hourly price differences between jurisdictions and are quick to respond to changes in supply and demand conditions in Ontario. Their responsiveness promotes both the reliable operation of the electricity grid and a more efficient use of the province's generation assets. Imports and exports also provide a stabilizing influence on Ontario's electricity prices.

During the hot summers of 2002 and 2005, imports played an integral role in maintaining reliability when local supplies were inadequate to meet demand. Tight conditions in Ontario resulted in higher prices which attracted imports from neighbouring jurisdictions. Imports helped Ontario achieve a level of reliability that would have otherwise required a significantly greater investment by the province in peaking generation capacity.

In 2006 and 2007, Ontario's overall supply balance improved and it went from being a net importer of energy to a net exporter of energy. In many hours, when the province's baseload generation capacity was greater than its energy demand, low energy prices resulted in exports that promoted a more efficient and reliable utilization of the baseload generation assets. These exports prevented the costly shut-downs of nuclear assets. In addition, Ontario baseload generators were able to export their surplus capacity and earn additional revenue which contributed to the recovery of their fixed costs.

A Catalogue of Seams Issues

Ontario is part of a regional interconnected system that also includes Quebec, Manitoba, 27 U.S. states and the District of Columbia. Trade flows between these control areas are typically fixed one hour in advance of real-time at hourly increments unlike domestic generation dispatches which are dispatched on a five-minute basis. As scheduling processes differ across jurisdictions, inefficiencies can emerge.

'Seams' issues, or technical, operational and/or procedural obstacles to trade across jurisdictional boundaries, are a topic of constant investigation amongst independent system operators (ISO) throughout North America.

These challenges include:

- **Unco-ordinated scheduling between jurisdictions:** Each jurisdiction schedules trades independently of the other jurisdictions. As a result, a trader that wants to buy electricity in one jurisdiction and sell it in another must assure that it schedules the energy in both markets. It is possible that a trader can successfully purchase energy in one market but fail to get that energy scheduled into another market to sell it. This creates risks for the trader with strong price sensitivities. This additional risk may prevent some trades from occurring, trades that with co-ordinated scheduling could be more efficient.
- **Inaccurate pricing at market boundaries, coupled with a lack of price transparency:** In Ontario, prices at the boundaries reflect unconstrained flows, despite real-time constraints at the interties. The Market Surveillance Panel has shown that this disconnect means that the prices that are paid to export power to a neighbouring jurisdiction often do not reflect the actual cost to supply the export.

- **Transmission tariffs:** Traders incur transmission usage charges with each jurisdiction using different mechanisms to determine them; this can distort the relative cost of trading between jurisdictions.
- **Differing pricing and pricing methods:** New York offers a capacity market, while Ontario does not. If a generator in Ontario is competing with a generator in New York to supply a customer in Michigan, they are not competing on quite the same basis. These kinds of differences in how suppliers generate revenue can affect the competitive dynamics in a trade region and distort the efficient trade flows.
- **Currency, tax and regulatory differences:** A different playing field creates inequities that make some markets more attractive to trading than others.
- **Complexity and lack of transparency:** As ISOs have tried to tune their rules and processes to better address seams issues, they have typically added complexity to the design of their markets. Further, as different markets use different rules to solve the same issue, this complexity is compounded and makes it more difficult for traders to understand the market and interpret the signals of the markets.

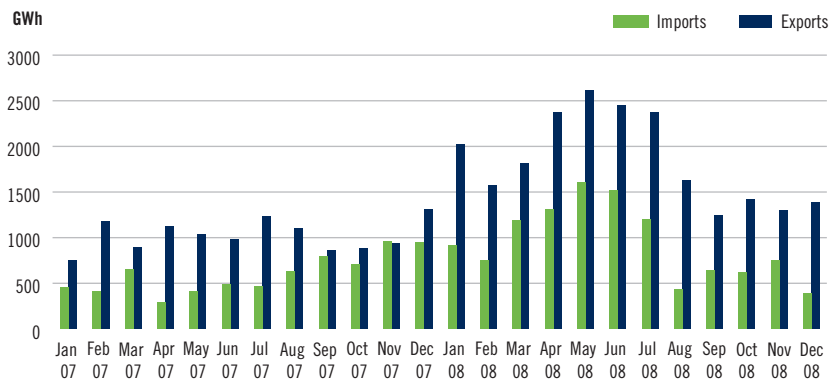
Seams issues in Ontario have been perhaps more acute than elsewhere due to the lack of a day-ahead market or comparable day-ahead mechanism. This was particularly evident in the hot summer of 2005 when many neighbouring jurisdictions were faced with tight supply conditions and at times had to cut exports scheduled in their market in real-time to maintain reliability. When choosing which exports to cut, some jurisdictions would first cut exports that did not have a corresponding day-ahead schedule as an import in one of the neighbour markets. Since Ontario did not have a day-ahead market nor did it give importers a firm commitment a day in advance, imports into Ontario from these jurisdictions were the first to be cut. As a result, the IESO market was experiencing import failures as high 1,005 MW within an hour, creating significant reliability concerns.

