

NEEDS ASSESSMENT REPORT

Greater Toronto Area East

December 11, 2024

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Needs Assessment Report Greater Toronto Area (GTA) East Region December 11, 2024

Lead Transmitter:

Hydro One Networks Inc.

Prepared by:

GTA East Technical Working Group









GTA East – Needs Assessment

December 11, 2024



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Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the Greater Toronto Area East 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 Needs Assessment phase and b) require further assessment and regional coordination. The results reported in this Need Assessment are based on the input and information provided by the Technical Working Group (the "TWG") for this region at the time. Updates may be made based on best available information throughout the planning process.

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December 11, 2024



Executive Summary

REGION		Greater Toronto Area East (GTA East) Region (the "Region")				
LEAD		Hydro One Networks Inc. ("H	ydro One")			
START DATE:	August 13, 2024	END DATE:	December 11, 2024			

1. INTRODUCTION

The second Regional Planning cycle for the GTA East Region was completed in February 2020 with the publication of the Regional Infrastructure Plan ("RIP") report (<u>RIP Report</u>). 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 Local Distribution Company ("LDC") 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. Considering these timelines, the 3rd Regional Planning cycle was triggered for the GTA East Region on August 13th, 2024.

3. SCOPE OF NEEDS ASSESSMENT

The scope of the GTA East Region NA 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 needs 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 LDCs 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.

4. **REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION**

The GTA East Region comprises the municipalities of Pickering, Ajax, Whitby, Oshawa and parts of Clarington, and other parts of the Durham area.

5. INPUTS/DATA

The TWG comprises of representatives from LDCs, 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 forecast.

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

6. ASSESSMENT METHODOLOGY

The need 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"



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 discussed in the GTA East Region second cycle RIP have been completed:

- Increase Transformation Capacity in Pickering-Ajax-Whitby Sub-region: Seaton MTS has been built and placed in-service in 2023.
- Wilson TS T1, T2 and Switchyard Refurbishment: Wilson TS T1/T2 have been replaced and new T7/T8 were placed in service in early 2024, maintaining station reliability and ensuring continued supply reliability to Oshawa PUC Inc. (OPUC) and Hydro One Distribution (H1DX) customers.

The following needs and projects discussed in the GTA East second cycle RIP are currently underway:

• Cherrywood TS 230kV Breaker Replacement (multi-phase projects): Two phases are underway with currently planned in-service dates of 2033 and 2037 respetively.

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

• Wilson TS - T3/T4 Replacement

b) Station Capacity

- Whitby TS T1/T2 DESN (44kV)
- Thornton TS T3/T4 DESN
- Wilson TS T7/T8 DESN
- Wilson TS T3/T4 DESN

c) Transmission Line Capacity

• No new transmission Line Capacity need identified

d) System Reliability, Operation and Load Restoration



• T23C/T29C corridor may exceed load security limit of 600MW in 2032 if all forecasted loads at the current stations are supplied from original connection points

e) Transmission System Reinforcement

• Major transmission expansion in Oshawa-Clarington sub-region area will be needed to accommodate increasing new large load connection requests. Existing 230kV transmission facilities do not have sufficient capacity to supply the new demand.

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 need dates and new station capacity needs. These needs will be assessed again during the next phases of this Regional Planning cycle.

No.		Need Date						
	Need Identified	Normal Growth	High Growth	Low Growth				
		Scenario	Scenario	Scenario				
	Needs upda	ite under high and low lo	ad growth scenarios					
1	Whitby TS T1/T2 (44kV) LTR	2032	2030	Beyond 2033				
2	Thornton TS T3/T4 LTR	2031	2027	Beyond 2033				
3	Wilson TS T7/T8 LTR	2032 2029		Beyond 2033				
	Wilcon TS T2/T4 LTP	2024	2024	2024				
4	WIISOIT IS IS/14 LIK	(2025*)	(2025*)	(Beyond 2033*)				
	Additional	capacity needs under hi	gh growth scenario					
5	Cherrywood T7/T8 LTR	Beyond 2033	2031	Beyond 2033				
6	Seaton MTS LTR**	Beyond 2033	2032	Beyond 2033				
7	Whitby TS T3/T4 LTR	Beyond 2033	Beyond 2033					
* If th	* If the transformers are replaced with higher LTR rating units as planned.							
** Ba:	sed on the LDC provided LTRs of 2	153MW (Summer) and 18	0MW (Winter) for Seato	on MTS				



9. **RECOMMENDATIONS**

The TWG recommendations are as follows:

