NPCC 2022 Ontario Interim Review of Resource Adequacy

For the period from 2023 to 2026

Approved by the RCC on December 6, 2022

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Executive Summary

The Independent Electricity System Operator (IESO) submits this assessment of resource adequacy for the Ontario Area to comply with the Reliability Assessment Program established by the Northeast Power Coordinating Council (NPCC). The 2022 Interim Review of Resource Adequacy covers the study period from 2023 through 2026 and identifies changes in assumptions from the 2021 Comprehensive Review, including changes to facilities and system conditions, generation resources' availability, demand forecast and the impact of these changes on the overall reliability of the Ontario electricity system.

The results presented in the table below conclude that Ontario will be able to meet the NPCC resource adequacy criterion that limits the loss of load expectation (LOLE) to no more than 0.1 days/year for all four years within the study period, 2023 to 2026. The NPCC criterion is satisfied for 2023 and 2024 with existing and planned resources. To satisfy the NPCC criterion, the use of 600 and 1,500 MW of tie benefits will be required for 2025 and 2026 respectively.

Annual LOLE Values

	2023	2024	2025	2026
Demand Forecast (MW)	22,930	23,490	23,856	24,104
Available Resources (MW)	25,670	27,456	26,522	25,956
Tie Benefits (MW)	0	0	600	1,500
LOLE (days/year)	0.04	0.01	0.09	0.09

The IESO's Resource Adequacy Framework comprises a suite of mechanisms to procure a portfolio of reliable, competitive and cost-effective supply. The annual capacity auctions held in December fulfills the short-term operational planning timeframe (one-year) capacity needs. Medium- and Long-term RFP processes are deployed to procure resources over varying time frames with the Annual Acquisition Report specifying the mechanisms and targets.

The IESO determines Ontario's level of resource adequacy using the General Electric Multi-Area Reliability Simulation (GE-MARS) program and applies the NPCC criterion that requires a loss of load expectation (LOLE) value of no more than 0.1 days/year.

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1. Introduction

The 2022 Interim Review of Resource Adequacy for Ontario is submitted to the Northeast Power Coordinating Council (NPCC) in accordance with Appendix D of the NPCC Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System."

This report was prepared by the Independent Electricity System Operator (IESO) in its capacity as the Planning Coordinator for Ontario.

The 2022 Interim Review of Resource Adequacy covers the study period from 2023 through 2026 and supersedes previous reviews. The last Comprehensive Review was approved by the NPCC Reliability Coordinating Committee in December 2021 and covered the 2022 to 2026 period.

This review is based on the 2021 Annual Planning Outlook (APO) published in December 2021, with material changes since then that include nuclear refurbishment schedule updates and updates to planned projects.

2. Changes in Assumptions from 2021 Comprehensive Review

2.1 Demand Forecast

Table 2-1 shows a comparison between the peak demand forecasts for the 2021 Comprehensive Review and the 2022 Interim Review.

Table 2-1 | Comparison of Demand Forecasts: Normal Weather Summer Peak (MW)

Year	2021 Review	2022 Review	Difference
2023	22,110	22,930	820
2025	21,772	23,490	1,718
2025	22,033	23,856	1,823
2026	22,348	24,104	1,756
Annual Growth Rate	0.37%	1.68%	

The 2021 Comprehensive Review demand forecast was developed in the early stages of the COVID-19 global pandemic and considered potential prolonged pandemic impacts, economic recession and resulting impacts on electricity demand, as well at a time when the province did not have a committed long term electricity conservation framework policy. The Interim 2022 Review demand forecast has been developed as the province is emerging from the pandemic, with a corresponding switch of focus to economic development and recovery, as well as climate change mitigation through societal decarbonization via electrification underlining a return to steady electricity demand growth and the recognition that conservation program frameworks would continue to be delivered over the long term period.

Over the forecast period of 2023 through 2026, Ontario normal weather grid level summer system peak demand is expected to increase by about an average 1.68% annually.

