NEEDS ASSESSMENT REPORT

Peterborough to Kingston Region

Date: December 20, 2024

Needs Assessment Report

Peterborough to Kingston

December 20, 2024

Lead Transmitter:

Hydro One Networks Inc.

Prepared by:

Prepared by: Peterborough to Kingston Technical Working Group

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Disclaimer

This Needs Assessment (NA) Report was prepared for the purpose of identifying potential needs in the Peterborough to Kingston (the "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 best available information throughout the planning process.

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Executive Summary

REGION	Peterborough to Kingston Region (the "Region")
LEAD	Hydro One Networks Inc. ("HONI")
START DATE: September 05, 2024	**END DATE:** December 20, 2024

1. INTRODUCTION

The second Regional Planning cycle for the Peterborough to Kingston Region was completed in May 2022 with the publication of the Regional Infrastructure Plan ("RIP") report. This is the third cycle of Regional Planning for the 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.

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. Due to an increase in load growth in the region, the Technical Working Group ("TWG") decided that the 3rd Regional Planning cycle be triggered in advance of the five-year period in September 2024.

3. SCOPE OF NEEDS ASSESSMENT

The scope of the region NA and includes:

a) Review and reaffirm needs/plans identified in the previous regional planning cycle RIP (as applicable),
b) Identify any new needs resulting from this assessment,
c) 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,
d) 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 TWG may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), Integrated Regional Resource Plan ("IRRP"), and RIP, based on updated information available at that time.

The planning horizon for this NA assessment is ten years.

4. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The region is comprised of the area roughly bordered geographically by the municipality of Clarington on the West, North Frontenac County on the North, and Lake Ontario on the South. Electrical supply to this region is provided by 3 "Three" major Transmission Stations with Autotransformers that feeds, 10 "Ten" step-down Transformer Stations, 8 "Eight" HV Distribution Stations and 5 "Five" Customer transformer Stations.

5. INPUTS/DATA

The TWG comprises of representatives from Local Distribution Companies ("LDC"), the Independent Electricity System Operator ("IESO"), and Hydro One and provides input and relevant information for the region regarding capacity needs, reliability needs, operational issues, and major high-voltage (HV) transmission assets requiring replacement over the planning horizon. The LDCs also capture input from municipalities in the development of their 10-year summer and winter load forecasts.

In accordance with the regional planning process, stakeholder engagement takes place during the IRRP phase.

6. ASSESSMENT METHODOLOGY

The needs assessment's primary objective is to identify the electrical infrastructure needs in the Region over the 10-year planning horizon. A 20-year planning assessment is undertaken in the next phases of regional planning, i.e., IRRP and RIP phases. The assessment methodology includes a review of planning information such as load forecast (which factors various demand drivers and consideration of MEPs and/or CEPs where available), conservation and demand management ("CDM") forecast, distributed generation ("DG") forecast, system reliability and operation, and major HV transmission assets requiring replacement.

A technical assessment of needs is undertaken based on:

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.

7. NEEDS

I. Updates on needs identified during the previous regional planning cycle.

The following needs and projects discussed in the region's second cycle RIP have been completed:

- Gardiner TS (Station Capacity) – Load transfer (~10MW) from DESN1 to DESN2 was completed in 2024.
- Belleville TS (Asset Renewal) – T1/T2 transformer were replaced by similar 75/100/125 MVA standard step-down transformers in 2021/2022.

- Cataraqui TS (Supply Capacity) – It was recommended to upgrade the existing copper conductor on secondary side of auto transformers. However, in an assessment the conductor was found to be sufficient and an update to this recommendation was suggested, which will be discussed in this RP cycle.

The following needs and projects discussed in the region's second cycle RIP are currently underway:

- Otonabee TS 44kV (Station Capacity) – 8 MW of load transfer will be transferred to Dobbin TS in 2025.
- Belleville TS (Station Capacity) – Build new Belleville DESN #2 with two 75/100/125 MVA transformers at the existing Belleville TS site. The new DESN is planned to be in service in end of 2026.
- Frontenac TS (Station Capacity) – Frontenac TS currently supplies Central Kingston and East Kingston but the existing 115kV lines and upstream autotransformers at Cataraqui TS that supply Frontenac TS have reached capacity. As recommended in second cycle RIP, Hydro One Transmission is working with Utilities Kingston to plan a new 230kV-44kV station in the West Kingston area in the near term, which may be built by the Transmitter or Utilities Kingston. This station capacity need will be further assessed in the next phases of this Regional Planning cycle.
- Gardiner TS DESN1 (Asset Renewal) – T1/T2 transformer will be replaced by like for like 75/100/125 MVA standard step-down transformers. Planned in-service year for T1 is 2026 and T2 is 2027.
- Port Hope TS (Asset Renewal) – T3/T4 transformer will be replaced by like for like 50/67/83 MVA standard step-down transformers. Planned in-service year is 2033.
- Picton TS (Asset Renewal) – T1/T2 transformer will be replaced by like for like 50/67/83 MVA standard step-down transformers. Planned in-service year is 2026.
- Dobbin TS (Asset Renewal and decommissioning) - T1 and T2 autotransformers are to be replaced by two new 150/250MVA units and decommissioning of T5 autotransformer with an expected in-service date in end of 2028.
- Lennox TS (Asset Renewal) – Ten (10) existing 230kV ABCB & oil breakers to be replaced by new SF6 breakers. Planned in-service year is 2026.
- Peterborough to Quinte West (P15C 230kV & Q6S 115kV Supply Capacity) - Hydro One have started the project to build a new 230kV double circuit line from Clarington TS to Dobbin TS as recommended in Gatineau Corridor End-of-Life Study published in December 2022. Planned in-service year is end of 2029.
- B5QK (Long-term Capacity need in 2038) – As recommended in the previous cycle IRRP, IESO will re-evaluate this capacity need in next phases of this Regional Planning cycle, when 20 year load forecast will be developed.

II. Newly identified needs in the region

The following are new needs that were identified as part of this assessment:

a) Asset Renewal for Major HV Transmission Equipment

- Cataraqui TS (T1/T2)

b) Transmission Station Capacity

- Dobbin TS
- Gardiner TS
- Napanee TS
- Belleville TS
- Cataraqui TS
- Picton TS
- Hinchinbrooke DS
- Frontenac TS

c) Transmission Line Capacity

- 115 kV B1S line under Q6S contingency

d) System Reliability, Operation and Load restoration

- No new System Reliability, Operation and Load restoration needs identified in this NA.

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 impact of the sensitivity analysis for the high and low growth scenarios identified the following updates to new station capacity needs:

- Sidney TS (2031), Otonabee TS 27.6kV (2026), Otonabee TS 44kV (2028) and 115kV P4S (2031).

These needs will be assessed again during the next phases of this Regional Planning cycle.

9. RECOMMENDATIONS

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

Needs that do not require further assessment and regional coordination: These needs are local in nature and do not have a regional impact. They can be addressed by a straightforward transmission and/or distribution wires solution. They do not require investment in any upstream transmission facility or require Leave to Construct (i.e., Section 92) approvals. These needs generally impact a limited number of LDCs and can be addressed directly between Hydro One and the LDC(s) to develop a preferred local plan. A list of these needs are as follows:

Needs which do not require further regional coordination.

Need location	Need description
Asset Renewal Needs	
Cataraqui TS	T1/T2 renewal based on asset condition assessment.
Station Capacity Needs	
Dobbin TS (T3/T4)	Projected to reach capacity in 2032
Cataraqui TS	Update on need identified in previous cycle RIP
Picton TS	Projected to reach capacity in 2026
Hinchinbrooke DS	Projected to reach capacity in 2028

Needs that require further assessment and regional coordination: These needs may have broader regional impacts and require further assessment and coordination during the next phases[1] of the regional planning cycle. A list of these needs are as follows:

Needs which require further regional coordination.

