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May 11, 2021

Mr. Greg Beharriell
Canadian Niagara Power Inc.
1130 Bertie Street,
Fort Erie, ON L2A 5Y2

Dear Mr. Beharriell,

Subject: Regional Planning Status

Please find attached a Planning Status letter as requested by you for Canadian Niagara Power Inc. (CNPI). It is also noted in this letter that CNPI owns and operate Eastern Ontario Power (EOP) and is also part of your upcoming Rate Application to the Ontario Energy Board (OEB).

As you are aware, the province of Ontario is divided into 21 Regions for the purpose of Regional Planning (RP), a map of Ontario showing the 21 Regions and the list of Local Distribution Companies (LDCs) in each of the Region are attached as Appendix A and B respectively. CNPI is an LDC within the Niagara region and EOP is an LDC within the Peterborough to Kingston region where Hydro One Networks Inc. (Hydro One) is the lead transmitter.

This letter confirms that the first cycle of RP for the Niagara region was completed in 2017. Since then, the second cycle for the region is in progress and needs are still being identified as part of the Needs Assessment (NA). The findings and the recommendations stemming out of the 1st cycle Regional Planning Infrastructure (RIP) are provided in details in the Niagara RIP report (attached as Appendix C). The report can be accessed from Hydro One's Regional Planning website for the Niagara region[1].

Similarly, the first cycle of RP for the Peterborough to Kingston (PtoK) region was completed in 2016. Since then, the second cycle for the region is in progress and the NA report was completed and published in February 2020. The findings and the recommendations stemming out of the 2nd cycle Needs Assessment are provided in details in the PtoK NA report (attached as Appendix D). The report can be accessed from Hydro One's Regional Planning website for the PtoK region[2].

Niagara Region

The Niagara Region comprises the municipalities of City of Port Colborne, City of Welland, City of Thorold, City of Niagara Falls, Town of Niagara-On-The-Lake, City of St. Catharines, Town of Fort Erie, Town of Lincoln, Township of West Lincoln, Town of Grimsby, Township of Wainfleet, and Town of Pelham. Haldimand County

[1] Niagara (hydroone.com)
[2] Peterborough to Kingston (hydroone.com)

has been included in the Niagara Region Group 3 for Regional Infrastructure Planning and Needs Assessment.

As mentioned above, the first cycle RIP report was completed and published in March 2017. The following transmission projects were completed / are underway to address near-term supply needs that were recommended in the first cycle of RIP. It is expected that there are no cost implications for CNPI from the following transmission projects being undertaken by Hydro One as recommended in the RIP report:

- DeCew Falls SS Circuit Breaker Replacement (2017)
- Sir Adam Beck SS #1 115kV Refurbishment Project (2018)
- 115kV Q11/Q12S Line Refurbishment from Glendale TS to Beck SS #1 (2019)
- Calrton TS; Switchgear Replacement (2026)
- Glendale TS; Station Refurbishment and Reconfiguration (2027)
- Thorold TS; Transformer Replacement (2024)
- Crowland TS; Transformer Replacement (2024)

Peterborough to Kingston Region

The Peterborough to Kingston Region includes the area roughly bordered geographically by the municipality of Clarington on the West, North Frontenac County on the North, Frontenac County on the East, and Lake Ontario on the South.

Currently, the second cycle of regional planning for the region is in progress and the NA report was completed and published in February 2020. The following transmission projects were completed / are underway to address near-term supply needs that were recommended in the 2nd Cycle NA. It is expected that there are no cost implications for EOP from the following transmission projects being undertaken by Hydro One as recommended in the NA report:

- Lennox TS – 230kV & 500kV Breaker Replacements (2020)
- Port Hope TS: Transformer Replacement (2023)
- Belleville TS: Transformer Replacement (2021/2025)
- Havelock TS: Transformer Replacement (2027)
- Belleville TS: Need for Additional capacity in the area
- Frontenac TS / Gardiner TS: Addressing TS overloading through distribution load transfer

The above projects are expected to strengthen the electrical system and improve the overall reliability performance in the region. However, no capital contribution is expected from CNPI or EOP for the transmission projects as recommended in the RIP report and NA Report respectively. CNPI and EOP are active participating members on the regional Study Teams and Hydro One is looking forward to continue working with CNPI and EOP in executing the regional planning process. Please feel free to contact me if you have any questions.

Sincerely,

Ajay Garg, Manager – Regional Planning Coordination
Hydro One Networks Inc.

Appendix A. Map of Ontario's Planning Regions

Northern Ontario

Southern Ontario

Greater Toronto Area (GTA)

Burlington to Nanticoke	East Lake Superior	Chatham/Lambton/Sarnia
Greater Ottawa	London area	Greater Bruce/Huron
GTA East	Peterborough to Kingston	Niagara
GTA North	South Georgian Bay/Muskoka	North of Moosonee*
GTA West	Sudbury/Algoma	North/East of Sudbury
Kitchener- Waterloo- Cambridge-Guelph (“KWCG”)	Northwest Ontario	Renfrew
Toronto	Windsor-Essex	St. Lawrence

*This region is not within Hydro One’s territory.

Appendix B. List of LDCs for Each Region

(Hydro One as Upstream Transmitter)

Region	LDCs
1. Burlington to Nanticoke	• Energy+ Inc. • Brantford Power Inc. • Burlington Hydro Inc. • Haldimand County Hydro Inc.** • Alectra Utilities Corporation • Hydro One Networks Inc. • Norfolk Power Distribution Inc.** • Oakville Hydro Electricity Distribution Inc.
2. Greater Ottawa	• Hydro 2000 Inc. • Hydro Hawkesbury Inc. • Hydro One Networks Inc. • Hydro Ottawa Limited • Ottawa River Power Corporation • Renfrew Hydro Inc.
3. GTA North	• Alectra Utilities Corporation • Hydro One Networks Inc. • Newmarket-Tay Power Distribution Ltd. • Toronto Hydro Electric System Limited • Elexicon Energy Inc.
4. GTA West	• B Hydro Inc. • Alectra Utilities Corporation • Halton Hills Hydro Inc. • Hydro One Networks Inc. • Milton Hydro Distribution Inc. • Oakville Hydro Electricity Distribution Inc.
5. Kitchener- Waterloo-Cambridge-Guelph ("KWCG")	• Energy+ Inc. • Centre Wellington Hydro Ltd. • Alectra Utilities Corporation • Halton Hills Hydro Inc. • Hydro One Networks Inc. • Kitchener-Wilmot Hydro Inc. • Milton Hydro Distribution Inc. • Waterloo North Hydro Inc. • Wellington North Power Inc.

6. Toronto	• Alectra Utilities Corporation • Hydro One Networks Inc. • Toronto Hydro Electric System Limited • Elexicon Energy Inc.
7. Northwest Ontario	• Atikokan Hydro Inc. • Chapleau Public Utilities Corporation • Fort Frances Power Corporation • Hydro One Networks Inc. • Kenora Hydro Electric Corporation Ltd. • Sioux Lookout Hydro Inc. • Thunder Bay Hydro Electricity • Distribution Inc.
8. Windsor-Essex	• E.L.K. Energy Inc. • Entegrus Power Lines lnc. [Chatham- Kent] • EnWin Utilities Ltd. • Essex Powerlines Corporation • Hydro One Networks Inc.
9. East Lake Superior* *Hydro One Sault Ste. Marie L.P. is the Lead Transmitter for the region.	• Algoma Power Inc. • Chapleau PUC • Sault Ste. Marie PUC • Hydro One Networks Inc.
10. GTA East	• Hydro One Networks Inc. • Oshawa PUC Networks Inc. • Elexicon Energy Inc.
11. London Area	• Entegrus Power Lines lnc. [Middlesex] • Erie Thames Power Lines Corporation • Hydro One Networks Inc. • London Hydro Inc. • Norfolk Power Distribution Inc.** • St. Thomas Energy Inc. • Tillsonburg Hydro Inc. • Woodstock Hydro Services Inc.**
12. Peterborough to Kingston	• Eastern Ontario Power Inc. • Hydro One Networks Inc. • Kingston Hydro Corporation • Lakefront Utilities Inc. • Peterborough Distribution Inc. • Elexicon Energy Inc.

