# Reliability Outlook

## An adequacy assessment of Ontario's electricity system

**FROM JULY 2020 TO DECEMBER 2021**

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# Executive Summary

Ontario's economy is starting to reopen after COVID-19 but there is still some uncertainty as to the pandemic's long-term impacts on demand for electricity. The stay-in in-place order and the closure of non-essential businesses caused overall electricity consumption to drop but as expected, with more people working from home, residential consumption has increased since the start of the lockdown. By contrast, commercial loads have declined significantly since the shutdown of non-essential businesses.

Although the situation remains fluid, demand patterns have started to return to normal as businesses re-start their operations. Given its role as Ontario's power system integrator, conversations with generators, transmitters, distributors and large customers are ongoing, and will help ensure we are collectively prepared to adapt to the "new normal." The IESO continues to monitor the situation closely and will provide further updates when available.

Overall, Ontario's electricity system is well-positioned for the next 18 months, with adequate supply to meet demand. Potential risks in summer 2020 and summer 2021 are expected to be mitigated by outage rescheduling. While COVID-19 has affected demand for electricity, its impacts have been far reaching across the sector. A number of planned outages at generation and transmission resources were rescheduled, and the pandemic may continue to impact these 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.

Late last week the government announced it would be implementing an Industrial Conservation Initiative (ICI) peak hiatus to enable and encourage businesses to focus on their operations during this time. After considering the impacts of an ICI hiatus, the IESO has determined that Ontario's electricity system should remain reliable this summer without the program. To help manage periods of high demand, we can rely on other tools such as imports and/or outage deferrals.

Recent events, whether it's COVID-19, or just unusually hot weather earlier this spring, show that Ontario's power system is resilient and has the flexibility needed to adapt to changing circumstances. Through electricity market mechanisms as well as our diverse supply mix, the IESO has a broad range of tools to manage the system and support reliability and cost-effectiveness.

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# 1. Introduction

This Outlook covers the 18 months from July 2020 to December 2021, and supersedes the Outlook released on March 24, 2020.

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 April, 2020, and has been updated to reflect the most recent economic projections. Actual weather and demand data for April and May 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 June 1, 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, 2020.

## 2.3 Updates to the Transmission Outlook

This Outlook also considers transmission outage plans that were submitted to the IESO's outage management system by April 27, 2020.

## 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 June 1, 2020.

# 3. Demand Forecast

The IESO has updated the demand forecast to reflect post-COVID-19 conditions. Economic disruption from COVID-19 is widespread, causing reductions in provincial energy demand and peak demand.

Going forward, the situation remains fluid and the IESO will continue to monitor and provide updated forecasts as new information becomes available.

The IESO is responsible for forecasting electricity demand on the IESO-controlled grid. This demand forecast covers the period July 2020 to December 2021 and supersedes the previous forecast released in March 2020. Tables of supporting information are contained in the 2020 Q2 Outlook Tables.

The onset of the coronavirus and the ensuing public health and policy responses, have had significant effects on Ontarians' behaviour and economic activity. These effects are being seen in changing patterns of electricity consumption.

The stay-in-place order and the closure of non-essential businesses have caused overall electricity consumption to drop. As expected, with more people working from home, residential consumption has increased. By contrast, commercial loads have dropped significantly due to the emergency lock down and physical distancing measures. However, the current state is unlikely to persist as the weather begins to warm up and the province continues to reopen the economy.

Going forward, the path is not clearly defined and remains fluid. A staged reopening of the economy will take place over the course of the summer. As people return to work and businesses open their doors, electricity demand in the business sector will begin to increase. By fall of 2020, schools of all levels are expected to be open in some form or another, further bolstering demand for electricity.

During the final two quarters of 2020, Ontario's economy is likely to start recovering which will result in a rebound in electricity demand.

There are risks to this forecast. A surge in virus cases could lead to further suspension of economic activities and, thus, further reductions in demand. As well, Ontario's economy is highly integrated with the American economy. Circumstances that impact the U.S. recovery and subsequent growth will be felt in Ontario. Barriers to trade could negatively impact Ontario's recovery.

In addition to demand profiles evolving as the economy reopens this summer, the Ministry of Energy, Northern Development, and Mines recently announced current participants in the Industrial Conservation Initiative (ICI) program[1] do not need to reduce demand during peak hours in 2020-2021 as part of the

[1] https://news.ontario.ca/mndmf/en/2020/06/ontario-provides-stable-electricity-pricing-for-industrial-and-commercial-companies.html?utm_source=ondemand&utm_medium=email&utm_campaign=m

government's response to COVID-19. This change contributes to a higher peak for summer 2020 than was previously forecast. The program is expected to return to its normal operation for 2021-2022.

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) | 129.6 | -3.40% |
| 2021 (Forecast) | 134.3 | 3.64% |

**Table 3-2 | Forecast Seasonal Peaks**

| Season | Normal Weather Peak (MW) | Extreme Weather Peak (MW) |
|---|---|---|
| Summer 2020 | 22,364 | 24,731 |
| Winter 2020-21 | 20,558 | 21,737 |
| Summer 2021 | 22,103 | 24,375 |

**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-Jul-20 | 18,697 | 20,789 | 814 | 2,445 |
| 12-Jul-20 | 21,570 | 23,034 | 838 | 2,638 |
| 19-Jul-20 | 22,239 | 24,261 | 1,035 | 2,659 |
| 26-Jul-20 | 22,329 | 24,347 | 841 | 2,672 |
| 02-Aug-20 | 22,364 | 24,377 | 958 | 2,667 |
| 09-Aug-20 | 20,608 | 24,325 | 985 | 2,548 |
| 16-Aug-20 | 21,397 | 24,506 | 1,362 | 2,684 |
| 23-Aug-20 | 21,631 | 24,731 | 1,413 | 2,675 |
| 30-Aug-20 | 20,407 | 22,783 | 1,370 | 2,532 |
| 06-Sep-20 | 20,312 | 22,487 | 680 | 2,516 |
| 13-Sep-20 | 20,217 | 22,192 | 781 | 2,459 |
| 20-Sep-20 | 18,980 | 21,720 | 420 | 2,374 |
| 27-Sep-20 | 17,963 | 20,250 | 554 | 2,333 |
| 04-Oct-20 | 17,293 | 19,558 | 786 | 2,275 |
| 11-Oct-20 | 16,129 | 16,436 | 507 | 2,249 |

