Reliability Outlook

An adequacy assessment of Ontario's electricity system

April 2024 to September 2025

ieso
Connecting Today.
Powering Tomorrow.

Executive Summary

Ontario's electricity system is prepared for the next 18 months and is expected to have adequate supply for the duration of the Outlook period. Electricity demand is projected to increase by 1.1 per cent in 2024, and accelerate in 2025 amid a slowing inflation rate and as electrification increases.

The system will be adequate in summer 2024 under normal weather conditions. The system is also expected to be adequate during extreme weather conditions with the availability of up to 2,000 MW of imports from neighbouring jurisdictions or other operating actions to ensure reliability.

Overall, Ontario is operating within a period where generation and transmission outages are more challenging to accommodate. The IESO has been actively co-ordinating and planning with market participants to maintain reliability.

A key factor affecting outage management – and by extension, availability of supply – is the amount of extended forced transmission outages. With more overlapping outage requests, including a significant number of major generation and transmission projects currently underway or expected to begin soon, as well as major transmission projects in development, operating the power system is becoming increasingly complex.

Prioritizing repairs of forced transmission outages is necessary to reduce the impact on the delivery of ongoing capital projects and to enable other necessary maintenance outages. Market participants are strongly encouraged to plan ahead and co-ordinate with the IESO before scheduling outages. They are also reminded that they should be prepared for the possibility that outages can be rejected or rescheduled in order for the IESO to maintain power system reliability.

As the IESO looks to execute a memorandum of understanding with Hydro-Québec to annually swap 600 MW of seasonal capacity starting in winter 2024/2025, we should begin seeing this additional available capacity firm up in future outlooks. Over the course of the first half of 2024, the IESO will pay careful attention to forecasted reserve levels to determine capacity needs in summer 2025. The IESO also retains the option to call in 500 MW of summer capacity under the 2015 Capacity Sharing Agreement between Ontario and Quebec.

System reliability will benefit from up to 1,867 MW and 1,310 MW of resources secured through the 2023 Capacity Auction, for the 2024 summer and 2024-25 winter obligation periods, respectively – the largest amount of capacity cleared to date. Supply will also benefit from resources procured via the Same Technology Upgrades Solicitation, which will start coming online in May 2025, and the potential connection of new storage to the grid.

Refurbishment of Ontario's nuclear resources, in which up to four units are on outage at any one time, are ongoing. Outage schedules remain on track, and the IESO is confident it will

maintain system reliability as refurbishment work continues at Bruce and Darlington nuclear generating stations.

Table of Contents

List of Figures

List of Tables

1. Introduction

This Outlook covers the 18 months from April 2024 to September 2025, and supersedes the Outlook released on December 21, 2023.

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 Reliability Outlook webpage.

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 2023, and has been updated to reflect the most recent economic projections. Actual weather and demand data for January and February 2024 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 March 4, 2024. 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, 2023.

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 February 23, 2024.

3. Demand Forecast

Weather adjusted electricity demand increased by 0.9% to 138.0 TWh in 2023. This follows higher growth in each of the previous two years: 1.4% in 2021 (133.7 TWh) and 2.2% increase in 2022 (136.7 TWh). The interest rate increases of 2022 and 2023 have slowed economic growth, and in turn, the growth in electricity demand. For 2024, demand is projected to grow 1.1% to 139.5 TWh. The IESO continues to monitor the evolving economic situation to assess the likely impacts to electricity demand over the 18-month horizon.

The IESO is responsible for forecasting electricity demand on the IESO-controlled grid. This demand forecast covers the period from April 2024 to September 2025 and supersedes the previous forecast released in December 2023. Tables of supporting information are contained in the 2024 Q1 Outlook Tables.

Electricity demand is very closely tied to economic activity. The Bank of Canada raised interest rates ten times over the 2022-23 timeframe, raising the overnight rate from 0.5% to 5.0%, in an effort to reduce inflationary pressures. Economic data shows that the economy is slowing and inflation is easing. Those trends should continue into 2024, muting economic and electricity demand growth over the front half of the year. As inflation falls into the Bank of Canada's target range, rate cuts combined with pent-up demand and population growth will accelerate economic and electricity growth over the latter half of the Outlook period. With the aforementioned economic trajectory, energy demand is projected to increase by 1.1% in 2024 and accelerate into 2025, due to a growing economy combined with the addition of large industrial loads and increased electrification from fuel switching. The growth in 2024 is boosted by the additional leap day.

The demand forecast faces significant uncertainties. Interest rate impacts can lag significantly and carries a risk to economic growth. Geopolitical events contribute to uncertainty and instability should they spread to other countries.

Table 3-1 | Forecast Energy Demand Summary

Year	Normal Weather Energy (TWh)	% Growth in Energy
2024	139.5	1.06%
2025	141.5	1.44%

Table 3-2 | Forecast Seasonal Peaks

Season	Normal Weather Peak (MW)	Extreme Weather Peak (MW)
Summer 2024	22,753	24,669
Winter 2024-25	21,718	22,915
Summer 2025	22,872	24,854

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)
07-Apr-24	17,840	18,792	567	2,524
14-Apr-24	17,731	18,254	471	2,507
21-Apr-24	17,689	18,324	496	2,474
28-Apr-24	17,396	17,799	531	2,410
05-May-24	17,364	19,062	721	2,405
12-May-24	17,274	19,568	849	2,385
19-May-24	17,475	21,027	845	2,410
26-May-24	17,543	20,993	1,175	2,349
02-Jun-24	19,149	21,646	1,330	2,435
09-Jun-24	19,554	22,045	1,292	2,470
16-Jun-24	21,217	22,282	1,055	2,540
23-Jun-24	21,880	23,110	835	2,599
30-Jun-24	22,502	24,017	754	2,663
07-Jul-24	22,449	24,194	1,016	2,665
14-Jul-24	22,685	24,380	814	2,749

