18-Month Outlook

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

FROM JULY 2018 TO DECEMBER 2019

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Executive Summary

Reliability Outlook

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

Under extreme weather conditions, the reserve levels are below requirement, without reliance on imports, for nine weeks in July-September 2018 and ten weeks in summer 2019, in the firm scenario. Both generator and transmission outages may be placed at risk during this period. If extreme weather conditions occur, the IESO may, at that time, reject some generator maintenance outages to ensure that Ontario demand is met during the summer peak. Generators expecting to perform maintenance during the summer are advised to review their plans and consider rescheduling their outages.

Demand Forecast

Ontario's peak demand is expected to be essentially flat over the forecast horizon. Conservation savings, embedded generation output and the expanded Industrial Conservation Initiative (ICI) all work to offset any increase in demand due to population growth and economic expansion.

The start of 2018 has seen demand increase over 2017 for the months observed to date. This is a significant change in trajectory as weather corrected demand fell by 2.8% in 2017. Increased demand from both wholesale customers and distributors account for the change. The forecast expects demand to increase in both 2018 and 2019 due to strong economic fundamentals.

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

Season	Normal Weather Peak (MW)	Extreme Weather Peak (MW)
Summer 2018	22,076	24,535
Winter 2018-19	21,328	22,235
Summer 2019	22,016	24,460

Supply

About 1,470 MW of new supply – 985 MW of gas, 375 MW of wind, 100 MW of solar and 15 MW of hydroelectric – is expected to be connected to the province's transmission grid over the Outlook period. By the end of the period, the amount of grid-connected wind is expected to increase to about 4,800 MW and grid-connected solar to about 500 MW.

By the end of the Outlook period, embedded wind capacity will exceed 600 MW and embedded solar will surpass 2,300 MW. Overall contracted embedded capacity will reach over 3,500 MW by the end of Outlook horizon.

Transmission Adequacy

Ontario's transmission system is expected to continue to reliably serve Ontario's demand while experiencing normal contingencies defined by planning criteria under both normal and extreme weather conditions forecast for this Outlook period**.** Several local area supply and transmission improvement projects underway will be placed in service during the timeframe of this Outlook.

These projects, shown in Appendix B, will help relieve loading of existing transmission stations and provide additional capacity for future load growth.

Concurrent planned outages continue to cause transmission limitations on the Flow East toward Toronto (FETT) interface during this forecast period. Outages submitted for generation resources located east of the FETT interface and/or transmission elements that impact the FETT interface may be placed at risk. Market participants should expect that these limitations will persist while Ontario's nuclear fleet is being refurbished.

Operability

Conditions that may result in periods of surplus baseload generation are projected to continue over the Outlook period. It is expected that these conditions will continue to be managed effectively through existing market mechanisms, which include intertie scheduling, the dispatch of grid-connected renewable resources and nuclear manoeuvres or shutdowns.

To assist in addressing flexibility needs, the IESO concluded a stakeholder engagement in Spring 2018 and will schedule additional 30-minute operating reserve as required to represent flexibility need. In addition, the IESO has procured 55 MW of regulation to expand its capability to schedule more regulation as required. The successful regulation providers have now completed commissioning.

Outage Management

The proposed changes to the IESO's adequacy criterion that feeds the Outage Management process are planned to take effect for outage plans occurring from May 2019 onwards. The new criteria will use extreme weather instead of normal weather conditions and assumes up to 2,000 MW of imports are available for determining if there is sufficient reserve above requirement. Participants should benefit from improved certainty in obtaining outages with this new criterion. The new adequacy criterion will allow more planned outages in the winter or shoulder months when there is more room for outages. To facilitate these changes, modifications were made to Market Manual 7.2 in June 2018. More information can be found on the stakeholder webpage available here:
http://www.ieso.ca/en/sector-participants/engagement-initiatives/engagements/proposed-ieso-outage-approval-criteria

Changes to the 18-Month Outlook

The IESO is considering including an additional assessment with a longer time horizon to one or more 18-Month Outlooks per year in light of the period of significant change Ontario's electricity system is entering into: driven by multiple nuclear refurbishment outages over the next few years; changing transmission flow patterns; and generation facilities reaching end of contract term. All of these changes have an impact to the generation and transmission adequacy outlook and an opportunity exists to provide an extended assessment will provide better signals to market participants on when opportunities exist to take outages in light of the changes ahead. Further information will be made available on the stakeholder webpage available here:
http://www.ieso.ca/en/sector-participants/engagement-initiatives/engagements/18-month-outlook-refresh.

Ongoing Stakeholder Engagements Relating to Reliability

- Market Renewal: System Flexibility; Capacity Exports; Single Schedule Market; Incremental Capacity Auction
- Interchange Enhancements
- Proposed IESO Outage Approval Criteria

Caution and Disclaimer

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1 Introduction

This Outlook covers the 18-month period from July 2018 to December 2019 and supersedes the last Outlook released on March 21, 2018.

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
- to report on initiatives being put in place to improve reliability within the 18-month timeframe of this Outlook.

Additional supporting documents are located on the IESO website at: http://www.ieso.ca/sector-participants/planning-and-forecasting/18-month-outlook

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

Security and adequacy assessments are published on the IESO website on a daily basis and progressively supersede information presented in this report.

For questions or comments on this Outlook, please contact us at:

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- Tel: 905-403-6900
- Fax: 905-403-6921
- E-mail: customer.relations@ieso.ca.

- End of Section -

2 Updates to This Outlook

2.1 Updates to Demand Forecast

The demand forecast used in this Outlook is based on actual demand, weather and economic data through to the end of March 2018. The demand forecast has been updated to reflect the most recent economic projections. Actual weather and demand data for April and May has also been included in the tables.

2.2 Updates to Resources

The 18-Month Outlook uses planned generator outages submitted by market participants to the IESO's outage management system.

As of May 22, 2018, the following generators completed the market registration process since the last Outlook:

- North Kent Wind 1 CGS (99.1 MW)

2.3 Updates to Transmission Outlook

Transmission outage plans that were submitted to the IESO's outage management system by April 27, 2018, were used for this Outlook.

2.4 Updates to Operability Outlook

The Outlook for surplus baseload generation (SBG) conditions over the next 18 months is based on generator outage plans submitted by market participants to the IESO's outage management system as of May 28, 2018.

- End of Section -

3 Demand Forecast

The IESO forecasts electricity demand on the IESO-controlled grid. This demand forecast covers the period June 2018 to December 2019 and supersedes the previous forecast released in March 2018. Tables of supporting information are contained in the 2018 Q2 Outlook Tables spreadsheet.

Electricity demand is shaped by a several factors, which have differing impacts:

- those that increase the demand for electricity (population growth, economic expansion and the increased penetration of end-uses)
- those that reduce the need for grid-supplied electricity (conservation and embedded generation)
- those that shift demand (time-of-use rates and the Industrial Conservation Initiative [ICI]).

How each of these factors impacts electricity consumption varies by season and time of day. The demand forecast found in this Outlook incorporates these impacts.

Grid-supplied energy demand has been virtually flat since the 2009 global economic recession with some small annual variation. 2017 was a bit of a departure in that demand dropped significantly. This decline was due to the combined impacts of conservation and the continuing evolution of the Ontario economy towards less energy intensive activities. For 2018 and 2019 demand growth is expected to be positive, albeit small. The economic environment remains positive for industrial growth leading to increased demand from that sector. As well, growth is expected in the greenhouse industry, driven by the legalization of cannabis, which is an electricity-intensive agricultural commodity. Though the load is relatively small, the transportation sector may be a source of growth going forward as well as the province endeavours to reduce its carbon footprint.