| Week Ending | Normal Peak (MW) | Extreme Peak (MW) | Load Forecast Uncertainty (MW) | Normal Energy Demand (GWh) |
|---|---|---|---|---|
| 18-Oct-20 | 16,213 | 16,610 | 392 | 2,228 |
| 25-Oct-20 | 16,368 | 16,955 | 318 | 2,297 |
| 01-Nov-20 | 16,560 | 17,298 | 416 | 2,338 |
| 08-Nov-20 | 17,170 | 17,964 | 601 | 2,372 |
| 15-Nov-20 | 17,949 | 18,162 | 342 | 2,426 |
| 22-Nov-20 | 18,311 | 18,915 | 607 | 2,510 |
| 29-Nov-20 | 18,730 | 19,670 | 409 | 2,558 |
| 06-Dec-20 | 19,152 | 20,501 | 555 | 2,655 |
| 13-Dec-20 | 19,574 | 20,980 | 690 | 2,687 |
| 20-Dec-20 | 19,514 | 20,920 | 362 | 2,698 |
| 27-Dec-20 | 19,297 | 20,536 | 528 | 2,604 |
| 03-Jan-21 | 19,271 | 20,528 | 528 | 2,617 |
| 10-Jan-21 | 20,388 | 21,737 | 570 | 2,828 |
| 17-Jan-21 | 20,353 | 21,555 | 547 | 2,849 |
| 24-Jan-21 | 20,535 | 21,532 | 483 | 2,856 |
| 31-Jan-21 | 20,558 | 21,552 | 404 | 2,856 |
| 07-Feb-21 | 20,132 | 20,978 | 734 | 2,767 |
| 14-Feb-21 | 19,707 | 20,559 | 635 | 2,755 |
| 21-Feb-21 | 19,533 | 20,701 | 581 | 2,717 |
| 28-Feb-21 | 19,216 | 20,690 | 501 | 2,727 |
| 07-Mar-21 | 18,834 | 20,161 | 531 | 2,626 |
| 14-Mar-21 | 18,053 | 19,482 | 649 | 2,574 |
| 21-Mar-21 | 17,518 | 18,986 | 611 | 2,508 |
| 28-Mar-21 | 17,370 | 18,530 | 569 | 2,460 |
| 04-Apr-21 | 17,013 | 18,043 | 567 | 2,359 |
| 11-Apr-21 | 16,488 | 17,026 | 471 | 2,340 |
| 18-Apr-21 | 16,405 | 17,167 | 496 | 2,331 |
| 25-Apr-21 | 16,312 | 16,902 | 531 | 2,276 |
| 02-May-21 | 16,304 | 17,132 | 721 | 2,273 |
| 09-May-21 | 16,726 | 18,652 | 849 | 2,293 |
| 16-May-21 | 17,236 | 19,239 | 845 | 2,323 |
| 23-May-21 | 17,569 | 20,942 | 1,175 | 2,311 |
| 30-May-21 | 18,257 | 20,913 | 1,330 | 2,292 |
| 06-Jun-21 | 18,786 | 20,246 | 1,292 | 2,382 |
| 13-Jun-21 | 20,183 | 21,352 | 1,055 | 2,516 |
| 20-Jun-21 | 20,751 | 21,896 | 835 | 2,547 |
| 27-Jun-21 | 21,561 | 22,451 | 754 | 2,600 |
| 04-Jul-21 | 21,018 | 21,908 | 1,016 | 2,586 |
| 11-Jul-21 | 21,920 | 22,766 | 814 | 2,777 |

| Week Ending | Normal Peak (MW) | Extreme Peak (MW) | Load Forecast Uncertainty (MW) | Normal Energy Demand (GWh) |
|---|---|---|---|---|
| 18-Jul-21 | 21,936 | 24,006 | 838 | 2,789 |
| 25-Jul-21 | 22,018 | 24,098 | 1,035 | 2,804 |
| 01-Aug-21 | 22,103 | 24,098 | 841 | 2,800 |
| 08-Aug-21 | 21,484 | 24,006 | 958 | 2,687 |
| 15-Aug-21 | 21,716 | 24,177 | 985 | 2,812 |
| 22-Aug-21 | 21,870 | 24,375 | 1,362 | 2,794 |
| 29-Aug-21 | 21,234 | 22,404 | 1,413 | 2,658 |
| 05-Sep-21 | 20,706 | 22,055 | 1,370 | 2,630 |
| 12-Sep-21 | 20,929 | 21,706 | 680 | 2,573 |
| 19-Sep-21 | 19,676 | 21,219 | 781 | 2,485 |
| 26-Sep-21 | 18,637 | 20,922 | 420 | 2,440 |
| 03-Oct-21 | 17,930 | 20,197 | 554 | 2,386 |
| 10-Oct-21 | 16,705 | 17,003 | 786 | 2,340 |
| 17-Oct-21 | 16,764 | 17,157 | 507 | 2,316 |
| 24-Oct-21 | 16,887 | 17,472 | 392 | 2,380 |
| 31-Oct-21 | 17,049 | 17,788 | 318 | 2,415 |
| 07-Nov-21 | 17,166 | 17,962 | 416 | 2,432 |
| 14-Nov-21 | 18,419 | 18,629 | 601 | 2,503 |
| 21-Nov-21 | 18,790 | 19,393 | 342 | 2,589 |
| 28-Nov-21 | 19,240 | 20,183 | 607 | 2,639 |
| 05-Dec-21 | 19,677 | 20,425 | 409 | 2,727 |
| 12-Dec-21 | 20,114 | 20,920 | 555 | 2,774 |
| 19-Dec-21 | 20,077 | 20,883 | 690 | 2,788 |
| 26-Dec-21 | 20,478 | 21,116 | 362 | 2,810 |
| 02-Jan-22 | 19,555 | 20,812 | 528 | 2,698 |

