# 18 Month Outlook

## An Assessment of the Reliability and Operability of the Ontario Electricity System

**FROM OCTOBER 2015 TO MARCH 2017**

Independent Electricity System Operator

# Executive Summary

The outlook for the reliability of Ontario's electricity system remains positive for the next 18 months, with adequate generation and transmission to supply Ontario's demand.

About 1,900 MW of new supply – mostly wind and solar generation – will be added to the province's transmission grid over the Outlook period. By the end of the period, the amount of grid-connected wind generation is expected to increase by 1,300 MW to about 4,500 MW. The total distribution-connected wind generation over the same period is expected to be about 700 MW. Meanwhile, grid-connected solar generation is expected to increase to 380 MW, complementing the embedded solar generation capacity of about 2,200 MW located within distribution networks by the end of the Outlook.

As part of the IESO - Hydro Quebec seasonal firm capacity sharing agreement, Ontario will be supplying 500 MW of capacity to Quebec for the next two winter seasons. Ontario has the option to import up to 500 MW in summer months over the 10-year period of the agreement. The energy associated with the capacity agreement will be scheduled through existing market mechanisms.

Over the forecast period, peak demands will face downward pressure from conservation savings, growing embedded generation output and the Industrial Conservation Initiative (ICI). This is a continuation of the underlying trend of the last few years. With more typical weather, Ontario will return to summer peaking.

Energy demand is expected to decline this year as conservation savings and embedded generation will more than offset any growth from economic expansion or population growth. Despite positive economic fundamentals, the economy has not grown over the first half of 2015. Strong U.S. growth, a lower dollar and lower oil prices should provide a boost to Ontario's manufacturing sector throughout 2016, leading to increased electricity consumption. With 2016 being a leap year, the additional day will also contribute to year over year energy growth.

The following table summarizes the forecasted seasonal peak demands over the next 18 months.

| Season | Normal Weather Peak (MW) | Extreme Weather Peak (MW) |
|---|---|---|
| Winter 2015-16 | 22,389 | 23,181 |
| Summer 2016 | 22,712 | 24,569 |
| Winter 2016-17 | 22,340 | 23,109 |

A number of new opportunities for demand-side participation will be introduced over the next 18 months. In the summer of 2015, through an RFP process, the IESO selected approximately 80 MW of load-following and unit commitment capability from demand-side resources. These pilot projects will help identify opportunities to enhance participation of Demand Response (DR) in meeting Ontario's existing system needs and how to better integrate these resources into the electricity market. The pilot program will commence operation on May 1, 2016 for a two year term concluding on April 30, 2018.

An annual demand response auction is currently being developed by the IESO to procure DR capacity through a market-based mechanism. The quantity of DR capacity that the auction will seek to procure will be equivalent to the quantity (MW) expiring from the transitional Capacity

Based Demand Response (CBDR). The combined total of DR capacity in the CBDR program and selected through the DR auction will maintain the approximately 500 MW that was previously procured under DR2 and DR3 contracts. The first Demand Response Auction will be held in December 2015 for summer and winter commitment periods (May 1 – October 31, 2016 and November 1, 2016 – April 30, 2017, respectively).

Ontario will continue to experience Surplus Baseload Generation (SBG) conditions during this Outlook period. The magnitude of SBG is trending higher with the addition of new renewable generation and decline in grid demand due to conservation and embedded generation. SBG is expected to be effectively managed through existing market mechanisms, which include inter-tie scheduling, nuclear maneuvering or shutdown and the dispatch of grid-connected renewable resources.

# Conclusions & Observations

The following conclusions and observations are based on the results of this assessment.

### Demand Forecast

- Ontario's grid supplied peak demand is expected to decline throughout the period of this Outlook. Growth in embedded solar and wind generation capacity and on-going conservation initiatives reduce the need for energy from the bulk power system, while also putting downward pressure on peak electricity demands. Conservation, time-of-use rates and the ICI will also put downward pressure on peak demands, in particular summer peaks. Grid supplied energy demand is expected to decline in 2015 before increasing in 2016. The increase next year will be the result of economic expansion and the additional leap year day.

### Resource Adequacy

- Under the **planned scenario**, reserve requirements are expected to be met for the entire duration of this Outlook during normal weather. Under extreme weather conditions with planned resources, the reserve is below requirement for four weeks, with the highest shortfall of just over 950 MW.
- For the **firm scenario**, reserve requirements are expected to be met for the entire duration of this Outlook during normal weather conditions. Under extreme weather conditions, the reserve is below the requirement for seven weeks, with the highest shortfall of just over 1,350 MW. The firm scenario excludes any new generating facilities that haven't reached commercial operation. As a result, the shortfall is more pronounced in the **firm scenario** than in the **planned scenario**.
- About 1,900 MW of grid-connected generation is expected to be added throughout this Outlook period, which includes 1,300 MW of wind, 300 MW of gas, 240 MW of solar and 40 MW of biofuel resources.

### Transmission Adequacy

Ontario's transmission system is expected to be able to reliably supply the demand while experiencing normal contingencies defined by planning documents under both normal and extreme weather conditions forecast for this Outlook period.

- Several local area supply improvement projects are underway and will be placed in service during the timeframe of this Outlook. These projects, shown in Appendix B, will help relieve loadings of existing transmission stations and provide additional supply capacity for future load growth. Additional planning activities through the Regional Planning Process are currently active throughout the province.
- High voltages in southern Ontario continue to occur, especially during periods of light load. High voltages become more acute during these periods when shunt reactors are unavailable. While the IESO and Hydro One are currently managing this situation with day-to-day operating procedures, planning work for the installation of new voltage control devices continues.
- Hydro One continues the construction on the Guelph Area Transmission Refurbishment project, with an expected completion date of Q2 2016. This project will improve the transmission capability into the Guelph area by reinforcing the supply into Guelph-Cedar Transformer Station (TS).
- In the Cambridge area, work to install in-line switches on the Detweiler to Middleport circuits at Galt Junction continues. This project will ensure that IESO's load restoration criteria are met following a contingency on the main supply line. Studies will continue to assess the need for additional measures to address longer term needs in the area.
- Work to replace ageing components at Manby TS is scheduled for completion by Q2 2016. This includes bus reinforcement and insulator replacement work.
- A new station, Copeland TS, is planned to be in service in downtown Toronto in Q4 2016. The new station will facilitate the refurbishment of the facilities at John TS, while also enhancing the load security in the downtown core.

### Operability

Conditions for SBG will continue over the Outlook period. However, it is expected that SBG will continue to be managed effectively through existing market mechanisms, which include inter-tie scheduling, nuclear maneuvering or shutdown and the dispatch of grid-connected renewable resources.

## Caution and Disclaimer

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# 1 Introduction

This Outlook covers the 18-month period from October 2015 to March 2017 and supersedes the last Outlook released on June 22, 2015.

The purpose of the 18-Month Outlook is:

- To advise market participants of the resource and transmission reliability of the Ontario electricity system;
- To assess potentially adverse conditions that might be avoided through adjustment or coordination of maintenance plans for generation and transmission equipment; and
- To report on initiatives being put in place to improve reliability within the 18-month timeframe of this Outlook.

The contents of this Outlook focus on the assessment of resource and transmission adequacy. Additional supporting documents are located on the IESO website at http://www.ieso.ca/Pages/Participate/Reliability-Requirements/Forecasts-&-18-Month-Outlooks.aspx

This Outlook presents an assessment of resource and transmission adequacy based on the stated assumptions, using the described methodology. Readers may envision other possible scenarios, recognizing the uncertainties associated with various input assumptions, and are encouraged to use their own judgment in considering possible future scenarios.

Security and Adequacy Assessments are published on the IESO website on a weekly and daily basis, and progressively supersede information presented in this report.

Readers are invited to provide comments on this Outlook report or to give suggestions as to the content of future reports. To do so, please contact us at:

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- Tel: 905-403-6900
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- E-mail: customer.relations@ieso.ca.

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# 2 Updates to This Outlook

## 2.1 Updates to Demand Forecast

The demand forecast is based on actual demand, weather and economic data through to the end of June 2015. The demand forecast has been updated to reflect the most recent economic projections. Actual weather and demand data for July and August 2015 has been included in the tables.

## 2.2 Updates to Resources

The 18-month assessment uses planned generator outages submitted by market participants to the IESO's Integrated Outage Management System (IOMS) as of August 24, 2015. In addition, updates to available resources include the expected forced outage rates, seasonal generation derates and variable resource contribution as determined by market participants or calculated by the IESO based on actual experience.

This report period incorporates a number of nuclear outages, as identified in Table A8 of the 2015 Q3 Outlook Tables, including the commencement of the nuclear refurbishment program identified in the 2013 Long Term Energy Plan.