13. South Georgian Bay/Muskoka	• EPCOR • Hydro One Networks Inc. • InnPower Corporation • Lakeland Power Distribution Ltd. • Midland Power Utility Corporation • Orangeville Hydro Limited • Orillia Power Distribution Corporation • Alectra Utilities Corporation • Elexicon Energy Inc. • Elexicon Energy Inc. • Wasaga Distribution Inc.
14. Sudbury/Algoma	• Espanola Regional Hydro Distribution Corp. • Greater Sudbury Hydro Inc. • Hydro One Networks Inc.
15. Chatham/Lambton/Sarnia	• Bluewater Power Distribution Corporation • Entegrus Power Lines lnc. [Chatham- Kent] • Hydro One Networks Inc.
16. Greater Bruce/Huron	• Entegrus Power Lines lnc. [Middlesex] • Erie Thames Power Lines Corporation • Festival Hydro Inc. • Hydro One Networks Inc. • Wellington North Power Inc. • West Coast Huron Energy Inc. • Westario Power Inc.
17. Niagara	• Canadian Niagara Power Inc. [Port Colborne] • Grimsby Power Inc. • Haldimand County Hydro Inc.** • Alectra Utilities Corporation • Hydro One Networks Inc. • Niagara Peninsula Energy Inc. • Niagara-On-The-Lake Hydro Inc. • Welland Hydro-Electric System Corp. • Niagara West Transformation Corporation* * Changes to the May 17, 2013 OEB Planning Process Working Group Report

19. North/East of Sudbury	• Greater Sudbury Hydro Inc. • Hearst Power Distribution Company Limited • Hydro One Networks Inc. • North Bay Hydro Distribution Ltd. • Northern Ontario Wires Inc.
20. Renfrew	• Hydro One Networks Inc. • Ottawa River Power Corporation • Renfrew Hydro Inc.
21. St. Lawrence	• Cooperative Hydro Embrun Inc. • Hydro One Networks Inc. • Rideau St. Lawrence Distribution Inc.

**This Local Distribution Company (LDC) has been acquired by Hydro One Networks Inc.

Appendix C

1st cycle Niagara Regional Planning Infrastructure (RIP) Report – March 2017

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Niagara

Regional Infrastructure Plan ("RIP")

March 28th 2017

Canadian Niagara Power Inc.
Grimsby Power Inc.
Alectra Utilities
Hydro One Networks Inc. (Distribution)
Niagara Peninsula Energy Inc.
Niagara-On-the-Lake Hydro Inc.
Welland Hydro-Electric System Corporation

The Niagara Region includes the municipalities of City of Port Colborne, City of Welland, City of Thorold, City of Niagara Falls, Town of Niagara-On-The-Lake, City of St. Catharines, Town of Fort Erie, Town of Lincoln, Township of West Lincoln, Town of Grimsby, Township of Wainfleet, and Town of Pelham.

The Needs Assessment ("NA") report for the Niagara Region was completed on April 30th, 2016 (see attached). The report concluded that there were only two needs in the Region and that they should be addressed as follows:

- Thermal overloading of 115kV circuit Q4N: Addressed in a Local Plan ("LP") report.

The loading constraints on 115kV circuit Q4N was addressed in a LP report led by Hydro One Networks Inc. and published on November 11th, 2016. The report concluded that Hydro One already has plans to replace the existing section of conductor between Sir Adam Beck SS #1 and Portal JCT with a 910A continuous rating conductor at 93°C as part of their Beck #1 SS Refurbishment project. The expected in-service date for this conduction section upgrade is December 2019.

Consistent with a process established by an industry working group[1] created by the OEB the Regional Infrastructure Plan ("RIP") is the last phase of the planning process. In view that no further regional coordination was required, the attached NA and LP reports will be deemed to form the RIP for the Niagara Region.

The next planning cycle for the region will take place within five years of the start of this cycle (2021) or earlier, should there be a new need identified in the region.

Sincerely,

Ajay Garg | Manager, Regional Planning Co-ordination
Hydro One Networks Inc.

[1] Planning Process Working Group (PPWG) Report to the Ontario Energy Board available at the OEB website www.ontarioenergyboard.ca

Hydro One Networks Inc.
483 Bay Street
Toronto, Ontario
M5G 2P5

NEEDS ASSESSMENT REPORT

Region: Niagara

Date: April 30th 2016

Prepared by: Niagara Region Study Team

Niagara Study Team
Hydro One Networks Inc. (Lead Transmitter)
Independent Electricity System Operator
Hydro One Networks Inc. (Distribution)
Canadian Niagara Power Inc.
Grimsby Power Inc.
Haldimand County Hydro Inc.
Horizon Utilities Corp.
Niagara Peninsula Energy Inc.
Niagara on the Lake Hydro Inc.
Welland Hydro Electric System Corp.

DISCLAIMER

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the Niagara region and to assess whether those needs require further coordinated regional planning. The potential needs that have been identified through this Needs Assessment 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 Assessment Report are based on the information and assumptions provided by study team participants.

Study team participants, their respective affiliated organizations, and Hydro One Networks Inc. (collectively, "the Authors") make no representations or warranties (express, implied, statutory or otherwise) as to the Needs Assessment Report or its contents, including, without limitation, the accuracy or completeness of the information therein and shall not, under any circumstances whatsoever, be liable to each other, or to any third party for whom the Needs Assessment Report was prepared ("the Intended Third Parties"), or to any other third party reading or receiving the Needs Assessment Report ("the Other Third Parties"), for any direct, indirect or consequential loss or damages or for any punitive, incidental or special damages or any loss of profit, loss of contract, loss of opportunity or loss of goodwill resulting from or in any way related to the reliance on, acceptance or use of the Needs Assessment Report or its contents by any person or entity, including, but not limited to, the aforementioned persons and entities.

NEEDS ASSESSMENT EXECUTIVE SUMMARY

Region	Niagara (the "Region")		
Lead	Hydro One Networks Inc. ("Hydro One")		
Start Date	October 15, 2015	End Date	April 30th 2016

1. INTRODUCTION

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

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

2. REGIONAL ISSUE / TRIGGER

The NA for the Niagara Region was triggered in response to the Ontario Energy Board's (OEB) Regional Infrastructure 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. The NA for Group 1 and 2 regions is complete and has been initiated for Group 3 Regions. The Niagara Region belongs to Group 3. The NA for this Region was triggered on October 15, 2015 and was completed on April 30th 2016

3. SCOPE OF NEEDS ASSESSMENT

The scope of the NA study was limited to 10 years as per the recommendations of the Planning Process Working Group (PPWG) Report to the Board. As such, relevant data and information was collected up to the year 2025. Needs emerging over the next 10 years and requiring coordinated regional planning may be further assessed as part of the IESO-led SA, which will determine the appropriate regional planning approach: IRRP, RIP, and/or local planning. This NA included a study of transmission system connection facilities capability, which covers station loading, thermal and voltage analysis as well as a review of 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 Independent Electricity System Operator (IESO), and Hydro One transmission provided information for the Niagara Region. The information included: historical load, load forecast, conservation and demand management (CDM) and distributed generation (DG) information, load restoration data, and performance information including major equipment approaching end-of-useful life.

5. NEEDS ASSESSMENT METHODOLOGY

The assessment's primary objective was to identify the electrical infrastructure needs and system performance issues in the Region over the study period (2015 to 2024). The assessment reviewed available information, load forecasts and included single contingency analysis to confirm needs, if and when required. See Section 5 for further details.

6. RESULTS

Transmission Needs

A. Transmission Lines & Ratings

The 230kV and 115kV lines are adequate over the study period with a section of 115kV circuit Q4N being the exception.

B. 230 kV and 115 kV Connection Facilities

The 230kV and 115kV connection facilities in this region are adequate over the study period.

System Reliability, Operation and Restoration Review

There are no known issues with system reliability, operation and restoration in the Niagara region.