Need location	Need description
Station Capacity Needs	
Gardiner TS (T1/T2)	Projected to reach capacity now and 2028
Napanee TS (T1/T2)	Projected to reach capacity in 2026
Belleville TS	Capacity limitation due to transmission voltage restrictions
Frontenac TS	Further assess the capacity need in the next phases of this Regional Planning cycle
Transmission Lines Capacity Needs	
115 kV B1S line	Projected to reach capacity in 2028, under Q6S contingency with high hydro generation

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

- Hydro One Distribution
- Elexicon Energy Inc.
- Kingston Hydro Corporation
- Lakefront Utilities Inc.
- Eastern Ontario Power Inc.

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

- None

[1] Non-wires options are further considered (i.e. incremental to CDM and DG that is considered in this NA as potential options in addressing these needs during the IRRP phase.

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1. INTRODUCTION

The second cycle of the Regional Planning process for the Peterborough to Kingston (P to K) Region was completed in May 2022 with the publication of the Regional Infrastructure Plan ("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 P to K 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.

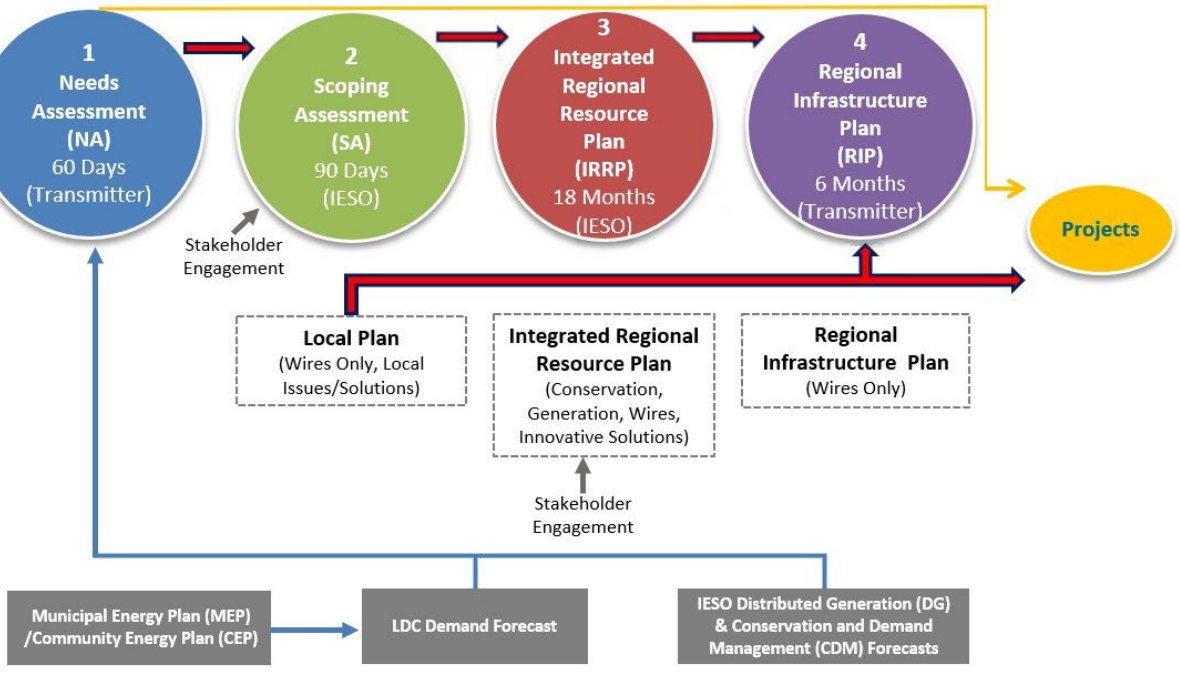


Figure 1: Regional Planning Process

This report was prepared by the Peterborough to Kingston region 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: Peterborough to Kingston Region TWG Participants

Sr. no.	Name of TWG Participants
1	Hydro One Transmission (Lead Transmitter)
2	Independent Electricity System Operator
3	Hydro One Distribution
4	Elexicon Energy Inc.
5	Kingston Hydro Corporation
6	Lakefront Utilities Inc.
7	Eastern Ontario Power Inc.

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least once every five years. Due to an increase in load growth in the region, the Technical Working Group ("TWG") decided that the 3rd Regional Planning cycle be triggered in advance of the five-year period in September 2024.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the Peterborough to Kingston 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 Peterborough to Kingston (P to K) region is comprised of the area roughly bordered geographically by the municipality of Clarington on the West, North Frontenac County on the North, and Lake Ontario on the South. The region includes Frontenac County, City of Kingston, Hasting County, Northumberland County, Peterborough County, and Prince Edward County. The geographical boundaries of the P to K region are shown in Figure 2 below.

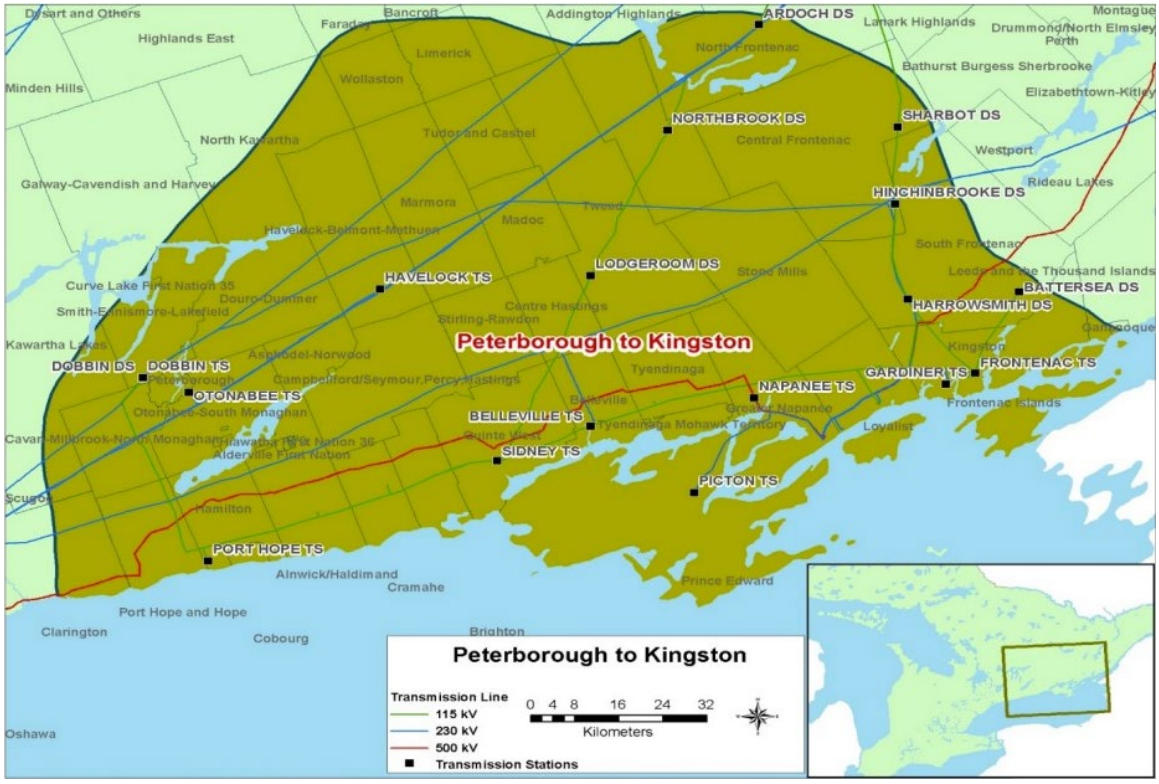


Figure 2: Map of P to K Regional Planning Area

Electrical supply to all five (5) Local Distribution Customers (LDC) listed in table -1 and five (5) Customer Transformer Stations (CTS) in the P to K region is provided by 500/230kV autotransformers at Lennox TS and 230/115kV autotransformers at Cataraqui TS and Dobbin TS through a 230kV and 115kV transmission lines network. There are seven (7) Generation Stations that generates a total of 3474 MW. The 500kV system is part of the bulk power system and is not studied as part of this Needs Assessment.

