NEEDS ASSESSMENT REPORT

Sudbury Algoma Region

October 24, 2025

Needs Assessment Report

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October 24, 2025

Lead Transmitter:

Hydro One Networks Inc.

Prepared by: Sudbury Algoma Technical Working Group

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Disclaimer

This Needs Assessment (NA) Report was prepared for the purpose of identifying potential needs in the Sudbury Algoma region and to recommend which needs a) do not require further regional coordination and can be directly addressed by developing a preferred plan as part of the NA phase and b) require further assessment and regional coordination. The results reported in this NA are based on the input and information provided by the Technical Working Group (TWG) for this region. Updates may be made based on the best available information throughout the planning process.

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Executive Summary

REGION **Sudbury Algoma** Region (the "Region")

LEAD Hydro One Networks Inc. ("HONI")

START DATE: June 27, 2025 **END DATE:** October 24, 2025

The second Regional Planning cycle for the Sudbury Algoma Region was completed in December 2020 with the publication of the Regional Infrastructure Plan ("RIP") report – Sudbury Algoma Regional Infrastructure Plan (RIP).

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. Considering these timelines, the 3rd Regional Planning cycle was triggered in **June 2025** for this Region. The planning horizon for this Needs Assessment ("NA") is ten years. A 20-year planning assessment is undertaken in the next phases of regional planning, i.e., IRRP and RIP phases.

The purpose and scope of the NA is to:

a) Identify any new needs and reaffirm needs identified in the previous regional planning cycle; and,
b) Recommend which needs:
   i) require further assessment and regional coordination to develop a preferred plan (and hence, proceed to the next phases of regional planning); and,
   ii) do not require further regional coordination (i.e., can be addressed directly between Hydro One and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

The Technical Working Group (TWG) comprises representatives from Local Distribution Companies ("LDC"), the Independent Electricity System Operator ("IESO"), and Hydro One Transmission. They provide input and relevant information for the region and undertake a technical assessment to identify the electrical infrastructure needs in the region. They collaborate to develop both summer and winter gross and net peak electricity demand forecasts (including input from municipalities), which form the basis for the technical assessment. The following are key considerations of the technical assessment:

a) Current and future station capacity and transmission adequacy.
b) System reliability needs and operational concerns.
c) Major HV transmission equipment requiring replacement with consideration to "right-sizing"; and,
d) Sensitivity analysis to capture uncertainty in the load forecast as well as variability of demand drivers such as electrification.

In this Needs Assessment, TWG has identified the following regional needs and recommendations:

Needs that require further regional coordination.

#	Need Location	Need Description
1	**Martindale TS 230/44 kV step-down transformers (T25 & T26)**	Capacity Need: The load exceeds the 10-day LTR of the step-down transformers, T25 and T26, based on winter demand forecast at the station by 2034.
2	**Martindale TS 230/115 kV Autotransformers (T21, T22, & T23)**	Capacity Need: With one autotransformer out-of-service and subsequent failure of another unit, the third autotransformer will exceed its winter 10-day LTR. The Martindale TS autotransformers supply the local 115 kV system serving LDCs and industrial customers. Based on the winter coincident forecast, this need is expected to materialize in 2030.
3	**Manitoulin TS 115 kV Voltage**	Voltage violation: The 115 kV bus at Manitoulin TS experiences low voltage under peak demand conditions at the station.

Needs that do not require further regional coordination.

#	Need Location	Need Description
1	**Martindale TS 230/44 kV step-down transformers (T25 & T26)**	Asset Renewal Need: T25 and T26 are approaching End of Life (EOL) based on their condition assessment. The transformers are planned for like-for-like replacement in 2032.

List of LDC(s) to be involved in further regional planning phases:

- Greater Sudbury Hydro
- North Bay Hydro (Embedded LDC)
- Hydro One Distribution

List of LDC(s) which are not required to be involved in further regional planning phases:

- N/A

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1. INTRODUCTION

The second cycle of the Regional Planning process for the Sudbury Algoma Region was completed in December 2020 with the publication of the Sudbury Algoma Regional Infrastructure Plan (RIP). The RIP report included a common discussion of all the options and recommended plans for preferred wire infrastructure investments to address the near- and medium-term needs.

This Needs Assessment initiates the third regional planning cycle for the Sudbury Algoma Region. The purpose of this Needs Assessment ("NA") is to:

a) Identify any new needs and reaffirm needs identified in the previous regional planning cycle; and,
b) Recommend which needs:
   i) require further assessment and regional coordination to develop a preferred plan (and hence, proceed to the next phases of regional planning); and,
   ii) do not require further regional coordination (i.e., can be addressed directly between Hydro One and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

The planning horizon for this NA assessment is ten years. A flow chart of the Regional Planning Process is shown in Figure 1 below.

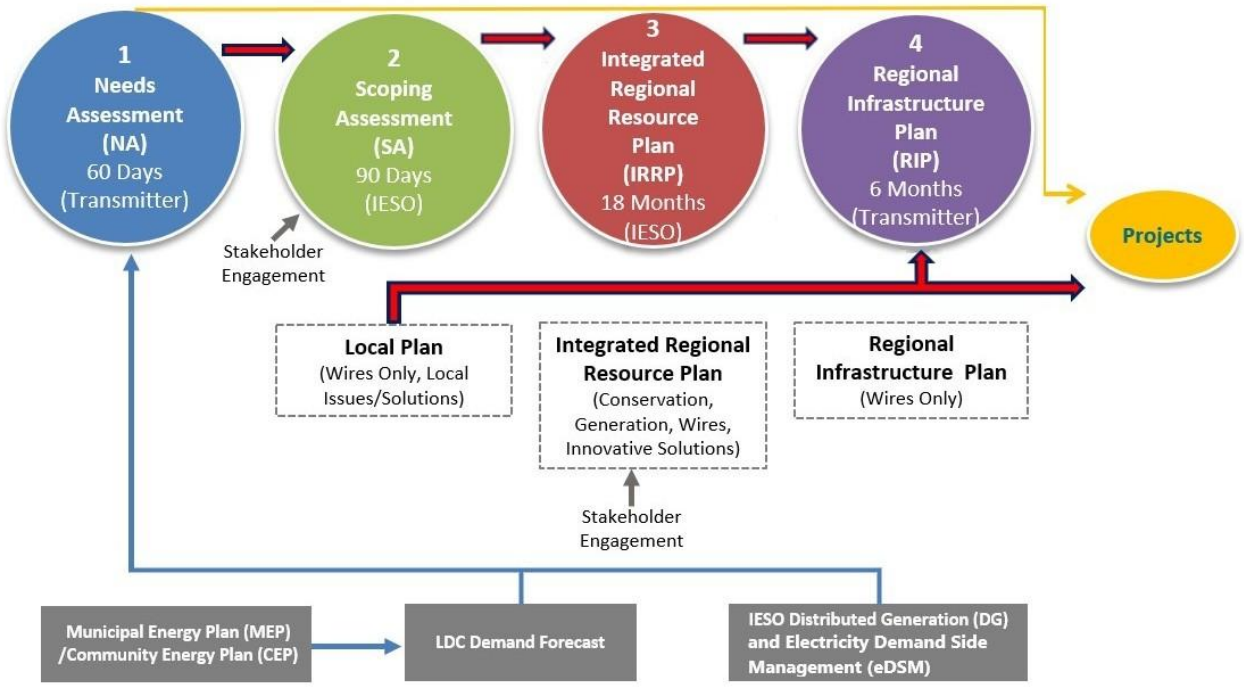


Figure 1: Regional Planning Process

This report was prepared by the Sudbury Algoma Technical Working Group ("TWG"), led by Hydro One Networks Inc. The report presents the results of the assessment based on information provided by the Hydro One, the Local Distribution Companies ("LDC") and the Independent Electricity System Operator ("IESO"). Participants of the TWG are listed below in Table 1.

