Reliability Outlook

An adequacy assessment of Ontario's electricity system

FROM APRIL 2020 TO SEPTEMBER 2021

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FOREWORD

The spread of COVID-19 will affect demand for electricity. While it's too soon to assess the full scope and scale of the virus' impacts, in many jurisdictions, including Ontario, it has already triggered significant reaction that will affect electricity demand. Our forecast included in this report was determined prior to the declaration of COVID-19 as a pandemic and our forecast will change as a result. The IESO is monitoring the situation closely and will provide further updates when available.

Demand patterns are already changing in the early days of the COVID-19 pandemic as more Ontarians work from home and businesses alter their operations. Overall demand is beginning to trend low, and it will likely continue to decrease as more businesses temporarily close their operations. Daily conversations are taking place with generators, transmitters, and distributors to share information and ensure we are collectively prepared to adapt.

This spring 2020 edition of the Reliability Outlook is designed to provide the sector an overview of supply, demand, resource adequacy and transmission considerations for the 18-month period from April 2020 to September 2021. This analysis is intended to provide an update on initiatives being implemented to improve reliability within this time frame and help market participants schedule their outages. While the forecasts are being revised based on current circumstances, two new facilities have come online to provide capacity and energy going forward:

- The Napanee Generating Station, a 994 MW gas-fired unit reached commercial operation on March 11.
- Loyalist Solar, a 54 MW solar facility.

Ontario's transmission system is expected to continue to reliably supply province-wide demand, while experiencing normal contingencies defined by planning criteria for the next 18 months. Reinforcements continue to move forward in areas like Windsor-Essex and northwest Ontario to help manage future demand growth.

The outbreak of COVID-19 may impact generator planned outages in the coming months. The IESO continues to monitor the situation, and will provide updated assessments when more information becomes available.

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1. Introduction

This Outlook covers the 18 months from April 2020 to September 2021, which supersedes the Outlook released on December 19, 2019.

The purpose of the 18-month horizon in the *Reliability Outlook* is to:

- Advise market participants of the resource and transmission reliability of the Ontario electricity system
- Assess potentially adverse conditions that might be avoided by adjusting or coordinating maintenance plans for generation and transmission equipment
- Report on initiatives being implemented to improve reliability within this time frame

This Outlook assesses resource and transmission adequacy based on the stated assumptions, following the Methodology to Perform the Reliability Outlook. Due to uncertainties associated with various assumptions, readers are encouraged to use their judgment in considering possible future scenarios.

Additional supporting documents are located on the IESO website.

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 905-403-6900 (toll-free 1-888-448-7777) or customer.relations@ieso.ca.

2. Updates to this Outlook

2.1 Updates to the Demand Forecast

The demand forecast used in this Outlook is informed by actual demand, weather and economic data through to the end of December 2019, and has been updated to reflect the most recent economic projections. Actual weather and demand data for January and February 2020 are included in the tables.

2.2 Updates to Resources

This *Reliability Outlook* considers planned generator outages over the 18-month period, submitted by market participants to the IESO's outage management system as of February 28, 2020. Market participants are required annually to submit information to enable the IESO to conduct reliability assessments. This information, provided to the IESO through Form 1230, was submitted by April 1, 2019.

The following resources completed market registration since the last Outlook:

- Loyalist Solar – 54 MW
- Napanee Generating Station – 994 MW

2.3 Updates to the Transmission Outlook

Transmission outage plans that were submitted to the IESO's outage management system by January 27, 2020, are considered in this Outlook.

2.4 Updates to the 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 February 28, 2020.

3. Demand Forecast

The demand forecast presented here reflects conditions prior to the outbreak of COVID-19, and the impact this may have on demand over the outlook period is uncertain at this time. The IESO continues to monitor the situation and will provide updated forecasts when more information becomes available.

The IESO is responsible for forecasting electricity demand on the IESO-controlled grid. This demand forecast covers the period April 2020 to September 2021 and supersedes the previous forecast released in December 2019. Tables of supporting information are contained in the 2020 Q1 Outlook Tables.

The demand forecast presented in the following tables reflects conditions prior to the outbreak of COVID-19, and shows modest growth in energy demand, and very slight growth in summer peak demand. Given the uncertainties associated with the COVID-19 pandemic, however, this forecast will change.

The IESO continues to monitor the situation and will provide updated forecasts when more information becomes available.

Table 3-1 | Forecast Energy Summary

Year	Normal Weather Energy (TWh)	% Growth in Energy
2020 (Forecast)	135.6	1.04%
2021 (Forecast)	137.3	1.32%

Table 3-2 | Forecast Seasonal Peaks

Season	Normal Weather Peak (MW)	Extreme Weather Peak (MW)
Summer 2020	22,195	24,584
Winter 2020-21	21,245	22,523
Summer 2021	22,368	24,781

Table 3-3 | Weekly Energy and Peak Demand Forecast

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
05-Apr-20	17,302	17,883	471	2,486
12-Apr-20	16,700	17,531	496	2,374
19-Apr-20	16,043	16,185	531	2,358
26-Apr-20	16,291	16,819	721	2,354
03-May-20	17,269	19,563	849	2,334
10-May-20	16,548	19,332	845	2,340
17-May-20	18,077	21,159	1,175	2,361
24-May-20	17,705	21,404	1,330	2,314
31-May-20	18,560	20,834	1,292	2,377
07-Jun-20	19,289	23,371	1,055	2,549
14-Jun-20	20,311	23,774	835	2,567
21-Jun-20	21,389	23,846	754	2,630
28-Jun-20	21,540	23,836	1,016	2,685
05-Jul-20	20,583	23,374	814	2,648
12-Jul-20	22,195	24,584	838	2,751
19-Jul-20	20,749	24,057	1,035	2,624
26-Jul-20	21,335	24,264	841	2,714
02-Aug-20	21,966	24,097	958	2,712
09-Aug-20	21,336	23,695	985	2,677
16-Aug-20	20,566	23,529	1,362	2,657
23-Aug-20	21,362	23,126	1,413	2,702
30-Aug-20	19,969	22,415	1,370	2,551
06-Sep-20	18,427	23,174	680	2,442
13-Sep-20	18,817	20,513	781	2,415
20-Sep-20	17,601	19,772	420	2,419
27-Sep-20	16,868	18,136	554	2,359
04-Oct-20	17,181	17,266	786	2,404
11-Oct-20	16,837	16,880	507	2,423
18-Oct-20	17,084	17,490	392	2,382
25-Oct-20	17,295	17,793	318	2,465
01-Nov-20	17,513	18,181	416	2,491
08-Nov-20	18,522	18,855	601	2,571
15-Nov-20	18,694	19,412	342	2,593
22-Nov-20	19,223	19,897	607	2,666
29-Nov-20	19,643	21,084	409	2,727
06-Dec-20	19,932	20,934	555	2,755
13-Dec-20	20,341	21,323	690	2,797
20-Dec-20	20,072	21,139	362	2,785