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
21-Jul-24	22,753	24,550	838	2,806
28-Jul-24	22,699	24,669	1,035	2,824
04-Aug-24	22,625	24,606	841	2,853
11-Aug-24	22,582	24,532	958	2,796
18-Aug-24	22,569	24,657	985	2,817
25-Aug-24	22,539	24,508	1,362	2,788
01-Sep-24	22,462	24,309	1,413	2,765
08-Sep-24	21,915	23,662	1,370	2,649
15-Sep-24	21,957	22,987	680	2,624
22-Sep-24	20,481	21,892	781	2,539
29-Sep-24	18,884	21,119	420	2,505
06-Oct-24	17,978	19,574	554	2,479
13-Oct-24	17,690	18,676	786	2,474
20-Oct-24	17,611	18,066	507	2,441
27-Oct-24	17,834	19,099	392	2,519
03-Nov-24	17,986	19,357	318	2,551
10-Nov-24	18,582	19,922	416	2,590
17-Nov-24	19,240	19,615	601	2,655
24-Nov-24	19,922	20,210	342	2,736
01-Dec-24	20,150	20,847	607	2,788
08-Dec-24	20,630	21,379	409	2,847
15-Dec-24	20,818	21,916	555	2,877
22-Dec-24	20,894	21,989	690	2,915

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
29-Dec-24	18,767	20,295	362	2,719
05-Jan-25	20,148	21,075	528	2,837
12-Jan-25	21,434	22,461	570	2,957
19-Jan-25	21,456	22,499	547	2,975
26-Jan-25	21,718	22,915	483	2,994
02-Feb-25	21,688	22,675	404	2,985
09-Feb-25	21,287	22,090	734	2,932
16-Feb-25	20,820	21,977	635	2,932
23-Feb-25	20,641	22,054	581	2,885
02-Mar-25	20,540	22,113	501	2,885
09-Mar-25	19,963	21,412	531	2,809
16-Mar-25	19,437	21,089	649	2,764
23-Mar-25	18,881	20,370	611	2,698
30-Mar-25	18,407	19,548	569	2,632
06-Apr-25	18,139	19,015	567	2,583
13-Apr-25	18,028	18,480	471	2,554
20-Apr-25	17,984	18,545	496	2,486
27-Apr-25	17,695	18,016	531	2,449
04-May-25	17,674	19,308	721	2,451
11-May-25	17,523	19,725	849	2,429
18-May-25	17,814	21,191	845	2,455
25-May-25	17,816	21,162	1,175	2,394
01-Jun-25	19,430	21,872	1,330	2,472

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
08-Jun-25	19,813	22,197	1,292	2,513
15-Jun-25	21,493	22,442	1,055	2,582
22-Jun-25	22,132	23,245	835	2,641
29-Jun-25	22,622	24,189	754	2,705
06-Jul-25	22,619	24,333	1,016	2,683
13-Jul-25	22,821	24,570	814	2,791
20-Jul-25	22,872	24,739	838	2,849
27-Jul-25	22,825	24,854	1,035	2,866
03-Aug-25	22,734	24,773	841	2,894
10-Aug-25	22,695	24,695	958	2,837
17-Aug-25	22,674	24,816	985	2,858
24-Aug-25	22,637	24,646	1,362	2,827
31-Aug-25	22,722	24,470	1,413	2,809
07-Sep-25	22,012	23,844	1,370	2,689
14-Sep-25	22,066	23,165	680	2,665
21-Sep-25	20,744	22,091	781	2,580
28-Sep-25	19,148	21,286	420	2,546
05-Oct-25	18,213	20,105	554	2,520

4. Resource Adequacy

Ontario's power system continues to operate in a period during which generation and transmission outages will be difficult to accommodate. The IESO expects these conditions to persist for the foreseeable future. Market participants are strongly encouraged to plan ahead and coordinate with the IESO to prepare the system and ensure planned outages can be appropriately scheduled.

The IESO expects to have sufficient reserves for the entirety of this outlook period under both normal and extreme weather conditions. However, Ontario may have to rely on up to 2,000 MW of supply from other jurisdictions and/or additional operating actions in order to ensure reliability under extreme weather conditions – particularly in summer 2024 and 2025, and primarily as a result of coincident generator outages. The IESO will work closely with market participants to schedule outages during this period.

This section assesses the adequacy of resources to meet the forecast demand. Resource adequacy is one of the reliability considerations used for approving generation and transmission 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.

Ontario's existing installed generation capacity is summarized in Table 4-1. 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 2024 Summer Peak Normal Weather (MW)	Forecast Capability at 2024 Summer Peak Extreme Weather (MW)	Number of Stations	Change in Number of Stations	Change in Installed Capacity
Nuclear	13,144	10,444	10,444	5	0	0
Hydroelectric	8,922	5,163	4,770	76	0	0
Gas/Oil	10,470	9,660	9,262	33	0	0
Wind	4,883	720	720	41	0	0
Biofuel	296	246	246	7	0	0
Solar	478	66	66	10	0	0
Demand Measures	-	996	996	-	-	-
Firm Imports (+) / Exports (-) (MW)	-	600	0	-	-	-
Total	38,193	27,894	26,503	172	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 (CAA) process, 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 4, 2024. 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 that only resources that have reached commercial operation status and completed commissioning at the time this assessment was completed are available.

Planned shutdowns or permanent[1] retirements of generators that have a high likelihood of occurring are considered for both scenarios.

