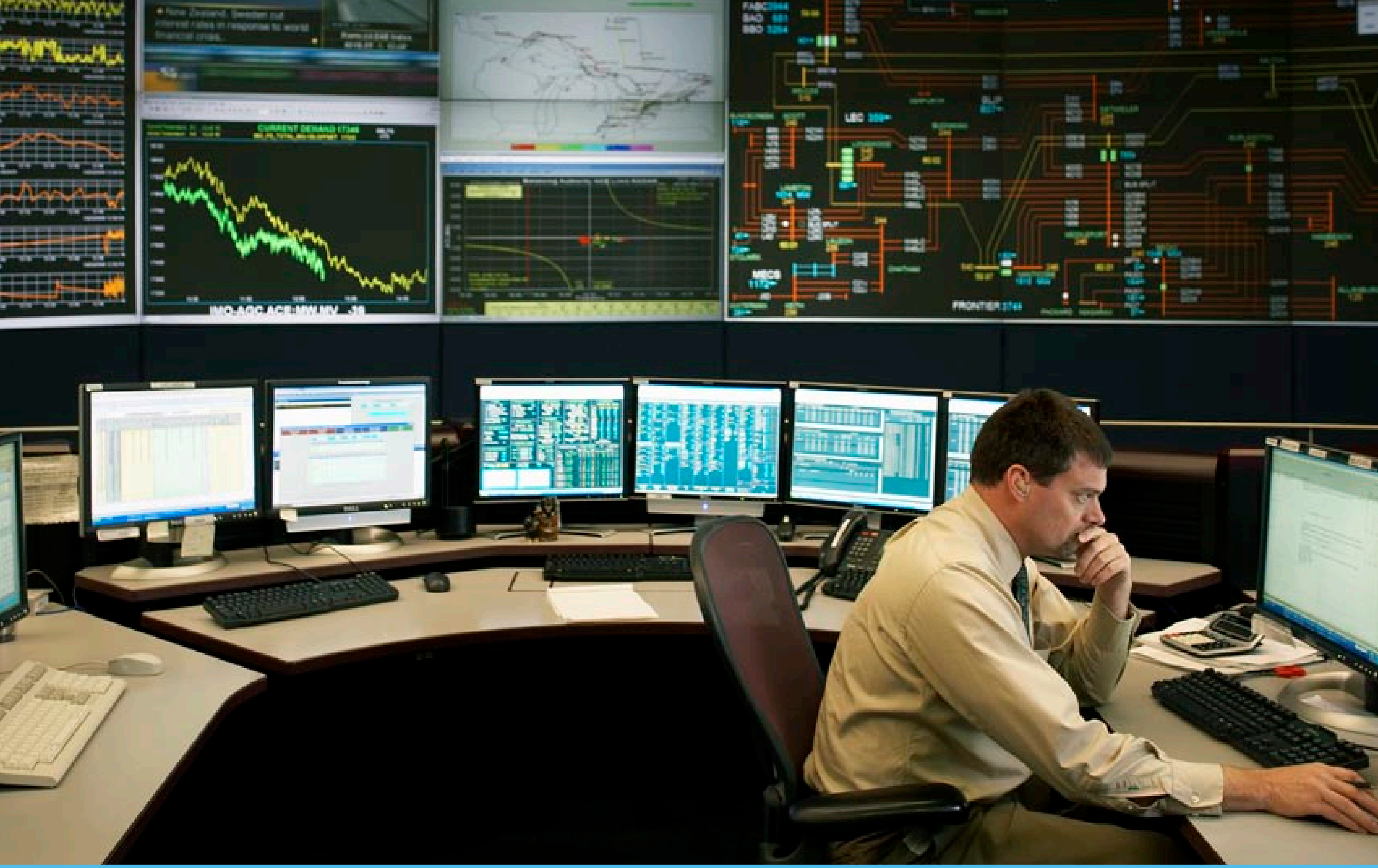
THE ONTARIO RELIABILITY OUTLOOK

DECEMBER

2008

ieso

Power to Ontario. On Demand.



IESO Control Room

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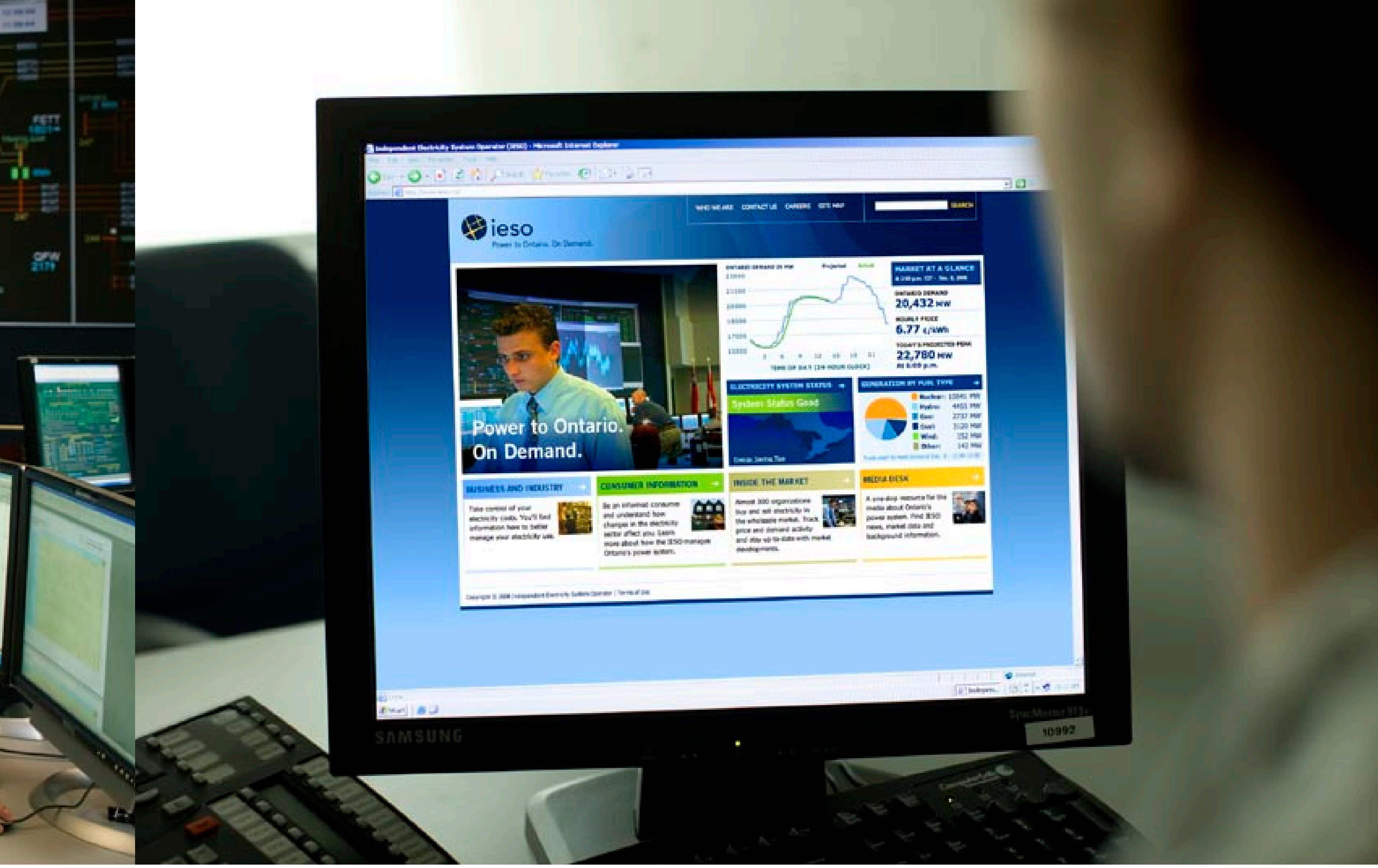


EXECUTIVE SUMMARY

The balance between demand and available supply in Ontario has improved considerably over the last number of years. Efforts to renew Ontario's electricity infrastructure and achieve the province's environmental targets have challenged the industry – yet these efforts are already providing tangible results with an improved reliability outlook in the near term.

In this Outlook, the IESO has identified three priority areas for reliability – the changing supply picture, the challenges of operating a greener electricity system and the continuing need for transmission enhancements. While significant progress has been achieved on all these fronts, other new challenges are emerging.