# 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.

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 | 11,223 | 10,681 | 5 | 0 | 0 |
| Hydroelectric | 9,065 | 5,187 | 4,086 | 76 | 0 | 0 |
| Gas/Oil | 11,270 | 9,333 | 8,963 | 32 | 0 | 0 |
| Wind | 4,486 | 634 | 634 | 39 | 0 | 0 |
| Biofuel | 295 | 286 | 261 | 7 | 0 | 0 |
| Solar | 478 | 64 | 64 | 10 | 0 | 0 |
| Demand Measures | - | 586 | 586 | - | - | - |
| Firm Imports (+) / Exports (-) (MW) | - | -15 | -15 | - | - | - |
| **Total** | **38,603** | **27,298** | **25,259** | **169** | **0** | **0** |

## 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 June 1, 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**

| | | | | | Capacity Considered | |
|---|---|---|---|---|---|---|
| **Project Name** | **Zone** | **Fuel Type** | **Estimated Effective Date** | **Project Status** | **Firm (MW)** | **Planned (MW)** |
| Henvey Inlet Wind Farm | Essa | Wind | 2020-Q3 | Commissioning | 0 | 300 |
| Romney Wind Energy Centre | West | Wind | 2020-Q4 | Commissioning | 0 | 60 |
| Calstock | Northeast | Biofuel | 2020-Q4 | Expiring Contract | -38 | -38 |
| Iroquois Falls | Northeast | Gas | 2021-Q4 | Expiring Contract | -131 | -131 |
| **Total** | | | | | **-169** | **191** |

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.

### 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 2020, 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) | 6,327 | 6,266 | 6,068 | 6,021 | 6,116 | 5,940 | 5,790 | 5,431 | 5,227 | 5,600 | 5,851 | 6,312 |
| Historical Hydroelectric Median Contribution without Outages (MW) | 6,835 | 6,854 | 6,593 | 6,542 | 6,561 | 6,427 | 6,238 | 5,998 | 6,068 | 6,430 | 6,601 | 6,815 |