Offsetting Ontario's demand for electricity are energy savings achieved through conservation efforts and contributions from distribution-connected (embedded) generators. Conservation efforts will continue to offset the need for electricity but the impact of embedded generation has mostly plateaued as the addition of new capacity has slowed.

Peak demands are subject to the same forces as energy demand, as described above, although the impacts vary. This is true not only when comparing energy versus peak demand, but also in comparing the summer and winter peaks. Summer peaks have been significantly impacted by the growth in embedded generation capacity and pricing impacts (ICI and time-of-use rates). The majority of embedded generation is provided from solar facilities that have high output levels during the summer peak period and no output during the winter peak periods, which are typically at night. In addition to reducing summer peaks embedded solar has also pushed the summer daily peaks later in the day. Since the penetration of embedded generation has slowed, ICI impacts and prices will be the dominant factor in offsetting summer peak demands. Peak demands will show a small decline over the forecast horizon.

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)
Summer 2018	22,076	24,535
Winter 2018-19	21,328	22,235
Summer 2019	22,016	24,460
Year	**Normal Weather Energy (TWh)**	**% Growth in Energy**
2006	152.3	-1.9%
2007	151.6	-0.5%
2008	148.9	-1.8%
2009	140.4	-5.7%
2010	142.1	1.2%
2011	141.2	-0.6%
2012	141.3	0.1%
2013	140.5	-0.6%
2014	138.9	-1.1%
2015	136.2	-1.9%
2016	136.2	0.0%
2017	132.3	-2.8%
2018 (Forecast)	133.6	1.0%
2019 (Forecast)	134.0	0.3%

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)
03-Jun-18	18,983	21,380	1,292	2,361	24-Mar-19	17,872	18,735	569	2,520
10-Jun-18	19,621	23,852	1,055	2,503	31-Mar-19	17,887	18,991	567	2,528
17-Jun-18	20,463	23,830	835	2,519	07-Apr-19	17,567	18,170	471	2,464
24-Jun-18	21,890	24,189	754	2,582	14-Apr-19	16,836	17,943	496	2,402
01-Jul-18	21,790	23,734	1,016	2,616	21-Apr-19	16,403	16,724	531	2,322
08-Jul-18	22,076	24,535	814	2,612	28-Apr-19	16,391	16,501	721	2,332
15-Jul-18	22,023	23,358	838	2,682	05-May-19	17,502	19,935	849	2,315
22-Jul-18	21,424	23,450	1,035	2,585	12-May-19	16,620	19,397	845	2,322
29-Jul-18	21,351	24,249	841	2,660	19-May-19	18,280	21,518	1,175	2,350
05-Aug-18	21,946	24,292	958	2,692	26-May-19	17,982	21,703	1,330	2,299
12-Aug-18	21,665	24,257	985	2,657	02-Jun-19	18,694	21,236	1,292	2,362
19-Aug-18	20,847	24,029	1,362	2,634	09-Jun-19	19,434	23,708	1,055	2,515
26-Aug-18	20,899	22,981	1,413	2,615	16-Jun-19	20,214	23,642	835	2,530
02-Sep-18	20,110	22,666	1,370	2,508	23-Jun-19	21,484	24,039	754	2,593
09-Sep-18	18,626	22,050	680	2,360	30-Jun-19	21,523	23,516	1,016	2,625
16-Sep-18	19,013	21,319	781	2,426	07-Jul-19	22,016	24,460	814	2,619
23-Sep-18	17,632	20,300	420	2,392	14-Jul-19	21,533	23,222	838	2,688
30-Sep-18	17,002	18,866	554	2,340	21-Jul-19	21,095	23,322	1,035	2,589
07-Oct-18	17,257	17,528	786	2,377	28-Jul-19	21,115	24,011	841	2,664
14-Oct-18	17,097	17,485	507	2,355	04-Aug-19	21,846	24,434	958	2,699
21-Oct-18	17,374	17,922	392	2,399	11-Aug-19	21,548	24,282	985	2,669
28-Oct-18	17,491	18,140	318	2,441	18-Aug-19	20,747	23,882	1,362	2,648
04-Nov-18	17,799	18,482	416	2,455	25-Aug-19	20,707	22,739	1,413	2,624
11-Nov-18	18,734	19,331	601	2,552	01-Sep-19	19,961	22,469	1,370	2,521
18-Nov-18	18,980	19,877	342	2,564	08-Sep-19	18,524	21,889	680	2,370
25-Nov-18	19,421	20,327	607	2,639	15-Sep-19	18,890	20,647	781	2,438
02-Dec-18	19,752	20,942	409	2,680	22-Sep-19	17,472	19,595	420	2,404
09-Dec-18	19,911	21,209	555	2,709	29-Sep-19	16,898	18,215	554	2,354
16-Dec-18	20,450	21,446	690	2,761	06-Oct-19	17,129	17,151	786	2,391
23-Dec-18	20,220	21,416	362	2,742	13-Oct-19	16,982	17,165	507	2,414
30-Dec-18	18,993	19,587	528	2,530	20-Oct-19	17,242	17,740	392	2,366
06-Jan-19	20,867	22,163	570	2,785	27-Oct-19	17,371	17,961	318	2,454
13-Jan-19	21,328	22,235	547	2,861	03-Nov-19	17,659	18,300	416	2,472
20-Jan-19	20,826	21,628	483	2,850	10-Nov-19	18,565	19,111	601	2,563
27-Jan-19	20,727	21,743	404	2,857	17-Nov-19	18,816	19,665	342	2,574
03-Feb-19	20,735	21,872	734	2,864	24-Nov-19	19,259	20,113	607	2,650
10-Feb-19	19,929	21,348	635	2,799	01-Dec-19	19,588	20,734	409	2,688
17-Feb-19	19,718	21,188	581	2,751	08-Dec-19	19,726	20,980	555	2,720
24-Feb-19	19,325	21,113	501	2,701	15-Dec-19	20,303	21,247	690	2,776
03-Mar-19	20,026	21,204	531	2,739	22-Dec-19	20,100	21,247	362	2,757
10-Mar-19	19,398	20,281	649	2,684	29-Dec-19	18,724	19,375	528	2,541
17-Mar-19	18,349	19,194	611	2,607	05-Jan-20	19,177	20,297	570	2,653

3.1 Actual Weather and Demand

Since the last forecast, the actual demand and weather data for March, April and May 2018 have been recorded.

March 2018

The weather experienced throughout March was unusual in that there was not much variation. The cold days were milder than normal and the warmer days were colder than normal.

- The peak occurred on March 6, which was only the sixth coldest day of the month. Though as mentioned previously, there was not a lot of temperature variation across the month and the difference between coldest day and the peak day was only two degrees.
- The peak for March was 18,462 MW, which is the lowest since market opening. Since it was milder than normal, the weather-corrected peak was higher at 19,934 MW, reflecting the warmer than normal temperatures.
- Energy demand for March 2018 was 11.4 TWh (11.2 TWh weather corrected). The weather-corrected value is a historic low.
- The minimum demand for the month was 12,158 MW, which is on the high side of historical standards and the exact same number as last March. The minimum occurred later in the month at 3 a.m. on Good Friday.
- Embedded generation for the month was 597 GWh, an increase of 6.4 percent compared to the previous March. Hydro-electric and non-contracted output was up offsetting declines for the other fuels (solar, wind and bio-fuel).
- Wholesale customers' consumption increased by 0.3 percent compared to the previous December. With the exception of pulp and paper, all the major sectors increased their consumption compared to the previous year.