I. 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:

- a) Integrated Transmission reinforcement at Oshawa-Clarington Sub-region area to accommodate large load connection requests and address T23C/T29C corridor load security issue
- b) Station capacity need at Thornton TS in Oshawa area due to load growth
- c) Station capacity need at Wilson TS T7/T8 in Oshawa area due to load growth
- d) Station capacity need at Wilson TS T3/T4 in Oshawa area due to load growth

II. Needs that do not require further regional coordination

These needs can be addressed by a straightforward transmission and/or distribution wires solution, or they are local in nature and do not have a regional impact. They either 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:

- a) Cherrywood TS 230kV Breaker Replacement
- b) Wilson TS T3/T4 Transformer Replacement
- c) Station capacity need at Whitby TS T1/T2 (44kV) in North Whitby area due to load growth

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

- Elexicon Energy Inc.
- Oshawa PUC Networks Inc.
- Hydro One Networks Inc. (Distribution)

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 GTA East Region was completed in February 2020 with the publication of the Regional Infrastructure Plan ("RIP") Report ^[1] - (<u>RIP link</u>). 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 GTA East 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. The flow chart of the Regional Planning Process is shown in Figure 1 below.



Figure 1: Regional Planning Process



This report was prepared by the GTA East 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.

No.	Name of TWG Participants
1	Hydro One Networks Inc. (Transmission) - (Lead Transmitter)
2	Independent Electricity System Operator
3	Elexicon Energy Inc.
4	Oshawa PUC Networks Inc.
5	Hydro One Networks Inc. (Distribution)

Table 1: GTA East Region TWG Participants



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 third Regional Planning cycle was triggered for the GTA East Region.

3. Scope of Needs Assessment

The scope of this NA covers the GTA East region and includes:

- Review and update needs and plans identified in the previous cycle RIP,
- Identify any new needs resulting from this assessment,
- Recommend which needs 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 LDCs 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"), 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 GTA East Region comprises the municipalities of Pickering, Ajax, Whitby, Oshawa and parts of Clarington, and other parts of the Durham area.



The geographical boundaries of the Region are shown in Figure 2.

Figure 2: Map of GTA East Regional Planning Area

Electrical supply to the GTA East Region is provided through 500/230kV autotransformers at Cherrywood Transformer Station (TS) and Clarington Transformer Station (TS) and six 230 kV transmission lines connecting Cherrywood to Eastern Ontario. There are six step-down transformer stations (five Hydro One owned and one LDC owned), and three direct transmission connected load customers. Metrolinx Traction Power Substation (TPSS) is proposed to be in service in 2029. The distribution system is at two voltage levels, 44kV and 27.6kV.



The Local Distribution Customers (LDC) in the Region include Elexicon Energy Inc., Oshawa PUC Networks Inc. and Hydro One Networks Inc. (Distribution). An electrical single line diagram for the GTA East Region facilities is shown in Figure 3.

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

230kV circuits	Transformer Stations	Generation Stations
T23C	Cherrywood TS ¹	CGS D, 60MW gas-fired cogeneration
T24C	Seaton MTS	Pickering Nuclear Generating Station
T26C	Thornton TS	(NGS), approximately 3000 MW
T28C	Whitby TS	
T29C	Wilson TS	
C10A	Enfield TS	
	CTS A	
	CTS B	
	CTS C	
	Metrolinx TPSS (in-service 2029)	

Table 2: Transmission Station and Circuits in the GTA East Region

1: 500kV Stations with Autotransformers installed



Figure 3: GTA East Transmission Single Line Diagram



5. Inputs and Data

TWG participants, including representatives from LDCs, IESO, and Hydro One provided input for the GTA East 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 ^[2]. 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 followings:

- GTA East 10-year summer and winter load forecast for all supply stations inclusive of the inputs provided by the municipalities listed in Appendix E
- Known capacity and reliability needs, operating issues, and/or major assets requiring replacement or refurbishment
- Planned transmission and distribution investments that are relevant to Regional Planning for the GTA East
- Captured uncertainty in the load forecast as well as variability of electric demand drivers to identify any emerging needs and/or advancement or deferment of recommended investments.



6. Assessment Methodology

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

6.1 Technical Assessments and Study Assumptions

The technical assessment of needs was undertaken based on:

- Current and future station capacity and transmission adequacy
- System reliability and operational considerations
- Asset renewal for major high voltage transmission equipment requiring replacement with consideration to "right-sizing"
- Load forecast data requested from industrial customers in the region
- Summer and Winter peak load conditions. Three load forecasts were developed for Summer and Winter respectively, i.e. normal growth scenario, high and low growth scenario. The high and low growth load forecasts are 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 assumptions are made in this report:

- The study period for this Needs Assessment is 2024-2033.
- The Region is summer peaking, but will be transitioning to winter peaking for most of transformer stations in this study period, 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 without low-voltage capacitor banks and 95% lagging power factor for stations with low-voltage capacitor banks.
- Normal planning supply capacity for transformer stations is determined by the Hydro One Summer/Winter 10-Day Limited Time Rating (LTR) at 35 and 10 degree celcius respectively for Summer/Winter of a single transformer at that station.
- Adequacy assessment is conducted as per Ontario Resource Transmission Assessment Criteria (ORTAC)^[3].