#### 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.

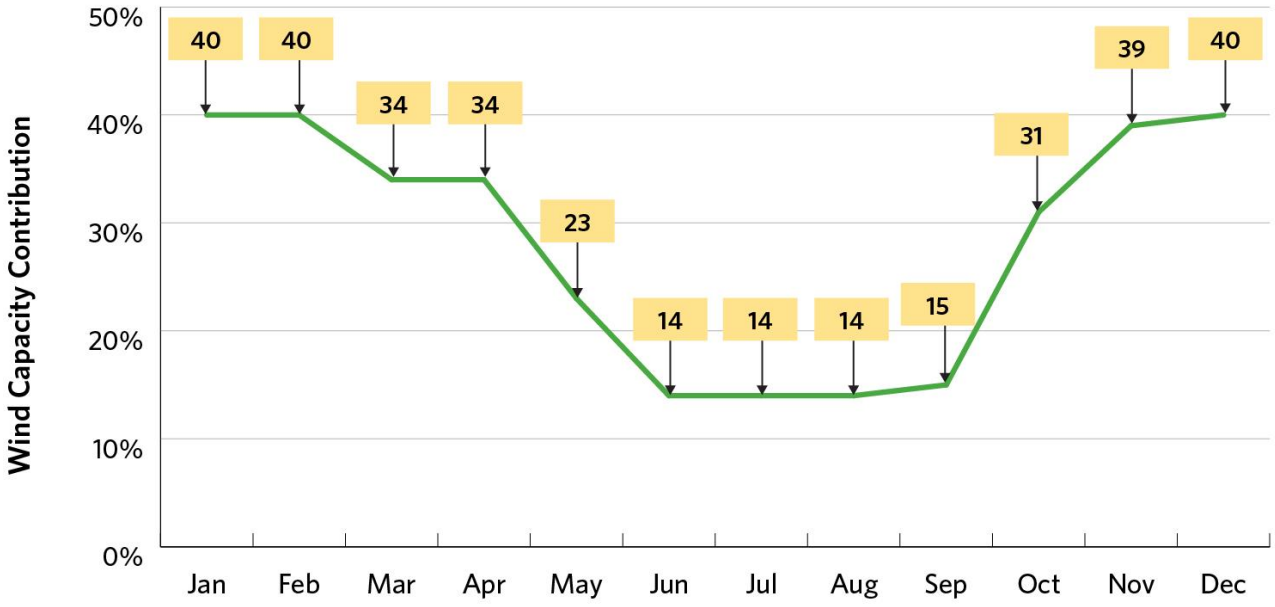


**Figure 4-1 | Monthly Wind Capacity Contribution Values**

### 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 in part 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.

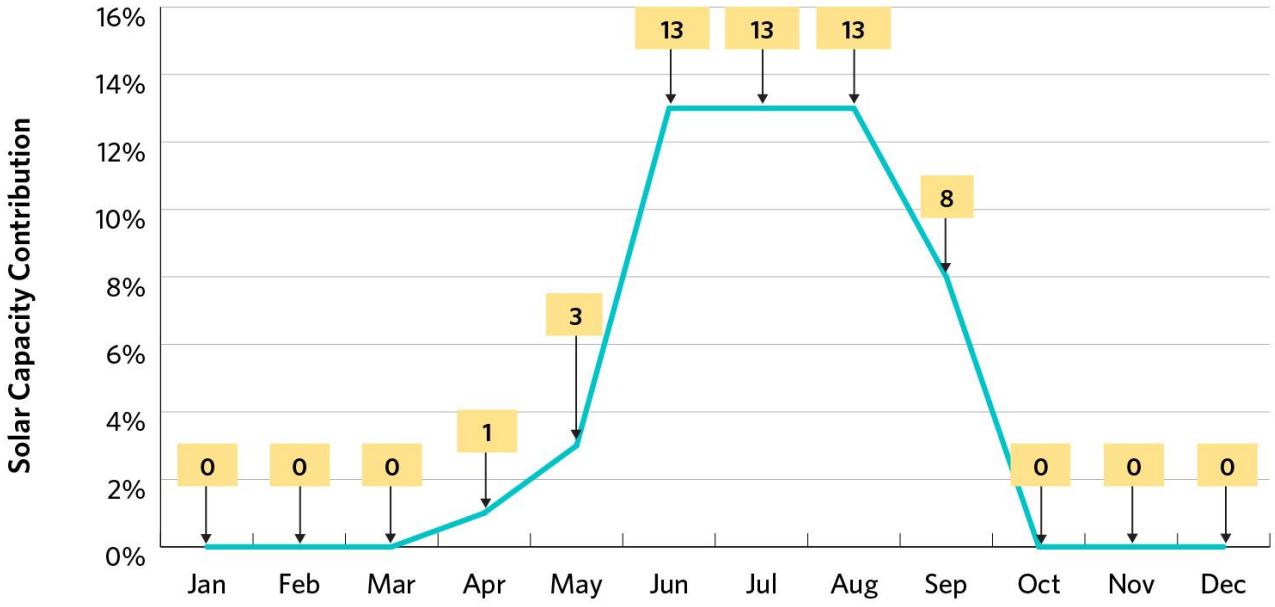


**Figure 4-2 | Monthly Solar Capacity Contribution Values**

#### 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, but only if Ontario has adequate supply. Capacity-backed exports of 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**

| | | Summer Peak 2020 | | Winter Peak 2020/2021 | | Summer Peak 2021 | |
|---|---|---|---|---|---|---|---|
| Notes | Description | Firm Scenario | Planned Scenario | Firm Scenario | Planned Scenario | Firm Scenario | Planned Scenario |
| 1 | Installed Resources (MW) | 38,603 | 38,903 | 38,603 | 38,963 | 38,603 | 38,963 |
| 2 | Total Reductions in Resources (MW) | 11,876 | 12,133 | 11,194 | 11,433 | 12,322 | 12,631 |
| 3 | Demand Measures (MW) | 586 | 586 | 700 | 700 | 28 | 28 |
| 4 | Firm Imports (+) / Exports (-) (MW) | -15 | -15 | -500 | -500 | 0 | 0 |
| 5 | Available Resources (MW) | 27,298 | 27,341 | 27,609 | 27,730 | 26,309 | 26,360 |
| 6 | Bottling (MW) | 0 | 0 | 647 | 671 | 0 | 0 |
| 7 | Available Resources without Bottling (MW) | 27,298 | 27,341 | 28,256 | 28,401 | 26,309 | 26,360 |

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 April 27, 2020. The generation planned outages occurring during this Outlook period have been assessed as of June 1, 2020.

The outbreak of COVID-19 has added some uncertainty to our forecasts. The IESO will continue to provide timely updates to these assessments as new 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 June 1, 2020.

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

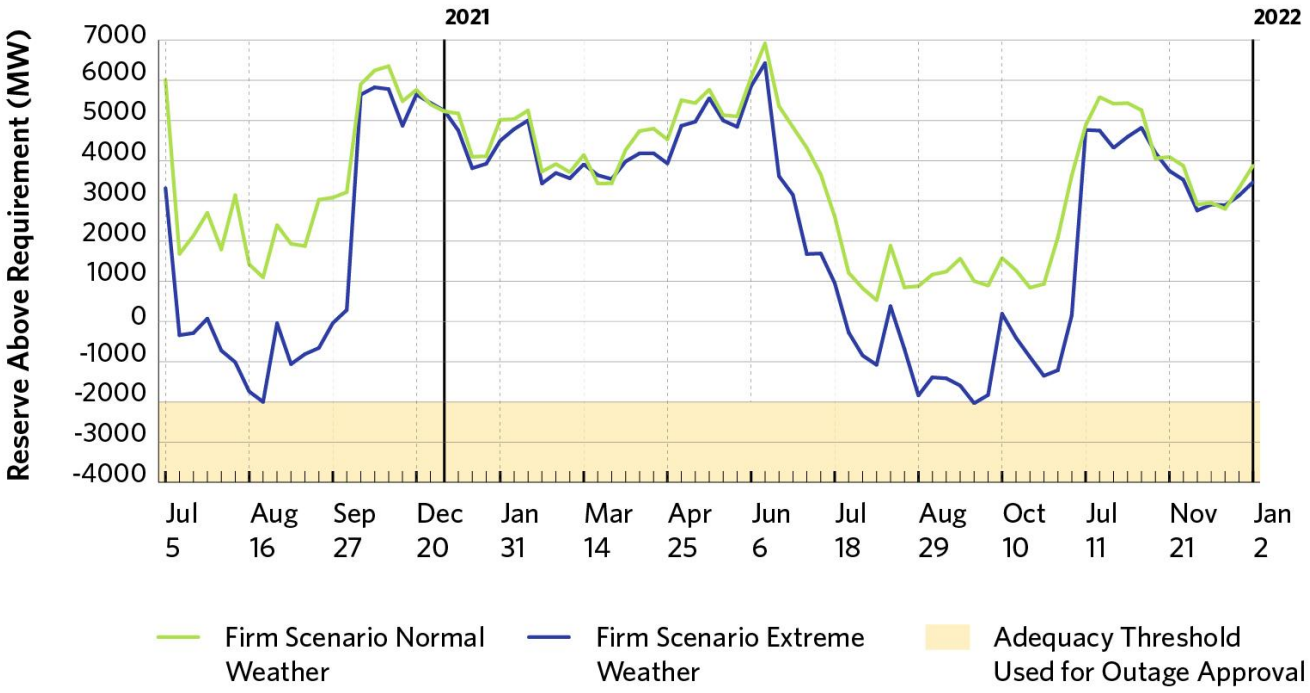


**Figure 4-3 | Comparison of Normal and Extreme Weather: Firm Scenario Reserve Above Requirement**

### 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 169 MW of generation capacity contracts will expire, and these resources will no longer be available to meet demand for electricity.

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.