The demand is shaped by two competing factors: those that increase the demand for electricity; and those that act to reduce electricity demand. The increase in demand for electricity is being driven by population growth (via a reopening of immigration), increased penetration of electrically powered devices, economic recovery and expansion, structural decentralization of office work (persisting and permanent work from home trends), and emerging climate change mitigation policy and evolving consumer preferences towards energy consuming devices with reduced greenhouse gas emissions, including building heating and modes of transportation. Offsetting the growth are reductions from conservation including energy efficiency programs, building codes and equipment standard (C&S)

regulations, electricity price responsiveness, and continued electricity supply by embedded (non-market participant) generators[1].

Demand growth in the forecast period is expected primarily from the industrial mining sub-sector in northern Ontario, agricultural sector greenhouse expansion in western Ontario, expectations that existed pre-pandemic, and slow steady growth in transportation sector through electric vehicle adoption and rail transit electrification. In addition, minor areas of steady growth are in the residential sector, supported by a reopening of immigration and continued work-from-home trends; and flat levels of demand in the commercial sector (projected after an economic recovery from pandemic period business closures mandated by public health measures, in the 2020-2022 period). Significant increases in levels of electrification in industry (including a small number of industrial steel producer electric arc furnace projects and potential electric vehicle battery cell factories) and transportation electrification are not forecasted until after the forecast period (2023-2026). The 2022 Interim Review demand forecast varies from the 2021 Comprehensive Review which included assumptions of a prolonged pandemic and economic recession.

The system remains weather sensitive as a large portion of the workforce continues to work from home (or remote work) and is expected to persist at moderate levels in the post-pandemic era, leaving the system more weather sensitive. This has a significant impact on the summer system peak demand due to increased residential sector occupancy and resulting air conditioning, lighting and electronic device load on top of pre-pandemic levels of commercial sector air conditioning load. The winter peak is less impacted as changes in residential loads have less of an influence on winter peak demand.

Conservation program demand savings in the post 2020 framework period have been included in the 2022 Interim Review demand forecast in the form of the 2021-2024 CDM Program framework and a number of federal government funded programs with electricity savings which is expected to achieve electricity savings through the end of the forecast period, whereas the 2021 Comprehensive Review did not include assumptions of continued conservation program delivery in the post 2020 period.

The effect of price-responsive loads reducing consumption on their own under the Industrial Conservation Initiative[2] (ICI) are included in the demand forecast with an estimate of 1,300 MW of price-responsive loads reducing on their own under the ICI.

Although discrete value forecasts are presented, the forecast has an associated levels of uncertainty which represents the variability of demand due to weather volatility, as well as specific scale and timing of the development and implementation of a small number of specific large industrial sector projects that have recently been announced.

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[1] *Contracted Embedded Generation (or Embedded Generation* for short) refers to generators that supply electricity to local distribution systems, and have power purchase agreements (contracts) with the IESO. They do not participate in the IESO-administered market, but rather reduce demand on the transmission grid. Since these generators have contracts with the IESO, the IESO can track their existing and future capacities.

[2] Industrial Conservation Initiative (ICI) is a form of demand response that incents participating customers to reduce demand during peak periods. Customers who participate in the ICI, referred to as Class A, pay global adjustment costs based on their percentage contribution to the top five peak Ontario demand hours (i.e., peak demand factor) over a 12-month base period.

2.2 Resource Forecast

Table 2-2 compares the capacity of supply resources at the time of the annual peak for the current 2022 Interim Review with the last year's Comprehensive Review. This 2022 Interim Review assumes resource availability based on the available information for existing and planned resources. These values do not include distributed energy resources (DERs), except for those that participate in the IESO-administered markets.