The details of existing facilities in the region are summarized below and depicted in the single line diagram shown in figure 3.

- 500/230kV Autotransformer: Lennox TS is the major transmission station that connects the 500kV network to the 230kV system via two autotransformers.
- 230/115kV Autotransformer: Cataraqui TS and Dobbin TS are the two (2) transmission stations that connect the 230kV network to the 115kV system via 230/115 kV autotransformers.
- Ten (10) step-down transformer stations and eight (8) High Voltage Distribution Stations (HVDS) are connected to 230 and 115 kV lines that supply load in the Region.
- Five Customer Transformer Stations (CTS) are supplied in the Region.
- Seven Generating stations are also connected.

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

Table 2: Transmission Station and Circuits in the P to K Region

115kV circuits	230kV circuits	Hydro One Transformer Stations	Generation Stations
P3S, P4S, Q6S, B1S, Q3K & B5QK.	X1H, X2H, X3H, X4H, X21, X22, H23B, H27H, X1P, C27P, T32H, C25H, T22C, P15C & T25B.	Dobbin TS*, Cataraqui TS*, Lennox TS*, Belleville TS, Dobbin TS, Frontenac TS, Gardiner TS, Havelock TS, Napanee TS, Otonabee TS, Picton TS, Sidney TS, Port Hope TS, CTS -1, CTS-2, CTS-3, CTS-4 & CTS-5.	Seven (7) Generating Stations with total capacity of 3474 MW.

*Stations with Autotransformers installed

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

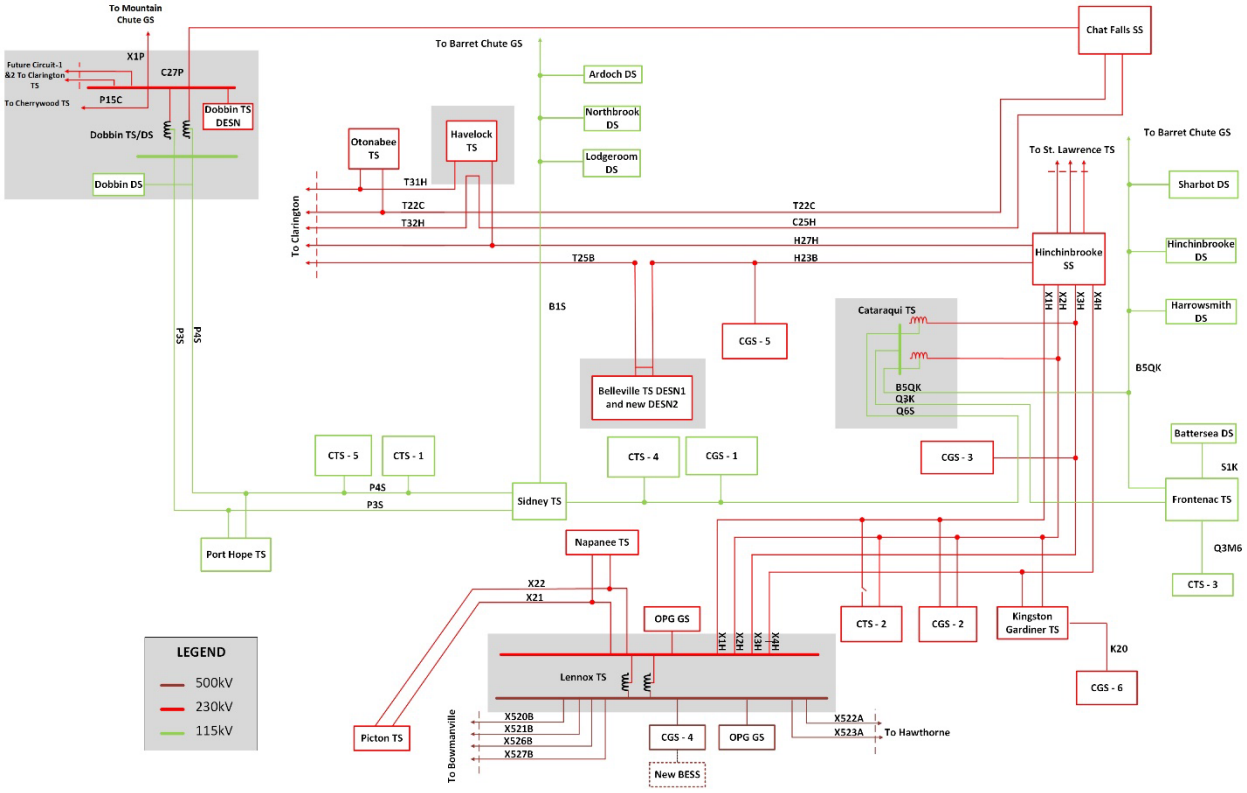


Figure 3: P to K region Transmission Single Line Diagram

5. INPUTS AND DATA

TWG participants, including representatives from LDCs, IESO, and Hydro One provided information and input for the P to K 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:

- P to K 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 need, operating issues, and/or major assets requiring replacement/ refurbishment; and

- Planned/foreseen transmission and distribution investments that are relevant to Regional Planning for the P to K 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;" and,
- Load forecast data was requested from industrial customers in the region, and
- This assessment is based on 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.

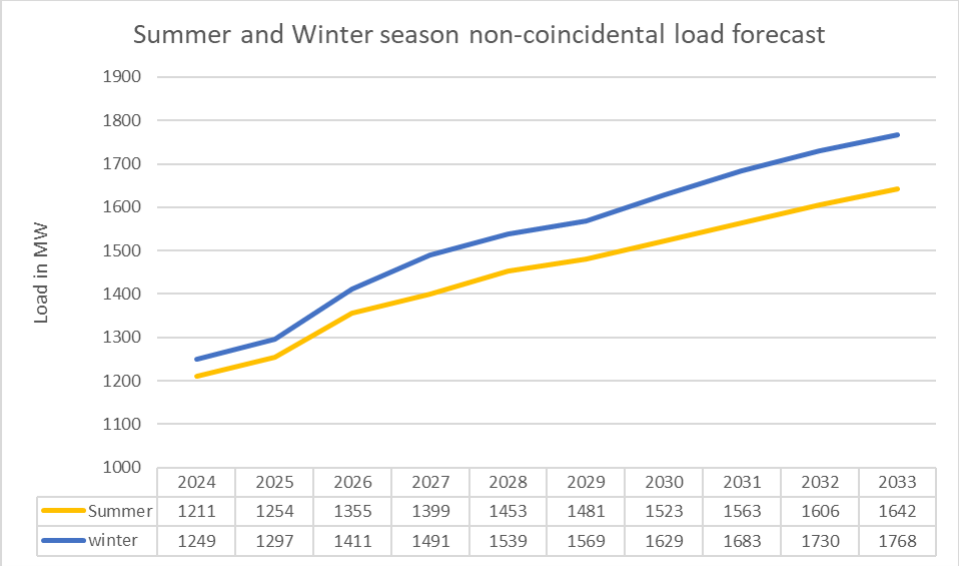
The following other assumptions are made in this report.