PRIORITY AREA #1: THE CHANGING SUPPLY PICTURE

Ontario is well positioned for the phase-out of coal-fired generation by the end of 2014. Replacement capacity is either on-line or on schedule. In the years following the coal phase-out, the province's next reliability challenge will be to carefully manage the renewal of its existing nuclear fleet.

From today's perspective, the successful phase-out of all coal production in the province is achievable.

Overall, almost 10,000 MW of new generation or demand management is in service or planned, comprising nuclear refurbishment, new natural gas generation, conservation and more than 1,400 MW of renewable generation projects. Together, these resources will aid in the balancing of the provincial supply mix and support the reduction and eventual phase-out of existing coal generation.

Progress toward these milestones has enabled the implementation of further emission restrictions for coal-powered generation at the beginning of 2009. By 2011, these limitations will significantly reduce coal-plant emissions and are structured so that the IESO can manage potential reliability impacts.

There is a need, however, for the careful management of transmission operations as the Nanticoke Generating Station transitions away from coal-fired generation at a time when Units 1 and 2 at the Bruce A Generating Station are planned to be reintroduced into service. Nanticoke provides critical voltage support to the transmission network, particularly along the 500 kV corridor between London and Toronto. The loss of the Nanticoke generation coupled with the increase in production from Bruce A and new renewable generation in the area will require the installation of shunt capacitor banks and interim reactive power support from the Nanticoke site.

The development of gas-fired generation is rapidly providing replacement capacity and many of the operational capabilities offered by coal. Capacity from gas-fired facilities has surpassed coal generation in the province. Over the last year, the Greenfield Energy Centre and the first phase of the Portlands Energy Centre have been placed in service, providing 1,500 MW of capacity. Another 1,600 MW of gas supply is expected to become operational before the summer of 2009.

As Ontario's electricity sector becomes more dependent on natural gas as a primary fuel, the adequacy and security of the natural gas supply infrastructure becomes even more critical to the reliability of the electricity system. The IESO has been working with its partners in both the gas and electricity industries to develop communication protocols and shared operational and planning studies.

Beyond the coal shutdown, a new challenge emerges – the need to refurbish or retire and replace aging nuclear units. Ministry of Energy and Infrastructure directives call for the amount of planned nuclear capacity be limited to 14,000 MW over the next 20 years. To meet this objective, the majority of nuclear units will need to be refurbished or be replaced through new-build projects.

All four 500 MW units at Pickering B will be nearing the end of their service lives, requiring an analysis of how best to maintain or replace this capacity. Similarly, all four Bruce B units will reach the end of their service lives within the next decade. In addition, a decision is anticipated soon about which technology is to be used in the two new nuclear units on the Darlington site.

These decisions will have significant impacts between 2015-2020 as many of these developments will require major grid-related outage programs and new transmission capability. This convergence of decisions regarding Ontario's nuclear fleet will require intricate planning as some facilities are taken out of service, others are reintroduced, and still others are commissioned for the first time. This planning needs to take into account the operational challenges that each option entails.

PRIORITY AREA #2: OPERATING A GREENER ELECTRICITY SYSTEM

A more sustainable, diverse and variable supply mix requires a more flexible and innovative approach to operating the electricity system. A new model for system operations is emerging – one that responds to production and consumption activity on a local level and then moves to meet remaining provincial electricity needs.

A rapid transformation is taking place within Ontario's generation mix. New renewable resources with different operating characteristics are coming on-stream; generation is becoming increasingly dispersed and demand management is taking a more active role in providing reliability.

Ontario now leads the country in wind power capacity, with over 700 MW of installed wind generation, and more to come. Production from these facilities has been strong with an average capacity factor of 30 per cent for the first 10 months of 2008. Ontario is extremely well-positioned to support the growth of wind generation in the province – with a diversity of potential sites.

Given the intermittent nature of wind facilities, the IESO has been proactively working with others to address any impediments to additional wind integration. It is also looking at operational, planning and forecasting issues. For example, winter forecasts will now incorporate higher capacity factors for wind generation, a reflection of wind's stronger performance at that time of the year.

Providing the necessary flexibility and ramping capability within the new supply mix will be key. Supply must be continually balanced to meet the needs of the province and its interconnections. The IESO will be looking at ways to evolve these capabilities efficiently during this transformation.

Increased distributed or embedded generation will also facilitate the growth of renewables in the province. Distributed generation can be more efficient in mitigating local reliability concerns and reducing power system losses. The Ontario Power Authority (OPA) has signed contracts for approximately 1,400 MW of distributed generation – mostly through wind, solar and biomass projects – to be in place by 2011.

Demand response (DR) programs that specifically target load reduction during hours with tight supply cushions are beginning to take shape, signalling to consumers when those demand reductions are most needed.

DR programs are maturing, and in particular, the OPA's DR 3 program launched this fall is contracting with large customers to reduce load over 100 or 200 peak hours in a year. The structure of this new program will also provide a highly reliable and verifiable supply resource.

The innovation taking place to create a more sustainable supply mix needs to be matched with innovation in system operations. The IESO has been working with industry partners to develop a greater understanding of these new resources as well as what tools and standards are needed to effectively manage them.

With many more players contributing to system reliability, a need for more centralized information gathering and co-ordination is emerging. In jurisdictions with significant amounts of renewable generation, system control centres often have the ability to track production and consumption activity on a local level and then move to maintain reliability by directing large-scale generation to provide energy for the remaining demand.

To be effective, this new approach to system operations would benefit from the co-ordinating influence of market prices and smart grid technologies. Wholesale electricity markets signal to consumers and producers when generation and demand response is needed the most – harmonizing all participants to work in ways that support reliability.

A greener and more distributed electricity sector also requires advanced information technologies to enable the flow of information to and from the distribution level. Smart grid technologies extend the reach of system operations to the distribution system, enabling the system operator to understand how local consumption and production activity can impact the broader reliability picture. These same technologies (such as smart meters) also open the door for a broader group of consumers to respond to price signals and reduce their energy use during peak periods.

The IESO is leading an industry forum to develop a vision for a smart grid in Ontario. The forum report will be released early in 2009.

PRIORITY AREA #3: THE CONTINUING NEED FOR TRANSMISSION ENHANCEMENTS

While significant progress is being made to revitalize the province's transmission system, the demands of the changing supply mix are accelerating. Additional transmission capacity will be needed to support new generation from renewables and to address regional congestion concerns.

Ontario's transmission infrastructure faces challenges on two fronts: an aging existing infrastructure and the need to adapt to the new demands of the changing supply mix. Work is proceeding on a number of important projects to address short-term needs.

The conditional approval provided by the Ontario Energy Board (OEB) to proceed on the construction of a new 500 kV double-circuit line along the Bruce to Milton transmission corridor was an important milestone toward delivering the full capability of the two Bruce nuclear units that are being refurbished as well as new wind resources in the area. It is scheduled to be in service by the winter of 2011/12.

Completion of the new Ontario/Quebec interconnection near Ottawa will increase import capability by an additional 1,250 MW when at full capacity. New transfer capability is being planned for the North-South interface, which will relieve the restrictions on existing generating capacity and accommodate output from expanded hydro facilities on the Mattagami River.

Hydro One has also identified sustainment capital investments totalling over $600 million to be completed during the next two years. These investments are required to maintain both the reliability and the continued availability of its aging transmission infrastructure.

And while significant progress is being made in preparing transmission facilities for the increase of new supply, there remain a number of areas of concern.

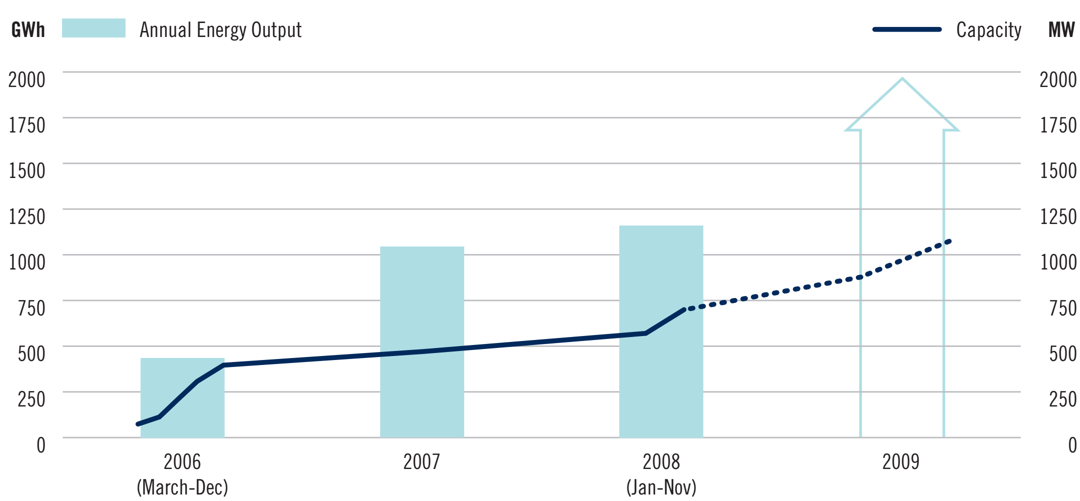
New transmission and generation reinforcements in the West GTA will come in service over the next two years and will greatly support reliability, yet the southerly part of this area still requires additional generation capacity. New peaking facilities in the Kitchener-Guelph-Cambridge area are needed to address supply constraints in that area. Congestion in Northern York Region is being addressed in part by a new transformer station to come in service in summer 2009 and through demand response. The need continues, however, for a peaking gas plant in the area. The OPA is procuring generation for all three regions.

