THE ONTARIO RELIABILITY OUTLOOK

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ieso
Power to Ontario. On Demand.

ABOVE: The IESO provides assessments of the reliability of Ontario's electricity system through its 18-Month Outlook and Ontario Reliability Outlook.

COVER: Ontario's electricity system is monitored 24 hours a day, seven days a week from the IESO control room.

CONTENTS

The reliable supply of electricity is a cornerstone of Ontario's economy.

EXECUTIVE SUMMARY

Ontario's longer-term reliability picture is positive. Generation, transmission and demand-side initiatives necessary to maintain future reliability have been identified and address the areas of concern highlighted by the Independent Electricity System Operator (IESO) in previous issues of the Ontario Reliability Outlook (ORO). Going forward, the focus will need to shift to ensuring that these projects are implemented in time to meet needs as well as addressing the integration and operational challenges of a changing generation mix.

Delays to the scheduled in-service dates for Phase One of the Goreway Generating Station in the Greater Toronto Area (GTA) and unplanned outages at the Pickering Nuclear Station resulted in more than 1,500 megawatts (MW) of supply being unavailable over the summer of 2007. Despite this, there was no major disruption in service as the IESO continued to reliably operate the power system with strong performance from generation and transmission facilities, increased demand management efforts and more moderate weather.

Through regular issues of the ORO, the IESO reports on progress of the inter-related generation, transmission and conservation projects underway to meet future reliability requirements. Future Outlooks will also track the progress of the various projects identified in the Ontario Power Authority's (OPA) Integrated Power System Plan (IPSP) and will assess their impact on future reliability.

New Supply Being Introduced

Almost 4,000 MW of new gas-fired supply is expected to come into service over the next three years. This includes more than 1,000 MW at the Greenfield Energy Centre near Sarnia, 540 MW from the Portlands Energy Centre in Toronto, 860 MW from the Sithe Goreway facility in Brampton and 600 MW from the Halton

Hills Generating Station northeast of Milton. Approximately 630 MW of grid-connected wind power is also expected to come into service before the end of 2008.

Four hundred and seventy five megawatts of wind resources are currently installed in the province and wind power is expected to take on an increasingly significant presence in Ontario's supply mix over the next decade. This could present future operating challenges given the intermittent nature of wind and the fact that the highest levels of wind output do not often correlate with demand peaks. Since the publication of the last ORO, the IESO's Wind Integration Standing Committee has developed recommendations and implemented decisions on operational and forecasting issues aimed at reducing barriers to the successful integration of wind. Through collaboration, the IESO anticipates that wind-related issues will be resolved in a timely manner.

Operability of the Power System

The IESO previously identified operability as the key parameter for future supply mix. Since that time, the OPA has submitted the IPSP to the Ontario Energy Board (OEB) for approval.

Ontario's future supply includes increased amounts of less flexible generation, resources that cannot as easily be ramped up to meet increasing load or reduced as demand drops off. Flexibility is particularly important in the morning hours when significant increases in demand occur and in the late evening hours when demand quickly drops off.

In addition to wind and solar generation, resources include new and refurbished nuclear, co-generation, and combined cycle gas generators that have high minimum loading points.

The IESO discussed operability matters with the OPA throughout the preparation of the IPSP. Following the publication of that plan, the IESO is undertaking an operability review, simulating future operating conditions under the proposed supply portfolio to assess whether there is enough operating flexibility to meet the ever-changing demand for electricity and continue to operate the electricity system reliably. The IESO will release the findings of the study during the first part of 2008.

Transmission

Timely implementation of proposed transmission facilities remains a key component to addressing future reliability needs and a major risk to the successful implementation of the IPSP.

Over the next decade transmission enhancements, some of which are major and extensive, must be implemented in:

- Southwestern Ontario to deliver additional nuclear and wind supply from the Bruce area
- Northern Ontario (including the north-south transmission corridor) to enable the expansion of hydroelectric capability and wind projects
- The GTA in order to improve reliability of supply to Toronto – Canada's largest city
- York Region, Kitchener-Waterloo-Cambridge-Guelph and Windsor-Essex to enhance the adequacy of local load supply
- South-central Ontario, to reconfigure the Cherrywood and Claireville stations to improve reliability at these critical facilities

The development of new transmission facilities in southwestern Ontario remains a high priority. These new facilities are needed to deliver the planned and future increases from the expected wind developments in that area and the expanded capacity of the Bruce nuclear station resulting from planned refurbishments. Reinforcements of existing facilities can increase transfer capability out of the Bruce nuclear complex in the short term but the new 500 kilovolt (kV) Bruce to Milton line proposed by Hydro One is needed to deliver the full capability of the Bruce refurbishment and the expected new wind resources.

Until new transmission facilities are operable in the identified areas, the IESO will need to operate existing facilities near their maximum capabilities, with little margin for unexpected events and requiring complex arrangements and procedures to do routine maintenance on critical facilities. A number of local transmission initiatives are also needed to maintain local reliability in areas throughout Ontario.

Transmission enhancements are required to enable the replacement of the coal-fired stations with cleaner resources.

Conservation and Demand Management

Addressing Ontario's supply challenge over the next 20 years will not only require new generation and transmission facilities, but also achieving substantial load reduction through electricity conservation.

The Ontario government has set aggressive load reduction targets for the near future, targeting a 2,700 MW reduction in peak demand by 2010. While conservation measures are a cleaner way to help address Ontario's supply needs, achieving this target may require fundamental changes in the way electricity is used.

For residential and small business consumers, Ontario's Smart Metering Initiative can help enhance the reliability of the power system by providing customers with the tools they need to help shift their electricity use to off-peak hours. This shift in use would reduce the need for expensive forms of generation to meet demand. The initiative calls for smart meters to be installed in homes and small businesses throughout the province by 2010.

As conservation and demand response measures become more prominent, the IESO will closely monitor their contribution during peak demand in order to reliably and efficiently schedule resources and operate the system.

Approvals Process

The filing of the IPSP with the OEB represented a major milestone in the program to address Ontario's supply needs over the next two decades. However, as has been identified in previous Outlooks, the IESO remains concerned about the uncertainty around the length of approvals process, which presents risks to the timely implementation of the planned generation and transmission projects.

Substantial work is underway by a number of stakeholders, including the provincial government, to address the inefficiencies in the current approvals process. Given the risks to reliability, there is an urgent need to implement a comprehensive strategy for streamlining the relevant regulatory approvals process.

Approvals process improvements should ensure appropriate public review of infrastructure proposals, while reducing the redundancy of the existing processes and ensuring reasonable and defined timelines to allow the projects to be implemented when needed.

The Portlands Energy Centre in Toronto is currently under construction.

SUPPLY

Progress continues to be made in the development of new resources to meet Ontario's electricity supply needs. Delays in new generation projects have underscored the importance of managing the integration of the new generation fleet into the system with sufficient reserve margins to ensure reliability.

Immediate Reliability Concerns for the Greater Toronto Area

Reliability in the GTA during the summer of 2007 was a concern as a result of lower than anticipated supply availability. The delay of Phase One of the Goreway Generating Station and unplanned outages at the Pickering Nuclear Station contributed to a total reduction of more than 1,500 MW in generation capacity. Reliability throughout the period was maintained by strong performance from generation and transmission facilities as well as lower overall demand resulting from increased demand management efforts and more moderate weather.