April 2018

- April 2018 set records for cold. It was the coldest April on record for Hamilton and set records going back decades for other areas. Temperatures were consistently colder than normal throughout the whole month.
- The month's peak demand occurred on Wednesday, April 4, which was the tenth coldest day of the month. The coldest days of the month fell ten days later on a weekend and were therefore not a peak. April is generally a cold peaking month but the correlation between temperature and peaks is not as strong as during the winter. Temperature variations across the province can account for the difference.
- The actual peak was 18,011 MW and the weather-corrected peak was 17,489 MW. The weather-corrected peak was the lowest by historical standards whereas the actual was higher due to the cold weather.
- Actual energy demand for the month was 10.6 TWh and weather-corrected energy demand was 10.4 TWh. Both of these demand figures were increases over April 2017, but low by historical standards.
- The minimum demand of 11,497 MW occurred at 3 a.m. on Monday, April 23. This was the second warmest day of the month. The minimum was unusual in that it occurred on a weekday.
- Embedded generation for the month was 585 GWh. This represents a 1.4 percent decline compared to the previous April. Solar output was up 14% but all other forms of embedded generation were down.
- Wholesale customers' consumption increased 0.5 percent over the previous April. The increase was widespread across all of the major energy consuming industrial classes.

May 2018

- The weather for May was generally cooler than normal for the province. However, the peak weather was warmer than normal.
- The actual peak for the month was 20,473 MW occurring on Monday, May 28. It was the hottest day of the month. The weather-corrected value was lower at 19,076 MW. Both the actual and weather-corrected were the highest May values since 2012.
- Energy demand for the month was 10.4 TWh (10.3 TWh weather-corrected). These values are a slight increase over the past two Mays.
- Minimum demand of 10,541 MW occurred Sunday, May 6 at 3 a.m. This was a one of the cooler days for the month. This value is consistent with May minimums since the 2009 recession.
- Reported embedded generation topped 661 GWh for the month, which represents an increase of 6.7 percent compared to the previous May. Increases in output from solar (2.7 percent) and non-contracted (144.0 percent) offset declines in wind (-29.3), hydro (32.6) and biogas (9.0).
- Wholesale customers' consumption increased 0.4 percent compared to the previous May. Pulp and paper and iron and steel were the sectors driving the growth this month.

2018 Spring Actuals

The spring of 2018 was colder than normal. Both April and May were colder than normal. As such, energy demand for the spring was up 2.7% compared to the previous spring. However, after adjusting for weather, the year over year increase was 1.0% compared to spring 2017.

Distributors' loads have increased by 3.1% over the spring compared to last spring. After making the weather adjustments the increase is 1.1%, which stands in contrast to the experience of 2017 which saw loads decline across the year. This increase came at the same time as embedded generation was also increasing by 3.9% over the previous spring.

For the spring months, wholesale loads showed an increase of 0.4% compared to the previous spring. Pulp and paper, iron and steel and mining led the growth in electricity demand.

The 2018 Q2 Outlook Tables contain 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

The economic environment remains positive for the Ontario economy. A strong U.S. economy, a low Canadian dollar and, low interest rates are all favourable to Ontario's export-oriented industrial sector. Strong growth in the greenhouse industry, due in part to the legalization of cannabis, will lead to an increase in electricity demand. Ontario has 57 of the 104 licensed production facilities. Since the United States is the largest consumer of Ontario exports, there is a downside economic risk with the potential disruption of NAFTA and/or trade disputes.

Table 3.3.4 of the 2018 Q2 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.

Table 3.3.5 of the 2018 Q2 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 assessed 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 (TOU) rates 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 overall consumption. TOU rates can factor into all weekdays throughout the year, and the size of the impact will be determined by the pricing structure.

The changes to the ICI program in 2017 opened the door for participation from the commercial sector. Hospitals, office buildings, hotels, universities and other large commercial buildings with peaks greater than 1 MW can now reduce their electricity costs by shifting loads during the ICI peak day periods. These changes enable the commercial sector to have greater load flexibility and the ability to follow the system peaks. The commercial sector impacts are not visible to the IESO as these participants, based on size, would be distribution-level customers. The ICI year runs from May to the following April and as such reporting for the May 2017 to April 2018 timeframe had not concluded when this report was created. Based on preliminary data, the initial estimate of the ICI impact for a peak day is a demand reduction of 1,400 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 end-use consumption. Conservation will continue to grow throughout the forecast period, and the demand forecast is decremented for those impacts.

Demand measures now include Dispatchable Loads, Capacity-Based Demand Response (CBDR) and resources secured through the Demand Response (DR) auction. Demand measures are treated as peak resources in the assessment and are further discussed in section 4.1.3. Demand reductions due to these programs are added back to the actual demand, and the forecast is based on demand prior to the impacts 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. Resource adequacy is one of the reliability considerations used for approving outages. When reserves are below required levels, with potentially adverse effects on the reliability of the grid, the IESO will reject outage requests based on their order of precedence. Conversely, an opportunity can exist for additional outages when reserves are above required levels, provided other factors such as local considerations, operability or transmission security do not pose a reliability concern. In those cases, the IESO may place an outage at risk signaling to the facility owner to consider rescheduling the outage.

The existing installed generation capacity is summarized in Table 4.1. This includes capacity from new projects that have completed IESO's market registration process since the previous Outlook. The forecast capability at the Outlook peak is based on the firm resource scenario, which includes resources currently under commercial operation, and takes into account deratings, planned outages and allowance for capability levels below rated installed capacity.

Table 4.1: Existing Generation Capacity as of May 22, 2018

Fuel Type	Total Installed Capacity (MW)	Forecast Capability at Outlook Peak (MW)	Number of Stations	Change in Installed Capacity (MW)	Change in Stations
Nuclear	13,009	9,782	5	0	0
Hydroelectric	8,472	5,815	74	0	0
Gas/Oil	10,277	8,561	31	0	0
Wind	4,412	601	38	99	1
Biofuel	495	453	9	0	0
Solar	380	38	8	0	0
Total	**37,044**	**25,251**	**165**	**99**	**1**

4.1 Assessment Assumptions

4.1.1 Generation Resources

All generation projects that are scheduled to come into service, or those scheduled to be upgraded or shut down within the Outlook period are summarized in Table 4.2. This includes generation projects in the IESO's Connection Assessment and Approval process (CAA), those that are under construction, as well as contracted resources. Details regarding the IESO's CAA process and the status of these projects can be found on the IESO's website below, under Application Status:

http://www.ieso.ca/Pages/Participate/Connection-Assessments/default.aspx

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 information is current as of May 1, 2018. If a project is delayed, the estimated effective date will be the best estimate of the commercial operation date for the project that is available to the IESO by the cutoff date.

