Reliability Outlook

An adequacy assessment of Ontario's electricity system

July 2024 to December 2025

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Executive Summary

Ontario's electricity system is prepared for the upcoming summer season and is expected to have adequate supply for the duration of the Outlook period.

Electricity demand is projected to increase by 1.0 per cent in 2024, increasing to 2.9 per cent in 2025 as a result of the addition of large industrial loads to the grid, increasing electrification throughout the economy and a slowing inflation rate.

Throughout the Outlook period, the system will be adequate under normal weather conditions and is also expected to have sufficient reserves and access to 2,000 megawatts (MW) of imports from neighbouring jurisdictions to ensure reliability under extreme weather conditions, if needed. While Ontario imports energy on an ongoing basis to reduce costs, it rarely needs to rely on imports to ensure reliability.

During this Outlook period, we will see system reliability being supported by both firm and planned resources including:

- Connection of the 235 MW Oneida energy storage project to the grid, expected in mid-2025;
- A number of executed contracts under the Medium-Term 1 RFP taking effect;
- Resources secured through the annual Capacity Auction, with 1,867 MW and 1,310 MW secured for the 2024 summer and 2024-25 winter obligation periods, respectively; and
- Resources procured via the Same Technology Upgrades Solicitation, which will begin to come online in May 2025.

Grid reliability will also be supported by the approximately 137,000 smart thermostats that are enrolled in the Save on Energy Peak Perks residential demand response program, which reduces peak demand on hot summer days. Current participants in the program can deliver a demand reduction of up to about 120 MW, which is equivalent to taking a city the size of Barrie off the grid at summer peak.

Refurbishment of Ontario's nuclear resources are ongoing, with up to three units on outage at any one time. 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, and following the retirement of two units at Pickering by the end of 2024.

Multiple new transmission lines are under development that will increase available supply starting mid-decade. In the West zone, two new 230-kilovolt circuits are expected to be in service by end of this summer. The IESO is also anticipating both the electricity transfer capability into the Northwest and the flexibility and efficiency of the electricity system in that zone to improve once outages are completed, and the benefits of the East-West Tie Expansion

– a new 230 kV transmission line between Wawa and Thunder Bay – are fully realized by the end of this year.

As always, the IESO has been actively co-ordinating and planning with market participants to maintain reliability. With more overlapping outage requests, some combinations of transmission and/or generation outages could create operating challenges. 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 may be rejected or rescheduled for the IESO to maintain power system reliability.

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1. Introduction

This Outlook covers the 18 months from July 2024 to December 2025, and supersedes the Outlook released on March 21, 2024.

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 March 2024, and has been updated to reflect the most recent economic projections. Actual weather and demand data for April and May 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 June 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, 2024.

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 May 24, 2024.

3. Demand Forecast

Forecasted energy demand is projected to grow over this Reliability Outlook period, with a projected increase of 1.0% for 2024 and 2.9% for 2025. As energy demand is correlated with economic activity, energy demand growth has slowed as a result of the interest rate increases over 2022 and 2023. Economic activity and underlying energy demand are expected to strengthen as interest rates are lowered over the course of the forecast. Additionally, electricity demand is increasing over the latter part of the forecast as large loads in the form of electric arc furnaces, electric vehicle (EV) battery manufacturing facilities, and data centres are added to the system, substantially increasing the demand.

Weather-adjusted electricity demand increased by 0.9% to 138.0 TWh in 2023. 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 1.0% to 139.4 TWh and is generally informed by the underlying economic trends. Market expectations are for interest rate cuts over the latter half of 2024 and a gradually strengthening economy over the remainder of the forecast period. For 2025, demand is projected to increase 2.9% to 143.5 TWh as a number of large industrial loads are added to the system. The IESO continues to monitor the evolving economic situation and the timelines of these new large loads 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 July 2024 to December 2025 and supersedes the previous forecast released in March 2024. Tables of supporting information are contained in the 2024 Q2 Outlook Tables.

Electricity demand is very closely tied to economic activity. Economic data shows that the economy is slowing and inflation is easing as a result of rate increases over the previous two years. With the goal of reducing inflation nearly achieved, the expectation is that the Bank of Canada will begin to cut rates over the latter part of 2024 leading to a strengthening economy. Economic and population growth will lead to an increasing underlying trend in electricity demand over the forecast period. The demand for electricity increases significantly over the latter part of 2025 as a number of large loads are added to that underlying growth trend.