Table 1: Sudbury Algoma Region TWG Participants

Sr. no.	Name of TWG Participants
1	Independent Electricity System Operator (IESO)
2	Hydro One Networks Inc. (Transmission & Distribution)
3	Greater Sudbury Hydro
4	North Bay Hydro (Embedded LDC)

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. As such, the 3rd Regional Planning cycle was triggered for the Sudbury Algoma region.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the Sudbury Algoma region and includes:

- Review and reaffirm needs/plans identified in the previous cycle RIP (as applicable),
- Identify any new needs resulting from this assessment,
- Recommend which need(s) require further assessment and regional coordination in the next phases of the regional planning cycle to develop a preferred plan; and,
- Recommend which needs do not require further regional coordination (i.e., can be addressed directly between Hydro One and the impacted LDC(s) to develop a preferred plan and/or no regional investment is required at this time and the need may be reviewed during the next regional planning cycle).

The Technical Working Group TWG may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP"), Local plan (LP) and RIP, based on updated information available at that time.

The planning horizon for this NA assessment is 10 years.

4. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

Electrical supply to the Sudbury Algoma Region is provided through a network of 230kV and 115kV transmission circuits supplied by autotransformers at Hanmer TS, Algoma TS and Martindale TS. This area is further reinforced through the 500kV circuits (P502X and X504/503E) connecting Hanmer TS (Sudbury) to both Porcupine TS (Timmins) and Essa TS (Barrie). It is also connected to Northwest Ontario through Mississagi TS.

The geographical boundaries of the Sudbury Algoma region are shown in Figure 2 below.

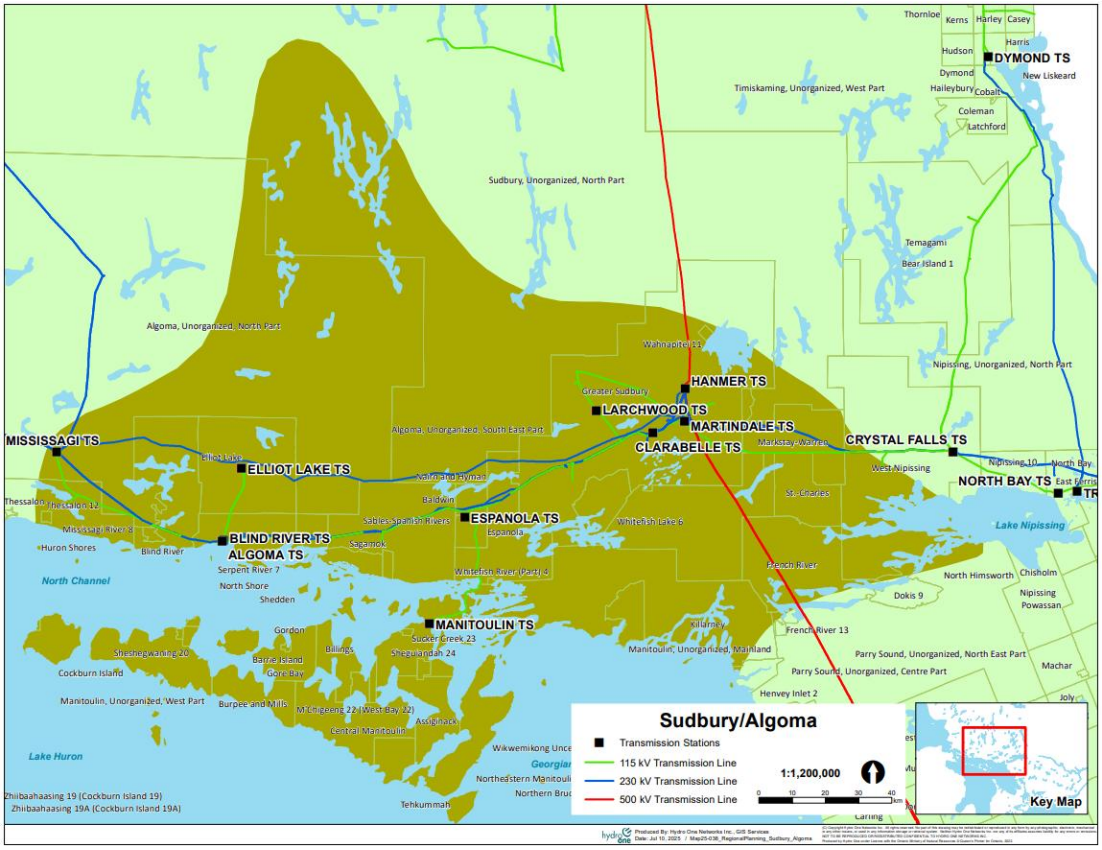


Figure 2: Map of Sudbury Algoma Regional Planning Area

The circuits and stations of the area are summarized in Table 2 below:

Table 2: Transmission Stations and Circuits in the Sudbury Algoma Region

115kV circuits	230kV circuits	Hydro One Transformer Stations	Generation Stations
• S6F • S5M • S2B • B4B • T1B • B3E • B4E • L1S	• X74P • X27A • A23P • A24P • X23N • S21N • X25S • X26S • X29S • S22A	• Algoma TS* • Martindale TS* • Hanmer TS* • Clarabelle TS • Elliot Lake TS • Espanola TS • Larchwood TS • Manitoulin TS • Mississagi TS	• Red Rock GS • Rayner GS • McLean Mountain WGS • Aux Sable GS • Serpent River CGS

*Stations with autotransformers installed

The single line diagram of the Transmission Network of Sudbury Algoma region is shown in Figure 3 below.