Pressures will also be placed on the transmission system as a result of the growth of renewable generation. A series of transmission lines is needed to support new wind capacity in areas that are either congested or located away from existing transmission facilities. For example, a line is being proposed to Manitoulin Island to accommodate new generation resources to be located on the island.

Transmission enhancements will also be required to accommodate replacement nuclear capacity from the Darlington site. The existing right-of-way between the Bowmanville and Cherrywood transformer stations east of Toronto can accommodate a third 500kV transmission line. The installation of this new line, together with the development of the Oshawa Area Transformer Station, would then provide sufficient transfer capability to allow up to 3,600 MW of new generating capacity from Darlington.

Given the pace of change, managing the system as some generation facilities are retired, new ones incorporated and new transmission facilities are constructed, will require careful outage planning. Changing one component of the system, whether it is generation or transmission, impacts the flows, limits and capabilities of all the other parts of the system. Switching, replacing, refurbishing or building new infrastructure cannot be done on an ad-hoc basis. It requires close co-ordination of all the elements impacted by the proposed changes. Through its outage management process, the IESO will work closely with Hydro One and other partners to ensure the reliable operation of the system during this period of significant change.

ONTARIO WIND CAPACITY AND GENERATION (EXISTING AND PLANNED 2006-2009)



Darlington Generating Station

THE CHANGING SUPPLY PICTURE

Ontario is currently benefiting from a high level of reliability, due in part to new supply coming in service as coal-fired facilities remain operable. There are, however, a number of challenges to reliability following the coal phase-out as the province's aging nuclear fleet undertakes an extensive process of renewal.

Coal Phase-out

Since the 1960s, Ontario's fleet of coal-fired generation has provided both substantial amounts of capacity and operational flexibility to the province's electricity system. Yet concerns about the emission of greenhouse gases and other pollutants from these facilities have led to the provincial decision to phase-out all coal-fired electricity production in Ontario by the end of 2014.

Replacing coal will represent the single largest greenhouse gas reduction initiative in North America – equivalent to taking almost seven million cars off the roads. Lakeview Generating Station, with a capacity of roughly 1,140 MW, was closed in 2005. While the precise timing for the phase-out of coal generation at the remaining stations – Nanticoke, Atikokan, Thunder Bay and Lambton – is still under development, the IESO has released an operational study which concluded that the future resources planned in Ontario Power Authority's (OPA) Integrated Power System Plan will provide sufficient reliability and operational flexibility following the phase-out of coal.

The OPA is presently managing 9,871 MW of generation and demand management contracts, excluding the Standard Offer Program (SOP) for smaller scale projects. These contracts include 3,000 MW of nuclear refurbishment, more than 5,400 MW of natural gas generation, and more than 1,400 MW of renewable and demand reduction capacity, all of which are expected to be in service by 2013. Together, they will aid in the balancing of the provincial supply mix and support the replacement and eventual elimination of existing coal-fired generation.

The retirement of coal-generating capabilities at the Nanticoke station does create operational concerns. As power flows in the Bruce/Southwestern Ontario area begin to change, careful management of the transmission system is crucial. With an increase in generation from Bruce A and new wind farms in the area, coupled with the decrease in generation from Nanticoke, additional reactive power support through the installation of shunt capacitor banks and interim voltage support from the Nanticoke units will be required.

Progress on the coal phase-out is also aiding the implementation of provincial limits on greenhouse gas emissions from the coal-fired units in the near-term. New reductions start next year, initially with targets of 19.6 megatonnes (Mt) in 2009, 15.6 Mt in 2010 with a hard cap of 11.5 Mt by 2011.

"If implemented effectively, climate change initiatives can result in improvements to reliability in North America, bring new generation technologies to fruition, diversifying the fuel mix, strengthening the transmission system and encouraging the development of the smart grid,"

Reliability Impacts of Climate Change Initiatives a report by the North American Electric Reliability Corporation (NERC)

These new restrictions will require close attention and careful management by Ontario Power Generation (OPG) and the IESO to minimize reliability impacts. During this interim period, the IESO can direct OPG's coal-fired assets to exceed those limitations should reliability concerns emerge, providing an added level of confidence that emissions reductions can proceed without jeopardizing reliability.

The Renewal of Ontario's Nuclear Fleet

Nuclear energy provides roughly 50 per cent of Ontario's power needs. This capacity makes up the majority of Ontario's baseload generation that runs continuously, 24 hours a day. Based on Ontario's experience over the last few decades, this proportion of nuclear capacity within the supply mix works to enhance reliability and helps dampen the financial impacts of fluctuating fuel costs.

In determining Ontario's supply mix, the province directed the OPA to plan enough nuclear generation to meet baseload requirements up to a maximum of 14,000 MW capacity. Much of this capacity is, however, nearing the end of its service life, requiring a series of decisions about how to replace it.

This replacement can be achieved through the refurbishment of existing units, the construction of new units or a combination of both. How much of the replacement capacity will be provided through new-build projects will have a significant impact on how electricity supply is managed following the elimination of coal-fired production in 2014.

The approvals process and construction period for new nuclear generation take longer than any other type of generation – as decisions need to be made at least 10 years before the units are required. As a result, these decisions are needed in a timely fashion if the province is to sustain the desired levels of nuclear capacity needed to manage reliability.

How these decisions unfold will also have a significant impact on system reliability and, in particular, will require a sophisticated outage management program in order to incorporate new supply and facilitate retirements or outages for refurbishment. More detail about the impact of changes in Ontario's nuclear capability on the transmission system can found on pages 13-16.

Here's an overview of Ontario's nuclear fleet:

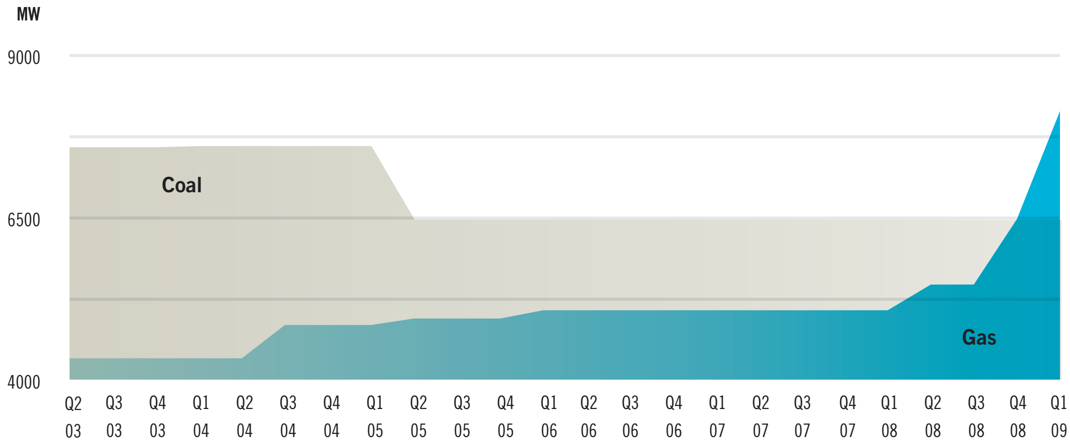
Bruce Generating Station: The refurbished Bruce A Units 1 and 2 are expected to be placed back in commercial service by summer 2010. The service lives of Bruce A Units 3 and 4 are expected to be extended through 2010 and 2015 respectively. These units will then be taken out of service for more than two years for refurbishment. Four Bruce B units are currently operating and will reach their end of service life within the next decade.