The demand forecast faces significant uncertainties in both the economic outlook and in terms of new loads on the system. Interest rate impacts can lag significantly and carries a risk to economic growth. Geopolitical events contribute to economic uncertainty and instability should they spread to other countries. Additionally, the large industrial loads seeking connection to the grid represent a significant risk to the forecast should those projects be delayed, accelerated, cancelled, or altered in a significant way. At the same time there are a number of firms indicating interest in locating in or expanding production in Ontario that have not been included

in the forecast due to a current lack of information or commitment. Should those loads materialize, 2025 electricity demand could exceed 144 TWh in 2025.

Table 3-1 | Forecast Energy Demand Summary

Year	Normal Weather Energy (TWh)	% Growth in Energy
2024	139.4	1.00%
2025	143.5	2.93%

Table 3-2 | Forecast Seasonal Peaks

Season	Normal Weather Peak (MW)	Extreme Weather Peak (MW)
Summer 2024	22,729	24,689
Winter 2024-25	21,832	23,056
Summer 2025	22,990	25,057

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-Jul-24	22,408	24,178	1,016	2,661
14-Jul-24	22,647	24,352	814	2,746
21-Jul-24	22,729	24,517	838	2,803
28-Jul-24	22,672	24,650	1,035	2,821
04-Aug-24	22,602	24,590	841	2,857
11-Aug-24	22,593	24,566	958	2,805
18-Aug-24	22,580	24,689	985	2,826
25-Aug-24	22,558	24,539	1,362	2,797
01-Sep-24	22,488	24,357	1,413	2,774

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
08-Sep-24	21,950	23,720	1,370	2,660
15-Sep-24	21,998	23,051	680	2,634
22-Sep-24	20,543	21,946	781	2,549
29-Sep-24	18,942	21,163	420	2,515
06-Oct-24	18,040	19,626	554	2,489
13-Oct-24	17,756	18,726	786	2,484
20-Oct-24	17,674	18,123	507	2,452
27-Oct-24	17,900	19,157	392	2,531
03-Nov-24	18,065	19,430	318	2,564
10-Nov-24	18,656	19,998	416	2,604
17-Nov-24	19,325	19,689	601	2,669
24-Nov-24	20,009	20,284	342	2,751
01-Dec-24	20,242	20,924	607	2,804
08-Dec-24	20,720	21,457	409	2,862
15-Dec-24	20,915	22,002	555	2,893
22-Dec-24	20,980	22,078	690	2,929
29-Dec-24	18,814	20,330	362	2,728
05-Jan-25	20,282	21,178	528	2,857
12-Jan-25	21,570	22,588	570	2,980
19-Jan-25	21,596	22,627	547	2,998
26-Jan-25	21,832	23,056	483	3,017
02-Feb-25	21,798	22,809	404	3,007
09-Feb-25	21,421	22,227	734	2,955

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
16-Feb-25	20,952	22,115	635	2,955
23-Feb-25	20,777	22,198	581	2,909
02-Mar-25	20,679	22,249	501	2,910
09-Mar-25	20,107	21,538	531	2,834
16-Mar-25	19,580	21,192	649	2,788
23-Mar-25	19,025	20,510	611	2,723
30-Mar-25	18,548	19,685	569	2,656
06-Apr-25	18,286	19,161	567	2,608
13-Apr-25	18,176	18,617	471	2,578
20-Apr-25	18,138	18,689	496	2,510
27-Apr-25	17,837	18,160	531	2,473
04-May-25	17,815	19,439	721	2,475
11-May-25	17,660	19,867	849	2,454
18-May-25	17,941	21,343	845	2,478
25-May-25	17,958	21,323	1,175	2,418
01-Jun-25	19,588	21,992	1,330	2,499
08-Jun-25	19,969	22,367	1,292	2,540
15-Jun-25	21,670	22,609	1,055	2,611
22-Jun-25	22,261	23,416	835	2,670
29-Jun-25	22,738	24,355	754	2,732
06-Jul-25	22,710	24,448	1,016	2,716
13-Jul-25	22,937	24,777	814	2,833
20-Jul-25	22,990	24,904	838	2,893