6.2 Information Gathering Process

6.2.1 Load forecast

The LDCs provided their summer and winter load forecast for all the stations supplying their loads in the GTA East 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 Region. 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 weather corrected net load forecast for the individual stations in the Region is given in Appendix A.

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

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

6.2.4 System reliability and operational issues

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



7. Needs

This section describes new needs identified in the Region and 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 with associated projects that were recently completed and reaffirmed needs that are underway, are briefly described below with relevant updates:

- Increase Transformation Capacity in Pickering-Ajax-Whitby Sub-region: Seaton MTS has been built and placed in-service in 2023.
- Wilson TS T1, T2 and Switchyard Refurbishment: Wilson TS T1/T2 have been replaced and new T7/T8 were placed inservice in early 2024, maintaining station reliability and ensuring continued supply reliability to Oshawa PUC Inc. (OPUC) and Hydro One Distribution (H1DX) customers.
- Cherrywood TS 230kV Breaker Replacements (multi-phase projects): Two phases are underway with currently planned in-service dates of 2033 and 2037 respectively.

All near and midterm needs that are discussed as a part of this report are summarized in Table 3. Note the planned in-service year for the projects is tentative and is subject to change.

Need Description	Recommended Plan/Update	Previous RIP Report Section	NA Report Section					
	Asset Renewal Needs							
Cherrywood TS 230kV Breaker Replacements (multi-phase projects)	Two phases are underway with currently planned in-service dates of 2033 and 2037 respectively.	Sec. 7.2	Sec. 7.1					
Wilson TS T3/T4 Transformer Replacement	Replacement of T3/T4 transformers with planned in-service date of 2031.	N/A	Sec. 7.1					
	Station Capacity Needs							
Whitby TS T1/T2 (44kV) Station Capacity need	Plan a new Transformer Station at North Whitby area, tapping on 230kV circuits of P15C and T28C. TWG agreed to proceed with local planning, no further regional coordination is required.	N/A	Sec. 7.2.1					
Thornton TS T3/T4 Station Capacity need	Further regional coordination to address this need along with the identified new needs at Wilson TS T3/T4 and Wilson TS T7/T8 in Oshawa area (see Section 7.2.3 and 7.2.4).	N/A	Sec. 7.2.2					

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



Wilson TS T7/T8 Station Capacity need	TS T7/T8 Station Further regional coordination required to address this need along with the identified new needs at Wilson TS T3/T4 (Section 7.2.4), and a new Transformer Station will be required.								
Wilson TS T3/T4 Station Capacity need	A new Transformer Station will be required as early as 2028/2029 and further regional coordination to address this need along with the needs at Wilson TS T7/T8 and Thornton TS T3/T4 (Section 7.2.2 and 7.2.3). As a near term solution, the LDCs are encouraged to continue transferring loads to Enfield TS.	N/A	Sec. 7.2.4						
Syst	System Reliability, Operation and Load restoration Needs								
T23C/T29C corridor exceeds load security limit of 600MW	Further regional coordination required, especially when determining where to connect new Transformer Station to accommodate new needs identified in Section 7.2.2, 7.2.3 and 7.2.4.	N/A	Sec. 7.4						
Transmission System Reinforcement Needs									
Oshawa-Clarington Sub- region area transmission reinforcement for load supply	Further regional coordination to address the capacity needs. Coordinated efforts from IESO bulk system planning, Hydro One, LDCs and major customers should continue in developing solutions.	N/A	Sec. 7.5						

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 need for major high voltage transmission equipment that are expected to be replaced over the next 10 years in the Region. The complete list of planned major HV transmission equipment requiring replacement is provided in Table 4. Note the in service year is subject to change as the asset renewal planning is a dynamic process.

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.

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

- 230 load serving step down transformers
- 230kV breakers where:



replacement of six breakers or more than 50% of station breakers, the lesser of the two

- 230kV transmission lines requiring refurbishment where:
 Leave to Construct (i.e., section 92) approval is required for any alternative to like-for-like
- 230kV 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.