Aging Infrastructure / Replacement Plan

Within the regional planning time horizon, the following sustainment work is currently planned by Hydro One in the region:

- DeCew Falls SS: Circuit Breaker Replacement (2017)
- Sir Adam Beck SS #1: 115kV Refurbishment Project (2018)
- 115kV Q11/Q12S Line Refurbishment from Glendale TS to Beck SS #1 (2019)
- Carlton TS: Switchgear Replacement (2020)
- Sir Adam Beck SS #2: 230kV Circuit Breakers Replacement (2020)
- Glendale TS: Station Refurbishment and Reconfiguration (2021)
- Stanley TS: Station Refurbishment (2021)
- Thorold TS: Transformer Replacement (2021)
- Crowland TS: Transformer Replacement (2021)

Based on the findings of the Needs Assessment, the study team recommends that thethermal overloading of 115kV circuit Q4N shouldbe further assessed as part of a Local Plan. No further regional coordination or planning is required.

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1 Introduction

This Needs Assessment (NA) report provides a summary of needs that are emerging in the Niagara Region ("Region") over the next ten years. The development of the NA 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 NA is to undertake an assessment of the Niagara Region to identify any near term and/or emerging needs in the area and determine if these needs require a "localized" wires only solution(s) in the near-term and/or a coordinated regional planning assessment. Where a local wires only solution is necessary to address the needs, Hydro One, as transmitter, with Local Distribution Companies (LDC) or other connecting customer(s), will further undertake planning assessments to develop options and recommend a solution(s). For needs that require further regional planning and coordination, the Independent Electricity System Operator (IESO) will initiate the Scoping Assessment (SA) process to determine whether an IESO-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution), or both are required. The SA may also recommend that local planning between the transmitter and affected LDCs be undertaken to address certain local type of needs if straight forward wires solutions can address a need. Ultimately, assessment and findings of the local plans are incorporated in the RIP for the region.

This report was prepared by the Niagara Region NA 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 LDCs, and the Independent Electricity System Operator (IESO).

Table 1: Study Team Participants for Niagara Region

No.	Company
1	Hydro One Networks Inc. (Lead Transmitter)
2	Independent Electricity System Operator
3	Canadian Niagara Power Inc.
4	Grimsby Power Inc.
5	Haldimand County Hydro Inc
6	Horizon Utilities Corp.
7	Hydro One Networks Inc. (Distribution)
8	Niagara Peninsula Energy Inc.
9	Niagara on the Lake Hydro Inc.
10	Welland Hydro Electric System Corp.

2 Regional Issue / Trigger

The NA for the Niagara Region was triggered in response to the OEB's Regional Infrastructure 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. The NA for Group 1 Regions is complete and has been initiated for Group 2 Regions. The Niagara Region belongs to Group 3.

3 Scope of Needs Assessment

This NA covers the Niagara Region over an assessment period of 2015 to 2024. The scope of the NA includes a review of transmission system connection facility capability which covers transformer station capacity, thermal capacity, and voltage performance. System reliability, operational issues such as load restoration, and asset replacement plans were also briefly reviewed as part of this NA.

3.1 Niagara Region Description and Connection Configuration

For regional planning purposes, the Niagara region includes the City of Port Colborne, City of Welland, City of Thorold, City of Niagara Falls, Town of Niagara-on-the-Lake, City of St. Catharines, Town of Fort Erie, Town of Lincoln, Township of West Lincoln, Town of Grimsby, Township of Wainfleet, and Town of Pelham. Haldimand County has also been included in the

regional infrastructure planning needs assessment for Niagara region. A map of the region is shown below in Figure 1.

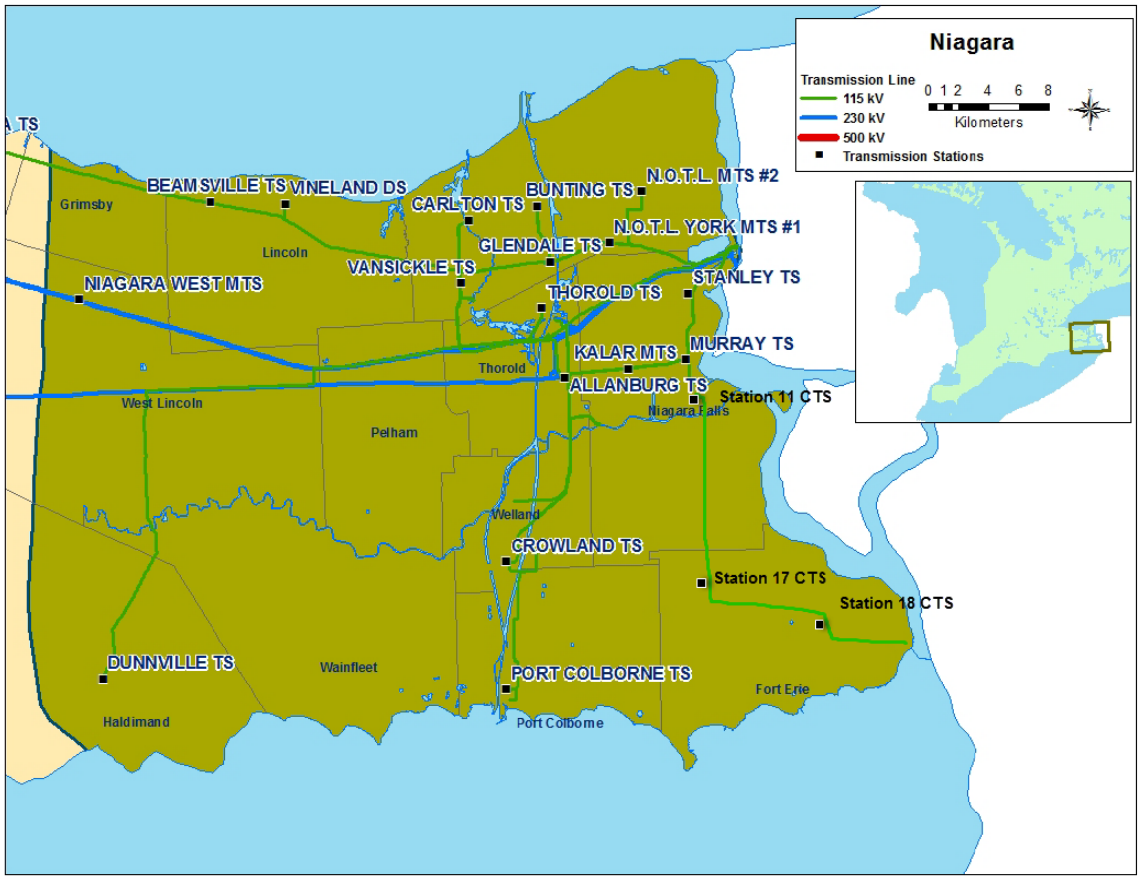

Figure 1: Niagara Region Map

Electrical supply for this region is provided through a network of 230kV and 115kV transmission circuits supplied mainly by the local generation from Sir Adam Beck #1, Sir Adam Beck #2, Decew Falls GS, Thorold GS and the autotransformers at Allanburg TS.

Bulk supply is provided through the 230kV circuits (Q23BM, Q24HM, Q25BM, Q26M, Q28A, Q29HM, Q30M, and Q35M) from Sir Adam Beck #2 SS. These circuits connect this region to Hamilton/Burlington.

The Niagara Region has the following local distribution companies (LDC):

- Canadian Niagara Power Inc.
- Grimsby Power Inc.
- Haldimand County Hydro Inc.
- Horizon Utilities
- Hydro One Distribution Inc.
- Niagara Peninsula Energy Inc.
- Niagara on the Lake Hydro Inc.
- Welland Hydro Electric System Corporation

Large transmission connected customers in the area will not actively participate in the regional planning process, however their load forecasts will used in determining regional supply needs.

