NPCC 2019 Ontario Interim Review of Resource Adequacy

FOR THE PERIOD FROM 2020 TO 2023
APPROVED BY THE RCC ON DECEMBER 3, 2019

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Document Change History

Issue	Reason for Issue	Date
1.0	For submission to CP-8	September 19, 2019
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1 EXECUTIVE SUMMARY

The Independent Electricity System Operator (IESO) submits this assessment of resource adequacy for the Ontario Area in accordance with the Northeast Power Coordinating Council (NPCC) Regional Reliability Reference Directory #1, "Design and Operation of the Bulk Power System."

The 2019 Interim Review of Resource Adequacy covers the study period from 2020 through 2023 and identifies changes in assumptions from the 2018 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 Table 1 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 years within the study period (2020 to 2023) for both demand scenarios.

For the median demand growth scenario, the NPCC criterion is satisfied for 2020 to 2022 forecast years with existing and planned resources. For the 2023 forecast year, the invoking of Emergency Operating Procedures (EOP) and 501 MW of tie benefits would be required to meet the LOLE criterion.

For the high demand growth scenario, the NPCC criterion is met for 2020 and 2021 forecast years with existing and planned resources. For the 2022 and 2023 forecast years, the invoking of EOP and the use of up to 2,707 MW of tie benefits would be required to meet the LOLE criterion.

Table 1 Annual LOLE Values - Median and High Demand Forecast

Scenario	EOPs	Tie Benefits (MW)	LOLE [days/year]			
			2020	2021	2022	2023
Median	No	0	0.001	0.003	0.028	0.669
	Yes	0	-	-	-	0.234
	Yes	501	-	-	-	0.090
High	No	0	0.001	0.014	0.505	9.167
	Yes	0	-	-	0.147	4.771
	Yes	2,707	-	-	0.000	0.098

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3 CHANGES IN ASSUMPTION FROM 2018 COMPREHENSIVE REVIEW

3.1 Demand Forecast

Table 3.1 compares the peak demand forecasts for the 2019 Interim Review with the 2018 Comprehensive Review under median and high demand growth scenarios for the overlapping years. Although point forecasts are presented for both the median and high demand growth scenarios, each scenario has an associated "uncertainty" distribution which recognizes the variability of demand due to weather volatility.

Table 3.1 Comparison of Demand Forecasts

Year	Normal Weather Summer Peak					
	Median Demand Growth			High Demand Growth		
	2018 Review	2019 Review	Difference	2018 Review	2019 Review	Difference
2020	22,085	22,095	10	22,969	22,314	-655
2021	22,155	22,378	223	23,750	23,271	-479
2022	22,098	22,650	552	24,308	24,280	-28
2023	22,139	22,819	680	24,796	25,101	305
Annual Growth Rate	0.08%	1.08%		2.58%	4.00%	

Ontario grid demand is shaped by two opposing sets of drivers: those that increase grid demand and those that act to reduce it. Economic expansion, population growth and increased penetration of electrically powered devices act to increase the need for grid-supplied electricity. Conservation programs, increasing embedded generation output and price incentives act to reduce the amount of grid-supplied electricity needed. The interplay of these drivers will shape both peak and energy demand over the course of the forecast period.

When comparing the demand forecasts in the 2018 Comprehensive Review and the 2019 Interim Review, the differences are attributable to three items:

- The energy conservation program savings projections have been updated to reflect policy changes in Ontario. This specifically applies to the period beyond 2020. Projected energy efficiency program savings have been significantly reduced post 2020. Over the forecast, projected conservation savings have been reduced by a cumulative 3.4 TWh.
- Growth in embedded generation has plateaued and a number of projects have been terminated by government directive. Further, Ontario has no policy framework for contracting embedded generation moving forward.
- When 2018 actual historical demand data was included in the updated forecast for the 2019 Interim Review, this resulted in resetting the starting point of the demand forecast thus having an impact on the ensuing demand levels. The

resetting of the starting point resulted in higher energy demand compared to that of the 2018 Comprehensive Review forecast.

These combined impacts led to higher growth rates in both growth scenarios.

Drivers impact on grid demand

Over the forecast horizon, the summer peaks are expected to increase under the median growth scenario. This is because much of the downward pressure from increased energy efficiency program savings and the growth in embedded generation output has been removed from the forecast. Price impacts will continue to moderate increases in the summer peak.

Price impacts stem mainly from the Industrial Conservation Initiative (ICI) which incents large users to reduce demand during peak system conditions.

In the high growth scenario, the summer peaks are expected to grow much faster over the forecast horizon as higher than expected economic growth and population growth combined with increased electrification will increase peak demand. Price impacts will not be strong enough to offset the underlying growth.

3.2 Resource Forecast

Table 3.2 compares the capacity of supply resources at the time of the summer peak for the current 2019 Interim Review with the 2018 Comprehensive Review. This 2019 review assumes resource availability based on the latest 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.

Available resources are determined based on the following:

1) Historical median contribution of hydroelectric resources during peak demand hours;
2) Total capacity available from thermal units (nuclear, gas, oil and biofuel) after discounting for planned outages and seasonal derating;
3) Historical median contribution of wind and solar resources during the peak demand hours; and
4) Projected effective capacity of the following demand-side resources: Demand Response (DR) and Dispatchable Loads.

Table 3.2 shows how the available capacity of supply resources has changed compared to the 2018 Comprehensive Review.