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
27-Jul-25	22,967	25,057	1,035	2,913
03-Aug-25	22,889	24,980	841	2,942
10-Aug-25	22,890	24,908	958	2,884
17-Aug-25	22,851	25,023	985	2,906
24-Aug-25	22,813	24,905	1,362	2,876
31-Aug-25	22,879	24,720	1,413	2,857
07-Sep-25	22,218	24,094	1,370	2,738
14-Sep-25	22,306	23,490	680	2,716
21-Sep-25	21,053	22,393	781	2,630
28-Sep-25	19,445	21,582	420	2,597
05-Oct-25	18,535	20,406	554	2,570
12-Oct-25	18,251	19,172	786	2,564
19-Oct-25	18,156	18,550	507	2,532
26-Oct-25	18,380	19,596	392	2,610
02-Nov-25	18,550	19,843	318	2,644
09-Nov-25	19,122	20,452	416	2,682
16-Nov-25	19,785	20,112	601	2,748
23-Nov-25	20,470	20,726	342	2,832
30-Nov-25	20,732	21,384	607	2,883
07-Dec-25	21,235	21,948	409	2,947
14-Dec-25	21,418	22,480	555	2,977
21-Dec-25	21,508	22,575	690	3,013
28-Dec-25	20,318	22,231	362	2,868

Week Ending	Normal Peak (MW)	Extreme Peak (MW)	Load Forecast Uncertainty (MW)	Normal Energy Demand (GWh)
04-Jan-26	20,704	22,596	528	2,988

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. Additional outage coordination may be required considering the period around Market Renewal Go Live date in May 2025.

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 August 2024 and summer 2025, and primarily as a result of coincident generator outages and an updated demand forecast. 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	13,214	10,392	10,332	5	0	70
Hydroelectric	8,862	4,805	3,894	76	0	-60
Gas/Oil	10,471	9,377	9,029	33	0	1
Wind	4,943	742	742	42	1	60
Biofuel	296	250	45	7	0	0
Solar	478	66	66	10	0	0
Demand Measures	-	959	959	-	-	-
Firm Imports (+) / Exports (-) (MW)	-	563	-37	-	-	-
Total	38,264	27,154	25,031	173	1	71

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 June 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)
Pickering G1	Toronto	Nuclear	2024-Q3	Retirement	-515	-515
Pickering G4	Toronto	Nuclear	2024-Q4	Retirement	-515	-515
Oneida Storage	Southwest	Storage	2025-Q2	Under Development	0	235
Total					-1,030	-795

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.
- Retirement – projects scheduled for permanent shutdown

[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.

In addition to the assumed retirement of Pickering A G1 and G4 units shown in Table 4-2, the continued safe operation of Pickering B is assumed beyond December 2024 to September 2026 – pending approval from the Canadian Nuclear Safety Commission.

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 31, 2024 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)	6,098	6,018	5,813	5,864	5,936	5,683	5,544	5,243	5,020	5,366	5,625	6,090
Historical Hydroelectric Median Contribution without Outages (MW)	6,627	6,590	6,391	6,368	6,390	6,206	6,101	5,867	5,927	6,223	6,425	6,610