Table 2-2 | Comparison of Available Resources Forecasts (MW) at Annual Peak

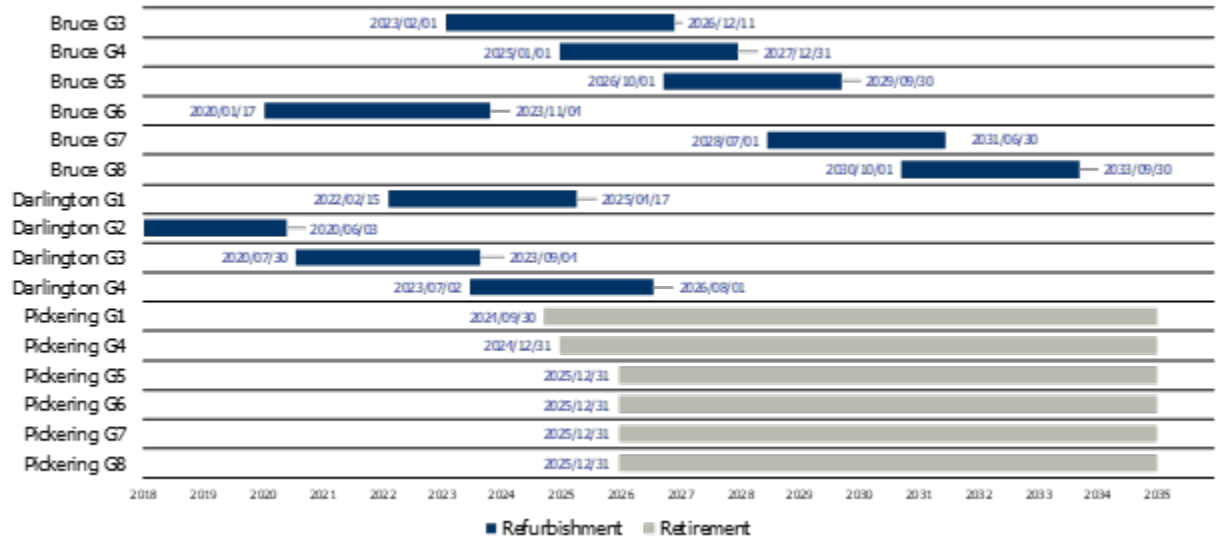
Year	2021 Comprehensive Review	2022 Interim Review	Difference
2023	26,884	25,670	-1,214
2024	26,396	27,456	1,060
2025	26,768	26,522	-246
2026	24,664	25,956	1,292

Available resources are determined based on the following:

1. Total capacity available from thermal units (nuclear, gas, oil and biofuel) after discounting for seasonal derating;
2. Outage schedules, including potential outages over the seasonal peak. The majority of outages that occur over the peak period are due to the refurbishment of nuclear generators, whose outages last around three years per generator. The nuclear refurbishment and retirement schedule is shown in the Figure 2-1.
3. Historical median contribution of hydro resources during peak demand hours;
4. Historical median contribution of wind and solar resources during the peak demand hours; and
5. Effective capacity of projected demand measure resources: DR and Dispatchable Loads.

The nuclear refurbishment and retirement schedule assumed for the assessment is shown in Figure 2-1.

Figure 2-1 | Nuclear Refurbishment and Projected End of Life Schedule



The differences in available resources between the 2021 Comprehensive Review and the 2022 Interim Review, for overlapping periods, are primarily due to the factors below.

- Changes to nuclear outages and refurbishment schedule
- Small changes to demand response available capacity values at peak
- Small changes from EFORd updates
- Capacity Imports of 500 MW from Hydro Québec for summer of 2026

2.3 Emergency Operating Procedures (EOP)

Emergency operating procedures (EOPs) are used in the resource adequacy assessment. Table summarizes the assumptions regarding the load relief from EOPs used when required in this study. For this study, all EOPs are applied in one block. There are no changes to EOPs compared to last year's review.

Table 2-3 | Emergency Operating Procedure Assumptions

EOP Measure	EOP Impact (% of Demand)
Public Appeals	1.00
No 30-minute OR (473 MW)	0*
No 10-minute OR (945 MW)	0*
Voltage Reductions	1.94
Aggregated Net Impact	**2.94**

*Although 30-minute and 10-minute operating reserve (OR) are included in this list of EOPs, the analysis does not impose a requirement to provide for OR since only loss of load events are being considered. Therefore, the net benefit of applying EOPs in the analysis excludes relaxation of OR requirements.