7.1.1 Wilson TS T3/T4

Based on asset condition assessment, Wilson TS T3/T4 transformers are newly identified assets for replacement with currently planned in-service date of 2031. The existing T3 and T4 (75/100/125 MVA) transformers at Wilson TS and associated LV equipment require replacement. It is expected that Wilson TS T3/T4 capacity will increase to approximate 160 MW for Summer and 180 MW for Winter, once being replaced with the new standard 75/100/125 MVA transformers (Section 7.2.4).

No other HV station equipment or transmission lines in the GTA East region have been identified for replacement at this time over the next ten year. If and when new and/or additional information is available, it will be provided during the next regional planning phases.

The needs below in Table 4 do not need further regional coordination.

Station/Circuit	Need Description	Planned ISD
Cherrywood TS	230kV Breaker Replacements (multi-phase projects), two phases are underway	2033/2037
Wilson TS T3/T4	Asset condition based replacement with "like for like" standard units	2031

Table 4: Major HV Transmission Asset Assessed for Replacement in the Region in Next 10 Years



7.2 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2024-2033 for the 230kV Transforming stations in the Region using the summer and winter peak load forecasts. Based on the results, the identified station capacity needs are flagged in Table 5. Comparing with the recommendations in RIP 2022^[1], all Transformer Stations below are newly identified needs in this NA period.

·												
тс	Concorn	LTR		Net Load Forecast (MW)								
15	Season	(MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Whitby TS T1/T2 (44kV)	Winter	113.2	36.6	47.5	56.9	66.6	76.7	87.1	98.1	107.4	118.2	130.1
Thornton TS T3/T4	Summer	154.9	138.0	138.8	139.5	140.0	141.1	142.4	144.7	147.7	151.5	156.2
	Winter	175.5	154.5	157.8	160.3	162.6	165.6	168.9	173.3	178.0	183.7	190.4
Wilson TS T7/T8	Summer	169.1	139.7	147.5	149.1	150.8	155.7	159.5	163.4	168.2	174.1	181.3
Wilson TS T3/T4	Summer	130.2	144.6	161.2	176.0	187.7	198.8	213.6	232.2	254.6	290.5	311.6
	Winter	152.0	136.1	154.7	171.5	185.1	198.2	214.6	234.6	257.2	293.0	312.8

7.2.1 Whitby TS T1/T2 (44kV)

Whitby TS T1/T2 (44kV) supplies loads from one LDC - Elexicon at 44kV level. Elexicon forecasts rapid annual gross load growth of approximate 6.3% at its 44kV service area in North Whitby in next ten years. With forecasted DG and CDM in place, the forecasted net load at Whitby TS T1/T2 (44kV) is expected to exceed its Winter LTR in 2032/2033 by 5MW or 17 MW respectively. In addition, the LDC has indicated that its 44kV distribution capacity at Whitby area will be exceeded by Summer 2032, and majority of the load growth in North Whitby area, which is currently supplied through Whitby TS T3/T4 and Whitby T1/T2 (27.6kV and 44kV), is highly expected post 2033. Also, in Northeast Pickering, there is projected load in the region that cannot be supplied by Whitby TS due to the long distance of the load center from the station.

In order to accommodate these needs, the LDC is currently consulting with Hydro One Tx to build a new Transformer Station, with preliminary option of tapping on two 230kV transmission circuits in the region, namely T28C and P15C. This new Transformer Station will address future projected load growth from North Whiby and North Pickering area. The TWG recommends LDC and Hydro One to proceed to local planning as no expected network reinforcement is required. No further regional coordination is required.

7.2.2 Thornton TS T3/T4

Thornton TS T3/T4 supplies loads from two LDCs, namely Hydro One Distribution (H1DX, with Elexicon's load embedded in) and Oshawa PUC Networks Inc. (OPUC), at 44kV level. OPUC forecasts rapid annual load growth of approximate 4.6% at Thornton TS T3/T4 in next ten years, while Elexicon load forecast remains flat in the study period. With forecasted DG and CDM in place, the net forecasted load at



Thornton TS T3/T4 is expected to exceed its LTRs as early as 2031 for Winter, or 2033 for Summer. The TWG recommends further regional coordination to address this need along with the identified new needs at Wilson TS T7/T8 and Wilson TS T3/T4 in Oshawa area (see Section 7.2.3 and 7.2.4 below).