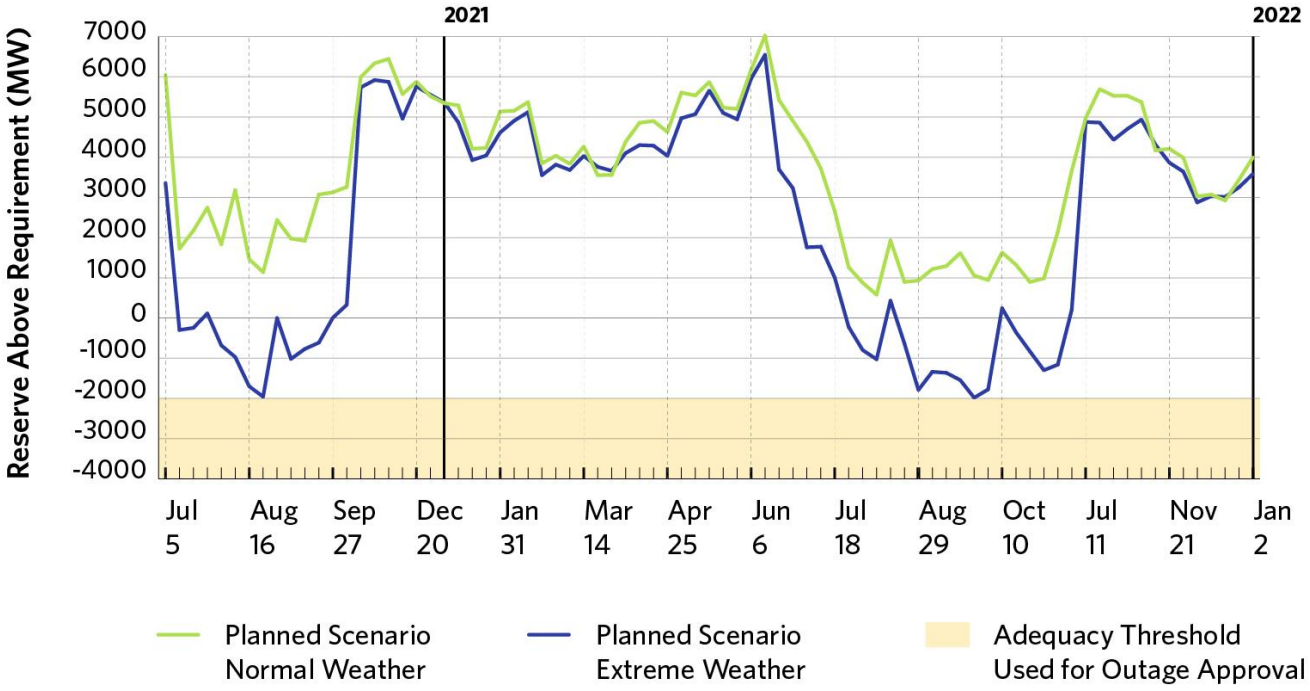


**Figure 4-4 | Comparison of Normal and Extreme Weather: Planned Scenario Reserve Above Requirement**

### 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 March 24, 2020. The difference is primarily the result of changes in planned outages and the expected in-service dates of new resources, as well as the removal of ICI impacts from summer 2020 (see chapter 3).