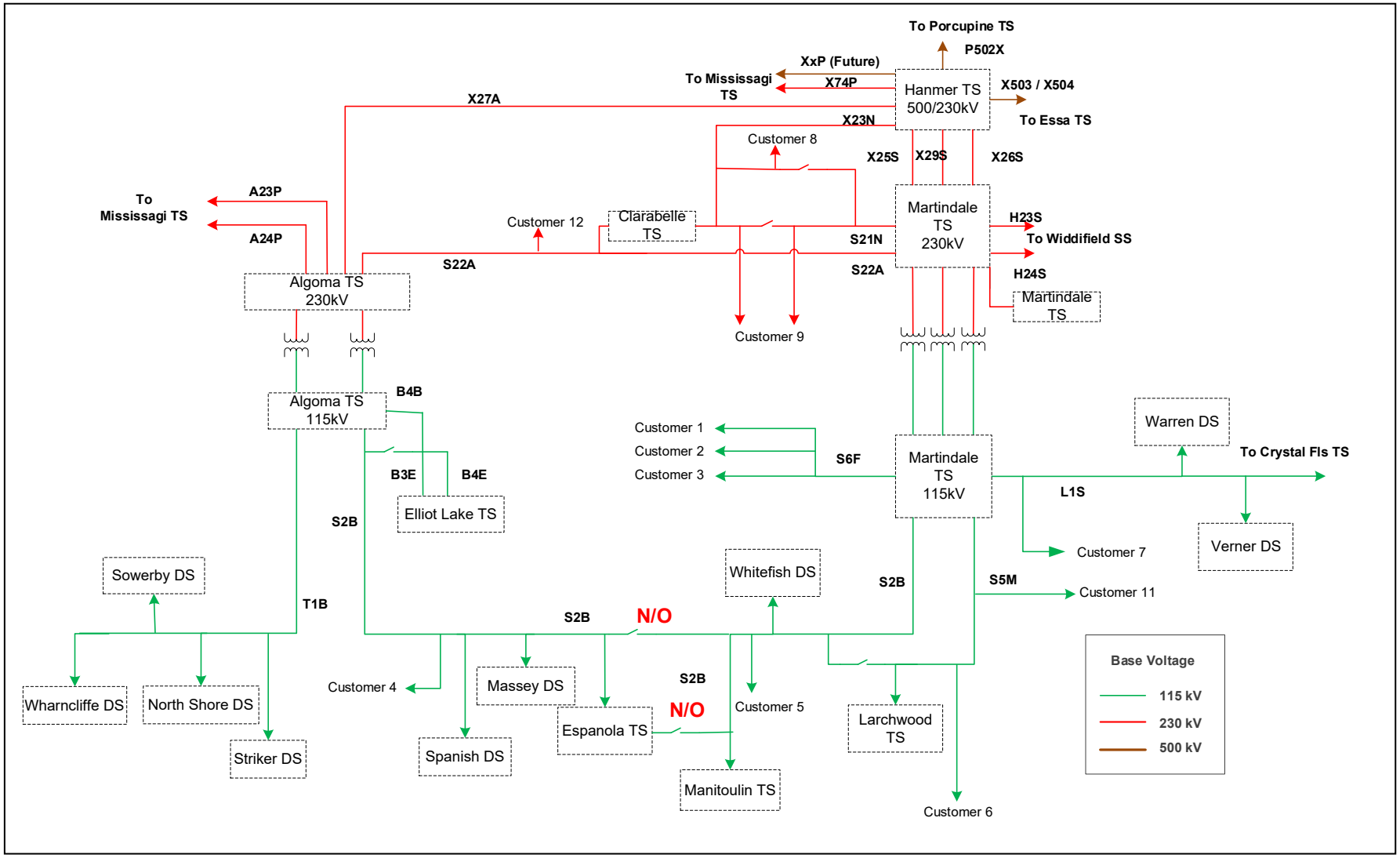


Figure 3: Sudbury Algoma Transmission Single Line Diagram

5. INPUTS AND DATA

TWG participants, including representatives from LDCs, IESO, and Hydro One provided information and input for the **Sudbury Algoma NA**. With respect to the load forecast information, the OEB Regional Planning Process Advisory Group (RPPAG) recently published a document called "Load Forecast Guideline for Ontario" in Oct. 2022. The objective of this document is to provide guidance to the TWG in the development of the load forecasts used in the various phases of the regional planning process with a focus on the NA and the IRRP. The list of all the Municipalities falling under the geographical boundaries of the region is given in Appendix-E.

The information provided includes the following:

- **Sudbury Algoma** 10-year summer and winter Load Forecasts for all supply stations inclusive of the inputs provided by the municipalities (e.g. through their MEPs & CEPs).
- Known capacity and reliability needs, operating issues, and/or major assets requiring replacement/ refurbishment.
- Planned/foreseen transmission and distribution investments that are relevant to Regional Planning for the **Sudbury Algoma region**.
- Captured uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments.

6. ASSESSMENT METHODOLOGY

The following methodology and assumptions are made in development of this Needs Assessment:

6.1 Technical Assessments and Study Assumptions

The technical assessment of needs was undertaken based on:

- Current and future station capacity and transmission adequacy.
- System reliability and operational considerations.
- Asset renewal for major high voltage transmission equipment requiring replacement with consideration to "right-sizing".
- Load forecast data requested from industrial customers in the region.
- This assessment is based on both summer and winter peak loads. Three load forecasts were developed, i.e. Normal Growth scenario, High and Low Growth scenarios. The High and Low Growth scenarios were developed to conduct a sensitivity analysis to cover unforeseen developments such as fuel switching, Government policies, higher than expected EV charging trend during peak load conditions, etc.
- Consideration of existing or planned distributed energy resources.

The following other assumptions are made in this report.

