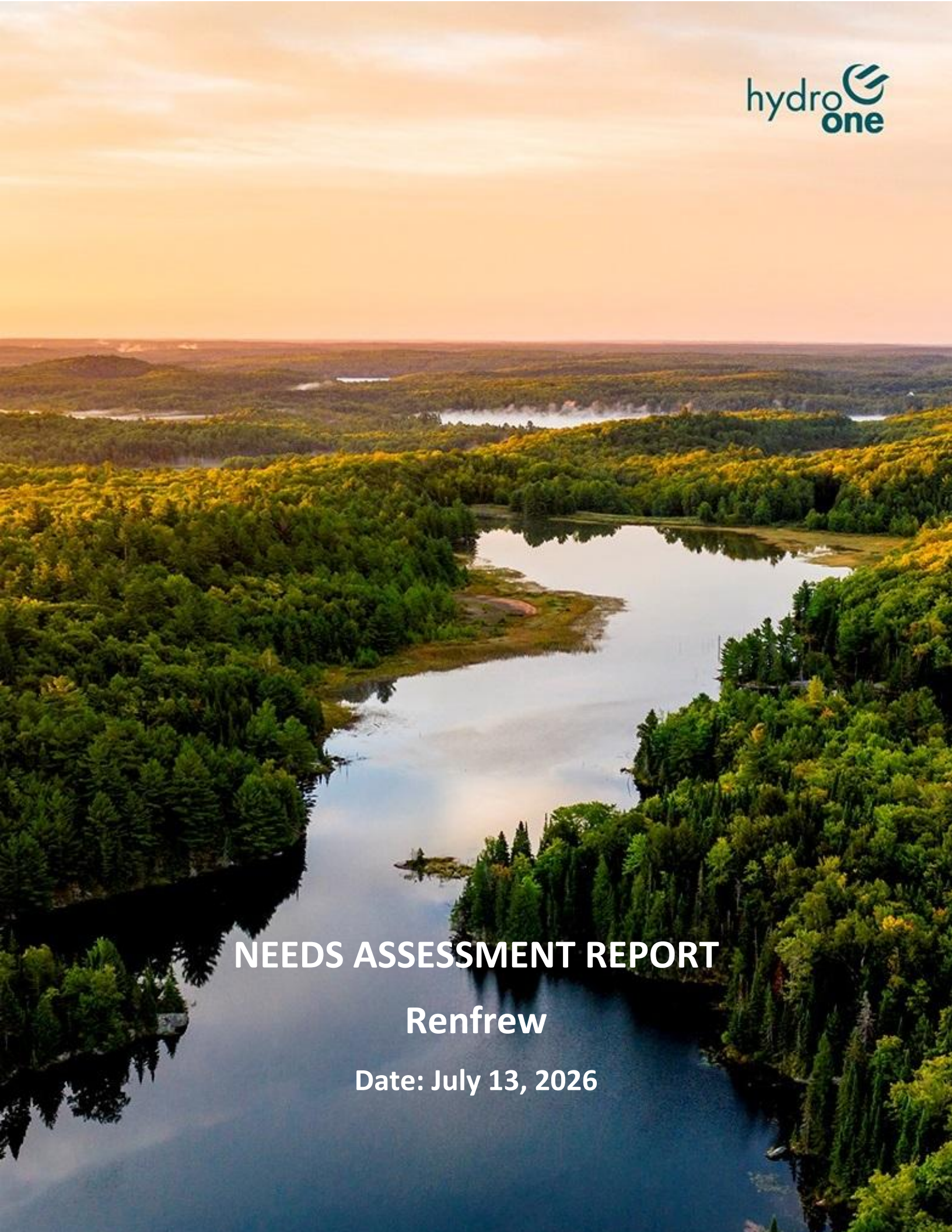

NEEDS ASSESSMENT REPORT

Renfrew

Date: July 13, 2026

Needs Assessment Report

Renfrew

Date: July 13, 2026

Lead Transmitter:

Hydro One Networks Inc.

Prepared by: Renfrew Technical Working Group

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Disclaimer

This Needs Assessment (NA) Report was prepared for the purpose of identifying potential needs in the Renfrew 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 at the time. Updates may be made based on the best available information throughout the planning process.

The TWG participants, their respective affiliated organizations, and Hydro One Networks Inc. (collectively, "the Authors") shall not, under any circumstances whatsoever, be liable to each other, to any third party for whom the Needs Assessment Report was prepared ("the Intended Third Parties") or to any other third party reading or receiving the Needs Assessment Report ("the Other Third Parties"). The Authors, Intended Third Parties and Other Third Parties acknowledge and agree that: (a) the Authors make no representations or warranties (express, implied, statutory or otherwise) as to this document or its contents, including, without limitation, the accuracy or completeness of the information therein; (b) the Authors, Intended Third Parties and Other Third Parties and their respective employees, directors and agents (the "Representatives") shall be responsible for their respective use of the document and any conclusions derived from its contents; (c) and the Authors will not be liable for any damages resulting from or in any way related to the reliance on, acceptance or use of the document or its contents by the Authors, Intended Third Parties or Other Third Parties or their respective Representatives.

Executive Summary

REGION Renfrew Region (the "Region")

LEAD Hydro One Networks Inc. ("HONI")

START DATE: May 15, 2026 **END DATE:** July 13, 2026

The second Regional Planning cycle for the Renfrew Region was completed in July 2023 with the publication of the Regional Infrastructure Plan ("RIP") report (RIP Report).

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 January 2026 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 of 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:

Table 1: Needs that Do Not Require Further Regional Coordination

#	Need Location	Need Description
Station Capacity Needs		
1	Cobden DS	Projected to reach capacity in 2029 under normal growth summer forecast and in 2028 under summer High growth scenario.

Table 2: Needs that Require Further Regional Coordination

#	Need Location	Need Description
Station Capacity Needs		
1	Cobden TS T1/T2	Projected to reach capacity in 2033 under summer High growth scenario.
Transmission Capacity Needs		
2	115 kV D6	Projected to reach capacity in 2031 under summer high growth scenario.
3	115 kV X2Y	Projected to reach capacity limits at the end of study period (2035) during X6 contingency and summer high growth scenario.
System Reliability, Operation and Load restoration Needs		
4	115 kV D6 – Voltage Performance	Voltage issues identified in 2035 for normal summer forecast and in 2031 for High growth summer forecast
5	X2Y Load Restoration	Projected to exceed thermal ratings of X2Y when complete load of Cobden TS needs to be restored under X6 contingency in 2029 under normal growth scenario and 2028 under high growth scenario.

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

- Hydro One Distribution
- Ottawa River Power Corporation (ORPC)

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

- None

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1. INTRODUCTION

The second cycle of the Regional Planning process for the Renfrew Region was completed in July 2023 with the publication of the Regional Infrastructure Plan ("RIP") Report (RIP Report). 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 Renfrew 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.