Darlington Generating Station: The existing units at Darlington will reach their end of service lives within a decade, or soon after. No decision has been made concerning the possible refurbishments of these units. However, a decision has been taken to build new additional nuclear units at Darlington and a competitive process is currently underway to determine which supplier and technology will be used.

Pickering Generating Station: As Ontario's oldest nuclear facility, the Pickering Generating Station comprises four units operating at Pickering B and two at Pickering A. Pickering A Units 1 and 4 were recently refurbished and placed back in service. Pickering B units will reach their end of service life by the middle of the next decade. A decision is pending about whether to refurbish these remaining units or replace them.

In the case of refurbishment of Pickering B units, the work could begin as early as 2013, and be completed around 2020. To minimize the impact

GAS-FIRED GENERATING CAPACITY NOW EXCEEDS COAL GENERATING CAPACITY



on the system, refurbishment work needs to be staggered to limit the number of units removed from service at any one time.

The alternative to refurbishment of Pickering B is its subsequent replacement with new-build nuclear facilities. The OPA's Integrated Power System Plan assumes that if new-build replacement for Pickering B were contracted, the first unit would begin service around 2020, taking into account the 10-year lead time for design, regulatory and construction activity.

The Pickering decision could affect Ontario's electricity system capacity by the retirement of 2,000 MW of capacity from Pickering B combined with the possible re-assessment of sustaining the 1,000 MW of operable capacity from Pickering A. This capacity and associated energy might be replaced with stepped-up implementation of conservation, more installation of renewables, more intensive operation of existing gas generation, the introduction of new build gas generation, or higher volumes of imports.

Without refurbishment, it is possible that Pickering B might continue to be operated for a few years beyond its otherwise scheduled retirement. There are various means of achieving a short-term extension of Pickering service, including the option of lower production levels from those reactors.

Increased Reliance on Gas

Gas generation is key to providing the flexibility that will be lost with the elimination of coal-fired generation. Projects that were procured earlier in the decade are coming on-stream. Since 2006, more than 1,600 MW of new gas generation has come online. In the next three years, another 3,300 MW of new gas generation is expected to become operational.

The commissioning of the first phase of the Portlands Energy Centre in the summer of 2008 was a critical step in addressing the supply needs of the Toronto area. This fall, the Greenfield Energy Centre in the Sarnia area brought another 1,153 MW of capacity to the system. Looking just ahead to the first quarter of 2009, the Goreway station, St. Clair Energy Centre and the combined cycle operations of the Portlands station, representing a total of approximately 1,660 MW, will ramp up production. The OPA is also in the process of procuring a number of other new generation plants to address regional concerns and to provide the additional operating flexibility needed to eliminate coal generation.

This shift toward natural gas also creates new challenges for the industry. By mid-2009, gas will represent 23 per cent of supply, up from 12 per cent in 2001. As Ontario becomes more dependent on natural gas as a primary fuel for electricity generation, the adequacy and security of the natural gas supply and its infrastructure becomes even more critical to the reliability of electric supply.

Unlike the electricity industry, the effect of contingencies in the gas sector are not always immediate and often take time to become more widespread. As a result, communications channels are being established to ensure that information between the IESO and provincial gas distributors is exchanged when events occur on one system that could impact the other. Work on an agreement to develop a framework for conducting coordinated gas and electricity operating and planning studies is close to completion.

Melancthon Wind Farm Project

OPERATING A GREENER ELECTRICITY SYSTEM

The move to a greener, more distributed supply mix will promote greater innovation in the way the system is managed. System operations need to adapt to the operating characteristics of these resources to ensure that the inherent diversity of the new supply mix works to maintain reliability.

The New Supply Mix

Renewable generation and conservation are taking a more prominent position in Ontario's supply mix. In 2006, the Ontario Government set a target of 22,000 MW of renewable resources and conservation efforts by 2025. The OPA is looking at ways to accelerate – or even surpass – target in its current review of the Integrated Power System Plan (IPSP).

Work to achieve this goal is well underway. Ontario now leads the country in wind generation capacity; the number of distributed generation projects is escalating; and demand response programs are moving to a level where they can be considered as reliable as traditional capacity resources.

Wind

Ontario is moving ahead quickly with the implementation of new wind power developments. There is more than 700 MW of installed wind capacity in the province, which, between January and November 2008, produced more than 1 TWh of electricity. This capacity is expected to grow considerably by the summer of 2009 to 1,100 MW.

The potential to increase the amount of wind supply in the province is significant. In its analysis of the operability of the IPSP, the IESO determined that approximately 5,000 MW of wind generation could be accommodated.

The report recognized that at higher wind penetration levels, heightened attention would be required for the system to be able to handle the variability of wind generation. The report also indicated that the generation mix in the plan did provide adequate load-following capability to support this level of wind generation.

Ontario is well-positioned for considerable growth in wind generation in the province even beyond that level. A 2006 study commissioned by the IESO, the OPA and the Canadian Wind Energy Association provided important analysis that will help facilitate the growth of wind power in the province:

- Ontario has promising wind development potential – with a good selection of sites across the province. A diversity of wind farm locations will mitigate the variability impacts of this resource. For example, it is unlikely that extreme weather incidents would have a sudden impact on the entire system.
- Wind persistence is high from each 10 minute interval to the next. As a result, wind output is not likely to vary more than 10 per cent over these short periods. Understanding this variability is important in understanding whether any additional operational capability from other generation is needed.

The operational characteristics of wind differ significantly from the other resources in the supply mix. The intermittent nature of wind power makes it difficult to forecast generation with certainty. For example, wind output on December 2, 2008 reached 617 MW. By contrast, wind production reached a low of just 2 MW on July 19, 2008, a hot and windless day.

This seasonal bias is reflected in the monthly capacity factors, or the percentage of capacity that actually produced energy. In January and February of this year, average capacity factors were 43 per cent, yet in August, this same figure reached only 13.5 per cent.

To some extent, improved forecasting can help accommodate this level of variability. The IESO has been working to develop new wind forecasting methodologies that will take into account the wind's stronger performance in the winter and shoulder periods of the year. Some of these methodologies are being implemented by the end of 2008 and will result in higher forecast capacities for the winter.

As more variable generation comes online, new tools and processes will be needed to balance this supply against other types of supply during periods of low demand. For example, high levels of wind generation during periods of low demand could create surplus baseload generation concerns. Surplus baseload generation currently occurs only a few times a year and is resolved through the rescheduling of outages to take advantage of these conditions, or through increased exports.

The IESO will continue to work with its partners to ensure the reliable and effective integration of wind within the province – which includes tapping into the experience with wind generation developing in other jurisdictions.

Current Large Wind Operations in Ontario

Erie Shores Wind Farm (99 MW)	Bayham/Malahide/ Houghton Township
Kingsbridge I Wind Power Project (39.6 MW)	Goderich
Melancthon I Wind Project (67.5 MW)	Melancthon Township
Prince I Wind Power Project (99 MW)	Aweres/Dennis/ Pennefather/Prince Township
Prince II Wind Power Project (90 MW)	Dennis/Pennefather Township
Ripley Wind Power Project (76 MW)	Huron/Kinloss Township
Melancthon II Wind Project (132 MW)	Amaranth/ Melancthon Township
Kruger Energy Port Alma Wind Power Project (101 MW)	Port Alma

The expansion of renewables – wind, solar, biomass and others – will increasingly take place within distribution systems, and outside the traditional control of the IESO and its operation of the bulk electrical system. The OPA has already signed contracts for approximately 1,400 MW of renewable embedded generation to be in place by 2011 under its Standard Offer Program.

It is expected that embedded generation will soon displace significant amounts of output from larger generating units that are connected to the high-voltage system. These large units currently provide fast voltage control, operating reserve and load following that contribute to reliability of the grid. The IESO is assessing all of these aspects and will be working closely with stakeholders to maintain reliability of the grid as the types and characteristics of the future supply mix changes.

The IESO is also working with local distribution companies, the OPA and the OEB to increase visibility of the real-time output of distributed generation in an effective and cost-efficient manner. Knowing how much generation is available and operating within a distribution area is one aspect that will assist the IESO to reliably manage overall provincial load requirements.

Demand Management

Demand response and conservation efforts throughout the province are gaining momentum and are starting to play a more active role in maintaining reliability of the system. The IESO-administered market – with real-time prices that signal the supply/demand situation – ensures that demand management initiatives are triggered when they are most needed. In order to know in advance how much demand management can be relied on, these programs have to be carefully identified, well co-ordinated and their results verified.