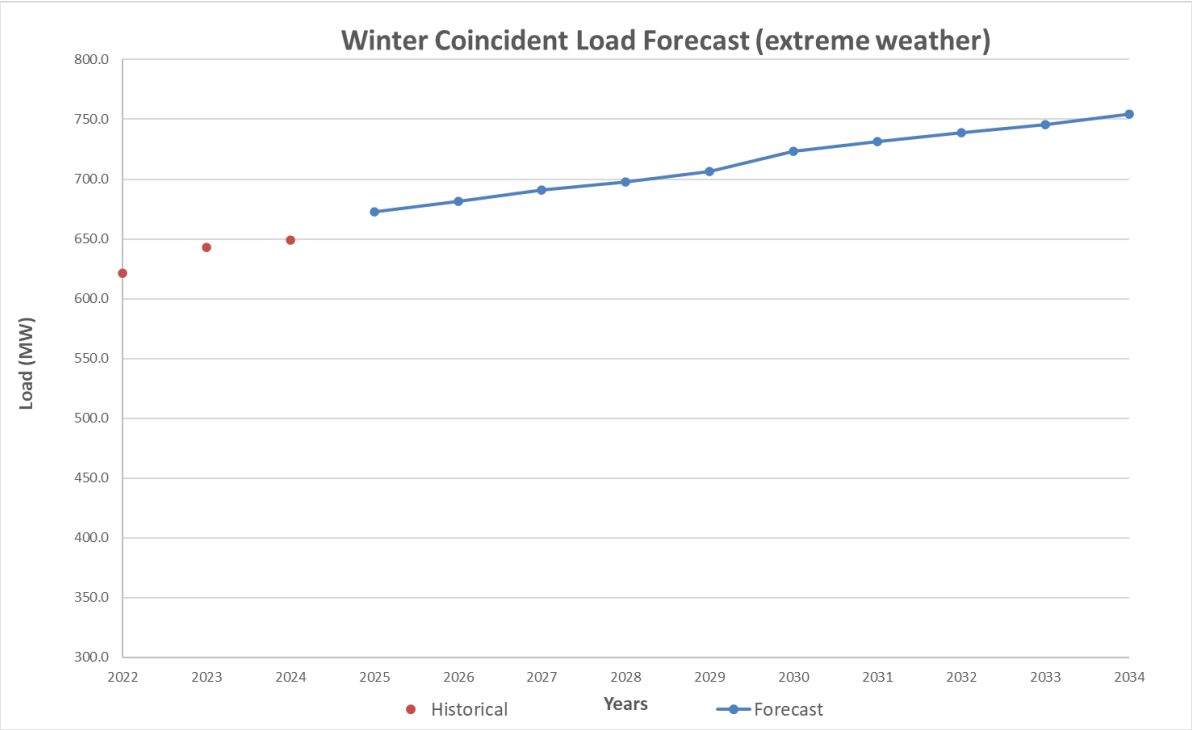
- The study period for this Needs Assessment is 2025-2034.
- While the Region is currently winter peaking, this assessment covers both summer and winter peak loads in the area.
- Line capacity adequacy is assessed by using coincidence peak loads in the area.
- Station capacity adequacy is assessed by comparing the non-coincident peak load with the station's normal planning supply capacity, assuming a 90% lagging power factor for stations having no low-voltage capacitor banks and 95% lagging power factor for stations having low-voltage capacitor banks.
- Normal planning supply capacity for transformer stations is determined by the Hydro One summer and winter 10-Day Limited Time Rating (LTR) of a single transformer at that station.
- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC).

6.2 Information Gathering Process

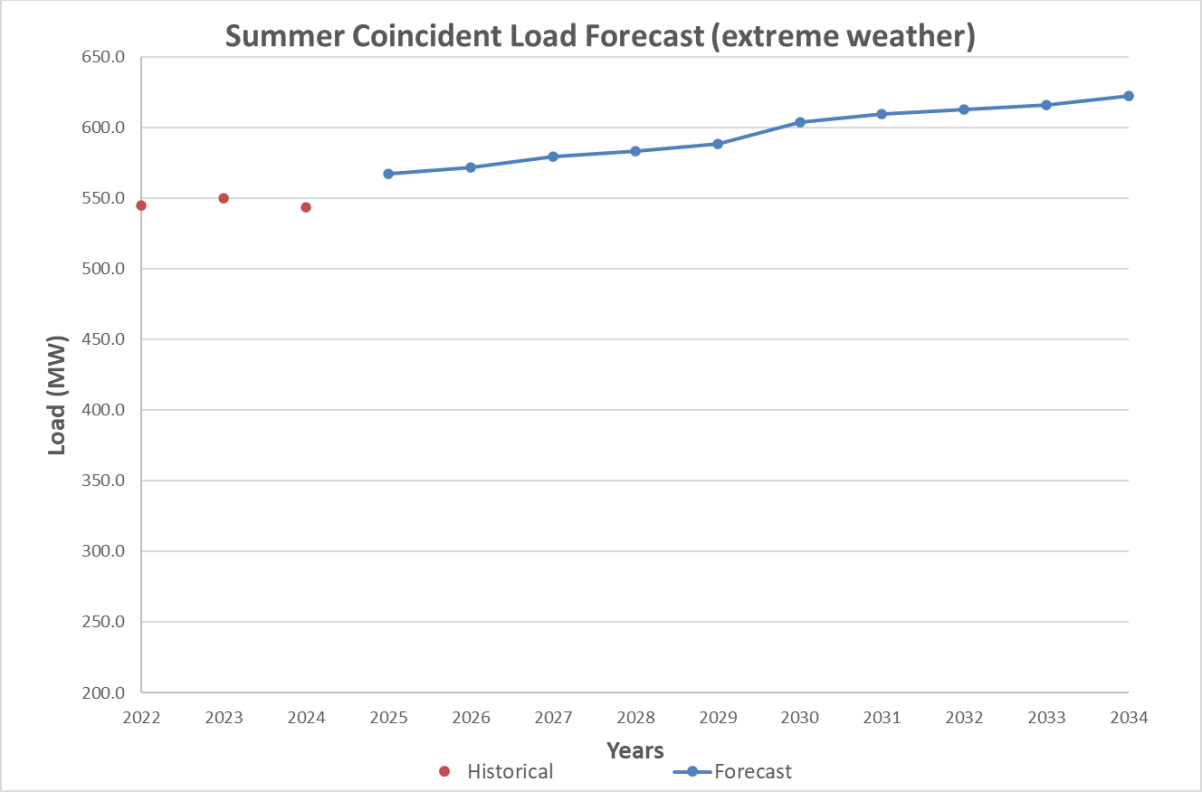
6.2.1. Load forecast:

The LDCs provided their load forecasts for summer and winter for all the stations supplying their loads in the Sudbury Algoma region for the 10-year study period including the inputs from the Municipalities such as MEPs and CEPs. The IESO provided an Electricity Demand Side Management ("eDSM"), and Distributed Generation ("DG") forecast for the Sudbury Algoma region. The region's extreme summer and winter non-coincident peak gross load forecasts for each station were prepared by applying the LDC load forecast growth rates to the actual 2024 summer peak extreme weather corrected loads. The extreme summer and winter weather correction factors were provided by Hydro One. The net extreme summer weather load forecasts were produced by reducing the gross load forecasts for each station by the percentage CDM and by the amount of effective DG capacity provided by the IESO for that station. It is to be noted that as contracts for existing DG resources in the region begin to expire, at which point the load forecast has a decreasing contribution from local DG resources, and an increase in net demand. This extreme summer and winter weather corrected net load forecast for the individual stations in the Sudbury Algoma region is given in Appendix A. Note, the industrial loads have not been shown in the tables in Appendix A. The winter and summer coincident load forecast are shown in graphs below, which include industrial loads in the region. The Sudbury Algoma region is winter peaking and the winter coincident load is expected to grow from 650 MW in 2024 to 755 MW by 2034. The summer coincident peak load is expected to grow from 543 MW in 2024 to 623 MW by 2034. Graphs 1 and 2 show the winter and summer coincident load forecasts over the study period.