Looking ahead to the summer of 2008, the timely completion of Phase One of the Portlands Energy Centre, as well as the continued availability of local autotransformers and generation from the Pickering nuclear units will be essential to maintaining reliability in the GTA.

Generation Expansion

By the end of 2008, a cluster of new generation projects representing approximately 2,800 MW is scheduled to come online to address Ontario's supply needs – and ultimately help replace coal-fired plants. Accordingly, Ontario should be better positioned for the 2009 to 2011 summer peaks with additional levels of reserve margins to accommodate any unanticipated delays or changes in the schedule for new generation.

In the fourth quarter of 2008, both phases of the Goreway Generating Station and the Greenfield Energy Centre near Sarnia are scheduled for completion. The Greenfield Energy Centre is the largest generation project procured under the OPA's request for proposals (RFP) process, and construction is progressing well.

Between 2008 and the end of 2010, more than 6,000 MW of new capacity is expected to come into service, including: the refurbishment of two units at Bruce A, providing 1,500 MW in baseload supply, more than 400 MW in new co-generation facilities, and approximately 630 MW in wind capacity. Besides the Greenfield Energy Centre and the Goreway Station, the natural gas-fired production slated to come into service by 2010 includes the St. Clair Energy Centre, the Portlands Energy Centre and the Halton Hills Generating Station.

Completing the Coal Replacement

Supply is expected to continue to increase as new procurement initiatives are launched. This November, the OPA announced two new RFPs to secure approximately 1,000 MW of additional clean energy and renewable generation capacity: 500 MW of combined heat and power projects contributing to a Ministry-directed target of 1,000 MW; and an additional 500 MW of renewable generation projects larger than 10 MW that will be procured as part of the first phase of the 2,000 MW Renewable Energy Supply III RFP.

The map on page 12 shows areas where generation and transmission infrastructure developments are needed to enhance the adequacy of local load supply. These targets include: 350 MW in northern York Region, 450 MW in the Cambridge area, 850 MW in southwest GTA and 550 MW in the GTA.

In addition to resolving local area concerns, the development of new generation is critical in preparation for the replacement of the remaining coal-fired facilities in the province. As set out in an Ontario Regulation under the Environmental Protection Act, the last of Ontario's fleet of coal-fired generating plants must cease burning coal by the end of 2014.

The OPA's IPSP has set out a series of milestones for the replacement of coal-fired generation based on a combination of conservation and supply-side initiatives. The IESO will be actively monitoring progress on all aspects of the coal replacement program to ensure that reliability can be maintained.

Meeting Ontario's Power Needs Until 2027

This past summer, the OPA filed its 20-year IPSP with the OEB for approval. In addition to the completion of the retirement of coal, the plan proposes the actions needed to meet the province's electricity needs until 2027:

- reduce Ontario demand through conservation measures
- replace coal-fired generation with natural gas and renewable resources
- restore the nuclear power capability through the refurbishment of existing facilities or the construction of new ones
- implement transmission improvements needed to support the new generation portfolio and increase system efficiency

The supply mix outlined in the plan represents an unprecedented transformation in Ontario's electricity infrastructure. The IESO has provided the OPA with analytical support in the development of the plan that included transmission and supply adequacy analysis.

A key concern for the IESO is the impact of the declining percentage of dispatchable generation in the supply mix. As the chart on page 6 demonstrates, the amount of manoeuvrable – or load-following – generation will decrease by almost nine per cent by 2027. The flexibility provided by dispatchable generation is critical for responding to fluctuations in consumer demand and supply from intermittent resources, or unanticipated losses in generation. The IESO is analysing how it would manage this supply mix in a variety of critical day scenarios when balancing supply and demand would be most challenging and will report on its findings during the first part of 2008.

Other Supply Issues:

Peaking Generation

One of the challenges in maintaining reliability is addressing the extreme peaks in demand that often occur during sustained hot weather – particularly in areas with local congestion concerns and/or limited local generation. In 2006, for example, 2,000 MW of capacity was needed just to meet 32 hours of unusually high demand.

To ensure that adequate capacity will be available to meet these requirements, the OPA has announced its intention to contract additional peaking gas-fired generation – particularly in areas that are currently experiencing local constraints. The IESO is working with the OPA to define the operability requirements of this new generation and to assess the needs, if any, to integrate them into the market.

In addition to peaking generation, the OPA is developing a demand response program (DR III) that is designed to reduce demand during the most valuable 100 to 200 hours of the year. More information on DR III can be found in the Conservation and Demand Management section.

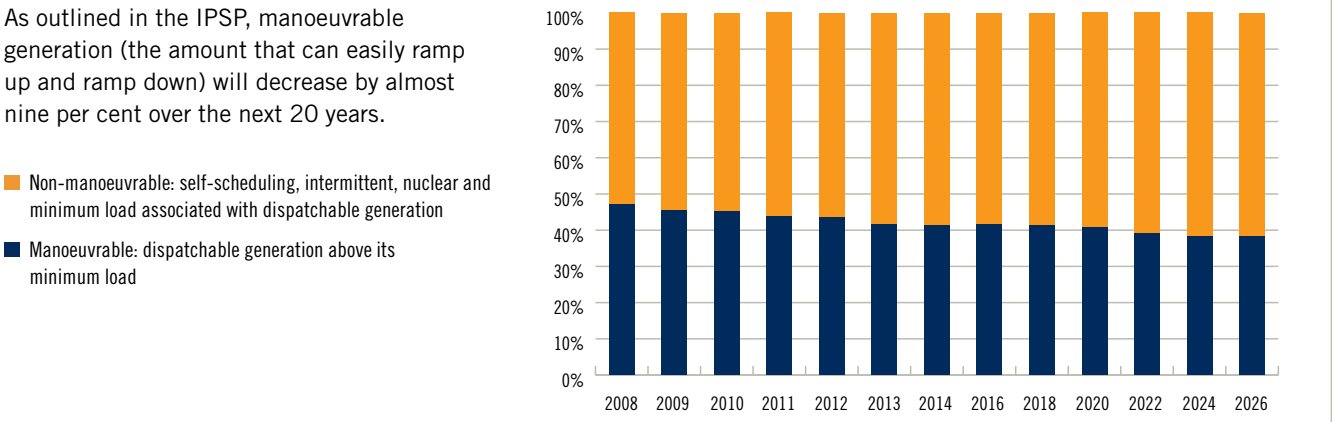
Distributed Generation

In future, distributed generation – small scale production connected to local distribution systems – will also be taking on a more prominent role in ensuring security of supply. This type of generation uses technologies such as combined heat and power, solar, wind, biomass and gas. As it is located close to load centres, distributed generation typically does not require expensive transmission infrastructure.

The OPA, the OEB, local distribution companies (LDC) and transmitters are working together to address barriers to the development of these projects. For its part, the IESO will be consulting with stakeholders on how to integrate these generators into the operation of the IESO-controlled grid as well as the market. The objective will be to ensure that the generation can connect reliably through transformation facilities, meet expected performance standards and has adequate visibility to the IESO and LDCs.