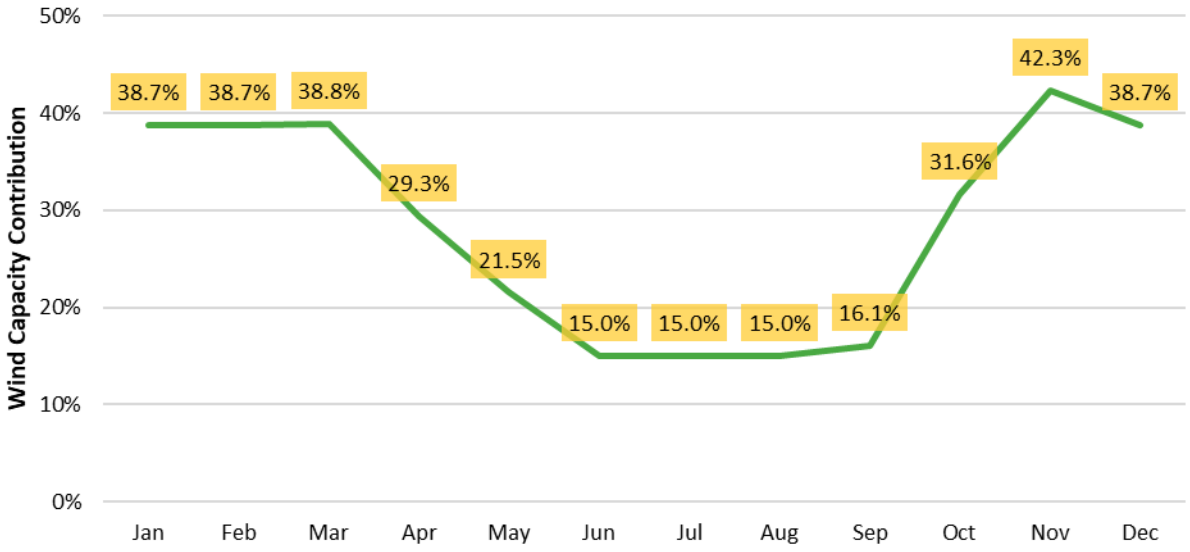
Thermal Generators

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.

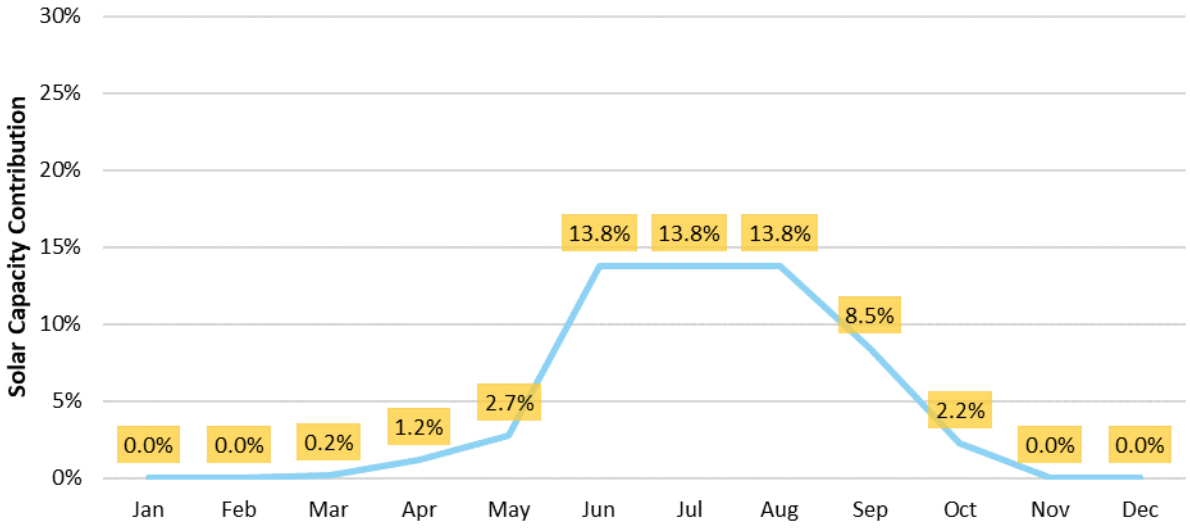
Figure 4-1 | Monthly Wind Capacity Contribution Values



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] will allow up to 37 MW of capacity-backed exports from Ontario between June 2024 and October 2024.

Capacity Sharing Agreement

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

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

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)	38,264	38,264	37,234	37,234	37,234	37,469
2	Total Reductions in Resources (MW)	12,032	11,983	10,712	10,467	12,199	11,824
3	Demand Measures (MW)	959	959	915	915	1,791	1,791
4	Firm Imports (+) / Exports (-) (MW)	563	563	150	-450	0	0
5	Available Resources (MW)	27,754	27,803	27,587	27,232	26,826	27,436
6	Bottling (MW)	0	0	528	552	0	0
7	Available Resources without Bottling (MW)	27,754	27,803	28,115	27,784	26,826	27,436

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 May 7, 2024 The generation planned outages occurring during this Outlook period have been assessed as of June 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 June 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.

