REGIONAL INFRASTRUCTURE PLAN REPORT

Burlington to Nanticoke

Regional Infrastructure Plan Report

Burlington to Nanticoke

June 16, 2025

Lead Transmitter:

Hydro One Networks Inc.

Prepared by:

Burlington to Nanticoke Technical working group

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Disclaimer

This Regional Infrastructure Plan (RIP) Report for Burlington to Nanticoke region was prepared for the purpose of developing an electricity infrastructure plan to address electrical supply needs identified in previous planning phases and any additional needs identified based on new and/or updated information provided by the RIP Technical Working Group (TWG).

The preferred solution(s) that have been recommended in this report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this RIP report are based on the information provided and assumptions made by the participants of the RIP TWG at the time.

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Executive Summary

REGION	**Burlington to Nanticoke** (the "Region")		
LEAD	Hydro One Networks Inc. ("HONI")		
START DATE:	December 18, 2024	**END DATE:**	June 16, 2025

1. INTRODUCTION

The Regional Infrastructure Plan (RIP) is the final step of Regional Planning Process for the Burlington to Nanticoke region, preceded by, the publication of Needs Assessment (NA) report in September 2022 by Hydro One, followed by the Scoping Assessment (SA) & Integrated Regional Resource Plan (IRRP) which were published in December 2022 and in November 2024 respectively, by the Independent Electricity System Operator (IESO). The assessment for Hamilton sub-region was not completed in the November 2024 IRRP and re-assessment of the Bronte TS supply area due to upcoming load forecast revision will be completed as an addendum to the IRRP.

Hydro One as the lead transmitter undertakes the development of a RIP with input from the TWG for the region and publishes an RIP report. The RIP report includes a common discussion of all the options and recommended plans, and preferred wire infrastructure investments identified in earlier phases to address the near- and medium-term needs. The RIP load forecast was refreshed for the next 10 years following the completion of IRRP based on input from WG members and developed an additional alternative for one of the 115kV supply capacity needs in Brant Area as well as an alternative location for one of the Dundas DESNs recommended in the IRRP south of Hamilton near Hydro One's existing Middleport TS. In addition, Hydro One will issue an addendum to this RIP with a final recommendation based on the findings of the Technical Working Group for the additional alternatives within 90 days of the IESO Hamilton area addendum IRRP kickoff.

Objectives:

- Provide a comprehensive summary of needs and wires plans to address the needs for the Burlington to Nanticoke region.
- Identify new supply needs that may have emerged since previous planning phases (e.g., Needs Assessment, Scoping Assessment, Local Plan, and/or Integrated Regional Resource Plan).
- Assess and develop wires plans to address these new needs.
- Identify investments in transmission and distribution facilities or both that should be developed and implemented on a coordinated basis to meet the electricity infrastructure needs within the region.

Scope:

- A consolidated report of the needs and relevant wires plans to address near and medium-term needs 2025 - 2035 identified in previous planning phases (i.e., Needs Assessment, Scoping Assessment, or Integrated Regional Resource Plan).

- Identification of any new needs over the 2025-2035 period and wires plans to address these needs based on new and/or updated information.
- Consideration of long-term needs identified by the TWG.

2. REGIONAL PLANNING PROCESS & RIP METHODOLOGY

This section provides a detailed overview of the various steps followed during different phases of Regional Planning Process and their outcomes starting with the Needs Assessment, Scoping Assessment, Integrated Regional Resource Plan and finally details the Regional Infrastructure plan Methodology.

3. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

This section provides a general overview of the Geographical boundaries, Circuit connections and Stations located in the Burlington to Nanticoke region though a regional planning area map and a Single Line diagram.

The Burlington to Nanticoke region covers the City of Brantford, Municipality of Hamilton, counties of Brant, Haldimand and Norfolk. The portions of Cities of Burlington and Oakville south of Dundas Street are included in the Burlington to Nanticoke region up to Third Line Road in the east.

4. TRANSMISSION FACILITIES COMPLETED IN THE LAST TEN YEARS AND/OR UNDERWAY

This section provides a summary and brief description of all the projects completed in the past ten years or are currently underway.

i. The following major projects were completed during the last ten years:

i. Burlington TS (2016) – Installed an additional 230 kV circuit breaker to reduce probability of the simultaneous loss of two autotransformers to improve supply reliability of the stations supplied from 115 kV bus.

ii. Transformer replacement at stations: Dundas TS (T1&T2 -2015), Brant TS (T1&T2 -2016), Beach TS (T3 &T4 -2018), Mohawk TS (T1&T2 -2018) and Newton TS (T1&T2 - 2020).

iii. B7/B8 115 kV Transmission line capacity (2018) – addressed supply capacity constraint to Bronte TS through distribution load transfers.

iv. Horning TS (2018) – replaced 230/ 13.8 kV transformers (T1 &T2) & LV switchgear.

v. Bronte TS (2019) – replaced 115/ 27.6 kV transformers (T5 &T6) & associated LV switchgear.

vi. Brant Switching Station (2019) – installed three (3) 115 kV breakers at Brant TS integrating 115 kV B12BL/B13BL circuits with 115 kV B2 circuit from Karn TS, to provide additional supply capacity for Brant TS and Powerline MTS.

vii. Cumberland TS (2019): Power factor correction – Capacitors installed at customer level.

viii. 115 kV B3/B4 (2020): Refurbished line section from Horning Mountain Jct. to Glanford Jct. based on asset condition assessment.

ix. Elgin TS (2022): Transformers & switchgear replacement based on asset condition assessment and reconfiguring from two (2) DESNs to a single DESN.
x. Kenilworth TS (2023): Transformer & switchgear replacement based on asset condition assessment and reconfiguration from two (2) DESNs to single DESN.
xi. Gage TS (2024): Transformers & switchgear replacement based on asset condition assessment, reconfiguring station from a three (3) DESNs station to a two (2) DESNs station replacing equipment.

ii. The following major projects are underway:

i. Kenilworth TS: Power factor correction (2025)
ii. Dundas TS: Load Balancing between DESNs (2025)
iii. Norfolk area supply capacity – Load transfer and additional reactive support (2026)
iv. 115 kV B7/B8: Refurbish of line section from Burlington TS to Nelson Jct. (2025)
v. Beach TS: Autotransformer (T1/ T7/T8) Replacement (2028)
vi. Lake TS: Transformer (T2) Replacement (2028)

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

5. LOAD FORECAST AND STUDY ASSUMPTIONS

During the study period, the load in the Burlington to Nanticoke region is expected to grow at an average annual rate of approximately 3.1% in summer from 2025 to 2035. The Region is summer peaking, so this assessment is based on summer peak loads.

The following actions and assumptions are made in this report.

- The study period for the RIP assessments is 2025-2035.
- LDCs are requested to confirmed load forecasts up to 2035 in the area.
- The CDM values were updated based on the 2025 APO to incorporate the expanded eDSM programs.
- All planned facilities for which work has been initiated and are listed in section 4 are assumed to be in-service.
- The Region is summer peaking, so this assessment is based on summer peak loads.
- 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, or based on historical power factor data.
- Normal planning supply capacity for transformer stations in the region is determined by the summer 10-day Limited Time Rating (LTR) based on 35°C ambient temperature.
- Bulk transmission line capacity adequacy is assessed by using coincident peak loads in the area. Capacity assessment for radial lines and stepdown transformer stations uses non-coincident peak loads.
- Adequacy assessment is conducted as per required regulations.

6. SYSTEM ADEQUACY AND REGIONAL NEEDS

This section reviews the adequacy of the existing Transmission Systems and Transformer Station facilities supplying Burlington to Nanticoke region and lists the facilities requiring reinforcement over the near and midterm period. The adequacy assessment assumes that all the projects that are currently underway are completed.

Needs identified in the region:

a. **Asset Renewal for Major HV Transmission Equipment**
   i. Nebo TS: Transformer (T3/ T4) refurbishment
   ii. Lake TS: DESN (T3/T4) refurbishment
   iii. Beach TS: DESN (T5/T6) refurbishment
   iv. Caledonia TS: Transformer (T2) refurbishment
   v. Birmingham TS: Transformer (T1) and MV Metalclad Switchgear refurbishment
   vi. Gage TS: DESN (T8/T9) refurbishment
   vii. Jarvis TS: Transformer (T3/T4) refurbishment

The refurbishment needs that currently fall beyond the study period of this report are not included in this report and will be reassessed, as needed, during the next planning cycle. The Hamilton 115 kV cable refurbishment needs will be studied as part of the upcoming Hamilton IRRP report, led by the IESO.

b. **Area Supply Needs**
   i. Brant Area
   ii. Norfolk Area
   iii. Dundas Area
   iv. Bonte Area

c. **Station Capacity**
   i. Nebo TS (T3/T4) 13.8 kV DESN
   ii. Mohawk TS
   iii. Newton TS
   iv. Nebo TS (T1/T2) 27.6 kV DESN

The station capacity needs beyond the study period of this report are not included in this report and will be reassessed, as needed, during the next planning cycle.

d. **Transmission Line Supply Capacity**

The TWG identified overloading of 115 kV B2 intertie line between Brant and Woodstock area which is studied as part of the Brant area supply needs and supply capacity of C9/C12 will be studied as part of Norfolk area supply need.

e. System Reliability, Operation and Load restoration

The Technical Working Group did not identify any other reliability, operation and load restoration needs for this region during this regional planning cycle.

7. REGIONAL PLANS

This section discusses the regional electric supply needs and presents all the wires alternatives considered to address these needs and identifies the best and preferred wires solutions for the Burlington to Nanticoke Region. The needs include those previously identified in the NA and IRRP for the Burlington to Nanticoke Region as well as any new needs identified during the RIP phase.

8. CONCLUSION AND RECOMMENDATIONS

The major infrastructure investments recommended by the TWG in the Burlington to Nanticoke region are given below:

Station/Circuit Name	Recommended Plan	Lead	Planned ISD	Section No.
Asset Renewal Needs				
Nebo TS	Transformer (T3/ T4) refurbishment	Hydro One	2030-2035	8.1.1
Lake TS	DESN (T3/T4) Refurbishment	Hydro One	2030-2035	8.1.2
Beach TS	DESN (T5/T6) Refurbishment	Hydro One	2030-2035	8.1.3
Caledonia TS	Transformer (T2) refurbishment	Hydro One	2030-2035	8.1.4
Birmingham TS	Transformer (T1) and MV Metalclad Switchgear Refurbishment	Hydro One	2030-2035	8.1.5
Gage TS	DESN (T8/T9) Refurbishment	Hydro One	2030-2035	8.1.6
Jarvis TS	Transformer (T3/T4) refurbishment	Hydro One	2030-2035	8.1.7
Area Supply Needs				
Brant Area*	Two (2) new 230kV/ 27.6 kV 200 MVA transformation facilities near the existing Brant TS.	Hydro One	2029	8.2.1
Norfolk Area	Load transfers, additional reactive support and large Battery Storage.	Hydro One	2025	8.2.2

Station/Circuit Name	Recommended Plan	Lead	Planned ISD	Section No.
Dundas Area*	Two (2) new 230kV/ 27.6 kV 200 MVA transformation facilities near existing Dundas TS.	Hydro One	2035	8.2.3
Bronte Area	To be assessed as part of the upcoming Hamilton IRRP	Hydro One	TBD	8.2.4
Station Capacity Needs				
Nebo TS (T3/T4) 13.8 kV DESN	Transformers are to be replaced based on their asset condition assessment with Hydro One standard units	Hydro One	2025	8.3.1
Mohawk TS	Load monitoring, load transfers to neighboring stations and operational measures as required. This need to be reassessed during the next regional planning cycle	Hydro One	2035	8.3.2
Newton TS	Load monitoring, load transfers to neighboring stations and operational measures. This need to be reassessed during the next regional planning cycle	Hydro One	2035	8.3.4
Nebo TS (T1/T2) 27.6 kV DESN	Load monitoring, load transfers to neighboring stations and operational measures. Additional transformation required in the forecasted timeframe south of Hamilton.	Hydro One/ Alectra	2031	8.3.5
Transmission Line Capacity Needs				
The overloading of 115 kV B2 intertie line between Brant area and Woodstock area is included as part of the Brant area and supply capacity of C9/C12 115 kV circuits as part of the Norfolk area supply needs.				
System Reliability, Operation and Load restoration Needs				
No other system reliability, operation and load restoration needs have been identified for this region				

**- New options identified during RIP phase for these needs and will be assessed as an addendum to this report.*
Note: The planned in-service dates are tentative and subject to change.

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1. INTRODUCTION

The Regional Infrastructure Plan (RIP) is the final step of the Regional Planning Process. Hydro One as the lead transmitter undertakes the development of a RIP with input from the Technical Working Group (TWG) for the region and publishes a RIP report. The third cycle of the Regional Planning process for the Burlington to Nanticoke region initiated with the publication of Needs Assessment (NA) and the report published in September 2022 by Hydro One. This followed by the Scoping Assessment (SA) & Integrated Regional Resource Plan (IRRP) which were published in December 2022 and November 2024 respectively, by the Independent Electricity System Operator (IESO). Typically, an IRRP takes 18 months to complete. However, due to the complex nature of the needs in the region, the IESO requested a six-month extension from the OEB to finalize the plan. The 3rd cycle IRRP did not include the assessment for Hamilton sub-region which is planned for completion in 2026 and will be an addendum to this IRRP. The LDCs supplied by Bronte TS are currently updating their load forecast. The assessment of Bronte area supply will be completed in the Hamilton IRRP addendum.