2.4 Equivalent Forced Outage Rates (EFORd)

The EFORd values were updated for the 2022 Interim Review. The EFORd are the same for nuclear generators and are lower for non-nuclear generators compared to last year's.

Table 2-4 | Weighted Average EFORd Assumptions

Fuel Type	2021 EFORd	2022 EFORd
Nuclear	5.1%	5.1 %
Gas/Oil	10.7%	10.2%
Biomass	5.9%	5.8%

2.5 Firm Sales and Purchases

As part of the electricity trade agreement between Ontario and Québec, Ontario will supply 500 MW of capacity to Québec for winter months from December 2022 to March 2023. Ontario has the option to receive 500 MW of capacity from Québec before 2030, and modelled that capacity for summer of 2026. This capacity was not assumed in the last year's review.

2.6 Non-firm Imports

The IESO includes non-firm imports in resource adequacy assessments starting in 2021. The amounts of non-firm imports assumed are updated every year using the most recent four years of data. In this year update, there are no changes to the assumptions of using 250 MW of non-firm imports in the summer and 240 MW in the winter.

3. Resource Adequacy Assessment

The 2022 Interim Review of Resource Adequacy for Ontario is submitted to demonstrate compliance with the resource adequacy requirements of NPCC Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System." This report was prepared by the Independent Electricity System Operator (IESO) in its role as the Planning Coordinator for Ontario.

The 2022 Interim Review of Resource Adequacy covers the study period from 2023 through 2026. The assessment is based on the APO published in 2021 with material changes since then that include nuclear refurbishment schedule updates and updates to planned projects.

The resource adequacy probabilistic assessment is performed using GE-MARS. The following inputs are used:

- Demand growth forecast and associated (LFU);
- Forecast of available resources and existing EOPs;
- Planned outage schedules submitted by market participants;
- EFORd for thermal units derived using historical generator performance data; and
- Transmission limits of major interfaces connecting different zones.

3.1 Assessment Results

The results presented in

 show that the NPCC LOLE criterion is satisfied.

The NPCC criterion is satisfied for 2023 and 2024 with existing and planned resources. To satisfy the NPCC criterion, the use of 600 and 1,500 MW of tie benefits will be required for 2025 and 2026 respectively.

Table 3-1 | Annual LOLE Values

	2023	2024	2025	2026
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Ontario is interconnectied with Manitoba, Minnesota, Québec , New York and Michigan and the tie-benefits are used as needed. The most recent 2021 NPCC Review of Interconnection Assistance Reliability Benefits study indicates a range of estimated tie benefit potential of 3,223 MW to 3,325 MW for 2026.

The following are the developments since the last Comprehensive Review in 2021 and is not included in the Interim Review assessment.

- The target capacities for the December 2022 capacity auction will be 1,200 MW for the summer 2023 obligation period, and 750 MW for the winter 2023/2024 obligation period as announced in the IESO's 2022 Annual Acquisition Report.
- In September 2022, Ontario's Ministry of Energy announced that it was supporting a plan by Ontario Power Generation (OPG) to extend operation of its Pickering Nuclear Generating Station B (2,000 MW) by one more year to 2026. OPG will need approval from the Canadian Nuclear Safety Commission to proceed with this plan, and that decision is not expected until 2024.
- In October, the Minister of Energy issued a directive and amended the 2021-2024 Conservation and Demand Management Framework. The directive enables the IESO to deliver additional conservation programs that will provide provincial peak demand savings of 285 MW and an annual energy savings of 1.1 TWh by 2025.
- In October, the Ministry of Energy issued a directive on the procurement of electricity resources and resource eligibility. The procurements will target about 4,000 MW of capacity to be delivered over the period 2025-2027 through three competitive procurement mechanisms, approximately 2,500 MW of storage, and up to 1,500 MW of natural gas.

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