Since market opening, the IESO has had at its disposal almost 500 MW of dispatchable load. For the most part, these participants offer operating reserve into the market, curtailing production should the IESO need to invoke operating reserve to maintain reliability. At times, this economically-driven demand response capability has been critical over the last few years to maintain reliability, as it can free up much-needed generation for energy production.

With the launch of the OPA's DR 3 program this summer, demand response efforts are becoming more accessible to a broader group of consumers and will also be able to make a more active contribution to system reliability. The OPA has begun to contract with large customers and aggregators of small customers to reduce consumption for 100 or 200 hours during periods when the supply cushion is low. Registration for this program has accelerated rapidly over the last two months, with an initial 80 MW of load, out of a target of 250 MW, already subscribed to the program.

The operability of the DR 3 program starts to mimic traditional forms of generation in that it is dispatched when supply is needed most. Demand response resources are committed to respond to dispatches for the duration of the contract. The IESO directs DR 3 participants to reduce demand either directly or through an aggregator when the supply cushion is diminished. The IESO is also responsible for the settlement, measurement and verification of the program.

Demand response programs are continuing to evolve. Programs such as Peaksaver, which cycle down residential air conditioners, will also be linked to the same triggers as DR3, widening the scope of concrete demand response measures. Another OPA program, DR2, expected to launch in the new year, will promote institutional changes within organizations that will contribute to lower daily peaks. It will provide the equivalent of capacity payments to companies that revamp their ongoing processes to shift energy use from peak hours to off-peak hours.

Smart Meters

Ontario's smart metering initiative is moving into a new phase with the implementation of time-of-use rates. Currently, Milton Hydro and Newmarket Hydro are billing the majority of their customers on time-of-use rates.

The IESO is responsible for the oversight and management of the central data repository (MDM/R) that collects smart meter consumption data and bundles it into time-of-use billing quantities for local distribution companies. This repository went live in 2008. Further enhancements to the MDM/R and increased customer education will lead the way to a broader roll out of the time-of-use rates in 2009.

Ontario's smart metering network captures information from residential and small business consumers on an hourly basis providing them with a tool to better manage their energy use. This system provides a more flexible platform for other sophisticated demand response programs and tools to be built. As the province contemplates a vision for the development of smart grid capabilities, it has the benefit of a comprehensive smart metering system and consumers who will be accustomed to variable pricing.

Maintaining Reliability and Sustainability

Achieving a more sustainable and diverse supply mix requires more than creating new supply resources and expanding transmission infrastructure. It necessitates a fundamental rethinking of how all the pieces that comprise the electricity system work in tandem to provide a reliable electricity service.

In the traditional system management model, reliability is maintained primarily through large-scale generation that delivers supply through the transmission system. For the most part, the IESO maintains reliability by forecasting provincial demand, directing generators to meet demand, and then monitoring the power flows to ensure reliability is maintained. In effect, almost all system operations take place on the bulk-electricity system.

This paradigm is changing. As increasing amounts of generation will take place within distribution systems, the impact of this activity won't be visible on a provincial level. Distributed generation will also be mostly renewable and potentially intermittent in its operating characteristics. Add to that a more engaged consumer base that makes its energy use decisions based on market signals or demand response programs, and the task of system management clearly needs to evolve.

Reliability standards will need to be updated to facilitate a greater contribution by renewables and distributed generation. Forecasting processes will also need to better incorporate these new forms of supply. Work in both these areas is already progressing. Most importantly, however, the system operator will require a clearer view of electricity production and consumption on all levels of the system. Balancing supply and demand only on the transmission grid will no longer be sufficient to meet the electricity needs of Ontarians, and creates potential reliability risks.

In the coming years, the role of system manager will require a more sophisticated level of information gathering and analysis – particularly within distribution service areas. Advanced technologies will provide the IESO with more detailed information about how local needs are being met through distributed generation and demand response, so that it can then move to address the broader provincial needs that aren't being met.

Through the Ontario Smart Grid Forum, the electricity industry is looking to better understand how to leverage information technologies to support reliability. Automated controls, advanced monitoring systems and information technology provide the capability to bring the "customer to the control room," using electricity consumption and production information on a granular level to build a more accurate overall picture of the province's true energy needs.

More discussion about smart grid technologies can be found on page 17.

Wind Generation in Leading Jurisdictions around the World

Jurisdiction	Wind Capacity (MW)	Total Installed Capacity (MW)	Local Approach
California	2,600 (4.6% of total installed capacity)	56,136	Actively involved in storage technology initiatives. Recent transmission planning study focused on the integration of large volumes of wind to determine load following, hourly ramping requirements, regulation capacity and over-generation issues.
Texas (ERCOT)	6,023 (9.8% of total installed capacity)	61,552	Proactively involved in enhancing high-voltage transmission system to accommodate wind generation.
Spain	15,039 (17% of total installed capacity)	86,231	Wind power is facilitated by pumped generation storage and 40,000 MW of reserve capacity in excess of peak demand. Wind capacity expected to increase by 3,500 MW per year.
Germany	22,247 (17.5% of total installed capacity)	127,000	Infrastructure supports renewables with high rates of transmission capacity and population density.
Denmark	3,125 (24% of total installed capacity)	12,969	Infrastructure supports renewables with high rates of transmission capacity and population density.

LOADING UP: ELECTRICITY STORAGE TECHNOLOGY

New technologies are emerging that store electricity for varying periods of time, allowing better management of supply and demand fluctuations. Storage technologies can be highly responsive to system control requirements, with the ability to ramp-up quickly to meet rising demand and capture excess generation during periods of low demand. This flexibility can work to balance the variability of renewable generation, providing reliability with the added benefit of low emissions.

There are a number of storage technologies currently available:

Pumped Storage reverses the water flow between reservoirs which is then used to produce electricity during peak hours. Many of the newer pumped storage projects use wind turbines to drive the pumps directly – creating a renewable and extremely reliable resource. Pumped generation can, however, come with high construction costs and be difficult to locate given land-use impacts.

Flywheel Systems are literally massive rotating cylinders that can spin as much as 30,000 RPM, developing such inertia that they can be available to provide highly flexible generation regulation. A 20 MW flywheel facility is currently in development in New York State.

Compressed Air Storage takes advantage of abandoned gas and oil wells by storing compressed air and using it to run turbines during peak periods.

Other technologies – including hydrogen production and storage, supercapacitors and advanced battery technologies – are also developing with the potential to offer a suite of new options to manage reliability.

These technologies are being explored by system operators around the world. Many are adapting their current procedures to take advantage of the high-responsive operating characteristics of this form of supply, which can be an ideal companion to some of the variable renewable generation options.

The Sir Adam Beck Pump Generating Station in Niagara provides 174 MW of electricity by using excess generation capacity to pump water from the Niagara River into a 300 hectare reservoir.

The Thorold Cogeneration Project currently under development

THE CONTINUING NEED FOR TRANSMISSION ENHANCEMENTS

Ontario's transmission system is undergoing a similar process of renewal. New infrastructure is needed to replace or upgrade aging facilities, while changes in the provincial supply mix are requiring additional transmission support. In particular, new transmission projects are proceeding to address the province's short-term needs.

Further transmission enhancements will be needed to address the rapid growth of renewable generation in the province to extend the reach of the system to remotely located wind and hydro facilities. New transmission resources, as well as a carefully co-ordinated outage management process, will also be required to accommodate changes within the province's nuclear fleet.

The Bruce Area

Earlier this year, the Ontario Energy Board approved a leave to construct for a new 500 kV double-circuit line between the Bruce nuclear complex and Milton TS. Subject to an environmental assessment approval, the line is scheduled to be in service by winter 2011/12.

This new line will provide sufficient new transmission capacity to deliver the energy from all eight units at the Bruce complex and up to 1,700 MW of wind generation. About 700 MW of this wind generation is already committed and in various stages of construction. Two enabler* lines are proposed to support an additional 1,000 MW of generating capacity: one in the Bruce Peninsula area; and one into the Goderich area. Both would be available by winter 2015/2016.

Construction of the new 500 kV Bruce to Milton line and the associated facilities at the terminal stations will require numerous outages on the grid. This is expected to be especially challenging, particularly since seven or possibly eight Bruce generating units could be available for operation at the Bruce complex before construction of the line is completed. The IESO will be

*Enabler lines are special purpose transmission facilities that connect remote generation and load to the IESO-controlled grid.

working with Hydro One to facilitate the outages required to complete the line construction and to reduce congestion.