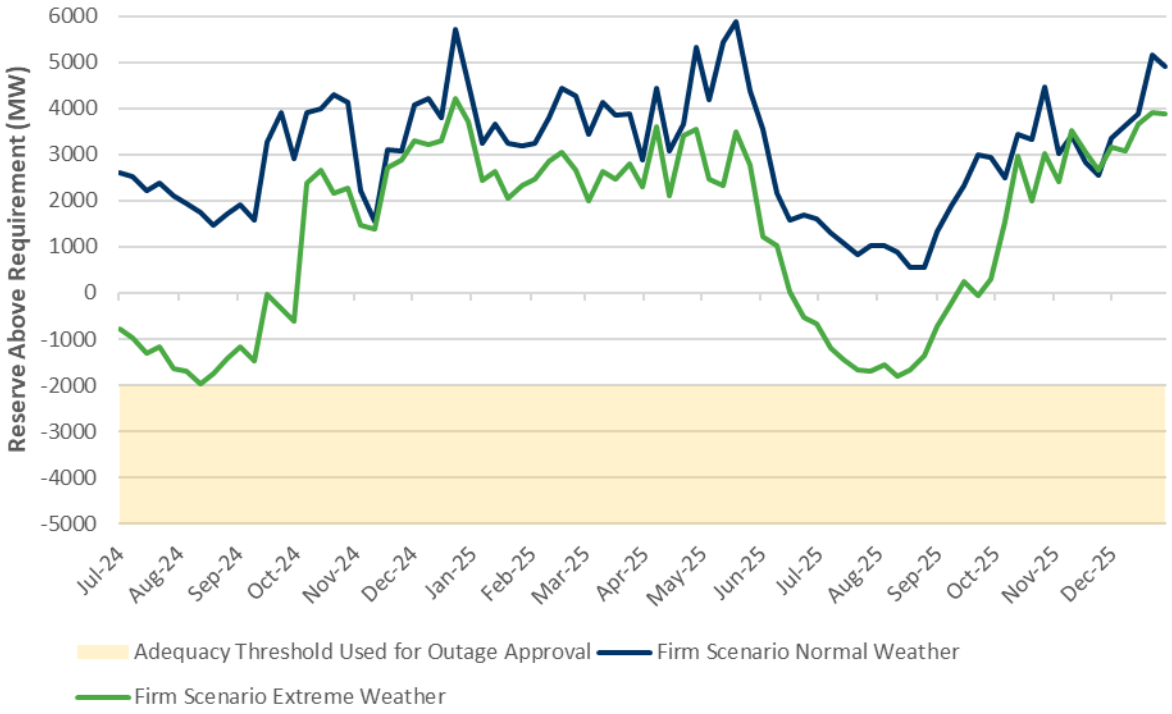
The IESO expects to have sufficient reserves for the summers of 2024 and 2025, and winters of 2024/25 and 2025/26. In the firm scenario under extreme weather conditions, the reserve drops below 0 MW for 14 weeks in the summer of 2024 and for 13 weeks in the summer of 2025, but does not cross the adequacy threshold at any time. Notably, the RAR is marginally above the threshold in the week of August 18, 2024.

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. 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, especially during periods of low reserves.

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. Outage requests during periods when reserves fall below the adequacy threshold under extreme weather conditions will be put at risk and may be rejected should those conditions materialize.