The RIP report includes a common discussion of all the options and recommended plans, and preferred wire infrastructure investments identified in earlier phases to address the near- and medium-term needs.

This report was prepared by Burlington to Nanticoke TWG, led by Hydro One Networks Inc. The report presents the results of the assessment based on information provided by Hydro One, the Local Distribution Companies ("LDC"), the Municipalities and the IESO. Participants of the TWG are listed below in Table 1.

Table 1: Burlington to Nanticoke Region TWG Participants

Sr. no.	Name of TWG Participants
1	Alectra Utilities Corporation
2	Burlington Hydro Inc.
3	Grand Bridge Energy Inc.
4	Hydro One Networks Inc. (Distribution)
5	Independent Electricity System Operator (IESO)
6	Oakville Hydro
7	Hydro One Networks Inc. (Lead Transmitter)

2. OBJECTIVES AND SCOPE OF REGIONAL INFRASTRUCTURE PLAN

This RIP report examines the needs in the Burlington to Nanticoke region. Its objectives are to:

- Provide a comprehensive summary of needs and wires plans to address the needs for the Burlington to Nanticoke region.
- Identify new supply needs that may have emerged since previous planning phases (e.g., Needs Assessment, Scoping Assessment, Local Plan, and/or Integrated Regional Resource Plan).
- Assess and develop wires plans to address these new needs.
- Identify investments in transmission and distribution facilities or both that should be developed and implemented on a coordinated basis to meet the electricity infrastructure needs within the region.

The RIP reviewed factors such as the load forecast, asset renewal for major high voltage transmission equipment, transmission and distribution system capability along with any updates with respect to local plans, conservation and demand management ("CDM") forecasts, renewable and non-renewable generation development, and other electricity system and local drivers that may impact the need and alternatives under consideration.

The scope of this RIP is as follows:

- A consolidated report of the needs and relevant wires plans to address near- and medium- term needs (2025-2035) identified in previous planning phases (i.e., Needs Assessment, Scoping Assessment, Local Plan, or Integrated Regional Resource Plan).
- Identification of any new needs over the 2025-2035 period and wires plans to address these needs based on new and/or updated information.
- Consideration of long-term needs identified in Burlington to Nanticoke IRRP, Bulk system studies or as identified by the TWG.

3. REGIONAL PLANNING PROCESS & RIP METHODOLOGY

3.1 Overview

Bulk System Planning, Regional Planning and Distribution Planning are the three levels of planning for the electricity system in Ontario. Bulk system planning typically looks at issues that impact the system on a provincial level and require longer lead time and larger investments. Comparatively, planning at the regional and distribution levels looks at issues on a more regional or localized level. Typically, the most essential and effective regional planning horizon is the near- to medium-term (1- 10 years), whereas long-term (10-20 years) regional planning mostly provides an outlook with little details about investments because the needs and other factors may vary over time. On the other hand, bulk system plans are developed for the long term because of the larger magnitude of investments.

The regional planning process begins with a Needs Assessment which is led by the transmitter to identify, assess, and document which of the needs that,

a) can be addressed directly between the customer and transmitter along with a recommended plan, and;
b) require further regional coordination and identification of Local Distribution Companies (LDCs) to be involved in further regional planning activities for the region.

At the end of the NA, a decision is made by the TWG as to whether further regional coordination is necessary to address some or all regional needs. If no further regional coordination is required, recommendation to implement the recommended option and any necessary investments are planned directly by the LDCs (or customers) and the transmitter. The region's TWG can also recommend to the transmitter and LDCs to undertake a local planning process for further assessment when needs are:

a) local in nature;
b) require limited investments in wires (transmission or distribution) solutions, and;
c) do not require upstream transmission investments.

If coordination at the regional or sub-regional levels is required for identified regional needs, then the IESO initiates the SA phase. During this phase, the IESO, in collaboration with the transmitter and impacted LDCs, reviews the information collected as part of the NA phase, along with additional information on potential non-wires or resource alternatives, e.g., Conservation and Demand Management (CDM), Distributed Generation (DG), etc., in order to make a decision on the most appropriate regional planning approach including Local Plan (LP), IRRP and/or RIP.

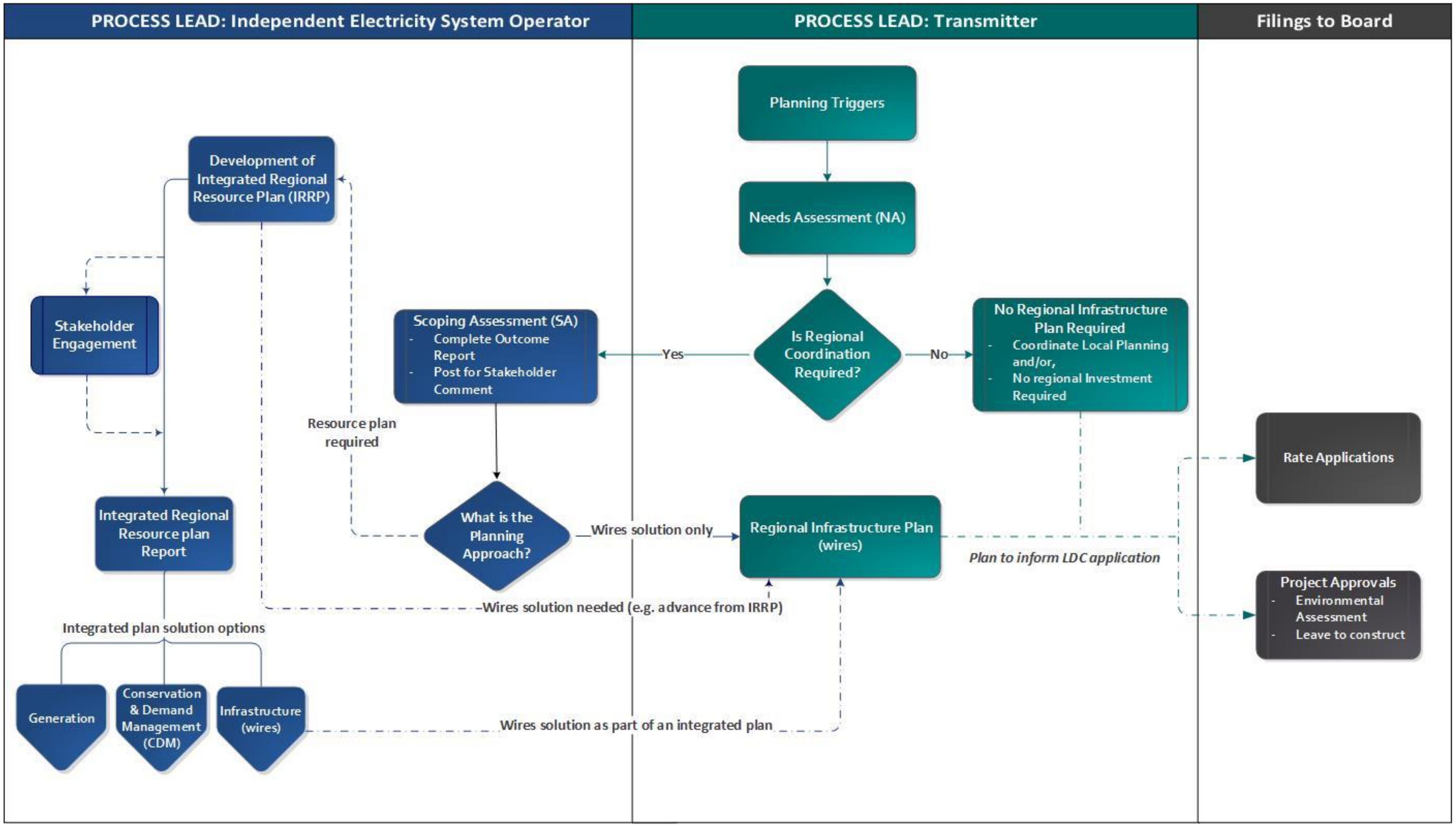
The primary purpose of the IRRP is to identify and assess both resource and wires options at a higher or macro level, but sufficient to permit a comparison of resource options vs. wire infrastructure to address the needs. Worth noting, the LDCs' CDM targets as well as contracted DG plans provided by IESO and LDCs are reviewed and considered at each step in the regional planning process.

If and when an IRRP identifies that resource and/or wires options may be most appropriate to meet a need, resource/wires planning can be initiated in parallel with the IRRP or in the RIP phase to undertake a more detailed assessment, develop specific resource/wires alternatives, and recommend a preferred wires solution.

The RIP phase is the final phase of the regional planning process and involves discussion of previously identified needs and plans; identification of any new needs that may have emerged since the start of the planning cycle; and development of a wires plan to address these needs. This phase is led and coordinated by the transmitter, and the deliverable is a comprehensive and consolidated report of a wires plan for the region. Once completed, this report is also referenced in transmitter's rate filing submissions and as part of LDC rate applications with a planning status letter provided by the transmitter to the LDC(s). Respecting the OEB timeline provision of the RIP, planning level stakeholder engagement is not undertaken during this phase. However, stakeholder engagement at a project specific level will be conducted as part of the project approval requirement.

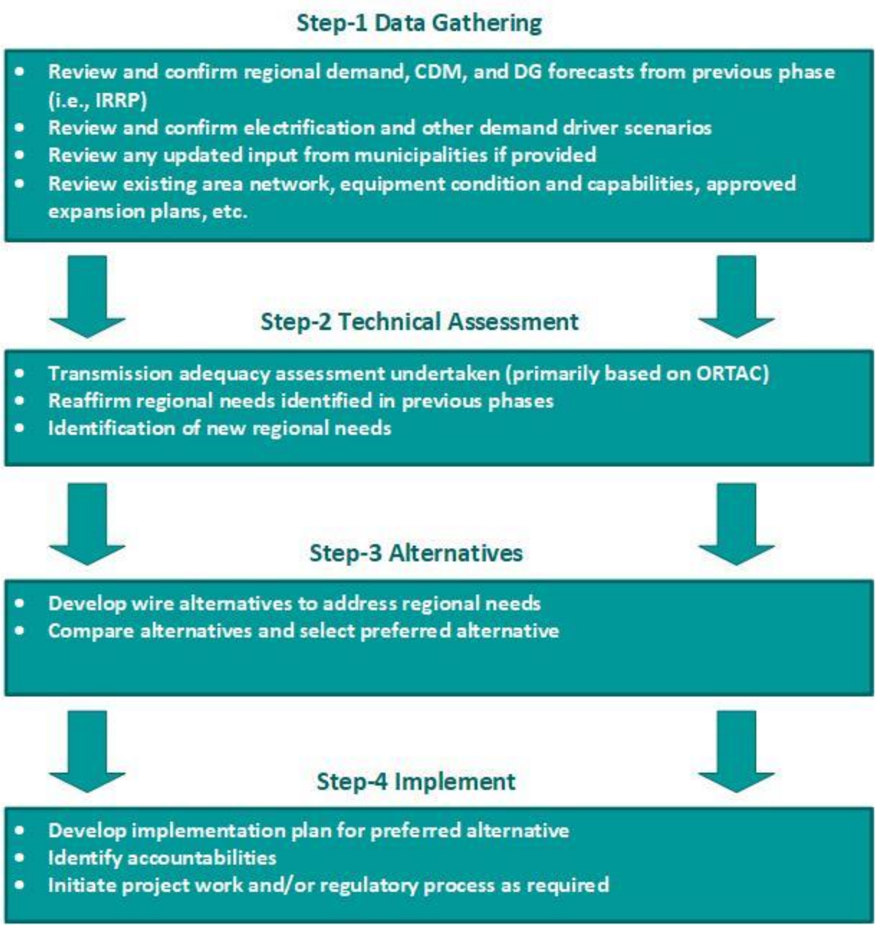
The various phases of Regional Planning Process (NA, SA, IRRP, and RIP) and their respective phase trigger, lead, and outcome are shown below in figure-1.

Figure-1 Regional Planning Process Flowchart



3.2 Regional Infrastructure Plan Methodology

Figure-2 Regional Infrastructure Plan Methodology



Regional Infrastructure Plan phase is a four-step process which are described below:

3.2.1. Data Gathering:

The first step of the RIP process is the review of planning assessment data collected in the previous stages of the regional planning process. Hydro One collects this information and reviews it with TWG to reconfirm or update the information as required. The data collected includes:

- Net peak demand forecast at the transformer station level. This includes the effect of any distributed generation or conservation and demand management programs. The municipalities were contacted as part of IRRP stakeholder engagement process to get their insight on the future load growth and was translated into the load forecast through inputs provided by their respective

LDCs. As agreed by TWG members, the load forecast from the IRRP to be used for this RIP unless material changes in the load forecast are envisaged.
- Review and confirm electrification and other growth scenarios which affect the projects recommended in previous stages.
- Existing area network and capabilities including any bulk system power flow assumptions.
- Other data and assumptions as applicable such as asset condition, load transfer capabilities, and previously committed transmission and distribution system plans.

3.2.2. Technical Assessment:

The second step is a technical assessment to review the adequacy of the regional system, including any previously identified needs. Additional near and medium-term needs may be identified at this stage.