The following generators completed the market registration process since the release of the last Outlook, as of August 14, 2015:

- Bornish Wind Energy Centre – 73.5 MW
- Adelaide Wind Energy Centre – 60 MW
- Jericho Wind Energy Centre – 150 MW
- Grand Renewable Energy Park (Solar) – 100 MW

## 2.3 Updates to Transmission Outlook

The list of transmission projects, planned transmission outages and actual experience with forced transmission outages have been updated from the previous 18-Month Outlook. For this Outlook, transmission outage plans submitted to the IOMS as of July 28, 2015 were used.

## 2.4 Updates to Operability Outlook

The Outlook for Surplus Baseload Generation (SBG) conditions over the next 18 months uses the updated planned generator outages. The generator outage plans are submitted by market participants to the IESO's IOMS. This Outlook is based on submitted generation outage plans as of August 24, 2015.

**- End of Section -**

# 3 Demand Forecast

The IESO is responsible for forecasting electricity demand on the IESO-controlled grid. This demand forecast covers the period October 2015 to March 2017 and supersedes the previous forecast released in June 2015. Tables of supporting information are contained in the 2015 Q3 Outlook Tables.

Electricity demand is shaped by several factors which have differing impacts. These factors can be grouped into those that increase demand (population growth and economic expansion); those that reduce demand (conservation and embedded generation) and those that shift demand (time of use rates and the Industrial Conservation Initiative). How each of these factors impacts electricity consumption varies by season and time of day. The forecast of demand incorporates these impacts.

Grid-supplied energy demand is forecasted to show a slight decline in 2015 due in part to the negative growth over the first three quarters. Though economic expansion and population growth lead to increased demand for electricity, the impacts of conservation and embedded generation more than offset these increases in 2015. This is due to the fact that conservation reduces the amount of end-use consumption and increased embedded generation output offsets the need for grid-supplied electricity by generating it on the distribution system. For 2016, the additional leap year day will automatically add 0.3% growth for the year. Though recent economic news has been negative, a stronger U.S economy combined with a lower dollar will lead to increased manufacturing activity in Ontario, and in turn, higher electricity demand from that sector. That will push demand growth higher in 2016.

Peak demands are subject to the same forces as energy demand, though the impacts vary. The impacts also vary across the seasonal peaks. Summer peaks are significantly impacted by the growth in embedded generation capacity and pricing impacts (Industrial Conservation Initiative and time-of-use rates). The majority of embedded generation is provided from solar powered facilities that have high output levels during the summer peak period and no output during the winter peak periods. Over the shoulder periods the timing of the peak hour and sunset are moving so the impact of embedded solar will vary. Winter peaks see downward pressure from conservation and lighting efficiency improvements in particular.

With a return to typical weather, the ICI will be impactful on summer peaks rather than winter peaks. A reversal of what occurred during the summer of 2014 and winter of 2014-15.

Minimum demand levels are similarly impacted by these same forces - primarily economic activity and embedded generation. The recession had led to lower levels of industrial activity, particularly overnight and on weekends due to reductions in the number of shifts. Although most embedded generation is solar, embedded wind generation contributes to lower minimums by supplanting grid-supplied electricity. Over the forecast horizon, minimums are expected to remain fairly flat as increased demand through population and economic growth is offset by conservation savings.

The following tables show the seasonal peaks and annual energy demand over the forecast horizon of the Outlook.

**Table 3.1: Forecast Summary**

| Season | Normal Weather Peak (MW) | Extreme Weather Peak (MW) |
|---|---|---|
| Winter 2015 - 16 | 22,389 | 23,181 |
| Summer 2016 | 22,712 | 24,569 |
| Winter 2016 - 17 | 22,340 | 23,109 |
| **Year** | **Normal Weather Energy (TWh)** | **% Growth in Energy** |
| 2006 Energy | 152.3 | -1.9% |
| 2007 Energy | 151.6 | -0.5% |
| 2008 Energy | 148.9 | -1.8% |
| 2009 Energy | 140.4 | -5.7% |
| 2010 Energy | 142.1 | 1.2% |
| 2011 Energy | 141.2 | -0.6% |
| 2012 Energy | 141.3 | 0.1% |
| 2013 Energy | 140.5 | -0.6% |
| 2014 Energy | 138.9 | -1.1% |
| 2015 Energy (Forecast) | 137.4 | -1.1% |
| 2016 Energy (Forecast) | 138.7 | 1.0% |

**Table 3.2: Weekly Energy and Peak Demand Forecast**

| Week Ending | Normal Peak (MW) | Extreme Peak (MW) | Load Forecast Uncertainty (MW) | Normal Energy Demand (GWh) | Week Ending | Normal Peak (MW) | Extreme Peak (MW) | Load Forecast Uncertainty (MW) | Normal Energy Demand (GWh) |
|---|---|---|---|---|---|---|---|---|---|
| 04-Oct-15 | 17,215 | 17,579 | 554 | 2,464 | 03-Jul-16 | 22,333 | 23,989 | 1,016 | 2,681 |
| 11-Oct-15 | 17,371 | 17,798 | 786 | 2,502 | 10-Jul-16 | 22,712 | 24,569 | 814 | 2,725 |
| 18-Oct-15 | 17,871 | 18,279 | 507 | 2,463 | 17-Jul-16 | 22,607 | 23,710 | 838 | 2,627 |
| 25-Oct-15 | 17,861 | 18,400 | 392 | 2,545 | 24-Jul-16 | 22,155 | 24,158 | 1,035 | 2,739 |
| 01-Nov-15 | 18,339 | 18,790 | 318 | 2,579 | 31-Jul-16 | 21,930 | 24,113 | 841 | 2,720 |
| 08-Nov-15 | 19,058 | 19,452 | 416 | 2,646 | 07-Aug-16 | 21,238 | 24,265 | 958 | 2,677 |
| 15-Nov-15 | 19,367 | 20,130 | 601 | 2,669 | 14-Aug-16 | 21,237 | 23,826 | 985 | 2,666 |
| 22-Nov-15 | 19,847 | 20,684 | 342 | 2,750 | 21-Aug-16 | 21,243 | 23,506 | 1,362 | 2,686 |
| 29-Nov-15 | 20,306 | 21,343 | 607 | 2,793 | 28-Aug-16 | 20,062 | 22,701 | 1,413 | 2,564 |
| 06-Dec-15 | 20,755 | 21,881 | 409 | 2,857 | 04-Sep-16 | 18,575 | 22,100 | 1,370 | 2,471 |
| 13-Dec-15 | 21,041 | 21,966 | 555 | 2,899 | 11-Sep-16 | 18,062 | 20,565 | 680 | 2,423 |
| 20-Dec-15 | 20,725 | 21,819 | 690 | 2,884 | 18-Sep-16 | 17,824 | 19,945 | 781 | 2,448 |
| 27-Dec-15 | 20,436 | 22,199 | 362 | 2,845 | 25-Sep-16 | 16,980 | 18,225 | 420 | 2,399 |
| 03-Jan-16 | 20,720 | 21,670 | 528 | 2,797 | 02-Oct-16 | 17,093 | 17,454 | 554 | 2,440 |
| 10-Jan-16 | 22,389 | 23,181 | 570 | 3,023 | 09-Oct-16 | 17,227 | 17,654 | 786 | 2,478 |
| 17-Jan-16 | 21,650 | 22,330 | 547 | 2,970 | 16-Oct-16 | 17,693 | 18,101 | 507 | 2,437 |
| 24-Jan-16 | 21,809 | 22,369 | 483 | 2,973 | 23-Oct-16 | 17,679 | 18,214 | 392 | 2,520 |
| 31-Jan-16 | 21,815 | 22,380 | 404 | 3,009 | 30-Oct-16 | 18,153 | 18,613 | 318 | 2,554 |
| 07-Feb-16 | 20,976 | 21,938 | 734 | 2,935 | 06-Nov-16 | 18,364 | 18,757 | 416 | 2,606 |
| 14-Feb-16 | 20,372 | 21,772 | 635 | 2,852 | 13-Nov-16 | 19,162 | 19,923 | 601 | 2,640 |
| 21-Feb-16 | 20,299 | 21,700 | 581 | 2,813 | 20-Nov-16 | 19,635 | 20,470 | 342 | 2,722 |
| 28-Feb-16 | 20,258 | 21,765 | 501 | 2,894 | 27-Nov-16 | 20,114 | 21,148 | 607 | 2,766 |
| 06-Mar-16 | 19,901 | 20,710 | 531 | 2,819 | 04-Dec-16 | 20,323 | 21,692 | 409 | 2,820 |
| 13-Mar-16 | 19,493 | 20,492 | 649 | 2,756 | 11-Dec-16 | 20,853 | 21,784 | 555 | 2,874 |
| 20-Mar-16 | 18,308 | 19,414 | 611 | 2,631 | 18-Dec-16 | 21,051 | 21,647 | 690 | 2,862 |
| 27-Mar-16 | 18,394 | 19,307 | 569 | 2,590 | 25-Dec-16 | 20,626 | 22,688 | 362 | 2,949 |
| 03-Apr-16 | 18,297 | 19,053 | 567 | 2,580 | 01-Jan-17 | 20,366 | 21,467 | 528 | 2,751 |
| 10-Apr-16 | 17,456 | 18,455 | 471 | 2,507 | 08-Jan-17 | 21,445 | 22,150 | 570 | 2,899 |
| 17-Apr-16 | 16,796 | 17,277 | 496 | 2,447 | 15-Jan-17 | 22,340 | 23,109 | 547 | 2,972 |
| 24-Apr-16 | 16,569 | 16,938 | 531 | 2,423 | 22-Jan-17 | 21,506 | 22,185 | 483 | 2,963 |
| 01-May-16 | 17,434 | 19,796 | 721 | 2,420 | 29-Jan-17 | 21,566 | 22,179 | 404 | 2,979 |
| 08-May-16 | 17,536 | 20,105 | 849 | 2,385 | 05-Feb-17 | 21,118 | 22,189 | 734 | 2,976 |
| 15-May-16 | 18,470 | 21,668 | 845 | 2,416 | 12-Feb-17 | 20,731 | 21,900 | 635 | 2,923 |
| 22-May-16 | 18,804 | 21,748 | 1,175 | 2,424 | 19-Feb-17 | 20,277 | 21,479 | 581 | 2,836 |
| 29-May-16 | 19,278 | 21,429 | 1,330 | 2,362 | 26-Feb-17 | 20,089 | 21,688 | 501 | 2,825 |
| 05-Jun-16 | 19,490 | 22,969 | 1,292 | 2,541 | 05-Mar-17 | 20,154 | 21,132 | 531 | 2,842 |
| 12-Jun-16 | 20,670 | 23,389 | 1,055 | 2,591 | 12-Mar-17 | 19,839 | 20,649 | 649 | 2,800 |
| 19-Jun-16 | 21,428 | 23,827 | 835 | 2,629 | 19-Mar-17 | 18,844 | 19,829 | 611 | 2,729 |
| 26-Jun-16 | 22,122 | 23,789 | 754 | 2,700 | 26-Mar-17 | 18,316 | 19,122 | 569 | 2,617 |