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
27-Dec-20	18,817	20,639	528	2,742
03-Jan-21	20,252	21,092	528	2,742
10-Jan-21	21,245	22,523	570	2,950
17-Jan-21	20,928	21,799	547	2,920
24-Jan-21	20,729	21,904	483	2,921
31-Jan-21	20,772	22,072	404	2,946
07-Feb-21	20,267	21,679	734	2,872
14-Feb-21	19,899	21,237	635	2,806
21-Feb-21	19,657	21,304	581	2,771
28-Feb-21	20,170	21,403	501	2,824
07-Mar-21	19,774	20,339	531	2,757
14-Mar-21	19,093	19,493	649	2,688
21-Mar-21	17,963	18,659	611	2,565
28-Mar-21	17,932	18,654	569	2,561
04-Apr-21	17,949	18,272	567	2,488
11-Apr-21	17,061	17,892	471	2,438
18-Apr-21	16,575	16,638	496	2,402
25-Apr-21	16,645	16,972	531	2,388
02-May-21	17,618	19,912	721	2,371
09-May-21	16,693	19,682	849	2,374
16-May-21	18,228	21,511	845	2,400
23-May-21	17,854	21,758	1,175	2,400
30-May-21	18,716	21,185	1,330	2,358
06-Jun-21	19,450	23,627	1,292	2,575
13-Jun-21	20,468	23,933	1,055	2,602
20-Jun-21	21,539	23,896	835	2,665
27-Jun-21	22,001	23,998	754	2,722
04-Jul-21	21,901	24,573	1,016	2,684
11-Jul-21	22,293	24,735	814	2,788
18-Jul-21	20,812	24,218	838	2,661
25-Jul-21	21,503	24,431	1,035	2,753
01-Aug-21	22,136	24,569	841	2,749
08-Aug-21	21,502	24,058	958	2,717
15-Aug-21	20,736	23,803	985	2,695
22-Aug-21	21,516	23,483	1,362	2,739
29-Aug-21	20,119	22,584	1,413	2,587
05-Sep-21	18,569	23,313	1,370	2,479
12-Sep-21	18,954	20,651	680	2,449
19-Sep-21	17,736	19,922	781	2,454

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
26-Sep-21	17,016	18,287	420	2,393
03-Oct-21	17,319	17,511	554	2,439

4. Resource Adequacy

The IESO expects to have sufficient generation supply for winter 2020/2021, accounting for zonal transmission constraints. Potential risks in summer 2020 and summer 2021 are expected to be mitigated by outage rescheduling.

The outbreak of COVID-19 may impact generator planned outages and other inputs to the capacity and energy adequacy assessments. The IESO continues to monitor the situation, and will provide updated assessments when more information becomes available.

This section assesses 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, when reserves are above required levels, additional outages can be contemplated, 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 facilities that have completed the 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 in commercial operation, and takes into account deratings, planned outages and an allowance for capability levels below rated installed capacity.

Table 4-1 | Existing Grid-Connected Resource Capacity

Fuel Type	Total Installed Capacity (MW)	Forecast Capability at Outlook Peak Normal Weather (MW)	Forecast Capability at Outlook Peak [Extreme] (MW)	Number of Stations	Change in Number of Stations	Change in Installed Capacity
Nuclear	13,009	9,099	9,099	5	0	0
Hydroelectric	9,065	5,401	4,715	76	0	0
Gas/Oil	11,270	9,359	8,899	32	1	994
Wind	4,486	611	611	39	0	0
Biofuel	295	229	229	7	0	0
Solar	478	66	66	10	1	54
Demand Measures	-	518	518	-	-	-
Firm Imports (+) / Exports (-) (MW)	-	0	0	-	-	-
Total	**38,603**	**25,282**	**24,136**	**169**	**2**	**1,048**

4.1 Assessment Assumptions

4.1.1 Generation Resources

All generation resources scheduled to come into service, be upgraded or be 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 under construction, and contracted resources. Details regarding the IESO's CAA process and the status of these projects can be found on the Application Status section of the IESO website.

The estimated effective date column in Table 4-2 indicates when the market registration process is expected to be complete for each generation resource, based on information available to the IESO as of March 12, 2020. Two scenarios are used to describe project risks:

- The **planned scenario** assumes that all resources scheduled to come into service are available over the assessment period.
- The **firm scenario** assumes resources are restricted to those that have reached commercial operation status at the time this assessment was completed.

Planned shutdowns or retirements of generators that have a high certainty of occurring are considered for both scenarios.

Table 4-2 | Committed Generation Resources Status[1]

					Capacity Considered	
Project Name	**Zone**	**Fuel Type**	**Estimated Effective Date**	**Project Status**	**Firm (MW)**	**Planned (MW)**
Henvey Inlet Wind Farm	Essa	Wind	2020-Q1	Commissioning	0	300
Romney Wind Energy Centre	West	Wind	2020-Q1	Commissioning	0	60
Calstock	Northeast	Biofuel	2020-Q2	Expiring Contract	-38	-38
Total					**-38**	**322**

Notes on Table 4-2:

The total may not add up due to rounding and does not include in-service facilities. Project status provides an indication of the project progress, using the following terminology:

• Under Development – projects in approvals and permitting stages (e.g., environmental assessment, municipal approvals, IESO connection assessment approvals) and projects under construction.

• Commissioning – projects undergoing commissioning tests with the IESO.

• Commercial Operation – projects that have achieved commercial operation status under the contract criteria, but have not met all of the IESO's market registration requirements.