Greater Toronto Area

GTA-West

Following the completion of Hurontario SS by the spring 2010, the loads in northern Mississauga, Brampton and Bramalea will have an alternative source of supply, reducing the impact of potential contingencies. Further work in the Hurontario SS area to enhance the supply capability is scheduled to be completed by spring 2012.

Additional transmission enhancements are planned between Milton TS and Claireville TS in order to meet the growing supply needs of Georgetown, Milton, Halton Hills, Brampton and north Mississauga. This project includes new 500/230 kV auto-transformers to be installed at Milton TS by spring 2015 as well as the extension of the 230 kV transmission facilities from Meadowvale TS to Hurontario TS.

The completion of the Sithe-Goreway (840 MW) generating facilities by the spring 2009 will not only provide relief for the auto-transformers at Claireville TS but will also provide valuable reactive compensation to control system voltages. Voltage support is particularly important immediately following a contingency involving any of the 500 kV circuits from the Bruce complex, in southern Ontario, or in the GTA. The completion of the Halton Hills GS (630 MW) by the following spring will reduce the loading on the auto-transformers at Trafalgar TS and provide further post-contingency reactive support to the area.

GTA-Southwest

In response to a directive from the Minister of Energy and Infrastructure, the Ontario Power Authority (OPA) has initiated a process to procure 850 MW of gas-fired generating capacity in the southwestern GTA, along the Oakville TS to Manby TS corridor. The required in-service date for this new generating capacity is December 2013.

This new generating capacity is required to replace existing coal-fired generating facilities that are scheduled to be phased out in 2014 and to meet future local needs. Locating a facility in this area provides 500/230 kV autotransformer relief and will also defer future transmission investments by reducing loads on the 230 kV network that supplies parts of Oakville, southern Mississauga, and southwestern parts of Toronto. This facility will also help to control voltages in this same area.

GTA-Central

Work to increase the transfer capability of the 500 kV corridor that runs across north Toronto is required to reliably accommodate existing and additional supply east of the Greater Toronto Area. Operating currently as two double-circuit lines, these circuits are to be unbundled and terminated as four individual circuits. This work, scheduled to be completed by the winter 2010/11, will also facilitate further expansion at the stations along the corridor to accommodate increased supply to the growing loads north of Toronto.

Subject to the required approvals, an additional 115 kV circuit between Leaside TS and Bridgeman TS is to be installed by spring 2012. This addition, in combination with a planned upgrade of two of the existing 115 kV circuits in the area, will enhance the supply capability in the midtown Toronto area.

The reliability of supply to the central Toronto area is on track to be improved with the completion of the Portlands Energy Centre. The installation of the heat-recovery steam generators at Portlands is now complete, allowing the commissioning of the steam-turbine unit to commence. Once this phase of the work is finished early next year, the plant will then be able to deliver its full-rated output of 550 MW as an efficient combined-cycle facility. The addition of this new generating station, combined with the earlier completion of the John to Esplanade link has provided alternate sources of supply and improved the reliability to the area.

GTA-East

A new 500 kV double-circuit line between Bowmanville TS and Cherrywood TS is proposed in order to accommodate up to 3,600 MW of new generating capacity at Darlington B Generating Station. Subject to necessary approvals, the new line is scheduled to be in service by the summer 2016 to coincide with the planned development of the new generating facilities.

A new Oshawa area 500/230 kV transformer station is also planned to coincide with the completion of the new 500 kV line. This station would connect the existing and new 500 kV circuits with the existing 230 kV transmission facilities that supply loads in the Oshawa, Whitby and Ajax areas and relieve the loadings on the auto-transformers at Cherrywood TS.

It has been proposed that the new 500 kV line should be located on the existing transmission corridor. The IESO has initiated a review in conformance with NERC standards of the effect of losing all the transmission facilities on this common corridor. Any further increase in generation at Darlington or points east will require extensive analysis of the capacity of this transmission corridor.

Northern York Region

The plan to address the supply issues in Northern York Region involved the establishment of a new transformer station to provide relief for the heavily-loaded Armitage TS and the installation of up to 350 MW of gas-fired generating capacity.

Holland TS is nearing completion and will soon allow the transfer of some of the existing load at Armitage TS. This will then free-up capacity at Armitage TS to allow additional load growth in the immediate area to be accommodated at that station.

The OPA has recently procured a 393 MW gas-fired generation facility in the area to be in service by the end of 2011.

Northeast and Central Ontario

In order to remove restrictions on existing generating capacity and to allow additional renewable resources in the north, enhancements to the north to south transmission path are required. Projects in this area, with scheduled in-service dates through to the winter of 2011/12, are designed to increase transmission transfer capability by about 750 MW. This will be enough to remove restrictions on the existing generating capacity in the northeast and to accommodate the increased output from expanded generating facilities on the Mattagami River.

To accommodate additional wind resources on Manitoulin Island, an enabler line from the island to the existing 230 kV transmission corridor between Algoma and Sudbury is proposed to be available by the winter of 2015/16.

Additional renewable resources may need to be procured in the northeast and northwest parts of the province in order to meet provincial supply mix targets. Any further development of resources in the northeast and northwest will require additional transmission capacity. As a result, new transmission facilities both north and south of Sudbury have been proposed with an expected in-service date of winter 2017/18.

Northwest

A promising site for additional wind and hydroelectric generation is in the Lake Nipigon area. An enabler line from the existing 230 kV transmission corridor between Lakehead (Thunder Bay) and Marathon is being considered in order to connect future wind resources and include enough capacity for proposed the Little Jackfish hydroelectric station on Lake Nipigon.

Eastern Ontario

Various projects are underway to increase transfers of up to 1,250 MW in either direction between Ontario and Quebec following the completion of the new interconnection and its associated direct current facilities later next year.

Ontario-New York Ties at Niagara

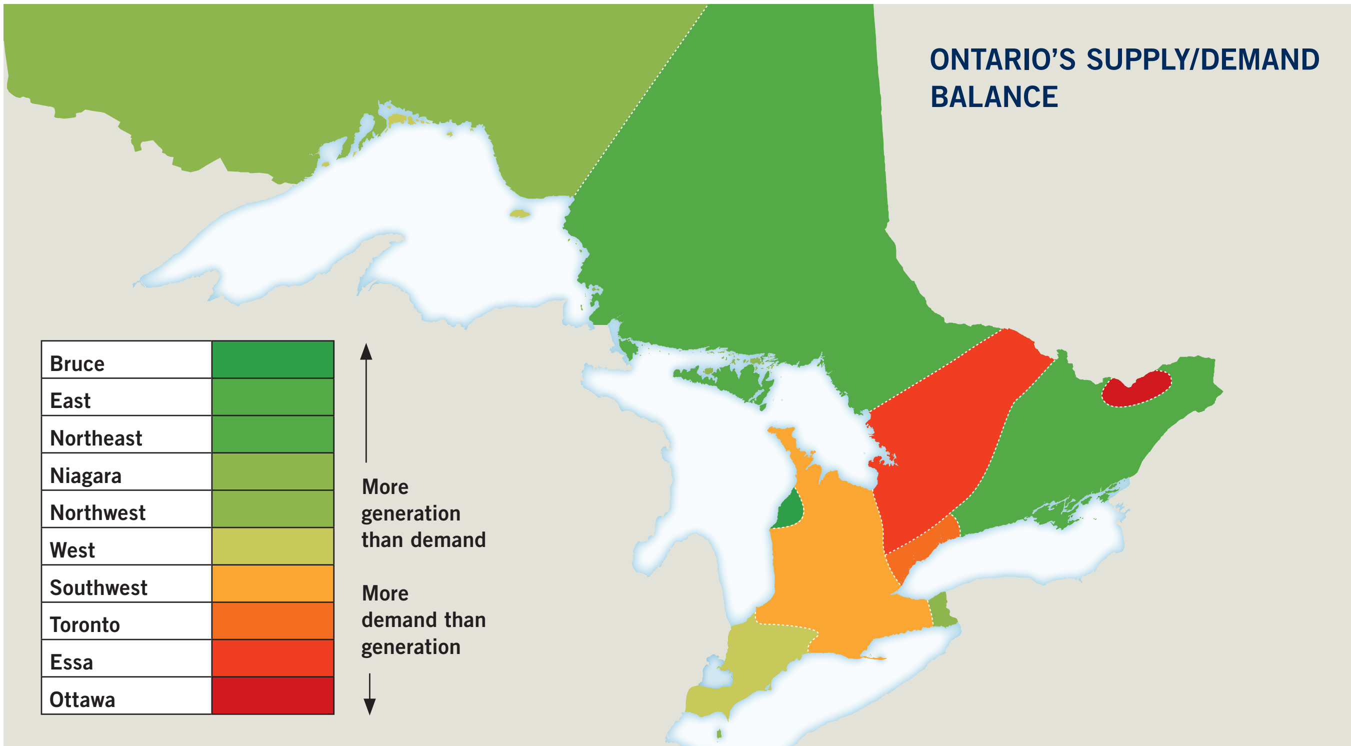
The import capability from New York via the two 345 kV and the two 230 kV interconnections at Niagara is often restricted by the thermal ratings of the existing transmission facilities of the QFW Interface. These limitations are even more pronounced during outage conditions. Completion of the reinforcement of this interface is necessary for improved utilization of the interconnection with New York at Niagara Falls.