## 3.1 Actual Weather and Demand

Since the last forecast, the actual demand and weather data for June, July and August have been recorded.

### June

- June's weather was both milder and considerably wetter than normal. In terms of average temperature, it was the fifth mildest in the past 30 years and had the lowest peak temperature over that time frame. In fact, the peak temperature was higher in May.
- The June peak occurred on the third hottest day of the month, as the hottest day landed on the weekend preceding it. As the temperature didn't even break 30°C, peak demand

was a very modest 19,339 MW, which was the lowest June peak since 1996. After adjusting for the weather, the peak was still a fairly low value of 21,509 MW. This is an increase over the previous June, but still low by historical standards.

- Energy demand for the month was 10.6 TWh (10.8 TWh weather corrected), which also represent low values for the month. These observations are comparable to values in the late 1990's.
- The minimum demand for the month was 10,804 MW, which is fairly consistent with June values since the 2009 recession.
- Wholesale customers' consumption for the month decreased by 7.0% compared to the previous June. Much of that reduction came from the Pulp & Paper and Iron & Steel sectors.

**July**

- The weather for July was very close to normal. Monthly energy demand was 12.1 TWh (both actual and weather corrected). The weather corrected values are very similar to last year.
- The peak occurred on Tuesday July 28, which was the hottest day of the month, and in the midst of a three-day heat wave, making it a perfect day for peak conditions. The peak was 22,516 MW and since the weather was near normal, the weather corrected peak was close at 22,559 MW. Demand response was activated for the following day but not on the peak day. At the same time, class A loads were active under the Industrial Conservation Initiative (ICI) and reduced the peak by an estimated 1,000 MW.
- Wholesale customers' consumption continued to decline for the 10th straight month as their load was 5.7% lower than the previous July. Declines in the Paper, Iron & Steel and Petroleum sectors led the decline.

**August**

- The weather for August was also close to normal. Energy demand for the month was 11.8 TWh (11.8 TWh weather corrected) which is almost identical to last August's results. Energy demand is lower than historical values but reflects the impacts of conservation and growth in embedded generation.
- Like July, the August peak occurred on the hottest day of the month, a Monday and in the midst of a three-day heat wave. The monthly peak demand of 22,383 MW (22,055 MW weather corrected) occurred on August 17th. Demand measures were not dispatched on that day but class A customers were once again active via the ICI program leading to a peak reduction of roughly 1,000 MW.
- Wholesale customers' consumption continued the weakness of the last quarter of 2014 into 2015. Year over year consumption fell by 4.8%.

**June to August**

Overall, energy demand for the three months from June to August was down 0.4% compared with the same three months one year prior. After adjusting for the weather, demand for the three months showed much larger decline of 1.0%. Most of the decline is attributable to the low June demand numbers.

For the three months, wholesale customers' consumption posted a 5.9% decrease over the same months a year prior with Pulp & Paper, Iron & Steel and Petroleum Products accounting for most of the reductions.

The 2015 Q3 Outlook Tables spreadsheet contains several tables with historical data. They are:

- Table 3.3.1 Weekly Weather and Demand History Since Market Opening
- Table 3.3.2 Monthly Weather and Demand History Since Market Opening
- Table 3.3.3 Monthly Demand Data by Market Participant Role.

## 3.2 Forecast Drivers

### 3.2.1 Economic Outlook

Despite recent world market turmoil, the current economic environment should bode well for central Canada. Strong U.S. growth, a lower Canadian dollar, low interest rates and lower oil prices are all favourable to Ontario's export-oriented energy-intensive manufacturing sector. As these conditions establish themselves as the "new equilibrium", economic growth should follow. If the conditions are just transitory or surrounded by uncertainty, that will stall or undermine the potential growth. Eurozone debt risks and Chinese market volatility represent significant risks to the economic outlook. For Ontario, manufacturing is more closely tied to U.S. growth, whereas commodities and the mining sector are more negatively impacted by China's recent struggles.

The latter half of 2015 should see growth flip back to the positive and 2016 should see stronger economic growth as manufacturing gains traction in the "new equilibrium".

Wholesale customers' electricity consumption had shown consistent growth since August 2013 before tailing off in the final quarter of 2014 through to the mid-way point of 2015. Over the last three quarters, wholesale customers load has decreased by 3.7%.

Table 3.3.4 of the 2015 Q3 Outlook Tables presents the economic assumptions for the demand forecast.

### 3.2.2 Weather Scenarios

The IESO uses weather scenarios to produce demand forecasts. These scenarios include normal and extreme weather, along with a measure of uncertainty in demand due to weather volatility. This measure is called Load Forecast Uncertainty (LFU).

Table 3.3.5 of the 2015 Q3 Outlook Tables presents the weekly weather data for the forecast period.

### 3.2.3 Pricing, Conservation and Embedded Generation

The demand forecast accounts for pricing, conservation and embedded generation impacts. These impacts are grouped together and termed as load modifiers as they act to reduce the grid supplied demand.

Pricing incentives cause both the reduction in demand and the shifting of demand away from peak periods. Pricing includes Time-of-Use rates (TOU) and the Industrial Conservation

Initiative (ICI). TOU rates incent consumers to reduce loads during peak demand periods by either shifting to off-peak periods or reducing consumption altogether. TOU can factor into all weekdays throughout the year and the size of the impact will be determined by the pricing structure. The ICI impacts the five to ten highest peak days of the program year. Prior to 2014, the impact of ICI was just under 900 MW on the five highest peaks. In 2014, the program was expanded to include loads with a peak demand of 3 - 5 MW. Though final data for the period May 2015 to April 2016 will not be available until next year, initial estimates would indicate that ICI impacts for the monthly peaks of July and August were in the neighbourhood of 1,000 MW.

Output from embedded generators directly offsets the need for the same quantity of grid supplied electricity. Embedded generation capacity is expected to grow over the forecast horizon and the impact of increased embedded output is factored into the demand forecast.

Conservation also reduces the need for grid supplied electricity by reducing the end-use consumption. Conservation will continue to grow throughout the forecast period and the demand forecast is decremented for those impacts.

The demand measures, which are dispatchable loads, Peaksaver Plus and Capacity Based Demand Response (CBDR), which was previously Demand Response 3 (DR3) are treated as resources in the assessment and are further discussed in section 4.1.3. In terms of the demand forecast, the actual impacts of these programs are added back to the demand and the forecast is based on demand prior to the effects of these programs.

