NEEDS SCREENING REPORT

Region: Burlington to Nanticoke

Date: May 23, 2014

Prepared by: Burlington to Nanticoke Study Team

Burlington to Nanticoke Region Needs Screening Study Team Members

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Disclaimer

This Needs Screening Report was prepared for the purpose of identifying potential needs in the Burlington to Nanticoke Region and to assess whether those needs require further coordinated regional planning. The potential needs that have been identified through this Needs Screening Report may be studied further through subsequent regional planning processes and may be reevaluated based on the findings of further analysis. The load forecast and results reported in this Needs Screening Report are based on the information and assumptions provided by study team participants.

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NEEDS SCREEN EXECUTIVE SUMMARY

NAME	Burlington to Nanticoke Region		
LEAD	Hydro One Networks Inc. ("Hydro One")		
REGION	Burlington to Nanticoke		
START DATE	March 24, 2014	**END DATE**	May 23, 2014

1. INTRODUCTION

The purpose of this Needs Screening report is to undertake an assessment of the Burlington to Nanticoke Region, determine if there are regional needs that would lead to coordinated regional planning. Where regional coordination is not required and a "wires" only solution is necessary such needs will be addressed between the relevant Local Distribution Companies (LDCs) and Hydro One and other parties as required.

For needs that require further regional planning and coordination, the Ontario Power Authority (OPA) will initiate the Scoping process to determine whether an OPA-led Integrated Regional Resource Planning (IRRP) process or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution) is required, or whether both are required.

2. REGIONAL ISSUE/TRIGGER

The Needs Screening for the Burlington to Nanticoke Region was triggered in response to the Ontario Energy Board's (OEB) new Regional Planning process approved in August 2013. To prioritize and manage the regional planning process, Ontario's 21 regions were assigned to one of three groups, where Group 1 Regions are being reviewed first. Burlington to Nanticoke Region belongs to Group 1 and the Needs Screening for this Region was triggered on March 24, 2014 and was completed on May 23, 2014.

3. SCOPE OF NEEDS SCREENING

The scope of this Needs Screening assessment was limited to the next 10 years because relevant data and information was collected up to the year 2023. Needs emerging over the near-term (0-5 years) and mid-term (6-10 years) should be further assessed as part of the OPA-led Scoping Assessment and/or IRRP, or in the next planning cycle to develop a 20-year plan and strategic direction for the Region.

The assessment included a review of transmission system connection facilities capacity which covers station loading, thermal and voltage analysis, system reliability, operational issues such as load restoration and assets approaching end-of-useful-life.

4. INPUTS/DATA

Study team participants, including representatives from LDCs, the OPA, the IESO, and Hydro One transmission provided information for the Burlington to Nanticoke Region. The information included historical load, load forecast, Conservation and Demand Management (CDM), Distributed Generation (DG), load restoration and performance information along with end-of-useful-life of any major equipment. See Section 4 for further details.

5. ASSESSMENT METHODOLOGY

The assessment's primary objective over the study period (2014 to 2023) is to identify the electrical infrastructure needs in the region. The study reviewed available information, load forecast and conducted single contingency analysis to confirm need, if and when required. See Section 5 for further details.

6. RESULTS

I Regional Supply Capacity

A. 230kV Regional Supply

- Over the study period no overload or capacity need was identified for the loss of single 230kV circuits in the region**.**

B. 230/115kV Autotransformers

- No overload or capacity issues were identified for the loss of any single 230kV/115kV autotransformer.
- For the loss of two autotransformers at Burlington TS (low probability) there may be situations when load restoration as per the IESO Ontario Resource and Transmission Assessment Criteria (ORTAC) may not be met.

C. 230kV and 115kV Connection Facilities

Brant Area

- The Brant Area sub-region currently has an OPA-led IRRP study underway. The results of this area IRRP will be later appended to the regional IRRP.
- Currently, IRRP study has identified voltage and capacity issues in the near-term on 115kV transmission circuits B12/B13. The OPA has issued a handoff letter to Hydro One to develop and implement a plan with relevant LDCs (Brantford Power and Brant County Power) to provide reactive support in the Brant area.