3.2.3. Alternative Development:

The third step is the development of wires options to address needs and determine a preferred alternative based on an assessment of technical considerations, feasibility, environmental impact, and costs.

3.2.4. Implementation Plan:

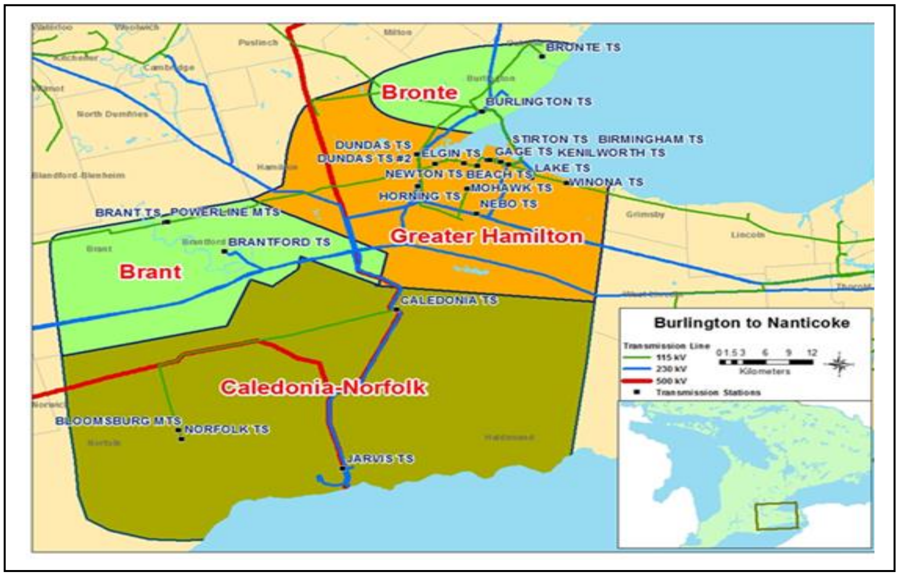
The fourth and last step is the development of the implementation plan for the preferred alternative, identifying accountabilities and initiating project work or obtaining permission from the Regulatory Commission, if any.

4. REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The Burlington to Nanticoke region covers the city of Brantford, municipality of Hamilton, and counties of Brant, Haldimand and Norfolk. Portions of Burlington and Oakville south of Dundas Street are included in the Burlington to Nanticoke region up to Third Line Road in the east.

The geographical boundaries of the Burlington to Nanticoke Region are shown in Figure 3 below.

Figure 3: Map of Burlington to Nanticoke Regional Planning Area



Bulk electrical supply to the Burlington to Nanticoke Region is provided through the 500/230 kV autotransformers at Nanticoke TS and Middleport TS and 230 kV circuits from Middleport TS, Nanticoke TS and Beck TS. The 115 kV network is supplied by 230/115 kV autotransformers at Burlington TS, Beach TS and Caledonia TS. The area loads are supplied by a network of 230 kV and 115 kV transmission lines and step-down transformation facilities. The area has been divided into four sub-regions as shown in Figure 3 and described below:

The **Brant sub-region** encompasses the County of Brant, City of Brantford, and surrounding areas. Electricity supply to the sub-region is provided by:

- Brant TS and Powerline MTS are supplied by 115 kV double circuit B12BL/B13BL line and B2 single circuit line.
- Brantford TS supplied by the 230 kV double circuit transmission line M32W/M33W.

The Brant Sub-region transmission facilities are shown in Figure 3-1.

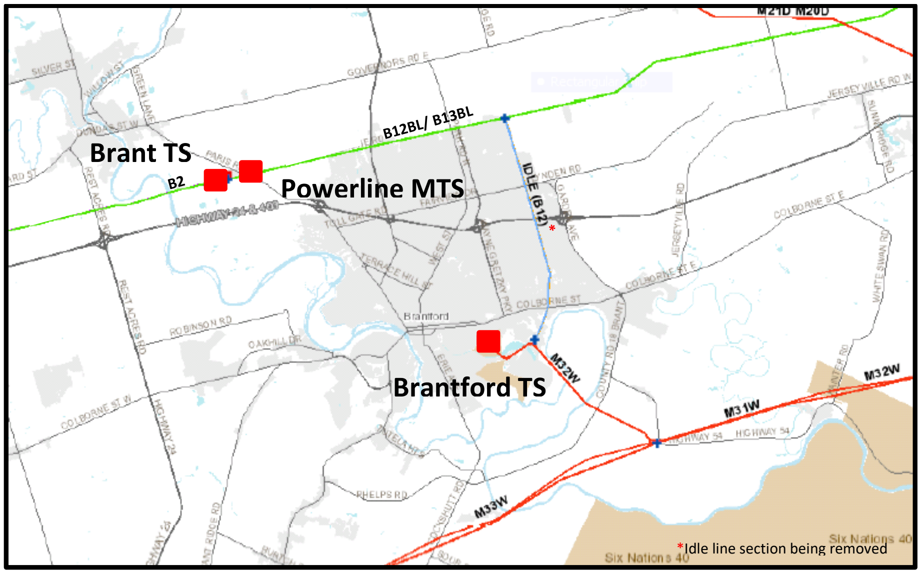


Figure 3-1 Brant sub-region

The total 2024 non-coincident peak demand for the three stations was 278 MW. GrandBridge Energy Inc. is the main LDCs that serves the electricity demand for the City of Brantford. Hydro One Distribution supplies load in the outlying areas of the sub-region. The electricity demand is comprised of residential, commercial, and industrial customers.

The **Bronte sub-region** covers the City of Burlington and the western part of the City of Oakville up to Third Line Road. Electricity supply to the sub-region is provided by:

- Bronte TS is supplied by 115 kV double circuit line B7/B8.
- Burlington TS is supplied by 230 kV double circuit line Q23BM/ Q25BM.
- Cumberland TS supplied by 230 kV double circuit transmission line B40C/ B41C.

The Bronte sub-region transmission facilities are shown in Figure 3-2.

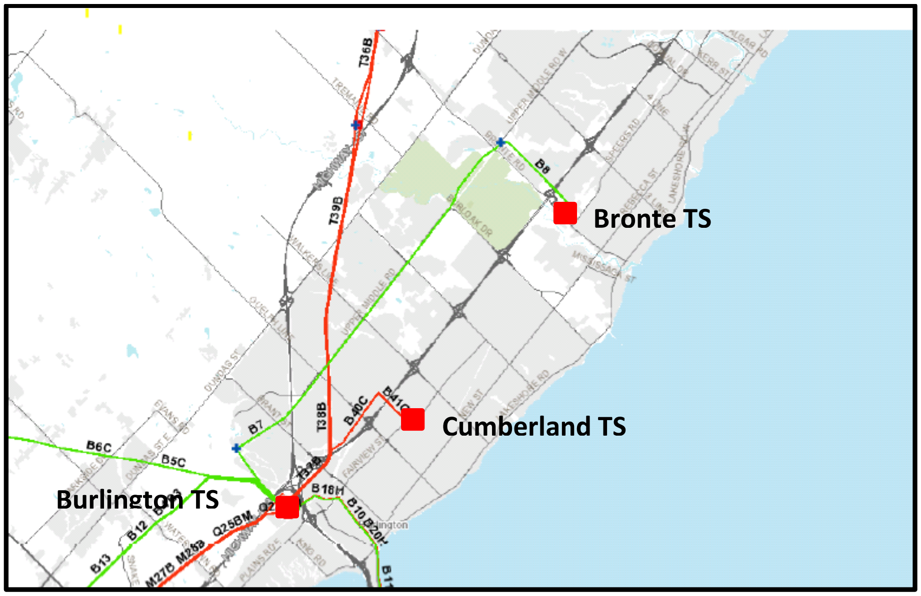


Figure 3-2 Bronte sub-region

This area is served by Burlington Hydro and Oakville Hydro. The electricity demand is comprised of residential, commercial, and industrial customers. The total 2024 non-coincident peak station demand for the three stations was 361 MW.

The **Greater Hamilton sub-region** encompasses the City of Hamilton that includes the Townships of Flamborough and Glanbrook and towns of Dundas and Stoney Creek. The electricity supply to the sub-region is as follows:

- Beach TS 115 kV area which includes four 115 kV step down stations Birmingham TS, Kenilworth TS, Stirton TS and Winona TS supplied from the 230/115 kV autotransformers at Beach TS.
- Burlington TS 115kV area which includes Dundas TS, Dundas #2, Elgin TS, Gage TS, Mohawk TS, Newton TS and one customer owned transformer station (CTS) supplied from the 230/115 kV autotransformers at Burlington TS.
- 230 kV area which includes Beach TS (T3/T4 & T5/T6 DESNs), Horning TS, Nebo TS, Lake TS and two customer owned stations supplied from 230 kV circuits connecting into Beach TS and Burlington TS.

The Greater Hamilton sub-region transmission facilities are shown in Figure 3-3.

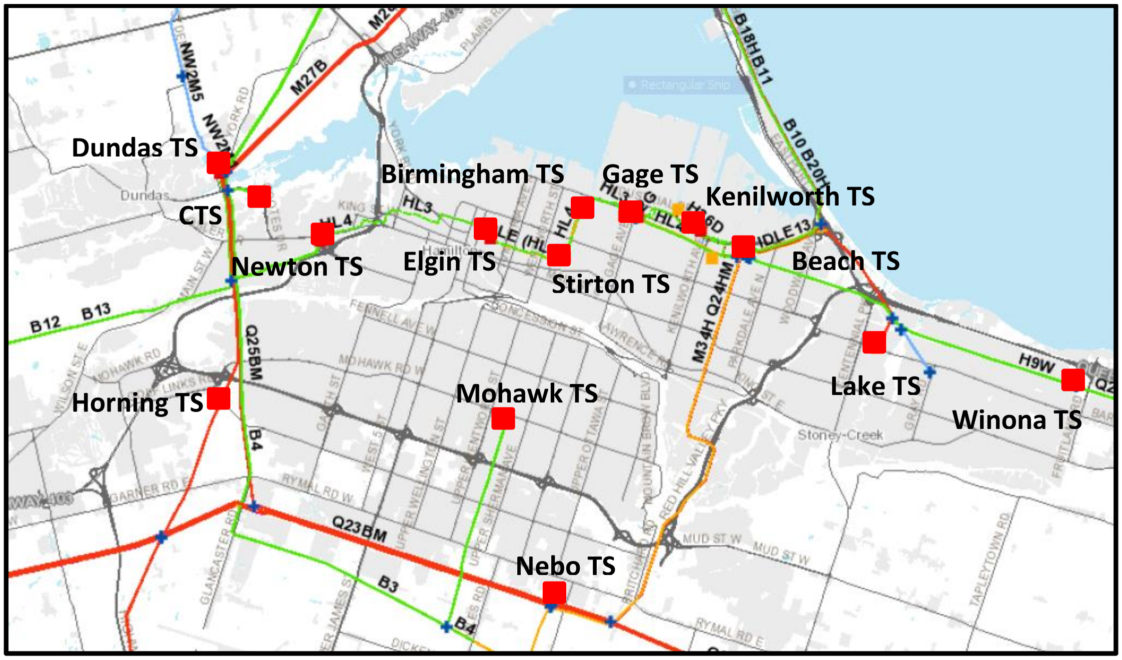


Figure 3-3 Greater Hamilton sub-region

The total 2024 non-coincident peak demand for the Greater Hamilton sub-region was 1330 MW. The area is served by Alectra Utilities, Hydro One Distribution, and CTSs comprise a significant number of large industrial customers along with commercial and residential customers.

The **Caledonia Norfolk sub-region** covers the eastern part of Norfolk County and the western part of Haldimand County. Electricity supply to the Sub-region is provided by:

- Caledonia TS supplied by 230 kV double circuit line N5M/S39M.
- Jarvis TS, a large Battery Energy Storage System (BESS) and two CTSs supplied from the 230 kV double circuit line N21J/N22J.
- One CTS is supplied from the 230 kV single circuit N20K.
- Bloomsburg DS and Norfolk TS are supplied from 115 kV double circuit transmission line C9/C12.

The Caledonia Norfolk sub-region transmission facilities are shown in Figure 3-4.

The area is served by Hydro One Distribution. The electricity demand mix is comprised of residential, commercial and industrial uses. The 2024 non-coincident peak demand for this sub-region was 429 MW.