[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

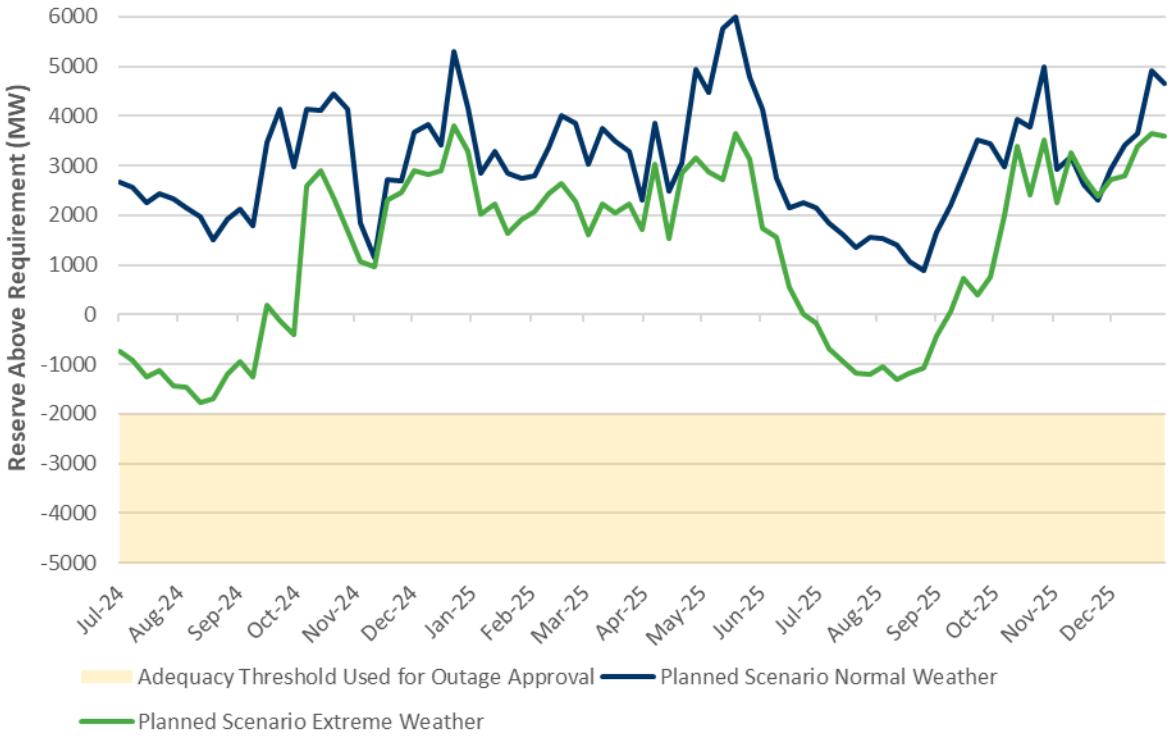


4.2.2 Planned Scenario with Normal and Extreme Weather

The Planned scenario incorporates all existing capacity, as well as all capacity expected to come into service. Approximately 235 MW of new generation capacity is expected to connect to Ontario's grid over this Outlook period, alongside 1,030 MW of generation capacity being retired between Pickering G1 and G4.

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.

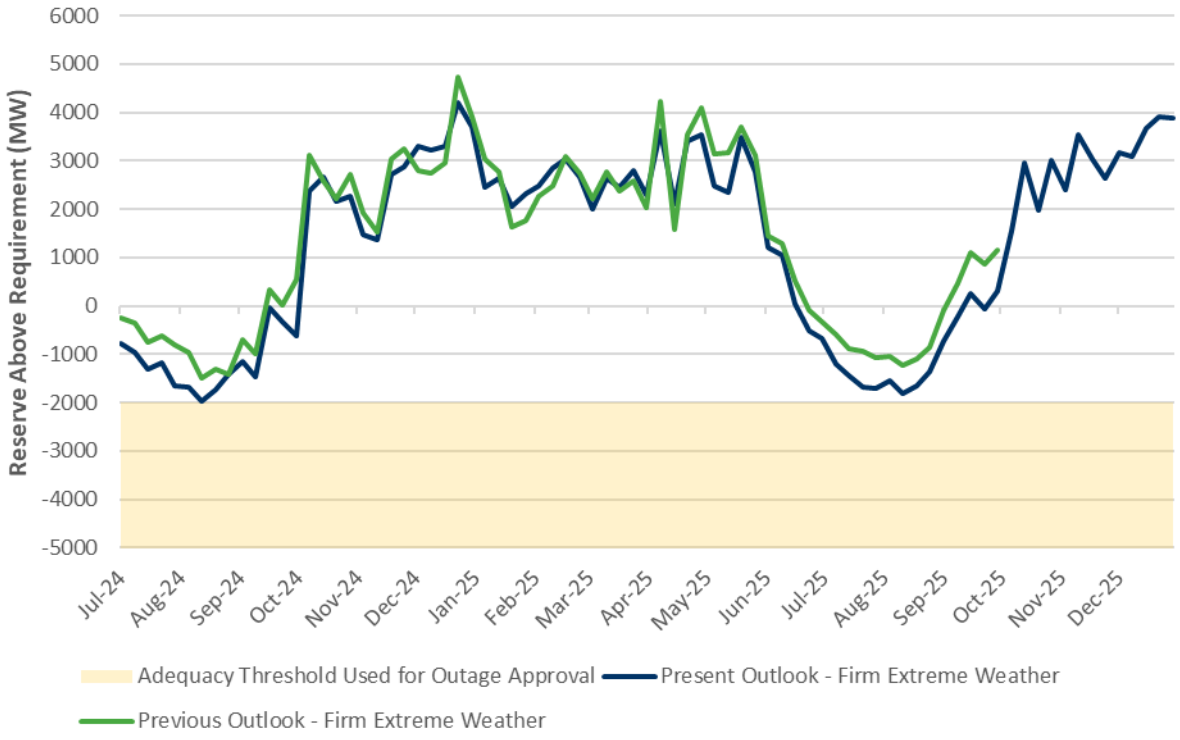
Figure 4-4 | Comparison of Normal and Extreme Weather: Planned Scenario Reserve Above Requirement