Burlington-Hamilton Area

There are several needs emerging in this area. Some of the needs identified during the study period include, but may not be limited to:

- Transmission circuits B7/B8 loads may reach their thermal capacity.
- Mohawk TS load is currently at its normal supply capacity, and will exceed capacity.
- At Dundas TS existing capacity of the two DESNs is expected to be sufficient over the study period. Load balancing between the two DESNs is required to mitigate overloading on one of the DESNs.

- Nebo TS (T3/T4 DESN) will require a switchgear to utilize the spare windings of transformers.
- Bronte TS may reach its normal supply capacity before the end of the study period.

Beach Area

- There are no significant needs in this area over the study period.

Caledonia-Norfolk Area

- Under peak load conditions and single contingency, there will be low voltage issues at Norfolk TS and Bloomsburg MTS.

II System Reliability, Operation And Load Restoration

Generally speaking, there are no significant system reliability and operating issues for one element out of service. However, for the loss of two elements, load restoration as per ORTAC criteria may not be met. Further study is required.

III Aging Infrastructure And Replacement Plan Of Major Equipment

During the study period, plans to replace major equipment do not affect the needs identified with the exception of the replacement of transformers at Mohawk TS.

7. RECOMMENDATIONS

Based on the assessment, the study team's recommendations are as follows:

a) At this time, some of the potential needs identified do not require further regional coordination. These potential needs can be adequately and more efficiently addressed through localized planning between Hydro One Networks Inc. and the LDCs. See Sections 6 and 7 for further details.

b) Coordinated regional planning is further required for some of the needs and OPA to undertake Scoping Assessment. See Sections 6 and 7 for further details.

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LIST OF TABLES AND FIGURES

1 INTRODUCTION

This Needs Screening report provides a summary of needs that are emerging in the Burlington to Nanticoke Region ("Region") over the next ten years. The development of the Needs Screening report is in accordance with the regional planning process as set out in the Ontario Energy Board's (OEB) Transmission System Code (TSC) and Distribution System Code (DSC) requirements and the Planning Process Working Group (PPWG) Report to the Board.

The purpose of this Needs Screening report is to undertake an assessment of the Burlington to Nanticoke Region, determine if there are regional needs that would lead to coordinated regional planning. Where regional coordination is not required and a wires-only only solution is necessary such needs will be addressed between the relevant Local Distribution Companies (LDCs) and Hydro One and other parties as required.

For needs that require further regional planning and coordination, the Ontario Power Authority (OPA) will initiate the Scoping process to determine whether an OPA-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution) is required, or whether both are required. This report was prepared by the Burlington to Nanticoke Region Needs Screening study team (Table 1) and led by the transmitter, Hydro One Networks Inc. The report captures the results of the assessment based on information provided by the LDCs, the Ontario Power Authority (OPA) and the Independent Electricity System Operator (IESO).

Table 1: Study Team Participants for Burlington to Nanticoke Region

No.	Company
1.	Hydro One Networks Inc. (Lead Transmitter)
2.	Ontario Power Authority
3.	Independent Electricity System Operator
4.	Brant County Power Inc.
5.	Brantford Power Inc.
6.	Burlington Hydro Inc.
7.	Haldimand County Hydro Inc.
8.	Horizon Utilities Corporation
9.	Hydro One Networks Inc. (Distribution)
10.	Norfolk Power Distribution Inc.
11.	Oakville Hydro Electricity Distribution Inc.

2 REGIONAL ISSUE/TRIGGER

The Needs Screening for the Burlington to Nanticoke Region was triggered in response to the Ontario Energy Board's (OEB) new Regional Planning process approved in August 2013. To prioritize and manage the regional planning process, Ontario's 21 regions were assigned to one of three groups, where Group 1 Regions are being reviewed first. The Burlington to Nanticoke Region belongs to Group 1. The Needs Screening for this region was triggered on March 24, 2014 and was completed on May 23, 2014.