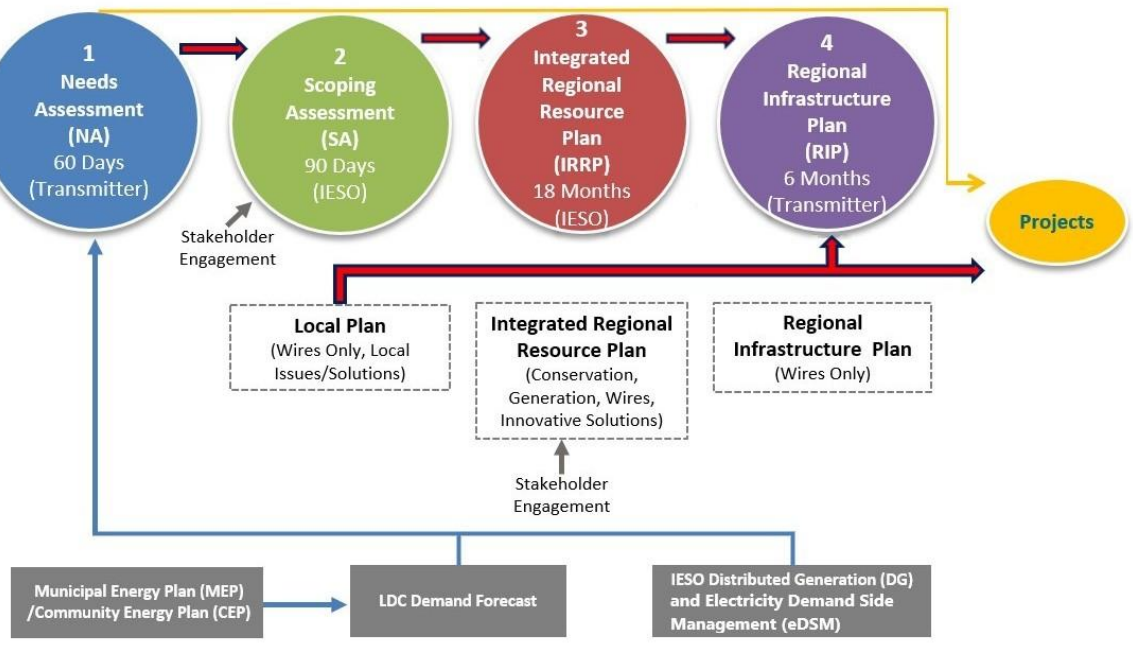


Figure 1: Regional Planning Process

This report was prepared by Renfrew 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 3.

Table 3: Renfrew Region TWG Participants

Sr. no.	Name of TWG Participants
1	Hydro One Networks Inc. (Lead Transmitter)
2	Independent Electricity System Operator (IESO)
3	Hydro One Networks Inc. (Hydro One Dx)
4	Ottawa River Power Corporation (ORPC) (embedded to Hydro One Dx)

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 Renfrew region.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the Renfrew 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

The Renfrew region is located in Eastern Ontario with the majority of the load along the Ottawa river. For electrical planning purposes this region includes eighteen municipalities including the towns of Arnprior, Deep River, Laurentian Hills, Petawawa and Renfrew. As well as the townships of Admaston/Bromley, Bonnechere Valley, Brudenell, Lyndoch and Raglan, Greater Madawaska, Head, Clara and Maria, Horton, Killaloe, Hagarty and Richards, Laurentian Valley, Madawaska Valley, McNab/Braeside, North Algona Wilberforce and Whitewater Region; as well as the City of Pembroke. The geographical boundaries of the Renfrew region are shown in Figure 2 below.

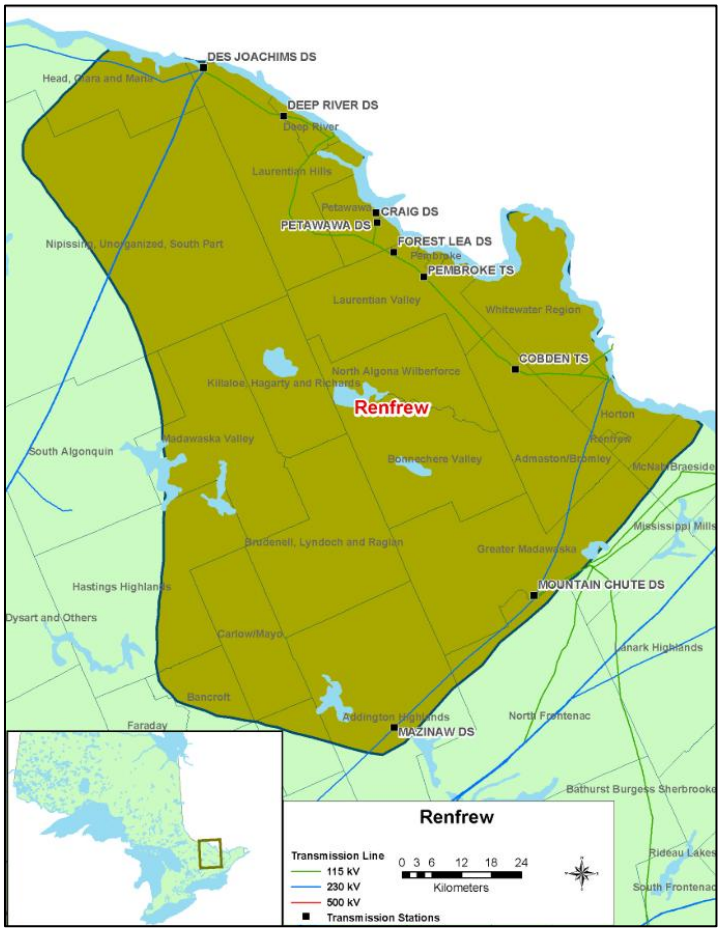


Figure 2: Map of Renfrew Regional Planning Area

The Renfrew region is located in Eastern Ontario, with most of its load concentrated along the Ottawa River. It is bounded by Des Joachims TS to the west, Chenaux TS to the east, and the 230 kV circuit X1P to the south. Electricity supply is provided through one 230 kV circuit (X1P) and three 115 kV radial circuits (D6, X6, and X2Y), with the 115 kV system fed by 230/115 kV autotransformers at Chenaux TS from the east and Des Joachims TS from the west. A normally open 115 kV switch at Pembroke TS separates the eastern and western portions of the region.

The distribution system in the Renfrew region operates at 44 kV and 12.5 kV. The main generation facilities in the area include Chenaux Generation Station (143.7 MW), Mountain Chute Generation Station (170.2 MW), and Des Joachims Generation Station (432.5 MW).

