THE ONTARIO RELIABILITY OUTLOOK

MARCH

2007

VOLUME 2 ISSUE 1

ieso

Power to Ontario. On Demand.

ABOVE: IESO Control Room

COVER: Melancthon Wind Project, one of Ontario's new commercial wind farms.

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Transmission towers at sunset. Image courtesy of Hydro One.

EXECUTIVE SUMMARY

The province's future electricity reliability picture has improved significantly as a result of decisions and actions taken since the release of the previous Ontario Reliability Outlook by the Independent Electricity System Operator (IESO) in June, 2006.

About 7,000 megawatts (MW) of new or refurbished generation has been contracted to come into service by 2011. The new supply will address previously identified concerns in specific areas such as Toronto and the western part of the Greater Toronto Area (GTA) and will contribute to overall improved resource adequacy for the province.

The decision to have the Ontario Power Authority (OPA) and the IESO jointly develop a coal transition plan to meet the government's directive to achieve the phase-out of coal while maintaining electricity supply reliability has addressed concerns identified by the IESO last June. This change will help ensure reliability and address any unforeseen delays in either the completion of planned supply facilities or in meeting conservation and demand management (CDM) targets.

The IESO also implemented a number of new market mechanisms designed to address reliability issues that had surfaced in the summer of 2005. These included the Day Ahead Commitment Process (DACP), intertie failure charges and the Emergency Load Reduction Program (ELRP). Overall, these initiatives resulted in greater certainty of generator availability, fewer transaction failures and additional flexibility for the IESO in managing the reliability of the system.

Consultation is underway with a number of stakeholders related to overall system and local reliability needs. The IESO remains concerned about the uncertainty around the length of approvals processes affecting generation and transmission projects. These approval processes may impact the nature and timing of the implementation of certain transmission and

renewable generation projects. The situation is particularly troublesome in the case of new transmission. While some changes have been made, until the approvals process is demonstrated to produce timely decisions, there will continue to be a risk that transmission will not be available when it is required.

Through regular issues of the Ontario Reliability Outlook, the IESO reports on progress of the inter-related generation, transmission and demand management projects underway to meet future reliability requirements. As project commitments are made by the OPA, or included in the Integrated Power System Plan (IPSP), the Ontario Reliability Outlook will monitor and report on the progress of infrastructure developments and their impact on future reliability.

New Supply Being Introduced

Ontario's electricity sector is in the early stages of the biggest infrastructure change in its history. Over the next decade, a number of aging and existing generating facilities will near or reach the end of their planned operating life, and refurbishments to extend reliable operation or replacement of these aging facilities will be necessary.

Increasing climate change concerns will continue to point to the need to reduce the use of coal-fired generating facilities, which are planned to be shut down as soon as reliability allows. In 2006, generation from coal-fired facilities was down three per cent from the previous year with a corresponding reduction in emissions. The deferral of the planned shutdown of Ontario's four coal-fired generating stations has largely addressed the concern over future supply needs, identified by the IESO last June. As new facilities come into service and CDM activities progress, reliance on coal to meet demand in Ontario can continue to decline.

More than 3,000 MW of new or refurbished generation has come on-line in Ontario in the past four years, including 700 MW in the past 12 months. Generator performance has also continued to improve over that period. Forced outage rates have declined continuously since 2003 while nuclear capability factors have increased from 78 per cent in 2003 to almost 83 per cent in 2006.[1]

Included in the planned new generation is the Portlands Energy Centre in Toronto which will begin to address the reliability concerns that the IESO had raised about supply to central Toronto. Phase One of the Portlands project, with a contract capacity of 250 MW, is scheduled to be ready to meet demands in the summer of 2008, with Phase Two (288 MW) scheduled to come into service before the summer of 2009.

The almost 1,500 MW of new generation slated to come in service in the western region of the GTA will address the previously identified concerns in that area. Phase One of the Goreway gas-fired generating project is targeted to be in service by this summer and provide 485 MW of new supply. An additional 375 MW from Phase Two of the Goreway project is scheduled for operation in the summer of 2008. The 600 MW Halton Hills gas-fired generating station is scheduled to be brought on-line in 2010.

Wind is making an increased contribution to meeting Ontario's electricity needs. More than 400 MW of wind is currently installed at four locations around the province with approximately 850 MW planned before the end of 2008. For capacity planning purposes, it is assumed that wind generation has a dependable capacity contribution of 10 per cent.

The IESO has been actively addressing wind integration in Ontario and has created a wind power working group comprised of wind generators and other stakeholders to address the various aspects related to the increasing contribution of wind in the Ontario power sector.

More generally, the IESO continues to identify a need to ensure that the future supply and demand response mix has sufficient generation that can be dispatched up or down to match changes in the level of demand. These load following requirements are critical during early morning hours, when demand climbs quickly and in the evening when demand begins to decline.

[1] Source: Canadian Nuclear Association

Over half of Ontario's installed capacity, including nuclear, co-generation, some hydro-electric and wind generating assets are baseload or non-manoeuvrable generation, meaning they cannot routinely be dispatched up and down as demand rises and falls. This type of capacity is expected to grow over the next few years with the addition of 1,500 MW of Bruce A generation and significant amounts of new wind generation.

Baseload and non-manoeuvrable generation must be consumed when it is made available. During certain periods, particularly overnight in the spring and fall, this type of generation can exceed the amount required to meet the demand, resulting in the need to shut down generation. While this can result in wasting available wind or water or in the case of nuclear units, can result in up to a 72 hour shut down, it can also impact reliability if demand rises quickly.

The IESO has undertaken a study to establish a quantifiable measure of load following requirement based on historical demand and market data.

Transmission

New transmission facilities, particularly in southwestern Ontario, remain a priority for the IESO over the next decade. Major transmission projects are required to deliver additional electricity from the Bruce area, to enable the planned expansion of hydroelectric capability in the northeast and to increase the capability to supply Toronto load. Without new transmission facilities, the IESO will eventually be forced to operate existing facilities near their maximum capabilities, with little margin for unexpected events and requiring complex arrangements to do routine maintenance on critical facilities.

A new 500 kV line out of the Bruce area is required as soon as possible to accommodate additional generation expected from new projects and refurbished Bruce nuclear units. Some short-term solutions are available to minimize potential congestion that could begin with the planned restart of Bruce Unit 2 in 2009.

Hydro One has proposed to address the need for short-term transmission enhancements in the northeastern part of the Ontario grid to allow the delivery of planned generation in the area to the southern Ontario load.

Hydro One and TransÉnergie are building a 1,250 MW interconnection which consists of a 230 kV line and back-to-back high-voltage direct-current (HVdc) converters. The new interconnection is scheduled to be brought into service in 2009.

Conservation and Demand Management

The Ontario government has set aggressive CDM targets for the near future.

The OPA and local distribution companies (LDC) have introduced a number of programs, which encourage electricity customers to adopt energy efficiency measures and engage in demand response activities. Targeted CDM savings totalling more than 1,000 MW are being pursued by a number of market participants, including the OPA. It will take some time before the results of the various CDM programs and initiatives can be verified and as such there is a risk in the short-term of relying on the associated contributions to capacity for operational planning.