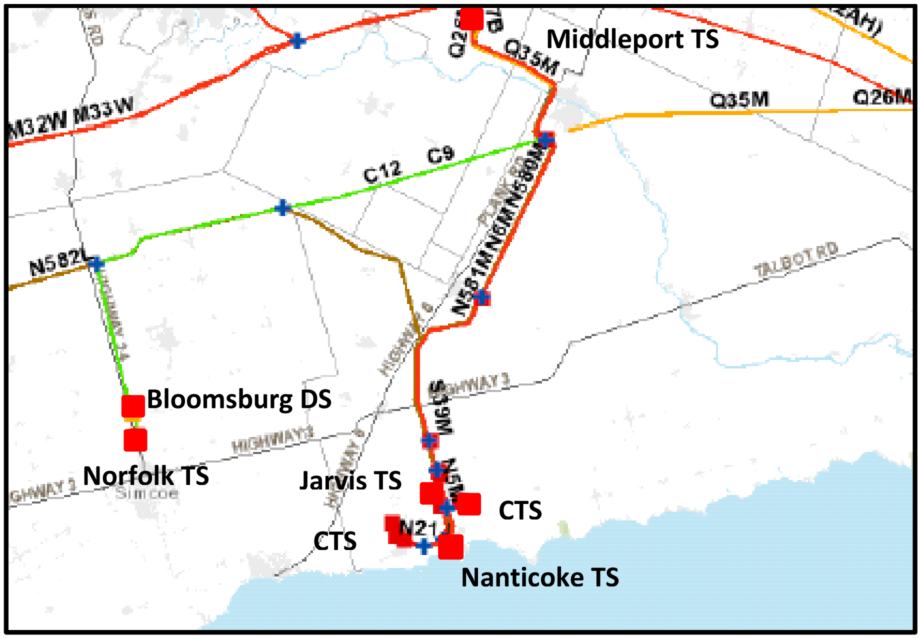


Figure 3-4 Caledonia Norfolk sub-region

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

Table 2: Transmission Station and Circuits in the Burlington to Nanticoke region

115kV circuits	230kV circuits	Hydro One Transformer Stations	Generation Stations
B10, B11, H5K, H6K, HL3, HL4, Q2AH, H9W, B12BL, B13BL, B7, B8, B5G, B6G, B3, B4, C9, C12, K1G, K2G	H35D, H36D, B18H, B20H, M34H, Q24HM, Q29HM, B40C, B41C, M27B, M28B, Q23BM, Q25BM, Q30M, M31W, M32W, M33W, M20D, M21D, N5M, N6M, S39M, K40M, N21J, N22J, N37S, N20K	Beach TS*, Birmingham TS, Bloomsburg DS, Brant TS, Brantford TS, Bronte TS, Burlington TS*, Caledonia TS*, Cumberland TS, Dundas TS, Dundas TS #2, Elgin TS, Gage TS, Horning TS, Jarvis TS, Kenilworth TS, Lake TS, Mohawk TS, Nebo TS, Newton TS, Norfolk TS, Powerline MTS, Stirton TS, Winona TS, CTS#1, CTS#2, CTS#3, CTS#4, CTS#5, CTS#6	CGS#1, CGS#2, CGS#3, CGS#4, CGS#5, BESS#1, BESS#2

*Stations with 230kV/ 115kV Autotransformers installed

The single line diagram of the Transmission Network of Burlington to Nanticoke region is shown in Figure 4 below.

Figure 4: Burlington to Nanticoke Region Transmission Single Line Diagram

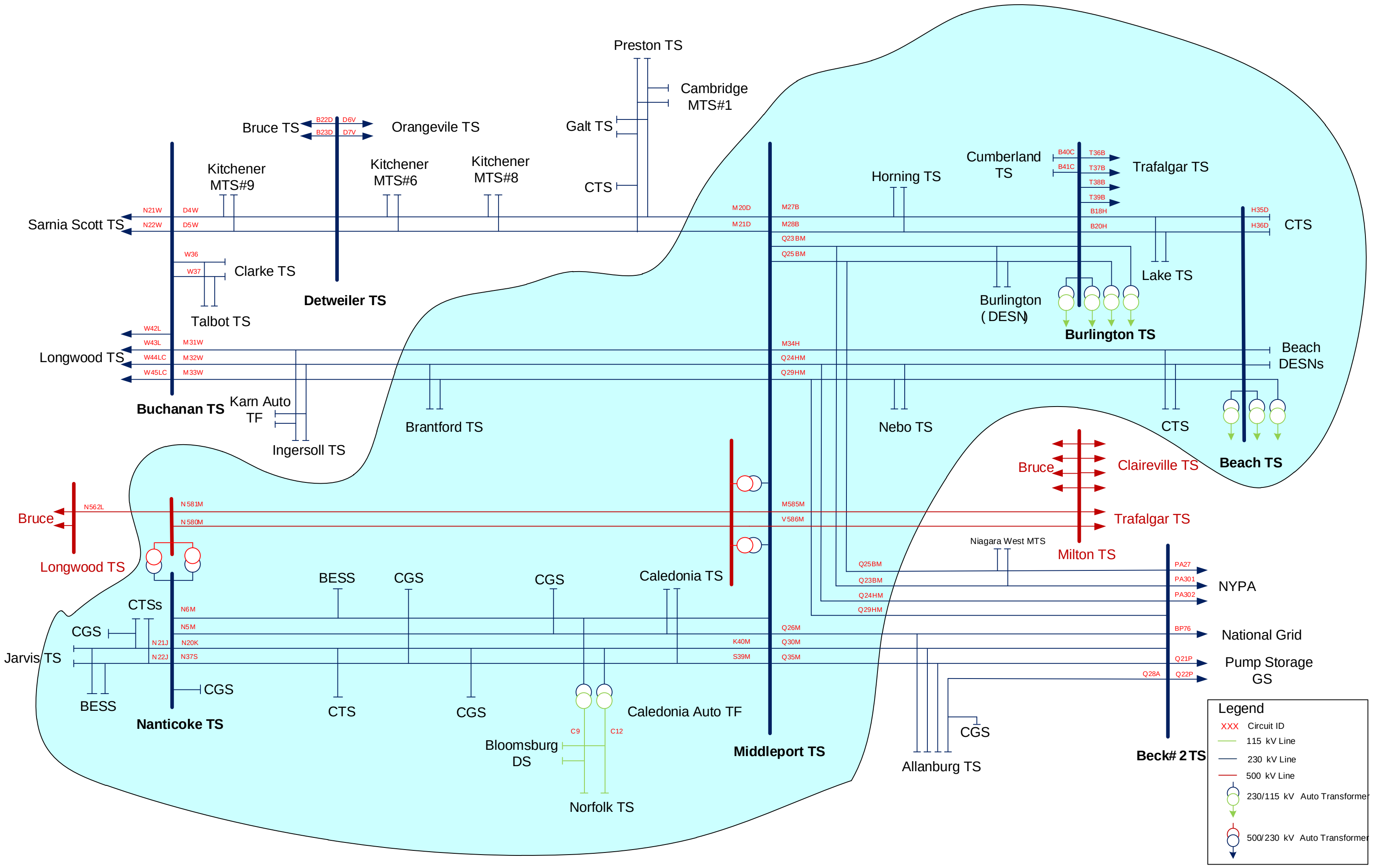
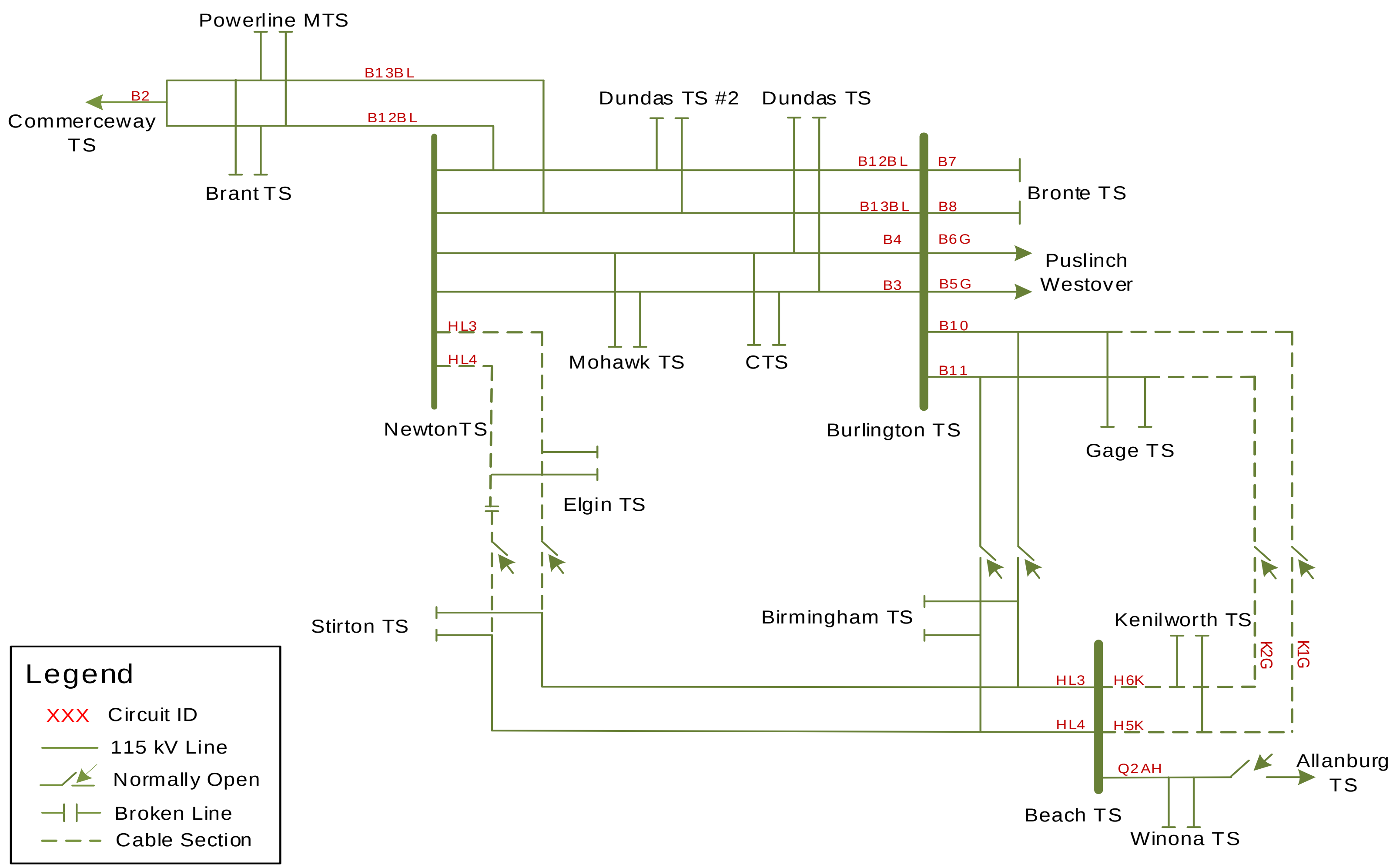


Figure 5: Burlington to Nanticoke Region Transmission Hamilton- Brant Area Single Line Diagram



5. TRANSMISSION FACILITIES COMPLETED IN THE LAST TEN YEARS AND/OR ARE UNDERWAY

In this section a complete list of all the projects that have been completed in the past ten years or are currently underway is provided and are briefly discussed in the sub-sections. As a part of this or previous Regional Planning Cycle(s), several “Major HV Transmission Projects” were recommended in the Burlington to Nanticoke region to improve the supply capability and reliability.

Hydro One, being the only Transmission Asset Owner (TAO) in the region, has undertaken the execution of the projects recommended in the past ten years. A summary and brief description of all the projects completed or are currently underway is given below:

I. The following major projects were completed during the last ten years:

i. Burlington TS (2016) – installed an additional 230 kV circuit breaker to reduce probability of the simultaneous loss of two autotransformers to improve supply reliability of the stations supplied from 115 kV bus.

ii. Transformer replacement at stations: Dundas TS T1&T2 (2015), Brant TS T1&T2 (2016), Beach TS T3&T4 (2018), Mohawk TS T1&T2 (2018) and Newton TS T1&T2 (2020).

iii. B7/B8 115 kV Transmission line capacity (2018) – addressed supply capacity constraint to Bronte TS through distribution load transfers (Ongoing)

iv. Horning TS (2018) – replaced 230/ 13.8 kV transformers (T1/T2) & LV switchgears.

v. Bronte TS (2019) – replaced 115/ 27.6 kV transformers (T5/T6) & associated LV switchgear.

vi. Brant Switching Station (2019) – installed three (3) 115 kV breakers at Brant TS integrating 115 kV B12BL/B13BL circuits with 115 kV B2 circuit from Karn TS, to provide additional supply capacity for Brant TS and Powerline MTS.

vii. Cumberland TS (2019): Power factor correction – Capacitors installed at customer level.

viii. 115 kV B3/B4 (2020): Based on asset condition assessment refurbish line section from Horning Mountain Jct. to Glanford Jct.

ix. Elgin TS (2022): Transformers & switchgear replacement based on asset condition assessment and reconfiguring from two (2) DESNs to a single DESN.

x. Kenilworth TS (2023): Transformer & switchgear replacement based on asset condition assessment and reconfiguration from two (2) DESNs to single DESN.

xi. Gage TS (2024): Transformers & switchgear replacement based on asset condition assessment, reconfiguring station from a three (3) DESNs station to a two (2) DESNs station replacing equipment based on their asset condition assessment.

II. Following Major projects are underway:

i. Kenilworth TS: Power factor correction (2025)
ii. Dundas TS: Load Balancing between DESNs (2025)
iii. Norfolk area supply capacity – Load transfer and reactive support (2026)
iv. 115 kV B7/B8: Refurbish line section from Burlington TS to Nelson Jct. (2025)
v. Beach TS: Autotransformer (T1/ T7/T8) replacement (2028)
vi. Lake TS: Transformer (T2) Replacement (2028)

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

6. LOAD FORECAST AND STUDY ASSUMPTIONS

6.1. Load Forecast

The loading pattern for the years prior to 2024 (2019 – 2023) were impacted by COVID 19 and may not provide a good base load for future load forecasting. A new load forecast has been developed with participation of the TWG using 2024 station loads as base year, updated CDM from the IESO and revised load forecast from GrandBridge Energy. This results in a 3.2% lower load forecast than IRRP. The municipalities were contacted as part of IRRP stakeholder engagement process to get their insight into the future load growth and was translated into the load forecast through inputs provided by their respective LDCs. TWG participants, including representatives from LDC's, IESO and Hydro One provided information and input for this new Load forecast that will be used in this report.