Hydro One Networks Inc. (Distribution) is the main LDC in the area. Other LDCs supplied by electrical facilities in the Renfrew region include Ottawa River Power Corporation and Renfrew Hydro Inc., both are embedded into Hydro One's distribution system. Renfrew Hydro Inc. customers are being fed from Stewartville TS, which is part of the Greater Ottawa Regional Planning. As such, Renfrew Hydro Inc. has not been included as part of this NA.

The existing facilities in the Region are summarized below and depicted in the single line diagram shown in Figure 3.

• Chenaux TS is a major 230 kV station in the region. The station has 143.7MW of hydraulic generation connected to the 230 kV bus. The station connects to the bulk system via a single 230 kV circuit X1P. Two autotransformers step down the voltage to 115 kV to supply two radial circuits X6 and X2Y.

• The 115kV circuits X6 and X2Y from Chenaux TS supply four stations: Pembroke TS, Cobden TS, Cobden DS and Customer Transformer Station (CTS-2).

• Des Joachims TS is the other major 230 kV transformer station in the Region. There are 432.5 MW of hydraulic generation connecting to the 230 kV bus. The station interconnects to the Bulk Electric System (BES) via five 230 kV circuits which are not in the scope of this regional assessment. Two autotransformers (one operates as standby) step down the voltage to 115 kV to supply one radial circuit D6.

• The 115 kV circuit D6 from Des Joachims TS 115 kV bus supplies six stations: Des Joachims Distribution Station (DS), Deep River DS, Craig DS, Forest Lea DS, Petawawa DS, and CTS-1

• Bryson GS from Hydro Quebec can be radially connected to Renfrew region via X2Y, when required.

• The 230 kV single circuit X1P from Dobbin TS to Chenaux TS connects two stations in Renfrew region: Mountain Chute GS (with hydraulic generation of 170.2 MW) and Mazinaw DS.

• Mountain Chute DS, a 115 kV station adjacent to Mountain Chute GS, is supplied by a circuit W3B from outside of the studied region.

The circuits and stations of the area are summarized in Table 4 below:

Table 4: Transmission Station and Circuits in the Renfrew Region

115kV circuits	230kV circuits	Hydro One Transformer Stations	Generation Stations
D6, X6, and X2Y	X1P	Des Joachims TS*, Des Joachims DS, Deep River DS, Chalk Craig DS, Petawawa DS, Forest Lea DS, Pembroke TS, Cobden TS, Cobden DS, Chenaux TS*, Mountain Chute DS, Mazinaw DS, CTS-1, CTS-2	Mountain Chute GS (170.2MW) Des Joachims GS (432.5MW) Chenaux GS (143.7MW)

*Stations with Autotransformers installed

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

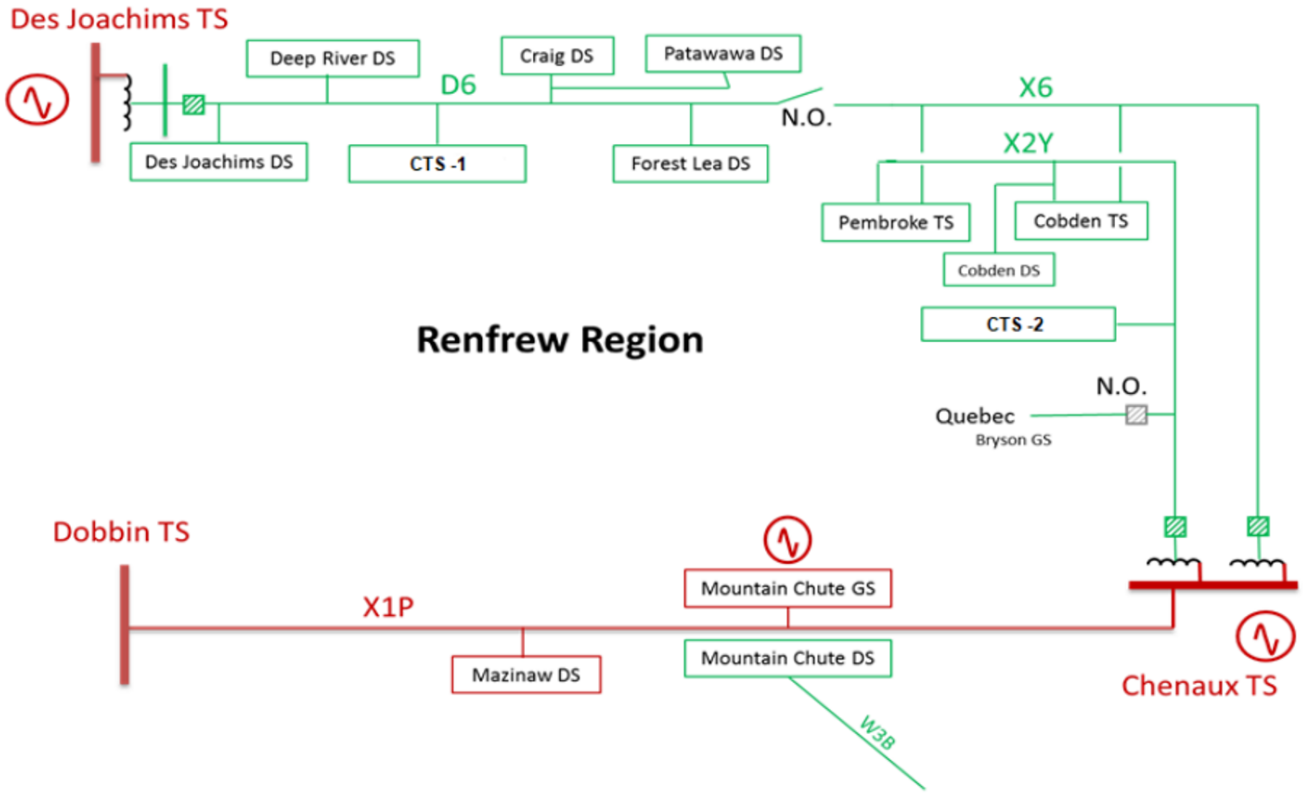


Figure 3: Renfrew Transmission Single Line Diagram

5. INPUTS AND DATA

TWG participants, including representatives from LDCs, IESO, and Hydro One provided information and input for Renfrew region 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. One of the inputs into the LDC's load forecast that is called for in this guideline is information from Municipal Energy Plans (MEP) and/or Community Energy Plans (CEP). The list of all the Municipalities falling under the geographical boundaries of the region are given in Appendix-E.

The information provided includes the following:

- Renfrew 10-year summer and winter Load Forecasts for all supply stations inclusive of inputs provided by the municipalities.

  However, sensitivity analysis is undertaken which captures uncertainties via different growth scenarios.