The Burlington to Nanticoke Region can be divided into four electrical areas: Brant, Caledonia-Norfolk, Burlington-Hamilton, and Beach. The Brant Sub-Region currently has an IRRP under development, which was initiated prior to the new Regional Planning process.

3 SCOPE OF NEEDS SCREENING

This Needs Screening covers the Burlington to Nanticoke Region over an assessment period of 2014 to 2023. The scope of the Needs Screening includes a review of system capability which covers transformer station loading and transmission line thermal and voltage analysis. System reliability, operation, load restoration and asset sustainment issues were also reviewed as part of this screening.

3.1 Burlington to Nanticoke Region Description and Connection Configuration

The Burlington to Nanticoke Region is located in Southern Ontario and comprises the municipalities of Burlington, Hamilton, Oakville, Brantford, Brant County, Haldimand County, and Norfolk County. The boundaries of the Burlington to Nanticoke region and its four sub-regions are shown in Figure 1.

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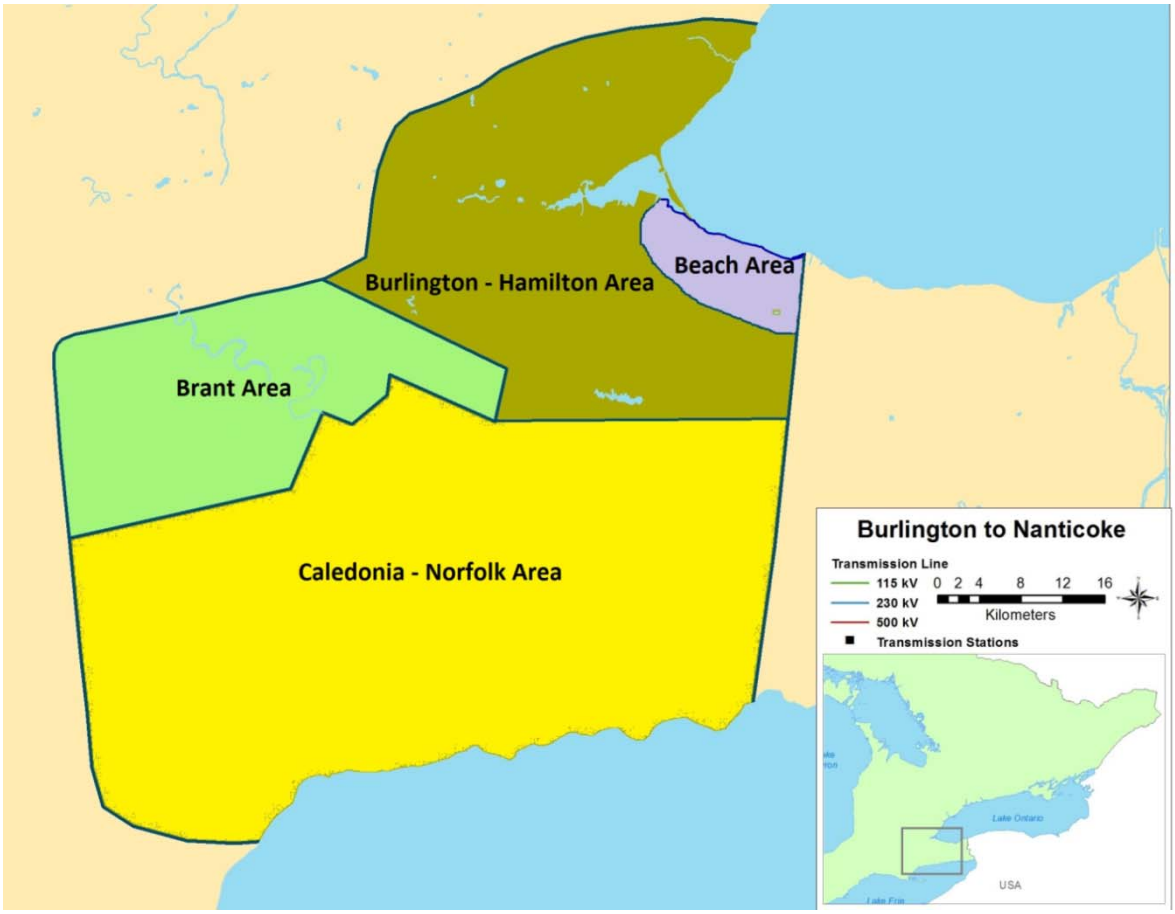