- The study period for this Needs Assessment is 2024-2033.
- The Region is winter peaking, but station LTRs are more limiting during the summer season. So, this assessment is based on both summer and winter peak loads.
- Line capacity adequacy is assessed by using coincident 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 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 P to K region for the 10-year study period including the inputs from the Municipalities such as MEPs and CEPs. The IESO provided a Conservation and Demand Management ("CDM"), and Distributed Generation ("DG") forecast for the P to K 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 weather corrected forecast starting point. The overall 10-year load forecast growth rate for summer season is 3.6% and 4.2% for winter season. 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 then 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 P to K region is given in Appendix A. The graphical representation of the regional net non-coincidental load growth for both summer and winter season over the study period is shown in figure 4 below.



	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Summer	1211	1254	1355	1399	1453	1481	1523	1563	1606	1642
winter	1249	1297	1411	1491	1539	1569	1629	1683	1730	1768

Figure 4: P to K region net summer and winter season non-coincidental load

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. The scope of equipment considered is given in section 7.1.

6.2.4. System Reliability and Operational Issues:

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 P to K Region and/or updates on previously identified needs since the completion of Previous Regional Planning cycle.

Needs that were identified and discussed in the previous regional planning cycle (Regional Infrastructure Plan ("RIP") report) with associated projects that were recently completed and reaffirmed needs that are underway and are briefly described below with relevant updates and will not be discussed further in the report. These projects include:

1. Gardiner TS (Station Capacity) – Load transfer (~10MW) from DESN1 to DESN2 was completed in 2024.
2. Belleville TS (Asset Renewal) – T1/T2 transformer were replaced by similar 75/100/125 MVA standard step-down transformers in 2021/2022.
3. Cataraqui TS (Supply Capacity) – It was recommended to upgrade the existing copper conductor on secondary side of auto transformers. However, in an assessment the conductor was found to be sufficient and an update to this recommendation was suggested, which will be discussed in this RP cycle. This station capacity need should be further assessed in conjunction with Frontenac TS in the next phases of this Regional Planning cycle.
4. Belleville TS (Station Capacity) – Build new Belleville DESN #2 with two 75/100/125 MVA transformers at the existing Belleville TS site. The new DESN is planned to be in service in end of 2026.
5. Frontenac TS (Station Capacity) – Frontenac TS currently supplies Central Kingston and East Kingston but the existing 115kV lines and upstream autotransformers at Cataraqui TS that supply Frontenac TS have reached capacity. As recommended in second cycle RIP, Hydro One

Transmission is working with Utilities Kingston to plan a new 230kV-44kV station in the West Kingston area in the near term, which may be built by the Transmitter or Utilities Kingston. This station capacity need will be further assessed in the next phases of this Regional Planning cycle.

6. Gardiner TS DESN1 (Asset Renewal) – T1/T2 transformer will be replaced by like for like 75/100/125 MVA standard step-down transformers. Planned in-service year for T1 is 2026 and T2 is 2027.
7. Port Hope TS (Asset Renewal) – T3/T4 transformer will be replaced by like for like 50/67/83 MVA standard step-down transformers. Planned in-service year is 2033.
8. Picton TS (Asset Renewal) – T1/T2 transformer will be replaced by like for like 50/67/83 MVA standard step-down transformers. Planned in-service year is 2026.
9. Dobbin TS (Asset Renewal and decommissioning) - T1 and T2 autotransformers are to be replaced by new 150/250MVA units and decommissioning of T5 autotransformer with an expected in-service date in end of 2028.
10. Lennox TS (Asset Renewal) – Ten (10) existing 230kV ABCB & oil breakers to be replaced by new SF6 breakers. Planned in-service year is 2026.
11. Peterborough to Quinte West (P15C 230kV & Q6S 115kV Supply Capacity) - Hydro One have started the project to build a new 230kV double circuit line from Clarington TS to Dobbin TS as recommended in Gatineau Corridor End-of-Life Study published in December 2022. Planned in-service year is end of 2029.
12. B5QK (Long-term Capacity need in 2038) – As recommended in the second cycle IRRP, IESO will re-evaluate this capacity need in next phases of current Regional Planning cycle, when 20 year load forecast will be developed.

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 3 below.

Table 3: Near/Mid-term Needs Identified in this NA and/or are updated from previous RIP

Need location	Need description/Update	Previous RIP Report Section	NA Report Section
Asset Renewal Needs			
Cataraqui TS	T1/T2 renewal based on asset condition assessment.	7.2	7.1.1
Transmission Station Capacity Needs			
Dobbin TS (T3/T4)	Projected to reach capacity in 2032	New	7.2.1
Gardiner TS (T1/T2)	Projected to reach capacity now and 2028	7.5 & 7.8	7.2.2
Napanee TS (T1/T2)	Projected to reach capacity in 2026	New	7.2.3
Cataraqui TS	Update on need identified in previous cycle RIP	7.2	7.2.4

Picton TS	Projected to reach capacity in 2026	7.6	7.2.5
Hinchinbrooke DS	Projected to reach capacity in 2028	New	7.2.6
Belleville TS	Capacity limitation due to transmission voltage restrictions	7.3	7.2.7
Frontenac TS	Further assess the capacity need in the next phases of this Regional Planning cycle	7.4	7.2.8
Transmission Line Capacity Needs			
115 kV B1S line	Projected to reach capacity in 2028, under Q6S contingency, high hydro output	New	7.3.1
System Reliability, Operation and Load restoration Needs			
No new system Reliability, Operation and Load restoration need is identified in this NA.			

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 TWG has also identified new asset renewal needs for major high voltage transmission equipment that are expected to be replaced over the next 10 years in the P to K Region. The complete list of major HV transmission equipment requiring replacement in the P to K Region is provided in table 4 in this section. Hydro One is the only Transmission Asset Owner (TAO) in the Region.

Asset Replacement 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, do 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 cost and longer duration of customer outages.

Table 4: Major HV Transmission Asset assessed for Replacement in the region

Station/Circuit	Need Description	Planned ISD*
Gardiner TS	T1/T2 replacement with like for like 75/100/125 MVA units.	2027
Port Hope	T3/T4 replacement with like for like 50/67/83 MVA units.	2033
Picton TS	T1/T2 replacement with like for like 50/67/83 MVA units.	2026
Dobbin TS	T1/T2 Autotransformers to be replaced by two bigger 150/250MVA units and decommissioning existing T5.	2028
Lennox TS	Ten (10) 230kV ABCB & Oil breakers to be replaced by new SF6 breakers.	2026
Cataraqui TS	T1 and T2 230/115kV Autotransformers to be replaced with 150/200/250 MVA units.	2034

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

7.1.1 Cataraqui TS – T1/T2 Autotransformers

The existing T1/T2, 230/115 kV, 150/200/250 MVA autotransformers were built in 1968 and are identified to be replaced based on asset condition assessment. The existing autotransformers have substandard rating due to internal limitations and will be replaced by similar size modern units which is expected to have a higher LTR. This replacement will also help resolve the station capacity need identified in previous cycle RIP and is discussed in section 7.2.4 of this report. The planned in-service date is 2034.