Generation Mix Breakdown

As outlined in the IPSP, manoeuvrable generation (the amount that can easily ramp up and ramp down) will decrease by almost nine per cent over the next 20 years.



Wind

Approximately 475 MW of wind-powered generation is currently installed at five locations around the province, with several more projects to be completed within the next couple of years. By the end of 2009, approximately 630 MW of new wind power facilities will be connected to the IESO-controlled grid while an additional 460 MW of embedded wind power generation is scheduled to come in service through the OPA's Renewable Energy Standard Offer Program.

Wind power has demonstrated a positive contribution to overall energy supply, despite its intermittent operation. In fact, the annual wind contribution increased from 410 gigawatt hours (GWh) in 2006 to more than 920 GWh in the first 11 months of 2007. The annual energy capacity factor for these wind farms for the period March 2006 through October 2007 averaged 27 per cent, with monthly average capacity factors reaching a monthly low of 14 per cent and a high of 43 per cent.

The intermittent nature of wind power will continue to pose challenges to the reliability of the system. The IESO is proactively engaged in addressing wind-power related operational and forecasting challenges through enhanced stakeholdering activities. Since the last publication of the ORO, the IESO's Wind Integration Standing Committee has developed recommendations and implemented decisions on priority operational and forecasting issues. Additionally, it is exploring a new wind forecasting method and associated capacity contribution for use in resource adequacy models that support future Outlooks.

One Project, One Process

Proponents of new generation and transmission projects continue to express concerns about potential delays created by the approvals processes that could delay successful implementation of the necessary infrastructure changes needed to ensure reliability.

Earlier this year, the Ontario Waterpower Association (OWA) undertook a benchmarking study focused on the requirements and timelines for new water power developments:

- The existing process is not well documented, leaving project proponents unsure of what permits are required, and by whom.
- Working with regulatory agencies often entails long waits, during which time proponents are poorly informed about the status of their project.
- Multiple government and regulatory agencies administer permits, and specific requirements are occasionally contradictory.
- Regulatory agencies often have localized fields of vision and influence, which results in a failure to identify "big picture" opportunities for streamlining.
- Requirements for environmental assessments and supporting studies are not identified in advance but, instead, build throughout the approvals process.
- There is no fixed and timely endpoint to the public consultation process.

Pointing to the fact that construction of a new hydroelectric facility can require dozens of separate permits, the study suggests that proponents could get new projects off the ground more quickly while still providing a venue for stakeholder concerns if there were an integrated and time-bound approach to regulation and approvals. The OWA has also recently filed a Class Environmental Assessment for water power projects designed, in part, to help achieve this objective.

TABLE 1: GENERATION PROJECTS PLANNED OR UNDERWAY IN ONTARIO

SOURCE OF PROJECT	GENERATION PROJECTS PLANNED OR UNDERWAY	INSTALLED CAPACITY (MW)	PLANNED IN-SERVICE DATES
RENEWABLE GENERATION			
Renewables I RFP – Hydroelectric generation	Umbata Falls Hydroelectric Project	23	Q2 2008
Renewables II RFP – Wind generation	Wolfe Island Wind Project	198*	Q4 2008
	Enbridge Ontario Wind Farm (formerly Leader A & B Wind Power Project)	200*	Q4 2008
	Kingsbridge II Wind Power Project	159*	Under Review
	Kruger Energy Port Alma Wind Power Project	101*	Q4 2008
	Melancthon II Wind Project	132*	Q4 2008
Renewables II RFP – Hydroelectric generation	Island Falls Hydroelectric Project	20	Q4 2009
Hydroelectric generation under development with Ontario Power Generation	Little Long, Harmon, Kipling and Smoky Falls	450	Unit in-service dates ranging from 2009 to 2012
	Lower Sturgeon, Sandy Falls and Wawaitin	16	
	Mattagami Lake Dam	5	
GAS-FIRED GENERATION			
Clean Energy Supply RFP	Greenfield Energy Centre	1,005	Q4 2008
	Greenfield South Power Plant	280	Under Review
	St. Clair Energy Centre	570	Q1 2009
Government directive for Central Toronto	Portlands Energy Centre – Phase I Simple Cycle	250	Q2 2008
	Portlands Energy Centre – Phase II Combined Cycle	288	Q2 2009
Government directive for Western GTA	Goreway Station	860	Q4 2008
GTA West RFP	Halton Hills Generating Station	600	Q2 2010
COMBINED HEAT AND POWER			
Combined Heat and Power (CHP) RFP	Great Northern Tri-Gen Facility	12	Q1 2008
	Durham College District Energy Project	2	Q2 2008
	Countryside London Cogeneration Facility	12	Q2 2008
	Warden Energy Centre	5	Q2 2008
	Algoma Energy Cogeneration Facility	63	Q2 2009
	East Windsor Cogeneration Centre	84	Q3 2009
	Thorold Cogeneration Project	236	Q2 2010
NUCLEAR GENERATION			
Bruce Power Nuclear Generating Station Refurbishment	Bruce A, Unit 2 Refurbishment	750	Q2 2009
	Bruce A, Unit 1 Refurbishment	750	Q4 2009
Nuclear capacity expansion	Additional capacity	27	Q4 2007
		27	Q4 2008
		28	Q3 2009
		28	Q3 2009
		28	Q4 2009
		28	Q1 2010

* For capacity planning purposes, wind generation has a dependable capacity contribution of 10 per cent of the listed installed capacity of the project.

TABLE 2: CONSERVATION AND DEMAND MANAGEMENT LOAD REDUCTION TARGETS (MW)

	2008	2009	2010	2011	2012	2013	2014
Conservation & Demand Response	428	697	706	727	748	769	790
Energy Efficiency	393	592	843	1080	1317	1554	1791
Fuel Switching	–	–	72	89	107	124	141
Self-Generation	38	86	151	159	167	174	182
Total	859	1375	1772	2055	2339	2621	2904

Development in high-growth areas such as Waterloo adds pressure to the existing transmission infrastructure.

TRANSMISSION

The IESO's call for transmission system enhancements throughout the province has been reflected in the IPSP, where the OPA has outlined the steps required to strengthen the transmission system, support the supply mix goals, enable the development and integration of renewable energy resources, and promote system efficiency.

Considerable analysis has been done by the IESO of the transmission improvements necessary for system reliability. This analysis shows that until new transmission infrastructure is in place, the IESO would be required to operate existing facilities near their maximum capabilities, with little margin for unexpected events. Routine maintenance on critical facilities could also be compromised by the lack of sufficient spare transmission capacity.

In particular, the IESO assessments indicate that transmission enhancements, some of which are extensive, should be undertaken in several regions over the next 10 years. The following areas have been identified as priorities:

- Southwestern Ontario, to deliver additional nuclear and wind supply from the Bruce area
- Northern Ontario, including the north-south transmission corridor, to enable the expansion of hydroelectric and wind projects
- The GTA, to improve reliability of supply
- York Region, Kitchener-Waterloo-Cambridge-Guelph and Windsor-Essex, to enhance the adequacy of local load supply
- South-central Ontario, to reconfigure the Cherrywood and Claireville stations to improve reliability at these critical facilities

Hydro One has begun work on all major transmission projects required in the short term and most are already under construction. In addition to new load and generation connection points, these projects include transformation capacity enhancements and voltage control resources that will provide relief to existing transformer stations and will improve supply to various load areas.