Once the QFW work is complete, it becomes appropriate to explore further expansion of the interface capability at Niagara. Since three of the eight river crossings at Beck GS are presently idle, these would appear to present an opportunity to establish an additional interconnection at this location. Increasing the capability of this interface would address these limitations and further augment any future moves toward a more regional approach to balancing supply. This need will become even more prominent with increased renewable resources associated with variable operating characteristics.

Southwestern Ontario

A new transformer station is proposed close to Leamington to supply the growing load in the Leamington area and to off-load the adjacent Kingsville TS. Subject to regulatory approvals, this work is scheduled to be completed by the winter of 2012/13.

The Windsor area is connected into the Ontario transmission grid via four circuits to Chatham, two connected from Keith TS and two from Lauzon TS. These two stations, with a 115 kV transmission path connecting them, provide the main supply to the other stations



in the Windsor area, and act as the main connection point for local generation. Also subject to regulatory approvals, a series of enhancements to the 230 kV transmission facilities in the area will remove the risk of overloads on the local 115 kV system, remove restrictions on local generation, and improve voltage performance in the area between Windsor and Chatham.

Ontario-Michigan Phase Angle Regulators

Phase angle regulating transformers, also known as phase shifters can be used to control, to a limited extent, the flow of power over the grid. For the Ontario-Michigan interconnection, phase shifters have been planned to limit unscheduled parallel or loop flows on transmission assets in southern Ontario and Michigan.

Two phase shifters located at Lambton TS require some remedial work, which is anticipated for 2009. A third phase shifter at Keith TS in Windsor is functioning normally. These phase shifters are available to control flows in emergency situations, but operation under normal conditions is not available pending agreements between the IESO and the Midwest Independent System Operator (MISO).

A fourth phase shifter near Port Huron, Michigan is scheduled to be replaced by late 2009. Control of the flows on this interface is limited until all four phase shifters are in service.

Kitchener-Waterloo-Cambridge-Guelph and Orangeville Areas

Transmission facilities presently supplying the Kitchener, Waterloo, Cambridge, and Guelph areas are all approaching their thermal limits and with continued load growth in the area, some circuits are expected to exceed IESO standards in less than five years.

The OPA is proposing to contract for up to 450 MW of gas-fired generating capacity to be incorporated into Cambridge-Preston TS. In addition to providing peaking capacity for the province, this generating facility would also address some of the existing local supply limitations and to assist with the restoration of the area's loads in the event of a protracted outage involving some of the critical transmission facilities. However, some potential for transmission overloads would still remain in the area.

Several alternatives, which would involve additional transmission reinforcements, are under consideration, and would depend on the eventual size, location and timing of the gas-fired generation.

SMART GRIDS: IMPROVING THE EFFICIENT USE OF INFRASTRUCTURE AND PROMOTING DEMAND MANAGEMENT

The move to greater customer involvement, increased renewable and distributed generation, and expanded transmission capacity necessitate even more flexible and responsive system operations. Smart grid technologies are emerging as a critical component of the renewal taking place in Ontario's electricity sector. They enable system operators to more effectively manage a system that is becoming more diverse, more complex and less predictable.

A smart grid can mean many things. As a whole, it refers to a power system that uses information technologies to automate the flow of information back and forth between consumers and producers and then uses that information to support more efficient production, delivery and consumption decisions. In its many parts, a smart grid can comprise residential smart meters; plug-in cars; widely dispersed micro- and small-scale generation; and aggregators of demand response, just to name a few. All of these components are connected through advanced monitoring and communications systems.

This ability to flow information to and from consumers and suppliers is critical for the development of Ontario's new supply mix. For example, demand management programs rely on consumers and their appliances being able to receive and respond to price signals. Embedded generation can become more efficient and more adequately relieve local congestion if it can respond to electricity prices and communicate directly to the provincial electric system.

For the system operator, the information provided by smart grid technology paints a more detailed and complete picture of the supply and demand situation at each moment – particularly on a local level. In congested areas, operators will have a better understanding of what demand response and generation is available to meet local needs and then be able to more effectively use the surrounding transmission infrastructure to serve remaining needs. Smart grid technology can also provide enhanced operational performance, whether it be anticipating and resolving problems before they become outages, or minimizing the impact and resolution times of those outages that do occur.

As a result, the IESO has launched an industry dialogue about how best to harness the potential of smart grid technologies for Ontario. Ontario's Smart Grid Forum is developing a vision for the province to develop a co-ordinated approach that leverages existing investments and ensures future investments yield full benefit to Ontarians.

Vehicle-2-Grid: How Plug-in Electric Vehicles Support Reliability

Electric plug-in vehicles offer a clear demonstration of how energy use decisions on a small scale can impact the broader reliability picture.

During off-peak hours, car owners can recharge their car batteries, benefiting from lower electricity prices. As a result, generation and transmission capacity is being used when demand is lowest. Homeowners may also choose to avoid higher peak prices by using their car batteries to provide electricity for some of their home consumption.

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	Q4 2008
Renewables II RFP – Wind generation	Wolfe Island Wind Project	198	Q2 2009
	Enbridge Ontario Wind Farm	182	Q1 2009
Renewables II RFP – Hydroelectric generation	Island Falls Hydroelectric Project	20	Q4 2009
Government directive for Hydroelectric Energy Supply Agreement with Ontario Power Generation	Little Long, Harmon, Kipling and Smoky Falls	450	Unit in-service dates ranging from 2012 to 2013
	Lac Seul	13	Q4 2008
	Hound Chute	9.5	Q4 2010
	Lower Sturgeon, Sandy Falls and Wawaitin	35	Q4 2010
GAS-FIRED GENERATION			
Clean Energy Supply RFP	Greenfield South Power Plant	280	Under Review
	St. Clair Energy Centre	577	Q1 2009
Government directive for Central Toronto	Portlands Energy Centre Combined Cycle Operation	245	Q1 2009
Government directive for Western GTA	Goreway Station	839	Q1 2009
GTA West RFP	Halton Hills Generation Station	632	Q2 2010
Government Directive for Northern York Region	York Energy Centre	393	Q4 2011
COMBINED HEAT AND POWER			
Combined Heat and Power (CHP) RFP	Algoma Energy Cogeneration Facility	63	Q2 2009
	East Windsor Cogeneration Centre	84	Q3 2009
	Thorold Cogeneration Project	236	Q2 2010
NUCLEAR GENERATION			
Government directive for Bruce Power Refurbishment Implementation Agreement	Bruce A, Unit 1 back in service after refurbishment	750	Q3 2010
	Bruce A, Unit 2 back in service after refurbishment	750	Q2 2010
	Bruce A, Unit 3 (life extended through to 2010) back in service after refurbishment	750	As early as Q3 2013
	Bruce A, Unit 4 (life extended through to 2015) back in service after refurbishment	750	As early as Q3 2018
Nuclear capacity expansion	Additional capacity	27	Q3 2009
	Darlington, two units	TBD	TBD

TABLE 2: REGIONAL REQUIREMENTS – PROJECTS CURRENTLY UNDER STUDY OR PROPOSED

This table lists the projects that Hydro One is actively pursuing. Some of these projects have already been committed and are planned to be in-service within the next two to three years. Others are in the design phase and are expected to be placed in-service in the following decade.