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 March 21, 2024. The difference is primarily the result of changes in planned outages and an updated demand forecast.

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 18Month Period GWh
Bruce	1.5	113	64.1	4,863	62.6	2.3	119.3
East	12.1	917	18.5	1,408	6.4	24.9	94.4
Essa	13.2	1,002	3.6	273	-9.6	29.2	16.3
Niagara	7.1	535	21.2	1,612	14.1	16.0	48.9
Northeast	16.8	1,278	15.4	1,166	-1.4	29.3	39.2
Northwest	6.9	525	6.6	501	-0.3	12.0	14.9
Ottawa	13.5	1,025	0.7	54	-12.8	30.6	1.5
Southwest	42.0	3,190	9.0	681	-33.0	94.9	21.3

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 18Month Period GWh
Toronto	76.2	5,781	58.5	4,437	-17.7	173.0	127.8
West	25.3	1,922	17.1	1,295	-8.2	57.8	77.0
Ontario	**214.6**	**16,289.0**	**214.6**	**16,289.0**	**0.0**	**470.0**	**560.5**

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

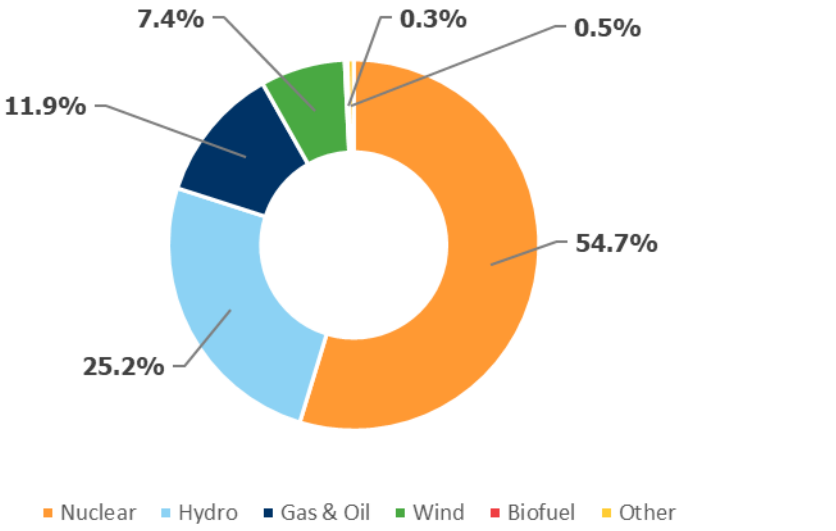


Figure 4-7 | Forecast Monthly Energy Production by Fuel Type

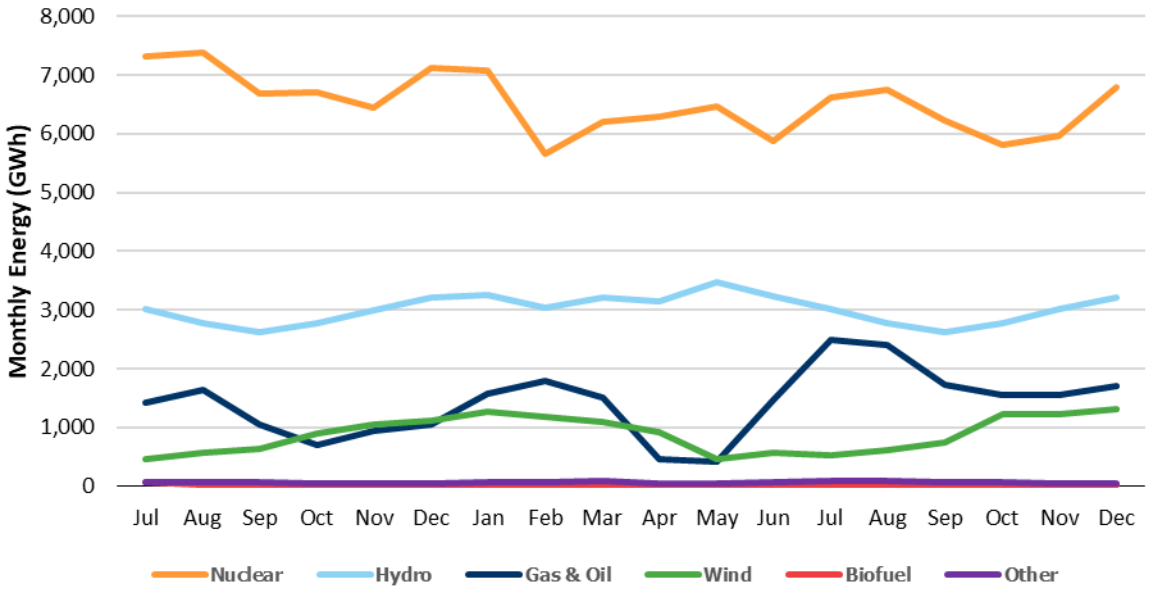


Table 4-6 | Energy Production by Fuel Type for the Firm Scenario Normal Weather

Fuel Type (Grid-Connected)	2024 (Jul 1 – Dec 31) (GWh)	2025 (Jan 1 – Dec 31) (GWh)	Total (GWh)
Nuclear	41,674	75,740	117,413
Hydro	17,389	36,800	54,189
Gas & Oil	6,785	18,674	25,459
Wind	4,726	11,154	15,880
Biofuel	212	326	538
Other (Solar & DR)	345	799	1,144
Total	**71,131**	**143,492**	**214,623**

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 March 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 May 24, 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 begun connecting. Work is currently on-going for the second South Middle Rd load station. Prior to transmission reinforcements coming into service, 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 by end of the summer of this year to support continued load growth. Outages at Chatham and Lakeshore stations are required in order to integrate the new circuits, and will temporarily reduce system resiliency during this time.

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 December 1, 2024, on circuit B502M, and another planned eleven-week outage starting May 9, 2025
- A planned five-week outage starting August 26, 2024, on circuit B560V

Toronto, East, and Ottawa Zones