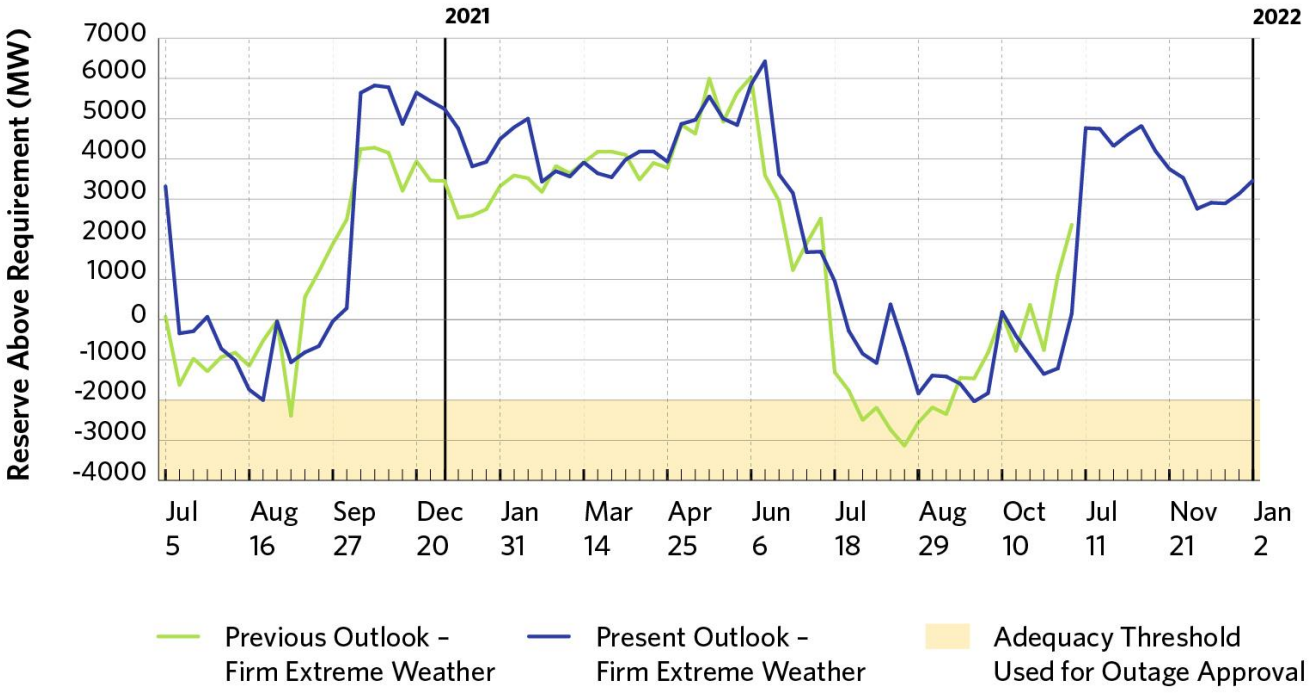


**Figure 4-5 | Comparison of Current and Previous Outlook: Firm Scenario Extreme Weather Reserve Above Requirement**

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 Q2 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 | 69 | 60.0 | 4,557 | 59.1 | 1.4 | 120.9 |
| East | 12.8 | 972 | 17.7 | 1,347 | 4.9 | 26.4 | 96.1 |
| Essa | 12.6 | 956 | 3.5 | 268 | -9.1 | 27.4 | 13.9 |
| Niagara | 6.1 | 460 | 20.7 | 1,567 | 14.6 | 15.3 | 53.0 |
| Northeast | 15.7 | 1,190 | 14.1 | 1,067 | -1.6 | 26.7 | 34.1 |
| Northwest | 6.3 | 475 | 6.9 | 522 | 0.6 | 10.7 | 20.6 |
| Ottawa | 20.0 | 1,521 | 0.2 | 17 | -19.8 | 42.3 | 1.2 |
| Southwest | 39.9 | 3,031 | 7.3 | 558 | -32.6 | 91.6 | 19.5 |
| Toronto | 71.3 | 5,413 | 61.9 | 4,698 | -9.4 | 164.3 | 185.4 |
| West | 21.2 | 1,612 | 14.5 | 1,099 | -6.7 | 49.2 | 74.5 |
| **Ontario** | **206.9** | **15,700** | **206.9** | **15,700** | **0.0** | **455.3** | **619.2** |

### 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.

The figures and tables in this section are based on a simulation of the province's power system, using the assumptions presented within the Outlook to confirm that Ontario will be energy adequate.

Figure 4-6 breaks down projected production by fuel type to meet Ontario's energy demand for the next 18 months, while Figure 4-7 shows the production by fuel type for each month. The province's energy exports and imports are not considered in this assessment. Table 4-6 summarizes these simulated production results by fuel type, for each year.

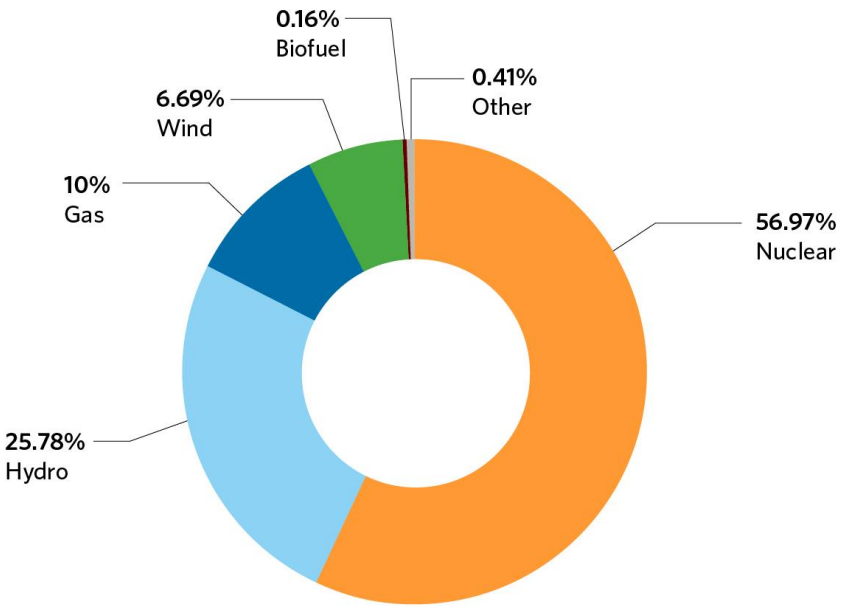


**Figure 4-6 | Forecast Energy Production by Fuel Type**

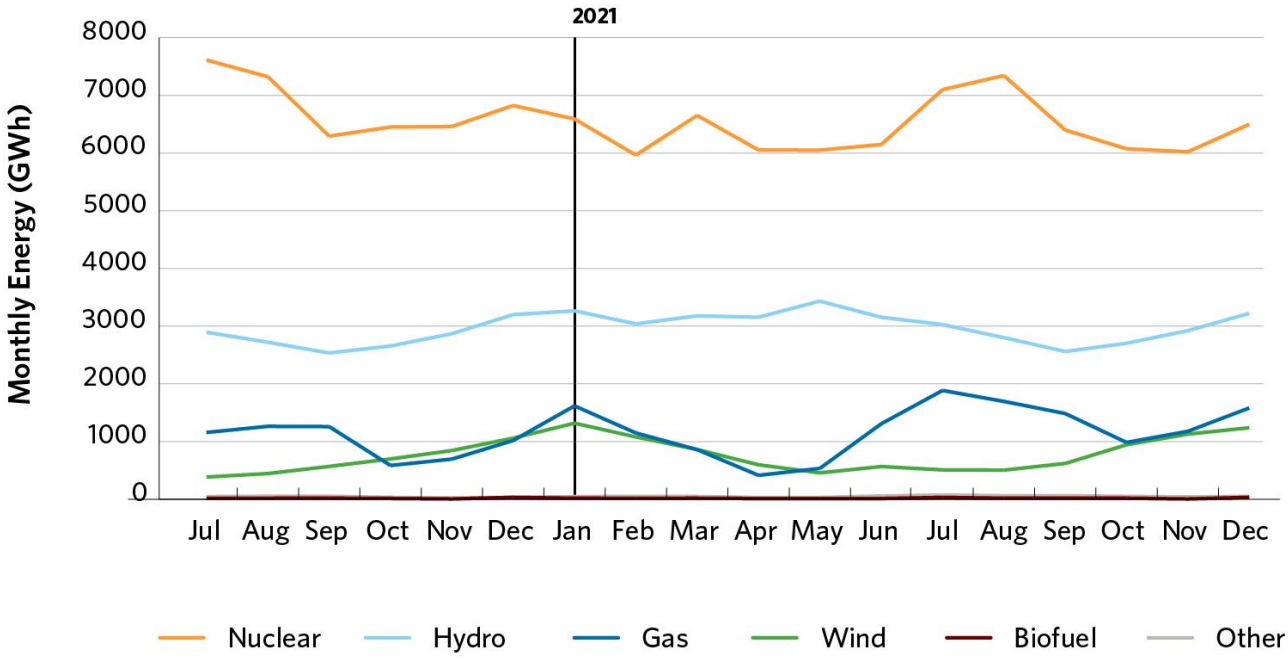


**Figure 4-7 | Forecast Monthly Energy Production by Fuel Type**

**Table 4-6 | Ontario Energy Production by Fuel Type for the Firm Scenario Normal Weather**

| Fuel Type (Grid-Connected) | 2020 (July – December) (GWh) | 2021 (GWh) | Total (GWh) |
|---|---|---|---|
| Nuclear | 40,961 | 76,886 | 117,847 |
| Hydro | 16,876 | 36,461 | 53,337 |
| Gas & Oil | 5,981 | 14,697 | 20,678 |
| Wind | 4,003 | 9,831 | 13,834 |
| Bio Fuel | 108 | 220 | 328 |
| Other (Solar & DR) | 239 | 601 | 840 |
| **Total** | **68,168** | **138,695** | **206,864** |

# 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. Note that the planned in-service dates in this table and throughout this document are as of March 2020. Some of these dates are expected to change as a result of the impact of the COVID-19 pandemic on project logistics. Any changes will be communicated through subsequent Reliability Outlooks.