Figure 1: Burlington to Nanticoke Regional and Area Boundaries

The Burlington to Nanticoke 230kV and 500kV systems are part of East-West bulk power system transfers mainly from the generation located in Western Ontario toward the Greater Toronto Area (GTA). This region has two 500kV stations, Nanticoke TS and Middleport TS, interconnected through two 500kV circuits and connected to 500kV Longwood TS and Milton TS. Both of these 500kV stations have transformation capacities to 230kV systems. The Burlington to Nanticoke Region's 230kV system has three autotransformer stations at Burlington TS, Beach TS, and Caledonia TS supplying the 115kV transformer stations. For Needs Screening, Dunnville TS has been included in the Niagara Region (Group 3, Region 17) instead of the Burlington to Nanticoke Region (Group 1, Region 1) – a change to the May 17, 2013 OEB Planning Process Working Group Report

The 230kV interconnections of Burlington to Nanticoke Region to the rest of system consist of two circuits to Detweiler TS, three circuits to Buchanan TS and seven circuits to Beck TS. The 115kV circuits are supplied from Burlington TS, Beach TS and Caledonia TS. A single line diagram of the 500kV, 230kV and 115kV systems in the Burlington to Nanticoke Region is shown in Figures 2 and 3.

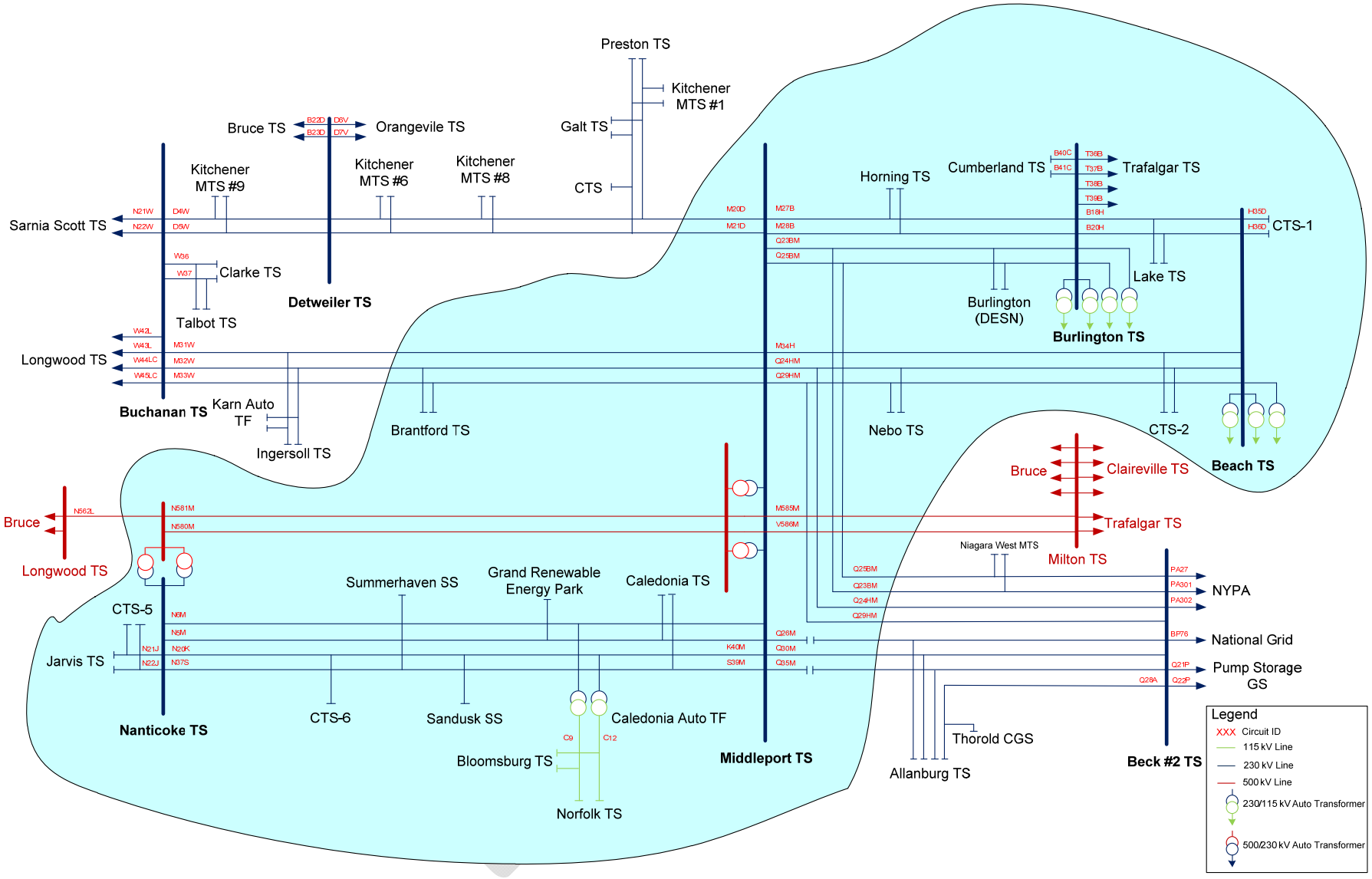

Figure 2: Burlington to Nanticoke Region – 230kV and 500kV Single Line Diagram

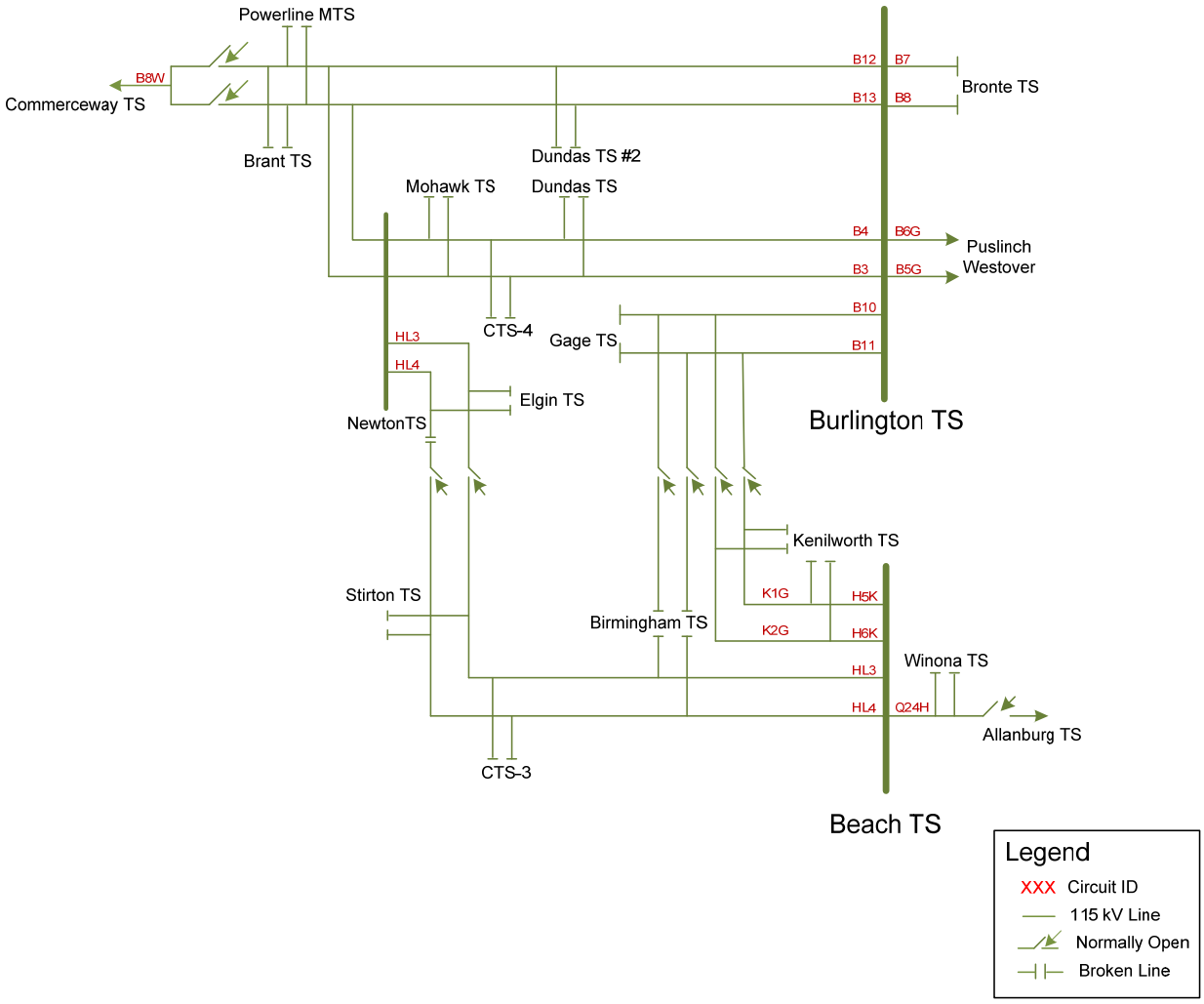

Figure 3: Burlington and Beach 115kV Single Line Diagram

3.2 Electrical Areas

Based on the geographical location and supply configuration, the Burlington to Nanticoke Region was divided into the following electrical areas for the purpose of this assessment:

- Brant Area
- Burlington-Hamilton Area
- Beach Area
- Caledonia-Norfolk Area

4 INPUTS AND DATA

In order to conduct this Needs Screening, study team participants provided the following information and data to Hydro One:

- IESO provided:
    i. Historical regional coincident peak load and station non-coincident peak load.
    ii. List of existing reliability and operational issues.
- LDCs and Transmission Connected Customers provided historical (2011-2013) net load and gross load forecast (2014-2023).
- Hydro One provided transformer, station, and line ratings.
- OPA provided Conservation and Demand Management (CDM) and Distributed Generation (DG) data.
- Any relevant planned transmission and distribution investments were provided by the transmitter and LDCs, etc.

4.1 Load Forecast

As per data provided by the study team, the load in the Burlington to Nanticoke Region is expected to grow at an approximate rate of 1.1% annually over the long term. The growth rates vary across the Region, from approximately 0.5% in the Beach Area to 2.8% in the Brant Area. The individual area load growth rates over the 2013-2023 period are given in Table 2:

Table 2: Annual Load Growth Rates for Burlington to Nanticoke Region

Area	Approximate %Growth Rate 2013-2018	Approximate % Growth Rate 2018-2023
Brant Area	2.8	2.5
Burlington-Hamilton Area	1.3	1.2
Beach Area	0.5	0.5
Caledonia-Norfolk Area	1.0	1.0
Overall Area	1.2	1.1

The Needs Screening assessment considered gross loads at individual stations based on the 2013 summer peak non-coincident load and the peak summer load forecast for stations within the Region. The station load forecast was developed by applying load growth rates derived from the LDC's load forecast.