**- End of Section -**

# 4 Resource Adequacy Assessment

This section provides an assessment of the adequacy of resources to meet the forecast demand. When reserves are below required levels, with potentially adverse effects on the reliability of the grid, the IESO will reject outages based on their order of precedence. Conversely, an opportunity exists for additional outages when reserves are above required levels.

The existing installed generation capacity is summarized in Table 4.1. This includes capacity from new projects that have completed commissioning and the market entry process.

**Table 4.1: Existing Generation Capacity as of August 14, 2015**

| Fuel Type | Total Installed Capacity (MW) | Forecast Capability at Outlook Peak (MW) | Number of Stations | Change in Installed Capacity (MW) | Change in Stations |
|---|---|---|---|---|---|
| Nuclear | 12,978 | 10,800 | 5 | 0 | 0 |
| Hydroelectric | 8,462 | 5,859 | 71 | 0 | 0 |
| Gas/Oil | 9,920 | 8,827 | 29 | 0 | 0 |
| Wind | 3,209 | 404 | 28 | 284 | 3 |
| Biofuel | 455 | 445 | 8 | 0 | 0 |
| Solar | 140 | 48 | 3 | 100 | 1 |
| **Total** | **35,163** | **26,384** | **144** | **384** | **4** |

## 4.1 Assessments Assumptions

### 4.1.1 Committed and Contracted Generation Resources

All generation projects that are scheduled to come into service, be upgraded or shut down within the Outlook period are summarized in Table 4.2. This includes committed generation projects in the IESO's Connection Assessment and Approval process (CAA), those that are under construction, as well as projects contracted by the IESO. Details regarding the IESO's CAA process and the status of these projects can be found on the IESO's website at http://www.ieso.ca/Pages/Participate/Connection-Assessments/default.aspx under Application Status.

The estimated effective date in Table 4.2 indicates the date on which additional capacity is assumed to be available to meet Ontario demand or when existing capacity will be shut down. This data is accurate as of August 14, 2015. For projects that are under contract, the estimated effective date is based on the best information available to the IESO. If a project is delayed, the estimated effective date will be the best estimate of the commercial operation date for the project.

**Table 4.2: Committed and Contracted Generation Resources**

| Project Name | Also Known As | Zone | Fuel Type | Estimated Effective Date | Project Status | Capacity Considered | |
|---|---|---|---|---|---|---|---|
| | | | | | | Firm (MW) | Planned (MW) |
| Thunder Bay Condensing Turbine Project | | Northwest | Biomass | | Commercial Operation | 40 | 40 |
| Goulais Wind Farm | | Northeast | Wind | | Commercial Operation | 25 | 25 |
| K2 Wind Project | | Bruce | Wind | | Commercial Operation | 270 | 270 |
| Northland Power Solar Empire | | Northeast | Solar | 2015-Q4 | Commissioning | | 10 |
| Cedar Point Wind Power Project Phase II | | Southwest | Wind | 2015-Q4 | Under Development | | 100 |
| Northland Power Solar Abitibi | | Northeast | Solar | 2015-Q4 | Commissioning | | 10 |
| Kingston Solar Project | | East | Solar | 2015-Q4 | Commissioning | | 100 |
| Northland Power Solar Martin's Meadows | | Northeast | Solar | 2015-Q4 | Commissioning | | 10 |
| Bow Lake Phase 1 | | Northeast | Wind | 2015-Q4 | Commissioning | | 20 |
| Northland Power Solar Long Lake | | Northeast | Solar | 2015-Q4 | Commissioning | | 10 |
| Grand Valley Wind Farms (Phase 3) | | Southwest | Wind | 2015-Q4 | Under Development | | 40 |
| Green Electron Power Project | | West | Gas | 2015-Q4 | Under Development | | 298 |
| Armow Wind Project | | Southwest | Wind | 2015-Q4 | Under Development | | 180 |
| White Pines Wind Farm | | East | Wind | 2016-Q2 | Under Development | | 60 |
| Niagara Region Wind Farm | | Southwest | Wind | 2016-Q2 | Under Development | | 230 |
| Grand Bend Wind Farm | Zurich | Southwest | Wind | 2016-Q2 | Under Development | | 99 |
| Amherst Island Wind Project | | East | Wind | 2016-Q4 | Under Development | | 75 |
| Belle River Wind | | West | Wind | 2016-Q4 | Under Development | | 100 |
| Bow Lake Phase 2b | | Northeast | Wind | 2016-Q4 | Under Development | | 40 |
| South Gate Solar | | Southwest | Solar | 2016-Q4 | Under Development | | 50 |
| Windsor Solar | | West | Solar | 2016-Q4 | Under Development | | 50 |
| North Kent Wind 1 | | West | Wind | 2016-Q4 | Under Development | | 100 |
| **Total** | | | | | | **335** | **1,917** |

**Notes on Table 4.2:**

1. The total may not add up due to rounding and does not include in-service facilities.
2. Project status provides an indication of the project progress. The milestones used are:
    a. Under Development - includes projects in approvals and permitting stages (e.g. environmental assessment, municipal approvals, IESO connection assessment approvals etc.) and projects under construction.
    b. Commissioning - the project is undergoing commissioning tests with the IESO.
    c. Commercial Operation – the project has achieved commercial operation under the contract criteria but has not met all the market registration requirements of the IESO.

### 4.1.2 Generation Capability Assumptions

**Hydroelectric**

The hydroelectric capability for the duration of this Outlook is based on median historical values (including energy and operating reserve) during weekday peak demand hours from May 2002 to March 2015. Table 4.3 shows the historical hydroelectric median values calculated with the data from May 2002 to March 2015. These values are updated annually to coincide with the release of the summer 18-Month Outlook.

**Table 4.3: Monthly Historical Hydroelectric Median Values**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Historical Hydroelectric Median Values (MW) | 6,069 | 6,002 | 5,868 | 5,792 | 5,822 | 5,649 | 5,651 | 5,408 | 5,062 | 5,411 | 5,730 | 6,120 |

**Thermal Generators**

Thermal generators' capacity and energy contributions, planned outages, expected forced outage rates and seasonal deratings are based on market participant submissions or calculated by the IESO based on actual experience.

**Wind**

For wind generation, the monthly Wind Capacity Contribution (WCC) values are used at the time of weekday peak. Table 4.4 shows the monthly WCC values (with actual historic wind output up to March 31, 2015). These values are updated annually to coincide with the release of the summer Outlook.

**Table 4.4: Monthly Wind Capacity Contribution Values**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WCC (% of Installed Capacity) | 37.3% | 37.3% | 28.9% | 28.5% | 21.3% | 12.6% | 12.6% | 12.6% | 17.3% | 28.8% | 36.7% | 37.3% |

**Solar**

For solar generation, the monthly Solar Capacity Contribution (SCC) values are used at the time of weekday peak. The specifics on wind and solar values can be found in the Methodology to Perform Long Term Assessments. Table 4.5 shows the monthly SCC values that are updated annually to coincide with the release of the summer Outlook.

**Table 4.5: Monthly Solar Capacity Contribution Values**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCC (% of Installed Capacity) | 0.0% | 0.0% | 0.2% | 1.4% | 3.2% | 33.6% | 33.6% | 33.6% | 7.8% | 1.9% | 0.0% | 0.0% |

### 4.1.3 Demand Measures

Both demand measures and load modifiers can impact demand but they differ in how they are treated within the Outlook. Demand measures are not incorporated into the demand forecast and are instead treated as resources. Load modifiers are incorporated into the demand forecast, as explained in section 3.2.3.

Demand measures are treated as generation resources and are therefore included in the supply mix. Demand measures are added back into the history when forecasting demand.

A number of new opportunities for demand-side participation will be introduced over the next 18 months. In the summer of 2015, through an RFP process, the IESO selected approximately 80 MW of load-following and unit commitment capability from demand-side resources. These pilot projects will help identify opportunities to enhance participation of Demand Response (DR) in meeting Ontario's existing system needs and how to better integrate these resources into the electricity market. The pilot program will commence operation on May 1, 2016 for a two year term concluding on April 30, 2018.

An annual demand response auction is currently being developed by the IESO to procure DR capacity through a competitive mechanism. The quantity of DR capacity that the auction will seek to procure will be equivalent to the quantity expiring from the transitional Capacity Based Demand Response (CBDR). The combined total of DR capacity in the CBDR program and selected through the DR auction will maintain the approximately 500 MW that was previously procured under DR2 and DR3 contracts. The first Demand Response Auction will be held in December 2015 for summer and winter commitment periods (May 1 – October 31, 2016 and November 1, 2016 – April 30, 2017, respectively).

### 4.1.4 Firm Transactions

In May 2015, the IESO signed a 500 MW seasonal firm capacity sharing agreement with Hydro Quebec Energy Marketing Inc. This agreement takes advantage of the Provinces' complementary seasonal peaks to support reliability and will be in effect for up to ten years, starting from December of 2015. The agreement provides for Ontario to make 500 MW of capacity available to Quebec in the winter, and Quebec to make 500 MW available to Ontario in the summer. The energy associated with the capacity agreement will be scheduled through existing market mechanisms.