• Expiring Contract – contracts that will expire during the Outlook period are included in both scenarios only up to their contract expiry date. Generators (including non-utility generators) that continue to provide forecast output data are also included in the planned scenario for the rest of the 18-month period.

[1] The Renewable Energy Approval (REA) for the Nation Rise wind farm was recently revoked and its capacity is no longer considered in this assessment. The IESO will continue to monitor developments on the status of the project.

4.1.2 Generation Capability

Hydroelectric

A monthly forecast of hydroelectric generation output 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 (see the first row in Table 4-3). To reflect the impact of hydroelectric outages on the reserve above requirement (RAR) and allow the assessment of hydroelectric outages as per the outage approval criteria, the hydroelectric capability is also calculated, without accounting for historical outages (see the second row of Table 4-3). Table 4-3 uses data from May 2002 to March 2019, which are updated annually to coincide with the release of the Q2 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 Contribution (MW)	6,338	6,276	6,102	6,035	6,139	5,958	5,876	5,522	5,273	5,643	5,882	6,336
Historical Hydroelectric Median Contribution without Outages (MW)	6,851	6,846	6,609	6,555	6,594	6,465	6,270	6,047	6,104	6,449	6,616	6,846

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 operational data. The IESO will continue to rely on market participant-submitted forced outage rates for comparison purposes.

Wind

For wind generation, monthly wind capacity contribution (WCC) values from the weekday peak time are used. The process for determining wind contribution can be found in the Methodology to Perform the Reliability Outlook. Figure 4-1 shows the monthly WCC values, which are updated annually with the release of the Q2 Outlook.

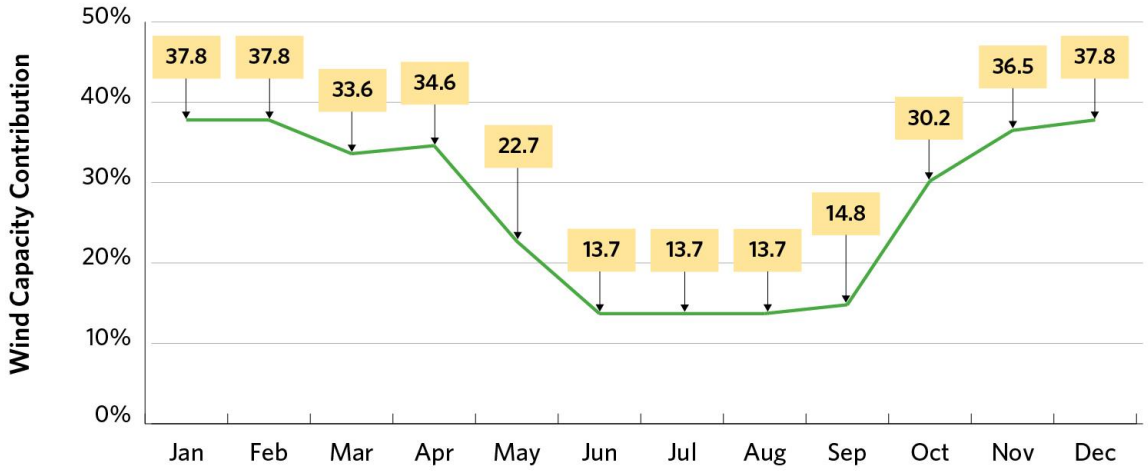

Figure 4-1 | Monthly Wind Capacity Contribution Values

Solar

For solar generation, monthly solar capacity contribution (SCC) values are used from the weekday peak time. Information on how the solar contribution is calculated can be found in the Methodology to Perform the Reliability Outlook. Figure 4-2 shows the monthly SCC values, which are updated annually for the release of the Q2 Outlook.

The grid demand profile has been changing, due to the increasing penetration of embedded solar generation, which is pushing summer peaks to later in the day. As a result, the contribution from grid-connected solar resources has declined at the time of peak Ontario demand.

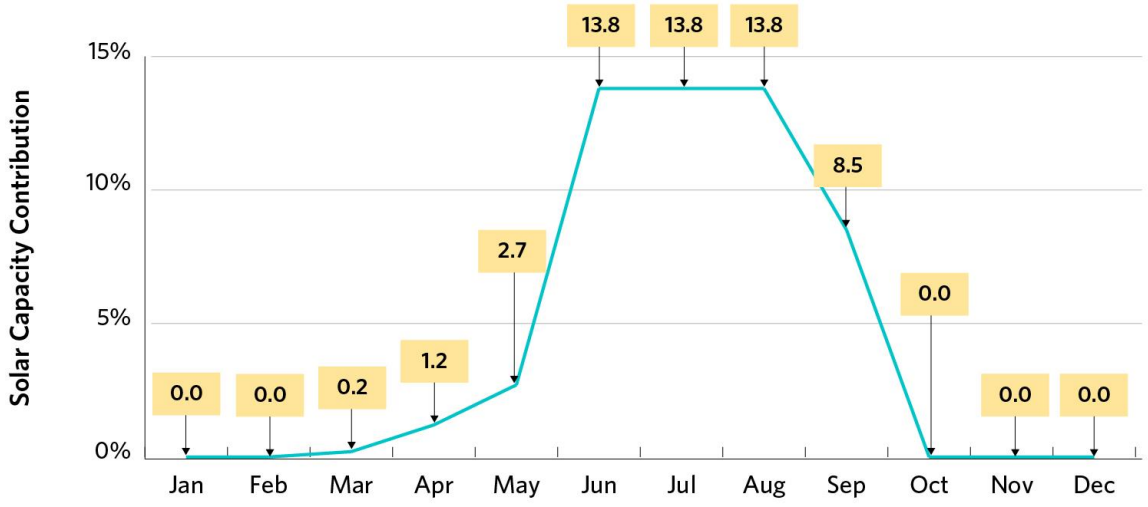

Figure 4-2 | Monthly Solar Capacity Contribution Values

4.1.3 Demand Measures

Both demand measures and load modifiers can impact demand, but differ in how they are treated within the Outlook. Demand measures, such as dispatchable loads and demand response procured through the IESO's capacity auction, are not incorporated into the demand forecast and are instead treated as resources. Load modifiers are incorporated into the demand forecast. The impacts of activated demand measures are added back into the demand history prior to forecasting demand for future periods.