- Known capacity and reliability needs, operating issues, and/or major assets requiring replacement/ refurbishment; and

- Planned/foreseen transmission and distribution investments that are relevant to Regional Planning for the Renfrew.

- 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"; and,
- Load forecast data was requested from industrial customers in the region, and

- This assessment is based on summer and winter peak loads. Three 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.

The following other assumptions are made in this report.

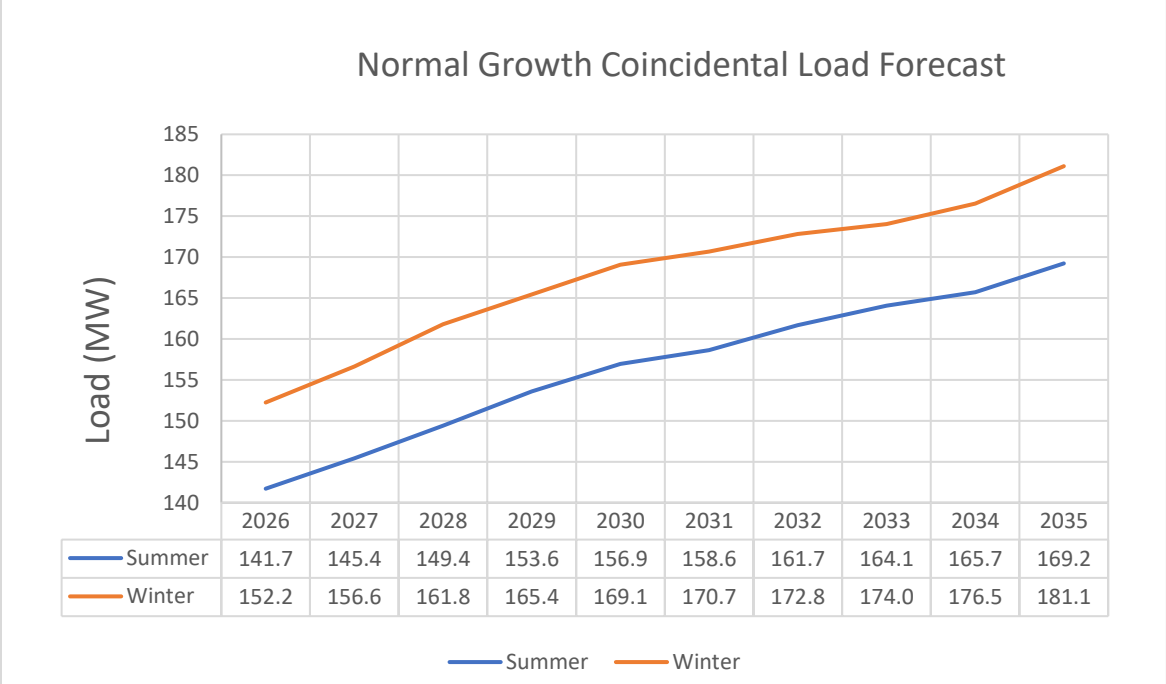
- The study period for this Needs Assessment is 2026-2035.
- The Region is winter peaking; however, system performance was assessed under both summer and winter peak load conditions, including studies for summer peak loads.
- System studies and reported results are based on N-1 (single contingency) conditions, meaning the system is assessed to remain within applicable thermal, voltage, and stability limits following the loss of any one credible transmission element, with the system otherwise in the base configuration.
- No import from Quebec from Bryson CGS.
- Transmission adequacy is assessed based on the system's ability to supply forecast coincident peak demand with all elements in service while maintaining equipment loading within continuous ratings and voltages within normal range, and with one element out of service while maintaining circuit loading within long-term emergency (LTE) ratings and transformer loading within their applicable summer 10-Day Limited Time Rating (LTR).
- 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 10-Day LTR of a single transformer at that station.
- Normal planning supply capacity for distribution stations is determined by the Hydro One summer Peak Loading Limit (PLL) at the 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 Renfrew 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 Energy Resources ("DER") forecast for the Renfrew region. The region's

extreme summer/winter coincident peak gross load forecasts for each station were prepared in accordance with the Load Forecast Guidelines published by the OEB RPPAG. The LDC load forecast growth rates were calculated (including expected growth, committed customers load etc.) and applied to the actual 2025 summer/winter peak extreme weather corrected loads. The extreme summer/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 eDSM and then by the amount of effective new DER capacity provided by the IESO for that station. It is to be noted that as contracts for existing DER resources in the region begin to expire, at which point the load forecast has a decreasing contribution from local DER resources, and an increase in net demand. This extreme summer/winter weather corrected net load forecast for the individual stations in the Renfrew region is given in Appendix A. The graphical representation of the regional net coincidental load growth for both summer and winter season over the study period is shown in Figure 4 below.



	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Summer	141.7	145.4	149.4	153.6	156.9	158.6	161.7	164.1	165.7	169.2
Winter	152.2	156.6	161.8	165.4	169.1	170.7	172.8	174.0	176.5	181.1

Figure 4: Renfrew Region Coincident Load Forecast

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 for the high and low growth scenarios are 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.

No new Asset renewal needs were identified during the study period.

6.2.4. System Reliability and Operational Issues:

In case of contingencies on the transmission system, ORTAC provides the load restoration requirements relative to the amount of load affected. Planned system configuration must not exceed 600 MW of load curtailment/rejection. In all other cases, the following restoration times are provided for load to be restored for the outages caused by design contingencies.

- All loads must be restored within 8 hours.
- Load interrupted in excess of 150 MW must be restored within 4 hours.
- Load interrupted in excess of 250 MW must be restored within 30 minutes.

Based on the net load forecast, the loss of one element will not result in load interruption greater than 150MW. The maximum load interrupted by configuration due to the loss of two elements is below the load loss limit of 600MW by the end of the 10-year study period.

During the studies TWG identified system operational issues on 115 kV D6 line. Under high growth scenarios there are voltage issues observed at end of line stations for Petawawa DS, Forest Lea DS and Craig DS during normal all in-service condition.

IESO will perform more detailed study to identify system reliability and operational issues in the region during next phases of regional planning.

7. NEEDS

This section describes emerging new needs identified in the Renfrew Region and/or updates on previously identified needs since the completion of 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. Pembroke TS T1/T2 – A station capacity need was identified in the previous regional planning cycle. However, based on updated detailed LTR studies with recent loading profile at the station the LTR of the station have been updated and this need no longer exists within the short-term planning cycle due to higher LTR ratings than the value used in the previous regional planning cycle.
2. Forest Lea DS – A load transfer need was identified in the previous regional planning cycle. However, based on the revised PLL, this need no longer exists, as the updated PLL is higher than the value used in the previous regional planning cycle.
3. 115 kV D6 Line Refurbishment - The existing HONI 115 kV circuit D6 will be partially relocated and will reduce the length of the line section between CTS-1 and Petawawa JCT from 38.9 km to 30.7 km and therefore will reduce the overall D6 circuit length from 90.8 km to 82.7 km. The project is expected to be completed in December 2027.
4. Des Joachims T6 Autotransformer- Due to asset condition Replacement of autotransformer T6 with standard 125 MVA 239/121-13.9 kV autotransformer completed in June 2026.