Table 2: Transmission Lines and Stations in Niagara Region

115kV circuits	230kV circuits	Hydro One Transformer Stations	Customer Transformer Stations
Q3N, Q4N, Q11S, Q12S, Q2AH, A36N, A37N, D9HS, D10S, D1A, D3A, A6C, A7C,C1P, C2P	Q23BM, Q24HM, Q25BM, Q26M, Q28A, Q29HM, Q30M, Q35M, Q21P, Q22P	Allanburg TS*, Stanley TS, Niagara Murray TS, Thorold TS, Vansickle TS, Carlton TS, Glendale TS, Bunting TS, Dunville TS, Vineland TS, Beamsville TS, Sir Adam Beck SS #1, Sir Adam Beck SS #2, Crowland TS, Port Colborne TS	Niagara on the Lake #1 and #2 MTS, CNPI Station 11 , CNPI Station 17, CNPI Station 18, Kalar MTS, Niagara West MTS

Stations with Autotransformers installed

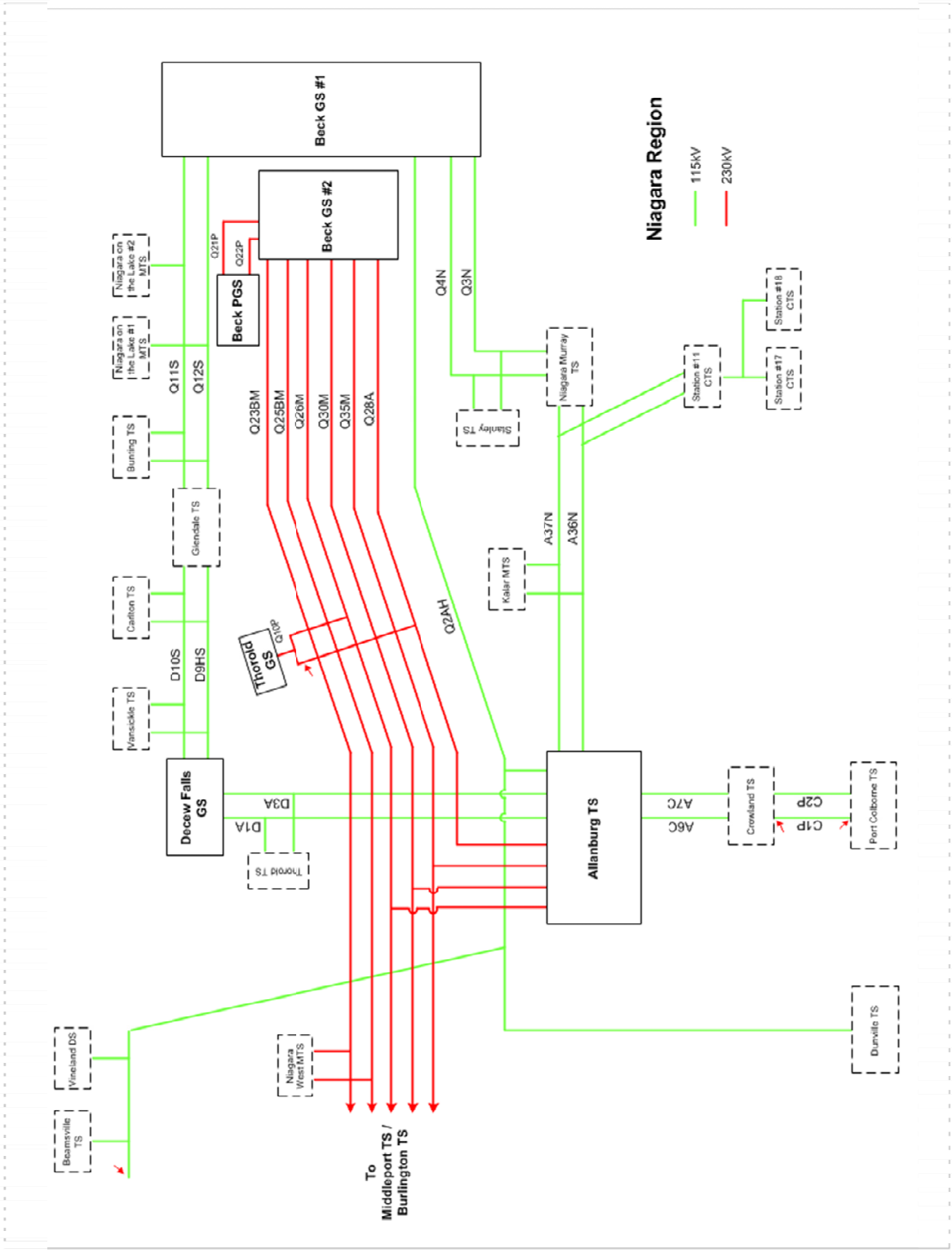

Figure 2: Simplified Niagara Regional Planning Electrical Diagram

4 Inputs and Data

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

- Actual 2013 regional coincident peak load and station non-coincident peak load provided by IESO;
- Historical (2012-2014) net load and gross load forecast (2015-2024 provided by LDCs and other Transmission connected customers;
- Conservation and Demand Management (CDM) and Distributed Generation (DG) data provided by IESO;
- Any known reliability and/or operating issues conditions identified by LDCs or the IESO;
- Planned transmission and distribution investments provided by the transmitter and LDCs, etc.

4.1 Load Forecast

As per the data provided by the study team, the gross load in region is expected to grow at an average rate of approximately 0.61% annually from 2015-2024.

The net load forecast takes the gross load forecast and applies the planned CDM targets and DG contributions. With these factors in place, the total regional load is expected to decrease at an average rate of approximately 0.26% annually from 2015-2024.

5 Needs Assessment Methodology

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

1. The Region is summer peaking so this assessment is based on summer peak loads.
2. Forecast loads are provided by the Region's LDCs.
3. Load data for the industrial customers in the region were assumed to be consistent with historical loads.
4. Accounting for (2), (3), above, the gross load forecast and a net load forecast were developed. The gross load forecast is used to develop a worst case scenario to identify needs. Where there are issues, the net load forecast which accounts for CDM and DG are analyzed to determine if the needs can be deferred. A gross and net non-coincident peak load forecast was used to perform the analysis for this report.

5. Review impact of any on-going and/or planned development projects in the Region during the study period.
6. 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.
7. 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 or the historical low voltage power factor, whichever is more conservative. For stations having low-voltage capacitor banks, a 95% lagging power factor was assumed or the historical low-voltage power factor, whichever is more conservative. Normal planning supply capacity for transformer stations in this Region is determined by the summer 10-Day Limited Time Rating (LTR). Summer LTR ratings were reviewed to assess the worst possible loading scenario from a ratings perspective.
8. Extreme weather scenario factor at 1.037 was also assessed for capacity planning over the study term.
9. To identify emerging needs in the Region and determine whether or not further coordinated regional planning should be undertaken, the study was performed observing all elements in service and only one element out of service.
10. Transmission adequacy assessment is primarily based on, but is not limited to, the following criteria:
    - 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 summer long-term emergency (LTE) ratings. Thermal limits for transformers are acceptable using summer loading with summer 10-day LTR.
    - All voltages must be within pre and post contingency ranges as per Ontario Resource and Transmission Assessment Criteria (ORTAC) criteria.
    - With one element out of service, no more than 150 MW of load is lost by configuration. With two elements out of service, no more than 600 MW of load is lost by configuration.

- With two elements out of service, the system is capable of meeting the load restoration time limits as per ORTAC criteria.

6 Results

6.1 Transmission Capacity Needs

230/115 kV Autotransformers

The 230/115kV transformers supplying the region are adequate for loss of single unit.

Transmission Lines & Ratings

The 230 kV circuits supplying the Region are adequate over the study period for the loss of a single 230 kV circuit in the Region.

The 115 kV circuits supplying the Region are adequate over the study period with Q4N as an exception between Sir Adam Beck SS #1 x Portal Junction.

230 kV and 115 kV Connection Facilities

A station capacity assessment was performed over the study period for the 230 kV and 115 kV transformer stations in the Region using the station summer peak load forecast provided by the study team. All stations in the area have adequate supply capacity for the study period even in the event of extreme weather scenario.

6.2 System Reliability, Operation and Restoration

6.2.1 Load Restoration

Load restoration is adequate in the area and meet the ORTAC load restoration criteria.

The needs assessment did not identify any additional issues with meeting load restoration as per the ORTAC load restoration criteria.

6.2.2 Thermal Overloading on Q4N Section

Under high generation scenarios at Sir Adam Beck GS #1, the loading on the *Beck SS #1 x Portal Junction* section (egress out from the GS) of 115kV circuit Q4N can exceed circuit ratings. Hydro One already has plans to address this issue as part of the Beck SS #1 Refurbishment Project.

6.2.3 Power Factor at Thorold TS

A few instances (<54 hours / year) of power factor below 0.9 (between 0.89 - 0.9) were observed at the HV side of Thorold TS. Hydro One Distribution will investigate these instances and work with Distribution customers to address.