Reducing peak demand will help contribute to the reliability of the system. Ontario's improved supply situation will help address any delays in achieving CDM savings. As CDM results are confirmed, the IESO will closely monitor their contribution during peak demand and tight supply events in order to reliably and efficiently schedule resources and operate the system.

Sithe Global,
Goreway Station

SUPPLY

A number of the IESO concerns related to supply needs in both the short-term and beyond are being addressed.

The new supply includes three gas-fired generating facilities that will make important contributions to maintaining reliability in and around the GTA. Phase One of the Goreway gas-fired station (485 MW) in Brampton is targeted to come into service before the summer of 2007, and Phase One of the Portlands Energy Centre (250 MW) in Toronto is planned to come into service before the summer of 2008, with Phase Two (288 MW) scheduled to come into service before the summer of 2009. Phase Two of the Goreway station (375 MW) is planned to come into service in the fall of 2008. In addition, the Greenfield South gas-fired generating station (280 MW) is scheduled to come into service in the fall of 2008, although municipal and environmental approvals issues may delay this.

An additional 5,400 MW has been contracted or planned to come into service in the longer term including 1,500 MW of refurbished nuclear generation from the Bruce nuclear facility, 471 MW of hydroelectric generation from the projects on the Mattagami River, 1,575 MW of gas-fired generation in the Sarnia area and approximately 850 MW of additional wind generation.

Trans Canada's new 600 MW Halton Hills Generating Station is expected to come into service in 2010 to help meet increasing demands for electricity in Halton Region and the City of Mississauga.

A number of Combined Heat and Power (CHP) projects totalling more than 400 MW are scheduled to be installed over the next four years.

Required Flexibility

While there are significant supply additions planned, there is a need to ensure that some of that future generation has the ability to rapidly increase or decrease its output to meet demands

that can change quickly. The ability to react to changing demands, known as load-following capability, is found in certain types of supply such as coal-fired or gas-fired generators and some hydroelectric generation. Load following requirements are highest during early morning when demand quickly rises and in the evening when demand quickly drops off.

Coal-fired generators are characterized by relatively high ramp rates and low minimum loading points, which translates into timely load following capability over a large range of output levels. Gas-fired generators can also have higher ramp rates and provide operational flexibility if appropriately designed. Many hydroelectric generators can ramp to their full output capability within a matter of minutes. However, during certain periods such as the spring when the snow is melting, they may be unavailable to ramp due to water conditions and regulatory requirements. Dynamic conditions such as these must be carefully considered when determining potential supply mixes for the future.

The IESO continues to be concerned with the future management of the province's water resources as they relate to electricity production. Preserving the operating flexibility of existing hydroelectric facilities and recognizing the capability of new resources should be an important consideration in the development of water management plans.

Over half of Ontario's installed capacity is baseload or non-manoeuvrable, types of supply that include nuclear, run-of-the-river hydro, co-generation and wind. This type of generation has to be used when it is available and does not have the flexibility to be dispatched up or down to meet the demand. While it has limited ability to increase output, it can also become problematic when this type of baseload generation exceeds the amount required to meet the demand. This can happen in the over-night periods during spring or fall resulting in the need to remove that generation from service. In the case of nuclear units where the unit could be shut down for up to 72 hours, it could impact reliability if demand rises quickly.

The IESO is currently studying the potential impact of proposed changes to the supply mix on the load following capability of and requirements for dispatchable generation and load in Ontario.

The IESO has undertaken a study to establish a quantifiable measure of load following requirement based on historical demand and market data. The results of this study will outline typical hourly requirements for load following over the course of a historical year.

The next steps will be to determine how Ontario's existing supply mix satisfies the identified load following requirements; and simulate how well potential supply mixes in the future will meet these requirements. This will likely include a detailed analysis of the amount of load following provided by generation technology type; and will address the potential impact of replacing coal-fired generation with other types of generation.

Wind

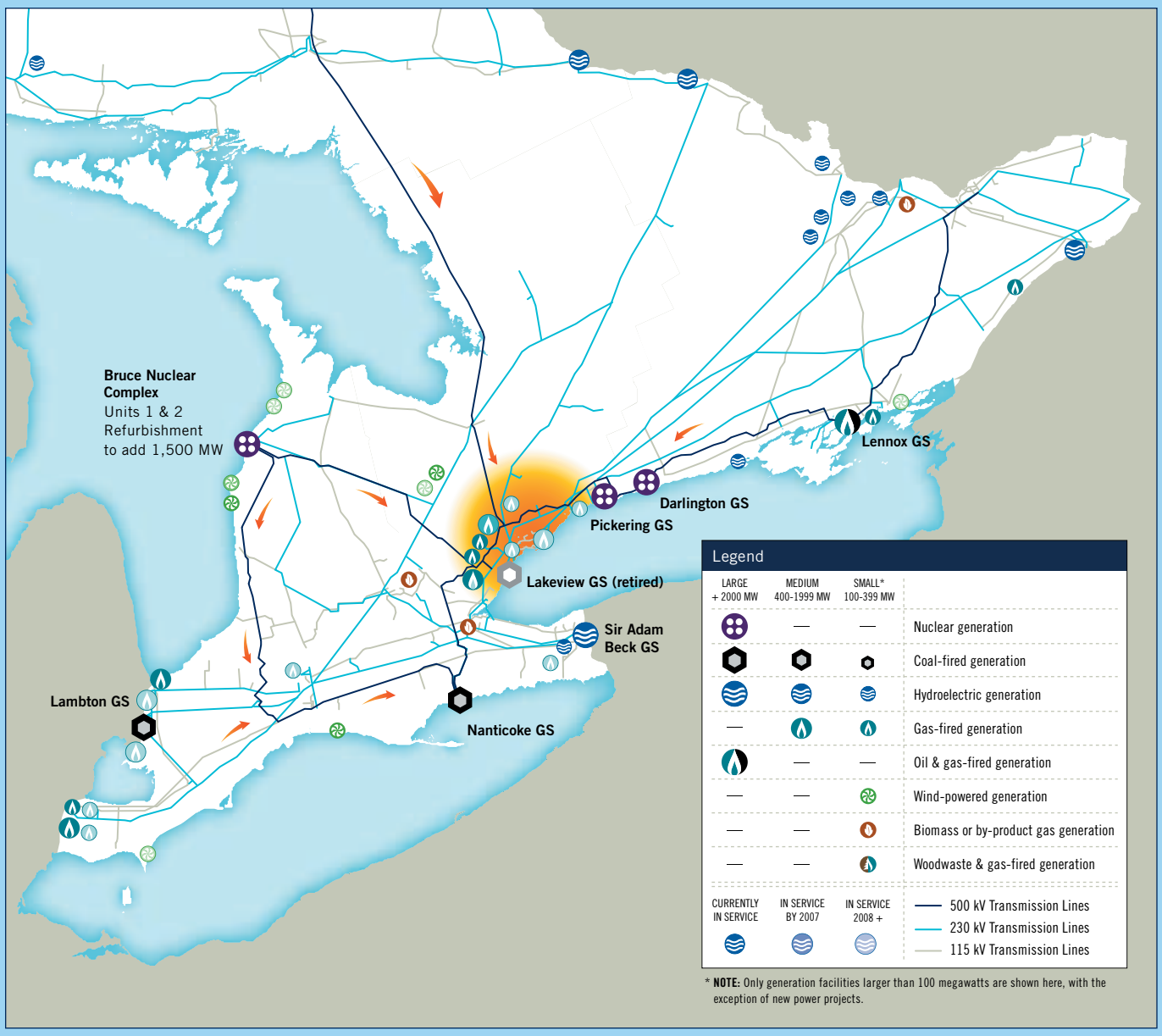
The IESO has been actively addressing wind integration in Ontario. Since the previous Ontario Reliability Outlook was released in June, 2006, the IESO has received the results of a study it co-sponsored on the potential contribution of wind to meeting the province's future power needs. This study, together with a growing body of experience with operational wind farms in Ontario and further study underway will form the basis for necessary changes to operational processes to integrate new facilities.