Table 4.2: Committed Generation Resources Status

Project Name	Zone	Fuel Type	Estimated Effective Date	Project Status	Capacity Considered	
					Firm (MW)	Planned (MW)
Yellow Falls	Northeast	Hydro	2018-Q2	Under Development	0	16
Amherst Island Wind	East	Wind	2018-Q3	Under Development	0	75
Napanee Generating Station	East	Gas	2018-Q4	Under Development	0	985
Douglas Generating Station	Toronto	Gas	2018-Q4	Expiring Contract	-122	-122
Loyalist Solar	East	Solar	2019-Q1	Under Development	0	54
Nanticoke Solar	Southwest	Solar	2019-Q1	Under Development	0	44
Whitby Cogeneration	Toronto	Gas	2019-Q2	Expiring Contract	-56	0
Henvey Inlet Wind Farm	Essa	Wind	2019-Q2	Under Development	0	300
Total					**-178**	**1,352**

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.
    d. Expiring Contract – Non-Utility Generators (NUGs) whose contracts expire during the Outlook period are included in both scenarios only up to their contract expiry date. If the NUGs continue to provide forecast output data, they are also included in the planned scenario for the rest of the Outlook period.

4.1.2 Generation Capability

Hydroelectric

A monthly forecast of hydroelectric generation output forecast is calculated based on median historical values of hydroelectric production and contribution to operating reserve during weekday peak demand hours. Through this method, routine maintenance and actual forced outages of the generating units are implicitly accounted for in the historical data. Table 4.3 shows the historical hydroelectric median values calculated with data from May 2002 to March 2017. These values are updated annually to coincide with the release of the summer 18-Month Outlook.

Table 4.3: Monthly Historical Hydroelectric Median Values for Normal Weather Conditions

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Historical Hydroelectric Median Values (MW)	6,049	5,991	5,851	5,794	5,843	5,697	5,634	5,338	5,068	5,377	5,692	6,082

Thermal Generators

Thermal generators' capacity, planned outages and deratings are based on market participant submissions. Forced outage rates on demand are calculated by the IESO based on actual operations data. The IESO will continue to rely on market participant-submitted forced outage rates for comparison purposes.

Wind

For wind generation, the monthly Wind Capacity Contribution (WCC) values are used at the time of weekday peak. The specifics on wind contribution methodology can be found in the Methodology to Perform Long-Term Assessments. Table 4.4 shows the monthly WCC values. 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)	37.8%	37.8%	33.6%	35.4%	22.8%	13.6%	13.6%	13.6%	14.8%	29.8%	36.5%	37.8%

Solar

For solar generation, the monthly Solar Capacity Contribution (SCC) values are used at the time of weekday peak. The specifics on solar contribution methodology 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.

It should be noted that due to the increasing penetration of embedded solar generation, the grid demand profile has been changing, with summer peaks being pushed later in the day. As a consequence, the contribution of grid-connected solar resources at the time of peak Ontario demand has declined.

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%	0.0%	1.3%	2.9%	10.1%	10.1%	10.1%	8.6%	0.0%	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, i.e., Dispatchable Loads, demand response procured through an annual Demand Response Auction and CBDR, 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. The impacts of actual activations of demand measures are added back into the demand history prior to forecasting demand for future periods.

563.2 MW of DR capacity, procured through the 2017 DR auction, is available for the summer six-month commitment period that began on May 1, 2018, and 712.4 MW for the winter six-month commitment period beginning on November 1, 2018. The DR capacity acquired through the DR auction is reflected in the Outlook.

4.1.4 Firm Transactions

Capacity Backed Export

101.6 MW of capacity was successful in the New York Independent System Operator (NYISO) summer 2018 capacity auction held at the end of March 2018. In addition, 186 MW of Ontario capacity has been cleared in New York's monthly auctions for September and October 2018. The 18 Month Outlook reflects the cleared amounts in the NYISO auctions. The capacities cleared in the NYISO capacity auctions by Ontario generators are posted on the NYISO website.

System Backed Export

As part of the electricity trade agreement between Ontario and Quebec, Ontario will supply 500 MW of capacity to Quebec each winter from December to March until 2023. In addition, Ontario will receive up to 2.3 terawatt-hours of clean energy annually. The imported energy will be targeting peak hours to help reduce greenhouse gas emissions in Ontario. The agreement includes the opportunity to cycle energy.

As part of the capacity exchange agreement, the 500 MW capacity delivered to Quebec in 2015/2016 winter will have to be returned to Ontario during summer before September 2030, based on Ontario's needs.

4.1.5 Summary of Scenario Assumptions

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
Total Existing Installed Resource Capacity (MW)	37,044	
New Generation and Capacity Changes (MW)	1,352	-178

The starting point of both scenarios 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 assessment 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. Submitted generator planned outages are reflected in both scenarios. 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	Summer Peak 2018		Winter Peak 2019		Summer Peak 2019	
		Firm Scenario	Planned Scenario	Firm Scenario	Planned Scenario	Firm Scenario	Planned Scenario
1	Installed Resources (MW)	37,044	37,060	36,922	37,998	36,866	38,396
2	Total Reductions in Resources (MW)	12,122	12,127	10,449	10,461	10,254	10,722
3	Demand Measures (MW)	630	630	793	793	533	533
4	Firm Imports (+) / Exports (-) (MW)	-102	-102	-500	-500	0	0
5	Available Resources (MW)	25,451	25,462	26,766	27,830	27,144	28,207

Notes on Table 4.7:

1. Installed Resources: the total generation capacity assumed to be installed at the time of the summer and winter peaks.
2. Total Reductions in Resources: 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 available for reduction at the time of peak.
4. Firm Imports / Exports: the amount of expected firm imports and exports at the time of summer and winter peaks.
5. Available Resources: 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

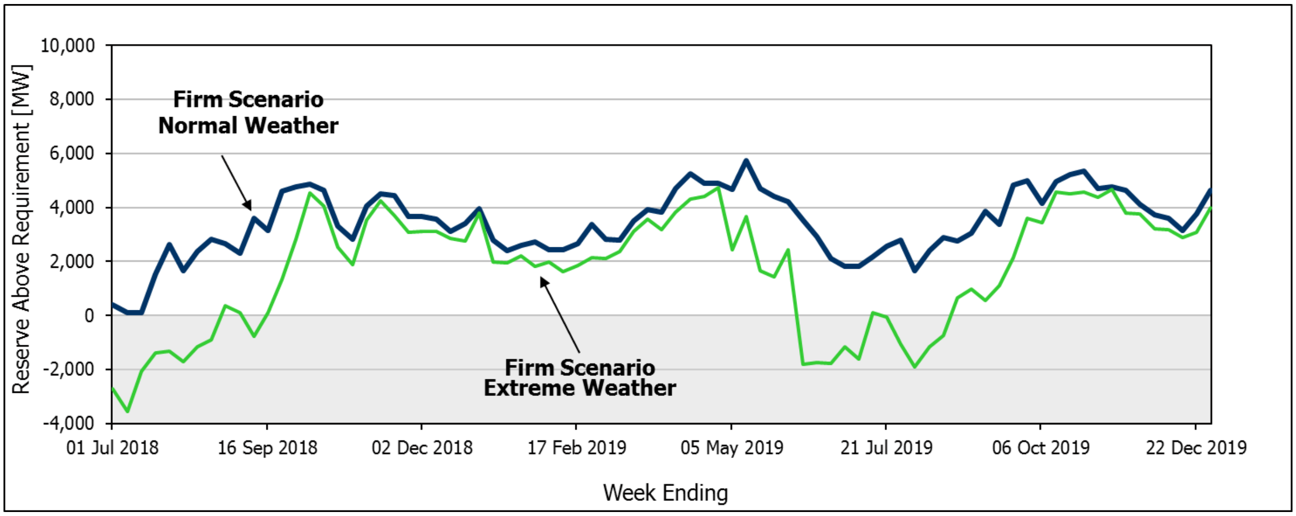
The capacity adequacy assessment accounts for zonal transmission constraints resulting from planned transmission outages and have been assessed as of April 27, 2018. The generation planned outages occurring during this Outlook period have been assessed as of May 28, 2018.