Table 3.2 Comparison of Available Resource Forecasts (MW)

Year	Available Resources at Summer Peak		
	2018 Review	2019 Review	Difference
2020	26,477	28,577	2,100
2021	25,362	28,577	3,215
2022	26,076	27,552	1,476
2023	25,638	25,570	-68

The differences in available resources between the 2019 Interim Review and the 2018 Comprehensive Review are primarily due to:

- Changes to nuclear outages and refurbishment schedule.
- Changes to hydroelectric outages in 2023.
- Firm imports of 500 MW not assumed for 2023 in 2019 Review.

Table 3.3 lists the major projects expected over the study period.

Table 3.3 Major Projects

Project Name	Fuel Type	Capacity (MW)
Loyalist Solar	Solar	54
Henvey Inlet Wind Farm	Wind	300
Nation Rise	Wind	100
Romney Wind Energy Centre	Wind	60
Napanee Generating Station	Gas	985

3.3 Transfer Capabilities and Fuel Supply

Northwestern Ontario is connected to the rest of the province by the double-circuit, 230 kV East–West Tie. Additional capacity is required to maintain reliable supply to this area under the wide range of possible system conditions. A new 450 km long 230 kV double-circuit transmission line is planned to come into service in 2021 to reinforce the connection of Northwestern Ontario to the rest of the provincial grid, providing reliable and cost-effective long-term supply to this area.

Supply to Ontario's gas fleet is robust and supported by significant firm supply and transportation contracts. Considering Ontario's gas-pipeline infrastructure and history of coordinated gas-electric operations, it is not expected that Ontario's gas generators will experience any material fuel supply constraints within the study period.

3.4 Emergency Operating Procedures (EOP)

EOP are used in the resource adequacy assessment if the existing and planned resources are not sufficient to meet the LOLE criterion. Table 3.4 summarizes the assumptions regarding the demand relief from EOP used when required in this study. For this study,

all EOP are applied in one block. There are no changes to the EOP assumptions compared to last year's Comprehensive Review.

Table 3.4 Emergency Operating Procedure Assumptions

EOP Measure	EOP Impact % of Demand
Public Appeals	1.0
No 30-minute OR (473 MW)	0*
No 10-minute OR (945 MW)	0*
Voltage Reductions	2.2
Aggregated Net Impact	**3.2**

* Although 30-minute and 10-minute Operating Reserve (OR) are included in this list of EOP, 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 EOP in the analysis excludes relaxation of OR requirements.

3.5 Equivalent Forced Outage Rates (EFORd)

The IESO updated the EFORd in the 2019 Interim Review. The changes to the values are insignificant compared to last year's Comprehensive Review.

Table 3.5 Ontario's EFORd

Fuel Type	EFORd Weighted Average	EFORd Range
Nuclear	6.4%	1.8 - 10.7 %
Gas/Oil	10.0%	0.1 - 23.0 %
Biofuel	8.1%	0.4 - 10.6 %

3.6 Firm Transactions: Purchase and Sale of Capacity

As part of the electricity trade agreement between Ontario and Quebec, Ontario will supply 500 MW of capacity to Quebec each winter from December to March, until 2023.

Ontario can call on 500 MW of capacity during summer months from June to September before 2030, based on the province's need. The IESO did not make use of this firm import in the assessments.

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4 RESOURCE ADEQUACY ASSESSMENT

The 2019 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 2019 Interim Review of Resource Adequacy covers the study period from 2020 through 2023. The assessment is based on information available to the IESO as of August 2019.

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

- Median and high demand growth forecast and load forecast uncertainty (LFU);
- Forecast of available resources and EOP;
- Planned outage schedules submitted by market participants;
- Equivalent Forced Outage Rates on Demand (EFORd) for thermal units derived using historical generator performance data; and
- Transmission limits of major interfaces connecting different zones.

4.1 Assessment Results

The results for the median and high demand growth scenarios are presented in Table 4 and show that the NPCC LOLE criterion is satisfied for the forecasted scenarios.

For the median demand growth scenario, the NPCC criterion is satisfied for 2020 to 2022 forecast years with existing and planned resources. For the 2023 forecast year, the invoking of Emergency Operating Procedures (EOP) and 501 MW of tie benefits would be required to meet the LOLE criterion.

For the high demand growth scenario, the NPCC criterion is met for 2020 and 2021 forecast years with existing and planned resources. For the 2022 and 2023 forecast years, the invoking of EOPs and the use of up to 2,707 MW of tie benefits would be required to meet the LOLE criterion.

Ontario is interconnected with Manitoba, Minnesota, Quebec, New York and Michigan and the tie-benefits are used as needed. The most recent NPCC Tie Benefits study[1] indicates a range of estimated tie benefit potential of 4,414 MW to 4,703 MW.

In December 2019, the Capacity Auction will replace the existing Demand Response Auction to include non-committed dispatchable generators for procuring capacity for the May 2020 to April 2021 commitment period. Resource types such as storage and system-backed imports will be added for the capacity auction in June 2020. The IESO intends to

[1] https://www.npcc.org/Library/Interconnections%20Assistance%20Reliability%20Benefits/RCC_Approved_CP-8_Tie_Benefit_Report_2016-03-02.pdf

acquire capacity through capacity auctions or other mechanisms to address capacity needs emerging in the coming years to ensure resource adequacy is maintained.

Table 4 Annual LOLE Values, Median and High Demand Forecast

Scenario	EOPs	Tie Benefits (MW)	LOLE [days/year]			
			2020	2021	2022	2023
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