7.2.3 Wilson TS T7/T8

Wilson TS T7/T8 serves loads from two LDCs, including OPUC and Hydro One Distribution (H1DX) at 44kV level. The two transformers have recently been replaced in early 2024 with largest size as per Hydro One standard transformer specification. Both LDCs forecast similar moderate annual gross load growth of approximate 3.2-3.7% at Wilson TS T7/T8 in next ten years. The net forecasted load at Wilson TS T7/T8 is expected to exceed its LTR as early as 2032 for Summer. The TWG recommends further regional coordination to address this need along with the identified new needs at Wilson TS T3/T4 (Section 7.2.4), and acknowledges that a new Transformer Station will be required for these needs.

7.2.4 Wilson TS T3/T4

Wilson TS T3/T4 serves loads from LDCs OPUC and Hydro One Distribution (H1DX) at 44kV level, with Elexicon's load embedded in H1DX. H1DX (including Elexicon) forecasts approximate 12% annual load growth at Wilson TS T3/T4 in next ten years, while OPUC forecasts moderate growth of approximate 3.6% annually in next ten years. The net forecasted load at Wilson TS T3/T4 is expected to exceed its LTR as early as 2024 for Summer, and 2025 for Winter.

As mentioned in Section 7.1.1, based on asset condition assessment, the T3 and T4 transformers at Wilson TS and associated LV equipment have been identified for replacement. Hydro One has identified the replacement of Wilson TS T3/T4 with planned in-service date of 2031. As the existing transformers have substandard LTRs, it is expected that Wilson TS T3/T4 will be replaced with standard 75/100/125 MVA transformers, and the capacity will increase from the current 130 MW for Summer and 152 MW for Winter to approximately 160 MW for Summer and 180 MW for Winter.

However, even with higher ratings of the new transformers, Wilson TS T3/T4 LTRs will still be exceeded based on load forecast. As a near term solution, the LDCs are encouraged to continue transferring loads to Enfield TS which can accommodate the additional loads that exceed Wilson TS T3/T4 station capacity. By doing so, the station capacity need could potentially be deferred for a few years. The TWG acknowledges that a new station will be required as early as 2028/2029 even with load transfers, and recommends further regional coordination to address this need along with the need in Section 7.2.2 and 7.2.3.

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 Transmission line circuits in the Region by assessing thermal limits of the circuit and the voltage range as per ORTAC^[3].

Based on the results, there is no new transmission line capacity need identified.

7.4 System Reliability, Operation and Restoration Needs

The transmission system must be planned to satisfy demand levels up to the extreme weather, medianeconomic forecast for an extended period with any one transmission element out of service. The system should also meet load security and load restoration criteria as defined in ORTAC^{[3].} Based on input from the IESO and LDCs, the following system reliability, operational and restoration issues were identified:

The new load forecast suggests T23C/T29C corridor will exceed load security limit of 600MW^[3] in 2032. Table 6 shows load growth of all double-circuit corridors in the Region (assuming all forecasted loads were supplied from original connection points). The TWG recommends further regional coordination to address the T23C/T29C corridor load security issue, especially when determining where to connect the new Transformer Station to accommodate new needs identified in Section 7.2.3 and 7.2.4. The other T24C/T28C corridor will not have more than 600MW net loads in the assessment window.

Circuits			Non-coincident Load served by the double circuits (MW)											
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033			
T22C/T20C	Summer	442.6	468.3	486.1	500.7	518.2	538.2	562.8	592.4	638.0	671.0			
1230/1290	Winter	362.1	395.3	420.3	442.1	466.3	493.1	524.0	557.0	605.3	639.5			
T24C/T26C	Summer	412.9	418.5	424.1	429.5	435.7	472.5	480.9	489.8	501.5	515.4			
124C/126C	Winter	399.0	414.9	428.3	441.7	456.4	501.6	518.7	534.2	552.6	573.3			

Table 6: Double-circuit Corridor Non-coincident Load

• All double-circuit corridor loads will exceed 250MW in this assessment timeframe. The ORTAC^[3] requires the amount of load interruption in excess of 250MW must be restored within 30 minutes (and within 4 hours for load loss more than 150MW). The TWG surveyed transmission load interruption performance data from 2014 to 2024 for the Region. The results show that delivery points supplied by the circuits in Table 6 did not log load loss of more than 250MW for longer than 30 minutes, or loss of more than 150MW for longer than 4 hours in the past 10 years. Based on past performance data, the TWG would not recommends capital investment for load restoration at this point. Hydro One shall proactively monitor load restoration data and identify opportunities to reduce risk of prolonged load restoration.