4.2.1 Firm Scenario with Normal and Extreme Weather

The **firm scenario** incorporates all existing capacity that had achieved commercial operation status as of May 1, 2018.

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 met throughout the entire Outlook period. During extreme weather conditions, the reserve is lower than the requirement for a total of 19 weeks during the 18-Month Outlook timeframe, in the firm scenario. This shortfall is largely attributed to the planned generator outages scheduled during those weeks. If extreme weather conditions do materialize, the IESO may reject some generator maintenance outage requests to ensure that Ontario demand is met during the summer peak periods. Therefore, generators expected to perform maintenance on their units during the summer should understand that those outages are at risk and are advised to review their planned maintenance plans and consider rescheduling them if they are critical for the continued operation of the units.

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

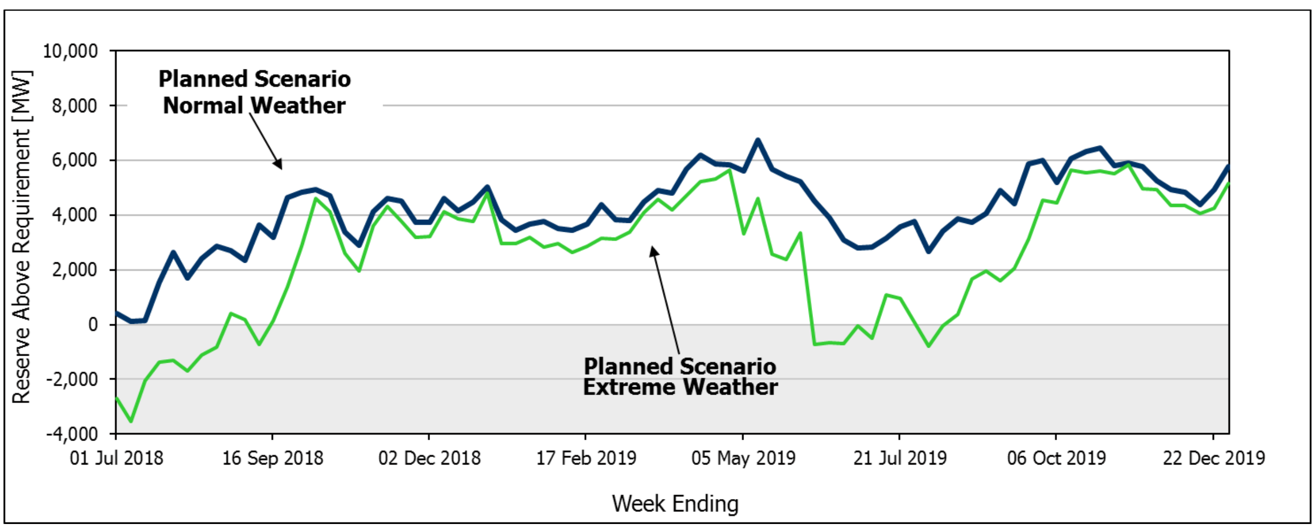


4.2.2 Planned Scenario with Normal and Extreme Weather

The **planned scenario** incorporates all existing capacity plus all capacity coming in service. Approximately 1,100 MW of net 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 a total of 16 weeks during the 18-Month Outlook timeframe under extreme weather conditions. This shortfall is largely attributed to the planned outages scheduled for those weeks.

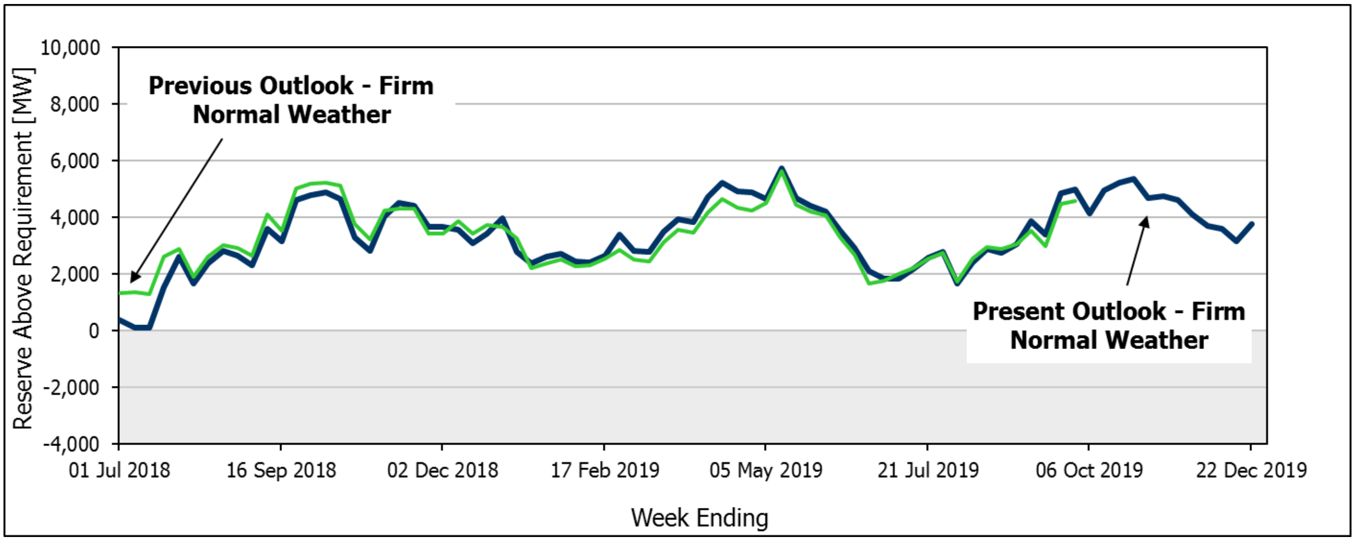
Figure 4.2: Normal vs. Extreme Weather: Planned Scenario RAR



4.2.3 Comparison of the Current and Previous Weekly Adequacy Assessments for the Firm 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 March 21, 2018. The difference is mainly due to changes in planned outages.

Figure 4.3: Present Outlook vs. Previous Outlook: Firm 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

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 as in the capacity assessment. Refer to Table 4.1 for the summary of Existing Generation Capacity and Table 4.2 for the list of Generation Resources Status for this information. The monthly forecast of energy production capability, based on the energy modelling results, is included in Table A7 of the 2018 Q2 Outlook Tables.

For the EAA, only the **firm scenario** as per Table 4.6 with normal weather demand is considered. The key assumptions specific to this assessment are described in the IESO document titled Methodology to Perform Long-Term Assessments.

4.3.2 Results – Firm Scenario with Normal Weather

Table 4.8 summarizes the energy simulation results over the 18-month Outlook period for the firm scenario with normal weather demand for Ontario as a whole and provides a breakdown by each transmission zone.