In accordance with the agreement, Ontario will supply 500 MW for the first two winters, winter of 2015 - 2016 and 2016 – 2017 which has been included in the adequacy assessments for this period. Depending on the availability of resources in Ontario, up to 500 MW of capacity will be provided in the subsequent two winter seasons. Ontario has the option to call on up to 500 MW of capacity from Quebec for summer seasons until 2025. No request was made for the summer 2016.

### 4.1.5 Summary of Scenario Assumptions

In order to assess future resource adequacy, the IESO must make assumptions on the amount of available resources. The Outlook considers two scenarios: a **firm scenario** and a **planned scenario** as compared in Table 4.6.

**Table 4.6: Summary of Scenario Assumptions for Resources**

| | | Planned Scenario | Firm Scenario |
|---|---|---|---|
| Over the 18-Month Period | Total Existing Installed Resource Capacity (MW) | 35,163 | |
| | New Generation and Capacity Changes (MW) | All Projects | Generators reached commercial operation and generator shutdowns and retirements |
| | | 1,917 | 335 |

Both scenarios' starting point is the existing installed resources shown in Table 4.1. The **planned scenario** assumes that all resources scheduled to come into service are available over the study period. The **firm scenario** only assumes resources that have reached commercial operation. The generator planned shutdowns or retirements that have high certainty of occurring in the future are also considered for both scenarios. The **firm** and **planned** scenarios also differ in their assumptions regarding the amount of demand measures. The **firm scenario** considers DR programs from existing participants only, while the **planned scenario** considers DR programs from future participants too. Both scenarios recognize that resources are not available during times for which the generator has submitted planned outages.

Table 4.7 shows a snapshot of the forecast available resources, under the two scenarios, at the time of the summer and winter peak demands during the Outlook.

**Table 4.7: Summary of Available Resources**

| Notes | Description | Winter Peak 2016 | | Summer Peak 2016 | | Winter Peak 2017 | |
|---|---|---|---|---|---|---|---|
| | | Firm Scenario | Planned Scenario | Firm Scenario | Planned Scenario | Firm Scenario | Planned Scenario |
| 1 | Installed Resources (MW) | 35,498 | 36,276 | 35,498 | 36,665 | 35,498 | 37,080 |
| 2 | Total Reductions in Resources (MW) | 6,707 | 7,075 | 9,311 | 10,056 | 7,809 | 8,719 |
| 3 | Demand Measures (MW) | 555 | 555 | 618 | 618 | 721 | 455 |
| 4 | Firm Imports (+) / Exports (-) (MW) | -500 | -500 | 0 | 0 | -500 | -500 |
| 5 | Available Resources (MW) | 28,846 | 29,256 | 26,805 | 27,227 | 27,910 | 28,316 |

**Notes on Table 4.7:**

1. Installed Resources: This is the total generation capacity assumed to be installed at the time of the summer and winter peaks.
2. Total Reductions in Resources: Represents the sum of deratings, planned outages, limitations due to transmission constraints and allowance for capability levels below rated installed capacity.
3. Demand Measures: The amount of demand expected to be reduced.
4. Firm Imports / Exports: The amount of expected firm imports and exports at the time of summer and winter peaks.
5. Available Resources: Equals Installed Resources (line 1) minus Total Reductions in Resources (line 2) plus Demand Measures (line 3) and Firm Imports / Exports (line 4).

## 4.2 Capacity Adequacy Assessment

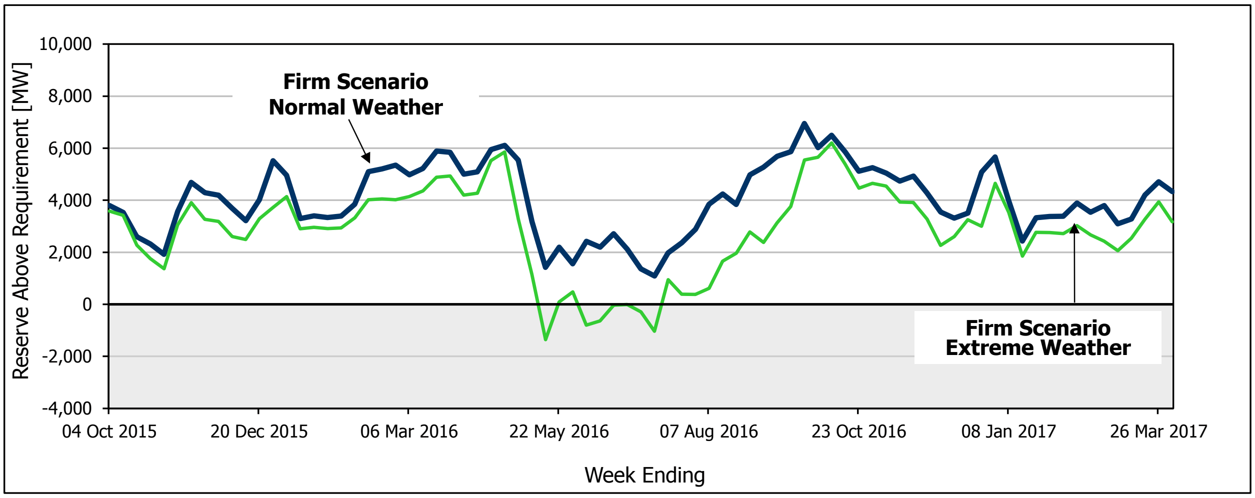
The capacity adequacy assessment accounts for zonal transmission constraints resulting from planned transmission outages. The planned outages occurring during this Outlook period have been assessed as of August 24, 2015.

### 4.2.1 Firm Scenario with Normal and Extreme Weather

The **firm scenario** incorporates generation capacity that reached commercial operation. This includes the addition of roughly 295 MW of wind and 40 MW of biofuel capacity.

Figure 4.1 shows the Reserve above Requirement (RAR) levels, which represent the difference between Available Resources and Required Resources. The Required Resources equals the Demand plus Required Reserve. As can be seen, the reserve requirement in the **firm scenario** under normal weather conditions is being met throughout the Outlook period. During extreme weather conditions, the reserve is lower than the requirement for a total of seven weeks during the spring and summer of 2016. This shortfall is largely attributed to the planned generator outages scheduled during those weeks.

**Figure 4.1: Normal vs. Extreme Weather: Firm Scenario RAR**

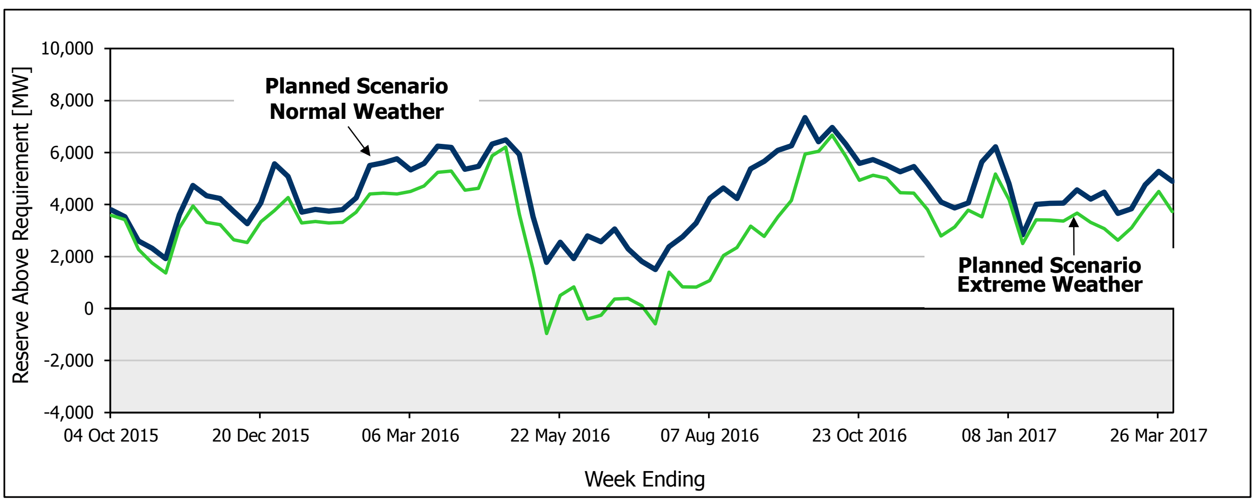



### 4.2.2 Planned Scenario with Normal and Extreme Weather

The **planned scenario** incorporates all existing capacity plus all capacity coming in service. Roughly 1,900 MW of generation capacity is expected to connect to Ontario's grid over this Outlook period.