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 a part of this report are summarized in Table 5 below.

Table 5: Near/Mid-term Needs Identified in this NA and/or Updated from Previous RIP

Need Location	Need Description/Update	NA Report Section
Asset Renewal Needs		
115 kV D6 Line	Complete 76.8 km line refurbishment between Des Joachims TS and Petawawa/Craig DS	7.1.1
Station Capacity Needs		
Cobden DS	Projected to reach capacity in 2029 under normal growth summer forecast and in 2028 under summer High growth scenario.	7.2.1
Cobden TS T1/T2	Projected to reach capacity in 2033 under summer High growth scenario.	7.2.2

Transmission Line Capacity Needs		
115 kV D6	Projected to reach capacity in 2031 under summer high growth scenario.	7.3.1
115 kV X2Y	Projected to reach capacity limits at the end of study period (2035) during X6 contingency and summer high growth scenario.	7.3.2
System Reliability, Operation and Load Restoration Needs		
115 kV D6 – Voltage Performance	Voltage issues identified in 2035 for normal summer forecast and in 2031 for High growth summer forecast	7.4.1
X2Y Load Restoration	Projected to exceed thermal ratings of X2Y when complete load of Cobden TS needs to be restored under X6 contingency in 2029 under normal growth scenario and 2028 under high growth scenario.	7.4.2

7.1 Asset Renewal Needs for Major HV Transmission Equipment

In addition to the previously identified asset renewal needs from the second regional planning cycle, Hydro One and the TWG identified no new asset renewal needs for major HV transmission equipment over the next 10 years in the Renfrew 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

Table 6: Major HV Transmission Assets Planned for Replacement in Renfrew Region in next 10 years

Station/Circuit	Need Description	Planned ISD
115 kV D6	Complete 76.8 km line refurbishment between Des Joachims TS and Petawawa/Craig DS	2027

7.1.1 115 kV D6 Line Refurbishment

The 115 kV D6 is a single circuit transmission line that connects Des Joachims TS to Pembroke TS along the Ottawa River in the Laurentian Hills area. Based on asset condition assessment, the circuit was identified for refurbishment and expected to be completed by end of 2027. The planned in-service date for the project is in end of 2027.

7.2 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2026-2035 for the 230kV and 115kV Transforming stations in the Renfrew Region using either the summer or 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 Cobden DS – T3

Cobden DS is located in the eastern part of the Renfrew region and is supplied by the 115 kV X2Y circuit, with provision to be supplied by X6 under contingency conditions. The station has one transformer, T3, with a summer PLL of 8.9 MW, and supplies load to Hydro One Distribution.

Based on the load forecast, Cobden DS is expected to exceed its summer PLL in 2029. Winter loading is forecast to remain within limits throughout the study period. Under the high-growth scenario, the projected summer need date advances to 2028.

The TWG recommends that the identified station capacity needs be addressed through coordinated planning between Hydro One Transmission and Hydro One Distribution. In the near term, feasible mitigation measures should be evaluated, including load transfers, transformer upgrades, and the implementation of SCADA-based fan monitoring to maximize the utilization of existing assets. The TWG further recommends continued monitoring of station loading and demand growth trends, with the objective of developing an appropriate longer-term solution through the Local Planning process when capacity reinforcement is required.

7.2.2 Cobden TS – T1/T2

Cobden TS is an important supply point for customers in and around the Cobden area. The station is supplied by X2Y and X6 circuits and is equipped with two 42 MVA transformers, T1 and T2 with a summer and winter LTR of 41.6 MW and 49.3 MW respectively.

Under the normal load forecast, no station capacity need has been identified at Cobden TS over the study period. However, sensitivity analysis indicates that under the summer high-growth forecast, Cobden TS is expected to exceed its summer LTR in 2033. Given that this need only materializes under the high-growth sensitivity scenario, TWG recommends continued monitoring of actual load growth at the station and revisiting the capacity need 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 2026-2035 for the 230kV and 115kV Transmission line circuits in the Renfrew Region by assessing thermal limits of the circuit and the voltage range as per ORTAC to cater this need. Based on the results, the following line capacity needs have been identified during the study period:

7.3.1 115 kV D6

The 115 kV Des Joachims subsystem is supplied from Des Joachims TS through 115kV circuit D6 and serves load eastward toward Petawawa DS, Craig DS and Forest Lea DS. Circuit D6 forms a critical supply path in the western Renfrew area, and prior regional planning has recognized the importance of this corridor in maintaining reliable supply to communities including Laurentian Hills, Deep River, Petawawa and Laurentian Valley. As outlined in section 7.1.1 Hydro One's D6 refurbishment project, involving

approximately 76.8 km of 115 kV transmission line between Des Joachims TS and Pembroke TS, was initiated to address end-of-life assets and support continued reliability of supply in the area this refurbishment with larger standard conductors have increased the load meeting capability of the circuit from 50.9 MW to 93.9 MW. Adequacy studies were completed for the Des Joachims subsystem under both a normal growth forecast and a high growth sensitivity with the new conductors are shown in Figure 5 below