To address high voltages in eastern Ontario and the Greater Toronto Area, which is expected to worsen with Pickering units retirement, two 500 kV line connected shunt reactors have now been installed and are in-service at Lennox TS. There continues 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, along with the staged shutdown of the Pickering NGS. 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 following outages will impact the flow into Ottawa:

- A planned five-week outage starting September 8, 2024, on circuit T31H

- A planned six-week outage starting October 7, 2024, on circuit T32H, and another planned three-week outage starting November 25, 2024

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 be realized by the end of the year, once all ongoing and upcoming outages as a result of work in the Northwest are completed. Specifically, the following outages on circuit W21M, will reduce the transfer capability of the East-West tie:

- A two-week outage starting September 4, 2024

In order to improve transmission system capacity, the Ansonville to Kirkland Lake A8K/A9K transmission circuits were refurbished and came in-service Q2 2023. Furthermore, in December 2023, a new RAS, which enables load rejection and eliminates the need for pre-contingency load curtailment, was placed in service in the Kirkland Lake area. 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, particularly prior to the completion of the system reinforcements recommended in the Northeast Bulk System plan.

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

- A four-week outage on circuit X503E starting October 2, 2024

To meet growing electricity need in the Northwest, mainly driven by economic development and electrification of mining activities, the Waasigan Transmission Line is currently under development. Phase 1 of the project, which consists of new double-circuit 230 kV transmission line between Lakehead TS and MacKenzie TS on common towers with existing circuits, is expected in-service by Q4 2025. Outages of the parallel circuits, as well as at Lakehead TS and MacKenzie TS will be required in order to integrate the new circuits, and will temporarily reduce system resiliency during this time. Phase 2 of the project, which consists of a new 230 kV transmission line between MacKenzie TS and Dryden TS, is recommended to be in-service by 2027.

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.

One 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: IESOControlled 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 Q2 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

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