7.2 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2024-2033 for the 230kV and 115kV Transforming stations in the P to K Region using the summer and winter non-coincidental peak net load forecasts that were provided by the Technical Working Group. Based on the results, the following Station[2] capacity needs have been identified in the during the study period:

7.2.1 Dobbin TS (T3/T4)

Dobbin TS is located near the city of Peterborough, Ontario, and supplies load to Hydro One Distribution through its two 75/100/125MVA, T3/T4 step down transformers. The 2032 non-coincident peak net load is expected to exceed its summer and winter LTRs of 156 MW and 177 MW, respectively.

While the need for additional capacity is projected toward the end of the study period, it depends on several factors, including whether the load increases as anticipated. There is a possibility that this overload could be managed through load transfers to nearby stations. It is recommended that Hydro One Transmission and Distribution collaborate to address this potential issue, and no regional planning coordination is required at this time.

7.2.2 Gardiner TS (T1/T2)

Gardiner TS DESN 1 is located in city of Kingston, Ontario, and is supplied by 230kV, X2H/X4H circuits and supplies load to Hydro One Distribution and Kingston Hydro Corporation (embedded) currently through its two 75/100/125 MVA, T1/T2 step down transformers. These transformers were identified for replacement in previous regional planning cycle and are planned to be replaced in 2027 and will have a better LTR (~170MW). The non-coincident peak net load summer load at this station is exceeding its LTR of 121 MW now.

Kingston Hydro Corporation has projected significant load growth in 2026, driven by an industrial development project, and again in 2032, due to a customer transitioning from a conventional gas heating system to geothermal heating. These new contributions will lead to exceed the new transformer to exceed its LTRs by 2028. It is recommended that a solution for this additional capacity be identified in the next phase of the regional planning cycle.

7.2.3 Napanee TS (T1/T2)

Napanee TS is located in Greater Napanee area, Ontario, and is supplied by 230kV, X21/X22 circuits and supplies Hydro One Distribution load through its 50/67/83 MVA T1/T2 step down transformers. The 2026 non-coincident peak net load is expected to exceed its summer and winter LTRs of 101.7 MW and 116.9 MW, respectively.

Hydro One Distribution has projected significant load growth in 2026, driven by two large customers. These new loads are expected to exceed the new transformer LTRs by 2026. However, as these load

[2] Belleville TS and Frontenac TS capacity needs were already identified in the 2nd cycle RP and there are no changes to the recommendations made in the RIP by TWG. Updates to all previously identified needs is provided in beginning of section-7 of this report.

forecasts are not committed load, the station capacity need may be shifted accordingly. It is recommended the load growth shall be monitored and a solution for this additional capacity be identified in the next phase of the regional planning cycle.

7.2.4 Cataraqui TS

Cataraqui TS is a 230/115kV autotransformer station that supplies the 115kV stations in the Eastern sub region of the P to k region. It was recommended upgrade the existing copper conductor on secondary side of auto transformers. However, in an assessment performed by Hydro One, the conductor in the 115kV yard was found to be sufficient. T1/T2, 230/115 kV, 150/200/250 MVA autotransformers will be replaced with similar size units in 2034. The new autotransformers are expected have higher LTRs and will further address the issue of overload at the station. The replacement of existing autotransformers is based on asset condition assessment and hence it is recommended that no further regional planning coordination is required at this time.

7.2.5 Picton TS

Picton TS is located in Picton area, Ontario, between Bay of Quinte and Prince Edward Bay, and is supplied by 230kV, X21/X22 circuits and supplies Hydro One Distribution load through its 50/67/83 MVA T1/T2 step down transformers. The 2026 non-coincident peak net load is expected to exceed its summer and winter LTRs of 75 MW and 89 MW, respectively.

The existing T1/T2 transformers have been identified for replacement based on asset condition assessments. The replacement units will be of similar size but will have higher LTRs (~100MW) due to modern designs, which will be enough to supply the load throughout the study period. It is recommended that no further regional planning coordination is required at this time.

7.2.6 Hinchinbrooke DS

Hinchinbrooke DS is located in Central Frontenac area, Ontario and is supplied by 115kV B5QK circuit and supplies Hydro One Distribution Load through its 115/13.2 kV T1 transformer. The 2028 non-coincident peak net load is expected to exceed its winter LTRs of 8.4 MW. The load growth in the area is not significant and can be monitored and addressed within Hydro One Transmission and Distribution. No further regional planning coordination is recommended at this time.

7.2.7 Belleville TS

Belleville TS is located in Belleville area and is supplied by two 230 kV T25B and H23B lines and supplies load to Hydro One Distribution and Elexicon Energy Inc. through its DESN1 two 75/100/125 MVA, 230/44kV, T1/T2 step down transformers. A new Belleville TS DESN2 will be in service by the end of 2026 to address the supply capacity need in the region. Based on the load forecast, and the existing voltage constraints on the transmission lines supplying Belleville TS for a H23B contingency at the Belleville TS, limiting the total loading by the year 2028-2031, depending on the load and LV configuration at Belleville TS DESN2. This undervoltage cannot be mitigated without a partial loss of load at DESN2 post 2028 loading. Therefore, it is recommended to conduct a comprehensive assessment in the next phases of the regional planning cycle to manage this need as well as a full bulk planning study as identified in the previous regional planning cycle.

7.2.8 Frontenac TS

Frontenac TS is located in Kingston area and is supplied by two 115kV B5QK and Q3K lines and supplies Hydro One Distribution, Utilities Kingston, and Eastern Ontario Power Inc. load through its two 50/67/83 MVA, 230/44kV, T3/T4 stepdown transformers. As recommended in second cycle RIP, Hydro One Transmission is working with Utilities Kingston to plan a new station in the area in the near term, which may be built by the Transmitter or the LDC. The Frontenac station capacity need should be further assessed in the next phases of this Regional Planning cycle.

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 2024-2033 for the 230kV and 115kV Transmission line circuits in the P to K 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 in the during the study period:

7.3.1 115kV B1S

B1S is a long 145km 115kV single-circuit radial line which extends between Barrett Chute GS and Sidney TS and serving Ardoch DS, Northbrook DS and Lodgeroom DS in between. The supply capacity of the line could exceed its continuous rating in in the near to medium timeline following a contingency on Q6S line and high hydro output from generators in the region. The B1S line is limited by a low sag temperature which is the main reason of this line could be overloaded. Hydro One Transmission will perform an internal assessment to see if there is room for improving the sag temperature to address the issue in near time, but it is also recommended to do a full assessment during the next phases of this regional planning cycle.

7.4 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. A study has been performed, considering the net coincident load forecast and the loss of one element over the study period 2024-2033 to cater this need**.** Based on the results, no new significant system reliability, operating and restoring issues have been identified for this Region.

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 P to K region

to be considered in this sensitivity analysis is the new Industrial load and expansion of urban areas from municipalities, 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 the new Industrial load and expansion of urban areas from municipalities, 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 and winter corrected Normal Growth net load forecasts. The low growth scenario was obtained by reducing the growth rate by 50%.

The normal and high growth forecasts are shown in Appendix A.

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

Table 5: 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	Dobbin TS (T3/T4)	2032	2029	2032
2	Gardiner TS (T1/T2)	Current and 2028	Current	Current and 2033
3	Gardiner (T3/T4)	NA	NA	NA
4	Napanee TS (T1/T2)	2026	2026	NA
5	Picton TS	2026	2026	NA
6	Hinchinbrooke DS	2028	2027	NA
7	Sydney TS	NA	2031	NA
8	Otonabee TS 25.6kV	NA	2026	NA
9	Otonabee TS 44kV	NA	2028	NA
10	B1S	2028	2028	2028
11	P4S	NA	2031	NA
12	Belleville TS (undervoltage)	2028	2027	NA
13	Frontenac TS	2027	2026	2030

In addition, the radial tap from 230kV circuits X2H and X4H serving Kingston through Gardiner TS DESN1 and DESN2 have a summer Long Term Emergency (LTE) rating of about 395 MW. Current normal summer loading forecast for Gardiner TS DESN1 and DESN2 total 293 MW by 2033, leaving about 102 MW of

thermal capacity remaining. If the area experiences a higher load growth as per the scenario above and/or large transmission customer connection up to 100 MWs, there will be capacity need in this area.