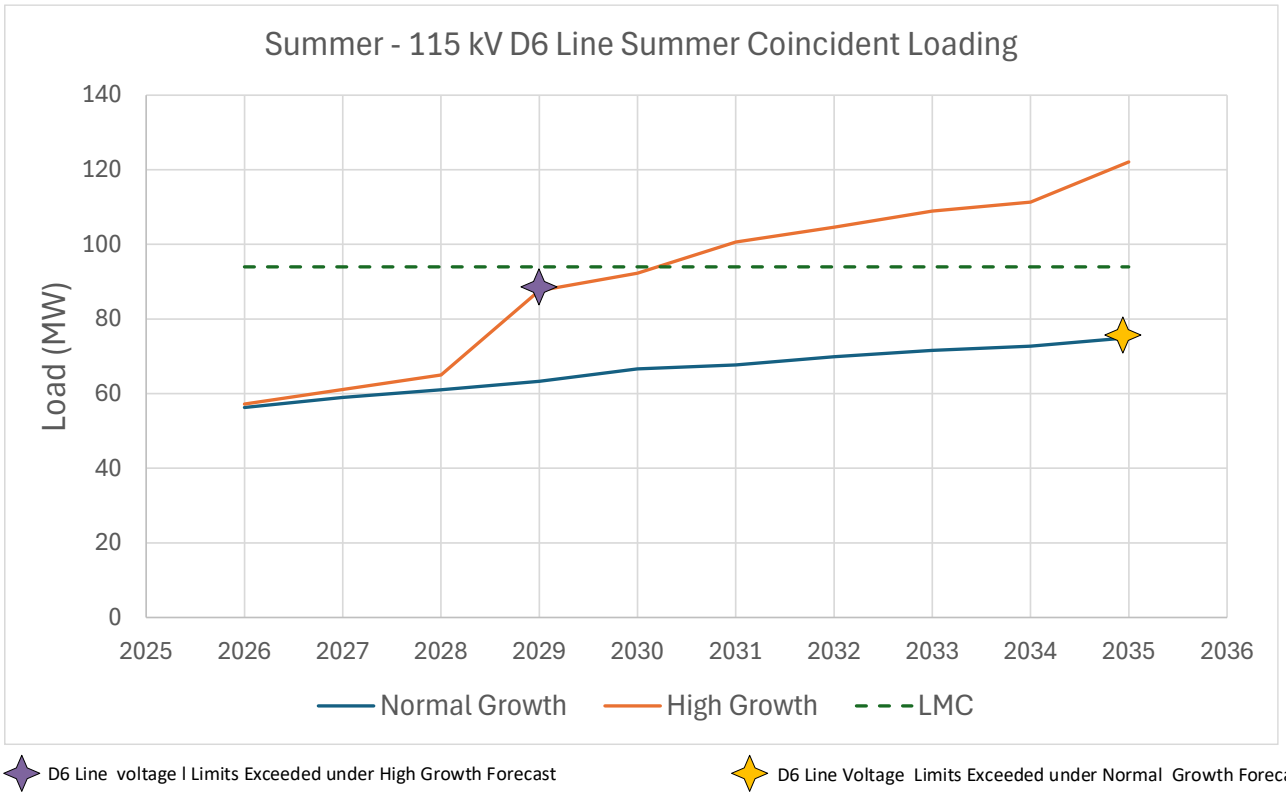


Figure 5: 115 kV D6 Loading

Normal Growth Scenario

Under the normal growth scenario, the 115 kV Des Joachims subsystem is expected to remain thermally adequate over the study period. The D6 line refurbishment project provides sufficient capacity to accommodate the forecast load growth on the subsystem. However, while no thermal capacity concerns were identified, the studies indicate that voltage performance becomes a limiting factor in the later years of the study period. In particular, stations located toward the remote end of Circuit D6, including Petawawa DS, Craig DS and Forest Lea DS, were found to experience voltage levels below the applicable ORTAC minimum voltage criteria. As a result, the subsystem is considered adequate from a line-loading perspective under normal growth, but voltage support or other mitigation measures will be required in the longer term to maintain acceptable voltage performance at the end-of-line stations.

High Growth Scenario

Under the high growth scenario, the adequacy of the 115 kV Des Joachims subsystem becomes more constrained. This sensitivity was developed to reflect increased connection interest along Circuit D6 and assumed 50% higher load growth than the normal forecast, along with potential new transmission-connected load with a high certainty score. Study results indicate that, under this higher load outlook, Circuit D6 exceeds its thermal capability beginning in the 2031 summer forecast year. In addition to the thermal limitation, voltage violations are also observed at the remote stations connected to D6, including Petawawa DS, Craig DS and Forest Lea DS in 2029. These results indicate that the subsystem would not be adequate under the high growth scenario without additional reinforcement or mitigation.

Further studies in next phase should be undertaken to develop solutions (including non-wires alternatives).

7.3.2 115 kV X2Y

X2Y is a 58 km, 115 kV circuit located northwest of the Greater Ottawa area and electrically associated with the Renfrew regional supply area. The circuits provide connection and/or supply to Pembroke TS, Chenaux TS, Cobden TS, Cobden DS, CTS-2, and Bryson CGS in Hydro-Québec. X2Y has an LTE rating of 91.0 MVA and 102.8 MVA in summer and winter respectively.

Under the normal growth forecast the X2Y remains within its thermal limits but under the high growth forecast X2Y approaches its thermal limits under X6 contingency at the end of study period.

TWG recommends studying this need in the next phase of the regional planning for long-term solution for the X2Y limiting section. If the total loading at Pembroke TS, Cobden TS, and Cobden DS exceeds the thermal rating of the limiting X2Y section before solutions are implemented, then operating measures can be deployed in the interim to alleviate the limit.

7.4 System Reliability, Operation and Restoration Needs

The transmission system must be planned to satisfy demand levels up to the extreme weather, and to provide a median-economic forecast for an extended period with any one transmission element out of service. A study has been carried out, considering the net coincident load forecast and the loss of one element over the study period 2026-2035 to cater for this need**.** Based on the results, the following needs have been identified during the study period:

7.4.1 Voltage Performance of 115 kV D6

A series of system studies were conducted to evaluate the voltage performance of the 115 kV D6 circuit under various operating conditions and long-term load growth assumptions.

Under the 2035 normal growth scenario and 2029 high growth scenario the analysis shows that the pre-contingency voltage on D6 violates ORTAC limits. Specifically, the voltage on the affected sections of

D6 falls below the minimum ORTAC limit of 113 kV, indicating inadequate voltage performance in this scenario.

TWG recommends further review of this need in the next phase of regional planning.

7.4.2 X2Y Load Restoration

Under normal configuration, Cobden TS is supplied from X6 and X2Y, with the low-voltage bus tie normally open. Following an X6 contingency, restoration of the full Cobden TS load requires manual closure of the LV tie switch. This restoration configuration transfers additional load onto X2Y, resulting in the circuit exceeding its LTE rating in the near term.

When restoring the load of Cobden TS from X2Y under X6 contingency the need is expected to emerge in 2029 under the normal summer growth scenario and advance to 2028 under the high-growth scenario whereas for the winter time the need is expected to emerge in 2028 for both normal and high growth scenarios. Accordingly, the restoration need is considered a near- to medium-term transmission loading need, depending on the growth scenario. As load loss is less than 150 MW for the contingency, it will be restored within 8 hours as per load restoration criteria in section 6.2.4

TWG recommends further review of this need in the next phases of regional planning.

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 Renfrew 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 EV scenarios, and any unforeseen electrification needs to develop high demand growth forecasts by applying 50% additional growth to the growth rate on the extreme summer/winter corrected Normal Growth net load forecasts. The low growth scenario was obtained by reducing the growth rate by 50%. The High Growth scenario incorporates EV scenarios, includes consideration of potential additional demand from electrification as well as anticipated large industrial and commercial customers expected to connect in the near to mid-term.