Approximately 400 MW of wind is currently installed at four locations around the province. Although wind power represents a small portion of the province's total supply mix, it nevertheless has demonstrated a positive contribution. For example over the relatively short period of production experienced with the operational wind farms connected to the grid, the annual energy capacity factor for these wind farms for the period March 2006 through February 2007 averaged 25 per cent. The monthly average capacity factor for the entire wind fleet in the month of December 2006 was 37 per cent.

Several wind projects are under development and are expected to be completed within the next couple of years. Approximately 850 MW of wind power is planned before the end of 2008.

A wind power stakeholdering working group has been created consisting of a variety of members in Ontario that have a special inter-est and focus on wind generation. The group is actively engaged in obtaining stakeholder feedback to address wind integration issues, to better understand the challenges wind power proponents face in becoming operational in the Ontario market, and to assist in reducing any barriers to participation in the Ontario market.

SOUTHERN ONTARIO ELECTRICITY SYSTEM AT A GLANCE



To download a copy of the full map, please visit www.ieso.ca/supply.

A map of Northern Ontario is available on page 10 of this report.

TABLE 1: GENERATION PROJECTS PLANNED OR UNDERWAY IN ONTARIO

SOURCE OF PROJECT	GENERATION PROJECTS PLANNED OR UNDERWAY	INSTALLED CAPACITY (MW)	PLANNED IN-SERVICE DATES
Renewables I RFP – Hydroelectric generation project	Umbata Falls Hydroelectric Project	23	Q2 2008
Government directive for Western GTA – Gas-fired generation projects	Goreway Station – Phase 1	485	Q2 2007
	Goreway Station – Phase 2	375	Q3 2008
GTA West RFP	Halton Hills Generation Station	600	Q2 2010
Government directive for Central Toronto – Gas-fired generation projects	Portlands Energy Centre – Phase I Simple Cycle	250	Q2 2008
	Portlands Energy Centre – Phase II Combined Cycle	288	Q2 2009
Clean Energy Supply RFP – Gas generation projects	Greenfield Energy Centre	1,005	Q4 2008
	Greenfield South Power Plant	280	Q4 2008
	St. Clair Energy Centre	570	Q1 2009
Renewables II RFP* – Wind generation projects	Wolfe Island Wind Project	198*	Q4 2008
	Leader A Wind Power Project	99*	Q4 2008
	Leader B Wind Power Project	101*	Q4 2008
	Kingsbridge II Wind Power Project	159*	Under review
	Ripley Wind Power Project	76*	Q4 2007
	Kruger Energy Port Alma Wind Power Project	101*	Q4 2008
	Melancthon II Wind Project	132*	Q2 2008
Renewables II RFP – Hydroelectric generation project	Island Falls Hydroelectric Project	20	Q4 2009
Nuclear generation projects underway with Bruce Power	Bruce Power Unit 1 Refurbishment	750	Q1 2010
	Bruce Power Unit 2 Refurbishment	750	Q3 2009
Hydroelectric generation project under development with Ontario Power Generation	Little Long, Harmon, Kipling and Smoky Falls	450	Unit in-service dates ranging from 2009 to 2011
	Lower Sturgeon, Sandy Falls and Wawaitin	16	
	Mattagami Lake Dam	5	
Combined Heat and Power (CHP) RFP – Co-generation projects	Great Northern Tri-Gen Facility	12	Q1 2008
	East Windsor Cogeneration Centre	84	Q2 2009
	Durham College District Energy Project	2	Q2 2008
	Thorold Cogeneration Project	236	Q2 2010
	Countryside London Cogeneration Facility	12	Q2 2008
	Algoma Energy Cogeneration Facility	63	Q2 2009
	Warden Energy Centre	5	Q2 2008

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

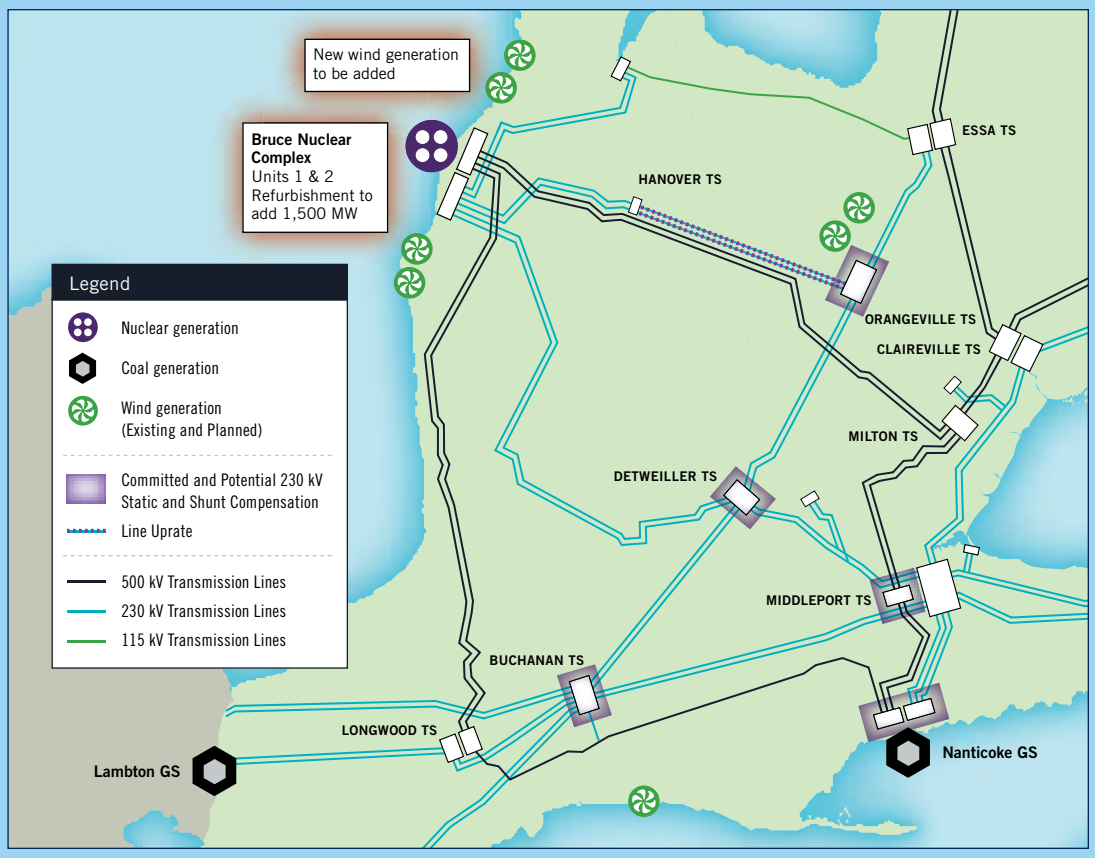
TABLE 2: EXPECTED CONSERVATION AND DEMAND MANAGEMENT SAVINGS

MW SAVINGS	2007	2008	2009	2010
Conservation	40-50	15	30	60
Energy Efficiency		199	463	777
Demand Management	225-250	92	231	370
Fuel Switching		18	46	81
Self-Generation		17	43	69