Table 4.8: Firm 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	**201.1**	**15,260**	**201.1**	**15,260**	**0.0**	**443.5**	**580.8**
Bruce	1.0	75	69.4	5,266	68.4	1.7	153.1
East	12.7	965	16.2	1,232	3.5	26.7	96.7
Essa	11.7	885	0.6	43	-11.1	24.5	4.0
Niagara	5.6	428	19.1	1,453	13.5	13.8	45.2
Northeast	14.7	1,116	12.8	968	-1.9	25.5	39.6
Northwest	5.6	427	6.5	490	0.9	10.8	18.6
Ottawa	11.7	890	0.0	1	-11.7	24.7	3.0
Southwest	41.8	3,170	5.0	380	-36.8	92.9	27.3
Toronto	76.2	5,787	64.3	4,880	-11.9	176.4	164.1
West	20.0	1,516	7.2	547	-12.8	46.5	78.0

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 firm scenario with normal weather demand, with no anticipated reliance on support from external jurisdictions.

Figure 4.4 shows the percentage production by fuel type to supply Ontario energy demand 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 – July 1, 2018, to Dec. 31, 2019

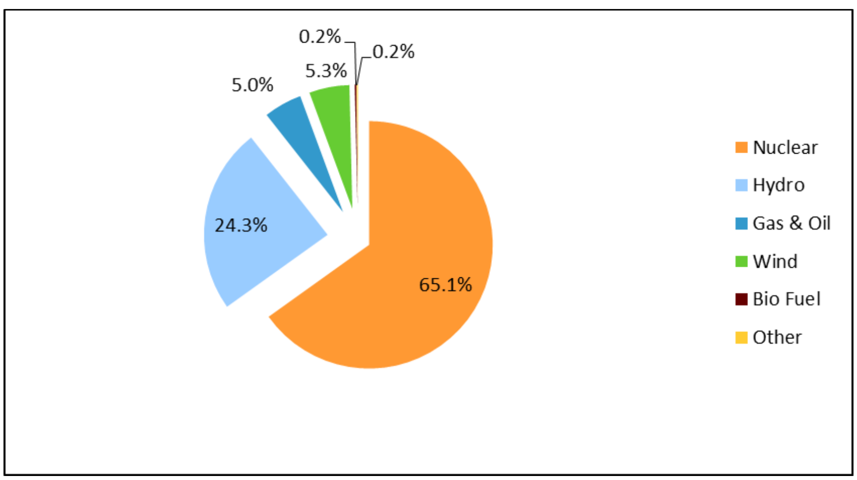


Figure 4.5: Monthly Production by Fuel Type – July 1, 2018, to Dec. 31, 2019

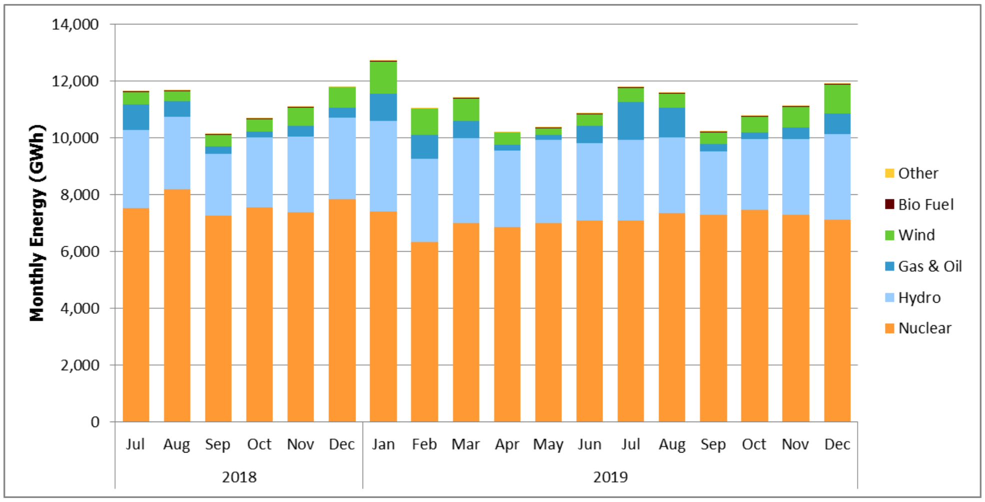


Table 4.9: Firm Scenario - Normal Weather: Ontario Energy Production by Fuel Type

Fuel Type (Grid Connected)	2018 Jul 1 - Dec 31)	2019 (Jan 1 - Dec 31)	Total
	(GWh)	(GWh)	(GWh)
Nuclear	45,700	85,242	130,942
Hydro	15,462	33,305	48,767
Gas & Oil	2,638	7,373	10,011
Wind	2,971	7,607	10,578
Bio Fuel	143	284	428
Other (Solar & DR)	102	232	335
Total	**67,015**	**134,045**	**201,060**

4.4 Outage Assessment Methodology

Over the past couple of years, the IESO enhanced the generation availability forecast of hydroelectric and thermal generators in the extreme weather scenario. The performance of thermal generators was adjusted to account for differences in ambient temperature between normal and extreme weather conditions. The performance of hydroelectric generators was also adjusted to account for seasonal low water conditions. Additionally, the spread between normal and extreme weather forecasts is now very pronounced during the May to September timeframe. The resource modelling enhancements allowed the IESO to have greater visibility of generation availability, and as a result, the IESO updated the adequacy criterion for the outage approval process through using extreme weather instead of normal weather conditions.

The changes to the IESO's Outage Management criteria are planned to take effect for outage plans occurring from May 2019 onwards. The new criteria will use extreme weather instead of normal weather conditions under the firm resource scenario and assume that up to 2,000 MW of imports are available for determining if there is sufficient reserve above requirement. Participants should benefit from improved certainty in obtaining outages with this new criterion. The new outage approval criteria will allow more planned outages in the winter or shoulder months when there is more room for outages. To facilitate these changes, modifications were made to Market Manual 7.2 in June 2018.

- End of Section -

5 Transmission Reliability Assessment

For the purpose of this report, transmitters provide information on the transmission projects that are planned for completion within the 18-month Outlook period. A list of such projects is provided in Appendix B. Only transmission and load-serving projects that are either major modifications or significantly improve reliability are included. Projects that are already in service or whose completion is planned beyond the period of this Outlook, or that are minor transmission equipment replacements or refurbishments, are not shown.

Some areas have experienced load growth to warrant additional investments in new load-serving stations and reinforcements of local area transmission. Several local area transmission 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 capacity to serve future load growth.

5.1 Transmission Outages

The IESO's assessment of the transmission outage plans is shown in Appendix C, Tables C1 to C11. 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 April 27, 2018.

5.2 Transmission System Adequacy

The IESO assesses transmission adequacy using the methodology based on conformance to established criteria including the Ontario Resource and Transmission Assessment Criteria (ORTAC), NERC transmission planning standard TPL 001-4 and NPCC Directory #1 as applicable. Planned system enhancements and known transmission outages are also considered for the studies. Zonal assessments are presented in the following sections. While the Ontario transmission system is capable of serving the demand under the normal and extreme conditions forecast for the Outlook period, some outage combinations can create transmission limitations. In particular, transmission limitations have been identified in the Flow East toward Toronto (FETT) interface during the 18-month Outlook period due to concurrent planned outages submitted for generation resources located east of this interface. These transmission limitations may cause bottling of generation resources West of FETT. Following contingencies in this interface, there may not be sufficient resources available to restore the reliability of the power system. As a result of these limitations, outages submitted for generation resources located East of FETT, or transmission elements that comprise FETT. These limitations are expected to persist for the duration of Ontario's nuclear refurbishment program.