7.5 Transmission System Reinforcement Needs

Oshawa-Clarington Sub-region area transmission reinforcement:

In addition to the rapid organic load growth forecasted in T23C/T29C/T24C/T26C corridors, multiple proponents have requested to connect large-scale loads in Oshawa-Clarington Sub-region area. Majority of the requests are large data centers. It is not feasible for the existing 230kV transmission infrastructure in Oshawa-Clarington Sub-region area to accommodate such sizeable loads. Due to the scale and complexity of such connections, the TWG recommends further regional coordination to address these potential capacity needs. Coordinated efforts from IESO bulk system planning, Hydro One, LDCs and major customers should continue in developing solutions.



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 GTA East 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 impact of sensitivity analysis for the high and low growth scenario is shown in Table 7. The additional capacity needs identified towards the end of the study period will be assessed again during the next phases of the Regional Planning cycle where another sensitivity anaylyis will be undertaken based on updated information.

		Need Date									
No.	Need Identified	Normal Growth Scenario	High Growth Scenario	Low Growth Scenario							
Needs update under high and low load growth scenarios											
1	Whitby TS T1/T2 (44kV) LTR	2032	2030	Beyond 2033							
2	Thornton TS T3/T4 LTR	2031	2027	Beyond 2033							
3	Wilson TS T7/T8 LTR	2032	2029	Beyond 2033							
4	Wilson TS T3/T4 LTR	2024 (2025*)	2024 (2025*)	2024 (Beyond 2033*)							
	Additiona	l capacity needs under hi	gh growth scenario								
5	Cherrywood T7/T8 LTR	Beyond 2033	2031	Beyond 2033							
6	Seaton MTS LTR**	Beyond 2033	2032	Beyond 2033							
7	Whitby TS T3/T4 LTR	Beyond 2033	2031	Beyond 2033							
* If th	e transformers are replaced with	higher LTR rating units as	planned.								
** Ba	sed on the LDC provided LTRs of 2	153MW (Summer) and 18	0MW (Winter) for Seato	on MTS							

Table 7: Impact of Sensitivity Analysis on Capacity Needs in the Region



9. Conclusion and Recommendation

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

Table 8: Needs that Do Not Require Further Regional Coordination

No.	Need	Recommendation
1	Cherrywood TS 230kV Breaker Replacement	Replace 230kV Breaker in multi phases. Two phases are underway with currently planned in-service dates of 2033 and 2037 respectively.
2	Wilson TS T3/T4 Transformer Replacement	Replace Wilson TS T3/T4 transformers with "like for like" standard units with currently planned in service date of 2031.
3	Station capacity need at Whitby TS T1/T2 (44kV) due to load growth	Plan a new Transformer Station at North Whitby area, tapping on 230kV circuits of P15C and T28C. TWG agreed to proceed with local planning and no further regional coordination is required.

Table 9: Needs Requiring Further Regional Coordination

No.	Need
1	Transmission reinforcement at Oshawa-Clarington Sub-region area to accommodate large
T	load connection requests and address potential load security issue
2	Station capacity need at Thornton TS T3/T4 due to load growth
3	Station capacity need at Wilson TS T7/T8 due to load growth
4	Station capacity need at Wilson TS T3/T4 due to load growth

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

- Elexicon Energy Inc.
- Oshawa PUC Networks Inc.
- Hydro One Networks Inc. (Distribution)



10. References

- [1] Hydro One, <u>RIP Report GTA East 2020 (hydroone.com)</u> (issue February 29, 2020)
- [2] Ontario Energy Board, Load Forecast Guideline for Ontario (issue October 13, 2022)
- [3] Independent Electricity System Operator, Ontario Resource and Transmission Assessment Criteria (issue 5.0 August 22, 2007)
- [4] Ontario Energy Board, <u>Transmission System Code</u> (issue July 14, 2000 rev. August 2, 2023)
- [5] Ontario Energy Board, Distribution System Code (issue July 14, 2000 rev. March 27, 2024)



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

Transformer Station Summer			Summer Non-Coincident NET Forecast (MW) - Normal Growth									
Name	DESN ID	(MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Cherrywood TS	T7/T8	167.2	143.4	145.8	148.3	150.8	153.5	156.2	159.3	162.8	163.6	163.1
Seaton MTS	T1/T2	N/A	4.1	10.1	17.0	25.6	36.9	47.0	56.8	66.7	76.7	86.7
Thornton TS	T3/T4	154.9	138.0	138.8	139.5	140.0	141.1	142.4	144.7	147.7	151.5	156.2
Whitby TS	T3/T4	182.4	158.2	159.5	161.0	162.2	163.6	165.1	167.1	169.6	173.4	178.1
Whitby TS	T1/T2 (27.6kV)	99.9	51.8	52.1	52.4	52.6	52.9	53.2	53.7	54.3	55.4	56.8
Whitby TS	T1/T2 (44kV)	100.8	46.1	50.6	55.2	59.9	64.7	69.8	75.5	80.8	87.6	95.4
Wilson TS	T7/T8	169.1	139.7	147.5	149.1	150.8	155.7	159.5	163.4	168.2	174.1	181.3
Wilson TS	T3/T4	130.2	144.6	161.2	176.0	187.7	198.8	213.6	232.2	254.6	290.5	311.6
Enfield TS	T5/T6	161.5	91.7	96.4	99.7	104.0	107.3	110.7	113.5	117.0	121.4	126.5
CTS A			40	40	40	40	40	40	40	40	40	40
CTS B	NI /	N/A		97	97	97	97	97	97	97	97	97
CTS C	N/A		40	40	40	40	40	40	40	40	40	40
Metrolinx TPSS			0	0	0	0	0	30	30	30	30	30