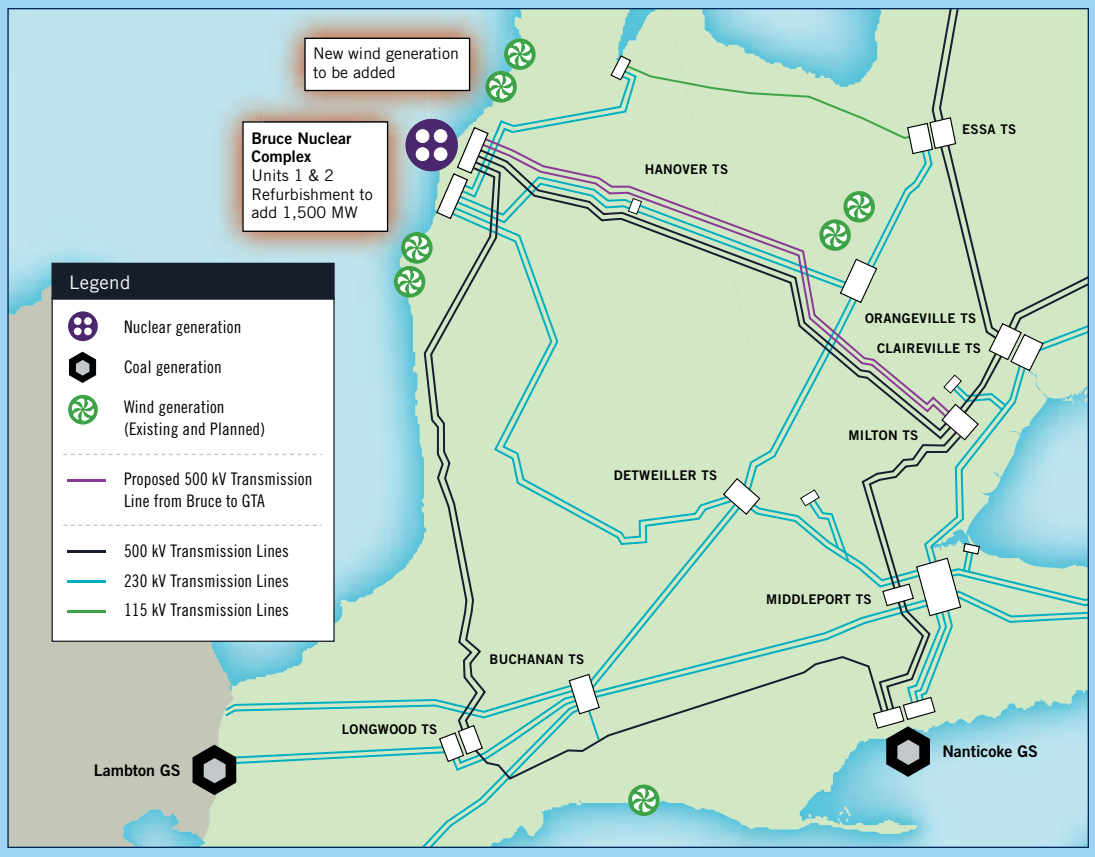
Source: Ontario Power Authority

SOUTHWESTERN ONTARIO

PLANNED
NEAR-TERM
REINFORCEMENTS



PLANNED
LONG-TERM
SOLUTIONS



TRANSMISSION

Over the next decade, the need for transmission enhancements is particularly evident in three areas of the province:

- In southwestern Ontario to deliver additional nuclear and wind supply from the Bruce area;
- In the northeast to enable the planned expansion of hydroelectric capability, and;
- In the Toronto region in order to improve reliability to Canada's largest city.

Without new transmission facilities, the IESO will be forced to operate existing facilities near their maximum capabilities, with little margin for unexpected events and requiring complex arrangements to do routine maintenance on critical facilities. A number of local transmission or generation initiatives are also needed in areas throughout Ontario. Hydro One has started work on all the transmission projects that are required in the near-term and the majority are already under construction. The IESO believes that work on local generation procurement in areas such as York Region needs to start expeditiously.

Southwestern Ontario

Enhancing the transmission system in southwestern Ontario, in particular to deliver the planned and future increases in generating capability in and around the Bruce peninsula, continues to be a high priority.

Currently, there is inadequate transmission out of the Bruce area to accommodate both the expected wind developments in that area and the expanded capacity of the Bruce nuclear station resulting from planned refurbishments. Some near-term reinforcements include the up-rating of the Hanover to Orangeville 230 kilovolt (kV) circuits, and the installation of additional voltage support facilities at various transmission stations in southwestern Ontario. These will increase the transfer capability out of Bruce in the short-term. A proposed new 500 kV double-circuit line from Bruce toward the GTA will provide the required transmission capability over the long-term to deliver the full capability of the Bruce refurbishment and both planned and potential new renewable resources in the Bruce area.

The new 500 kV line out of the Bruce area is required as soon as possible to accommodate the additional generation from both new wind projects and refurbished Bruce nuclear units. To minimize potential congestion costs, interim measures, that could begin as early as 2009, are being assessed. These measures include the use of generation rejection of Bruce units and wind turbines, 30 per cent series compensation of the existing 500 kV lines between Bruce, Longwood and Nanticoke, and restricting further generation development in the Bruce area, in addition to the near-term reinforcements described above. These measures are not substitutes for a new line, as they will not eliminate congestion and will increase the operational complexity of this part of the transmission system, and will stretch its design capability. However these measures are expected to reduce the amount of congestion until a new line is built.

Additional transfer capability may also be needed between Sarnia and London to facilitate imports from Michigan and energy from the new natural gas-fired generators in this area. The phase-out of the Lambton coal-fired generation station will alleviate this need. As the Nanticoke coal-fired station is phased out over the next decade, additional voltage support in southwestern Ontario will be required, as reported in previous Ontario Reliability Outlooks.

Additional transmission capacity is needed as a result of growing load in a number of cities in southwestern Ontario and transmission reinforcements are required to facilitate the development of generation from renewable resources, including wind generation on parts of Lake Huron and Lake Erie.

North – South

Hydro One has proposed to address the need for transmission enhancements in the northeastern part of the Ontario grid to allow the delivery of planned generation in northeastern Ontario to southern Ontario.