Table 4-2 | Committed Generation Resources Status

Project Name	Zone	Fuel Type	Estimated Effective Date	Project Status	Firm (MW)	Planned (MW)
Romney Wind Energy Center	West	Wind		Commercial Operation	0	60
Oneida Storage	Southwest	Storage	2025-Q2	Under Development	0	235
Total					0	295

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] Given the evolving nature of resource acquisitions and commitments in Ontario, Table 4-2 will be listing new resources as they commission and existing resources that are expected to permanently retire or mothball at the end of their current commitments.

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 2023 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)	6,167	6,090	5,910	5,927	5,958	5,769	5,604	5,306	5,087	5,453	5,708	6,162
Historical Hydroelectric Median Contribution without Outages (MW)	6,670	6,673	6,434	6,444	6,404	6,274	6,142	5,894	5,945	6,266	6,488	6,679

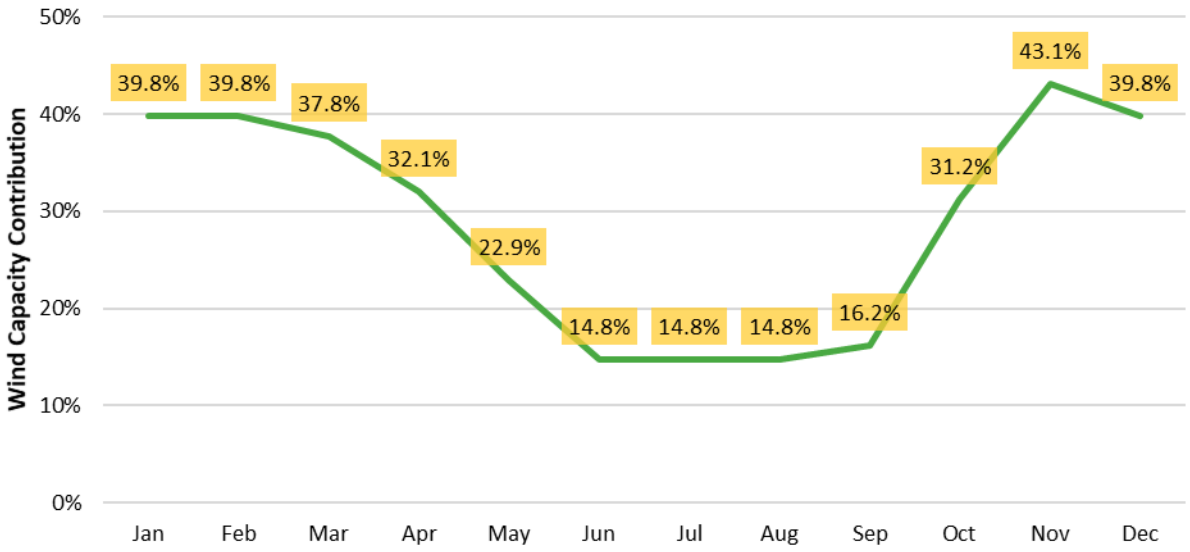
Thermal Generators

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 hour 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.

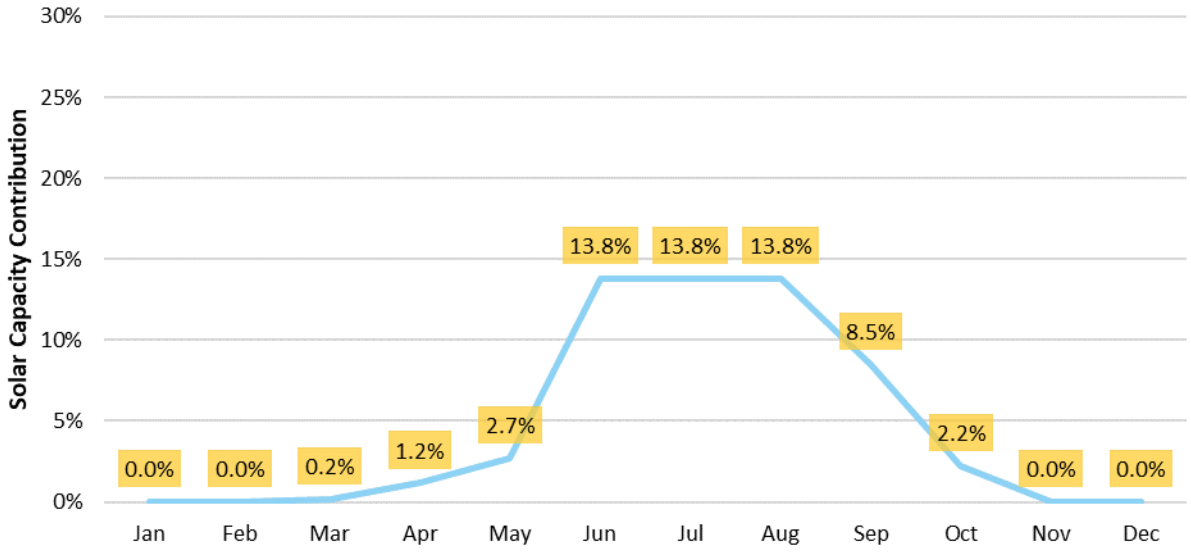
Figure 4-1 | Monthly Wind Capacity Contribution Values



Solar

For solar generation, monthly solar capacity contribution (SCC) values from the weekday peak hour are used. 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.

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 Exports

The IESO allows Ontario resources to compete in the capacity auctions held by certain neighbouring jurisdictions, but only if Ontario has adequate supply. New York Independent System Operator (NYISO)[2] auction results for capacity-backed exports for delivery between May to October 2024 will be known in April 2024.

[2] http://icap.nyiso.com/ucap/public/rgt_availability_display.do

Capacity Sharing with Hydro-Québec

A 2015 Capacity Sharing Agreement with Hydro-Québec saw Ontario provide 500 MW of capacity to Quebec in the winter of 2015/16. Ontario currently has a commitment from Quebec to return 500 MW of firm capacity for four months during a summer of the IESO's choosing.