In 2006, the IESO adopted a Day-Ahead Commitment Process (DACP) that schedules imports a day ahead, providing more certainty that the suppliers will deliver in real-time. It also gives importers more time to navigate adjacent markets and coordinate with neighbouring jurisdictions. The DACP provides a guarantee that imports will not risk being settled at a loss if their real-time price-based revenues turn out to be less than their day-ahead as-offered costs.

The IESO is currently developing an Enhanced Day-Ahead Commitment Process that will also accommodate the scheduling of exports a day ahead.

Figure 5:
Imports and Exports

In 2006, the IESO became a net exporter of energy, in part a reflection of increasing capacity and lower domestic demand.



Approaches

In the OMO discussion paper "Regional Electricity Trading: Opportunities and Challenges for Ontario," the authors (Brendan Ring, Larry Ruff and Usman Hannan) outline a number of approaches to addressing seams issues. These approaches run the gamut from creating a single, co-ordinated trading market to improved planning and co-ordination on an ad-hoc basis.

1. **Expand the Scope of Markets:** Control areas in the trade region would merge and be subjected to a uniform set of operational and pricing rules with integrated dispatch. Expanded markets increase trade, with maximum efficiency gains to be had through a high-level system operator managing constraints on the interties. Jurisdictional system operators would be left to control their specific areas. This is a radical solution as it would require consensus from all jurisdictions. The authors cite as examples the Irish market which crosses political boundaries, comprising both Northern Ireland and the Republic of Ireland and the Australian wholesale market which comprises all but two states and includes the island of Tasmania.

2. **A Parallel Integrated Market:** Such a market would determine prices and schedules across interconnected markets, based on bid and offer data within those markets. Imports and exports would still be settled within the local markets, but the regional information would be available to market participants so that they could more efficiently structure their bids.

3. **Intra-Hour Transactions or (Virtual Regional Dispatch):** Local ISOs would monitor price differences along the interties and adjust power flows accordingly, allowing a low-cost market to provide more energy to a higher-cost market. Such an approach has the potential to improve dispatch efficiency. However, it is an imperfect approach as it still fails to take into account the broader flow dynamic between markets.

4. **Standard Market Design:** Standardizing the design of the markets in the trade region could remove differences that distort the competitive dynamics in the region. While this would improve trade efficiency, it would be costly. Furthermore, boundaries would still exist between standard markets and so some seams issues would remain. There are also unique aspects of each jurisdiction which may necessitate different design approaches.

5. **Removing the Cost of Trade and Regulatory Barriers:** A standardized transmission charging regime, as well as mechanisms to manage the risks associated with currency and taxes would reduce some of the price distortion associated with trading across jurisdictions.

6. **Improved Information, Planning and Co-ordination:** Ad-hoc solutions could be developed on a bilateral or multilateral basis to squeeze out new trade opportunities through existing structures. This option would require significant information sharing and more established forms of collaboration.

With these approaches come a myriad of political, regulatory and economic implications, notwithstanding the sheer scale of work required to implement the more ambitious options.

Options for Ontario

There are several stakeholder initiatives either currently underway or contemplated for the near term that could address some of the seams issues. These include the following.

- The Market Pricing Working Group is exploring the possibility of having import and export transactions settled on the basis of the intertie zonal price rather than HOEP. It is expected that such treatment would reduce some of the export trading distortions identified by the Market Surveillance Panel.
- The IESO has initiated a dialogue with key stakeholders to discuss both current and future dispatch issues. One potential consideration being discussed is the possibility of scheduling imports and exports on a 15-minute basis rather than an hourly basis.
- As part of the 2007 Hydro One Networks rates review, the Ontario Energy Board charged the IESO with pursuing and negotiating acceptable reciprocal arrangements with neighbouring jurisdictions with the intention to eliminate the Export Transmission Service (ETS) tariff and study an appropriate ETS tariff. The IESO is to report back to the Board its findings by June 1, 2009.

Environmental Considerations: Greening the Market

There will be a drastic reduction in emissions from Ontario's electricity sector with the phase out of coal. Yet this does not eliminate the need for the electricity sector to continue to strive to reduce its environmental footprint beyond 2014.

Ontario has made a commitment to eliminate coal-fired generation by 2014. This decision will have a significant impact on reducing the pollution emitted by Ontario's electricity sector. Recently, following a directive from the Ministry of Energy and Infrastructure, Ontario Power Generation (OPG) has devised a strategy to reduce its air emissions, with a target of 19.6 megatonnes in 2009 and 15.6 megatonnes in 2010.