7 Aging Infrastructure and Replacement Plan of Major Equipment

Hydro One reviewed the sustainment initiatives that are currently planned for the replacement of any autotransformers and power transformers during the study period. At this time, the following sustainment work is planned at the following stations:

- DeCew Falls SS Circuit Breaker Replacement (2017)
- Sir Adam Beck SS #1 115kV Refurbishment Project (2018)
- 115kV Q11/Q12S Line Refurbishment from Glendale TS to Beck SS #1 (2019)
- Carlton TS; Switchgear Replacement (2020)
- Sir Adam Beck SS #2 230kV Circuit Breakers Replacement (2020)
- Glendale TS; Station Refurbishment and Reconfiguration (2021)
- Stanley TS; Station Refurbishment (2021)
- Thorold TS; Transformer Replacement (2021)
- Crowland TS; Transformer Replacement (2021)

8 Recommendations

Based on the findings and discussion in Section 6 and 7 of this report, the study team recommends that no further regional coordination or further planning is required. The region will be reassessed within five years as part of the next planning cycle.

9 Next Steps

No further Regional Planning is required at this time. The Niagara Region Regional Planning will be reassessed during the next planning cycle or at any time should unforeseen conditions or needs warrant to initiate the regional planning for the region.

10 References

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

ii) IESO 18-Month Outlook: March 2014 – August 2015

iii) IESO Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0

Appendix A: Non-Coincident Winter Peak Load Forecast

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Allanburg TS	Net Load Forecast	33.4	35.4	29.6										
Hydro One	Gross Peak Load				31.1	31.3	31.4	31.6	32.0	32.4	32.6	32.7	32.9	33.1
NPEI - Embedded	Gross Peak Load - DG - CDM				30.8	30.7	30.6	30.4	30.4	30.5	30.5	30.5	30.5	30.5
Beamsville TS	Net Load Forecast	53.6	55.9	49.0										
Hydro One	Gross Peak Load				54.9	55.6	56.8	58.0	59.2	59.4	59.6	59.8	60.0	60.2
Grimsby Power, NPEI - Embedded	Gross Peak Load - DG - CDM				54.1	54.2	55.0	55.5	56.1	55.8	55.6	55.5	55.4	55.3
Bunting TS	Net Load Forecast	58.3	55.9	49.6										
Horizion Utilities	Gross Peak Load				53.1	53.3	53.4	53.5	53.7	53.8	53.9	54.1	54.2	54.3
	Gross Peak Load - DG - CDM				52.5	52.1	51.8	51.4	51.0	50.7	50.5	50.3	50.2	50.1
Carlton TS	Net Load Forecast	100.1	98.3	76.7										
Horizion Utilities	Gross Peak Load				78.4	79.5	79.7	79.9	80.1	80.3	80.5	80.7	80.9	81.1
	Gross Peak Load - DG - CDM				77.6	77.8	77.5	76.8	76.1	75.7	75.4	71.6	71.4	71.2
Crowland TS	Net Load Forecast	89.1	93.6	74.6										
Welland Hydro	Gross Peak Load				75.2	77.5	78.5	80.0	81.0	82.0	83.0	84.0	85.0	86.0
Hydro One, CNPI - Embedded	Gross Peak Load - DG - CDM				70.4	71.9	72.3	72.9	73.0	73.3	73.8	74.2	74.8	75.3
Dunnville TS	Net Load Forecast	25.3	27.0	24.1										
Haldimand County Hydro	Gross Peak Load				24.1	24.3	24.4	24.5	24.7	24.9	25.0	25.1	25.2	25.4
Hydro One - Embedded	Gross Peak Load - DG - CDM				19.8	19.7	19.6	19.4	19.4	19.3	19.3	19.3	19.3	19.3
Glendale TS	Net Load Forecast	61.5	59.1	60.1										
Horizion Utilities	Gross Peak Load				66.5	62.5	62.6	62.8	62.9	63.1	63.2	63.4	63.5	63.7
	Gross Peak Load - DG - CDM				65.7	61.0	60.7	60.2	59.7	59.3	59.1	58.9	58.8	58.6
Kalar MTS	Net Load Forecast	39.5	38.6	33.9										
NPEI	Gross Peak Load				39.8	40.0	40.2	40.4	40.6	40.8	41.0	41.2	41.4	41.6
	Gross Peak Load - DG - CDM				39.4	39.2	39.1	38.8	38.6	38.5	38.4	38.4	38.4	38.4

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Niagara Murray TS	Net Load Forecast	97.0	101.7	90.2										
Hydro One	Gross Peak Load				89.7	90.0	90.4	90.7	91.0	91.4	91.7	92.0	92.4	92.7
NPEI - Embedded	Gross Peak Load - DG - CDM				88.9	88.3	88.0	87.4	86.9	86.5	86.3	86.2	86.1	86.0
Niagara On the Lake #1 MTS	Net Load Forecast	23.8	22.3	22.3										
Niagara On the Lake	Gross Peak Load				24.9	25.3	25.7	26.1	26.5	26.9	27.3	27.7	28.1	28.5
	Gross Peak Load - DG - CDM				24.7	24.8	25.0	25.1	25.2	25.3	25.6	25.8	26.1	26.3
Niagara On the Lake #2 MTS	Net Load Forecast	20.7	22.6	18.3										
Niagara On the Lake	Gross Peak Load				18.9	19.2	19.5	19.8	20.1	20.4	20.7	21.0	21.3	21.7
	Gross Peak Load - DG - CDM				18.8	18.8	19.0	19.0	19.1	19.2	19.4	19.6	19.8	20.0
Niagara West MTS	Net Load Forecast	47.5	43.5	35.7										
Grimsby Power	Gross Peak Load				35.8	35.9	36.1	36.5	36.7	37.0	37.2	37.6	37.8	38.1
NPEI Embedded	Gross Peak Load - DG - CDM				34.4	34.2	34.0	34.0	33.8	31.2	31.2	31.4	31.4	31.5
Stanley TS	Net Load Forecast	59.8	58.9	52.4										
NPEI	Gross Peak Load				52.7	52.9	53.1	53.3	53.5	53.7	53.9	54.1	54.3	54.5
	Gross Peak Load - DG - CDM				52.1	51.7	51.5	51.1	50.8	50.5	50.4	50.3	50.3	50.2
Station 17 TS	Net Load Forecast		16.1	16.6										
CNP	Gross Peak Load				16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
	Gross Peak Load - DG - CDM				16.4	16.2	16.1	15.9	15.8	15.6	15.5	15.5	15.4	15.3
Station 18 TS	Net Load Forecast		32.3	35.2										
CNP	Gross Peak Load				35.2	37.7	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
	Gross Peak Load - DG - CDM				34.8	36.9	39.1	38.6	38.2	37.9	37.7	37.4	37.3	37.1
Port Colborne TS	Net Load Forecast		40.2	35.7										
CNP	Gross Peak Load				30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8
	Gross Peak Load - DG - CDM				30.3	30.0	29.8	29.4	29.1	28.9	28.7	28.5	28.4	28.2

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Thorold TS	Net Load Forecast	20.1	21.3	18.4										
Hydro One	Gross Peak Load				21.3	21.5	21.6	21.7	22.0	22.2	22.4	22.5	22.6	22.7
	Gross Peak Load - DG - CDM				21.1	21.1	20.9	20.8	20.9	20.9	20.9	20.9	20.9	20.9
Vansickle TS	Net Load Forecast	46.3	53.3	43.7										
Horizion Utilities	Gross Peak Load				44.1	44.5	44.6	44.8	44.9	45.0	45.1	45.2	45.3	45.4
	Gross Peak Load - DG - CDM				43.7	43.6	43.4	43.0	42.7	42.4	42.2	42.1	42.0	41.9
Vineland TS	Net Load Forecast	17.4	17.0	17.0										
Hydro One	Gross Peak Load				21.9	22.3	22.4	22.7	23.1	23.5	23.8	24.0	24.3	24.5
NPEI - Embedded	Gross Peak Load - DG - CDM				21.7	21.8	21.8	21.8	22.0	22.2	22.3	22.4	22.5	22.6

Appendix B: Acronyms

BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GS	Generating Station
HVDS	High Voltage Distribution Station
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low-voltage
MW	Megawatt
MVA	Mega Volt-Ampere
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
NA	Needs Assessment
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Planning
SIA	System Impact Assessment
SS	Switching Station
TS	Transformer Station
TSC	Transmission System Code
ULTC	Under Load Tap Changer

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LOCAL PLANNING REPORT

Q4N THERMAL OVERLOAD

Region: Niagara

Revision: Final
Date: November 11th 2016

Prepared by: Niagara Region Study Team

Niagara Region Local Planning Study Team
Hydro One Networks Inc. (Lead Transmitter)
Hydro One Networks Inc. (Distribution)
Canadian Niagara Power Inc.
Grimsby Power Inc.
Haldimand County Hydro Inc.
Horizon Utilities Corp.
Niagara Peninsula Energy Inc.
Niagara on the Lake Hydro Inc.
Welland Hydro Electric System Corp.