For a more complete listing of the transmission requirements throughout the province and the projects proposed to meet them, please see Table 3 on page 13.

Southwestern Ontario

Planned refurbishments at the Bruce nuclear station and proposed wind farm developments in southwestern Ontario will result in increased generation capacity from that region. As a result, enhancing the transmission system in the region continues to be a high priority. Some near-term reinforcements include the uprating of the Hanover to Orangeville 230 kV circuits, and the installation of additional voltage support facilities at various local transmission stations, both of which will increase the transfer capability out of Bruce in the near term. Hydro One has also started the proceedings on a new 500 kV double-circuit line from Bruce to Milton. Once complete, this new line will provide the required transmission capability to deliver the full benefits of the Bruce refurbishment project and the development of new renewable resources in the area.

In addition to the near-term reinforcements described above, interim measures are being explored to reduce potential congestion costs until the Bruce to Milton line is placed in service. These measures include the use of generation rejection of Bruce units and wind turbines, the additional installation of voltage support facilities and restricting further generation development in the Bruce area. In the longer term, construction of the new line remains a priority in order for Ontario to meet its reliability needs.

Transmission enhancements are also required to enable the replacement of Ontario's coal-fired stations with cleaner resources and to reduce the congestion resulting from the recent addition of clean resources and committed combined heat and power projects. Planned upgrades in the Windsor-Essex area will address the adequacy of load supply to Windsor, Kingsville and Leamington and will reduce restrictions imposed on local generation facilities. Construction of additional voltage support facilities in southwestern Ontario will become necessary as the Nanticoke coal-fired station is phased out.

Integration of new generation in western Ontario may compound potential transmission congestion between Sarnia and London and may have an impact on the amount of imports that can be relied upon from Michigan. The shutdown of the Lambton station will alleviate this congestion, and therefore no transmission uprates are proposed to mitigate this potential situation.

The growing load in a number of cities in southwestern Ontario has created an urgent need for additional transmission capacity. In particular, extensive transmission additions are underway in the Kitchener-Waterloo-Cambridge area and planned for the Woodstock area. These enhancements will result in improved security of load supply and provide room for future load growth.

The existing transmission infrastructure can accommodate some development of generation from renewable resources, but reinforcements are required to facilitate the planned development of wind generation on parts of Lake Huron and Lake Erie.

Northern Ontario and North – South Transmission

Transmission enhancements are needed to relieve congestion in northern Ontario and allow the delivery of planned generation to consumers in the south. Hydro One has proposed a number of improvements: installation of series capacitors at Nobel Transmission Station (TS); addition of voltage support facilities at Porcupine TS and Kirkland Lake TS; enhancement of the Sudbury west transmission capability by adding voltage support facilities at Mississagi TS and Algoma TS; and improvement of the functionality of the Mississagi east special protection system.

Furthermore, Hydro One continues to investigate the effectiveness of combined voltage support facilities at Hanmer and Essa. These upgrades will help maximize the benefits from the expansion of four existing hydroelectric stations on the Mattagami River and other committed renewable energy developments in northeastern Ontario.

To facilitate the upcoming retirement of Atikokan and Thunder Bay stations in northwestern Ontario, several transmission enhancements are being implemented or explored. In the near term, additional reactive power facilities are required to help maintain adequate voltage and transfer capability in the area. Some of this work is already underway at Lakehead TS and will soon include Fort Frances TS and Dryden TS. Longer-term options depend on the load growth in the area and may require construction of a new 230 kV line between Lakehead TS and Birch TS.

Toronto and Surrounding Area (GTA)

Construction of the Portlands Energy Centre should help alleviate concerns identified in late 2005 about supply to central Toronto. Phase One, representing 250 MW, is expected to be in service by summer of 2008.

The central Toronto area is currently served through two transmission paths. Given the potential risks in the Toronto area, the IESO plans to develop a standard for supply to urban centres. This will be done in conjunction with stakeholders.

Transformer station capacity in northern York Region has already been exceeded. Rapidly growing loads around Newmarket and Aurora have demonstrated an immediate need for a new transformer station in the area. Although Hydro One had planned to have a new transformer station in service by late 2008, delays in the environmental assessment process have forced them to defer project completion to summer 2009. Demand management programs and load transfers to other distribution companies have helped the region meet existing electricity needs. However, longer-term transmission constraints are still expected to occur as early as 2011. These constraints could be alleviated by the local generation proposed in the IPSP, but work to procure this generation should begin soon.

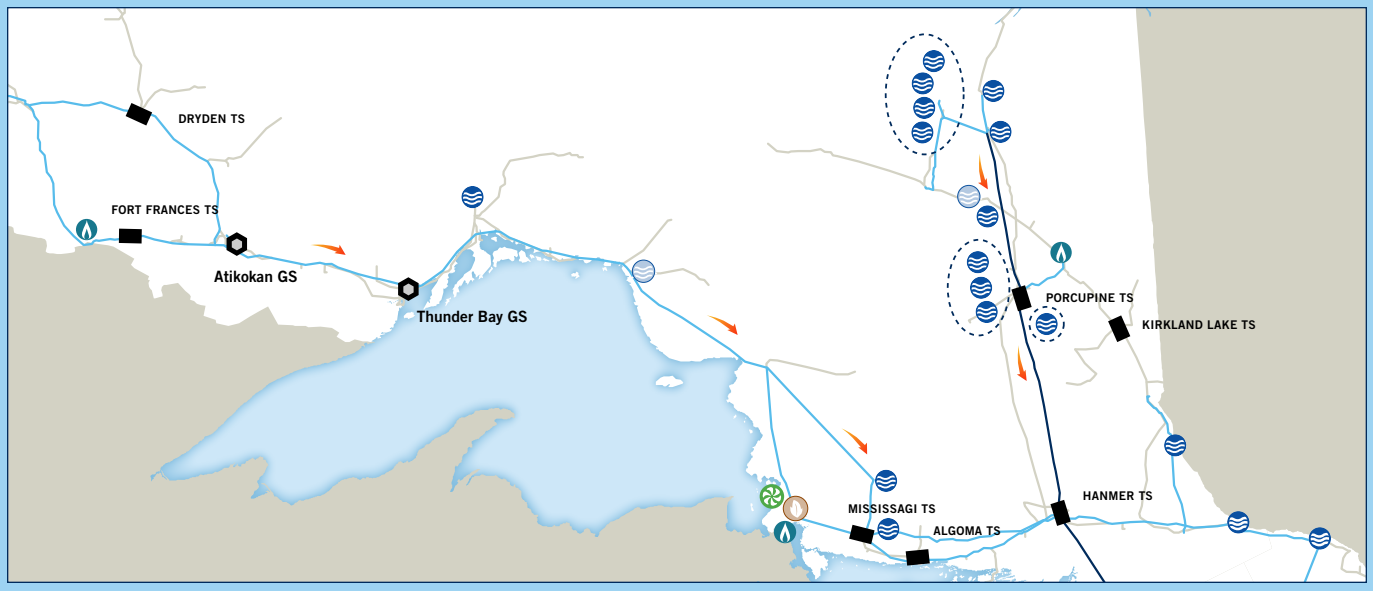
Additional transmission development may be needed in the eastern GTA depending on the decision to refurbish the nuclear units at Pickering B. This may include increased transformation capacity, additional reactive resources as well as a new transformer station at Oshawa. The new transformer station would be an additional supply point to the GTA and would help reduce loading on the Cherrywood transformers if Pickering B is retired or removed from service for refurbishment. The new station would also help to meet potential load growth in the eastern GTA and accommodate potential new supply from Darlington GS.