The System Impact Assessment Report for Hydro One's application to make certain transmission system modifications to allow the delivery of generation from the northeastern part of the grid is nearing completion. The results are expected to confirm the need for series capacitors at Nobel Transmission Station (TS), a static var compensator (SVC) at Porcupine TS and a further SVC at Kirkland Lake TS.

This work will address concerns previously identified regarding the need for transmission enhancements to address existing congestion and achieve full availability of additional output from the expansion of the four existing hydroelectric stations on the Lower Mattagami River and other committed renewable energy developments in northeastern Ontario.

Toronto and Surrounding Area

Concerns identified in late 2005 about supply to the central Toronto area are being alleviated with the construction of the Portlands Energy Centre. Phase One, representing 250 MW, is expected to be implemented in time to help meet demands during the summer of 2008.

The central Toronto area is currently served through two transmission paths into the area. The IESO continues to raise the need for a third path in the next decade in order to maintain long-term reliability and to provide a diversity of supply paths into the city.

In the York Region, the transformer station capacity has been exceeded due to the rapidly growing loads in the Newmarket and Aurora area. There is an immediate need for a new transformer station in the area. Hydro One plans to have a new transformer station in service before the end of 2008 to address the immediate needs. Longer term, transmission constraints are expected to occur as early as 2011. Local generation proposed by the OPA is expected to alleviate these constraints but work to procure this generation must begin soon.

Ontario – Quebec Interconnection

Hydro One and TransÉnergie are building a 1,250 MW interconnection between Hawthorne TS in Ontario and Outouais station in Quebec consisting of a 230 kV line and back-to-back HVdc converters. Work to accommodate the tie, scheduled to be in service in 2009, will also include improvements to the supply to stations in the Ottawa area.

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 11.

NORTHERN ONTARIO ELECTRICITY SYSTEM AT A GLANCE

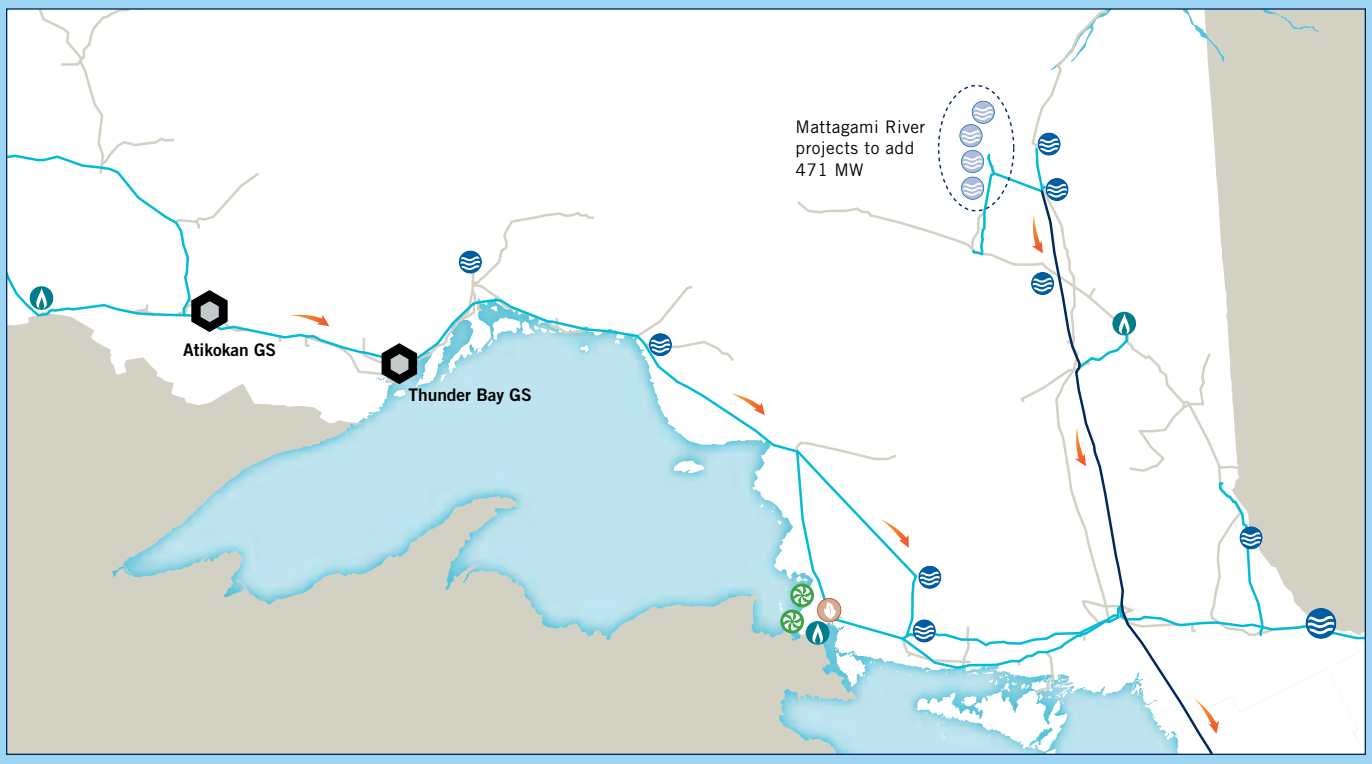


TABLE 3: REGIONAL REQUIREMENTS – PROJECTS CURRENTLY UNDER STUDY OR PROPOSED

AREA	RELIABILITY NEEDS IN THE AREA	EXPECTED/ REQUIRED BY	PROJECT(S) PROPOSED TO FULFILL REQUIREMENT
Central Toronto	Reduce transmission loading toward Central Toronto, and enhance supply to downtown	Summer 2008	Portlands Energy Centre
		Winter 2007-2008	John-Esplanade link
		Spring 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
		2011 to 2015	Install a third supply to downtown Toronto
GTA-West-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 supply for Vaughan and Richmond Hill loads and allow additional stations	Under review	Install breakers in Claireville to Parkway corridor on circuits V71RP and V75P
	Improve voltage control in the west GTA	Spring 2007	Install additional shunt capacitors at Halton, Meadowvale TS
		Under review	Investigate effectiveness and feasibility of capacitor at Hamilton Beach TS
	Improve the reliability of Cherrywood TS	Winter 2009-2010	A new 500 kV breaker and diameter positions at Cherrywood and Claireville
			Re-arrange 500 kV line termination at Cherrywood
	Improve supply to north Mississauga and Brampton loads	Spring 2009	Establish Hurontario Switching Station (SS) on circuits R19T and R21T and extend and connect circuits V72R and V73R from Cardiff TS
			Install new underground cables line from Hurontario SS to Jim Yarrow
		2008	Build new transformer station next to Pleasant 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	2006-2008	Additional reactive support
			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 auto-transformer 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
Burlington TS-Brant-ford-Woodstock	Loading on the auto-transformers near the maximum ratings	2008	Install over-current protections (planned for December 2007)
			Replace limiting connections and buswork to increase the limited-time thermal ratings and replace limiting transformer
	115 kV supply to Woodstock-Brant expected to be overloaded	Spring 2010	Install shunt capacitors at Woodstock TS (December 2007)
			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	Summer 2007	Re-terminate circuits M5E and E27 on to new busbar positions
		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 auto-transformer to supply Meaford TS
Eastern Ontario	Increase power transfer capability between Ontario and Quebec	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
			Uprate 230 kV circuits between Hawthorne and Merivale
	Enhance the supply to loads in the Oshawa and Belleville Areas	2010-2011	Relief of the 230 kV transmission east from Cherrywood is required to avoid overloads
			Investigate a connection to the 500 kV system