Disclaimer

This Local Planning Report was prepared for the purpose of developing wires options and recommending a preferred solution(s) to address the local needs identified in the Needs Assessment (NA) report for the Niagara Region that do not require further coordinated regional planning. The preferred solution(s) that have been identified through this Local Planning Report may be reevaluated based on the findings of further analysis. The load forecast and results reported in this Local Planning Report are based on the information and assumptions provided by study team participants.

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LOCAL PLANNING EXECUTIVE SUMMARY

REGION	Niagara Region ("Region")		
LEAD	Hydro One Networks Inc. ("Hydro One")		
START DATE	16 May 2016	**END DATE**	1 November 2016

1. INTRODUCTION

The purpose of this Local Planning ("LP") report is to develop and recommend a preferred wires solution that will address the local needs identified in the Needs Assessment (NA) report for the Niagara Region. The development of the LP report is in accordance with the regional planning process as set out in the Planning Process Working Group ("PPWG") Report to the Ontario Energy Board's ("OEB") and mandated by the Transmission System Code ("TSC") and Distribution System Code ("DSC").

2. LOCAL NEEDS REVIEWED IN THIS REPORT

This report reviewed the potential thermal rating violation for the Beck SS #1 x Portal Junction section of the 115kV Q4N circuit (egress out from Sir Adam Beck GS #1).

3. OPTIONS CONSIDERED

The following options were considered:

- Option 1: Status Quo
- Option 2: Uprate Circuit Section

4. PREFERRED SOLUTIONS

Option 2 is the preferred option. The uprating of limiting section of the circuit is included in Hydro One's Sustainment plan.

5. RECOMMENDATIONS

It is recommended that the circuit section upgrade proceed with current with an expected in-service date of December 2019.

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1 Introduction

The Needs Assessment (NA) for the Niagara Region ("Region") was triggered in response to the Ontario Energy Board's (OEB) Regional Infrastructure Planning process approved in August 2013. The NA for the Niagara Region was prepared jointly by the study team, including LDCs, Independent Electric System Operator (IESO) and Hydro One. The NA report can be found on Hydro One's Regional Planning website. The study team identified needs that are emerging in the Region over the next ten years (2015 to 2024) and recommended that they should be further assessed through the transmitter-led Local Planning (LP) process.

As part of the NA report for the Niagara Region, it identified that under high generation scenarios at Sir Adam Beck GS #1, the loading on the Beck SS #1 x Portal Junction section (egress out from the GS) of 115kV circuit Q4N can exceed circuit ratings in IESO's System Impact Assessment for the Sir Adam Beck-1 GS – Conversion of units G1 and G2 to 60 Hz

This Local Planning report was prepared by Hydro One Networks Inc. ("HONI"). This report captures the results of the assessment based on information provided by LDCs and HONI.

2 Regional Description and Circuit Q4N Description

Sir Adam Beck GS #1 is an 115kV hydroelectric generating station located on the Niagara Escarpment north of Niagara Falls in Queenston. Geographically, it roughly borders Highway 405 and the Canadian-American border via the Niagara River.

Electrical supply from Sir Adam Beck GS #1 is currently provided through eight (8) OPG generators connected to Hydro One's 115kV solid 'E' bus inside the station. Supply to the local 115kV area is delivered via five (5) Hydro One circuits (Q2AH, Q3N, Q4N, Q11S, Q12S) from 115kV 'E' bus within the power house. The 115 kV 'E' bus serves as a switching station for the Hydro One network as well as a connection facility for OPGI's generators. The generators, transformers and circuits on the 'E' bus are sectionalized via switches.

A single line diagram is shown of the 115 kV system originating from the 115kV Sir Adam Beck GS #1 in Figure 1.

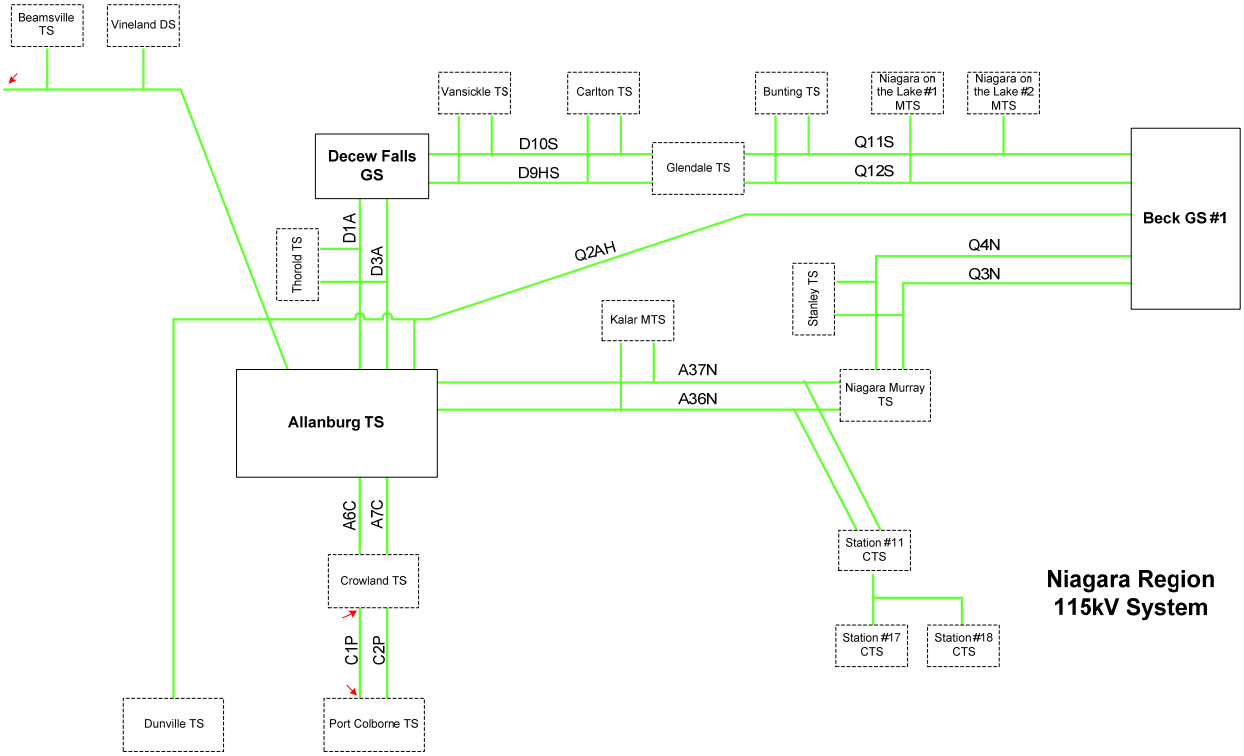

Figure 1: Single Line Diagram – Niagara Region 115kV System

From the NA report for the Niagara Region, a possible thermal limit issue on a section of the circuit Q4N was identified. Q4N is an approximately 9 km long, 115kV radial circuit from Sir Adam Beck GS #1, supplying Stanley TS and Niagara Murray TS.

The section of Q4N identified in the NA comprises of the section from Sir Adam Beck GS #1 to Portal Junction. This section of circuit is shown in Figure 2.