During the study period, the load in the Burlington to Nanticoke region is expected to grow at an average annual rate of approximately 3.1% in summer from 2025 to 2035. The Region is summer peaking, so this assessment is based on summer peak loads.

Figure 5 & 6 shows the Burlington to Nanticoke region extreme summer weather net coincident and non-coincident load forecast from 2025 to 2035. The load forecasts from the Burlington to Nanticoke region were adopted as agreed by the TWG. The load forecast shown is the regional non-coincident forecast, representing the sum of the load in the area for the step-down transformer stations.

Non-coincident and coincident forecast for the individual stations in the region is available in Appendix A and is used to determine any need for station capacity relief in the region.

Figure 6: Burlington to Nanticoke region summer coincident Net Peak Load Forecast

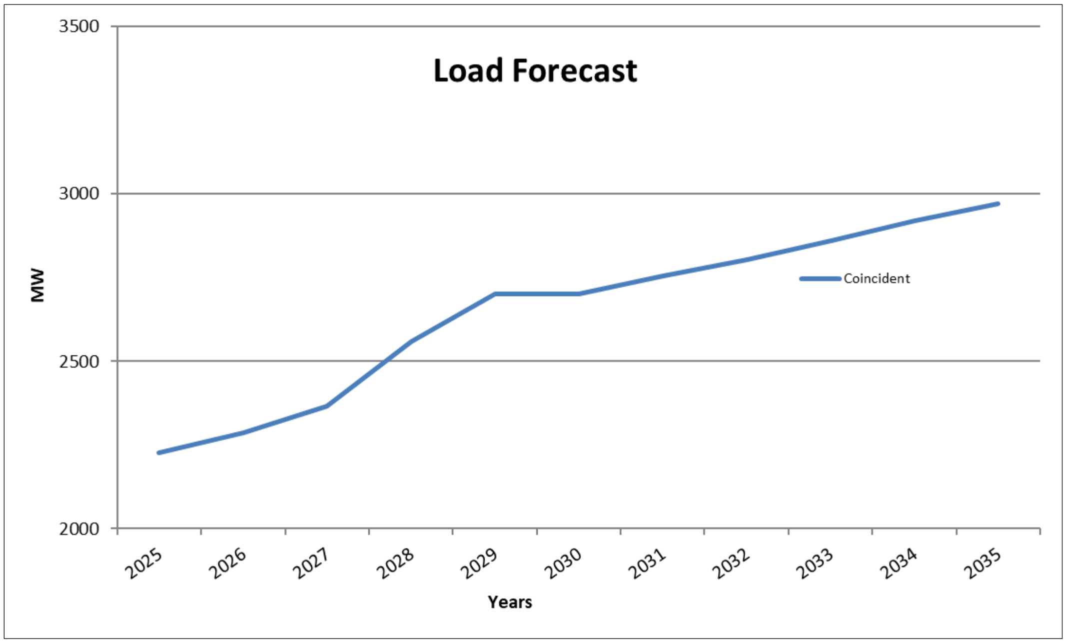
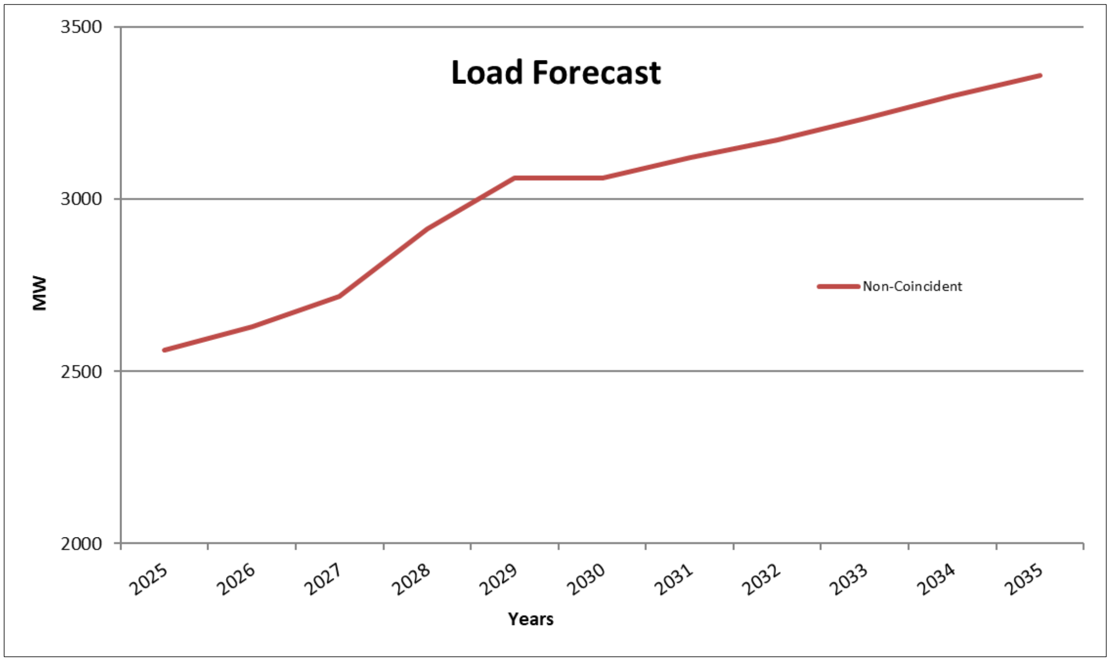


Figure 7: Burlington to Nanticoke region summer Non-coincident Net Peak Load Forecast



6.2. Other Study Assumptions

The following other actions and assumptions are made in this report.

- The study period for the RIP assessments is 2025-2035.
- Most LDCs reconfirmed and GrandBridge Energy updated the load forecast up to 2035 in the area.
- All planned facilities for which work has been initiated and are listed in section 5 are assumed to be in-service.
- The Region is peaking in summer, so this assessment is based on 2024 summer peak loads.
- 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 or based on historical power factor data.
- Normal planning supply capacity for transformer stations in the region is determined by the summer 10-day Limited Time Rating (LTR) based on 35°C ambient temperature.
- Bulk transmission line capacity adequacy is assessed by using coincident peak loads in the area. Capacity assessment for radial lines and stepdown transformer stations uses non-coincident peak loads.
- All Battery storage projects are assumed to only charge during off-peak hours. Any future charging of these battery storage projects may impact LMC (Load Meeting Capability) of some circuits.
- Adequacy assessment is conducted as per required regulations.

7. SYSTEM ADEQUACY AND REGIONAL NEEDS

This section reviews the adequacy of the existing Transmission Systems and Transformer Station facilities supplying Burlington to Nanticoke region and lists the facilities requiring reinforcement over the near and midterm period. The adequacy assessment assumes that all the projects that are currently underway, listed in **"Section 5"**, are completed.

In the current regional planning cycle, the following regional assessments were completed, and their findings were used as inputs to this RIP report:

- Burlington to Nanticoke region Third cycle Needs Assessment Report, Completed in September 2022 by Hydro One
- Burlington to Nanticoke region Third cycle Scoping Assessment Report, Completed in December 2022 by the IESO

- Burlington to Nanticoke region Third cycle Integrated Regional Resource Plan Report, Completed in November 2024 by the IESO

The Technical Working Group identified several regional needs based on the forecasted demand over the near-to-mid-term period in the reports mentioned above. The results of the Adequacy Assessment to define the needs are discussed in sub-sections “7.1 to 7.4” and a detailed description and status of plans to meet these needs are given in **“Section 8”** of this report.

7.1. Asset Renewal Needs for Major HV Transmission Equipment

In addition to the asset renewal needs identified in previous regional planning cycle, Hydro One and TWG have 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 Burlington to Nanticoke region. The complete list of major HV transmission equipment requiring replacement in the Burlington to Nanticoke region is provided in table 3 in this sub-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

Table 3: Major HV Transmission Asset assessed for Replacement in the Region

Station/Circuit	Need Description	Planned ISD
Nebo TS	Transformer (T3/ T4) refurbishment	2030 - 2035
Lake TS	T3/T4 DESN refurbishment	2030 – 2035
Beach TS	T5/T6 DESN refurbishment	2030 – 2035
Caledonia TS	Transformer (T2) refurbishment	2030 – 2035
Birmingham TS	Transformer (T1) and MV Metalclad Switchgear refurbishment	2030 – 2035
Gage TS	T8/T9 DESN refurbishment	2030 – 2035
Jarvis TS	Transformer (T3/T4) refurbishment	2030 - 2035

The above refurbishment needs are currently planned but may be adjusted or reconsidered based on a variety of evolving factors. The refurbishment needs T12 autotransformer at Burlington TS and MV switchgear refurbishment needs at Burlington TS, Dundas TS and Norfolk TS included in the earlier phases of Regional Planning cycle fall outside the study period of this report and will be reassessed during the next planning cycle. Any refurbishment needs for 115 kV cables in the Hamilton area will be assessed as part of the upcoming Hamilton IRRP report.

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

7.2. Area Supply Needs

Over the study period 2025-2035, RIP reviewed the area supply capacity needs that include combination of both the line and station supply capacity adequacy for isolated areas with limited available transfer capacities. During the earlier phases of this regional planning cycle two such areas, i.e. Norfolk and Brant areas, were identified requiring reinforcement/s. The future station supply capacity need at Dundas TS and Dundas TS#2 are combined as a single 27.6 kV Dundas area need. After the completion of the IRRP in late 2024, Burlington Hydro and Oakville Hydro approached TWG to revise the load forecast to accommodate additional supply capacity need in the area supplied by Bronte TS.

Sr. No.	Name of Area	Need	Maximum capacity	Current loading	Need Year
1	Brant Area	Supply Capacity	134 MW	148 MW	Current and 2029[1]
2	Norfolk Area	Line supply Capacity	80 MW	101 MW	Current
3	Dundas Area	Station Capacity	188MW	151 MW	2035[2]
4	Bonte Area	TBD*	135 MW	122 MW	TBD[3]

1- LDC will transfer loads to Brantford TS to adhere to 134 MW limit. Brantford TS will reach its supply capacity by 2029, assuming no transfer constraints. Need may be sooner as load balancing between the stations may be limited due to physical constraints.

2- Need may be sooner due to load transfer constraints between the stations

3- Burlington Hydro and Oakville Hydro, the local LDCs are in the process of developing a revised load forecast

7.3. Station Capacity Needs

Over the study period 2025-2035, RIP reviewed the capacity of all the 230kV and 115kV Transforming stations within the Burlington to Nanticoke region. The NA and IRRP studies had previously indicated that the following stations require capacity relief within the study period. This RIP has further confirmed those needs and based on the load forecast, the stations which require capacity relief during the study period are shown in Table 4 below. The need timeframe defines the time when the peak load forecast exceeds the most limiting seasonal (summer) Limited Time ratings.

Table 4: Burlington to Nanticoke region Station Capacity Needs in the study period

Sr. No.	Station Name	Station LTR(MW) (Summer)	2024 Loading (MW) (Summer)	Need Date
1	Nebo TS (T3/T4) 13.8 kV DESN	51	52	Current*
2	Mohawk TS	90	72	2035
3	Newton TS	75	48	2035
4	Nebo TS (T3/T4) 27.6 kV DESN	178	145	2031

*- The LDC has historically maintained the load power factor closed to unity that provides a little more supply capacity, and the loading has remained around its supply capacity.

The options and preferred solutions to address these needs are discussed further in Section 8 of the report.

7.4. Transmission Line Supply Capacity Needs

Over the study period 2025-2035 RIP reviewed the capacity of all the 230kV and 115kV Transmission lines within the Burlington to Nanticoke region. The NA and IRRP studies had previously indicated that the following Transmission lines require capacity relief within the study period. This RIP has further confirmed those needs and based on the load forecast and following contingencies, the Transmission lines which require capacity relief during the study period are shown in Table 5 below. The need timeframe defines the time when the peak load forecast exceeds the most limiting seasonal (summer) Limited Time ratings.

Table 5: Burlington to Nanticoke region Transmission Line Capacity Needs in the study period

Sr.no.	Name of Circuit	Name of Section	Maximum capacity	Current loading	Need Date
The overloading of 115 kV B2 intertie line between Brant area and Woodstock area is included in Brant area supply need and the supply capacity of 115 kV C9/C12 line is included in the Norfolk area need.					

7.5. System Reliability, Operation and Load Restoration Needs

Load security and load restoration needs were reviewed as part of the current study. The ORTAC Section 7 requires that no more than 600 MW of load be lost as a result of a double circuit contingency.

Further, loads are to be restored in the restoration times[1] specified as follows:

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

The RIP further confirms that there are no violations identified in the region with regards to System Reliability, Operation and Load restoration requirements.