Hydro One is also undertaking to reconfigure the four existing 500 kV circuits between its Clairville and Cherrywood Stations along with extensive equipment modifications within these stations. This work will improve the transmission transfer capability in southern Ontario under normal outage conditions, and reduce the potential impact to generation located east of Toronto during outages.

Eastern Ontario

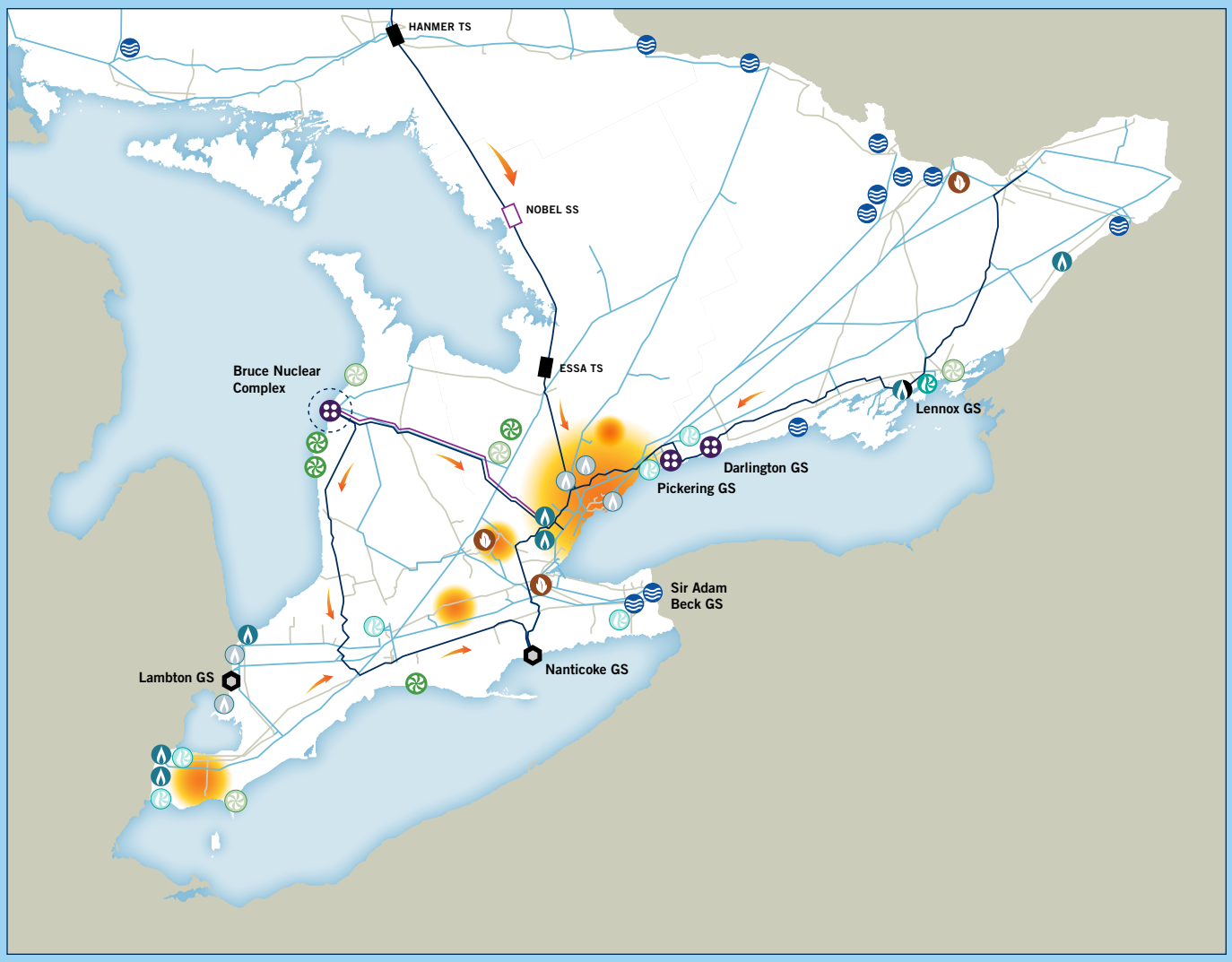
The Ontario to Quebec 1,250 MW interconnection between Hawthorne TS in Ontario and Outaouais station in Quebec, is scheduled to be in service in May 2009. This project comprises a 230 kV line and back-to-back high voltage direct current (HVdc) converters, as well as transmission enhancements that will improve supply to loads in the Ottawa area. The new interconnection will result in an increase of 1,250 MW in Ontario's import/export capability and provide increased operational flexibility.

NORTHERN ONTARIO ELECTRICITY SYSTEM AT A GLANCE



See page 12 for legend

SOUTHERN ONTARIO ELECTRICITY SYSTEM AT A GLANCE



Legend

*IN SERVICE	IN DEVELOPMENT		*IN SERVICE	IN DEVELOPMENT	
	—	Nuclear generation		—	Oil & gas-fired generation
	—	Coal-fired generation			Wind-powered generation
		Hydroelectric generation			Biomass or by-product gas generation
		Gas-fired generation			Cogeneration

* **NOTE:** In service generators shown if larger than 100 MW or were procured through OPA contracts.

- 500 kV Transmission Lines
- 230 kV Transmission Lines
- 115 kV Transmission Lines
- Transformer / Switching Station
- Planned Switching Station
- Planned Transmission Line
- Local Capacity Needs
- Future Development to Expand Existing Capacity