AREA	RELIABILITY NEEDS IN THE AREA	EXPECTED/ REQUIRED BY	PROJECT(S) PROPOSED TO MEET THE REQUIREMENT
Northeastern & Central Ontario	Isolate the Tembec (Spruce Falls) mill from the Smoky Falls line	Spring-2009	Kapuskasing TS: Install a 115kV breaker and reterminate the line from Smoky Falls GS
	Improve operational flexibility	Summer-2009	Pinard TS: Install 230kV circuit-switcher
	Increase transfer capability across the Flow-South Interface	Winter-2008/9	Essa TS x Claireville TS: Uprate 500kV circuits E510V & E511V
		Fall-2009	Porcupine TS: Install 2x125MVAr shunt capacitors
		Fall-2010	Porcupine TS: Install SVC
		Fall-2010	Kirkland Lake TS: Install SVC
		Fall-2010	Essa TS: Install 250MVAr shunt capacitor
		Winter-2010/11	Nobel SS: Install series capacitors in 500kV circuits
		Winter-2011/12	Hanmer TS: Install 149MVAr shunt capacitor
	Increase transfer capability across the Mississagi Flow-East Interface	Summer-2009	Mississagi TS: Expand existing generation rejection scheme
		Fall-2010	Mississagi TS: Install 2x75MVAr shunt capacitors
		Fall-2010	Algoma TS: Install 100MVAr shunt capacitor
		Fall-2011	Mississagi TS: Install +300/-100MVAr SVC
	Incorporate expanded facilities at the Mattagami River plants	Winter-2010/11	Pinard TS: Install 100MVAr shunt capacitor
		Winter-2010/11	Little Long SS: Expand 230kV switching facilities and install 100MVAr shunt capacitor
		Winter-2010/11	Harmon GS to Kipling GS: Modify 230kV transmission line
	Incorporate new, renewable generating capacity	Winter-2015/16	Manitoulin Island: Install new 230kV enabler line
		Summer-2017	North of Sudbury: Reinforce Transmission System
		Winter-2017/18	Sudbury to the GTA: Reinforce Transmission System
Northwestern Ontario	Provide voltage support	Spring-2009	Fort Frances TS: Install 22MVAr moveable shunt capacitor
		Winter-2010/11	Dryden TS: Install shunt capacitor
	Improve the supply to the Thunder Bay area	Summer-2010	Thunder Bay GS: Reconfigure the 115kV busbar
	Replacement for the C7 synchronous condenser	Winter-2010/11	Lakehead TS: Install a +60/ –40MVAr SVC
	Reinforce supply to the Thunder Bay area	Summer-2013	Lakehead TS to Birch TS: Install 230kV line
	Incorporate new, renewable generating capacity	Winter-2014/15	Lake Nipigon Area: Install new 230kV enabler line
Bruce Area	Increase transfer capability from the Bruce Area to accommodate a further 1000MW of new generating capacity	Winter-2008/09	Hanover TS x Orangeville TS: Uprate section of 230kV circuits B4V & B5V
		Spring-2010	Bruce Complex: Modify Bruce Special Protection System
		Spring-2011	Nanticoke TS: Install 500kV 350MVAr SVC
		Spring-2011	Detweiler TS: Install 230kV 350MVAr SVC
		Winter-2011/12	Bruce Complex to Milton TS: Install new 500kV double-circuit line
		Spring-2009 to Fall-2009	Middleport TS, Nanticoke TS & Buchanan TS: Install 7 capacitor banks
	Incorporate new, renewable generating capacity	Winter-2015/16	Goderich Area: Install new 230kV enabler line
		Winter-2015/16	Bruce Peninsula Area: Install new 230kV enabler line
Eastern Ontario	Increase transfer capability between Ontario & Quebec	Summer-2009 and Spring-2010	Hawthorne TS: Establish 1250MW dc Interconnection
		Fall-2008	St Lawrence: Revise Beauharnois-Saunders GR Scheme
		Fall-2012	Hawthorne TS to Merivale TS: Increase capacity of 230kV circuits M30A & M31A
	Increase supply capability to the area	Summer-2012	Ottawa South Area: Reinforce transmission facilities

TABLE 2: CONTINUED

AREA	RELIABILITY NEEDS IN THE AREA	EXPECTED/ REQUIRED BY	PROJECT(S) PROPOSED TO MEET THE REQUIREMENT
GTA-West	Provide voltage support	Winter-2008/09	Meadowvale TS: Install 44kV shunt capacitors
	Provide voltage support	Summer-2009	Halton TS: Install 27.6kV shunt capacitors
	Enhance the supply capability to Pleasant TS & Jim Yarrow TS and limit amount of load lost to individual contingencies	Spring-2010	Hurontario SS: Establish new SS & extend 230kV line from Cardiff TS
		Spring-2011	Hurontario SS to Jim Yarrow Jct: Build two 3km 230kV circuits
		Spring-2012	Hurontario SS to Pleasant TS: Build one 6km 230kV circuit
	Increase supply capability of the corridor and reduce transfers on the 500kV circuits to Claireville TS	Spring-2015	Milton TS: Install 500/230kV auto-transformers and construct new 230kV lines to Hurontario SS to create a new 230kV transmission corridor between Milton TS and Claireville TS.
GTA-Central	Reinforce corridor to allow Claireville 230kV bus to be operated open	Fall-2009	Claireville TS to Richview TS: Terminate idle 230kV circuit
	Increase transfer capability of transmission corridor	Winter-2010/11	Cherrywood TS to Claireville TS: Unbundle the two 500kV super-circuits
	Increase supply capability to the area	Spring-2012	Leaside TS to Bridgeman TS: Build new 115kV circuit
	Improve supply reliability	Summer-2016	Reinforce transmission facilities into downtown Toronto
GTA-East	Incorporate new generating facilities at Darlington B	Summer-2016	Bowmanville TS to Parkway TS: Reinforce the 500kV transmission facilities
	Reinforce supply to the Oshawa/ Whitby/Ajax areas	Summer-2016	Oshawa Area: Build new 500/230kV transformer station
Barrie-Stayner Area	Increase supply capability to the area	Spring-2009	Construct new 230kV double-circuit line between Essa and Stayner TS to replace existing 115kV line.
			Install 230/115kV auto-transformer at Stayner TS
			Install 230/44kV DESN station at Stayner TS
Niagara Area	Increase transfer capability of the Queenston Flow West Interface	Originally scheduled for Summer-2006. Delayed indefinitely	New 230kV double-circuit line between Allanburg TS to Middleport TS to reinforce the 230kV transmission corridor
	Increase supply capability	Spring-2009	Beck GS to Niagara-Murray TS: Uprate 115kV circuit Q4N
	Increase supply capability to the area	Spring-2009	St Catharines Area: Uprate circuits D9HS, D10S & Q11S
Burlington-Branford-Woodstock Areas	Increase load meeting capability of the station	Fall-2008	Burlington TS: Replace 215MVA transformers with 250MVA units
	Increase station's fault interrupting capability	Fall-2011	Burlington TS: Replace twelve 115kV breakers and buswork
	Improve 115kV supply in the Woodstock area	Spring-2011	Ingersoll TS: Extend 230kV tap to new 230/115kV transformer station
		Spring-2011	Woodstock East TS: Install new 115/27.6kV DESN station
Southwestern Ontario	Reinforce supply to the Windsor/Leamington/Kingsville Areas	Winter-2012/13	Essex County: 230kV double-circuit line to the new Leamington TS + 230kV double-circuit line between Sandwich Junction and Lauzon with full 230kV switching installed at Lauzon TS
	Increase the transfer capability through Keith TS	Spring-2013	Keith TS: Replace the two 115MVA transformers with 250MVA units
	Increase supply capability for Windsor	Spring-2014	Keith TS to Essex TS: Uprate 115kV circuits J3E and J4E
Kitchener-Waterloo-Cambridge-Guelph & Orangeville Areas	Provide dynamic voltage support	Spring-2011	Detweiler TS: Install 230kV 350MVAr SVC
	Increase the supply meeting capability for the Cambridge area	Winter-2012/13	Galt Junction to Galt TS: Uprate the 230kV circuits M20D and M21D
	Increase the supply meeting capability for the area	Spring-2012	Reinforce transmission facilities in the area

THE ONTARIO RELIABILITY OUTLOOK IS ISSUED 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.

ieso
Power to Ontario. On Demand.

Independent Electricity System Operator
655 Bay Street, Suite 410
P.O. Box 1
Toronto, Ontario M5G 2K4
Reception: 905.855.6100
Media inquiries: 416.506.2823

IESO Customer Relations
Phone: 905.403.6900
Toll-free: 1.888.448.7777
E-mail: customer.relations@ieso.ca

The Independent Electricity System Operator (IESO) 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.