[1] These approximate restoration times are intended for locations that are near staffed centers. In more remote locations, restoration times should be commensurate with travel times and accessibility

8. REGIONAL PLANS

This section discusses the regional electric supply needs and presents all the wires alternatives considered to address these needs and identifies the best and preferred wires solutions for the Burlington to Nanticoke Region. These needs include those previously identified in the NA and IRRP for the Burlington to Nanticoke Region as well as any new needs identified during the RIP phase. All estimated costs included in the alternative analysis are considered as planning budgetary estimates and are used for comparative purposes only and may vary. The Needs in the region are summarized below in Table 6 below:

Table 6: Near/ Mid-term Needs Identified in the Region

Area/ Station/Circuit	Description of Need	Need Date	RIP Report Section
Asset Renewal Needs*			
Nebo TS	Replace T3/ T4 transformers	2030 - 2035	8.1.1
Lake TS	Replace T3/T4 transformers and switchgear	2030 - 2035	8.1.2
Beach TS	Replace T5/T6 transformers and switchgear	2030 - 2035	8.1.3
Caledonia TS	Replace T2 transformer	2030 - 2035	8.1.4
Birmingham TS	Replace T1 Transformer and MV Switchgears	2030 - 2035	8.1.5
Gage TS	Replace T8/T9 transformers and switchgear	2030 - 2035	8.1.6
Jarvis TS	Replace T3/ T4 transformers	2030 - 2035	8.1.7
Area Supply Needs			
Brant Area	Supply capacity	Current and 2029**	8.2.1
Norfolk Area	Transmission line supply capacity	Current	8.2.2
Dundas Area	Station supply capacity constraint	2035	8.2.3
Bonte Area	LDC developing load forecast to identify additional needs above current supply capacity	TBD	8.2.4
Station Capacity Needs			
Nebo TS (T3/T4) DESN	Nebo T3/T4 is a 230kV / 13.8kV DESN operating around its supply capacity for a long time	Current	8.3.1
Mohawk TS	Mohawk TS will be approaching its supply capacity by the end of study period.	2035	8.3.2
Newton TS	Newton TS is a 115kV/ 13.8 kV single DESN station supply loads in western part of city of Hamilton	2035	8.3.3

Nebo TS (T1/T2) DESN	Nebo T1/T2 is a 230kV / 27.6 kV DESN requiring additional transformation capacity in the need timeframe.	2031	8.3.4
Transmission Line Capacity Needs			
The overloading of 115 kV B2 intertie line between Brant area and Woodstock area is included in Brant area supply need and the supply capacity of C9/C12 line is included in the Norfolk area need.			
System Reliability, Operation and Load restoration Needs			
The Technical Working Group did not identify any other reliability, operation and load restoration needs for this region.			

*- The above refurbishment needs are currently planned but may be adjusted or reconsidered based on a variety of evolving factors.

**- LDC will transfer loads to Brantford TS to adhere to 134 MW limit. Need may be sooner due to physical load transfer constraints.

8.1 Asset Renewal Needs for Major HV Transmission Equipment

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); and
- Replacing equipment with higher ratings and built to current standards.

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

8.1.1 Nebo TS - Replace T3/ T4 Transformers

Nebo TS is located south of the city of Hamilton, having two DESNs units T1/T2 and T3/T4 supplying loads in the city of Hamilton and surrounding areas. The loads at T3/T4 13.8 kV DESN at Nebo TS has been historically around its supply capacity and is currently marginally overloaded, supplying loads of 52 MW against its supply capacity of 51 MW. The loads at this DESN are currently forecasted to grow above and beyond its supply capacity.

At this time both T3/T4 230 kV / 13.8 kV 75 MVA transformers are planned for replacement based on their asset condition assessment in the next 10 years.

Alternatives and Recommended Plan

The following alternatives are considered to address Nebo TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T3/T4 DESN at Nebo TS. This alternative was considered but is not feasible.
- Replacement of the assets: Replace existing nonstandard 75 MVA T3/ T4 transformers with 100 MVA Hydro One standard units.

The TWG recommended that Hydro One and Alectra monitor the loading at Nebo TS T3/T4 DESN and take remedial measures, if required, until replacement of these transformers is completed. The TWG recommends that Hydro One replace T3/T4 transformers at Nebo TS with Hydro One standard 100 MVA units.

8.1.2 Lake TS - T3/ T4 DESN Refurbishment

Lake TS is located south-east of the city of Hamilton, having two DESNs units T1/T2 and T3/T4 supplying loads in the city of Hamilton and surrounding areas. T1/T2 is a 27.6 kV DESN with a current load of 49 MW having a sufficient supply capacity of 94 MW over the study period. The T3/T4 13.8 kV DESN is currently supplying 45 MW of loads having a sufficient supply capacity of 113 MW over the study period.

At this time both 230kV/13.8kV 75 MVA T3/ T4 transformers at Lake TS are planned for future replacement based on their asset condition assessment.

Alternatives and Recommended Plan

The following alternatives are considered to address Lake TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T3/T4 DESN at Lake TS. This alternative was considered but is not feasible.
- Replacement of the assets: Replace existing nonstandard 75 MVA T3/ T4 transformers with 100 MVA Hydro One standard units.

The TWG recommends that Hydro One replace T3/T4 transformers at Lake TS with Hydro One standard 100 MVA units.

8.1.3 Beach TS - T5/T6 DESN Refurbishment

Beach TS is located inside the city of Hamilton, having two DESNs units T3/T4 and T5/T6 having supply capacities of 135 MW and 96 MW and supplying loads of 16 MW and 64 MW respectively. The supply capacities of both T3/ T4 and T5/ T6 DESNs are sufficient over the study period.

At this time both 230 kV/ 13.8 kV T5/ T6 DESN transformers have been identified by Hydro One for future replacement based on their asset condition assessment.

Alternatives and Recommended Plan

The following alternatives are considered to address Beach TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T5/T6 DESN at Beach TS. This alternative was considered but is not feasible due to customer requirements.
- Replacement of the assets: Replace T5/T6 DESN replacing existing nonstandard 75 MVA T5/ T6 transformers with 100 MVA Hydro One standard units.

The TWG recommends that Hydro One replace T5/T6 transformers at Beach TS with Hydro One standard 100 MVA units.

8.1.4 Caledonia TS-Replace T2 Transformer

Caledonia TS is located in the Haldimand area supplying area loads. Caledonia TS is a single T1/T2 DESN station having 83 MVA transformers supplying loads of 53 MW and having a sufficient supply capacity of 99 MW over the study period.

At this time the T2 83 MVA 230 kV/ 27.6 kV transformer has been identified by Hydro One for replacement based on asset condition assessment.

Alternatives and Recommended Plan

The following alternatives are considered to address Caledonia TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance cost.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T1/T2 DESN at Caledonia TS. This alternative was considered but is not feasible as there are no nearby stations to transfer existing DESN loads.
- Replacement of the assets: Replace T2 transformer replacing existing 83 MVA transformer with a similar Hydro One standard unit.

The TWG recommends that Hydro One replace the T2 transformer at Caledonia TS with a similar sized Hydro One standard unit.

8.1.5 Birmingham TS - Replace T1 Transformer and MV Switchgears

Birmingham TS is located in the city of Hamilton, having two DESN units T1/T2 and T3/T4 of 75MVA each with supply capacities of 76 MW and 91 MW respectively which is sufficient over the study period. Birmingham TS mainly supplies a large industrial customer with unique connection requirements.

At this time, one 115 kV/ 13.8 kV transformer and three 13.8 kV MV Metalclad switchgears have been identified by Hydro One for future replacement based on asset condition assessment of these assets.

Alternatives and Recommended Plan

The following alternatives are considered to address Birmingham TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring Birmingham TS. This alternative was considered but is not feasible due to the customer's unique needs.
- Replacement of the assets: Replace the T1 transformer with a similar unit and replace three (3) Metalclad switchgears.

The TWG recommends replacing the T1 transformer and three 13.8 kV LV Metalclad switchgears at Birmingham TS to meet the unique connection needs of the customer at this station with similar equipment.

8.1.6 Gage TS - T8/T9 DESN Refurbishment

Gage TS is located inside the city of Hamilton, having two DESNs units T8/ T9 and T11/ T12 having supply capacities of 123 MW and 132 MW and supplying loads of 18 MW and 34 MW respectively. The supply capacities of both T8/ T9 and T11/ T12 DESNs are sufficient over the study period.

At this time both 115 kV/ 13.8 kV T8/T9 DESN having 120 MVA transformers have been identified by Hydro One for refurbishment.

Alternatives and Recommended Plan

The following alternatives are considered to address Gage TS asset replacement needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T8/T9 DESN at Gage TS. This alternative was considered but is not feasible due to customer requirements.
- Replacement of the assets: Replace T8/T9 DESN, nonstandard 120 MVA T8/ T9 transformers with 100 MVA Hydro One standard units.

TWG recommends that Hydro One replace T8/T9 DESN at Gage TS. Replacing the existing 120 MVA nonstandard transformers with Hydro One standard 100 MVA units.

8.1.7 Jarvis TS - Replace T3/ T4 Transformers

Jarvis TS is in Haldimand County, having a single T3/T4 DESN of 83 MVA 230 kV / 27.6 kV transformers supplying local area loads. Jarvis TS has a sufficient supply capacity of 99 MW over the study period.

Both 230kV/ 27.6kV 83 MVA T3/T4 transformers have been identified by Hydro One for future replacement based on asset condition assessment.

Alternatives and Recommended Plan

The following alternatives are considered to address Jarvis TS asset replacement needs:

- <u>Maintain status quo:</u> This alternative was considered and rejected as it does not address the risk of failure due to asset conditions and would result in increased maintenance costs.
- <u>Station/load consolidation:</u> Moving loads to neighboring station(s) and retiring T3/T4 DESN at Jarvis TS. This alternative was considered but it is not feasible.
- <u>Replacement of the assets:</u> Replace existing 83 MVA T3/ T4 transformers with similar Hydro One standard units.

TWG recommends that Hydro One continue with the replacement of the T3/T4 transformers replacing existing 83 MVA transformers with similar standard Hydro One units.

8.2 Area Supply Needs

An area supply capacity assessment was performed over the study period 2025-2035 for the 115kV Brant and Norfolk areas. This included both transmission line supply capacity as well as station supply capacity needs using the summer peak load forecast developed based on the information from TWG. The local distribution companies supplying the Bronte area are working on the revised long-term load forecasts and this area will be reassessed as part of the upcoming IRRP for Hamilton sub-region.

8.2.1 Brant Area Supply

The 115 kV Brant area is supplied by two stations, Brant TS and Powerline MTS. They currently supply 69 MW and 79 MW loads and have supply capacities of 101 MW and 114 MW respectively. The area supply is limited by the capacity of its transmission system.

In the IRRP completed by the IESO, it was indicated that with the current system conditions the Brant area's supply capacity is limited to 134 MW, which is a reduction from 165 MW that was previously identified. The current total coincident peak load in the Brant area already exceeds this supply capacity of 134 MW. The supply capacity in the Brant area depends on overall system flows, loading in the Woodstock and Hamilton areas and higher loading in Brant area may be possible depending on system conditions and loading in the Woodstock and Hamilton areas. The only nearby station where the Brant area loads can be transferred to is Brantford TS.

The combined supply capacity and loading in the Brant area and Brantford TS is as follows:

Supply Capacity	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
322*	283	296	313	320	331	338	350	358	366	374	383

*- Brant TS and Powerline MTS together limited to 134 MW

The loads in the Brant area and Brantford TS are forecasted to exceed the supply capacity by 2029 if managed through load transfers. The need may arise sooner due to physical constraints in load transfers.

Alternatives, Recommended Plan and Current Status

- Maintain status quo: This alternative was considered and rejected as it does not address the Brant area's load supply needs.
- Transfer excess Brant area loads to Brantford TS: Moving loads in excess to the Brant area supply capacity to Brantford TS as much available through load transfers, keeping the Brant area loads below supply capacity. This option will require reconfiguring distribution assets by the LDCs.
- Operational Measures: Increasing Brant area's supply capacity through operational measures including but not limited to opening DB2 115 kV breaker at Brant TS on 115 kV B2 circuit and opening the LV bus-tie breakers at Brant TS and Powerline MTS
- New 230kV area supply: A new 230 kV double circuit supply is being considered North of Brant area tapping 230 kV M20D/ M21D circuits and supplying loads through two (2) new 230 kV stations in the area offloading 115 kV system.
- These following new interim options have emerged after the completion of the IRRP.
    - New 115 kV Area Supply: The Commerce Way TS to Brant TS 115 kV is a single circuit built on a double circuit tower line. An additional circuit can easily be added to the existing towers:
        i. A new approximately 30km 115kV circuit from Commerce Way TS to Brant TS connected to existing B2 115 kV circuit increasing the capacity of the B2 circuit, a super circuit option.
        ii. A new approximately 30km 115kV circuit from Commerce Way TS to Brant TS parallel to existing B2 115 kV circuit along with an additional 115 kV breaker at Brant TS creating two (2) separate circuits. This will effectively extend 115kV circuit K7 parallel to the existing B2 / K12 circuit to Brant TS. This will increase transmission supply capacity to Brant area.

    These two different options for configuring additional circuit parallel to B2, may provide sufficient capacity for the Brant area over the study period.

TWG recommends transfer of load in excess of the supply capacity from Brant area to Brantford TS along operational measures as required within the near term. TWG recommends Hydro One and GrandBridge Energy to work together for the implementation of the above recommendations. Since the capacity need is in 2029 timeframe and a 230 kV solution takes at least 5-7 years to implement. A 230kV solution alone may not be a viable alternative to meet need timelines of 2029. Since a new interim alternative has emerged the TWG further recommends assessing the new 115 kV options that may provide sufficient time for the implementation of the 230 kV solution recommended in the IRRP. The assessment of this interim solution will be published in addendum to this RIP. The TWG recommends continuing with the IRRP solution of a new 230 kV double circuit supply tapping 230 kV M20D/ M21D circuits and supplying loads through two (2) new 230 kV stations in the area offloading 115 kV system.