In August 2023, the IESO and Hydro-Québec entered into a memorandum of understanding (MOU)[3] for the swap of 600 MW of capacity over a period of up to 10 years, expected to start in winter 2024/2025. Under this potential trade agreement, the IESO and Hydro-Québec would carry out an annual capacity swap of 600 MW. The IESO would provide 600 MW to Hydro-Québec in the winter and Hydro-Québec would provide 600 MW to the IESO in the summer. Ontario would have the opportunity to bank any amount of the 600 MW of summer capacity provided each year for use in any future summer period during the agreement up to the 1,250 MW capacity limit of the main intertie with Quebec, allowing Ontario to save capacity until it is required. More information can be found in the 2023 Capacity Sharing Agreement Backgrounder. Please note that this agreement is already considered when determining the 2,000 MW adequacy threshold.

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 likelihood 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 over the 18-month Outlook, under both scenarios in normal weather conditions, and at the time of the summer and winter peak demands.

[3] https://news.ontario.ca/en/release/1003444/the-governments-of-ontario-and-quebec-support-new-electricity-trade-agreement

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

Notes	Description	Summer Peak 2024 Firm Scenario	Summer Peak 2024 Planned Scenario	Winter Peak 2025 Firm Scenario	Winter Peak 2025 Planned Scenario	Summer Peak 2025 Firm Scenario	Summer Peak 2025 Planned Scenario
1	Installed Resources (MW)	38,193	38,253	38,193	38,253	38,193	38,488
2	Total Reductions in Resources (MW)	11,337	11,388	12,019	11,834	12,651	12,561
3	Demand Measures (MW)	996	996	915	915	1,791	1,791
4	Firm Imports (+) / Exports (-) (MW)	600	600	150	-450	0	0
5	Available Resources (MW)	28,452	28,461	27,239	26,884	27,333	27,718
6	Bottling (MW)	42	82	383	407	0	34
7	Available Resources without Bottling (MW)	28,494	28,543	27,622	27,291	27,333	27,752

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 reduction expected to be available 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 February 12, 2024. The generation planned outages occurring during this Outlook period have been assessed as of March 4, 2024.

4.2.1 Firm Scenario with Normal and Extreme Weather

The firm scenario incorporates all capacity that had achieved commercial operation status as of March 4, 2024.

Figure 4-3 shows Reserve Above Requirement (RAR) levels, which represents the difference between available resources and required resources. The required resources equals forecast demand plus the required reserve.

Capacity secured in the December 2023 Capacity Auction has been included in this assessment. This includes 1,867 megawatts (MW) of supply for summer 2024 and 1,310 MW for winter 2024-2025[4]. The target capacity of 1,600 MW for the next capacity auction, as announced in the IESO's Annual Planning Outlook, has been included and modelled as demand measures in the firm resource scenario for summer 2025.

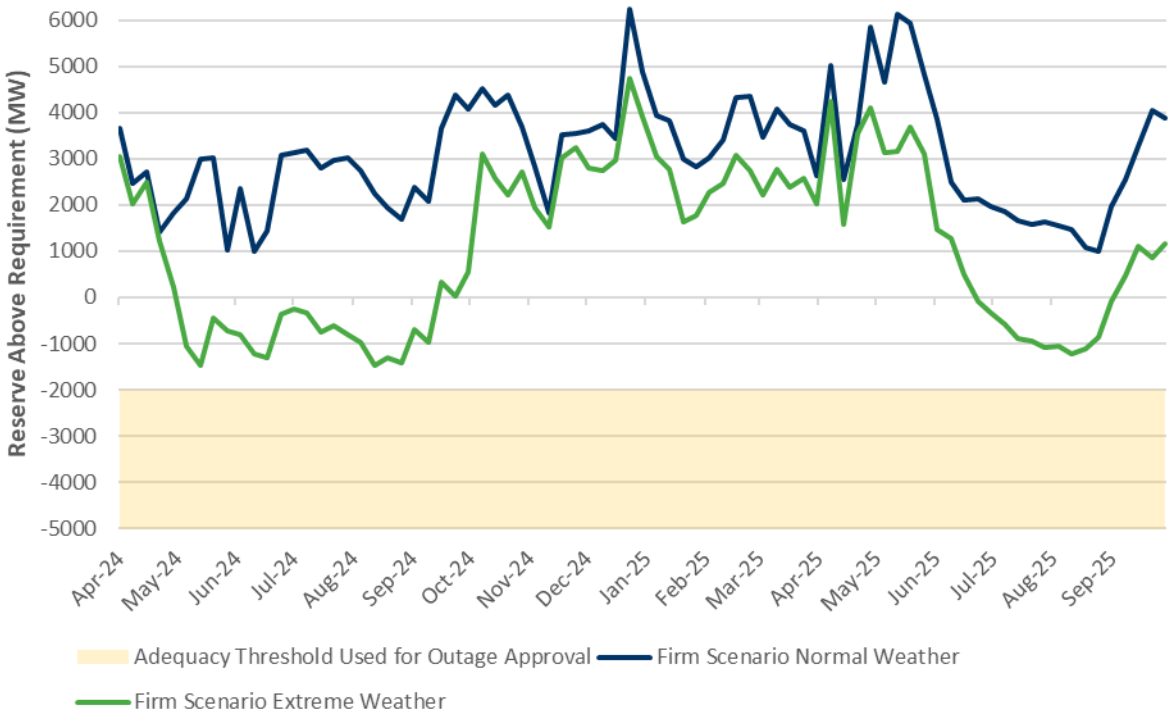
The IESO expects to have sufficient reserves for the summers of 2024 and 2025, and winter 2024/25. In the firm scenario under extreme weather conditions, the reserve drops below 0 MW for 19 weeks in the summer of 2024, and for 11 weeks in the summer of 2025, but does not cross the adequacy threshold at any time.