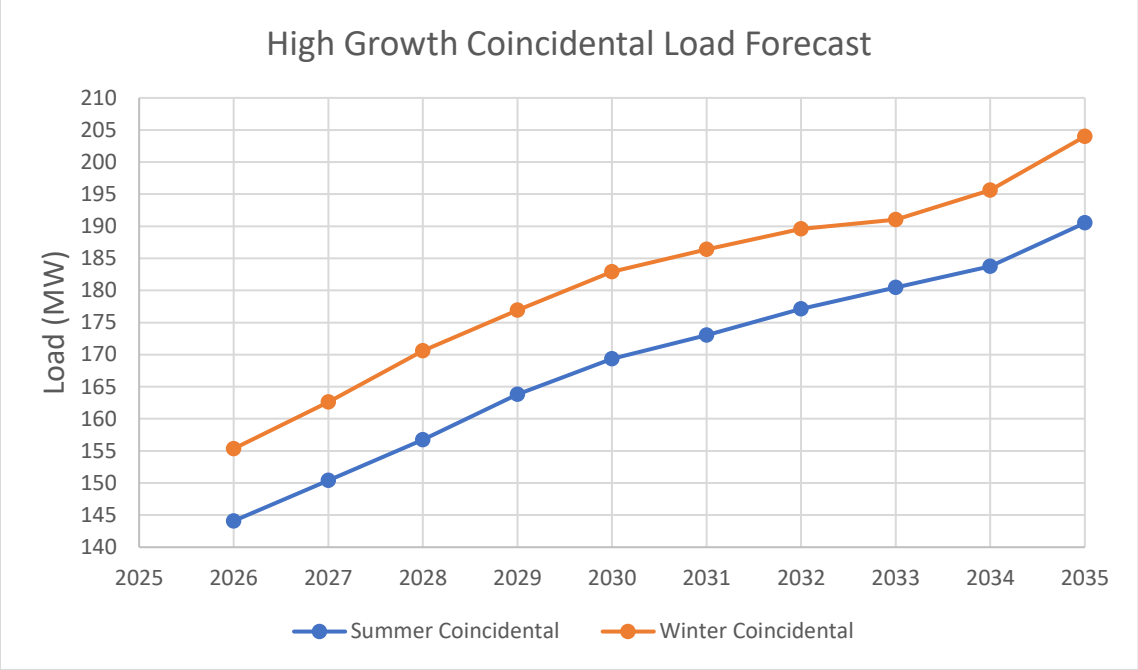


Figure 6: High Growth Forecast for existing station

The normal and high growth forecasts are shown in Tables A.1, A.2, A.3 and A.4.

The impact of sensitivity analysis for the high and low growth scenario identified the following updates or new Station/Line capacity needs:

Table 7: Impact of Sensitivity Analysis on Station/Line capacity Needs in the Region

Sr.no.	Need Identified	Normal Growth Scenario	High Growth Scenario	Low Growth Scenario
1	Cobden DS	2029	2028	-
2	Cobden TS T1/T2	-	2033	-
3	115 kV D6 Line	-	2031	-
4	115 kV X2Y Line	-	~2035	-
5	Voltage Performance of 115 kV D6	2035	2031	-
6	X2Y Load Restoration	2029	2028	-

9. CONCLUSION AND RECOMMENDATION

The Needs Assessment has considered N-1 contingency scenarios to identify needs in the area. The next phases will include a revised forecast and additional outage/contingency analysis beyond what was assessed here. These studies may find further limits on the system's ability to supply additional load. Technical Working Group's recommendations to address the needs identified are as follows:

Table 8: Needs that Require Further Regional Coordination

#	Need Location	Need Description
Station Capacity Needs		
1	Cobden DS	Projected to reach capacity in 2029 under normal growth summer forecast and in 2028 under summer High growth scenario.

Table 9: Needs that Require Further Regional Coordination

#	Need Location	Need Description
Station Capacity Needs		
1	Cobden DS	Projected to reach capacity in 2029 under normal growth summer forecast and in 2028 under summer High growth scenario.
2	Cobden TS T1/T2	Projected to reach capacity in 2033 under summer High growth scenario.
Transmission Line Capacity Needs		
3	115 kV D6	Projected to reach capacity in 2031 under summer high growth scenario.
4	115 kV X2Y	Projected to reach capacity in 2035 under summer high growth scenario.
System Reliability, Operation and Load restoration Needs		
5	115 kV D6 – Voltage Performance	Voltage issues identified in 2035 for normal summer forecast and in 2031 for High growth summer forecast.
6	X2Y Load Restoration	Projected to exceed thermal ratings of X2Y when complete load of Cobden TS needs to be restored under X6 contingency in 2029 under normal growth scenario and 2028 under high growth scenario.

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

- Hydro One Distribution
- Ottawa River Power Corporation (ORPC)

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

- None

10. REFERENCES

[1] Hydro One, RIP Report – Renfrew Region (Second cycle) , published in July, 2023

[2] Independent Electricity System Operator, IRRP Report (Second Cycle) , published in December 2022

[3] Hydro One, NA Report – Renfrew Region (Second cycle) , published in May, 2021

[4] Independent Electricity System Operator, Ontario Resource and Transmission Assessment Criteria (issue 6.0 September 10, 2025)

[5] Ontario Energy Board, Transmission System Code (issue July 14, 2000 rev. March 31, 2025)

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

[7] 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: Renfrew Region – Summer Non-Coincident- Normal Growth Net Load Forecast

Station Name	Summer LTR (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Cobden DS	8.9	8.4	8.6	8.8	9.0	9.0	9.0	9.1	9.1	9.2	9.3
Cobden TS	41.6	30.8	32.4	34.4	35.2	35.4	35.6	36.6	37.0	37.3	37.8
Craig DS	28.5	16.7	17.4	18.2	18.9	19.7	20.0	20.1	20.2	20.4	20.6
Deep River DS	16.4	9.7	9.9	10.2	10.3	10.3	10.3	10.3	10.3	10.4	10.4
Des Joachims DS	8.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Forest Lea DS	16.4	10.2	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7
Mazinaw DS	6.6	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.3	4.3
Mountain Chute DS	8.2	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pembroke TS	59.9	49.6	49.8	49.2	50.4	50.7	50.9	51.2	51.7	52.1	52.5
Petawawa DS	28.5	11.6	12.7	13.5	14.7	15.9	15.9	15.9	15.9	16.0	16.1
CTS-1		8	8	8.5	9	10	10.75	12.25	13.5	14	16
CTS-2		3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3
Net Demand		155.7	160.0	164.4	169.2	173.0	174.8	177.8	180.4	182.1	185.7

Table A.2: Renfrew Region – Winter Non-Coincident- Normal Growth Net Load Forecast