TABLE 3: REGIONAL REQUIREMENTS – PROJECTS CURRENTLY PROPOSED OR UNDERWAY

AREA	RELIABILITY NEEDS	EXPECTED/ REQUIRED BY	PROJECT(S) PROPOSED TO FULFILL REQUIREMENT
Central Toronto	Reduce transmission loading toward Central Toronto, and enhance supply to downtown	Spring 2008	John-Esplanade link
		Summer 2008	Portlands Energy Centre
		Fall 2008	Interchange terminations of circuits C3L and C17L at Leaside Transformer Station (TS)
		Spring 2010	Build new 115 kilovolt (kV) circuit between Leaside and Birch Junction and reconfigure existing transmission
		Spring 2012	Build new TS and connect to John-Esplanade link
		Under Review	Uprate transmission between Richview and Manby
		Under Review	Install a third supply to downtown Toronto
GTA-West and GTA	Accommodate higher short circuit levels at Claireville TS to allow increased west GTA generation	Fall 2009	Replace 230 kV breakers, and reconfigure line terminations to allow split bus operation
			Terminate V75R at Richview TS
	Improve voltage control in the west GTA	Spring 2008	Install additional shunt capacitors at Halton, Meadowvale TS
		Under Review	Investigate effectiveness and feasibility of capacitor at Hamilton Beach TS
	Reinforce Cherrywood to Claireville transmission	Winter 2009-2010	Provide 4x500 kV circuits between Cherrywood TS and Claireville TS by reconfiguring existing circuits and providing additional terminations at both Cherrywood TS and Claireville TS
			Add new 500 kV breaker at Claireville TS to eliminate need for bus outage
			Replace four aging 500 kV air blast circuit breakers at Cherrywood TS
	Improve supply to north Mississauga and Brampton loads	2008	Build new transformer station next to Pleasant TS
		Spring 2009	Establish Hurontario Switching Station (SS) on circuits R19T and R21T and extend and connect circuits V72R and V73R from Cardiff TS
		Fall 2009	Install new underground cables line from Hurontario SS to Jim Yarrow TS
		Spring 2013	Uprate 230 kV line between Hurontario SS and Pleasant TS
York Region: Newmarket-Aurora Area	Load growth exceeding the local transformer station capability	Summer 2009	New Holland Junction TS (OPA recommendation)
	Local growth exceeding capability of existing circuits	2011 or later	Additional TS at Aurora or Gormley, depending on the location and amount of local generation procured
Kitchener-Waterloo-Cambridge-Guelph and Orangeville Area	Local transmission enhancements required to relieve overloads and improve voltages	Fall 2007	Single 230/115 kV autotransformer at Cambridge-Preston TS
		Fall 2008 to 2011	New supply connections and transmission reinforcements may be required to supply the growing load in the area
			Switching arrangement reconfiguration at Detweiler TS
Burlington TS-Brantford-Woodstock	Loading on the autotransformers near the maximum ratings	2008	Replace limiting transformer
		Spring 2010	Replace limiting connections and buswork to increase the limited-time thermal ratings
	Improve 115 kV supply to Woodstock area	Spring 2008	Install shunt capacitors at Woodstock TS
		Spring 2010	Extend 230 kV tap from Ingersoll to a new 230/115 kV transformer station to supply Woodstock and Toyota load
Barrie-Stayner	Improve reliability to local loads	Spring 2009	Replace existing Essa to Stayner 115 kV circuit with 230 kV double-circuit line
			Convert Stayner to 230 kV DESN
			Add 230/115 kV autotransformer to supply Meaford TS

TABLE 3: CONTINUED

AREA	RELIABILITY NEEDS	EXPECTED/ REQUIRED BY	PROJECT(S) PROPOSED TO FULFILL REQUIREMENT
Bruce Complex	Ensure system has sufficient reactive capability to enable return-to-service of Bruce Power Units 1 and 2 and retire the Nanticoke units	Dependent on timetable for retiring Nanticoke	Requirement for additional dynamic var facilities such as static var compensators (SVC) and/or synchronous condensers
		Fall 2008	High voltage shunt capacitors at Detweiler and Orangeville
	Transmission enhancements required to allow increased power transfers to enable operation of up to eight units at the Bruce complex	Spring 2009	Update sections of the 230 kV Bruce to Orangeville circuits to allow increased output from Bruce
		Spring 2009	Additional shunt capacitors in southwestern Ontario (possible locations are Middleport, Buchanan and Nanticoke)
		2010	Additional dynamic var facilities such as SVCs and/or synchronous condensers at Detweiler TS and Nanticoke TS
		Winter 2011-2012	Proposed additional 500 kV transmission line from the Bruce area toward the GTA
Sarnia-Windsor Area	Enhancements to enable additional generation in the area resulting from Clean Energy Supply (CES) contracts	Fall 2008	Reconfigure the terminations at Lambton SS to accommodate split bus operation to limit short circuit level
	Windsor area enhancements to address adequacy of supply to Kingsville and Leamington, improve security of supply to the City of Windsor and reduce operational restrictions of generation in the Windsor area	Fall 2008	Expand the existing special protection system so that additional post-contingency responses can be initiated
			Replace existing 115/27.6 kV DESN station at Essex TS
		2011	Replace Keith autotransformers, upgrade Keith to Essex circuits and install new autotransformer station to improve the load supply to Leamington and Kingsville area loads
	Enable additional power transfer over the J5D Interconnection with Michigan	Under Review	Assess the feasibility of uprating the 230 kV line to allow transfers from Michigan to Ontario over the J5D Interconnection to be increased by at least 200 MW
Niagara Area	Increase import capability on Queenston Flow West (QFW)	Originally scheduled June 2006 (delayed indefinitely)	Install two new 230 kV circuits between Allanburg TS and Middleport TS and reinforce the 230 kV transmission facilities into Burlington TS
		Spring 2008	Circuit uprate in the St. Catharines area to increase load-meeting capability
Eastern Ontario	Increase power transfer capability between Ontario and Quebec	Spring 2009	1,250 MW Ontario-Quebec high voltage direct current (HVdc) connection and shunt capacitors at Hawthorne TS
			New special protection systems at Hawthorne and St. Lawrence
		2012	Uprate 230 kV circuits between Hawthorne and Merivale
	Enhance the supply to loads in the Oshawa and Belleville areas	Under Review	Relief of the 230 kV transmission east from Cherrywood is required to avoid overloads
			Investigate a connection to the 500 kV system
Northeastern Ontario	To expand the north to south transfer capability and reduce restrictions on northern resources	Spring 2010	Install series capacitors at Nobel SS to increase north to south transfer capability
	Transmission enhancements to enable committed renewable generation developments in the northeast	Spring 2010	Additional transfer capability and voltage control north of Sudbury to accommodate the increased generating capacity
			Effectiveness of combinations of SVCs and shunt capacitors at Porcupine, Hanmer and Essa to be investigated
	To expand transfer capability east of Mississagi	2010-2011	New SVC at Mississagi and shunt capacitor at Algoma
			New special protection system (2009) will replace the existing one and provide additional functionality
	Existing 115 kV switchgear at Abitibi Canyon GS is at end-of-life	2010	New switchgear should be consolidated at a new 115 kV busbar at Pinard TS
			Arrangement would also provide a suitable location for a future 230/115 kV autotransformer to reinforce the existing connection between the local 230 kV and 115 kV systems
Northwestern Ontario	Improve voltage control	Winter 2009-2010	Replace failed synchronous condenser at Lakehead with an SVC
			Install additional new shunt capacitors at Fort Frances and Dryden
		2013	230 kV transmission between Lakehead and Birch
	Increase import capability from Manitoba to 400 MW	Under Review	Accommodate new transformers and expanded 230 kV bus at Whiteshell
			Enhance voltage control with SVCs at Fort Frances TS, Mackenzie TS and Marathon TS

Kuntz Electroplating Inc. in Kitchener, uses back-up generation to provide demand response.

CONSERVATION AND DEMAND MANAGEMENT

Conservation represents one of the most challenging aspects of Ontario's proposed supply mix. Reducing, shifting, or eliminating electricity consumption during peak periods is, however, gaining momentum as an integral component of the provincial power infrastructure.