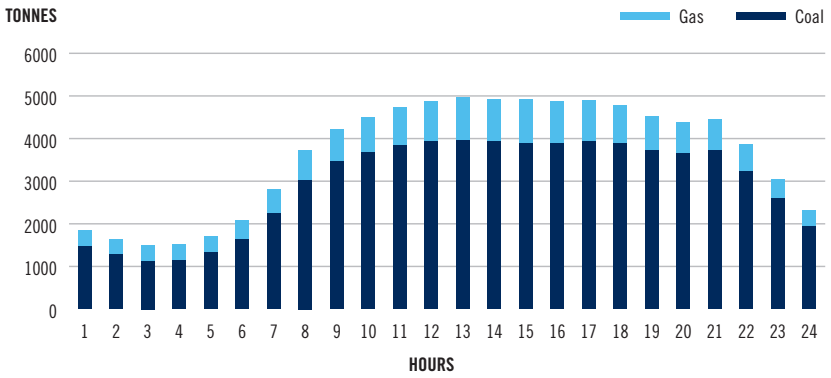
What remains is a discussion around what other options should be pursued in the electricity sector to further environmental objectives, which currently – and will continue to – include:

- Consumers need the information and the tools to exercise their choice for clean energy;
- Regulators and policy makers, including the IESO, need to ensure that the environment is a key consideration when making changes to the market;
- Renewable generation must continue to have the opportunity to contribute to the supply mix and compete with other types of generation; and
- Oversight and regulation will need to continue in the areas of supply mix, setting air standards and establishing the policies and programs to meet them.

In this scenario, the market can continue to offer options to achieve these objectives. It can provide a foundation for future environmental initiatives by doing what it does best – providing transparent and accessible information about the energy sector's activities and empowering the players to act on that information.

Figure 6:
Emissions Tracking

Coal-fired generation is responsible for the vast majority of emissions by Ontario's electricity sector. The phase-out of coal generation in the province will be the equivalent of taking seven million cars off the road. Figure 6 shows average CO_2 emissions during a summer weekday in 2008.



Indeed, many of the issues already raised in the Ontario Market Outlook have intrinsically positive environmental implications, for example:

Demand Response: promotes more judicious use of electricity supplies by empowering the demand side of the market, resulting in lower peaks and increased levels of conservation.

Incentives to Generation Investment: Proper pricing of environmental aspects in the market can promote investment in technologies with environmental advantages.

Interjurisdictional Trading: Once again, using environmental tracking or standardized systems of tagging across the broader trade region would facilitate a coordinated surcharging of less environmentally-friendly technologies or pricing that accounts for environmental attributes.

Overall, markets provide a framework for aggressive and meaningful ways to meet environmental targets. It is now generally accepted that the only way in which the international community will limit the rise in carbon emissions is if governments, industry and individuals take into account the costs associated with the emissions for which they are responsible. Carbon prices, in effect, turn the process of lowering carbon emissions into a business imperative. These prices can be established directly either using a carbon tax, or by setting a quantity limit and letting companies trade the resulting emission allowances.

Electricity markets provide price signals and price transparency. They also have existing processes and infrastructure to support carbon trading programs. ISOs/RTOs have developed expertise in data tracking and implementing market approaches for the sale of electricity. Policy makers can also leverage the expertise of these ISOs/RTOs to design and implement the appropriate carbon pricing mechanisms.

Environmental Tracking

In Ontario, in order to manage the environmental impacts of energy – both domestic and imported – on the air shed there must first be a sound method to measure what those are. Environmental tracking, or implementing a credible, standardized system to tag energy by generation type and its environmental attributes, would enable a multitude of activities.

Programs to limit emissions such as caps, taxes and trading would be supported by sound environmental tracking. Armed with this information, the sector can contemplate other ways to support its environmental goals.

Western Climate Initiative

In September of 2008, the Western Climate Initiative (WCI) announced its design recommendations for a regional cap and trade program. A more detailed workplan will be released in 2009.

This multi-sector program is a comprehensive carbon-reduction strategy designed to lower the cost of achieving greenhouse gas emission reductions and promote the development of a clean-energy economy. Mandatory and enforceable limits on emissions will be set for each partner region, with local entities designated to hold the allowances and enforce compliance. These allowances could then be purchased through auction, bought and sold in secondary markets or could be banked for future use.

It is proposed that the cap and trade program be phased in, with an initial year of emissions reporting taking place in 2011, and actual trading to commence in 2012. Electricity generation will be among the first sector to participate in the trading. The strength of the WCI approach is that it creates additional incentives beyond the current contract framework for energy production from renewable sources. It attaches an additional value to renewable energy that is not currently recognized.

For copies of the OMO discussion papers, please visit the IESO web site at www.ieso.ca/publications

Power to Ontario. On Demand.

Independent Electricity System Operator
655 Bay Street, Suite 410
P.O. Box 1
Toronto, Ontario M5G 2K4

www.ieso.ca

Phone: 905.403.6900
Toll-free: 1.888.448.7777
Fax: 905.403.6921
E-mail: customer.relations@ieso.ca