Table A.1: GTA East Region – Summer Non-coincident Normal Growth Net Load Forecast

Note:

1. All LTRs are based on 35C for Summer and 10C for Winter.

2. Cherrywood TS DESN LTR is limited by outdoor AL tube, decreasing summer LTR by 8MW.

3. Wilson TS T3/T4 will be replaced by 2031 with higher rating of approximate 160MW for Summer and 180MW for Winter.

Transformer Station Su		Summer	Summer Non-Coincident NET Forecast (MW) - Normal Growth									
Name	DESN ID	(MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Cherrywood TS	T7/T8	167.2	136.2	138.5	140.9	143.3	145.8	148.4	151.4	154.7	155.5	154.9
Seaton MTS	T1/T2	N/A	2.7	6.8	11.4	17.1	24.8	31.5	38.1	44.7	51.4	58.1
Thornton TS	T3/T4	154.9	127.0	127.7	128.3	128.8	129.8	131.0	133.1	135.9	139.4	143.7
Whitby TS	T3/T4	182.4	150.3	151.5	152.9	154.0	155.5	156.9	158.8	161.1	164.7	169.2
Whitby TS	T1/T2 (27.6kV)	99.9	49.2	49.5	49.8	50.0	50.3	50.6	51.0	51.6	52.6	53.9
Whitby TS	T1/T2 (44kV)	100.8	43.8	48.1	52.4	56.9	61.4	66.3	71.7	76.8	83.2	90.7
Wilson TS	Т7/Т8	169.1	125.8	132.8	134.2	135.8	140.2	143.5	147.1	151.4	156.7	163.2
Wilson TS	T3/T4	130.2	130.2	145.1	158.4	168.9	178.9	192.2	209.0	229.1	261.4	280.5
Enfield TS	T5/T6	161.5	85.3	89.7	92.7	96.8	99.8	102.9	105.5	108.8	112.9	117.7
CTS A			30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8
CTS B	NI /	NI / A		46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6
CTS C	N/A		38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
Metrolinx TPSS			0	0	0	0	0	30	30	30	30	30



Transformer Station Winter			Winter Non-Coincident NET Forecast (MW) - Normal Growth										
Name	DESN ID	(MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Cherrywood TS	T7/T8	204.5	127.8	134.8	140.9	147.0	153.6	160.0	167.1	170.9	170.2	169.6	
Seaton MTS	T1/T2	N/A	4.2	10.4	17.5	26.5	38.3	48.8	59.0	69.3	79.7	90.1	
Thornton TS	T3/T4	175.5	154.5	157.8	160.3	162.6	165.6	168.9	173.3	178.0	183.7	190.4	
Whitby TS	T3/T4	206.2	111.0	117.0	122.3	127.4	132.9	138.3	144.3	149.6	156.1	163.4	
Whitby TS	T1/T2 (27.6kV)	112.5	30.9	32.6	34.1	35.5	37.1	38.6	40.3	41.8	43.7	45.8	
Whitby TS	T1/T2 (44kV)	113.2	36.6	47.5	56.9	66.6	76.7	87.1	98.1	107.4	118.2	130.1	
Wilson TS	Т7/Т8	184.3	114.9	123.6	126.5	129.6	135.3	140.2	145.1	150.2	156.3	163.4	
Wilson TS	T3/T4	152.0	136.1	154.7	171.5	185.1	198.2	214.6	234.6	257.2	293.0	312.8	
Enfield TS	T5/T6	183.4	94.7	101.0	105.7	111.3	116.0	120.7	124.7	129.3	134.7	140.9	
CTS A				40	40	40	40	40	40	40	40	40	
CTS B	N/A		97	97	97	97	97	97	97	97	97	97	
CTS C			40	40	40	40	40	40	40	40	40	40	
Metrolinx TPSS			0	0	0	0	0	30	30	30	30	30	