The sensitivity analysis identified the additional capacity needs at towards the end of the study period. The sensitivity analysis and these needs will be assessed again during the next phases of this Regional Planning cycle.

9. CONCLUSION AND RECOMMENDATION

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

Needs that do not require further assessment and regional coordination: These needs are local in nature and do not have a regional impact. They can be addressed by a straightforward transmission and/or distribution wires solution. They do not require investment in any upstream transmission facility or require Leave to Construct (i.e., Section 92) approvals. These needs generally impact a limited number of LDCs and can be addressed directly between Hydro One and the LDC(s) to develop a preferred local plan. A list of these needs are as follows:

Table 7: Needs which do not require further regional coordination

Need location	Need description
Asset Renewal Needs	
Cataraqui TS	T1/T2 renewal based on asset condition assessment.
Station Capacity Needs	
Dobbin TS (T3/T4)	Projected to reach capacity in 2032
Cataraqui TS	Update on need identified in previous cycle RIP
Picton TS	Projected to reach capacity in 2026
Hinchinbrooke DS	Projected to reach capacity in 2028

Needs that require further assessment and regional coordination: These needs may have broader regional impacts and require further assessment and coordination during the next phases[3] of the regional planning cycle. A list of these needs are as follows:

Table 8: Needs which require further regional coordination

Need location	Need description
Station Capacity Needs	
Gardiner TS (T1/T2)	Projected to reach capacity now and 2028

[3] Non-wires options are further considered (i.e. incremental to CDM and DG that is considered in this NA) as potential options in addressing these needs during the IRRP phase.

Napanee TS (T1/T2)	Projected to reach capacity in 2026
Belleville TS	Capacity limitation due to transmission voltage restrictions
Frontenac TS	Further assess the capacity need in the next phases of this Regional Planning cycle
Transmission Lines Capacity Needs	
115 kV B1S line	Projected to reach capacity in 2028, under Q6S contingency with high hydro generation

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

- Hydro One Distribution
- Elexicon Energy Inc.
- Kingston Hydro Corporation
- Lakefront Utilities Inc.
- Eastern Ontario Power Inc.

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

- None

10. REFERENCES

[1] P to K 2nd cycle Regional Infrastructure Plan ("RIP") report (issue May 27, 2022)

[2] P to K 2nd cycle Integrated Regional Resource Plan report (issue November 4, 2021)

[3] Gatineau Corridor End-of-Life Study published in December 2022.

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

[5] Ontario Energy Board, Transmission System Code (issue July 14, 2000 rev. October 1, 2024)

[6] Ontario Energy Board, Distribution system Code (issue July 14, 2000 rev. March 27, 2024)

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

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

Table A.1: P to K Region – Summer Non-Coincident- Normal Growth Net Load Forecast

Transformer Station Name	DESN ID	LTR (MW)	Forecast Starting Point (Extreme Weather Corrected)	Near Term Forecast (MW)					Medium Term Forecast (MW)				
				2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Ardoch DS	T1	7.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.8	2.8	2.8
Battersea DS	T1/T2	21.9	8.9	9.2	9.1	9.1	9.0	9.1	9.1	9.2	9.2	9.3	9.3
Belleville TS	T1/T2	170.05	164.9	166.6	175.4	183.5	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Belleville New DESN	T3/T4	170.05	0.0	0.0	0.0	0.0	55.3	68.0	72.5	77.5	84.1	91.1	101.1
Dobbin DS	T1/T2	16.9	15.9	15.9	15.9	6.2	6.2	6.6	7.0	7.4	7.8	8.2	8.4
Dobbin TS	T3/T4	156.8	70.1	72.7	82.2	111.1	119.9	127.5	133.9	145.9	155.2	159.8	163.9
Frontenac TS	T3/T4	109.3	98.6	102.3	105.2	109.2	113.1	115.8	118.3	123.6	128.2	131.7	135.3
Gardiner TS	T1/T2	121.6	130.3	125.3	128.2	162.6	168.0	170.5	171.9	175.8	177.7	195.4	200.8
Gardiner TS	T3/T4	111.2	46.8	57.1	57.4	57.7	57.9	79.9	84.9	86.6	88.4	90.3	92.3
Harrowsmith DS	T1/T2	21.9	15.8	15.7	15.5	15.6	15.5	15.6	15.7	15.7	15.8	15.9	16.1
Havelock TS	T1/T2	86.4	63.1	62.5	65.2	64.8	64.5	65.0	65.1	65.6	66.0	66.3	66.7
Hinchinbrooke DS	T1	6.8	6.1	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.5	6.5	6.5
Lodgeroom DS	T1/T2	21.9	8.6	8.5	8.6	8.6	8.6	8.6	8.5	8.6	8.5	8.6	8.6
Napanee TS	T1/T2	101.7	66.6	75.2	82.4	108.4	110.9	105.2	108.3	111.6	113.0	114.3	118.2
Northbrook DS	T1	8.4	6.0	5.9	5.9	5.9	5.8	5.8	5.9	5.9	5.9	6.0	6.0
Otonabee TS 27.6kV	T1/T2	92.52	81.7	82.6	83.9	74.5	75.3	75.7	76.0	76.4	76.9	77.5	78.2
Otonabee TS 44kV	T1/T2	97.2	81.2	82.0	77.3	79.3	82.3	85.0	85.7	88.3	89.7	90.9	91.6
Picton TS	T1/T2	75.6	64.3	69.7	71.8	79.2	85.7	88.4	90.8	93.1	95.6	97.5	99.4
Sharbot DS	T1	6.2	3.9	4.0	4.0	4.0	3.9	4.0	4.0	4.0	4.0	4.0	4.1
Sidney TS	T1/T2	111.8	80.6	83.0	88.4	95.8	96.2	100.2	100.3	100.7	102.6	103.2	103.9
Port Hope TS	T1/T2	122.6	52.0	54.2	58.3	59.6	60.3	61.1	61.5	65.2	72.2	73.0	73.9

Port Hope TS	T3/T4	101.7	73.4	73.7	74.5	74.7	74.8	74.9	74.9	75.0	75.3	75.7	76.3
CTS -1			2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
CTS -2			26.1	26.1	26.3	26.6	26.8	27.1	27.3	27.5	27.7	28.0	28.2
CTS -3			10.3	10.3	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.8	10.9
CTS -4			0	0	0	0	0	0	0	0	0	0	0
CTS -5			0	0	0	0	0	0	0	0	0	0	0