4.1.4 Firm Transactions

Capacity-Backed Export

The IESO allows Ontario resources to compete in the capacity auctions held by certain neighbouring jurisdictions, only if Ontario is adequately supplied. Capacity-backed exports of up to 15 MW installed capacity were successful in the New York Independent System Operator (NYISO) auctions for delivery between May and October 2020.

System-Backed Exports

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 TWh of clean energy annually, scheduled economically via Ontario's real-time markets. The imported energy will target peak hours to help reduce greenhouse gas emissions in Ontario. The agreement includes the opportunity to cycle energy.

As part of this capacity exchange agreement, Ontario can call on 500 MW of capacity during summer before September 2030, based on the province's needs. Ontario does not expect to call on this capacity during this 18-month period.

4.1.5 Summary of Scenario Assumptions

To assess future resource adequacy, the IESO must make assumptions about the amount of available resources. The Outlook considers two scenarios: a firm scenario and a planned scenario.

The starting point for 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 considers only those resources that have reached commercial operation status as of the time of this assessment. Generator-planned shutdowns or retirements that have a high certainty of occurring are considered for both scenarios. They also both reflect planned outages submitted by generators. Table 4-4 shows the available resources that are forecast for the 18 months, under the two scenarios in normal weather conditions, at the time of the summer and winter peak demands during the Outlook.

Table 4-4 | Summary of Available Resources under Normal Weather

Notes	Description	Summer Peak 2020		Winter Peak 2020/2021		Summer Peak 2021	
		Firm Scenario	Planned Scenario	Firm Scenario	Planned Scenario	Firm Scenario	Planned Scenario
1	Installed Resources (MW)	37,609	38,954	37,609	38,954	37,609	38,954
2	Total Reductions in Resources (MW)	12,292	12,668	10,626	10,867	13,836	14,213
3	Demand Measures (MW)	518	518	761	761	518	518
4	Firm Imports (+) / Exports (-) (MW)	0	0	-500	-500	0	0
5	Available Resources (MW)	25,835	26,804	27,244	28,348	24,291	25,259
6	Bottling (MW)	66	66	97	120	72	72
7	Available Resources without Bottling (MW)	25,900	26,869	27,341	28,468	24,363	25,331

Notes on Table 4-4:

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 allowances 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). This differs from the Forecast Capability at System Peak shown in Table 4-1 due to the impacts of generation bottling (transmission limitations).
6. Available Resources without Bottling: Available resources after they are reduced due to bottling.

4.2 Capacity Adequacy Assessment

The capacity adequacy assessment accounts for zonal transmission constraints resulting from planned transmission outages assessed as of January 27, 2020. The generation planned outages occurring during this Outlook period have been assessed as of February 28, 2020.

The outbreak of COVID-19 is expected to impact the demand forecast used in this assessment, as discussed in chapter 3. Furthermore, the resulting economic repercussions may impact generator planned outages. The IESO continues to monitor the situation, and will provide updated assessments when more information becomes available.

4.2.1 Firm Scenario with Normal and Extreme Weather

The firm scenario incorporates all capacity that had achieved commercial operation status as of February 28, 2020.

Figure 4-3 shows Reserve Above Requirement (RAR) levels, which represent the difference between available resources and required resources. The latter equals the demand plus required reserve. The reserve requirement in the firm scenario under normal weather conditions is met throughout the entire Outlook period, with the exception of one week in summer 2021.

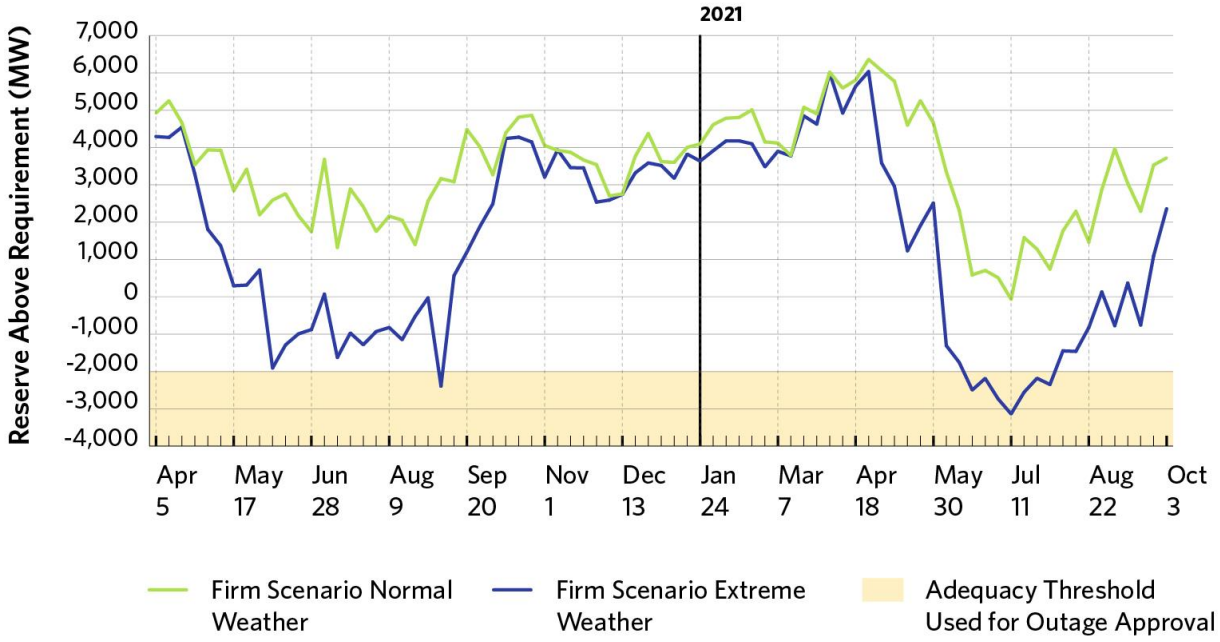

Figure 4-3 | Comparison of Normal and Extreme Weather: Firm Scenario Reserve Above Requirement

4.2.2 Planned Scenario with Normal and Extreme Weather

The planned scenario incorporates all existing capacity, as well as all capacity expected to come into service. Approximately 360 MW of generation capacity is expected to connect to Ontario's grid over this Outlook period, while 38 MW of generation capacity contracts will expire.