In some areas in the province, existing transmission infrastructure as described below, have been identified as either currently having or anticipated to have some limitations to serve the local needs. Additional planning activities are currently active across the province through regional planning with projects being initiated to address local area needs. For additional information on IESO's regional planning activities, please visit the IESO regional planning webpage: http://www.ieso.ca/get-involved/regional-planning.

5.2.1 Toronto and Surrounding Area

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

Due to the existing switching arrangement at both Manby East and Manby West TS, the failure of a single breaker to operate as intended can result in two autotransformers being removed from service simultaneously. During peak load periods, this could potentially overload the remaining autotransformer. A load rejection scheme, which will help minimize customer service interruptions while alleviating these overloads, is expected to be in service by Q4 2018. This scheme will also address the possible overloading that could occur should one of the three autotransformers be forced out of service while another is already out-of-service.

The new Copeland station, when in-service in Q3 2018, will allow some load to be transferred from John TS. This will help meet the short- and mid-term need for additional load-serving capacity in the area and will also enable the refurbishment of the facilities at John TS.

As was recommended in the Central Toronto Integrated Regional Resource Plan (IRRP), Hydro One is proceeding with construction of a new transformer station at Runnymede TS and upgrading the 115 kV circuits that serve Runnymede TS from Manby TS. This project, planned to be in service by Q4 2018, will provide relief for the existing Runnymede TS and nearby Fairbank TS, which are at capacity to serve the peak demand in the area. In addition, it will serve the new Eglinton Light Rail Transit project that is currently under construction.

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

5.2.2 Bruce and Southwest Zones

Hydro One is continuing work to replace the aging infrastructure at the Bruce 230 kV switchyard, which is scheduled to be completed by Q4 2020. While this work is being implemented, careful coordination of transmission and generation outages will be needed.

Hydro One is also continuing work on a new Bruce Remedial Action Scheme (RAS), which is now scheduled for completion by December 2018. This new RAS will replace the existing Special Protection System while having increased functionality to detect and operate for a greater number of system contingencies.

The transmission transfer capability in the Southwest zone and its vicinity is expected to be sufficient to serve the load in this area with enough 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 is underway with an expected in-service date of Q2 2019. Once completed, this project will 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

Occasionally, imports may be reduced in Eastern Ontario, typically for brief periods during the summer, due to the thermal limitations of the 230 kV Hawthorne-to-Merivale circuits, which are part of the transmission network path between Eastern Ontario and the major load centers near the GTA area. Reinforcement on the Hawthorne-to-Merivale path is being considered.

High voltages in Eastern Ontario and the GTA continue to present operational challenges. This can result from low transfer levels across the 500 kV transmission system from Bowmanville SS to Hawthorne TS. Temporary removal from service of at least one of the 500 kV circuits in Eastern Ontario continues to be required during those periods. The IESO and Hydro One are currently managing this situation with day-to-day operating procedures. To address this issue on a longer-term basis, the IESO requested that Hydro One install two 500 kV line-connected shunt reactors at Lennox TS with a target in-service date of Q4 2020.

Overall transmission transfer capability in the East and Ottawa zones is expected to be sufficient for the purpose of serving load in these areas with sufficient 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. Additional generation connection is restricted in some parts of this area.

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

5.2.6 Northeast and Northwest Zones

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. These higher transfers, combined with the output from the 30 MW of new hydroelectric and solar projects in the Kapuskasing area, are expected to cause the thermal capability of the 115 kV transmission facility between Hunta and Kapuskasing to be exceeded. To ensure that the existing level of service reliability is maintained, output of the generating facilities in the Kapuskasing area may need to be limited whenever these high transfers occur.

To maintain future supply reliability to local customers, which is another issue in the Kapuskasing area, as recommended by the IESO, Hydro One has filed for Leave to Construct to reinforce the system in the area. The Kapuskasing Area Reinforcement project is expected to be in service in early Q4 2019.

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. As a result, additional generation connection is restricted in this area. The upcoming East-West Tie expansion project may help address part of these constraints, but generation in Northwestern Ontario will continue to be limited by the remaining constraints in the Sault Ste. Marie and Sudbury areas. The East-West Tie expansion project is primarily required to ensure reliability of supply to the northwest while accommodating the forecast load growth for the region. The Leave to Construct applications for this project have been filed, and as requested by the Minister of Energy, on December 1st, 2017 the IESO completed and submitted an updated assessment of the need for the line, confirming the East-West Tie expansion project continues to be the least cost solution for meeting the reliability needs for the region. The IESO recommends that work continue to target an in-service date of Q4 2020.

Transmission transfer capability in the Northeast and Northwest zones is expected to be sufficient to serve the existing load in this area with enough margin to allow for planned outages.

- End of Section -

6 Operability

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

6.1 Storage

At the end of 2015, nine energy storage projects totaling 16.75 MW were offered 10-year contracts for capacity services as part of the Phase II energy storage competitive procurement process. At present, two projects have achieved Commercial Operation and the remaining seven are in development. The IESO anticipates these contracts will achieve Commercial Operation by November 2019.

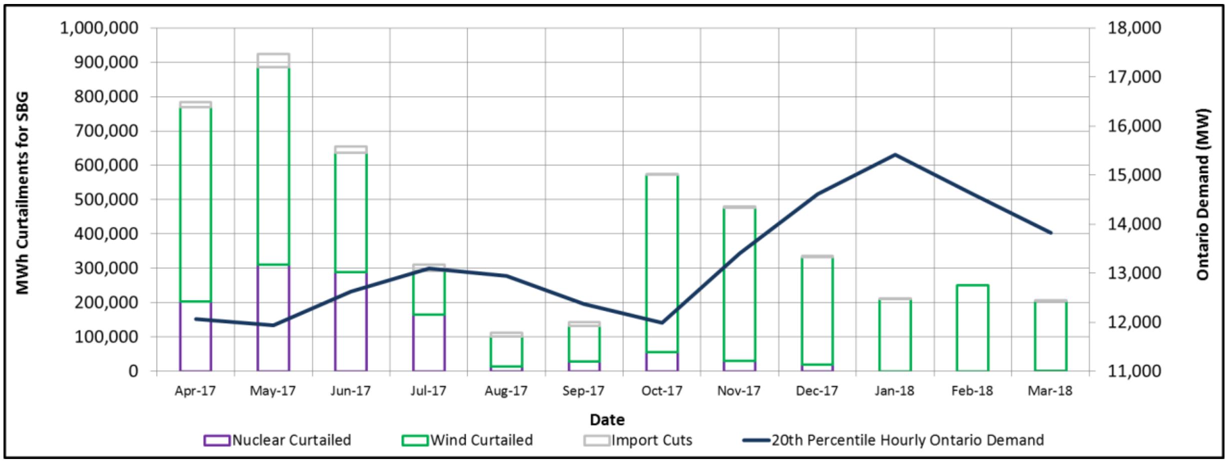
Phase II complements the approximately 34 MW of grid energy storage procured in the earlier (2014) in Phase I energy storage program by the IESO to offer ancillary services to support grid reliability. As of May~~,~~ 2018, seven Phase I energy storage facilities completed commissioning and become operational at various locations around the province. This includes five facilities providing Reactive Support and Voltage Control service, and two facilities providing regulation service. The remaining four Phase I facilities are expected to enter service at various times over the course of this next outlook period. Phase I storage facilities are intended to support the province's efforts to better understand the integration and operation of energy storage in Ontario's electricity system and markets while providing ancillary services.