5 ASSESSMENT METHODOLOGY

The following methodology and assumptions were made in this Needs Screening assessment:

1. The Region is summer peaking, so this assessment is based on summer peak loads.
2. Forecast loads are based on the anticipated forecast growth rates provided by the Region's LDCs using 2013 peak summer load as the reference point.
3. The 2013 historical peak loads are adjusted for extreme weather conditions according to Hydro One methodology.
4. A uniform and proportionated load growth is assumed over the study period.
5. Stations having negative load growth over the study period are assumed to have steady load.
6. In developing a worst-case scenario, DG and CDM contributions were not considered.
7. Review and assess impact of any on-going or planned development project in Burlington to Nanticoke region during the study period.
8. Review and assess impact of any critical/major elements planned/identified to be replaced at the end of their useful life such as autotransformers, cables and stations.
9. Station capacity adequacy is assessed assuming a 90% lagging power factor and non-coincident station loads.
10. To identify the emerging needs in each area, the study was performed observing all elements in service and one element out of service. Any known issues with two elements out of service have been provided by the IESO.
11. Transmission line adequacy to be assessed using non-coincident peak station loads in the region.
12. Transmission adequacy assessment is primarily based on:
    - With all elements in service, the system is to be capable of supplying forecast demand with equipment loading within continuous ratings and voltages within normal range.
    - With one element out of service, the system is to be capable of supplying forecast demand with circuit loading within their long-time emergency (LTE) ratings and transformers within their summer 10-Day limited time ratings (LTR).
    - All voltages must be within pre- and post-contingency ranges as per ORTAC criteria.

This Needs Screening assessment was conducted to identify emerging needs and determine whether or not further coordinated regional planning should be undertaken for the Region or electrical areas (sub-regions). It is expected that further studies in the subsequent regional planning process will undertake detailed analysis and also assess ORTAC performance requirements including loss of two elements.

6 RESULTS

This section summarizes the results of the Needs Screening in the Burlington to Nanticoke Region.

6.1 Regional Supply Capacity

6.1.1 230kV Regional Supply

The 230kV transmission system in the Region consists of Middleport TS connected to other stations in the Region by one circuit to Beach TS, two circuits to Burlington TS, one circuit to Beck TS, two circuits to Detweiler TS, three circuits to Buchanan TS and by another four circuits to Nanticoke TS. In addition, Middleport TS is connected to Beck TS through four circuits. Of these four circuits, two are tapped to Burlington TS and the remaining two to Beach TS. The Burlington TS and Beach TS are also connected to each other by two 230kV circuits.

The power flows on the 230kV circuits in the Region are mainly dependent on the Bulk system flows. Over the study period, no overloads were observed on 230kV lines in Burlington to Nanticoke Region for the loss of a single 230kV circuit. In some cases, the loss of a transmission structure with more than one circuit will result in loss of load.

6.1.2 230/115kV Autotransformers

The Region has three 230/115kV autotransformer stations in the Burlington-Hamilton, Beach and Caledonia-Norfolk areas. There are no overloading issues expected over the study period for the loss of a single autotransformer. This will require reassessment in the next regional planning cycle.

It has been identified that for the loss of two autotransformers at Burlington TS (low probability) there may be overloading and situations when load restoration as per ORTAC may not be met. Additional studies are required to examine the impact of the loss of two autotransformers.

6.1.3 230kV and 115kV Connection Facilities

Brant Area

The Brant area sub-region currently has an OPA-led IRRP study underway. The results of this IRRP will later be appended to the regional IRRP.

Currently, the IRRP study has identified voltage and capacity issues in the near-term on 115kV transmission circuits B12/B13. The OPA has issued a handoff letter to Hydro One to develop and implement a plan to provide reactive support in the area.

Burlington-Hamilton Area

There are several needs emerging in this area. Some of the needs identified during the study period include, but may not be limited to:

- Transmission circuits B7/B8 may reach their thermal capability and/or can be constrained by voltage issues and require further assessment.

- Mohawk TS is currently above its normal supply capacity (i.e. 10-day LTR). This is a known issue which had been discussed with the LDC and both loading and growth is being monitored. DG and CDM initiatives may help address the issue and/or defer needs.
- At Dundas TS there are two DESNs (Dundas TS and Dundas TS#2) with existing capacity expected to be sufficient over the study period. However, distribution investments are required to balance load amongst the two DESNs through load transfers.
- Nebo TS (T3/T4) is expected to have sufficient station capacity over the study period. However, a second switchgear will be required to utilize the spare winding of transformers.
- Bronte TS may reach its normal supply capacity before the end of the study period and require further assessment.
- Historical data shows that power factor at Cumberland TS may be below ORTAC criteria under peak load conditions and require further assessment.