Graph 1: Winter Coincident Forecast in Sudbury Algoma Region



Graph 2: Summer Coincident Forecast in Sudbury Algoma Region



6.2.2. Sensitivity Analysis:

A sensitivity analysis was undertaken by the TWG to capture uncertainty in the load forecast as well as variability of drivers such as electrification. Hence, the NA recommendations are not necessarily linked to sensitivity scenarios; but rather are used to identify any emerging needs for consideration in developing recommendations. The impact of sensitivity analysis on the high growth scenarios is provided in section 8 of this report.

6.2.3. Asset Renewal Needs for Major HV Equipment:

List of major HV transmission equipment planned and/or identified to be refurbished and/or replaced based on asset condition assessment, relevant for Regional Planning purposes. This includes HV transformers, autotransformers, HV Breakers, HV underground cables and overhead lines. The scope of equipment considered is given in section 7.1.

6.2.4. System Reliability and Operational Issues:

Relevant information regarding system reliability and operational issues in the region as feedback provided by the IESO and Hydro One Operation teams during the NA phase.

7. NEEDS

This section describes emerging needs identified in the Sudbury Algoma Region and/or updates on previously identified needs since the completion of the previous Regional Planning cycle.

Needs that were identified in the previous regional planning cycle with associated projects that were recently completed and reaffirmed needs that are underway are briefly described below with relevant updates and will not be discussed further in this report.

1. **Algoma TS - 230/115kV Autotransformer Replacement:** Replaced T5 and T6 autotransformers with new 230/115kV, 125 MVA transformers. The new replacement units have Under Load Tap Changer (ULTCs) for better operational flexibility. New T5 was placed in-service in 2021 and updated nomenclature to T7. New T6 was placed in-service in 2025 and updated nomenclature to T8.
2. **Clarabelle TS - 230/44kV Step-down transformer replacement:** The replacement of 230/44kV, 125 MVA step-down transformers T1 and T2 has been deferred to late 2030s based on their recent condition assessment.
3. **Coniston TS – Station Decommissioning:** The decommissioning of Coniston TS was completed in 2021.
4. **Elliot Lake TS – Station Refurbishment:** Right sizing the station by replacing EOL 115/44 kV, 42 MVA (T1) autotransformer with new 115/44kV 42 MVA unit and removal of autotransformer T2. Upon completion of this project, the station will remain with 2 – 115/44kV 42 MVA (T1/T3) auto transformers and a DESN. The project is expected to be completed in 2026.
5. **Hanmer TS to Martindale TS corridor unbundling:** Circuit X25S was unbundled and new circuit X29S was connected to the terminal stations. The project was completed in 2023.

6. **Martindale TS – 230/115kV Autotransformer Replacement:** Autotransformers T21 and T23 were replaced with 125 MVA unit in 2018.
7. **Martindale TS – 230/44kV Step-down transformer Replacement:** Transformers T25 and T26 were also identified for replacement in the previous regional planning cycle based on asset condition with planned completion in 2028. However, based on recent condition assessment the replacement of the transformers has been deferred to 2032.

Note: The planned in-service year for the above projects is tentative and is subject to change.

All near and mid-term needs that are discussed as part of this report are summarized in Table 3 below.

Table 3: Near/Mid-term Needs Identified in this NA and/or Updated from Previous RIP

Need Location	Need Description/Update
Asset Renewal Needs	
Martindale TS 230/44 kV step-down transformers (T25 & T26)	Transformers T25 and T26 are approaching EOL based on their condition assessment. The transformers are planned for like-for-like replacement in 2032.
Station Capacity Needs	
Martindale TS 230/44 kV step-down transformers (T25 & T26)	The load exceeds the 10-day LTR rating of the transformers based on winter demand forecast at the station by 2034.
Martindale TS 230/115 kV Autotransformers (T21, T22, & T23)	With one autotransformer out-of-service and subsequent failure of another unit, the third autotransformer will exceed its winter 10-day LTR. The Martindale TS autotransformers supply the local 115 kV system serving LDCs and industrial customers. Based on the winter coincident forecast, this need is expected to materialize in 2030.
Transmission Line Capacity Needs	
None Identified	None Identified
Voltage Performance	
Manitoulin TS 115 kV voltage	The 115 kV bus at Manitoulin TS experiences low voltage under peak demand conditions at the station.
System Reliability, Operation and Load restoration Needs	
None Identified	None Identified

7.1 Asset Renewal Needs for Major HV Transmission Equipment

Apart from the asset renewal needs identified during the second regional planning cycle, Hydro One and the TWG did not identify any new asset renewal requirements for major high-voltage transmission equipment over the next 10 years in the **Sudbury Algoma Region**. Hydro One remains the sole Transmission Asset Owner (TAO) in the Region.

Asset renewal needs are determined by asset condition assessment. Asset condition assessment is based on a range of considerations such as:

- Equipment deterioration due to aging infrastructure or other factors,
- Technical obsolescence due to outdated design,
- Lack of spare parts availability or manufacturer support, and/or
- Potential health and safety hazards, etc.

The major high voltage equipment information shared and discussed as part of this process is listed below:

- 230/115kV autotransformers
- 230 and 115kV load serving step down transformers
- 230 and 115kV breakers where:
  replacement of six breakers or more than 50% of station breakers, the lesser of the two
- 230 and 115kV transmission lines requiring refurbishment where:
  Leave to Construct (i.e., section 92) approval is required for any alternative to like-for-like
- 230 and 115kV underground cable requiring replacement where:
  Leave to Construct (i.e., section 92) approval is required for any alternative to like-for-like

The asset renewal assessment considers the following options for “right sizing” the equipment:

- Maintaining the status quo
- Replacing equipment with similar equipment with *lower* ratings and built to current standards
- Replacing equipment with similar equipment with *lower* ratings and built to current standards by transferring some load to other existing facilities
- Eliminating equipment by transferring all the load to other existing facilities
- Replacing equipment with similar equipment and built to current standards (i.e., “like-for-like” replacement)
- Replacing equipment with higher ratings and built to current standards

From Hydro One’s perspective as a facility owner and operator of its transmission equipment, doing nothing is generally not an option for major HV equipment due to safety and reliability risk of equipment failure. This also results in increased maintenance costs and longer duration of customer outages.

Table 4: Major HV Transmission Assets Requiring Replacement in Sudbury Algoma Region

Station/Circuit	Need Description	Planned ISD
Martindale TS	Existing T25 and T26 are 230/44 kV, 125 MVA step-down transformers at Martindale TS. These are the largest standard 230/44 kV units in Hydro One fleet. As per recent condition assessment, the units are approaching EOL. and need replacement. The transformers are currently planned for like-for-like replacement.	**2032**

7.2 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2025-2034 for the 230kV and 115kV Transforming stations in the **Sudbury Algoma** Region using the summer and winter peak load forecasts that were provided by the Technical Working Group. Based on the results, the following Station capacity needs have been identified during the study period:

7.2.1 Martindale TS (T25/T26)

T25 and T26 are 230/44 kV, 125 MVA step-down transformers supplying the DESN load at Martindale TS. For each season, the supply capacity of the DESN is determined by the winter and summer 10-day LTR of the most limiting transformer. The load at the DESN was expected to exceed its winter 10-day LTR of 164 MW by 2028 in the previous regional planning cycle. However, based on the latest load forecast developed in this Needs Assessment, the peak winter load is expected to exceed the winter 10-day LTR by 2034. The peak summer load at the station is lower and well within the summer 10-day LTR of the transformers.