In 2004, the Government of Ontario established an aggressive demand reduction target of 2,700 MW by 2010. The OPA advises that the province is on track to achieving peak reductions of 1,350 MW by the end of this year as well as another 1,350 MW by 2010. The Conservation Bureau will be issuing a report in May 2008 with an analysis of the peak reductions achieved to the end of 2007. Conservation and demand management, as well as reductions in energy-intensive sectors contributed to lower than anticipated peaks.

Table 2 on page 8 outlines the expected conservation savings by 2014.

Effective Demand Response

Currently, the IESO incorporates between 285 MW and 528 MW of demand response as part of its resources under different scenarios. These are verifiable programs that can dispatch consumers to reduce their electricity use on demand – much like a dispatchable generator. This range is anticipated to grow to more than 1,000 MW by 2015 as new demand response programs emerge and existing ones expand. Current demand response programs include the OPA's DR I and the IESO's dispatchable demand programs.

In order to make a more meaningful contribution to system reliability, however, demand response programs need to acquire the same level of performance and accountability as other dispatchable supply as well as provide more capacity as a whole. This will allow system planners and forecasters to reduce their projections for Ontario's supply needs.

The OPA is in the process of developing two new demand response programs – DR II and DR III. Participants in these DR programs will be contractually obligated to reduce predetermined amounts of load. DR II focuses on providing peak reductions every business day throughout the year, while DR III targets peak reduction during the most valuable periods of the year as determined by the OPA.

The IESO anticipates playing an increasing role in facilitating demand response in order to capture the associated economic and reliability benefits.

Creating a Conservation Culture

The IESO incorporates conservation projections into its demand forecasts. These conservation projects work to reduce overall demand and lower both baseload and peak requirements for the province. This is an important factor in the ongoing reliable operation of the power system by the IESO.

The OPA has launched a number of initiatives designed to reduce energy use in all sectors – such as increased efficiency in building codes, residential "fridge round-up" programs, and business incentives for electricity retrofits. While current contributions from conservation are low, they are expected to increase as conservation programs mature and the full impact of these investments is realized.

Making the Shift: Smart Meters in Ontario

Ontario's Smart Metering Initiative provides a key piece of infrastructure that will enable a more robust role for the demand side. By 2010, homes and small businesses throughout Ontario will be furnished with an electricity meter that tracks how much and when electricity is used – paving the way to time-of-use (TOU) prices. By the end of 2007, the government will have exceeded its target of installing more than 800,000 smart meters in homes and small businesses across the province.

The IESO was appointed as the Smart Metering Entity by the Ontario government. In this role, the IESO oversees the development, management and ongoing operations of the Meter Data Management Repository (MDM/R) that collects and prepares smart meter consumption data for billing purposes.

Smart meter

This December, Newmarket-Tay Power Distribution Ltd. became the first LDC in Ontario to connect in pilot production mode to the MDM/R. It has also begun the process of implementing TOU prices for its customers. All Ontario LDCs will be successively brought online with the MDM/R over the course of the next three years.

The full impact of smart meters in changing consumption behaviour will be determined by a number of factors, including customer education and the timing of the implementation of TOU prices across the province. The effects of smart meters will also be augmented by the availability of a variety of pricing and energy management tools to customers.

The IESO is working with the Ministry of Energy and LDCs to develop an education program to provide home consumers with a greater understanding of the value smart meters can provide in better managing electricity use.

Developing the Demand Side of the Market

New demand-side initiatives will also increase the competitiveness of the wholesale market. Demand response opens the market to a wider diversity of participants – including residential consumers through aggregators. With more consumers making electricity-use decisions based on price and/or incentives, the market price becomes an even more effective signal to trigger the efficient use of resources.

Since 2003, the IESO has led a customer education campaign directed at businesses and organizations that pay the market price for electricity, but are not wholesale market participants. These customers represent roughly one-third of the province's load and have the opportunity to control their electricity costs by changing their consumption patterns.

Ontario's public sector – municipalities, universities, schools and hospitals – will also be moving to the hourly market price in spring 2008. With large facilities – and often 24-hour operations – these organizations offer significant load-shifting potential, creating a new segment of electricity customers who will more actively respond to price signals.

The Bottom Line on Conservation and Demand Response

As increasing numbers of consumers are exposed to the market price and the technology to support load-shifting becomes more accessible, the amount of load that responds to price (and demand) is starting to have a positive impact on reliability.

The City of Mississauga, for example, closely monitors the market price and manages its energy consumption in City-owned facilities through a combination of computerized building automation systems and local controls. At present, the city achieves demand reduction by sending an e-mail to operations supervisors of all major facilities with a request to reduce load that is not essential for operation during peak price periods and/or when the IESO issues public appeals.

Computerized building automation systems for individual facilities are being upgraded to communicate through the Internet so that they could be linked to the IESO website and enable automatic demand reduction during high price periods.

Mississauga currently buys most of its electricity on the spot market, which creates opportunities to reduce its electricity bill. According to the City, the switch to the hourly price has saved them approximately $2.5 million in electricity costs over the past two years.

Over the first five years of its operation, the IESO has continued to evolve the market to enhance reliability and operational efficiency.

ENHANCING RELIABILITY THROUGH MARKETS

Over the first five years of operation, Ontario's wholesale market has delivered reliable supply to the province. During that time the IESO has incorporated a number of market changes to address operational and stakeholder concerns and to facilitate continued reliable supply. For example, the implementation of real-time intertie failure charges and the Day-Ahead Commitment Process (DACP) have made significant contributions to the reliable operation of the market when the system has been strained.

In summer 2006, the IESO implemented new settlement charges to address real-time intertie transaction failures, which in previous years have occasionally jeopardized reliability. Market participants are now issued an hourly market-based charge for transaction failures that are deemed to be under their control. With the settlement charge in effect, the incidence of intertie transaction failures has declined significantly, while the volume of intertie transactions remains constant.

Another clear example of how the market can work to promote reliability is the DACP. Launched in June 2006, the DACP was introduced to enhance reliability through day-ahead import and generator commitments. The IESO developed three main criteria for evaluating the program: the ability to schedule imports a day ahead; a reduction in import failures; and that sufficient internal generation was online to meet demand.

A review of 2007 operations demonstrated that all three criteria continue to be successfully met:

- 181,793 megawatt hours of imports were scheduled day ahead in 2007 so far, up 265 per cent from 2006.

- The total import failure rate fell from 8.6 per cent in 2005 to 6.6 per cent for 2007, remaining steady from 2006.
- The peak week real-time failure rate between the hours 15 and 19 (peak hours) has declined from 8.3 per cent in 2005 to 3.68 per cent in 2007. In 2007, day-ahead imports during the same peak hours failed at a rate of 0.61 per cent. This level of certainty for all imports provided increased levels of security at times when other supply options can be limited.
- Sufficient internal generation was online to meet demand. On a peak day during the past summer, 98.4 per cent of generation was economically scheduled a day ahead, consistent with 2006 results.