The IESO has been carefully managing outages with participants to minimize impacts to the RAR adequacy threshold and has successfully navigated the summer of 2023. Moving forward, the IESO will continue to work closely with participants that have planned outages to ensure Ontario maintains adequate reserves. However, Ontario may have to rely on up to 2,000 MW of supply from other jurisdictions and/or additional operating actions in order to ensure reliability under extreme weather conditions.

Under periods of tighter supply conditions, planned generator maintenance outages are difficult to schedule. Generators are advised not to schedule outages during periods when reserves are forecast to be low, and are strongly encouraged to plan ahead and coordinate the timing of outages with IESO staff.

[4] Capacity auction results can be found in the post-auction report on the IESO's webpage.

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

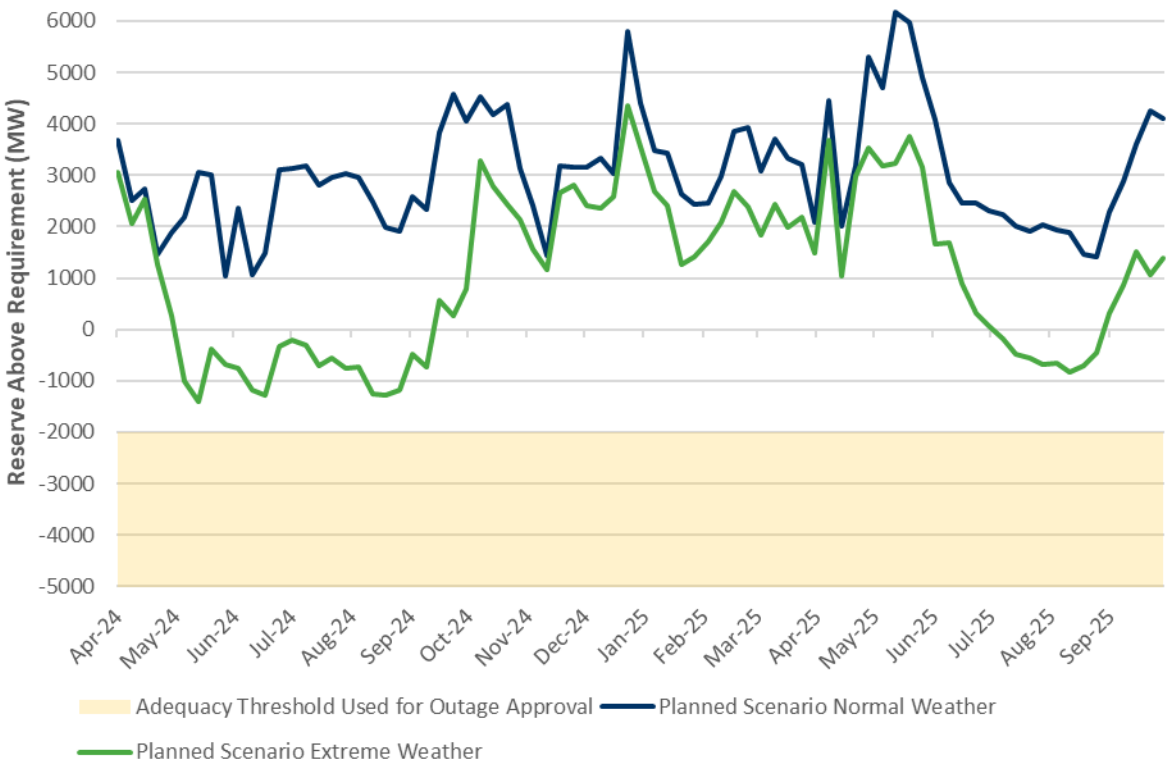


4.2.2 Planned Scenario with Normal and Extreme Weather

The Planned scenario incorporates all existing capacity, as well as all capacity expected to come into service. Approximately 295 MW of new generation capacity is expected to connect to Ontario's grid over this Outlook period.

Figure 4-4 shows RAR levels under the Planned scenario. Reserves do not fall below the adequacy threshold requirements in this outlook period under normal or extreme weather conditions.