Figure 4.2 shows the RAR levels under the **planned scenario**. As observed, the reserve requirement is being met throughout the Outlook period under normal weather conditions. The reserve is lower than the requirement for four weeks during the spring and summer months of 2016 under extreme weather conditions. This shortfall is largely attributed to the planned outages scheduled for those weeks.

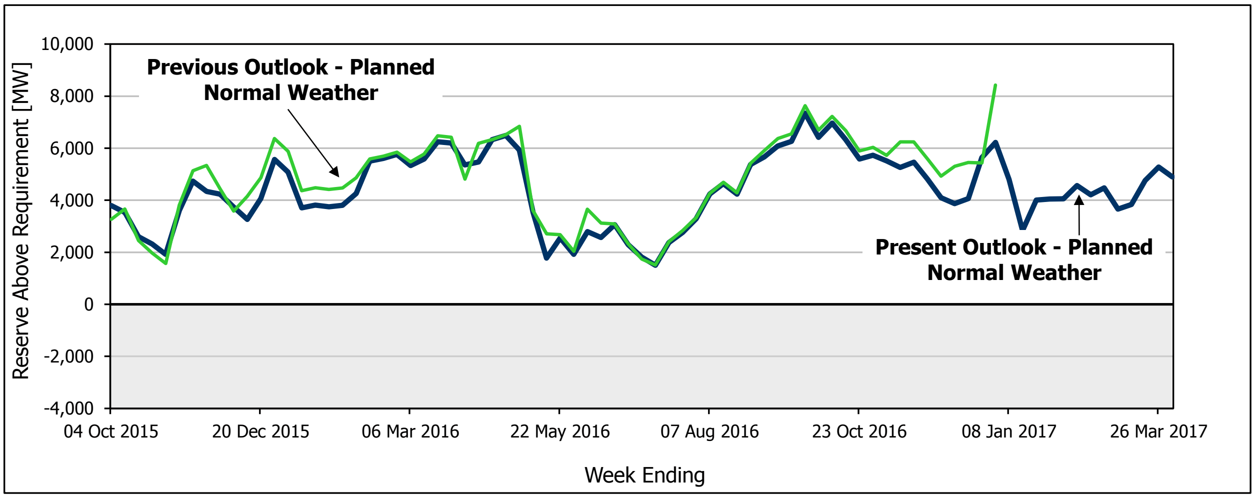
**Figure 4.2: Normal vs. Extreme Weather: Planned Scenario RAR**




### 4.2.3 Comparison of the Current and Previous Weekly Adequacy Assessments for the Planned Normal Weather Scenario

Figure 4.3 provides a comparison between the forecast RAR values in the present Outlook and the forecast RAR values in the previous Outlook published on June 22, 2015. The difference is mainly due to the changes to outages and changes in the demand forecast.

**Figure 4.3: Present Outlook vs. Previous Outlook: Planned Scenario - Normal Weather RAR**




Resource adequacy assumptions and risks are discussed in detail in the "Methodology to Perform Long Term Assessments".

## 4.3 Energy Adequacy Assessment

This section provides an assessment of energy adequacy; the purpose of which is to determine whether Ontario has sufficient supply to meet its forecast energy demands and to highlight any potential concerns associated with energy adequacy within the period covered under this 18-Month Outlook. At the same time, the assessment estimates the aggregate production by each resource category to meet the projected demand based on assumed resource availability.

### 4.3.1 Summary of Energy Adequacy Assumptions

In order to achieve results consistent with the capacity adequacy assessments, the Energy Adequacy Assessment (EAA) is performed using the same set of assumptions pertaining to resources expected to be available over the next 18 months. Refer to Table 4.1 for the summary of 'Existing Generation Capacity and Table 4.2 for the list of 'Committed and Contracted Generation Resources' for this information. The monthly forecast of energy production capability, based on information provided by market participants, is included in the 2015 Q3 Outlook Tables Appendix A, Table A7.

For the EAA, only the **planned scenario** as per Table 4.6 with normal weather demand is considered. In addition, in order to reasonably capture the variability and uncertainty associated with wind resources, multiple wind samples (hourly profiles) were considered in the EAA. The key assumptions specific to this assessment are described in the IESO document titled "Methodology to Perform Long Term Assessments".

### 4.3.2 Results - Planned Scenario with Normal Weather

Table 4.8 summarizes key energy statistics over the 18-Month period for the **planned scenario** with normal weather demand for Ontario as a whole, and provides a breakdown by each transmission zone.

The results indicate that supply is expected to be adequate over the 18-month timeframe of this Outlook with the analysis showing no occurrences of unserved energy.

**Table 4.8: Planned Scenario - Normal Weather: Summary of Zonal Energy**

| Zone | 18-Month Energy Demand | | 18-Month Energy Production | | Net Inter-Zonal Energy Transfer | Zonal Energy Demand on Peak Day of 18-Month Period | Available Energy on Peak Day of 18-Month Period |
|---|---|---|---|---|---|---|---|
| | TWh | Average MW | TWh | Average MW | TWh | GWh | GWh |
| **Ontario** | **210.7** | **15,995** | **210.8** | **15,995** | **0.0** | **446.7** | **583.5** |
| Bruce | 0.8 | 63 | 63.0 | 4,779 | 62.2 | 1.3 | 136.7 |
| East | 12.4 | 943 | 17.0 | 1,287 | 4.6 | 23.6 | 84.1 |
| Essa | 11.3 | 856 | 3.5 | 264 | -7.8 | 21.4 | 13.5 |
| Niagara | 6.9 | 524 | 20.2 | 1,533 | 13.3 | 15.9 | 41.2 |
| Northeast | 17.4 | 1,322 | 15.3 | 1,165 | -2.1 | 26.4 | 37.3 |
| Northwest | 6.2 | 470 | 6.7 | 512 | 0.5 | 9.3 | 16.1 |
| Ottawa | 13.5 | 1,024 | 0.6 | 47 | -12.9 | 27.7 | 2.1 |
| Southwest | 42.6 | 3,231 | 6.8 | 517 | -35.8 | 89.7 | 23.9 |
| Toronto | 79.8 | 6,058 | 66.2 | 5,024 | -13.6 | 185.5 | 153.9 |
| West | 19.8 | 1,504 | 11.4 | 868 | -8.4 | 45.9 | 74.7 |

Figure 4.4 shows the percentage production to supply Ontario energy demand by fuel type for the entire duration of the outlook, while Figure 4.5 shows the production by fuel type for each month of the 18-Month period. Exports out of Ontario and imports into Ontario are not considered in this assessment. Table 4.9 summarizes these simulated production results by fuel type, for each year.