6.2 Surplus Baseload Generation

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 using market mechanisms that include intertie scheduling, the dispatch of hydroelectric generation and grid-connected renewable resources, and nuclear manoeuvering or shutdown. In addition, out-of-market mechanisms such as import and linked wheel transaction curtailments could also be utilized to alleviate potential surplus conditions. These actions usually, but not always, occur when Ontario demand is at its lowest.

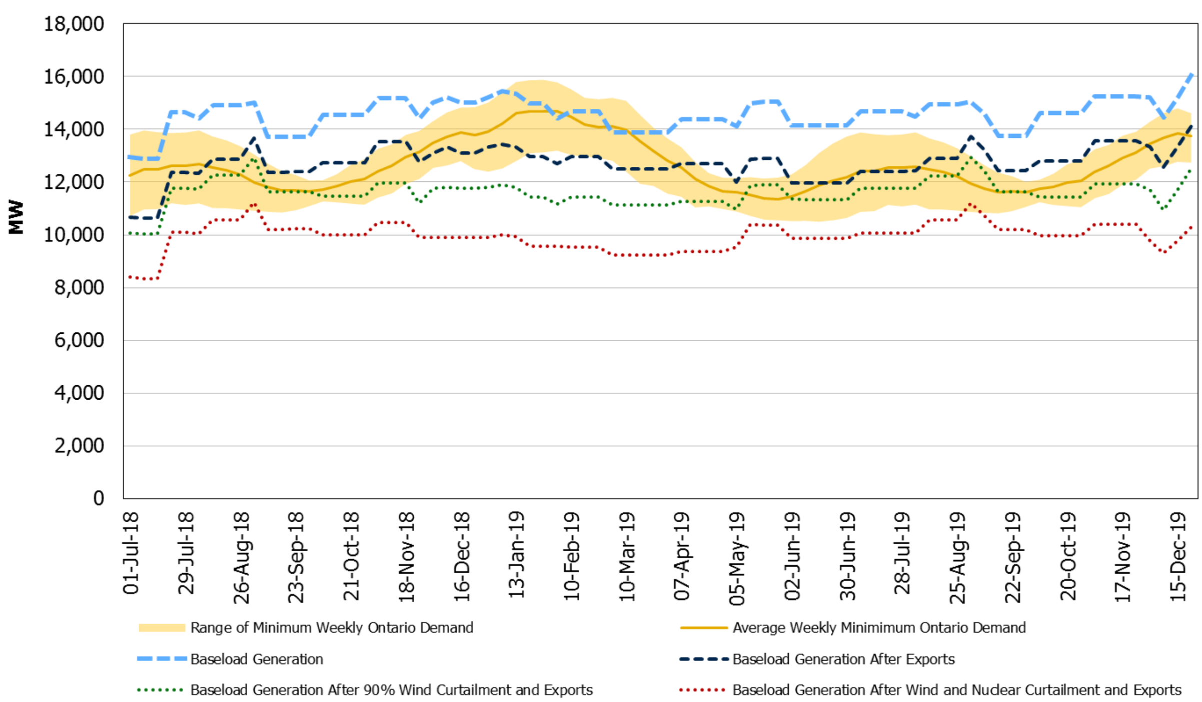
Figure 6.1 shows the nuclear, wind and import curtailments from April 2017 to the end of March 2018. As a result of the cold weather in 2018, the IESO has only reduced nuclear output once this year to date.

Figure 6.1 MWh Curtailments versus Ontario Demand



Ontario will continue to experience potential surplus baseload conditions during the Outlook period. Much of the surplus baseload conditions can be managed with existing market mechanisms, such as exports and curtailment of variable generation. Increased use of nuclear manoeuvers may be required in late Summer to Fall 2018 and Spring 2019.

Figure 6.2 Minimum Ontario Demand and Baseload Generation



The baseload generation assumptions include the expected exports and run-of-river hydroelectric production, the latest planned outage information and in-service dates for new or refurbished generation. The expected contribution from self-scheduling and intermittent generation has also been updated to reflect the latest data. The information on the dispatch order of wind, solar and flexible nuclear resources can be found in Market Manual 4 Part 4.2. 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 wind capacity contribution values calculated from actual wind output up to March 31,

2018. 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)	37.8%	37.8%	33.9%	35.8%	25.1%	15.2%	15.2%	15.2%	18.8%	31.0%	38.2%	37.8%

6.3 Operability Assessment

The need for more flexible capability to respond to intra-hour differences between expected and actual variable generation production and expected and actual Ontario demand continues to be a priority. To assist in addressing flexibility needs, the IESO concluded a stakeholder engagement in spring 2018 and will schedule additional 30-minute operating reserve as required to represent flexibility need.

Regulation service acts to match total system generation to total system demand on a second-to-second basis and helps correct variations in power system frequency. To address needs for additional regulation, the IESO completed an RFP for incremental regulation capacity in late 2017. Once in service, this additional 55 MW of regulation capacity will complement existing regulation service providers and allow the IESO to schedule 100-150MW each hour as needed to help ensure the reliable operation of the power system. Further information may be found on the 2017 Regulation RFP page here: http://www.ieso.ca/en/sector-participants/market-operations/markets-and-related-programs/regulation-service-rfp

6.4 Distributed Energy Resources

Distributed energy resources (DERs) are electricity producing resources or controllable loads that are directly connected to the distribution system or that are located behind customers' meter and indirectly connected to the distribution system. DERs can include small natural gas-fuelled generators, combined heat and power plants, electricity storage, solar photovoltaics (PV), electric vehicles and controllable loads, such as HVAC systems and electric water heaters. Embedded generation, as shown in Table 3.3.6 of the 2018Q2 Outlook Tables, is a subset of DERs; this table only includes generation that is contracted with the IESO.

Contributions from DERs are growing in Ontario. As a result of this increase, the IESO has seen periods where DERs have significantly reduced the Ontario demand by offsetting the load on the distribution system and in some cases supplying enough energy to flow energy back into the transmissions system. This creates challenges in how we forecast Ontario demand and in changing transmission flow patterns across the province. As the Reliability Coordinator and Balancing Authority for Ontario, we must understand the impacts and benefits of DER and work closely with providers and LDCs so we can effectively operate an integrated power system.

The rising penetration of DERs has created the need to share more data between the IESO, LDCs and DER operators to provide greater control room visibility and therefore improve forecasting and dispatch.

The Grid-LDC Interoperability Standing Committee was formed in 2016 to provide a forum for enhancing the communication and ultimately coordination between the IESO, LDC and DER operators. This has led to pilots for data sharing and is exploring other opportunities to enhance the reliability and efficiency of Ontario's electricity system. Data sharing is also beneficial for improving forecasts over different time frames, including for planning, and studying the impact on reliability. The Committee is actively engaged in pilots with several LDCs to share static and telemetered data to advance the IESO's forecasts and increase accuracy. More information is available at the Grid-LDC Interoperability Standing Committee webpage.

- End of Document -

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