Figure 4-4 shows RAR levels under the planned scenario. As observed, the reserve requirement will be met throughout the Outlook period under normal weather conditions.

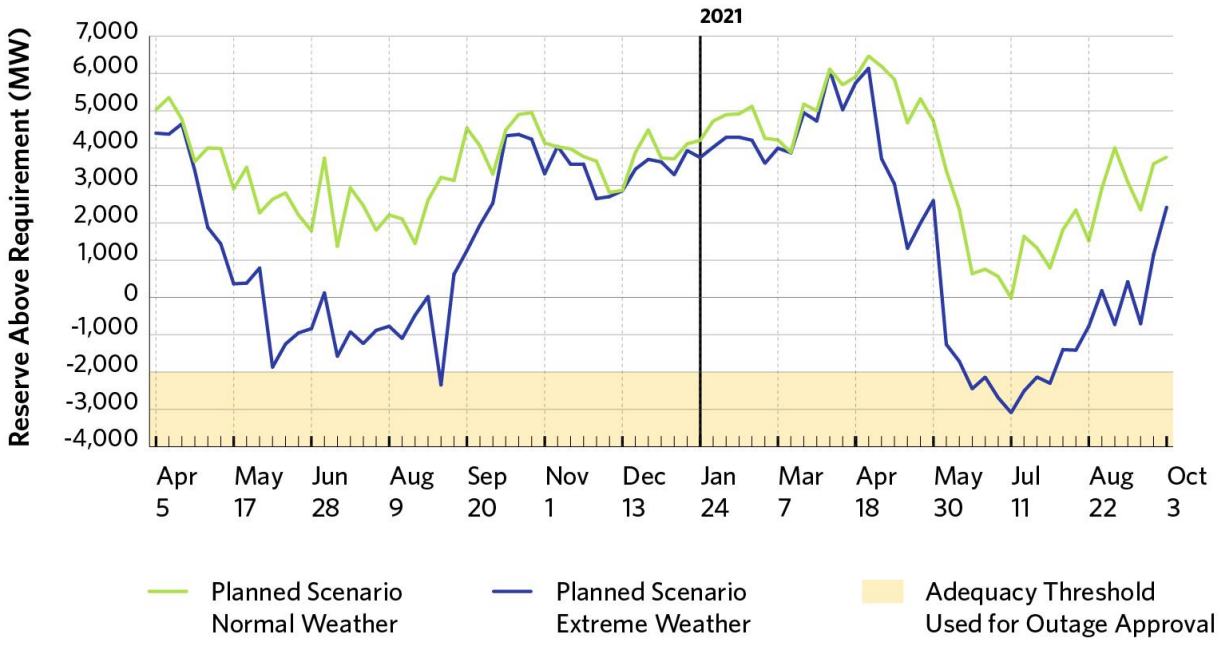

Figure 4-4 | Comparison of Normal and Extreme Weather: Planned Scenario Reserve Above Requirement

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

Figure 4-5 compares forecast RAR values in the current Outlook with those in the previous Outlook, which was published on December 19, 2019. The difference is primarily the result of the addition of Napanee GS to the firm scenario, as well as changes in planned outages and the expected in-service dates of new resources.

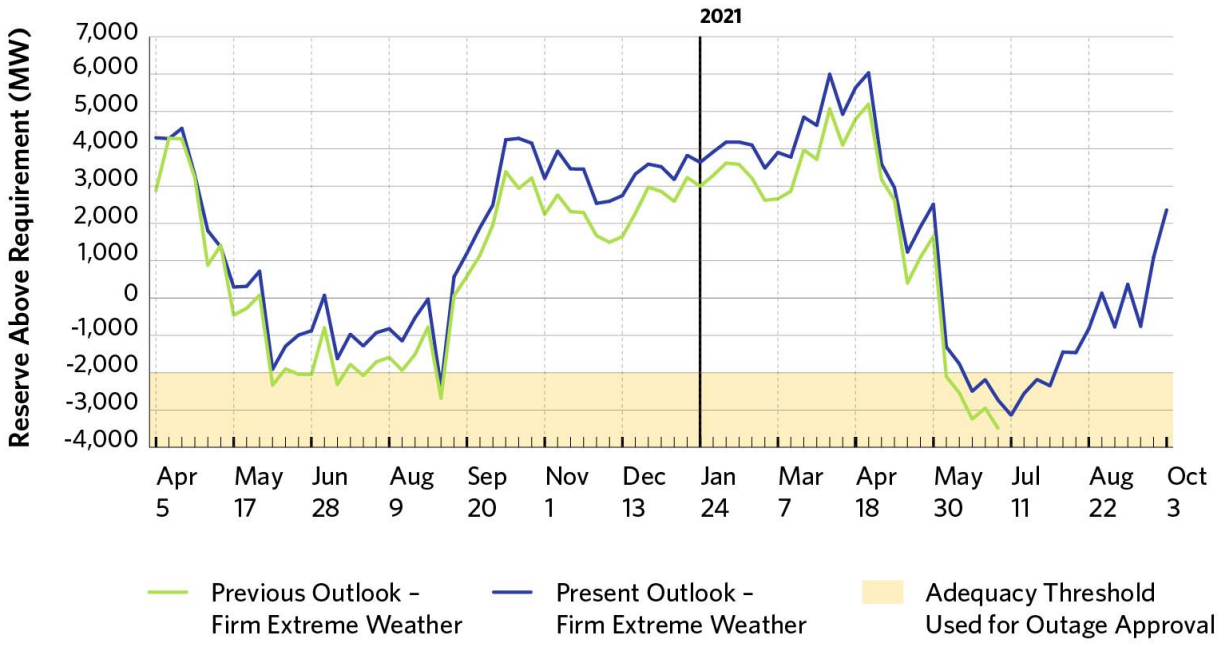

Figure 4-5 | Comparison of Current and Previous Outlook: Firm Scenario Extreme Weather Reserve Above Requirement

Resource adequacy assumptions and risks are discussed in detail in the Methodology to Perform the Reliability Outlook.

4.3 Energy Adequacy Assessment

This section assesses energy adequacy to determine whether Ontario has sufficient supply to meet its forecast energy demands, while highlighting potential adequacy concerns during the Outlook time frame. At the same time, the assessment estimates the aggregate production by 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) uses the same set of assumptions as the capacity assessment, as outlined in Table 4-1 and Table 4-2, which indicate the total capacity of committed resources and when they are expected to be available over the next 18 months. The monthly forecast of energy production capability, based on energy modelling results, is included in the 2020 Q1 Outlook Tables.