**Figure 4.4: Production by Fuel Type – Oct 1 to Mar 31, 2017**

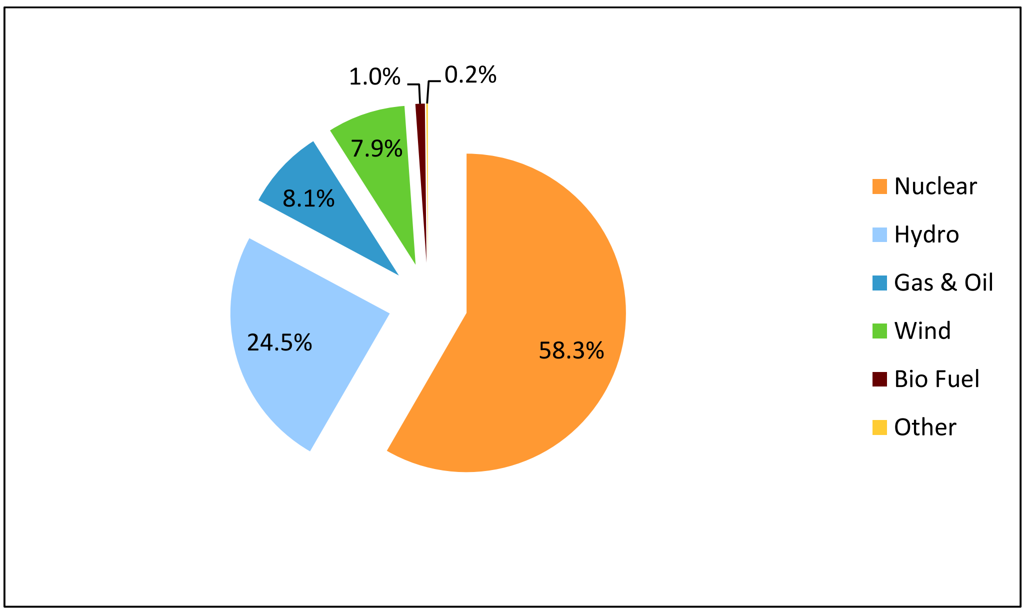


**Figure 4.5 Monthly Production by Fuel Type – Oct 1, 2015 to Mar 31, 2017**

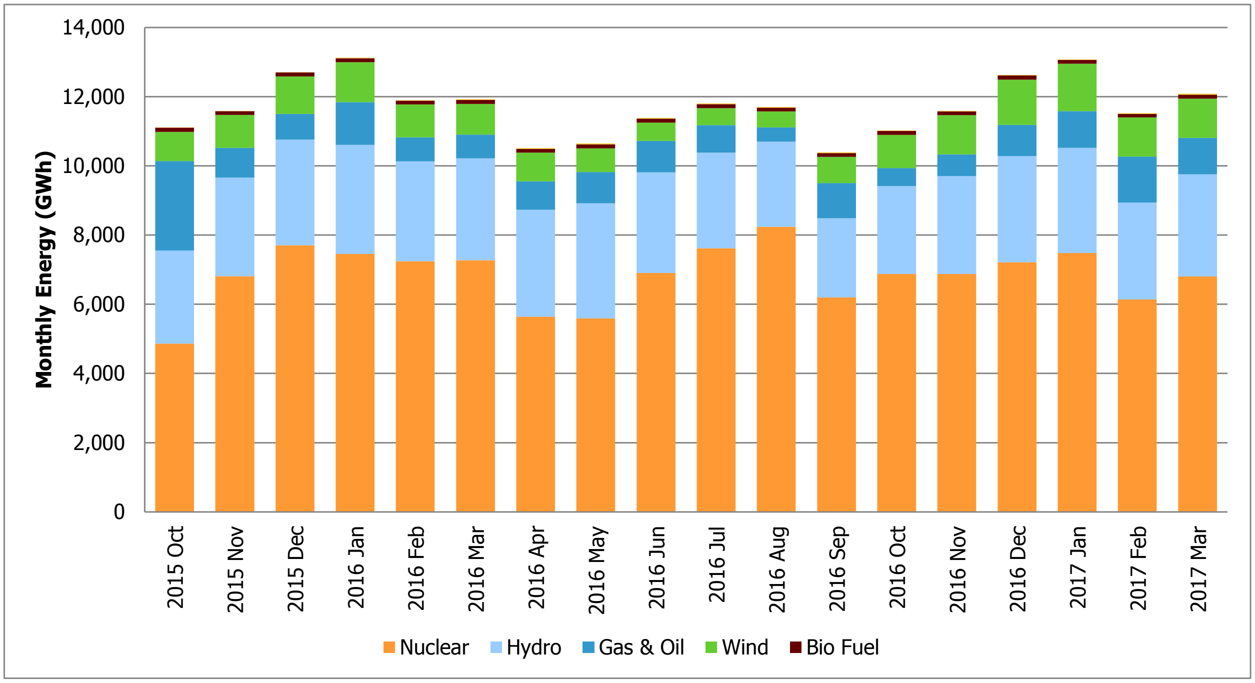



**Table 4.9: Planned Scenario - Normal Weather: Ontario Energy Production by Fuel Type**

| Fuel Type (Grid Connected) | 2015 (Oct 1 – Dec 31) | 2016 (Jan 1 – Dec 31) | 2017 (Jan 1 – Mar 31) | Total |
|---|---|---|---|---|
| | (GWh) | (GWh) | (GWh) | (GWh) |
| Nuclear | 19,377 | 83,144 | 20,428 | 122,948 |
| Hydro | 8,599 | 34,247 | 8,789 | 51,635 |
| Gas & Oil | 4,183 | 9,523 | 3,445 | 17,151 |
| Wind | 2,885 | 10,150 | 3,633 | 16,667 |
| Biofuel | 339 | 1,349 | 324 | 2,012 |
| Other (Solar & DR) | 29 | 239 | 69 | 338 |
| **Total** | **35,412** | **138,651** | **36,687** | **210,750** |

### 4.3.3 Findings and Conclusions

The EAA results indicate that Ontario is expected to have sufficient supply to meet its energy forecast during the 18-Month Outlook period for the **planned scenario** with normal weather demand.

**- End of Section -**

# 5 Transmission Reliability Assessment

The IESO requires transmitters to provide information on the transmission projects that are planned for completion within the 18-month period. Construction of several transmission reinforcements is expected to be completed during this Outlook period. Major transmission and load supply projects planned to be in service are shown in Appendix B. Projects that are already in service or whose completion is planned beyond the period of this Outlook are not shown. The list includes only the transmission projects that represent major modifications or are considered to significantly improve system reliability. Minor transmission equipment replacements or refurbishments are not shown.

Some areas have experienced load growth to warrant additional investments in new load supply stations and reinforcements of local area transmission. Several local area supply improvement projects are underway and will be placed in service during the timeframe of this Outlook. These projects help relieve loadings on existing transmission infrastructure and provide additional supply capacity for future load growth.

## 5.1 Transmission Outages

The IESO's assessment of the transmission outage plans is shown in Appendix C, Tables C1 to C10. The methodology used to assess the transmission outage plans is described in the IESO document titled "Methodology to Perform Long Term Assessments". This Outlook contains transmission outage plans submitted to the IESO as of July 28, 2015.

## 5.2 Transmission System Adequacy

The IESO assesses transmission adequacy using the methodology on the basis of conformance to established criteria, planned system enhancements and known transmission outages. Zonal assessments are presented in the following sections. Overall, the Ontario transmission system is expected to supply the demand under the normal and extreme weather conditions forecast for the Outlook period.

The existing transmission infrastructure in some areas in the province, as described below, have been identified as currently having or anticipated to have some limitations to supply the local needs. Additional planning activities are currently active throughout the province through Regional Planning. For links to completed plans and information on active plans, please visit the IESO Regional Planning webpage: http://www.ieso.ca/Pages/Participate/Regional-Planning/.

### 5.2.1 Toronto and Surrounding Area

The load supply capability to the GTA is expected to be adequate to meet the forecast demand through to the end of this 18-month period.

Work to replace ageing components at Manby TS is scheduled for completion by Q2 2016. This includes bus reinforcement and insulator replacement work.

In central Toronto, Copeland TS is now expected to be in service in Q4 2016. The new station will allow some load to be transferred from John TS. This will help meet the short- and mid-term need for additional supply capacity in the area and will also enable the refurbishment of the facilities at John TS.

High voltages in southern Ontario continue to present operational challenges during periods of light load requiring the temporary removal from service of at least one of the 500 kV circuits between Lennox TS and Bowmanville SS during those periods. The situation has become especially acute during those periods when the shunt reactors at Lennox TS have been unavailable due either to repair or maintenance activities. While the IESO and Hydro One are currently managing this situation with day-to-day operating procedures, the situation is expected to become more difficult once Pickering GS is shut down. Planning work to identify mitigation measures including the installation of voltage control devices continues.

In order to increase the load-meeting capability of the two 230 kV circuits between Claireville TS and Minden TS and allow the proposed Vaughan TS No. 4 to be connected, Hydro One is planning to install two 230 kV in-line breakers at Holland TS, together with a load rejection scheme. These facilities are now expected to be in service by Q4 2017. Until these facilities become available, operational measures will be required to avoid possible overloading of these circuits during peak load periods.

Transmission transfer capability in Toronto and surrounding area is expected to be sufficient for the purpose of supplying load, with a margin to allow for planned outages.

### 5.2.2 Bruce and Southwest Zones

In the Guelph area, Hydro One continues construction on the Guelph Area Transmission Refurbishment project to improve the transmission capability into the Guelph area by reinforcing the supply into Guelph-Cedar TS, the expected completion date remains Q2 2016. As part of this project, circuit switchers are to be installed at Guelph North Junction that will allow the 230 kV system between Detweiler TS and Orangeville TS to be sectionalized. These devices will reduce the restoration times for the loads in the Waterloo, Guelph and Fergus areas following a supply interruption.

Work to install in-line switches on the Detweiler to Middleport circuits at Galt Junction continues. This work will improve the load restoration capability to customers in the Cambridge area following outages on transmission circuits, and will accommodate the development of the Cambridge No. 2 transformer station on the 115 kV system between Preston TS and Detweiler TS to meet load growth in the area. Further planning work is required to address the longer-term supply needs of the area beyond 2016.

Hydro One is continuing work to replace the aging infrastructure at the Bruce 230 kV switchyard, with a completion date of June 2018. While this work is being implemented, careful coordination of the transmission and generation outages will be needed.

Hydro One is also continuing work on a new Bruce Special Protection System (SPS) which is scheduled for completion by December 2016. This new SPS will replace the existing one while having increased functionality to detect and operate for a greater number of contingencies.

The transmission transfer capability in the Southwest zone and its vicinity is expected to be sufficient to supply the load in this area with a margin to allow for planned outages.

### 5.2.3 Niagara Zone

Completion of the transmission reinforcements from the Niagara region into the Hamilton-Burlington area continues to be delayed and the transmission congestion continues to restrict the connection of new generation. This project, if completed, would increase the transfer capability from the Niagara region to the rest of the Ontario system by approximately 700 MW.