TABLE 3: CONTINUED

AREA	RELIABILITY NEEDS IN THE AREA	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 2007	High voltage shunt capacitors at Detweiler and Orangeville
	Transmission enhancements required to allow increased power transfers to enable return-to-service of Bruce Power Units 1 and 2	Spring 2007 to spring 2009	Additional shunt capacitors in southwestern Ontario (possible locations are Middleport, Buchanan and Nanticoke)
		2010	Series capacitors on the 500 kV circuits associated with the Bruce Complex (this option is under review)
	Transmission enhancements required to enable operation of 8 units at the Bruce complex	Spring 2009	Uprate sections of 230 kV Bruce to Orangeville circuits to allow increased output from Bruce
		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 2007	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 2007	Re-terminate two of the connections at Essex TS
			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
		2010	Provide transmission reinforcements and/or local generation additions in the Windsor/Essex area
	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)	Install two new 230 kV circuits between Allanburg TS and Middleport TS and reinforce the 230 kV transmission facilities into Burlington TS
	Relieve limitations on the autotransformer	Spring 2009	Bus uprating at Allanburg TS
		Spring 2008	Circuit uprate in the St. Catharines area to increase load meeting capability
Northeastern Ontario	Enhance the Special Protection Systems	Summer 2007	Enhancements to existing generation rejection scheme in the northeast and additional breaker at Porcupine TS
	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 Mattagami expansion and other 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 series capacitors with SVCs and shunt capacitors to be investigated
	To expand transfer capability east of Mississagi	2010	New SVC at Mississagi and shunt capacitor at Alogoma
			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	2009	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 auto-transformer to reinforce the existing connection between the local 230 kV and 115 kV systems
Northwestern Ontario	Improve voltage control	2009	Repair existing capacitor at Fort Frances
			Install new shunt capacitor to coincide with retirement of Atikokan
			Replace failed synchronous condenser at Lakehead with an SVC
	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, and shunt capacitors at Dryden TS

Local greenhouses in the Leamington area help reliability in Ontario by using backup generators managed by Genset Resource Management to satisfy their electricity needs when called upon by the IESO.

CONSERVATION AND DEMAND MANAGEMENT

All consumers in the province, from industrial to residential electricity consumers, can play a significant role in addressing part of Ontario's reliability needs. As businesses and homeowners become more conscious of their electricity use and become aware of opportunities to reduce and shift use away from peak demand periods, the reliability of the overall electricity system improves. In fact, the government has identified CDM as important components of its long-term plan for securing Ontario's electricity system.

The Ontario government has set aggressive CDM targets of 1,350 MW by 2007 and a further 1,350 MW by 2010.

The IESO, the Conservation Bureau of the OPA and LDCs have introduced a number of programs which encourage business owners and residential electricity customers to adopt energy efficiency measures and engage in demand response activities.

The IESO and the OPA operate demand response programs, which facilitate price responsive behaviour by customers. In such programs, customers that pay the hourly spot price for electricity have the option to reduce consumption when they foresee high electricity prices. Once customers make the commitment to reduce their consumption in approaching hours, the IESO may consider this demand reduction in its upcoming demand forecasts and dispatch decisions.

The first of the OPA's formal demand response programs, DR I, is essentially a permanent extension of the IESO's Transitional Demand Response Program (TDRP). The TDRP, which expires in April 2007, was established as a transitional program that provides incentive payments to fund the installation of demand response technologies and infrastructure. Launched on June 23, 2006, DR I is a permanent fixture that provides financial incentives to

customers that are willing to provide demand response capacity during high priced periods and system emergencies.

Phases two and three of the OPA's demand response program are expected to be implemented later this year. DR II is a load shifting program that provides financial incentives to shift demand to non-peak periods of the day. Under the third program, DR III, participants will be notified of specific demand response events and will be expected to shed load as defined under their contract.

As the CDM programs grow and results are verified, the IESO will integrate the demand response capacity procured through these programs in its reliability forecasts.

The IESO is currently working with the OPA to determine how demand response capacity that has been contracted under its programs can be integrated into the IESO's demand forecasts and system operations.

The system operational benefits of demand response programs are dependent upon a number of factors including:

- The resource must be available when and where needed for reliability;
- The resource operation must be visible and predictable to the IESO; and
- The efficient dispatch of other resources is not compromised.

The OPA will be establishing a portfolio of standard CDM programs aimed at residential and other low volume customers that can be implemented throughout the province. Three programs that the OPA has committed to expand province-wide include the appliance retirement program, the Summer Challenge energy reduction program and a residential load control program aimed at reducing the summer peak demand. LDCs are also actively developing and delivering a number of CDM programs.

Another element of the government's provincial CDM strategy is its smart meter initiative. The Ontario government has committed to installing 800,000 smart meters throughout the province by the end of 2007, and for all Ontario customers by the end of 2010. Because smart meters can measure electricity consumption on an hourly basis, they will provide Ontario customers with valuable information about their usage patterns. With greater understanding of how and when they use electricity, customers will be able to take actions to better manage their costs. In addition, providing more customers with the knowledge and opportunity to respond to pricing signals furthers the efficiency of the electricity market.

From the perspective of system operation, smart meters should encourage customers to curb energy use during peak periods, which in turn reduces the strain on the electricity system and could potentially defer the need to build new and expensive peaking generation. The success of this measure is, in part, dependent on providing consumers with timely information, in sufficient detail, for them to manage their energy use.

As the reliability coordinator, the IESO remains concerned with ensuring that demand response capacity is available when and where it is needed most. Some of the programs and initiatives described above are voluntary in nature and as such there is a risk that the associated benefits may not materialize in real-time or in the affected area. As CDM measures become more prominent, the IESO will closely monitor their contribution during peak demand and extreme weather events in order to reliably and efficiently schedule resources and operate the system.

Reducing peak demand will help contribute to the reliability of the system. The IESO recognizes that some investments in CDM can take longer to have a meaningful impact than conventional investments in generation and transmission infrastructure. As discussed earlier, the forecast supply situation will help address any delays in achieving CDM savings. Effective conservation and demand management measures require significant education and cultural shifts, which the IESO, the OPA, LDCs and the Ministry of Energy are encouraging through their respective programs.

For a list of the expected conservation and demand management savings, please see Table 2 on page 7.

INDUSTRIAL CUSTOMERS CONTRIBUTE TO RELIABILITY

There are a number of large industrial customers that regularly change their level of electricity consumption according to market prices without participating in any formal incentive-based programs offered by the OPA or the IESO. Some of these customers participate directly in the wholesale electricity market by making hourly bids to buy electricity. If the market price exceeds their bid price, they are instructed to stop consuming electricity. By participating directly in the market, these customers, known as dispatchable loads, will only pay up to what they consider to be the true value of electricity to them. If the cost is too high, they will shift their consumption to lower priced periods or operate on-site back-up generators.