For the EAA, only the firm scenario in Table 4-5 with normal weather demand is assessed. The key assumptions specific to this assessment are described in the Methodology to Perform the Reliability Outlook.

4.3.2 Results – Firm Scenario with Normal Weather

Table 4-5 summarizes the energy simulation results over the next 18 months for the firm scenario with normal weather demand both for Ontario and for each transmission zone.

Table 4-5 | Summary of Zonal Energy for Firm Scenario Normal Weather

	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
Zone	**TWh**	**Average MW**	**TWh**	**Average MW**	**TWh**	**GWh**	**GWh**
Bruce	0.9	68	62.3	4,735	61.4	1.2	107.5
East	13.7	1,039	20.0	1,524	6.3	30.1	101.1
Essa	12.1	921	3.9	294	-8.2	26.4	15.3
Niagara	5.9	446	20.4	1,549	14.5	14.1	53.1
Northeast	15.3	1,162	14.2	1,081	-1.1	26.6	33.0
Northwest	5.7	431	6.8	514	1.1	9.4	21.4
Ottawa	18.2	1,381	0.3	21	-17.9	37.6	0.9
Southwest	41.6	3,161	8.0	612	-33.6	91.8	24.0
Toronto	74.9	5,697	59.4	4,513	-15.5	180.5	130.2
West	21.1	1,601	14.0	1,065	-7.1	49.2	74.2
Ontario	**209.2**	**15,908**	**209.2**	**15,908**	**0.0**	**466.9**	**560.6**

4.3.3 Findings and Conclusions

The EAA results indicate that Ontario is expected to have sufficient supply to meet its forecast energy needs throughout the outlook period for the firm scenario with normal weather demand, without having to rely on support from external jurisdictions.

5. Transmission Reliability Assessment

Ontario's transmission system is expected to continue to reliably supply province-wide demand, while experiencing normal contingencies defined by planning criteria for the next 18 months. However, some combinations of transmission and/or generation outages could create operating challenges.

The IESO assesses transmission adequacy using a 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 projects, and known transmission outages are also considered in the studies.

Ontario's transmission system is expected to continue to reliably supply province-wide demand while experiencing normal contingencies defined by planning criteria for the next 18 months.

5.1 Transmission Projects

This section considers the information transmitters provide with respect to transmission projects that are planned for completion within the next 18 months. The list of transmission projects is provided in Appendix B1.

5.2 Transmission Outages

The IESO's assessment of 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 Methodology to Perform the Reliability Outlook. This Outlook contains transmission outage plans submitted to the IESO as of January 27, 2020.

5.3 Transmission Considerations

The purpose of this section of the report is to highlight projects and outages that may affect the scheduling of other outages and/or may affect reliability, and categorize these considerations by zone.

Bruce, Southwest and West Zones

Hydro One has begun replacing the aging infrastructure at the Bruce 230 kV switchyard, which requires careful coordination of transmission and generation outages. This project is scheduled to be completed by Q2 2021.

Aging circuit breakers in the Richview 230 kV switchyard are to be replaced in 2020. Hydro One and the IESO will coordinate the outages required to reduce the impact on the Flow East Toward Toronto (FETT) transfer capabilities.

A series of non-contiguous planned outages will impact the flow out of Bruce from March to November 2020. Planned outages include the following circuits: B501M, B502M, B560V, B561M, and N582L. A planned two-week outage starting April 20, 2020 will impact circuit B569B, reducing transfer capability into the West zone.

Significant growth in the greenhouse sector has led to a number of customer connection requests in the Windsor-Essex region that are expected to exceed the capacity of the existing transmission system in the area. A new switching station at the Leamington Junction is proceeding toward a Q3 2022 in-service date. Outages may be more challenging to facilitate as new load connections are made and required transmission reinforcements are being implemented.

Toronto, East and Ottawa Zones

Operational challenges due to high voltages in eastern Ontario and the Greater Toronto Area continue to occur during low-demand periods. The IESO and Hydro One are currently managing this situation by removing one of the 500 kV circuits in eastern Ontario during those periods. To address this issue on a longer-term basis, two 500 kV line-connected shunt reactors will be installed at Lennox TS with a target in-service date of Q4 2020 for the first reactor and Q4 2021 for the second reactor.

A planned outage of X522A will reduce flow into Ottawa for two months starting March 17, 2020.

Northwest, Northeast and Essa Zones

In the Kapuskasing area, system reinforcements, including upgrades to circuit H9K and the installation of reactive compensation, are planned for Q1 2020 and Q2 2021, respectively. During the construction of these reinforcements, certain outages may be restricted.

A number of non-contiguous planned outages will reduce transfer capability on the North-South Tie from May 2020 to October 2020. Planned outages include circuits X503E, X504E, and breakers at Hanmer TS.

A two-week outage in September 2020 and a four-week outage in November 2020 of circuits E510V and E511V respectively will impact transfer capabilities between the Essa and Toronto zones.

Significant construction activities for the East West Tie reinforcement project will also occur over the Outlook period, requiring outages to existing transmission facilities in the northwest. A three-and-a-half-week outage of W22M and M24L will impact the flows west across the East-West Tie starting July 6, 2020. A three-and-a-half-week outage of F25A and M23L will impact the flows east across the East-West Tie, starting August 18 2020.

Interconnections

The early 2018 failure of the phase angle regulator (PAR) connected to the Ontario-New York 230 kV interconnection circuit L33P continues to hinder the province's ability to import electricity from New York through the New York-St. Lawrence interconnection and from Quebec through the Beauharnois interconnection. This has required enhanced coordination with affected parties and more focused management of St. Lawrence area resources in real-time. Careful coordination of transmission and generation outages will continue to be required in the area. PARs are unique pieces of equipment and replacements are not readily available. Replacement options for the unit are being investigated jointly with the IESO, Hydro One, NYISO and the New York Power Authority. The preferred replacement option is a new PAR with a +/- 60-degree angle range, based on the recommendation by the joint New York/Ontario team to Hydro One for tendering. The return-to-service date for the L33P PAR is currently expected to be August 2022.