It is recommended that the capacity need of the step-down transformers be studied in the next phase of regional planning. Note, the capacity need of T25/T26 may be impacted by the asset renewal need of the same units if the 10-day LTR of the future units is greater than existing values.

7.2.2 Martindale TS (T21/T22/T23)

T21, T22 and T23 are 230/115 kV, 125 MVA autotransformers responsible for supplying the local 115 kV system which serves LDCs and industrial customers via 115 kV circuits. Under peak winter coincident load, the loss of two autotransformers will result in marginally overloading the third autotransformer above its 10-day LTR of 173 MW. This overload is expected to materialize in 2030 for transformer T23 with the least LTR (173 MW). The overload will be experienced on the other two units by 2034.

Similarly, autotransformer T22 reaches its 10-day LTR under a breaker fail contingency at Martindale TS which results in simultaneous loss of autotransformers T21 and T23. The 10-day LTR of T22 is slightly higher at 178 MW and the need is expected to materialize in 2034.

It is recommended that the capacity need of the autotransformers be further studied in the next phase of regional planning.

7.3 Transmission Lines Capacity Needs

All line and equipment loads shall be within their continuous ratings with all elements in service and within their long-term emergency ratings with any one element out of service. Immediately following contingencies, lines may be loaded up to their short-term emergency ratings where control actions such as re-dispatch, switching, etc. are available to reduce the loading to the long-term emergency ratings.

A Transmission Lines Capacity Assessment was performed over the study period 2025-2034 for the 230kV and 115kV Transmission line circuits in the **Sudbury Algoma** Region by assessing thermal limits of the circuit and the voltage range as per ORTAC to cater this need. Based on the results, in the Sudbury Algoma region there are no transmission lines capacity needs.

7.4 Voltage Performance

Voltage performance was assessed for the Sudbury Algoma region for all elements in-service and post system contingencies.

7.4.1 Manitoulin TS

The 115 kV bus experiences low voltage under peak load conditions at Manitoulin TS. Under system conditions when Mclean Mountain wind farm is unavailable and peak load conditions at Manitoulin TS, the 115 kV bus at the station is below the ORTAC limit of 113 kV. The ULTCs of the step-down transformers have a wide range and are able to maintain the 44 kV bus voltage within the ORTAC limits. This need was reaffirmed in the previous regional planning cycle. No mitigation was recommended since there was no material impact to customers connected on the 44 kV bus. Hydro One has monitored and will continue to monitor the performance of the 115 kV and 44 kV buses at the station.

It is recognized that voltage violation at Manitoulin TS 115 kV bus has no material impact to connected customers. Though mitigation is not necessary, the TWG recommends exploring potential wires and non-wires solutions in the next phase of regional planning that can also alleviate other needs in the region.

7.5 System Reliability, Operation and Restoration Needs

The transmission system must be planned to satisfy demand levels up to the extreme weather, median-economic forecast for an extended period with any one transmission element out of service. This section assesses the Load Security and Load Restoration criteria for the region over the study period.

7.5.1 Load Security

As per ORTAC load security criteria:

Criteria 1: With all transmission facilities in service, equipment loading must be within continuous ratings, voltages must be within normal ranges and transfers must be within applicable normal condition stability limits. This must be satisfied coincident with an outage to the largest local generation unit.

Low voltage is observed on the 115 kV bus at Manitoulin TS under peak load conditions as described in the needs above.

An outage of the largest generator in the region, Rayner G1/G2, resulted in all equipment loading to be within continuous rating and voltages to be in normal ranges.

Criteria 2: With any one element out of service, equipment loading must be within applicable long-term emergency ratings, voltages must be within applicable emergency ranges, and transfers must be within applicable normal condition stability limits. Planned load curtailment or load rejection, excluding voluntary demand management, is permissible only to account for local generation outages. Not more than 150 MW of load may be interrupted by configuration and by planned load curtailment or load rejection, excluding voluntary demand management.

For all n-1 contingencies in the Sudbury Algoma region, this criterion is satisfied.

Criteria 3: With any two elements out of service, voltages must be within applicable emergency ranges, equipment loading must be within applicable short-term emergency ratings and transfers must be within applicable emergency condition stability limits. Equipment loading must be reduced to the applicable long-term emergency ratings in the time afforded by the short-time ratings. Planned load curtailment or load rejection exceeding 150 MW is permissible only to account for local generation outages. Not more than 600 MW of load may be interrupted by configuration and by planned load curtailment or load rejection, excluding voluntary demand management.

Martindale TS autotransformers:

- If an autotransformer experiences unplanned outage at Martindale TS, the operating practice is to transfer load to another station to prepare for the loss of another autotransformer. This is achieved by transferring Martindale TS supplied section of circuit S2B to Algoma TS. The load transfer will prevent the remaining autotransformer from exceeding its 10-day LTR should a second autotransformer fail.
- Planned outages of autotransformers are scheduled during off peak seasons when the load in the 115 kV subsystem is low. Additionally, Martindale supplied section of circuit S2B is transferred to Algoma, if necessary. The low loading on 115 kV subsystem and/or load transfer will prevent the remaining autotransformer from exceeding its 10-day LTR should an autotransformer fail.
- Under the breaker fail contingency described in section 7.2.2, the breaker in question is equipped with motor operated disconnect switches. Hydro One control room can isolate the breaker by opening the motor operated disconnect switches and re-energizing the autotransformers within the time afforded by the short-term rating of the units.

This criterion is satisfied with any two elements out of service in the Sudbury Algoma region.

7.5.2 Load Restoration

The transmission system is planned with design criteria in a way to ensure that the affected loads can be restored within restoration time provided.

- All loads must be restored within approximately 8 hours.
- Load interruption greater than 150 MW, the excess amount of load greater than 150 MW needs to be restored within approximately 4 hours.
- Load interruption greater than 250 MW, the excess amount of load greater than 250 MW needs to be restored within approximately 30 minutes.

In the Sudbury Algoma region, there are radial circuits and loads that are supplied by single transformers, with limited transfer capability. Planned outages are taken by transferring load (where possible) and in coordination with any impacted customers. Unplanned outages may require investigation by operators and field crews to identify and replace faulted equipment in the system to restore power to impacted customers. Though there can be instances where load may not be restored within 8 hours as per ORTAC, all reasonable efforts are made to achieve the criterion.