8.2.2 Norfolk Area Supply

The Norfolk area loads are supplied through Norfolk TS and Bloomsburg DS supplied through two 115 kV circuits from Caledonia autotransformers. The current supply capacity of the Norfolk area is limited by the two (2) 115kV circuits supplying this area, which is approximately 80 MW. Norfolk TS and Bloomsburg DS are currently supplying loads of 61MW and 41MW and have supply capacities of 97MW and 49MW respectively. The total supply capacity of Norfolk TS and Bloomsburg DS are sufficient over the study period, however load balancing between the two stations through distribution load transfers will be required. These loads already exceed the Norfolk area supply capacity of 80 MW. An earlier IESO assessment has recommended load transfers out of the Norfolk area and additional reactive support at Norfolk TS to provide local area voltage support.

Alternatives, Recommended Plan and Current Status

- Maintain status quo: This alternative was considered and rejected as it does not address the Norfolk area's load supply needs.
- Opening LV bus-tie breakers at Norfolk TS and Bloomsburg DS
- Additional Reactive Support and Load Transfers: Installing additional reactive support (capacitor bank) at Norfolk TS and moving Norfolk area loads to Jarvis TS as much is available through load transfers. This work is already in progress.
- Battery Storage in Norfolk Area: Install a new battery energy storage system close to Norfolk TS capable of providing dynamic reactive power support connecting to both 115 kV C9 and C12 circuits and offsetting area loads. Reactive support should be able to provide sufficient support to maintain adequate voltages in the Norfolk area for the loss of one of the C9/ C12 circuits under peak load conditions over the study period and beyond. Load balancing between Norfolk TS and Bloomsburg DS will be required. A sufficient sized Battery Storage System (BES) close to Norfolk TS meeting MW and MVAR requirements to allow the area load meeting capability to increase to about 150 MW. This is expected to defer the need for area transmission reinforcement well beyond the study period.
- New 230kV area supply: A new 230 kV double circuit supply extending 230 kV N21J/N22J circuits to Norfolk area supplying a new 230 kV supply station in Norfolk area.

TWG recommends continuing with the load transfers out of the Norfolk area and providing new additional reactive support at Norfolk TS, and opening the LV bus-tie breakers at Norfolk TS and Bloomsburg DS as required until a new battery energy storage system is procured capable of providing the required dynamic reactive support and providing peak load reducing function. This recommendation is in line with the IRRP completed for the Burlington to Nanticoke region led by IESO. The arrangement to install BESS to provide the above-mentioned functions will be sufficient to meet the load supply needs over the study period and beyond. The ultimate supply solution will be a new 230 kV/ station in the Norfolk area, but the need is currently beyond the foreseeable future.

8.2.3 Dundas Area Supply

The Area west of Hamilton are supplied through a 27.6 kV distribution system. Dundas TS (T1/T2) and Dundas TS #2 (T5/T6) are supplying a total peak load of 151 MW at the west end of the city of Hamilton. The total supply capacity of both stations is 188 MW with loads forecasted to reach this supply capacity by the end of the study period.

Alternatives and Recommended Plan

The following alternatives are considered to address supply for supply capacity need at these three stations:

- <u>Maintain status quo:</u> This alternative was considered and rejected as it does not address the customer's supply capacity needs.
- <u>Load Transfers or Station/load consolidation:</u> Moving excess loads to the neighboring station/s or moving all loads to neighboring station/s and retiring assets at Dundas TS or Dundas TS #2 and opening the LV bus-tie breakers at these stations.
- <u>Two (2) New 200 MVA 230/ 27.6 kV DESNs near Dundas:</u> The recently completed IRRP proposed two (2) new 200 MVA 230/27.6 kV stations near Dundas TS transferring all existing Dundas TS and Dundas TS#2 load to the 230 kV system to address 115 kV system future needs.
- <u>Build New Middleport DESN south of Hamilton:</u> This new option emerged after the completion of the IRRP. Due to forecasted load growth in the south of Dundas area a new supply station of 200 MVA in the area close to Hydro One's existing 500 kV Middleport TS may be preferrable.

TWG recommended Hydro One and Alectra to continue with load balancing between the two Dundas transformer stations and monitor the loading levels at these stations. If required, to proceed with load transfers and opening LV bus-tie breakers. TWG recommends continuing with the IRRP recommendation of building two (2) new 200 MVA transformations near Dundas TS. The alternate 200 MVA transformation location close to Middleport TS assessment will be published as an addendum to this RIP.

8.2.4 Bronte TS Area Supply

An IRRP was completed in 2016 to address the supply capacity issues for the loads supplied by Bronte TS. Bronte TS has a supply capacity of 208 MVA and is radially supplied from the double-circuit 115 kV transmission line B7/B8 originating from Burlington TS. The supply capacity from Bronte TS is limited to 135 MW as recommended by the IRRP mainly due to thermal limitations of 115kV B7/B8 supply circuits.

Recently Oakville Hydro and Burlington Hydro, the local distribution companies serving area loads, informed TWG of future additional supply capacity needs from Bronte TS.

Alternatives, Recommended Plan and Current Status

- Maintain status quo: This alternative was considered and rejected as it does not address the Bronte TS supply area's needs.
- Transfer customer load to Neighboring Stations: Moving loads in excess to the Bronte TS area supply capacity to neighboring stations.
- Upgrade 115 kV B7/B8 circuits: Upgrade the 115 kV B7/B8 3 km long line section with larger conductor.
- Additional Reactive Support: Additional reactive support at Bronte TS to maintain pre and post contingency voltages at this station.
- New 230kV area supply: A new 230 kV double circuit supply from Burlington TS, replacing the existing 115 kV circuits and transformers or a new additional 230 kV supply and station to supply additional loads.

Oakville Hydro and Burlington Hydro, the LDCs supplied by this station are working to develop a long-term load forecast for Bronte TS area to determine timeframe and amount of additional supply capacity needs. A decision can't be made until Oakville Hydro and Burlington Hydro finalize their load forecast.

TWG recommends that the additional supply capacity need of more than 135 MW at Bronte TS be assessed as part of the upcoming IRRP for Hamilton sub-region to be completed by the IESO.

8.3 Station Capacity Needs

A Station Capacity assessment was performed over the study period 2025-2035 for the 230kV and 115kV Transforming stations in the Burlington to Nanticoke region using the summer peak load forecasts that were provided by the study team. Based on the results, the following Station capacity needs have been identified during the study period:

8.3.1 Nebo TS (T3/T4) DESN

Nebo TS is located south of the city of Hamilton, having two DESNs units T1/T2 and T3/T4 supplying loads in the city of Hamilton and surrounding areas. The current loads at T3/T4 13.8 kV DESN is 52 MW and have been historically around the same level against its supply capacity of 51MW. The loads at this DESN are currently forecasted to grow well above its supply capacity.

At this time both T3/T4 230 kV / 13.8 kV 75 MVA Hydro One nonstandard transformers have been identified by Hydro One for future replacement based on their asset condition assessment.

Alternatives and Recommended Plan

The following alternatives are considered to address Nebo TS supply capacity needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the risk of failure due to asset condition and would result in increased maintenance cost.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T3/T4 DESN at Nebo TS. This alternative was considered but is not feasible.
- Opening LV bus-tie breakers at Nebo T3/T4 DESN and transferring excess loads to neighboring stations
- Replacement of the assets: Replace existing nonstandard 75 MVA T3/ T4 transformers with 100 MVA Hydro One standard units.

The TWG recommends that Hydro One and Alectra monitor the loading at Nebo TS T3/T4 DESN and take remedial measures like transferring excess loads and opening the LV bus-tie breaker, if required, until replacement of these transformers is completed. Hydro One would replace the existing 75 MVA nonstandard transformers with Hydro One standard 100 MVA units providing sufficient supply capacity over the foreseeable future.

8.3.2 Mohawk TS

Mohawk TS is a single DESN 115kV / 13.8 kV station located in the city of Hamilton. This station has a supply capacity of 90 MW and currently supplying about 72MW of loads. The station is forecasted to approach its supply capacity by the end of the study period.

Alternatives and Recommended Plan

The following alternatives are considered to address Mohawk TS supply capacity needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the customer’s supply capacity needs at this station.
- Load Transfers or Station/load consolidation: Moving excess loads to the neighboring station/s or moving all loads to neighboring station/s and retiring Mohawk TS. This alternative was considered but is not feasible as there are no nearby station/s having sufficient surplus capacity to accommodate these loads.
- Opening LV bus-tie breakers at Mohawk TS
- Additional Station Supply: Replace existing 75 MVA transformers with 100 MVA Hydro One standard units.

TWG recommends that Hydro One and Alectra monitor the loading at Mohawk TS as the supply capacity need is close to the end of the study period and open the LV bus-tie breaker at this station, if required. This need will be again reassessed during the next regional planning cycle.

8.3.3 Newton TS

Newton TS is a single DESN 115kV / 13.8 kV station located in the city of Hamilton. This station has a supply capacity of 75 MW and currently supplying about 48MW of loads. The station is forecasted to be approaching its supply capacity by the end of the study period.

Alternatives and Recommended Plan

The following alternatives are considered to address Newton TS supply capacity needs:

- Maintain status quo: This alternative was considered and rejected as it does not address the customer's supply capacity needs at this station.
- Load Transfers or Station/load consolidation: Moving excess loads to the neighboring station/s or moving all loads to neighboring station/s and retiring Newton TS. This alternative was considered but is not feasible as there are no nearby station/s having sufficient surplus capacity to accommodate these loads.
- Opening LV bus-tie breakers at Newton TS
- Additional Station Supply: Replace existing 75 MVA transformers with 100 MVA Hydro One standard units.

TWG recommends that Hydro One and Alectra monitor the loading at Newton TS as the need is close to the end of the study period and open the LV bus-tie breaker, if required. This need will be again reassessed during the next regional planning cycle.

8.3.4 Nebo TS (T1/T2) DESN

Nebo TS is located south of the city of Hamilton, having two DESNs units T1/T2 and T3/T4 supplying loads in the city of Hamilton and surrounding areas. The current loading at T1/T2 27.6 kV DESN is 145 MW having a supply capacity of 178MW. The loads at this 27.6 kV DESN are forecasted to reach its supply capacity by 2031.

Alternatives and Recommended Plan

The following alternatives are considered to address Nebo TS supply capacity needs:

- Maintain status quo: This alternative was considered and rejected as it does not meet customer needs.
- Station/load consolidation: Moving loads to neighboring station(s) and retiring T1/T2 DESN at Nebo TS. This alternative was considered but is not feasible.
- Transferring loads to neighboring stations and opening LV bus-tie breakers at Nebo T1/T2 DESN

The TWG recommends that Hydro One and Alectra monitor the loading at Nebo TS T1/T2 DESN and take remedial measures like transferring loads to neighboring stations and opening the LV bus-tie breaker, if required.

8.4 Transmission Lines Capacity Needs

All line and equipment loads shall be within their continuous ratings with all elements in service and within their long-term emergency ratings with any one element out of service. Immediately following contingencies, lines may be loaded up to their short-term emergency ratings where control actions such as re-dispatch, switching, etc. are available to reduce the loading to the long-term emergency ratings. A Transmission Lines Capacity Assessment was performed over the study period 2025-2035 for the 115kV Transmission line circuits in the Burlington to Nanticoke region by assessing thermal limits of the circuit and the voltage range as per ORTAC to cater for this need. The TWG identified overloading of 115 kV B2 intertie line between Brant and Woodstock area which is studied as part of the Brant area supply needs and the supply capacity need of 115 kV C9/C12 circuits as part of the Norfolk area study.

8.5 System Reliability, Operation and Restoration Needs

The Technical Working Group did not identify any restoration needs during this regional planning cycle.

9. CONCLUSION AND RECOMMENDATION

This section concludes the Regional Infrastructure plan Report for Burlington to Nanticoke region. The Major Infrastructure investments recommended by the TWG in the near and mid-term planning horizon [2025-2035] are provided in Table 7 below, along with their planned in-service dates (ISD) and budgetary estimates for planning purposes.