There are two outages that will reduce import and export transfer capability between Ontario and Michigan. The first outage is a planned two-and-a-half-week outage starting April 14, 2020, which will impact interconnection circuit L51D. The second outage is a planned two-week outage starting September 21, 2020, which will impact equipment at Lambton TS.

A planned outage of T22C will reduce import capabilities from HQ Paugan on P33C for a week and a half starting June 15, 2020.

6. Operability

During the Outlook period, Ontario will continue to experience potential surplus baseload conditions, much of which can be managed with existing market mechanisms, such as exports and curtailment of variable generation.

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

6.1 Surplus Baseload Generation

Baseload generation is made up of nuclear, run-of-the-river hydroelectric and variable generation, such as wind and solar. When baseload supply is expected to exceed Ontario demand, market signals reflect such conditions through lower prices, and resources in Ontario and at the interties respond accordingly. The resulting market outcomes may include higher export volumes, dispatching down of hydroelectric generation and grid-connected renewable resources, and nuclear manoeuvring or shutdowns. For severe surplus conditions that could affect the reliability of the system, the IESO may take out-of-market actions, such as manually curtailing resources and/or imports.

Ontario will continue to experience potential surplus baseload conditions during the Outlook period. Figure 6-1 highlights the periods during which expected baseload generation may exceed forecast demand.

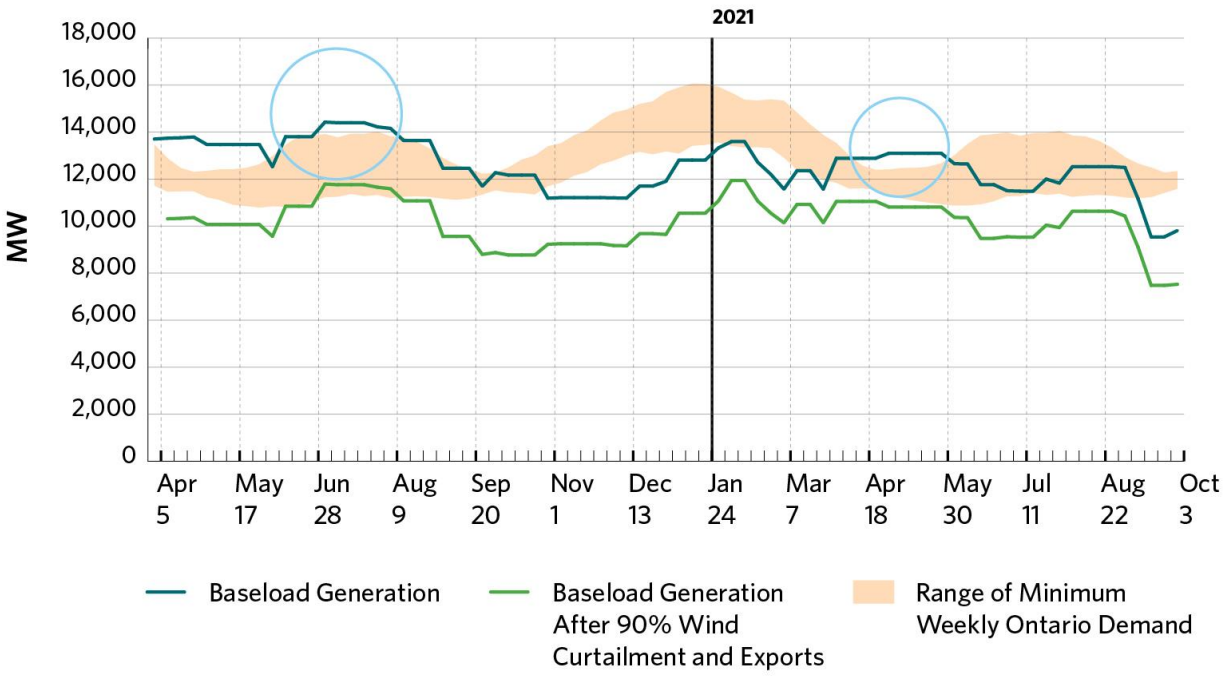

Figure 6-1 | Minimum Ontario Demand and Baseload Generation

Most of the surplus baseload conditions can be managed with existing market mechanisms signaling for exports, and by curtailing variable and nuclear generation. Going forward, as shown in Figure 6-2, existing mechanisms will be sufficient for managing SBG.