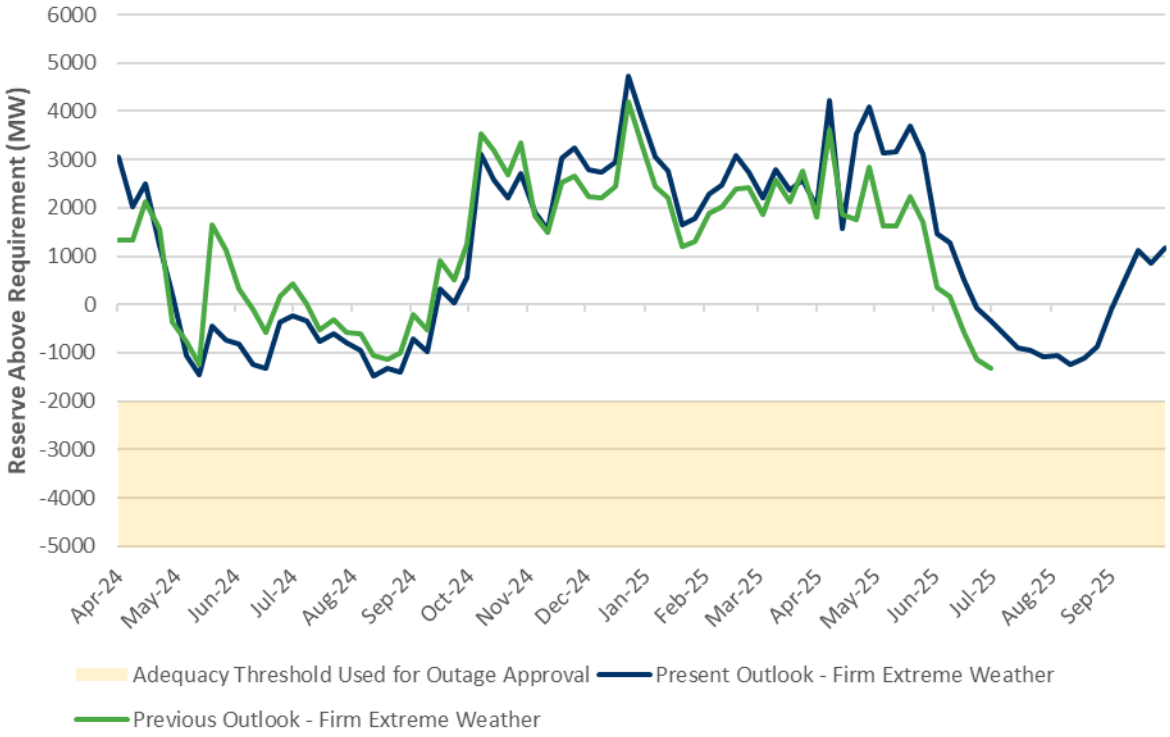
Figure 4-4 | Comparison of Normal and Extreme Weather: Planned Scenario Reserve Above Requirement



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

Figure 4-5 compares forecast RAR values in the current Outlook with those in the previous Outlook, which was published on December 21, 2023. The difference is primarily the result of new scheduled outages and actual 2023 capacity auction results exceeding targets.

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 outlined in Tables 4-1 and 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 Reliability 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

Zone	18-Month Energy Demand TWh	18-Month Energy Demand Average MW	18-Month Energy Production TWh	18-Month Energy Production Average MW	Net Inter-Zonal Energy Transfer TWh	Zonal Energy Demand on Peak Day of 18-Month Period GWh	Available Energy on Peak Day of 18-Month Period GWh
Bruce	0.9	71	62.2	4,729	61.3	1.3	118.4
East	13.1	1,000	18.2	1,380	5.1	27.7	105.4
Essa	15.1	1,146	3.6	271	-11.5	33.5	17.0
Niagara	6.4	483	21.1	1,604	14.7	15.0	48.7
Northeast	15.1	1,145	15.1	1,151	0.0	26.4	37.8
Northwest	5.3	403	6.5	497	1.2	9.4	15.4
Ottawa	13.2	1,004	0.7	50	-12.5	30.4	1.6
Southwest	42.7	3,244	8.0	606	-34.7	96.9	22.0

Zone	18-Month Energy Demand TWh	18-Month Energy Demand Average MW	18-Month Energy Production TWh	18-Month Energy Production Average MW	Net Inter-Zonal Energy Transfer TWh	Zonal Energy Demand on Peak Day of 18-Month Period GWh	Available Energy on Peak Day of 18-Month Period GWh
Toronto	74.5	5,665	57.3	4,358	-17.2	171.1	145.3
West	22.6	1,717	16.2	1,232	-6.4	52.8	80.4
Ontario	**208.8**	**15,878**	**208.8**	**15,879**	**0.0**	**464.5**	**591.9**

4.3.3 Findings and Conclusions

The EAA indicates 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 assess whether 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 expected 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