### 5.2.4 East Zone and Ottawa Zone

To address load growth in the Ottawa area, a new load supply transformer station, Orleans TS, came into service in Q2 2015.

With further increases in the amount of load supplied from the 230 kV system in the Merivale area and with a minimum threshold of 400 MW on the level to which the transfers from Hydro Quebec can be automatically reduced following the loss of one of the 230 kV Hawthorne-to-Merivale circuits, there is an increased possibility that imports may need to be restricted during peak load periods. The situation may be especially challenging during periods of low hydroelectric output from the plants on the Ottawa and Madawaska Rivers, which is not uncommon during summer peak periods.

Transmission transfer capability in the East Zone and Ottawa Zone is expected to be sufficient for the purpose of supplying load in this area with a margin to allow for planned outages.

### 5.2.5 West Zone

Transmission constraints in this zone may restrict resources in southwestern Ontario. This is evident in the constrained generation amounts shown for the Bruce and West zones in Tables A3 and A6.

Transmission transfer capability into the West zone is expected to be sufficient to supply load in this area with a margin to allow for planned outages.

### 5.2.6 Northeast and Northwest Zones

Work is continuing to modify the existing line-connected reactors at Hanmer TS to allow post-contingency switching of these reactors to occur, thereby increasing the transfer capability of the Flow South Interface.

Following the expansion of the Mattagami River plants, increased transfers are being experienced from the 230 kV system to the 115 kV system at Kapuskasing TS. Because of these higher transfers, combined with the output from the 30 MW of new hydroelectric and solar projects in the Kapuskasing area, the thermal capability of the 115 kV transmission facility between Hunta and Kapuskasing is expected to be exceeded. To ensure that the existing level of supply reliability is maintained, it is therefore expected that some of the generating facilities in the Kapuskasing area will need to be constrained-off whenever these high transfers occur.

The limited reactive absorption facilities that are available in the Timmins area are proving to be a major obstacle to the restoration of the system in the northeast following an outage involving either of the 500 kV circuits. Maintaining the voltage below the agreed maximum of 550 kV during the restoration process before the system can be loaded, has been challenging, particularly with the reduction that has occurred to the loads in the Timmins area.

Transmission constraints may restrict resources in northwestern Ontario. This is evident in the constrained generation amounts shown for the Northwest zone in Tables A3 and A6. Transmission transfer capability in the Northeast and Northwest zones is expected to be sufficient to supply the existing load in this area with a margin to allow for planned outages.

**- End of Section -**

# 6 Operability Assessment

This section highlights any existing or emerging operability issues that could potentially impact the system reliability of Ontario's power system.

## 6.1 Storage

Last year, the IESO completed the Phase I RFP procurement for 34 MW of storage projects. The IESO expects that all of these projects will come into service during this outlook period.

Qualified applicants for the Phase II procurement for 16 MW of storage projects were selected on March 25, 2015. The IESO is evaluating the proposals received before the July 10, 2015 submission deadline from the qualified applicants. The IESO is seeking a broad range of technologies to test their ability to provide capacity and energy time-shifting benefits.

## 6.2 Operation during Nuclear Outages

For the major nuclear outages scheduled for fall 2015 and spring 2016, the IESO will be actively working with transmitters, generators, natural gas pipelines and our interconnected neighbours to ensure reliable operation during this period.

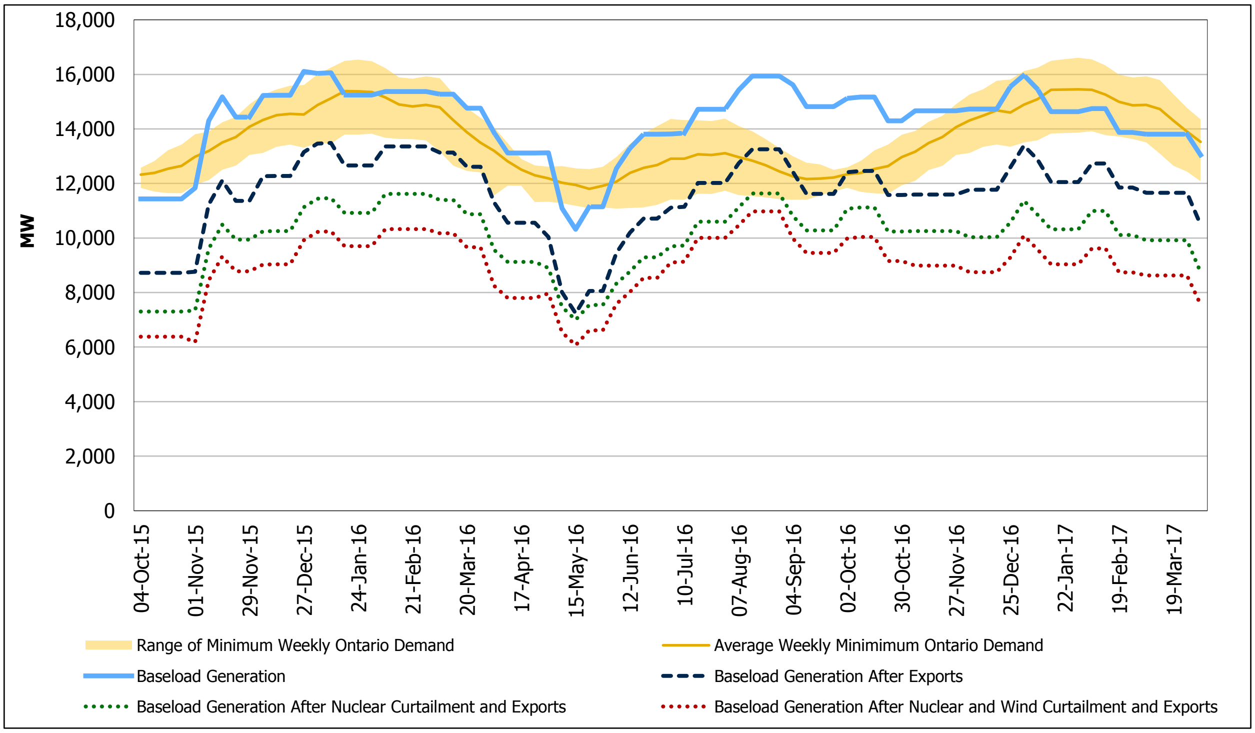
## 6.3 Surplus Baseload Generation (SBG)

Baseload generation is made up of nuclear, run-of-the-river hydroelectric and variable generation such as wind and solar. When the baseload supply is expected to exceed Ontario demand, the system is balanced via market mechanisms which include export scheduling, nuclear manoeuvering or shutdown and wind curtailment. In addition, out of market mechanisms such as import cuts could also be utilized to alleviate SBG conditions.

Nuclear maneuvering capability and dispatchable variable generation has provided additional flexibility to manage SBG, while also mitigating the need for manual control actions. These actions usually, but not always, occur when Ontario demand is at its lowest.

Figure 6.1 shows the forecast SBG for the next 18 months and the flexibility from nuclear and variable generation.

**Figure 6.1 Minimum Ontario Demand and Baseload Generation**




Ontario will continue to experience SBG conditions during this Outlook period. The magnitude of SBG is trending higher with the addition of new renewable generation and decline in grid demand due to conservation and embedded generation. The SBG can be managed through existing market mechanisms.

The decline in SBG in the fall of 2015 and spring of 2016 is attributed to planned generation outages.

The baseload generation assumptions include market participant-submitted minimum production data, the latest planned outage information, in-service dates for new or refurbished generation, and reliable export capability. The expected contribution from self-scheduling and intermittent generation has also been updated to reflect the latest data. Output from commissioning units is explicitly excluded from this analysis due to uncertainty and the highly variable nature of commissioning schedules. Table 6.1 shows the monthly Off-Peak WCC values (with simulated wind output and actual historic wind output up to March 31, 2015). These values are updated annually to coincide with the release of the summer 18-Month Outlook.

**Table 6.1: Monthly Off-Peak Wind Capacity Contribution Values**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Off-Peak WCC (% of Installed Capacity) | 33.5% | 33.5% | 31.5% | 34.2% | 24.1% | 15.4% | 15.4% | 15.4% | 21.6% | 28.4% | 33.1% | 33.5% |

## 6.4 Gas-Electric Interdependency

To prepare for the peak seasons, the IESO meets with gas pipeline operators every six months (in April and October) to discuss gas supply and planned maintenance on the gas and electric systems. The natural gas storage level at Dawn, Ontario is at the five year average.

The IESO continues to work on enhancing our existing communication protocols with gas pipeline and distribution system operators to facilitate information sharing. There is currently a stakeholder engagement initiative (Gas-Electric Coordination Enhancements) underway to seek input on proposed enhancements to the communication and coordination efforts.

**- End of Document -**

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