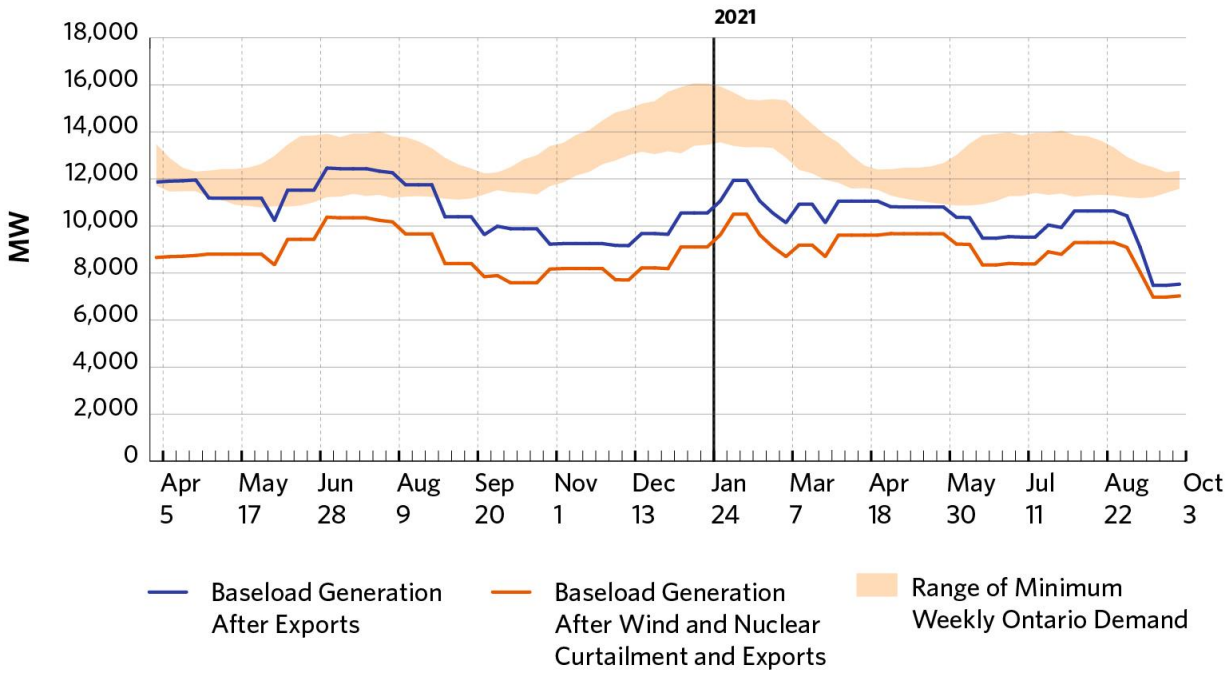

Figure 6-2 | Minimum Ontario Demand and Baseload Generation

The baseload generation assumptions include 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 been updated to reflect the latest data. 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. Figure 6-3 shows the monthly off-peak wind capacity contribution values calculated from actual wind output up to March 31, 2019. These values are updated annually to coincide with the release of the Q2 Outlook.

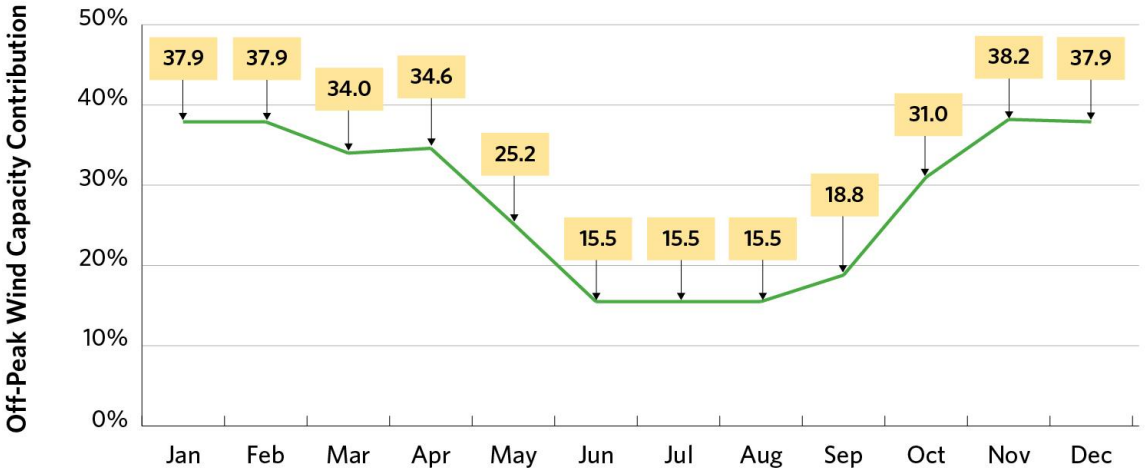

Figure 6-3 | Monthly Off-Peak Wind Capacity Contribution Values

7. Resources Referenced in This Report

The table below lists additional resources in the order they appear in the report.

Table 7-1 | Additional Resources

Resource	URL	Location in This Report
Reliability Outlook Webpage	http://www.ieso.ca/en/Sector-Participants/Planning-and-Forecasting/Reliability-Outlook	Introduction
Security and Adequacy Assessments	http://www.ieso.ca/power-data/data-directory	Introduction
2020 Q1 Outlook Tables	http://www.ieso.ca/-/media/files/ieso/document-library/planning-forecasts/reliability-outlook/ReliabilityOutlookTables_2020Mar.xls	Throughout
Connection Assessments and Approval Process	http://www.ieso.ca/en/sector-participants/connection-assessments/application-status	Assessment Assumptions
Methodology to Perform the Reliability Outlook	http://www.ieso.ca/-/media/files/ieso/document-library/planning-forecasts/reliability-outlook/ReliabilityOutlookMethodology2020Mar.pdf	Throughout
Capacity Auction	http://www.ieso.ca/en/Sector-Participants/Market-Operations/Markets-and-Related-Programs/Capacity-Auction	Demand Measures
Enabling Capacity Exports	http://www.ieso.ca/en/Sector-Participants/Market-Renewal/Capacity-Exports	Firm Transactions
Ontario Resource and Transmission Assessment Criteria	http://www.ieso.ca/-/media/files/ieso/Document%20Library/Market-Rules-and-Manuals-Library/market-manuals/market-administration/IMO-REQ-0041-TransmissionAssessmentCriteria.pdf	Transmission Considerations
NERC Transmission Planning Standard TPL-001-4	http://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-4.pdf	Transmission Considerations
NPCC Directory #1	https://www.npcc.org/Standards/Directories/Directory_1_TFCP_rev_20151001_GJD.pdf	Transmission Considerations
Market Manual 4 Part 4.2	http://www.ieso.ca/-/media/Files/IESO/Document-Library/Market-Rules-and-Manuals-Library/market-manuals/market-operations/mo-dispatchdatartm.pdf?la=en	Surplus Baseload Generation
Grid-LDC Interoperability Standing Committee	http://www.ieso.ca/Sector-Participants/Engagement-Initiatives/Standing-Committees/Grid-LDC-Interoperability-Standing-Committee	Distributed Energy Resources

8. List of Acronyms

CAA	Connection Assessment and Approval
CROW	Control Room Operations Window
DER	Distributed Energy Resource
DR	Demand Response
EAA	Energy Adequacy Assessment
ESAG	Energy Storage Advisory Group
FETT	Flow East Toward Toronto
GS	Generating Station
GTA	Greater Toronto Area
ICI	Industrial Conservation Initiative
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
MW	Megawatt(s)
NERC	North American Electric Reliability Corporation
NPCC	Northeast Power Coordinating Council
NYISO	New York Independent System Operator
ORTAC	Ontario Resource and Transmission Criteria
PAR	Phase Angle Regulator
RAR	Reserve Above Requirement
RAS	Remedial Action Scheme
SBG	Surplus Baseload Generation
SCC	Solar Capacity Contribution
TS	Transmission/Transformer Station
TWh	Terawatt-hour(s)
WCC	Wind Capacity Contribution

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