Beach Area

There are no significant needs in this area over the study period. However, historical data shows that the power factor at Beach TS (115kV) and Kenilworth TS may be below ORTAC criteria under peak load conditions and require further assessment.

Caledonia-Norfolk Area

Under peak load conditions and single contingency there can be low voltage issues at Norfolk TS and Bloomsburg MTS. Additional reactive support at Bloomsburg MTS may mitigate this issue.

6.2 System Reliability, Operation and Load Restoration

Generally speaking, there are no significant system reliability and operating issues for one element out of service.

For the loss of two elements or for a single contingency taking two circuits out (on a single tower), load restoration under peak load conditions as per ORTAC criteria may not be met and require further study.

6.3 Aging Infrastructure and Replacement Plan of Major Equipment

During the study period:

- None of the autotransformers are expected to reach the end of their useful life.
- Upgrades or refurbishment of Gage TS and Elgin TS are currently planned within the study period. These reconfigurations are not expected to affect any capacity needs identified in the region.
- Replacement of transformers at Mohawk TS is planned in the near term and may address capacity needs at the station.
- No high voltage cables in the area are expected to reach the end of life within the study period.

7 RECOMMENDATIONS

The study team's recommendations are as follows:

a) At this time, the following potential needs identified above do not require further regional coordination. Rather, these potential needs can be adequately and more efficiently addressed through localized planning between Hydro One Networks Inc. and the relevant LDCs.

Burlington-Hamilton Area

- Dundas TS – distribution reconfiguration(s) and/or investments to balance load amongst the two DESNs is required.
- Nebo TS (T3/T4 DESN) – a second switchgear to utilize the spare winding of transformers.
- Cumberland TS – assessment of power factor at Cumberland TS to meet ORTAC criteria under peak load conditions.

Caledonia-Norfolk Area

- Bloomsburg TS – Additional reactive support at Bloomsburg MTS may resolve this issue, and further assessment by the transmitter and the LDC should be undertaken.

Beach Area

- Assessment of power factor at Beach TS (115kV) and Kenilworth TS to meet ORTAC criteria under peak load conditions.

b) Coordinated regional planning is further required by the OPA to undertake Scoping Assessment for the remaining needs identified in Section 6 of this report and develop study scope. As part of its Scoping Assessment process, the OPA will determine if the OPA-led IRRP process and/or transmitter-led RIP process (for wires solutions) should be undertaken to address these potential needs in this Region.

The Brant area sub-region currently has an OPA-led IRRP study underway. OPA will later append the results of this sub-region IRRP to the Regional IRRP.

8 NEXT STEPS

Following the Needs Screening process, the next regional planning step, based on the results of this report, is for:

a) Hydro One Transmission and relevant LDCs to further assess and develop local wires solutions in Section 7.a; and

b) OPA to initiate a Scoping Assessment(s) to determine which of the needs in Section 7.b require an IRRP and/or RIP.

9 REFERENCES

i) Planning Process Working Group (PPWG) Report to the Board The Process for Regional Infrastructure Planning in Ontario – May 17, 2013

ii) OPA's February 6, 2014 letter to Hydro One: Brant Area Regional Planning-Initiating the implementation of the Near Term Wire(s) Solutions.

iii) IESO 18-Month Outlook

iv) SIA - Powerline MTS- CAA ID 2005-196

10 ACRONYMS

BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CGS	Customer Generating Station
CIA	Customer Impact Assessment
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GTA	Greater Toronto Area
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
LTR	Limited Time Rating
LV	Low-voltage
MTS	Municipal Transformer Station
MVA	Mega Volt-Ampere
MW	Megawatt
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council
NS	Needs Screening
OEB	Ontario Energy Board
OPA	Ontario Power Authority
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Planning
SIA	System Impact Assessment
SS	Switching Station
TS	Transformer Station
TSC	Transmission System Code