A significant benefit of dispatchable loads is that they are an additional source of operating reserve supply. Operating reserve is stand-by capacity that is kept on-line in case the power system suffers a severe strain and reserve power is required. Dispatchable loads can serve as operating reserve because they can be instructed to stop consuming when the system is strained. The availability of dispatchable loads to serve as operating reserve tends to reduce energy and operating reserve prices and contribute to system reliability.

At the opening of the electricity market in 2002, there were only two large industrial customers registered as dispatchable loads. Today, there are nine, accounting for over 700 MW of directly connected price responsive load.

The availability of dispatchable load was notable when Ontario set records for peak demand during the summers of 2005 and 2006.

During the record setting days of July 2005 and August 2006, dispatchable loads contributed to maintaining the overall reliability of the Ontario system. Because dispatchable loads have the ability to respond quickly to dispatch instructions, the IESO was able to dispatch them down, thereby reducing demand and relieving some of the strain on the system.

In addition to these observations, the IESO's market assessment unit examined the consumption patterns of other large non-dispatchable industrial customers on August 1, 2006, to determine if any other customers reduced their electricity purchases in response to expectations of high demand and prices without specific instructions from the IESO.

The analysis revealed that four large industrial customers did in fact respond to the high price signals by reducing the amount of energy withdrawn from the system by a combined 25 MW for four hours. Their processes and systems remained unaffected as they were able to switch to their on-site back-up generators, which are typically uneconomic to operate.

The market price impact of the combined 25 MW load reduction was material. The market assessment unit estimates the price was almost one cent per kilowatt-hour lower as a result of the demand response of these customers.

A number of industries participate in the Ontario electricity market as dispatable loads.

INTERCONNECTED ELECTRICITY MARKETS

The Benefits of Being Interconnected

Ontario is part of a bigger North American electricity market which has been described in the past as the single largest machine ever built by humans. Ontario is interconnected with Manitoba, Quebec, New York, Minnesota and Michigan and through those jurisdictions, other provinces and states. Among all of its interconnections, Ontario has the ability to import and export between 4,000 MW and 5,000 MW.

Ontario benefits from its interconnections from both an economic and reliability perspective. First, when prices are less expensive in neighbouring jurisdictions than generation in Ontario, imports reduce the price to Ontario consumers from what it otherwise would have been. In addition, Ontario generators are able to export surplus capacity which contributes to the recovery of their fixed costs.

Being interconnected allows Ontario to achieve a level of reliability that would otherwise require a significantly greater amount of installed generating capacity, and associated higher costs. Under tight supply conditions, such as those experienced during the summers of 2002 and 2005, Ontario was able to attract imports at unprecedented levels to help maintain reliability in the province. In addition, the ability to export excess output provides generators with more demand certainty. As a result, they are more likely to ramp up in the morning and remain on-line during the day, which has significant reliability benefits for Ontario.

Longer-term Ontario may not be able to continue to rely on the same level of support from its interconnected neighbours as it has received in the past. Surrounding jurisdictions continue to meet their resource adequacy requirements, but as their load grows, they are beginning to face the prospect of declining supply margins.

According to the North American Electric Reliability Corporation's (NERC) 2006 Long-Term Reliability Assessment, there is expected to be a general decline in reserve margins over the next decade, including in those areas directly connected with Ontario. Although the benefits of being interconnected continue to exist, this decline will serve to reduce Ontario's confidence in imports.

Ontario's Improved Supply Picture

Fortunately Ontario can count on more domestic supply than it has in recent years. Since the market opened in May 2002 approximately 4,400 MW of new and refurbished supply has come on-line in Ontario. Over the same period, the 1,200 MW Lakeview coal-fired generating station in Mississauga was shut down, resulting in a reduction in emissions.

The improved supply situation is underscored by the fact that in 2006, Ontario was a net exporter for the first time since 2000. Last year, Ontario imported just over six terawatt hours (TWh) of energy from its neighbours while exporting almost double that amount.

There are also other indications of the improvement in Ontario's supply picture since May 2002.

In addition to having enough supply to meet demand, Ontario is required to carry an operating reserve to protect against contingencies and changing conditions. Since market opening, the number of hours when the required operating reserve plus demand exceeds the available domestic capacity has decreased substantially. In fact, operating reserve plus Ontario demand exceeded available domestic capacity in just 246 hours in 2006 compared to 622 hours in 2003.

Both planned and forced outage rates for Ontario's nuclear and fossil fleets have declined over the past four years, declining by seven per cent since the summer of 2003. This improved performance is influenced by the competitive and transparent environment in which generators operate today as compared to before market opening. It reflects, in part, the operating risks that generators bear and the need to operate to recover their costs and earn a rate of return.

ONTARIO AND ITS INTERCONNECTED MARKETS

Transmission Limits In to and Out of Ontario*

Manitoba	In to Ontario	Out of Ontario
summer	331 MW	263 MW
winter	343 MW	275 MW

Minnesota	In to Ontario	Out of Ontario
summer/winter	90 MW	140 MW

Michigan	In to Ontario	Out of Ontario
summer	1,550 MW	2,150 MW
winter	1,800 MW	2,400 MW

New York Niagara	In to Ontario	Out of Ontario
summer	1,300 MW	1,300 MW
winter	1,650 MW	1,950 MW

New York St. Lawrence	In to Ontario	Out of Ontario
summer/winter	400 MW	400 MW

Quebec North	In to Ontario	Out of Ontario
summer	65 MW	95 MW
winter	84 MW	110 MW

Quebec South (East)	In to Ontario	Out of Ontario
summer	800 MW	420 MW
winter	800 MW	470 MW

Quebec South (Ottawa)	In to Ontario	Out of Ontario
summer	748 MW	147 MW
winter	748 MW	167 MW

* As of December 2006. Actual transfer capability will vary depending on current system conditions.

Market Evolution

The IESO has been working to evolve the electricity market to encourage reliable supply and improve economic efficiency.

In 2006, the IESO responded to a variety of operational and stakeholder concerns by placing its highest priority on resolving immediate reliability based market issues before proceeding with significant market evolution programs.

Consequently, the first half of 2006 was focused on the implementation of the DACP, day-ahead and real-time intertie failure charges and the development and implementation of the ELRP.

These initiatives contributed favourably to the reliable operation of Ontario's power system during the record setting days of early August 2006. Overall, these initiatives resulted in greater certainty of generator availability, fewer transaction failures and additional flexibility for the IESO in managing the reliability of the system.

As it matures, the market will help to encourage investment in the Ontario electricity system, facilitate competition in the generation and sale of electricity, and drive innovation. Market-based rates will promote more informed consumption decisions, including energy efficiency, time-of-use management, conservation, and the development of distributed and renewable generating facilities.

All the while, the market must evolve in a manner that permits Ontario to benefit from the interconnected markets. This can best be achieved by pursuing designs that are consistent, or at a minimum, compatible with surrounding jurisdictions. Current design inconsistencies, including price calculation differences and the lack of a day-ahead market in Ontario continue to present challenges for importing and exporting electricity in the most efficient manner.