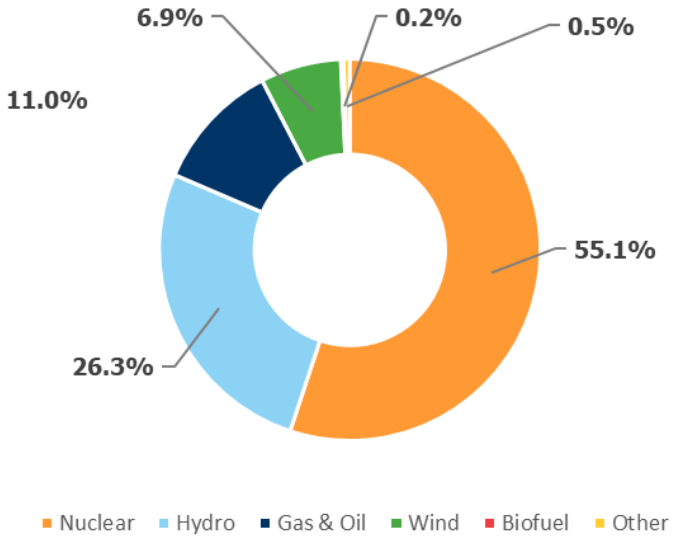


Figure 4-7 | Forecast Monthly Energy Production by Fuel Type

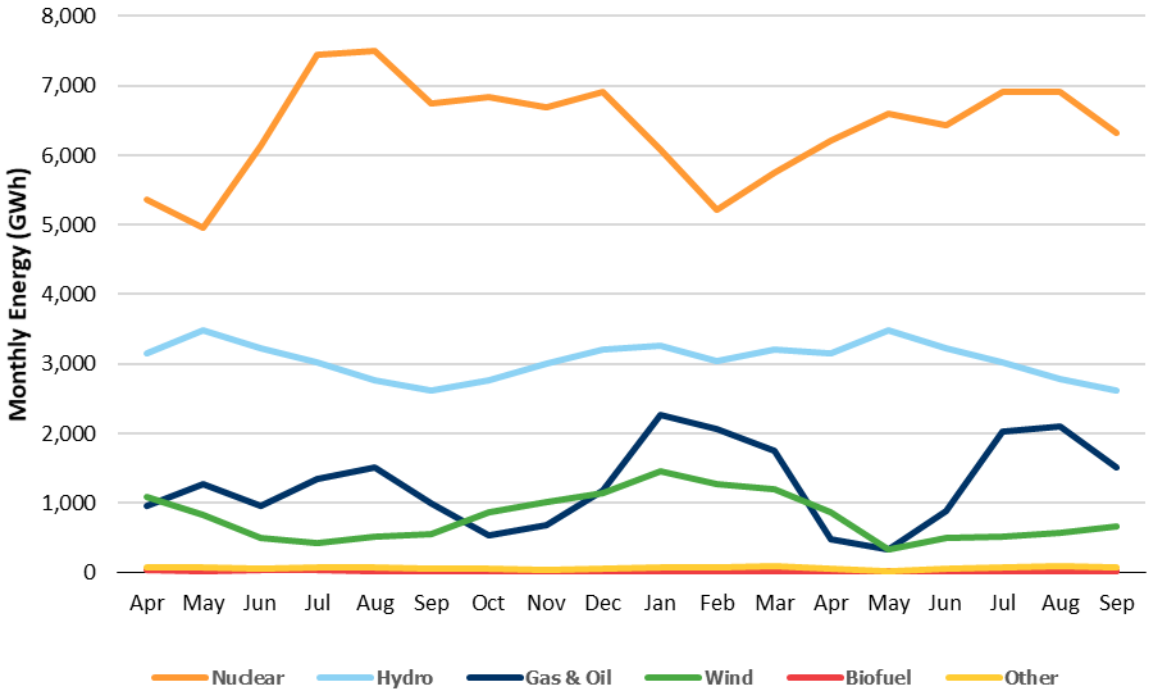


Table 4-6 | Energy Production by Fuel Type for the Firm Scenario Normal Weather

Fuel Type (Grid-Connected)	2024 (Apr 1 – Dec 31) (GWh)	2025 (Jan 1 – Sep 30) (GWh)	Total (GWh)
Nuclear	58,615	56,418	115,033
Hydro	27,230	27,797	55,027
Gas & Oil	9,441	13,436	22,878
Wind	6,941	7,379	14,320
Biofuel	252	222	474
Other (Solar & DR)	525	578	1,103
Total	**103,006**	**105,830**	**208,835**

5. Transmission Reliability Assessment

Ontario's transmission system is expected to continue to reliably supply province-wide demand for the next 18 months, even while experiencing normal contingencies defined by planning criteria. However, some combinations of transmission and/or generation outages could create operating challenges. For this reason, it is – and will continue to be – increasingly difficult to schedule certain outages to avoid reliability concerns. The volume of outage requests and the limited time periods available to complete the work will make outage scheduling a challenge for the foreseeable future.

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.

5.1 Transmission Projects

This section considers the information transmitters have provided with respect to transmission projects that are planned for completion within the next 18 months. The list of transmission projects can be found in Appendix B1. Note that the planned in-service dates in this table and throughout this document are as of January 2024. 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 February 23, 2024.

5.3 Transmission Considerations

The purpose of this section of the report is to highlight projects and outages that may affect reliability and/or the scheduling of other outages, and to consolidate these considerations by zone. For more information about the IESO's transmission zones and interfaces, please see the Transfer Capability Assessment Methodology.

Bruce, Southwest, and West Zones

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. The new switching station ("Lakeshore TS") at the Leamington Junction has been installed and all four of the existing circuits have been cut over. The first South Middle Rd load station is connected by radial circuits to Lakeshore TS and new loads have began connecting. Work is currently on-going for the second load station. The new Lakeshore RAS has been installed, and resulting operational measures available will be restrictive over the course of this period. During this time, system resiliency will be reduced, and per market rule exemptions in place, certain customers in the area may experience a lower level of reliability.

Multiple new transmission lines are under development in the region that will increase available supply starting mid-decade. Specifically, two new 230-kV circuits from Chatham SS to Lakeshore SS are expected to be in service in 2025 to support continued load growth.

The Bruce B 500 kV switchyard is being rebuilt and expected to be in-service by 2025 Q2. The existing circuits are being cut-over to the new switchyard, among other outages that are required.

The following outages will impact the flow out of the Bruce zone:

- A planned two-week outage starting May 19, 2024, on circuit B501M
- A planned three-week outage starting April 5, 2024, on circuit B502M, and another planned two-week outage starting December 1, 2024
- A planned five-week outage starting August 26, 2024, on circuit B560V
- A planned three-week outage starting June 11, 2024, on circuit B561M

Toronto, East, and Ottawa Zones

To address high voltages in eastern Ontario and the Greater Toronto Area, two 500 kV line connected shunt reactors have now been installed and are in-service at Lennox TS. There may continue to be a need to remove from service certain 500 kV circuits for voltage control during specific prevailing conditions.

There are upcoming nuclear refurbishments of multiple units at Darlington with overlapping timelines. As a result, it will be increasingly challenging for market participants to take outages impacting the Flow East Towards Toronto (FETT) interface. Future planned outages will necessitate enhanced coordination between transmitters and generators. Planned outages for certain windows may need to be rescheduled or rejected to ensure reliability. Of note, the FETT Capacity Upgrade (i.e., Richview-Trafalgar Reinforcement) project to address future needs is underway; the project is expected to be in-service by Q1 2026.

The two 230 kV circuits between Merivale TS and Hawthorne TS, a length of 12 km which supplies load in western Ottawa and delivers eastern Ontario resources, and imports from Quebec to other Ontario load centres, has been upgraded and is now in-service.