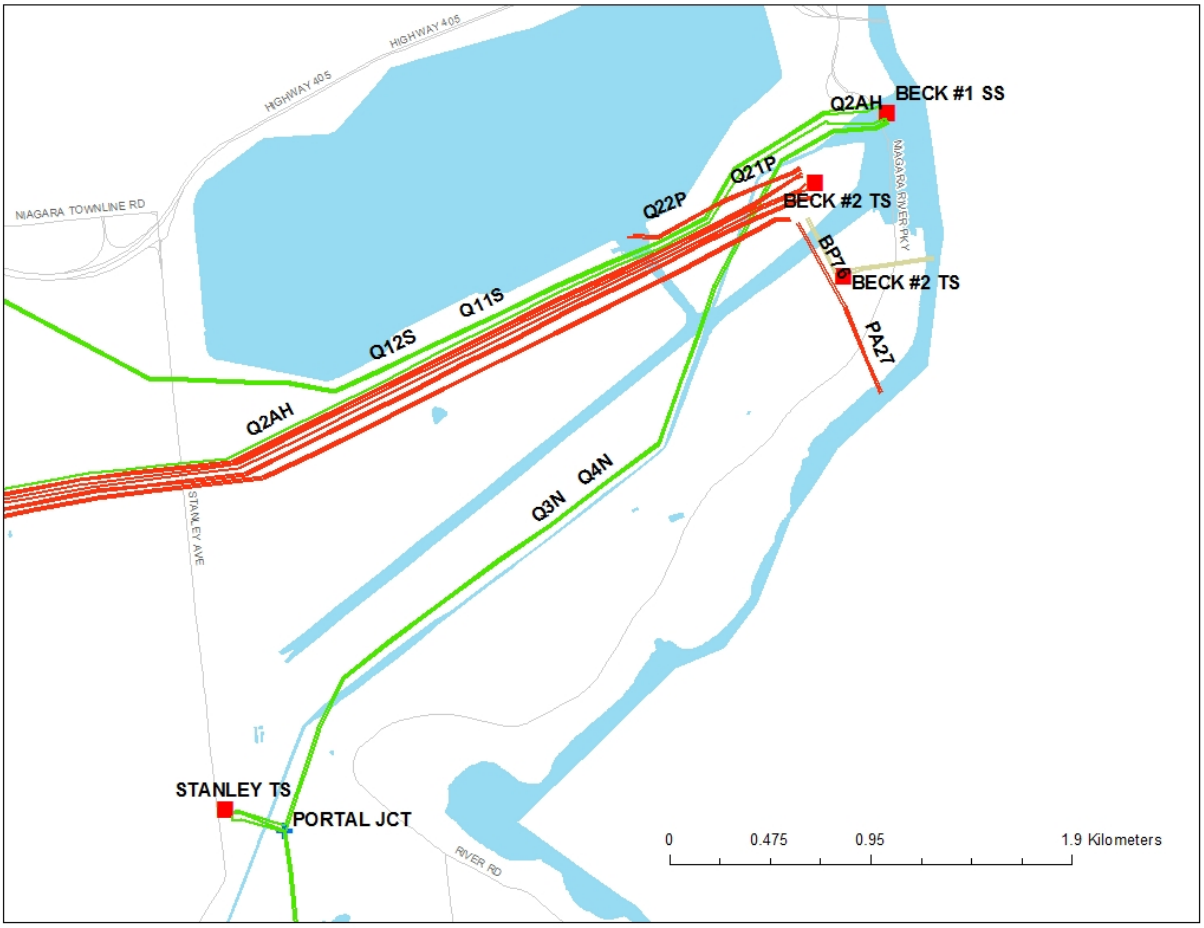

Figure 2: Single Line Diagram – Q4N from Beck #1 SS to Portal Junction

3 Local Niagara Need (Q4N)

In the past decade, OPG has been steadily increasing the power output of their generators with station upgrades.

In the IESO SIA for "Sir Adam Beck-1 GS – Conversion of units G1 and G2 to 60 Hz" it was identified that the thermal loading on circuit section Q4N from Beck #1 SS to Portal junction exceeds its continuous rating by 109.6% at total generation output of Sir Adam Beck #1 GS. This study was based on 2018 summer peak demand with high generation dispatch in the 115 kV transmission system in the vicinity with the existing 8 generators and 2 future generators (G1 and G2) at full output. This thermal loading is based on an ambient 35ºC temperature condition with 4 km/hr wind speed during daytime.

Reducing the generation output of Sir Adam Beck #1 GS from its maximum capacity of 556 MW to 509 MW reduces the loading on Q4N (Beck #1 SS by Portal Junction) to below its continuous rating.

4 Study Result / Options Considered

The conductor on a 64m section of the 115kV circuit Q4N between Sir Adam Beck SS #1 and Portal Jct. is comprised of 605.0 kcmil aluminum, 54/7 ACSR. The continuous rating for this type of conductor at 93°C is 680A. The options considered are outlined below.

4.1 Option 1: Status Quo

Status Quo is not an option because there is a risk that for maximum generation dispatch in extreme weather conditions. Under these conditions generation would have to be curtailed to meet line thermal rating requirements and thus causing financial losses to customer.

4.2 Option 2: Uprate Conductor Section

Hydro One has plans already in place to replace the existing section of conductor with a 910A continuous rated conductor at 93°C as part of their Beck #1 SS Refurbishment project. This will enable this section of circuit to meet all pre and post contingency thermal limits during max generation and under extreme weather conditions.

5 Recommendations

It is recommended that Hydro One continues with their sustainment plans (Option 2) on replacing the section of the 115kV circuit Q4N between Sir Adam Beck SS #1 and Portal Jct. with a larger ampacity conductor (increase of 680A to 910A).

The expected in-service date for this conduction section upgrade is December 2019.

6 References

i) Planning Process Working Group (PPWG) Report to the Board: The Process for Regional Infrastructure Planning in Ontario – May 17, 2013
ii) IESO Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0
iii) Needs Assessment Report Niagara Region

Appendix A: Load Forecast

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Allanburg TS	Net Load Forecast	33.4	35.4	29.6										
Hydro One, NPEI - Embedded	Gross Peak Load				31.1	31.3	31.4	31.6	32.0	32.4	32.6	32.7	32.9	33.1
	Gross Peak Load - DG - CDM				30.8	30.7	30.6	30.4	30.4	30.5	30.5	30.5	30.5	30.5
Beamsville TS	Net Load Forecast	53.6	55.9	49.0										
Hydro One & NPEI, Grimsby Power, NPEI - Embedded	Gross Peak Load				54.9	55.6	56.8	58.0	59.2	59.4	59.6	59.8	60.0	60.2
	Gross Peak Load - DG - CDM				54.1	54.2	55.0	55.5	56.1	55.8	55.6	55.5	55.4	55.3
Bunting TS	Net Load Forecast	58.3	55.9	49.6										
Horizion Utilities	Gross Peak Load				53.1	53.3	53.4	53.5	53.7	53.8	53.9	54.1	54.2	54.3
	Gross Peak Load - DG - CDM				52.5	52.1	51.8	51.4	51.0	50.7	50.5	50.3	50.2	50.1
Carlton TS	Net Load Forecast	100.1	98.3	76.7										
Horizion Utilities	Gross Peak Load				78.4	79.5	79.7	79.9	80.1	80.3	80.5	80.7	80.9	81.1
	Gross Peak Load - DG - CDM				77.6	77.8	77.5	76.8	76.1	75.7	75.4	71.6	71.4	71.2
Crowland TS	Net Load Forecast	89.1	93.6	74.6										
Welland Hydro & Hydro One, CNPI - Embedded	Gross Peak Load				75.2	77.5	78.5	80.0	81.0	82.0	83.0	84.0	85.0	86.0
	Gross Peak Load - DG - CDM				70.4	71.9	72.3	72.9	73.0	73.3	73.8	74.2	74.8	75.3
Dunnville TS	Net Load Forecast	25.3	27.0	24.1										
Hydro One	Gross Peak Load				24.1	24.3	24.4	24.5	24.7	24.9	25.0	25.1	25.2	25.4
	Gross Peak Load - DG - CDM				19.8	19.7	19.6	19.4	19.4	19.3	19.3	19.3	19.3	19.3