## 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 reflects transmission outage plans submitted to the IESO as of April 27, 2020. Following the start of the state of emergency in Ontario due to the COVID-19 outbreak, the IESO in coordination with market participants, recalled all of the ongoing and planned transmission outages prior to July 2020 to prepare for potential workforce shortages resulting from social distancing and quarantine measures.

## 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 to 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. A series of non-contiguous planned outages will impact the flow out of Bruce from July 2020 to January 2021. Planned outages affect the following circuits: B501M, B502M, B560V, and B561M.

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 Q2 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. This has been exacerbated due to business closures following the pandemic-related quarantine measures. The IESO and Hydro One are currently managing this situation by removing from service certain 500 kV circuits mainly in eastern Ontario and occasionally in the Bruce area during those periods. Up to three 500 kV circuits were removed from service during instances of the lowest demand periods in Ontario. 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.

Aging circuit breakers in the Richview 230 kV switchyard are to be replaced by Q1 2021. Hydro One and the IESO will coordinate the outages required to reduce the impact on the Flow East Toward Toronto transfer capabilities.

### Northwest, Northeast, and Essa Zones

In the Kapuskasing area, system reinforcements are planned for Q4 2021. During the construction of these reinforcements, certain outages may be restricted.

A two-and-a-half-week breaker outage at Hanmer TS starting July 28, 2020 will reduce transfer capability south on the North-South Tie. A one-month outage of circuit X504E starting September 28, 2020 will reduce transfer capability of the North-South Tie.

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 two-week outage of M24L will impact the transfer capability west across the East-West Tie starting July 6, 2020. A two-week outage of M23L will impact the transfer capability east across the East-West Tie, starting November 9, 2020.

**Interconnections**

The failure of the phase angle regulator (PAR) connected to the Ontario-New York 230 kV interconnection circuit L33P in early 2018 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 three outages that will reduce import and export transfer capability between Ontario and Michigan. The first outage is a planned one-week outage starting July 26, 2020, which will impact interconnection circuit J5D. The second outage is a planned two-week outage starting September 21, 2020, which will impact equipment at Lambton TS. The third outage is a planned two-month outage starting January 18, 2021, which will impact interconnection circuit J5D.

# 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.

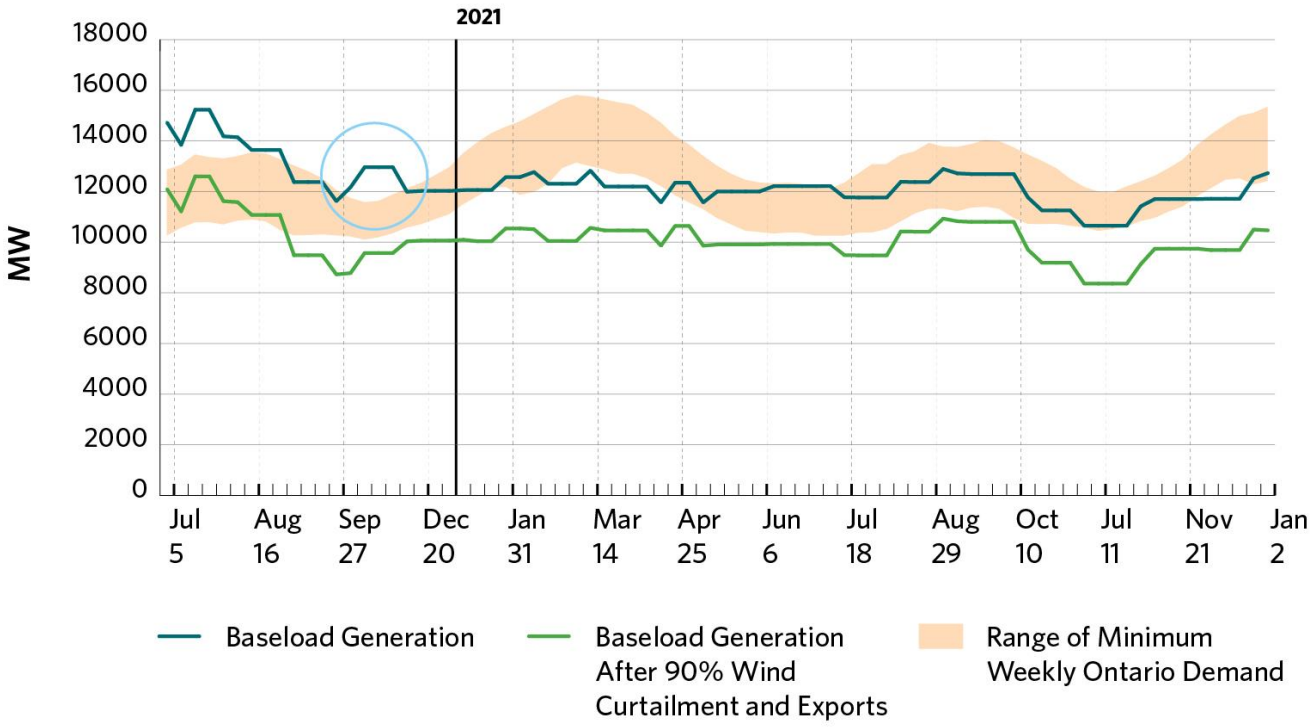


**Figure 6-1 | Minimum Ontario Demand and Baseload Generation**

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.