Station Name	Winter LTR (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Cobden DS	11.4	7.3	7.6	7.7	7.8	7.9	7.9	8.0	8.0	8.1	8.2
Cobden TS	49.3	29.2	30.7	32.8	33.5	33.6	33.7	33.8	34.0	34.2	34.6
Craig DS	28.5	13.0	13.7	14.6	15.3	16.1	16.4	16.5	16.6	16.7	17.0
Deep River DS	22.1	10.5	10.7	11.1	11.2	11.2	11.2	11.2	11.3	11.3	11.4
Des Joachims DS	11.4	4.0	4.0	4.1	4.0	4.1	4.1	4.1	4.1	4.1	4.1
Forest Lea DS	22.1	9.0	9.3	9.5	9.6	9.9	10.0	10.1	10.3	10.4	10.6
Mazinaw DS	8.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	4.0	4.0
Mountain Chute DS	11.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Pembroke TS	67.5	54.3	54.6	54.9	55.0	55.2	55.4	55.7	55.0	56.3	57.7
Petawawa DS	28.5	11.6	12.7	13.5	14.8	16.1	16.1	16.1	16.1	16.1	16.3
CTS-1		8.0	8.0	8.5	9.0	10.0	10.8	12.3	13.5	14.0	16.0
CTS-2		3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3
Net Demand		154.8	159.3	164.6	168.3	172.1	173.7	175.9	177.1	179.6	184.2

Table A.3: Renfrew Region Summer Non-Coincident – High Growth Net Load Forecast

Station Name	Summer LTR (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Cobden DS	8.9	8.5	8.9	9.3	9.5	9.6	9.7	9.8	9.9	10.0	10.2
Cobden TS	41.6	31.7	34.2	37.3	38.7	39.2	39.7	41.0	41.7	42.4	43.3
Craig DS	28.5	17.2	18.4	19.7	21.0	22.4	23.0	23.3	23.6	24.0	24.4
Deep River DS	16.4	9.8	10.2	10.7	10.9	11.0	11.0	11.1	11.2	11.3	11.4
Des Joachims DS	8.9	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.9	2.9	3.0
Forest Lea DS	16.4	10.5	10.9	11.3	11.5	11.9	12.1	12.4	12.7	13.0	13.3
Mazinaw DS	6.6	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.5	4.5	4.6
Mountain Chute DS	8.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
Pembroke TS	59.9	52.8	53.3	52.7	54.7	55.3	56.0	56.6	57.4	58.2	59.0
Petawawa DS	28.5	12.1	14.0	15.2	17.5	19.7	19.8	19.8	19.9	20.1	20.3
CTS-1		8.0	8.0	8.5	9.0	10.0	11.5	13.0	14.0	15.0	19.0
CTS-2		3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3
Net Demand		161.4	168.7	175.7	183.9	190.3	194.2	198.5	202.0	205.5	212.5

Table A.4: Renfrew Region –Winter Non- Coincident – High Growth Net Load Forecast

Station Name	Winter LTR (MW)	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Cobden DS	11.4	7.4	7.9	8.2	8.4	8.5	8.6	8.7	8.8	8.9	9.0
Cobden TS	49.3	30.0	32.4	35.4	36.6	37.0	37.3	37.6	38.0	38.4	39.1
Craig DS	28.5	13.5	14.7	16.1	17.3	18.7	19.3	19.5	19.8	20.1	20.5
Deep River DS	22.1	10.7	11.1	11.6	11.8	11.9	12.0	12.1	12.2	12.3	12.4
Des Joachims DS	11.4	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.3	4.3
Forest Lea DS	22.1	9.3	9.7	10.1	10.3	10.7	11.0	11.2	11.5	11.8	12.1
Mazinaw DS	8.8	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3
Mountain Chute DS	11.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1
Pembroke TS	67.5	58.1	58.6	59.2	59.7	60.2	60.7	61.2	60.3	62.5	64.8
Petawawa DS	28.5	12.1	14.0	15.3	17.7	19.9	20.0	20.1	20.2	20.4	20.6
CTS-1		8.0	8.0	8.5	9.0	10.0	11.5	13.0	14.0	15.0	19.0
CTS-2		3.1	3.2	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3
Net Demand		160.9	168.4	176.6	183.2	189.4	192.9	196.1	197.6	202.3	210.7

Appendix B: Lists of Step-Down Transformer Stations

No.	Transformer Station	Voltage (kV)	Supply Circuits
1	Cobden DS (T3)	115/12.5	X2Y
2	Cobden TS (T1/T2)	115/44	X2Y/X6
3	Craig DS (T1/T2)	115/12.5	D6
4	Deep River DS (T1/T2/T3)	115/12.5	D6
5	Des Joachims DS (T1)	115/12.5	D6
6	Forest Lea DS (T1/T2)	115/12.5	D6
7	Mazinaw DS (T1/T2)	230/12.5	X1P
8	Pembroke TS (T1/T2)	115/44	X2Y/X6
9	Petawawa DS (T1/T2)	115/12.5	D6

Appendix C: List of Transmission Lines

No.	Connecting Stations	Circuit ID	Voltage (kV)
1	Des Joachims DS to Pembroke	D6	115
2	Chenaux TS to Pembroke TS	X6	115
3	Chenaux TS to Pembroke TS	X2Y	115
4	Dobbin TS to Chenaux TS	X1P	230

Appendix D: List of Municipalities in the Renfrew Region

No.	Name of Municipality
1	Town of Arnprior
2	Town of Deep River
3	Town of Laurentian Hills
4	Town of Petawawa and Renfrew
5	Township of Admaston/Bromley
6	Township of Bonnechere Valley
7	Township of Brudenell
8	Township of Lyndoch and Raglan
9	Township of Greater Madawaska
10	Township of Head
11	Township of Clara and Maria Horton
12	Township of Killaloe
13	Township of Hagarty and Richards
14	Township of Laurentian Valley
15	Township of Madawaska Valley
16	Township of McNab/Braeside
17	Township of North Algona Wilberforce and Whitewater Region
18	City of Pembroke

Appendix E: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BESS	Battery Energy Storage System
BPS	Bulk Power System
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
DER	Distributed Energy Resources
DS	Distribution Station
eDSM	Electricity Demand Side Management
EV	Electric Vehicle
GS	Generating Station
HV	High Voltage
IESO	Independent Electricity System Operator
IPL	International Power Lines
IRRP	Integrated Regional Resource Plan
kV	Kilo Volt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage
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

Acronym	Description
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
PLL	Planned Loading Limit
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
RPPAG	Regional Planning Process Advisory Group
SA	Scoping Assessment
SIA	System Impact Assessment
RAS	Remedial Action Scheme
SS	Switching Station
TAO	Transmission Asset Owner
TS	Transformer Station
TWG	Technical Working Group