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

Transformer Station Name	DESN ID	LTR (MW)	Forecast Starting Point (Extreme Weather Corrected)	Near Term Forecast (MW)					Medium Term Forecast (MW)				
				2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Ardoch DS	T1	10.5	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.5
Battersea DS	T1/T2	24.3	11.9	12.2	12.2	12.3	12.3	12.4	12.4	12.4	12.5	12.5	12.6
Belleville TS	T1/T2	183.4	158.5	159.9	172.9	184.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Belleville New DESN	T3/T4	183.4	0.0	0.0	0.0	0.0	59.2	75.6	82.2	90.0	98.2	107.3	119.6
Dobbin DS	T1/T2	21.6	10.3	10.4	10.4	10.4	10.5	11.6	12.6	13.7	14.7	15.8	16.3
Dobbin TS	T3/T4	177.7	80.2	83.5	93.5	105.6	117.5	127.8	136.3	164.7	177.0	183.0	188.4
Frontenac TS	T3/T4	123.5	101.8	110.0	112.7	116.3	120.0	122.6	124.7	129.4	132.2	135.2	138.3
Gardiner TS	T1/T2	143.5	128.4	123.4	126.5	159.8	165.3	168.1	169.4	173.2	175.1	192.0	197.4
Gardiner TS	T3/T4	138.7	41.5	51.7	52.1	52.6	80.0	85.8	87.5	89.4	91.3	93.3	95.5
Harrowsmith DS	T1/T2	24.3	19.7	20.2	20.5	20.7	20.9	21.1	21.2	21.4	21.5	21.7	21.9
Havelock TS	T1/T2	97.2	78.2	80.5	81.5	82.7	83.5	84.3	84.7	85.3	87.5	88.3	89.2
Hinchinbrooke DS	T1	8.6	8.2	8.4	8.5	8.6	8.7	8.7	8.8	8.9	8.9	9.0	9.1
Lodgeroom DS	T1/T2	24.3	11.1	11.4	11.5	11.7	11.8	12.0	12.0	12.1	12.4	12.5	12.7
Napanee TS	T1/T2	116.9	81.0	89.0	95.9	120.2	122.7	117.8	120.7	121.9	123.2	124.4	125.7
Northbrook DS	T1	10.8	8.7	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.5	9.6	9.8
Otonabee TS 27.6kV	T1/T2	109.8	54.9	55.8	57.1	58.1	58.9	59.3	59.5	59.7	60.0	60.3	60.8
Otonabee TS 44kV	T1/T2	109.8	77.8	78.8	74.0	76.1	79.2	81.9	82.6	85.1	94.3	95.3	96.0
Picton TS	T1/T2	89.1	60.9	68.6	70.8	78.3	85.0	87.8	90.2	92.5	94.9	96.6	98.6

Sharbot DS	T1	8.4	5.4	5.6	5.7	5.7	5.8	5.8	5.9	5.9	6.0	6.0	6.1
Sidney TS	T1/T2	111.8	77.1	76.6	82.4	96.8	97.2	102.4	103.1	104.5	107.3	108.4	109.6
Port Hope TS	T1/T2	139.7	61.3	63.4	67.4	68.7	69.6	70.6	71.0	74.5	81.0	81.8	82.7
Port Hope TS	T3/T4	115.9	75.6	76.1	77.1	77.6	77.9	78.3	78.3	78.5	78.9	79.3	79.9
CTS - 1			2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
CTS - 2			26.1	26.1	26.3	26.6	26.8	27.1	27.3	27.5	27.7	28.0	28.2
CTS - 3			10.3	10.3	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.8	10.9
CTS - 4			5	5	5	5	5	5	5	5	5	5	5
CTS - 5			8	8	8	8	8	8	8	8	8	8	8

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

Transformer Station Name	DESN ID	LTR (MW)	Forecast Starting Point (Extreme Weather Corrected)	Near Term Forecast (MW)					Medium Term Forecast (MW)				
				2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Ardoch DS	T1	7.8	2.7	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.9	2.9	3.0
Battersea DS	T1/T2	21.9	8.9	9.4	9.5	9.6	9.7	9.7	9.7	9.8	9.9	10.0	10.1
Belleville TS	T1/T2	170.05	164.9	167.4	180.7	192.7	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Belleville New DESN	T3/T4	170.05	0.0	0.0	0.0	0.0	70.4	89.5	96.3	103.8	113.7	124.2	139.2
Dobbin DS	T1/T2	16.9	15.9	15.9	16.0	6.0	6.0	6.6	7.2	7.8	8.4	9.1	9.3
Dobbin TS	T3/T4	156.8	70.1	73.9	88.2	131.6	144.8	156.1	165.8	183.8	197.8	204.7	210.7
Frontenac TS	T3/T4	109.3	98.6	104.2	108.5	114.5	120.3	124.4	128.2	136.1	143.0	148.2	153.6
Gardiner TS	T1/T2	121.6	130.3	137.7	142.1	193.7	201.7	205.5	207.6	213.4	216.3	242.9	251.0
Gardiner TS	T3/T4	111.2	46.8	62.2	62.6	63.1	63.4	96.4	103.9	106.4	109.1	112.0	115.0
Harrowsmith DS	T1/T2	21.9	15.8	16.0	16.3	16.5	16.7	16.8	16.9	16.9	17.1	17.4	17.6
Havelock TS	T1/T2	86.4	63.1	63.8	67.9	68.4	69.0	69.8	69.9	70.6	71.2	71.7	72.2
Hinchinbrooke DS	T1	6.8	6.1	6.7	6.7	6.8	6.9	6.9	6.9	7.0	7.0	7.1	7.1
Lodgeroom DS	T1/T2	21.9	8.6	8.7	8.7	8.8	8.8	8.8	8.9	8.9	9.0	9.1	9.2
Napanee TS	T1/T2	101.7	66.6	79.5	90.3	129.4	133.0	141.5	146.1	151.1	153.1	155.1	161.0
Northbrook DS	T1	8.4	6.0	6.1	6.1	6.2	6.2	6.3	6.3	6.4	6.4	6.5	6.5
Otonabee TS 27.6kV	T1/T2	92.52	81.7	83.0	85.0	99.0	100.2	100.8	101.3	101.8	102.6	103.5	104.5
Otonabee TS 44kV	T1/T2	97.2	81.2	82.4	89.6	92.7	97.2	101.2	102.3	106.1	108.3	110.0	111.1
Picton TS	T1/T2	75.6	64.3	72.4	75.5	86.6	96.5	100.4	104.1	107.5	111.2	114.1	117.0
Sharbot DS	T1	6.2	3.9	4.1	4.1	4.2	4.2	4.2	4.2	4.3	4.3	4.3	4.4
Sidney TS	T1/T2	111.8	80.6	84.1	92.3	103.4	104.0	109.9	110.1	110.7	113.5	114.5	115.6
Port Hope TS	T1/T2	122.6	52.0	55.3	61.5	63.3	64.4	65.6	66.2	71.7	82.3	83.5	84.9
Port Hope TS	T3/T4	101.7	73.4	73.8	75.1	75.4	75.5	75.7	75.7	75.9	76.3	76.9	77.7
CTS -1			2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
CTS -2			26.1	26.1	26.3	26.6	26.8	27.1	27.3	27.5	27.7	28.0	28.2
CTS -3			10.3	10.3	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.8	10.9