8. SENSITIVITY ANALYSIS

The objective of a sensitivity analysis is to capture uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments. The TWG determined that the key electric demand driver in the Sudbury Algoma region to be considered in this sensitivity analysis is electric vehicle (EV) penetration and unforeseen electrification which would cause the load to increase at a faster rate than shown in the forecast; or the potential delay in some projects which could result in less demand than anticipated.

The TWG reviewed any unforeseen electrification needs to develop high demand growth forecasts by applying 50% additional growth to the growth rate on the extreme summer and winter load forecast for all LDC serving stations. A 75% additional growth was used for Martindale TS and Clarabelle TS to reflect greater interest in connecting to these stations from proponents. Industrial customer load was not increased. Instead, a fictitious new load of 40 MW was connected to the 115 kV system at Martindale TS, and another 40 MW load was connected to 115 kV circuit S2B emanating from Algoma TS.

No new needs were identified as part of the sensitivity analysis. Table 5 below lists the impact on capacity needs at Martindale TS. Note, it is understood that adding the 40 MW load on section of S2B supplied by Martindale TS would exacerbate the existing voltage concerns at Manitoulin TS 115 kV bus and was not discussed further.

Table 5: Impact of Sensitivity Analysis on Needs in the region

#	Need Identified	Winter Growth Scenario	
		Normal Growth Scenario	High Growth Scenario
1	**Martindale TS 230/44 Step-down Transformer overload**	2034	2030
2	**Martindale TS 230/115 Autotransformer overload**	2030	Imminent

9. CONCLUSION AND RECOMMENDATION

The Technical Working Group's recommendations to address the needs identified are as follows:

Table 7: Needs that Do Not Require Further Regional Coordination

#	Need Location	Need Description
1	**Martindale TS 230/44 kV step-down transformers (T25 & T26)**	Asset Renewal Need: T25 and T26 are approaching End of Life (EOL) based on their condition assessment. The transformers are planned for like-for-like replacement in 2032.

Table 8: Needs that Require Further Regional Coordination

#	Need Location	Need Description
1	**Martindale TS 230/44 kV step-down transformers (T25 & T26)**	Capacity Need: The load exceeds the 10-day LTR of the step-down transformers, T25 and T26, based on winter demand forecast at the station by 2034.
2	**Martindale TS 230/115 kV Autotransformers (T21, T22, & T23)**	Capacity Need: With one autotransformer out-of-service and subsequent failure of another unit, the third autotransformer will exceed its winter 10-day LTR. The Martindale TS autotransformers supply the local 115 kV system serving LDCs and industrial customers. Based on the winter coincident forecast, this need is expected to materialize in 2030.
3	**Manitoulin TS 115 kV Voltage**	Voltage violation: The 115 kV bus at Manitoulin TS experiences low voltage under peak demand conditions at the station.

List of LDC(s) to be involved in further regional planning phases:

- Greater Sudbury Hydro
- North Bay Hydro (Embedded LDC)
- Hydro One Distribution

List of LDC(s) which are not required to be involved in further regional planning phases:

- N/A

10. REFERENCES

[1] Independent Electricity System Operator, Ontario Resource and Transmission Assessment Criteria (issue 5.0 August 22, 2007)

[2] Ontario Energy Board, Transmission System Code (issue July 14, 2000 rev. March 21, 2025)

[3] Ontario Energy Board, Distribution system Code (issue July 14, 2000 rev. September 16, 2025)

[4] Ontario Energy Board, Load Forecast Guideline for Ontario (issue October 13, 2022)

Appendix A: Extreme Summer/Winter Weather Adjusted Net Load Forecast

Table A.1:

Sudbury Algoma Region – Non-Coincident Summer Extreme Weather Net Load Forecast (MW)

Station	DESN ID	LTR (MW)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Clarabelle TS	T1/T2	169.8	106.4	107.0	107.5	108.1	108.7	109.2	109.7	110.4	111.0	111.7
Elliot Lake TS	T1/T3	38.2	13.7	13.8	13.8	13.8	13.8	13.8	13.8	13.9	13.9	14.0
Espanola TS	T1/T2	53.3	9.6	9.7	9.7	9.7	9.7	9.8	9.8	9.8	9.8	9.9
Larchwood TS	T2	50.1	10.7	10.8	10.8	10.9	11.0	11.0	11.1	11.2	11.2	11.3
Manitoulin TS	T3/T4	41.1	24.9	25.2	25.3	25.5	25.7	26.1	26.3	26.9	27.1	27.3
Martindale TS	T25/T26	151.8	116.4	118.1	122.0	123.6	125.2	126.6	128.1	129.7	131.2	135.0
Massey DS	T1	6.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.9
North Shore DS	T1	8.4	5.6	5.6	5.6	5.7	5.7	6.4	6.4	6.5	6.5	7.0
Sowerby DS	T1	6.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Spanish DS	T1	8.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Striker DS	T1/T2	8.4	4.9	5.0	5.0	5.0	5.0	5.1	5.1	5.1	5.1	5.2
Verner DS	T1/T2	8.4	4.7	4.7	4.7	4.7	4.7	4.8	4.8	4.8	4.8	4.9
Warren DS	T1/T2	8.4	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.1	6.1	6.1
Wharncliffe DS	T1/T2	8.4	3.6	3.6	3.7	3.7	3.7	3.8	3.8	3.8	3.8	3.9
Whitefish DS	T1	8.4	5.4	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.6

Table A.2:

Sudbury Algoma Region – Non-Coincident Winter Extreme Weather Net Load Forecast (MW)

Station	DESN ID	LTR (MW)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Clarabelle TS	T1/T2	184.3	123.7	125.8	127.7	129.8	131.8	133.8	135.7	137.8	139.8	141.9
Elliot Lake TS	T1/T3	41.4	17.5	17.6	17.7	17.8	17.9	18.0	18.0	18.1	18.2	18.3
Espanola TS	T1/T2	58.0	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4	12.5
Larchwood TS	T2	53.9	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.7	12.8
Manitoulin TS	T3/T4	50.0	39.3	39.7	40.1	40.6	41.0	42.2	42.6	44.3	44.8	45.3
Martindale TS	T25/T26	164.3	142.6	146.5	149.2	151.4	153.7	155.9	157.9	160.3	162.4	164.7
Massey DS	T1	8.6	6.4	6.4	6.4	6.5	6.5	6.5	6.6	6.6	6.6	6.7
North Shore DS	T1	10.8	6.1	6.2	6.3	6.3	6.4	8.5	8.6	8.6	8.7	10.3
Sowerby DS	T1	8.6	4.3	4.3	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5
Spanish DS	T1	10.8	3.9	3.9	3.9	4.0	4.0	4.0	4.1	4.1	4.1	4.2
Striker DS	T1/T2	10.8	7.1	7.2	7.3	7.3	7.4	7.4	7.5	7.5	7.6	7.7
Verner DS	T1/T2	10.8	6.5	6.5	6.6	6.6	6.7	6.7	6.8	6.9	6.9	7.0
Warren DS	T1/T2	10.8	8.0	8.1	8.1	8.2	8.3	8.3	8.4	8.5	8.6	8.6
Wharncliffe DS	T1/T2	10.8	4.5	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	5.0
Whitefish DS	T1	10.8	6.6	6.6	6.7	6.7	6.8	6.8	6.9	6.9	7.0	7.0