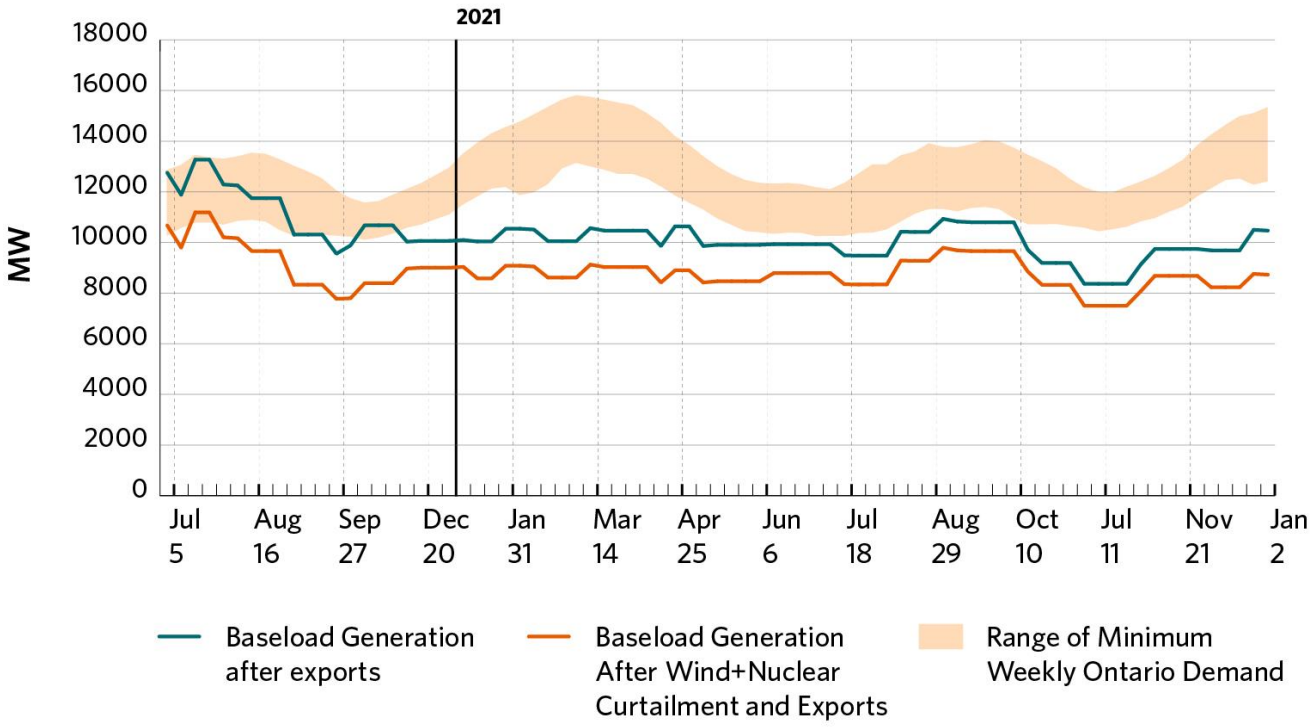


**Figure 6-2 | Minimum Ontario Demand and Baseload Generation**

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, 2020. These values are updated annually to coincide with the release of the Q2 Outlook.

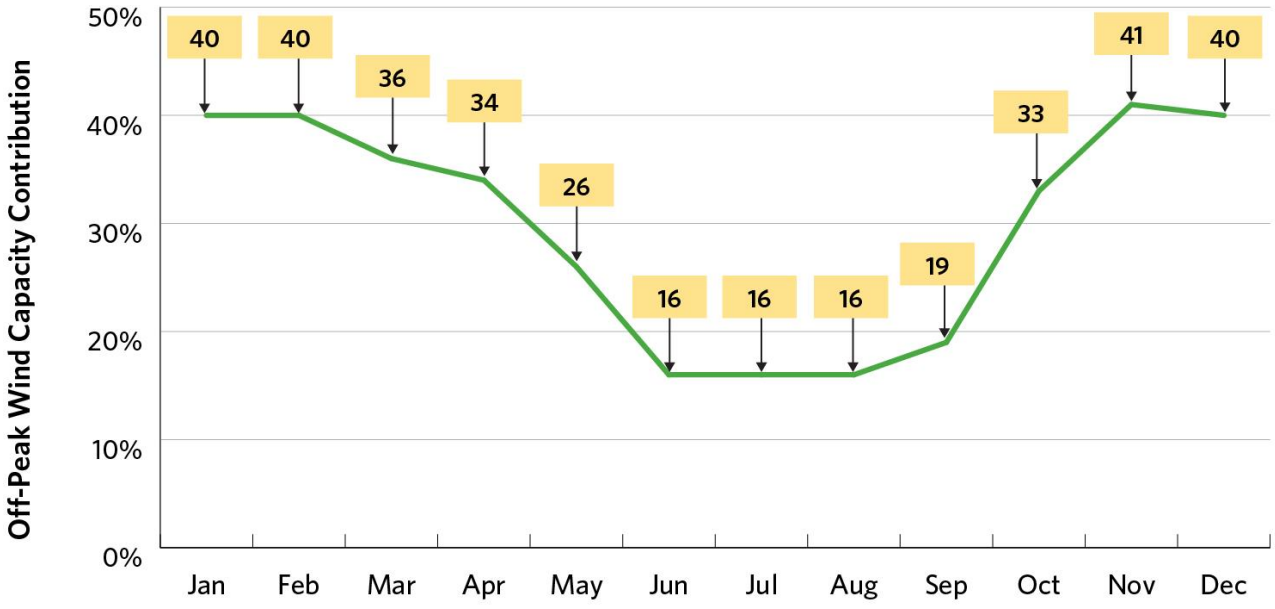


**Figure 6-3 | Monthly Off-Peak Wind Capacity Contribution Values**

# 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 Q2 Outlook Tables | http://www.ieso.ca/-/media/files/ieso/document-library/planning-forecasts/reliability-outlook/ReliabilityOutlookTables_2020Jun.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/ReliabilityOutlookMethodology2020Jun.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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