The following outages will impact the flow into Ottawa:

- A planned five-week outage starting September 8, 2024, on circuit T31H
- A planned three-week outage starting October 7, 2024, on circuit T32H

Northwest, Northeast, and Essa Zones

The East-West Tie Expansion project consists of a new 230 kV transmission line roughly paralleling the existing East-West Tie Line between Wawa and Thunder Bay. The new line will increase the electricity transfer capability into Northwest Ontario and will improve the flexibility and efficiency of the Northwest electricity system. As part of this project, upgrades were planned for the Lakehead, Marathon and Wawa transformer stations to accommodate the new line. The project was placed in-service at the end of Q1 2022. However, the full benefit of the project will not be realized right away due to ongoing and upcoming outages as a result of work in the Northwest.

The following outages, all on circuit W21M, will reduce the transfer capability of the East-West tie:

- A seven-week outage starting March 4, 2024
- A seventeen-week outage from June 18, 2024

In the Kirkland Lake area, a new RAS was placed in service in December 2023, and will enable load rejection, eliminating the need for pre-contingency load curtailment. In order to improve transmission system capacity, the Ansonville to Kirkland Lake A8K/A9K transmission circuits were refurbished and came in-service Q2 2023. Additional transmission refurbishments on Kirkland Lake to Matachewan are expected to be in-service by Q4 2024.

In the Sault Ste. Marie area, there will be an increase in load because of Algoma Steel converting their coke-fired furnaces to electric-arc furnaces over the next couple of years. The fluctuating nature of electric-arc furnace operation in an electrical area with limited transmission will require special attention to manage voltage and power fluctuations prior to the completion of the system reinforcements recommended in the Northeast Bulk System plan.

The "Barrie Area Transmission Upgrade" project is now completed. The project involved converting the existing Barrie TS and its supply lines from Essa TS (circuits E3B and E4B) from 115 kV to 230 kV, and will enable additional load to be supplied from Barrie TS. The existing 230/115 kV auto-transformers at Essa TS will be retired.

The following outages will reduce the transfer capability of the North-South tie:

- A three-week outage on circuit X504E starting May 21, 2024
- A four-week outage on circuit X503E starting October 1, 2024

6. Operability

Ontario's power system is operating within a period of tighter supply conditions requiring careful consideration of outage management. The IESO will continue to assess other aspects of operability and report on them in future Outlooks where appropriate. This section highlights existing or emerging operability issues that could impact the reliability of Ontario's power system.

Operability refers to the IESO's ability to manage a variety of conditions on the power system as they occur in real-time. The IESO works to ensure that the power system is reliable under changing system conditions, variability of supply and fluctuations in load, while respecting thermal, voltage and transient stability limits on the system. Operability is assessed in advance to ensure that the power system is adequately prepared for expected real-time conditions, while also having the ability to absorb and adapt to unexpected changes.

6.1 Outage Management Considerations

Ontario continues to experience a period during which generation and transmission outages will be difficult to accommodate, and the IESO is working with market participants to manage this. In addition to meeting global Ontario adequacy needs, transmission adequacy and security must be safeguarded.

There are a significant number of major generation and transmission projects either currently underway or expected to begin in the near future. As the timing of many of these projects overlap with each other and can require multiple equipment outages, reliability assessments are increasingly complex. An example mentioned earlier describes major projects that are related to the Flow East Towards Toronto (FETT) interface.

A key factor impacting outage management is the amount of extended forced transmission outages. With more overlapping and urgent outage requests, as well as major transmission projects in different development stages targeting in-service dates, operating the power system is becoming increasingly complex. Prioritizing the timely repair of a forced outage is necessary to reduce the impact on the delivery of other ongoing capital projects, and to enable other necessary maintenance outages to proceed.

With consideration of equipment failure, tighter supply conditions and other factors such as supply chain delays, some outages may need to be rejected and rescheduled. Transmitters and generators are strongly encouraged to plan ahead, coordinate with one another, submit outage requests early, and coordinate with the IESO; scheduling outages at desired times may still be difficult due to the significant number of major projects that are planned for the same time.

Furthermore, outages are not guaranteed as unanticipated equipment failures may change reliability assessments.

Another important aspect of grid equipment outages is recall time. Recall times indicate how long it takes for equipment on outage to return to service. Minimizing recall times increases the likelihood of outages being approved. If many outages are non-recallable, it can be difficult to accommodate additional outages as there needs to be a reliable plan to reposture the system after an equipment failure occurs on the grid. If multiple equipment failures occur, there may be instances where outage management alone will not address the concern. Under such circumstances the IESO may need to rely on additional non-firm imports or emergency operating procedures in order to ensure reliability. More information on actions the IESO can take to ensure reliability can be found in Market Manual 7.1: IESO-Controlled Grid Operating Procedures.

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	Location in this Report
Reliability Outlook Webpage	Introduction
Security and Adequacy Assessments	Introduction
2024 Q1 Outlook Tables	Throughout
Connection Assessments and Approval Process	Assessment Assumptions
Methodology to Perform the Reliability Outlook	Throughout
Capacity Auction	Demand Measures
Enabling Capacity Exports	Firm Transactions
Ontario Resource and Transmission Assessment Criteria	Transmission Considerations
NERC Transmission Planning Standard TPL-001-4	Transmission Considerations
NPCC Directory #1	Transmission Considerations
Market Manual 4 Part 4.2	Surplus Baseload Generation
Market Manual 7.1	Operability
Annual Planning Outlook	Resource Adequacy

8. List of Acronyms

Acronym	Definition
CAA	Connection Assessment and Approval
DR	Demand Response
EAA	Energy Adequacy Assessment
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

Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, Ontario M5H 1T1

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

ieso.ca

@IESO_Tweets
linkedin.com/company/IESO

Connecting Today.
Powering Tomorrow.