Over the coming months and years, the IESO will be working on a number of new market initiatives with the OPA, including long-term forward contracting and the development of load serving entities (LSE). The primary focus for the IESO in 2007 will be to assess the benefits, costs and viability of a day-ahead market in Ontario.

The development of LSEs is an important initiative that is currently being tested by the OPA through pilot programs. Generally, LSEs would have responsibility for sourcing electricity supply for default electricity customers, who, in the case of Ontario, are customers under the Ontario Energy Board's (OEB) Regulated Price Plan (RPP). The current environment where both RPP consumers and some other consumers are not actively represented in the market insulates a considerable portion of the load from market drivers. Development of LSEs can help address that. The pilot programs underway will provide valuable learning for Ontario by examining procurement, pricing, implementation and settlement issues around long-term LSE development.

In other jurisdictions, a day-ahead market enables participants to lock into prices one day in advance of real-time energy delivery if they so desire. This provides more certainty to suppliers and consumers, allowing them to react to price by leveraging added flexibility they may have a day in advance that is just not possible to take advantage of in real time. The added certainty and flexibility of day-ahead planning by more market participants is expected to improve the overall efficiency of the market and improve reliability. Stakeholder discussions about the development of enhanced day-ahead arrangements that make the most sense at this time for Ontario are continuing.

OTHER CONCERNS

A number of developments have occurred since the release of the previous Ontario Reliability Outlook in June. These new developments, in addition to previously identified concerns which still require action, are highlighted below.

25 Hertz System

The vast majority of Ontario's electricity system operates at a frequency of 60 Hertz (Hz), however two small pockets remain where generation and, in one case, load remain in operation at 25Hz, a carryover from 60 years ago when Ontario operated at this frequency.

Near Niagara Falls, a relatively small amount of load (approximately 50 MW) and generation (approximately 100 MW) continue to operate within the Niagara 25 Hz sub-system. The two remaining customers on this system are serviced by Ontario Power Generation's (OPG) Sir Adam Beck 1 Units 1 and 2 and OPG's 25 Hz frequency changer, FC1.

It has become increasingly difficult and expensive to maintain the reliability of this sub-system due to the age of the generation, transmission and distribution facilities and the obsolescence of 25 Hz equipment. Since 2003, the IESO has been working with all concerned parties to arrive at a retirement plan for the 25 Hz system at Niagara in order to eliminate significant inefficiencies identified by the Market Surveillance Panel in their July 2003 report. In June 2005, the IESO advised stakeholders to plan for the retirement of these facilities by April 2009 and to make arrangements for connection to the more reliable and efficient 60 Hz system.

National Grid in New York State has recently retired the US portion of the Niagara 25 Hz system earlier than their scheduled date of December 31, 2007. Late in 2006, OPG applied to the IESO to de-register its 25 Hz equipment at the Sir Adam Beck 1 Generation Station by April 2009.

Phasing out the Niagara 25 Hz system will eliminate the inefficiencies associated with the 25 Hz generation and transmission facilities. By converting their facilities to the standard 60 Hz system, the affected customers will align themselves with the rest of the Ontario system, which will enhance the reliability and stability of their supply needs. The IESO is working closely with these customers and other stakeholders to ensure that conversion to the 60 Hz system is well coordinated.

In northeastern Ontario, three small 25 Hz hydroelectric generation stations, totalling about 20 MW, continue to operate at 25 Hz, delivering power to the grid through frequency changers located near Sudbury. All 25 Hz loads in this area have long been converted to 60 Hz. Plans are underway to remove these stations from service in 2007 and 2008, convert them to 60 Hz operation and restore them to service by late 2008 into 2009. Once converted, the generation output will be increased to about 35 MW.

Lennox Reliability-Must-Run Contract

Since 2005, OPG has annually requested permission to remove Lennox generating station from service because market revenues are insufficient to cover its operating costs. Lennox, a 2,100 MW dual-fuel (natural gas and oil) facility, is located just west of Kingston and is an important source of supply in the region east of Toronto. Studies undertaken by the IESO to determine the impact of removing Lennox from service conclude that all four units at Lennox are necessary for maintaining reliability in the region at least until new transmission enhancements in the Ottawa area and new generating resources in the Toronto area are in-service.

To offset the revenue deficit and maintain Lennox in-service, the IESO and OPG have entered into reliability-must–run (RMR) contracts, which guarantee that OPG will recover the costs of running the facility as long as it is continued to be made available to the Ontario electricity market. As required by OPG's license conditions, these contracts have been approved by the OEB.

The IESO has recently received another application from OPG for permission to remove Lennox from service, as the current RMR contract expires later this year. Even when current local area requirements are addressed, the capability of the station is critical to provincial resource adequacy and must be retained or replaced to satisfy that requirement. This resource adequacy requirement cannot be achieved through an RMR under the current Market Rules. The OPA has notified the IESO that it will undertake development of a solution to the Lennox requirements.

Approvals Process

The IESO remains concerned about the impact of the current approvals processes on the ability to achieve the timely implementation of generation and transmission projects. This issue was first raised in the February, 2006, Ontario Reliability Outlook.

In the meantime, a number of projects awarded contracts under the Renewable Energy Supply and Clean Energy Supply Requests for Proposals have been delayed by various municipal permitting or environmental screening requirements. Of particular concern in these cases has been the open-ended nature of the appeals process which does not provide time-certainty to the decisions.

While some changes have been made, there will continue to be a risk that projects will not be available when needed because of uncertainties and timelines under local and environmental approvals.

The potential impacts of the current approvals process on planned projects will need to be continually evaluated to determine whether other decisions affecting planned or existing facilities are required to maintain reliability.

CONCLUSIONS AND RECOMMENDATIONS

- The reliability outlook for Ontario's power system has improved since June, 2006, as a result of actions to bring into service 7,000 MW of new or refurbished supply by 2011 and by the decision to have the OPA and IESO jointly develop a coal transition plan. This improved outlook reflects both overall resource adequacy as well as a number of local areas where supply concerns are now being addressed.
- A number of transmission enhancements are required to accommodate the planned new and refurbished supply and address local reliability needs. Otherwise, a number of transmission facilities in Ontario will be operated near their maximum capability, with little margin for unexpected events and requiring complex arrangements to do routine maintenance on critical facilities.
- The IESO remains concerned about the uncertainty around the length of approvals processes affecting generation and transmission projects and the impact on the timing of the implementation of the projects. Until the approvals process is demonstrated to be effective, there will continue to be a risk that projects will not be available when required.
- There is a need to ensure that the future supply and demand response mix has sufficient generation that can be dispatched up or down to match changes in the level of demand. These load following requirements are critical during early morning hours, when demand climbs quickly and in the evening when demand begins to decline.
- Aggressive targets have been set in the near future for CDM. Reducing peak demand will help contribute to the reliability of the system. Ontario's improved supply situation will help address any delays in achieving CDM savings. As CDM results are verified, the IESO will integrate the demand response capacity in its reliability forecasts.
- The planned installation of 4.5 million smart meters over the next four years combined with prices that reflect time of use can provide customers with an opportunity to curb their use of electricity during peak periods. Customer education efforts, and the provision of timely information in sufficient detail, will increase the demand response capability offered through smart meters.

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

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