CTS -4			0	0	0	0	0	0	0	0	0	0	0
CTS -5			0	0	0	0	0	0	0	0	0	0	0

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

Transformer Station Name	DESN ID	LTR (MW)	Forecast Starting Point (Extreme Weather Corrected)	Near Term Forecast (MW)					Medium Term Forecast (MW)				
				2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Ardoch DS	T1	10.5	3.3	3.3	3.3	3.3	3.4	3.4	3.5	3.5	3.6	3.6	3.7
Battersea DS	T1/T2	24.3	11.9	12.3	12.4	12.5	12.6	12.6	12.6	12.7	12.7	12.8	12.9
Belleville TS	T1/T2	183.4	158.5	160.6	180.2	196.7	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Belleville New DESN	T3/T4	183.4		0.0	0.0	0.0	79.6	104.1	114.0	125.8	138.1	151.6	170.1
Dobbin DS	T1/T2	21.6	10.3	10.4	10.4	10.5	10.5	12.2	13.7	15.3	16.9	18.6	19.2
Dobbin TS	T3/T4	177.7	80.2	85.2	100.2	118.2	136.1	151.5	164.3	206.9	225.4	234.4	242.4
Frontenac TS	T3/T4	123.5	101.8	114.0	118.1	123.6	129.0	133.0	136.2	143.2	147.4	151.8	156.6
Gardiner TS	T1/T2	143.5	128.4	135.9	140.5	190.4	198.7	202.9	204.9	210.6	213.4	238.8	246.9
Gardiner TS	T3/T4	138.7	41.5	56.8	57.4	58.1	99.2	107.9	110.5	113.3	116.2	119.3	122.5
Harrowsmith DS	T1/T2	24.3	19.7	20.5	20.9	21.2	21.5	21.8	22.0	22.2	22.4	22.7	23.0
Havelock TS	T1/T2	97.2	78.2	81.7	83.2	84.9	86.1	87.4	88.0	88.8	92.1	93.3	94.7
Hinchinbrooke DS	T1	8.6	8.2	8.5	8.6	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5
Lodgeroom DS	T1/T2	24.3	11.1	11.6	11.8	12.0	12.2	12.4	12.5	12.7	13.0	13.2	13.5
Napanee TS	T1/T2	116.9	81.0	93.0	103.3	139.8	143.6	150.9	155.3	157.0	159.0	160.7	162.8
Northbrook DS	T1	10.8	8.7	9.0	9.2	9.3	9.5	9.6	9.7	9.8	10.0	10.1	10.3
Otonabee TS 27.6kV	T1/T2	109.8	54.9	56.3	58.2	59.8	61.0	61.5	61.8	62.1	62.5	63.1	63.8
Otonabee TS 44kV	T1/T2	109.8	77.8	79.3	86.5	89.7	94.2	98.4	99.5	103.2	116.9	118.5	119.6
Picton TS	T1/T2	89.1	60.9	72.5	75.8	87.0	97.0	101.2	104.8	108.3	111.9	114.5	117.4
Sharbot DS	T1	8.4	5.4	5.7	5.8	5.9	6.0	6.0	6.1	6.2	6.2	6.3	6.4
Sidney TS	T1/T2	111.8	77.1	77.8	86.5	108.1	108.6	116.5	117.5	119.6	123.8	125.5	127.2
Port Hope TS	T1/T2	139.7	61.3	64.5	70.4	72.5	73.8	75.2	75.8	81.0	90.8	92.0	93.4
Port Hope TS	T3/T4	115.9	75.6	76.3	77.9	78.6	79.0	79.6	79.7	80.0	80.5	81.2	82.1

CTS - 1			2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
CTS - 2			26.1	26.1	26.3	26.6	26.8	27.1	27.3	27.5	27.7	28.0	28.2
CTS - 3			10.3	10.3	10.3	10.4	10.5	10.6	10.6	10.7	10.8	10.8	10.9
CTS - 4			5	5	5	5	5	5	5	5	5	5	5
CTS - 5			8	8	8	8	8	8	8	8	8	8	8

Appendix B: Lists of Step-Down Transformer Stations

No.	Transformer Station	Voltage (kV)	Supply Circuits
1	Ardoch DS (T1)	115	B1S
2	Battersea DS (T1/T2)	115	S1K
3	Belleville TS (T1/T2)	230	T25B, H23B
4	Dobbin DS (T1/T2)	115	P3S, P4S
5	Dobbin TS (T3/T4)	115	Q20H, Q20A
6	Frontenac TS (T3/T4)	115	B5QK, Q3K
7	Gardiner TS (T1/T2)	230	X4H, X2H
8	Gardiner TS (T3/T4)	230	X2H, X4H
9	Harrowsmith DS (T1/T2)	115	B5QK
10	Havelock TS T1/T2	115	T31H, H27H
11	Hinchinbrooke DS (T1)	115	B5QK
12	Lodgeroom DS (T1/T2)	115	B1S
13	Napanee TS (T1)	230	X21, X22
14	Northbrook DS (T1)	115	B1S
15	Otonabee TS (T1/T2) 27.6	230	T22C, T31H
16	Otonabee TS (T1/T2) 44	230	T22C, T31H
17	Picton TS (T1/T2)	230	X21, X22
18	Sharbot DS (T1)	115	B5QK
19	Sidney TS (T1/T2)	115	Q12AT, Q6S
20	Port Hope TS (T1/T2)	115	P3S, P4S
21	Port Hope TS (T3/T4)	115	P3S, P4S

Appendix C: Lists of Transmission Circuits

No.	Connecting Stations	Circuit ID	Voltage (kV)
1	Hinchinbrooke SS – Lennox TS	X1H, X2H, X3H, X4H	230
2	Picton TS – Lennox TS	X21, X22	230
3	Belleville TS – Hinchinbrooke SS	H23B	230
4	Hinchinbrooke SS – Havelock TS	H27H	230
5	Dobbin TS – Chenaux TS	X1P	230
6	Dobbin TS – Chat Falls GS	C27P	230
7	Clarington TS – Havelock TS	T32H	230
8	Chat Falls GS – Havelock TS	C25H	230
9	Clarington TS – Chat Falls GS	T22C	230

10	Cherrywood TS – Dobbin TS	P15C	230
11	Clarington TS – Belleville TS	T25B	230
12	Dobbin TS – Sidney TS	P3S, P4S	115
13	Cataraqui TS – Sidney TS	Q6S	115
14	Barrett Chute TS – Sidney TS	B1S	115
15	Cataraqui TS – Frontenac TS	Q3K	115
16	Cataraqui TS – Frontenac TS to Barrett Chute TS	B5QK	115

Appendix D: List of LDC's

No.	Name of LDC
1	Hydro One Distribution
2	Elexicon Energy Inc.
3	Kingston Hydro Corporation
4	Lakefront Utilities Inc.
5	Eastern Ontario Power Inc.

Appendix E: List of Municipalities in the P to K Region

No.	Name of Municipality
1	Municipality of Clarington
2	City of Kingston
3	County of Frontenac
4	Township of North Frontenac
5	Township of South Frontenac
6	Township of Central Frontenac
7	Township of Frontenac Islands
8	City of Belleville
9	City of Quinte West
10	Municipality of Centre Hastings
11	Municipality of Hastings Highlands
12	Municipality of Marmora and Lake
13	Municipality of Tweed
14	Town of Bancroft
15	Town of Deseronto
16	Township of Carlow/Mayo
17	Township of Faraday
18	Township of Limerick
19	Township of Madoc
20	Township of Stirling-Rawdon
21	Township of Tudor & Cashel
22	Township of Tyendinaga
23	Township of Wollaston
24	Municipality of Brighton
25	Town of Cobourg
26	Municipality of Port Hope
27	Municipality of Trent Hills
28	Township of Alnwick/Haldimand
29	Township of Cramahe
30	Township of Hamilton
31	City of Peterborough
32	Township of Asphodel-Norwood
33	Township of Cavan Monaghan
34	Township of Douro-Dummer
35	Township of Havelock-Belmont-Methuen
36	Township of North Kawartha
37	Township of Otonabee-South Monaghan
38	Township of Selwyn

39	Municipality of Trent Lakes
40	Prince Edward
41	Town of Greater Napanee
42	Township of Addington Highlands
43	Township of Loyalist
44	Township of Stone Mills

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
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
SPS	Special Protection Scheme
SS	Switching Station
STG	Steam Turbine Generator
TS	Transformer Station