Table 7: Recommended Plans over the next 10 Years

Station/Circuit Name	Recommended Plan	Lead	Planned ISD
Asset Renewal Needs			
Nebo TS	Replace T3/ T4 transformers	Hydro One	2030-2035
Lake TS	Replace T3/T4 transformers and switchgear	Hydro One	2030-2035
Beach TS	Replace T5/T6 transformers and switchgear	Hydro One	2030-2035
Caledonia TS	Replace T2 transformer	Hydro One	2030-2035
Birmingham TS	Replace T1 Transformer and MV Switchgears	Hydro One	2030-2035
Gage TS	Replace T8/T9 transformers and switchgear	Hydro One	2030-2035
Jarvis TS	Replace T3/ T4 transformers	Hydro One	2030-2035
Area Supply Needs			
Brant Area	Two (2) new 230kV/ 27.6 kV 200 MVA transformation facilities near the existing Brant TS.	Hydro One/ GBE	2029
Norfolk Area	Battery Storage along with load transfers, additional reactive support and operational measures.	Hydro One	2025
Dundas Area	Two (2) new 230kV/ 27.6 kV 200 MVA transformation facilities near existing Dundas TS.	Hydro One/ Alectra	2035
Bonte Area	LDC developing load forecast to identify additional need above current supply capacity	Hydro One/ Oakville Hydro/ Burlington Hydro	TBD
Station Capacity Needs			
Nebo TS (T3/T4) DESN	Nebo T3/T4 is a 230kV / 13.8kV DESN transformers to be replaced with Hydro One standard 100 MVA units. In the meantime, operational measures, if required	Hydro One/ Alectra	Current
Mohawk TS	The loading at this station to be monitored and as required excess load transferred to neighboring station/s along with operational measures, if required	Hydro One/ Alectra	2035
Newton TS	The loading at this station to be monitored and as required excess load transferred to neighboring station/s along with operational measures, if required	Hydro One/ Alectra	2035
Nebo TS (T1/T2) DESN	Nebo T1/T2 is a 230kV / 27.6kV DESN. The loading at this station to be monitored and as required excess	Hydro One	2031

Station/Circuit Name	Recommended Plan	Lead	Planned ISD
	load transferred to neighboring station/s along with operational measures, if required		
Transmission Line Capacity Needs			
The Technical Working Group did not identify any other line capacity needs. The overloading of 115 kV B2 intertie line between Brant area and Woodstock area is included in Brant area supply need.			
System Reliability, Operation and Load restoration Needs			
The Technical Working Group did not identify any reliability, operation and load restoration needs for this region.			

Note: The planned in-service dates are tentative and subject to change.

10. REFERENCES

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

[2] Ontario Energy Board, Transmission System Code (issue July 14, 2000 rev. August 2, 2023)

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

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

[5] Burlington to Nanticoke 3rd Cycle Needs Assessment (NA) Report

[6] Burlington to Nanticoke region Integrated Regional Resource Planning (IRRP) Report

Appendix A: Extreme Summer Weather Adjusted Net Load Forecast

Table A.1: Burlington to Nanticoke region – Summer Coincident- Net Load Forecast

Area	Station	LTR	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Brant 115 kV	Brant TS (T1 / T2)*	101	64	64	57	57	56	56	55	54	54	53	53
	Powerline MTS (T1 / T2)*	114	46	51	56	55	57	56	55	53	52	51	50
Brant 230 kV	Brantford TS (T3 / T4)*	188	146	151	168	176	185	193	206	215	223	232	242
Burlington and Oakville 115 kV	Bronte TS (T2 / T5 / T6)	193	107	106	104	103	102	101	100	99	98	97	97
Burlington and Oakville 230 kV	Burlington TS (T15 / T16)	185	116	116	116	117	118	120	121	123	124	127	130
	Cumberland TS (T3 / T4)	174	81	81	81	81	81	82	83	84	84	86	88
Greater Hamilton 115 kV	Birmingham TS (T1 / T2)	76	12	12	12	13	13	14	14	14	15	16	16
	Birmingham TS (T3 / T4)	91	59	59	59	60	60	61	61	61	62	63	64
	Dundas TS (T1 / T2)	99	94	93	92	92	92	92	92	92	93	93	95
	Dundas TS #2 (T5 / T6)	89	49	69	68	67	67	67	67	67	68	69	70
	Elgin TS (T1 / T2)	134	78	82	84	88	88	90	91	92	93	95	98
	Gage TS (T8/ T9)	123	12	12	12	12	13	13	13	13	13	13	13
	Gage TS (T11/ T12)	132	22	23	24	24	25	26	26	27	27	27	28
	Kenilworth TS (T2 / T3)	124	26	26	26	26	26	26	26	26	26	26	27
	Mohawk TS (T1 / T2)	90	65	66	67	68	69	70	71	71	73	74	77
	Newton TS (T1 / T2)	75	49	54	57	58	60	60	61	62	64	65	67
	Stirton TS (T3 / T4)	112	52	52	52	53	54	55	55	56	57	58	60
	Winona TS (T1 / T2)	89	49	49	48	47	47	48	48	49	50	51	52
	CTS		32	32	32	32	32	32	32	32	32	32	32
Greater Hamilton 230 kV	Beach TS (T3/T4)	135	10	11	11	11	11	11	12	12	12	12	13
	Beach TS (T5 / T6)	91	41	41	43	43	44	44	45	45	46	47	48
	Horning TS (T3 / T4)	107	58	59	59	60	61	62	62	63	64	66	68
	Lake TS (T1 / T2)	94	42	42	43	43	44	44	45	45	46	47	49
	Lake TS (T3 / T4)	113	38	41	43	44	45	46	46	47	48	49	51
	Nebo TS (T1/T2)	178	126	133	137	141	144	148	152	155	159	161	163
	Nebo TS (T3 / T4)	51	45	46	46	47	48	48	49	50	51	52	53
	CTS		321	321	321	471	561	510	510	510	510	510	495
Caledonia Norfolk 115 kV	Norfolk TS (T1/T2)**	97	54	54	54	53	55	55	59	59	59	59	60
	Bloomsburg DS (T1/T2)**	49	36	36	35	35	35	35	35	35	37	37	38
Caledonia Norfolk 230 kV	Caledonia TS (T1/T2)	99	50	59	61	61	63	65	66	67	68	74	75
	Jarvis TS (T3/T4)**	99	36	37	37	37	37	37	38	38	38	39	39
	CTS		210	211	261	286	311	336	361	386	411	436	461

**- Temporary load transfers from Brant TS and Power line MTS keeping loads below Brant area supply capacity.*

***- Load transfers from Norfolk TS and Bloomsburg DS to Jarvis TS as one of the measures to reduce loads in Norfolk area.*

Table A.2: Burlington to Nanticoke region – Summer non-Coincident – Net Load Forecast

Area	Station	LTR	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Brant 115 kV	Brant TS (T1 / T2)	101	69	69	62	61	60	60	59	58	58	57	57
	Powerline MTS (T1 / T2)	114	52	58	64	63	65	64	63	61	60	58	57
Brant 230 kV	Brantford TS (T3 / T4)	188	162	168	187	196	205	215	229	239	248	259	270
Burlington and Oakville 115 kV	Bronte TS (T2 / T5 / T6)	193	125	124	122	121	119	118	117	116	115	114	114
Burlington and Oakville 230 kV	Burlington TS (T15 / T16)	185	128	128	129	129	130	132	134	136	137	140	144
	Cumberland TS (T3 / T4)	174	122	122	122	122	123	124	125	126	127	129	132
Greater Hamilton 115 kV	Birmingham TS (T1 / T2)	76	12	13	13	14	14	14	15	15	16	16	17
	Birmingham TS (T3 / T4)	91	62	63	63	63	64	64	65	65	66	67	68
	Dundas TS (T1 / T2)	99	105	107	106	106	106	106	106	106	107	107	109
	Dundas TS #2 (T5 / T6)	89	56	76	75	74	74	74	74	74	75	76	77
	Elgin TS (T1 / T2)	134	81	85	88	91	92	93	94	95	97	99	102
	Gage TS (T8/ T9)	123	19	20	20	20	21	21	22	22	22	22	22
	Gage TS (T11/ T12)	132	37	38	39	40	41	42	44	44	45	45	46
	Kenilworth TS (T2 / T3)	124	50	50	50	51	51	52	52	53	53	54	55
	Mohawk TS (T1 / T2)	90	76	77	78	79	80	81	82	83	85	87	89
	Newton TS (T1 / T2)	75	55	60	64	65	66	67	68	69	71	72	75
	Stirton TS (T3 / T4)	112	52	52	52	53	54	55	55	56	57	58	60
	Winona TS (T1 / T2)	89	53	52	51	51	50	51	51	52	53	54	56
	CTS		32	32	32	32	32	32	32	32	32	32	32
Greater Hamilton 230 kV	Beach TS (T3/T4)	135	17	17	17	18	18	18	19	19	20	20	21
	Beach TS (T5 / T6)	91	66	67	69	70	71	71	72	73	74	76	78
	Horning TS (T3 / T4)	107	71	72	73	74	75	76	77	78	80	81	84
	Lake TS (T1 / T2)	94	52	53	53	54	54	55	56	56	57	59	60
	Lake TS (T3 / T4)	113	47	51	53	55	56	57	57	58	60	61	63
	Nebo TS (T1/T2)	178	153	161	166	170	174	178	181	185	188	191	193
	Nebo TS (T3 / T4)	51	55	56	56	57	58	59	59	60	61	62	64
	CTS		321	321	321	471	561	510	510	510	510	510	495
Caledonia Norfolk 115 kV	Norfolk TS (T1/T2)	97	60	59	59	58	60	60	65	65	65	65	67
	Bloomsburg DS (T1/T2)	49	39	39	39	39	39	39	39	39	41	41	41
Caledonia Norfolk 230 kV	Caledonia TS (T1/T2)	99	53	62	63	64	66	68	69	71	72	78	79
	Jarvis TS (T3/T4)	99	69	69	70	70	70	71	71	72	72	73	74
	CTS		210	211	261	286	311	336	361	386	411	436	461

Appendix B: Lists of Step-Down Transformer Stations

Sr. No.	Transformer Station	Voltage (kV)	Supply Circuits
1	Beach TS	230	Beach TS 230 kV Bus[1]
2	Birmingham TS	115	HL3, HL4
3	Bloomsburg DS	115	C9, C12
4	Brant TS	115	B12BL, B13BL
5	Brantford TS	230	M32W, M33W
6	Bronte TS	115	B7, B8
7	Burlington TS DESN	230	Q23BM, Q25BM
8	Caledonia TS	230	N5M, S39M
9	Cumberland TS	230	B40C, B41C
10	CTS#1	230	Q24HM, Q29HM
11	CTS#2	230	H35D, H36D
12	CTS#3	230	N20K
13	CTS#4	230	N21J, N22J
14	CTS#5	230	N21J, N22J
15	CTS#6	115	B3, B4
16	Dundas TS	115	B3, B4
17	Dundas TS #2	115	B12BL, B13BL
18	Elgin TS	115	HL3, HL4
19	Gage TS	115	B10, B11
20	Horning TS	230	M27B, M28B
21	Jarvis TS	230	N21J, N22J
22	Kenilworth TS	115	H5K, H6K
23	Lake TS	230	B18H, B20H
24	Mohawk TS	115	B3, B4
25	Nebo TS	230	Q24HM, Q29HM
26	Newton TS	115	Newton TS 115 kV Bus[2]
27	Norfolk TS	115	C9, C12
28	Powerline MTS	115	B12BL, B13BL
29	Stirton TS	115	HL3, HL4
30	Winona TS	115	Q2AH

(1) Beach TS 230 kV bus is supplied by five 230 kV B18H, B20H, Q24HM, Q29HM and M34H circuits

(2) Newton TS 115 kV bus is supplied by four 115 kV B3, B4, B12BL and B13BL circuits

Appendix C: Lists of Transmission Circuits

Sr. No.	Connecting Stations	Circuit ID	Voltage (kV)
1	Beach TS - CTS	H35D, H36D	230
2	Beach TS - Burlington TS	B18H, B20H	230
3	Beach TS - Middleport TS	M34H	230
4	Beach TS - Middleport TS - Beck #2 TS	Q24HM, Q29HM	230
5	Burlington TS - Cumberland TS	B40C, B41C	230
6	Burlington TS - Middleport TS	M27B, M28B	230
7	Burlington TS - Middleport TS - Beck #2 TS	Q23BM, Q25BM	230
8	Middleport TS - Beck #2 TS	Q30M	230
9	Middleport TS - Buchanan TS	M31W, M32W, M33W	230
10	Middleport TS - Detweiler TS	M20D, M21D	230
11	Middleport TS - Nanticoke TS	N5M, N6M	230
12	Middleport TS - Summerhaven SS	S39M	230
13	Middleport TS - Sandusk SS	K40M	230
14	Nanticoke TS - Jarvis TS	N21J, N22J	230
15	Summerhaven SS - Nanticoke TS	N37S	230
16	Sandusk SS - Nanticoke TS	N20K	230
17	Beach TS - Gage TS	B10, B11	115
18	Beach TS - Kenilworth TS	H5K, H6K	115
19	Beach TS - Newton TS	HL3, HL4	115
20	Beach TS - Winona TS	Q2AH	115
21	Beach TS - CSS	H9W	115
22	Burlington TS - Brant TS	B12BL, B13BL	115
23	Burlington TS - Bronte TS	B7, B8	115
24	Burlington TS - Cedar TS	B5G, B6G	115
25	Burlington TS - Newton TS	B3, B4	115
26	Caledonia TS - Norfolk TS	C9, C12	115
27	Kenilworth TS - Gage TS (Idle)	K1G, K2G	115

Appendix D: List of LDC's

Sr. no.	Name of LDC
1	Alectra Utilities Corporation
2	Burlington Hydro Inc.
3	Grand Bridge Energy Inc.
4	Hydro One Networks Inc. (Distribution)
5	Oakville Hydro

Appendix E: List of Municipalities in the region

Sr. no.	Name of Municipality
1	City of Brantford
2	City of Hamilton
3	Brant County
4	Haldimand County
5	Norfolk County
6	City of Burlington
7	City of Oakville (partial)

Appendix E: 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
LMC	Load Meeting Capability
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

Acronym	Description
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
TWG	Technical Working Group