Day-Ahead Market (DAM)

The success of the DACP illustrates the benefits of making day-ahead arrangements in the market. The DACP, however, is a process that is specifically designed to address reliability needs. Most established electricity markets in North America offer day-ahead markets to provide better resource commitment and price certainty. Over the past year, the IESO has been assessing a variety of day-ahead mechanisms which, if implemented, would further contribute favourably to the reliable operation of Ontario's power system in the coming years.

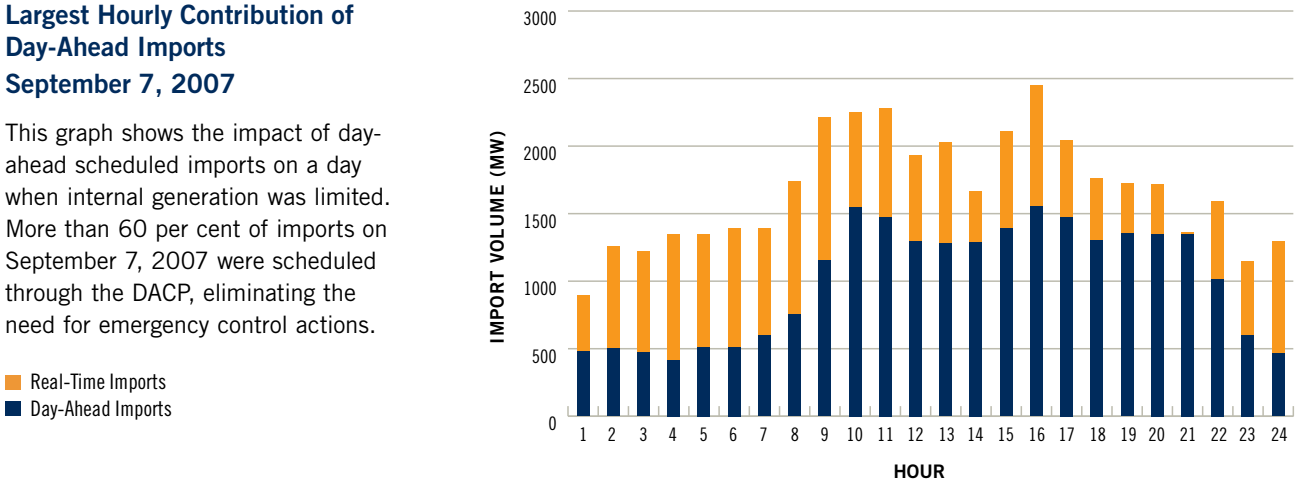
Demand-side resources are limited in today's real-time market as they currently respond based on their expectations of the current price and what it will be over the near term. Only through a day-ahead mechanism will consumers be able to fully reap the rewards of responding to real-time operational challenges – times when they will be contributing to the improved reliability of the market. As increasing numbers of customers receive smart meters and become enabled to manage their own electricity consumption, it's clear that new mechanisms are needed to provide the demand side of the market with the information needed to make more effective energy-use decisions.

The IESO has focused on a DAM that requires little if any change to the real-time market and one in which the majority of consumption would be priced day ahead. Both generators and consumers would hold financial positions going into the day ahead, with only changes from those day-ahead expectations being priced in real time. This would effectively relegate the real-time market to a balancing role.

The IESO has been working with stakeholders to understand how a day-ahead mechanism might impact their businesses and to evaluate both the costs and benefits of such a proposal. A recommendation to proceed with the further definition and evaluation of the Unconstrained Day-Ahead Market was presented to the IESO Board of Directors this December, and approved.

Largest Hourly Contribution of Day-Ahead Imports September 7, 2007

This graph shows the impact of day-ahead scheduled imports on a day when internal generation was limited. More than 60 per cent of imports on September 7, 2007 were scheduled through the DACP, eliminating the need for emergency control actions.



CONCLUSIONS AND RECOMMENDATIONS

- Meeting the short-term reliability needs for summer 2008 is dependent on the timely completion of Phase One of the Portlands Energy Centre. Any delay to the in-service date of this project will result in similar pressures on reliability in the GTA to those experienced in 2007.
- The completion of a suite of new generation projects between 2008 and 2010 will pave the way for the retirement of Ontario's remaining coal-fired generation. The IESO will be closely monitoring the progress of these projects and their supporting transmission infrastructure to ensure that reliability can be maintained and coal can be replaced.
- To ensure the reliable operation of Ontario's supply resources as set out in the IPSP, the IESO will be publishing a detailed report summarizing the operational changes needed to support the proposed supply mix. This report will be available in the first part of 2008.
- Ontario's supply mix continues to expand and become more diverse. The IESO is working actively with its partners to find ways to accommodate the operating characteristics of generating sources such as distributed generation, wind-powered generation, and new gas-fired generation targeted for peaks. Each will play an important role in providing reliability, but the challenge of integrating these resources should not be underestimated.
- In addition to the province's supply requirements, the timely implementation of new transmission facilities is essential to addressing future reliability needs. The staged completion of interim measures, and ultimately the completion of the new 500 kV line from Bruce to Milton will provide the required transmission capability to deliver the full benefits of the Bruce refurbishment project and the development of new renewable resources in the area. Equally important are the transmission projects that will support local area concerns identified by the IESO, such as: the GTA, York Region, Kitchener-Waterloo-Cambridge-Guelph and Windsor-Essex.
- Concerns continue to be raised about the impact of the current approvals process on implementation timelines. The IESO urges all regulatory bodies to accelerate and coordinate their work in this area. Lags in approvals represent the biggest risk to meeting the province's need for new supply and transmission facilities over the next 20 years.
- Experience over the summer of 2007 demonstrated the potential of demand management to help reduce peaks – which in turn increases reliability. This potential, however, is still largely untapped. As conservation and demand management programs mature, the contribution on the consumer side of the market should grow. The IESO is looking forward to the transition of municipalities, universities, schools and hospitals from the Regulated Price Plan to the hourly price, which will increase the pool of consumers who can more effectively respond to market signals.
- The province's LDCs are on track to meet the government target of installing smart meters in homes and small businesses throughout Ontario by 2010. The full benefit of this achievement will not be realized until the implementation of TOU rates for all consumers.
- As Ontario's demand response capacity becomes entrenched in business and home energy management practices, the IESO could incorporate increasing amounts of verifiable demand response into both its reliability forecasts and as an additional tool for managing power system operations.
- Programs such as the DACP point to the value of developing market-based mechanisms to enhance reliability. The IESO is exploring the development of a DAM that would deliver greater efficiency in the use of the province's supply resources and increase the role of consumers in providing reliability.

THE ONTARIO RELIABILITY OUTLOOK IS ISSUED SEMI-ANNUALLY BY THE INDEPENDENT ELECTRICITY SYSTEM OPERATOR TO REPORT ON PROGRESS OF THE INTER-RELATED GENERATION, TRANSMISSION AND DEMAND MANAGEMENT PROJECTS UNDERWAY TO MEET FUTURE RELIABILITY REQUIREMENTS.

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The Independent Electricity System Operator manages the province's power system so that Ontarians receive power when and where they need it. It does this by balancing demand for electricity against available supply through the wholesale market and directing the flow of electricity across the transmission system.