Table A.3:

Sudbury Algoma Region – Coincident Summer Extreme Weather Net Load Forecast (MW)

Station	DESN ID	LTR (MW)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Clarabelle TS	T1/T2	169.8	94.7	95.3	95.7	96.3	96.8	97.2	97.7	98.3	98.8	99.5
Elliot Lake TS	T1/T2	38.2	12.2	12.2	12.2	12.3	12.3	12.3	12.3	12.3	12.4	12.4
Espanola TS	T1/T2	53.3	8.7	8.8	8.8	8.8	8.8	8.9	8.9	8.9	8.9	9.0
Larchwood TS	T2	50.1	9.2	9.2	9.3	9.4	9.4	9.5	9.5	9.6	9.6	9.7
Manitoulin TS	T3/T4	41.1	23.0	23.3	23.4	23.6	23.8	23.9	24.1	24.3	24.5	24.7
Martindale TS	T25/T26	151.8	101.7	103.3	106.6	108.1	109.6	110.9	112.2	113.7	115.1	118.3
Massey DS	T1	6.8	3.4	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5
North Shore DS	T1	8.4	4.2	4.2	4.3	4.3	4.4	5.0	5.0	5.1	5.1	5.6
Sowerby DS	T1	6.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Spanish DS	T1	8.4	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9
Striker DS	T1/T2	8.4	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2
Verner DS	T1/T2	8.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.6
Warren DS	T1/T2	8.4	5.6	5.6	5.6	5.7	5.7	5.7	5.8	5.8	5.8	5.9
Wharncliffe DS	T1/T2	8.4	2.8	2.8	2.8	2.8	2.8	2.9	2.9	2.9	2.9	3.0
Whitefish DS	T1	8.4	5.0	5.0	5.1	5.1	5.1	5.1	5.1	5.1	5.2	5.2

Table A.4:

Sudbury Algoma Region – Coincident – Winter Extreme Weather Net Load Forecast (MW)

Station	DESN ID	LTR (MW)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Clarabelle TS	T1/T2	184.3	108.1	109.8	111.5	113.2	115.0	116.7	118.3	120.1	121.8	123.5
Elliot Lake TS	T1/T2	41.4	17.3	17.4	17.5	17.6	17.7	17.8	17.8	18.0	18.0	18.2
Espanola TS	T1/T2	58.0	11.9	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.4	12.5
Larchwood TS	T2	53.9	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.5	12.6
Manitoulin TS	T3/T4	50.0	37.6	38.0	38.4	38.8	39.2	39.6	40.0	40.5	40.9	41.4
Martindale TS	T25/T26	164.3	129.8	133.3	135.7	137.7	139.8	141.8	143.6	145.7	147.6	149.7
Massey DS	T1	8.6	6.2	6.2	6.2	6.3	6.3	6.3	6.4	6.4	6.4	6.5
North Shore DS	T1	10.8	2.4	2.4	2.5	2.5	2.6	4.6	4.6	4.7	4.7	6.2
Sowerby DS	T1	8.6	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2
Spanish DS	T1	10.8	3.9	3.9	3.9	3.9	4.0	4.0	4.0	4.1	4.1	4.1
Striker DS	T1/T2	10.8	7.1	7.2	7.3	7.3	7.4	7.4	7.5	7.5	7.6	7.7
Verner DS	T1/T2	10.8	6.3	6.4	6.4	6.5	6.5	6.6	6.6	6.7	6.7	6.8
Warren DS	T1/T2	10.8	8.1	8.2	8.3	8.3	8.4	8.5	8.6	8.6	8.7	8.8
Wharncliffe DS	T1/T2	10.8	3.9	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3
Whitefish DS	T1	10.8	6.2	6.3	6.3	6.3	6.4	6.4	6.5	6.5	6.6	6.6

Appendix B: Lists of Autotransformer and Step-Down Transformer Stations

No.	Transformer Station	Voltage (kV)
1	Algoma TS	230/115
2	Clarabelle TS	230/44
3	Elliot Lake TS	115/44
4	Espanola TS	115/44
5	Hamner TS	500/230
6	Larchwood TS	115/44
7	Manitoulin TS	115/44
8	Martindale TS	230/115, 230/44

Appendix C: Lists of Transmission Circuits

No.	Connecting Stations		Circuit ID	Voltage (kV)
1	Hanmer TS	Mississagi TS	X74P	230
2	Hanmer TS	Algoma TS	X27A	230
3	Algoma TS	Mississagi TS	A23P, A24P	230
4	Hanmer TS		X23N	230
5	Martindale TS		S21N	230
6	Hanmer TS	Martindale TS	X25S, X26S, X29S	230
7	Martindale TS	Algoma TS	S22A	230
8	Martindale TS		S6F	115
9	Martindale TS	Larchwood TS	S5M	115
10	Martindale TS	Algoma TS	S2B	115
11	Algoma TS	B3E Tap	B4B	115
12	Algoma TS		T1B	115
13	B4B Tap	Elliot Lake TS	B3E	115
14	B4B Tap	Elliot Lake TS	B4E	115
15	Martindale TS	Crystal Falls TS	L1S	115

Appendix D: List of LDC's

No.	Name of Municipality
1	Greater Sudbury Hydro Inc.
2	Hydro One Networks Inc. (Distribution)
3	North Bay Hydro (Embedded LDC)

Appendix E: List of Municipalities in the Sudbury Algoma Region

No.	Name of Municipality
1	City of Elliot Lake
2	Municipality of Billings
3	Municipality of Central Manitoulin
4	Municipality of French River
5	Municipality of Gordon/Barrie Island
6	Municipality of Killarney
7	Municipality of Markstay-Warren
8	Municipality of St. Charles
9	Town of Blind River
10	Town of Espanola
11	Town of Gore Bay
12	Town of Northeastern Manitoulin and The Islands
13	Township of Assiginack
14	Township of Baldwin
15	Township of Burpee & Mills
16	Township of Chapleau
17	Township of Cockburn Island
18	Township of Nairn & Hyman
19	Township of Sables Spanish Rivers
20	Township of Tehkummah

Appendix F: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CEP	Community Energy Plan
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DS	Distribution Station
GS	Generating Station
HV	High Voltage
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	kilovolt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage

Acronym	Description
MEP	Municipal Energy Plan
MTS	Municipal Transformer Station
MW	Megawatt
MVA	Mega Volt-Ampere
MVAR	Mega Volt-Ampere Reactive
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
NUG	Non-Utility Generator
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
SA	Scoping Assessment
SIA	System Impact Assessment
RAS	Remedial Action Scheme
SS	Switching Station
TS	Transformer Station