Table A.3: GTA East Region – Winter Non-coincident Normal Growth Net Load Forecast

Note:

1. All LTRs are based on 35C for Summer and 10C for Winter.

2. Cherrywood TS DESN LTR is limited by outdoor AL tube, decreasing summer LTR by 8MW.

3. Wilson TS T3/T4 will be replaced by 2031 with higher rating of approximate 160MW for Summer and 180MW for Winter.

Transformer	Winter	Winter Non-Coincident NET Forecast (MW) - Normal Growth										
Name	DESN ID	LTR (MW)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Cherrywood TS	T7/T8	204.5	125.2	132.1	138.1	144.1	150.5	156.8	163.7	167.5	166.8	166.2
Seaton MTS	T1/T2	N/A	2.6	6.4	10.9	16.4	23.8	30.2	36.6	43.0	49.4	55.9
Thornton TS	T3/T4	175.5	140.6	143.6	145.9	148.0	150.7	153.7	157.7	162.0	167.2	173.3
Whitby TS	T3/T4	206.2	108.8	114.7	119.8	124.8	130.2	135.6	141.4	146.6	153.0	160.1
Whitby TS	T1/T2 (27.6kV)	112.5	30.2	31.9	33.4	34.8	36.3	37.8	39.5	41.0	42.8	44.8
Whitby TS	T1/T2 (44kV)	113.2	35.9	46.6	55.8	65.3	75.1	85.4	96.1	105.2	115.8	127.5
Wilson TS	Т7/Т8	184.3	108.0	116.2	118.9	121.8	127.2	131.8	136.4	141.2	146.9	153.6
Wilson TS	T3/T4	152.0	128.0	145.4	161.2	174.0	186.3	201.7	220.5	241.8	275.4	294.0
Enfield TS	T5/T6	183.4	87.1	92.9	97.2	102.4	106.7	111.1	114.7	118.9	123.9	129.6
CTS A			35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
CTS B	NI /	N1/A		86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3
CTS C	N/A		34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
Metrolinx TPSS				0	0	0	0	30	30	30	30	30

Table A.4: GTA East Region – Winter Coincident Normal Growth Net Load Forecast



No.	Transformer Stati	ion	Voltage (kV)	Supply Circuits		
1	Cherrywood TS	Т7/Т8	230/44	Cherrywood TS, DK Bus		
2	Seaton MTS	N/A	230/27.6	C10A/T28C		
3	Thornton TS	T3/T4	230/44	T24C/T26C		
		T1 /T2	230/27.6	T24C/T26C		
4	Whitby TS	11/12	230/44	1240/1200		
		T3/T4	230/44	T23C/T29C		
-	Wilson TC	T1/T2	230/44	T220/T200		
5	Wilson 15	T3/T4	230/44	1230/1290		
6	Enfield TS	T5/T6	230/44	Clarington TS, PK Bus		
7	CTS A	N/A	N/A	T24C/T26C		
8	CTS B	N/A	N/A	T24C/T26C		
9	СТЅ С	N/A	N/A	T24C/T26C		



Appendix C: Lists of Transmission Circuits

No.	Circuit ID	From Station	To Station	Voltage (kV)
1	C10A	Cherrywood TS	Seaton MTS	230
2	T23C	Cherrywood TS	Clarington TS	230
3	T24C	Cherrywood TS	Clarington TS	230
4	T26C	Cherrywood TS	Clarington TS	230
5	T28C	Cherrywood TS	Clarington TS	230
6	T29C	Cherrywood TS	Clarington TS	230



Appendix D: List of LDC's

No.	Name of LDC	Connection Type (TX/DX)
1	Elexicon Energy Inc.	TX / DX
2	Oshawa PUC Networks Inc.	TX / DX
3	Hydro One Networks Inc. (Distribution)	ΤХ



Appendix E: List of Municipalities in the region

No.	Name of Municipality
1	City of Pickering
2	Town of Ajax
3	Town of Whitby
4	City of Oshawa
5	Municipality of Clarington
6	Township of Scugog
7	Township of Uxbridge
8	Regional Municipality of Durham



Appendix F: Acronyms

Acronym	Description
CDM	Conservation and Demand Management
CEP	Community Energy Plan
CIA	Customer Impact Assessment
CGS	Customer Generating 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
КОР	Key Operating Point
kV	Kilovolt
LDC	Local Distribution Company
LTE	Long Term Emergency
LP	Local Plan
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
MVGIS	Medium Voltage Gas Insulated Switchgear
NA	Needs Assessment
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
SS	Switching Station
TS	Transformer Station