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Glendale TS	Net Load Forecast	61.5	59.1	60.1										
Horizion Utilities	Gross Peak Load				66.5	62.5	62.6	62.8	62.9	63.1	63.2	63.4	63.5	63.7
	Gross Peak Load - DG - CDM				65.7	61.0	60.7	60.2	59.7	59.3	59.1	58.9	58.8	58.6
Kalar MTS	Net Load Forecast	39.5	38.6	33.9										
NPEI	Gross Peak Load				39.8	40.0	40.2	40.4	40.6	40.8	41.0	41.2	41.4	41.6
	Gross Peak Load - DG - CDM				39.4	39.2	39.1	38.8	38.6	38.5	38.4	38.4	38.4	38.4
Niagara Murray TS	Net Load Forecast	97.0	101.7	90.2										
Hydro One & NPEI	Gross Peak Load				89.7	90.0	90.4	90.7	91.0	91.4	91.7	92.0	92.4	92.7
	Gross Peak Load - DG - CDM				88.9	88.3	88.0	87.4	86.9	86.5	86.3	86.2	86.1	86.0
Niagara On the Lake #1 MTS	Net Load Forecast	23.8	22.3	22.3										
Niagara On the Lake	Gross Peak Load				24.9	25.3	25.7	26.1	26.5	26.9	27.3	27.7	28.1	28.5
	Gross Peak Load - DG - CDM				24.7	24.8	25.0	25.1	25.2	25.3	25.6	25.8	26.1	26.3
Niagara On the Lake #2 MTS	Net Load Forecast	20.7	22.6	18.3										
Niagara On the Lake	Gross Peak Load				18.9	19.2	19.5	19.8	20.1	20.4	20.7	21.0	21.3	21.7
	Gross Peak Load - DG - CDM				18.8	18.8	19.0	19.0	19.1	19.2	19.4	19.6	19.8	20.0
Niagara West MTS	Net Load Forecast	47.5	43.5	35.7										
Grimsby Power, NPEI Embedded	Gross Peak Load				35.8	35.9	36.1	36.5	36.7	37.0	37.2	37.6	37.8	38.1
	Gross Peak Load - DG - CDM				34.4	34.2	34.0	34.0	33.8	31.2	31.2	31.4	31.4	31.5

Transformer Station Name	Customer Data (MW)	Historical Data (MW)			Near Term Forecast (MW)					Medium Term Forecast (MW)				
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Stanley TS	Net Load Forecast	59.8	58.9	52.4										
NPEI	Gross Peak Load				52.7	52.9	53.1	53.3	53.5	53.7	53.9	54.1	54.3	54.5
	Gross Peak Load - DG - CDM				52.1	51.7	51.5	51.1	50.8	50.5	50.4	50.3	50.3	50.2
Station 17 TS	Net Load Forecast		16.1	16.6										
CNP	Gross Peak Load				16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
	Gross Peak Load - DG - CDM				16.4	16.2	16.1	15.9	15.8	15.6	15.5	15.5	15.4	15.3
Station 18 TS	Net Load Forecast		32.3	35.2										
CNP	Gross Peak Load				35.2	37.7	40.2	40.2	40.2	40.2	40.2	40.2	40.2	40.2
	Gross Peak Load - DG - CDM				34.8	36.9	39.1	38.6	38.2	37.9	37.7	37.4	37.3	37.1
Port Colborne TS	Net Load Forecast		40.2	35.7										
CNP	Gross Peak Load				30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8
	Gross Peak Load - DG - CDM				30.3	30.0	29.8	29.4	29.1	28.9	28.7	28.5	28.4	28.2
Thorold TS	Net Load Forecast	20.1	21.3	18.4										
Hydro One	Gross Peak Load				21.3	21.5	21.6	21.7	22.0	22.2	22.4	22.5	22.6	22.7
	Gross Peak Load - DG - CDM				21.1	21.1	20.9	20.8	20.9	20.9	20.9	20.9	20.9	20.9
Vansickle TS	Net Load Forecast	46.3	53.3	43.7										
Horizion Utilities	Gross Peak Load				44.1	44.5	44.6	44.8	44.9	45.0	45.1	45.2	45.3	45.4
	Gross Peak Load - DG - CDM				43.7	43.6	43.4	43.0	42.7	42.4	42.2	42.1	42.0	41.9
Vineland DS	Net Load Forecast	17.4	17.0	17.0										
Hydro One, NPEI - Embedded	Gross Peak Load				21.9	22.3	22.4	22.7	23.1	23.5	23.8	24.0	24.3	24.5
	Gross Peak Load - DG - CDM				21.7	21.8	21.8	21.8	22.0	22.2	22.3	22.4	22.5	22.6

Appendix B: Acronyms

BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DSC	Distribution System Code
GS	Generating Station
GTA	Greater Toronto Area
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low-voltage
MW	Megawatt
MVA	Mega Volt-Ampere
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
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
ULTC	Under Load Tap Changer

Appendix D

2nd cycle Peterborough to Kingston Needs Assessment (NA) Report – February 2020

Hydro One Networks Inc.
483 Bay Street
Toronto, Ontario
M5G 2P5

NEEDS ASSESSMENT REPORT

Peterborough to Kingston Region

Date: February 10, 2020

Prepared by: Peterborough to Kingston Region Study Team

Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the Peterborough to Kingston Region and to recommend which need may be a) directly addressed by developing a preferred plan as part of NA phase and b) identify needs requiring further assessment and/or regional coordination. The results reported in this Needs Assessment are based on the input and information provided by the Study Team for this region.

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

Executive Summary

REGION Peterborough to Kingston Region (the "Region")

LEAD Hydro One Networks Inc. ("HONI")

START DATE: December 09, 2019 **END DATE:** February 10, 2020

1. INTRODUCTION

The first cycle of the Regional Planning process for the Peterborough to Kingston (PtoK) Region was completed in July 2016 with the publication of the Regional Infrastructure Plan ("RIP") which provided a description of needs and recommendations of preferred wires plans to address near-term needs.

This is the second cycle of regional planning starting from Needs Assessment ("NA"). The purpose of this NA is a) to identify any new needs and/or to reaffirm needs identified in the previous PtoK Regional Planning cycle and b) recommend which need may be a) addressed by developing a preferred plan as part of NA phase and b) identify needs requiring further assessment and/or regional coordination.

2. REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the regional planning cycle should be triggered at least every five years. In light of these timelines, the 2nd Regional Planning cycle was triggered for PtoK Region.

3. SCOPE OF NEEDS ASSESSMENT

The assessment's primary objective is to identify the electrical infrastructure needs over the study period, develop options and recommend which needs require further regional coordination.

The scope of this NA includes:

- Review and reaffirm needs/plans identified in the previous RIP; and
- Identification and assessment of system capacity, reliability, operation, and aging infrastructure needs in the region: and
- Develop options for need(s) and/or a preferred plan or recommend which needs require further assessment/regional coordination.

The Study Team may also identify additional needs during the next phases of the planning process, namely Scoping Assessment ("SA"), IRRP and RIP, based on updated information available at that time.

As per the PPWG Regional Planning Report to the Board (May 2013), the planning horizons of regional facilities are typically considered over the 1-20 years; however, in most situations focus is over the 1 – 10 years.

4. INPUTS/DATA

The Study Team representatives from Local Distribution Companies ("LDC"), the Independent Electricity System Operator ("IESO"), and Hydro One provided input and relevant information for this Region regarding capacity needs, reliability needs, operational issues, and major assets/facilities approaching end-of-life ("EOL").

In addition, community energy plans in the region have also been scanned and reviewed (Section 9 for references). Federal and Provincial agencies either operate and/or subsidize facilities, such as Canadian Forces Bases, Corrections Institutions and Post-Secondary Institutions in the region and similarly, municipal agencies operate many facilities in the study region; water, wastewater and recreation arenas to name a few. All these agencies are contemplating to reduce Green House Gas (GHG) emissions and to achieve carbon neutrality by no later than 2050 through renewable resources, energy efficiency and/or electrification of heating and transportation. At this time, there is insufficient data available for input into the load forecast for this Needs Assessment study however, the Study Team should monitor the evolving climate action plans of federal, provincial and municipal agencies as they are expected to lead climate action over the next five years.

5. ASSESSMENT METHODOLOGY

The assessment methodology include review of planning information such as load forecast, conservation and demand management ("CDM") forecast and available distributed generation ("DG") information, any system reliability and operation issues, and major high voltage equipment identified to be at or near the end of their life.

A technical assessment of needs was undertaken based on:

- Current and future station capacity and transmission adequacy;
- Reliability needs and operational concerns; and
- Any major high voltage equipment reaching the end of its life.

6. NEEDS

I. Update on plan implementation of identified needs from previous cycle

a. The load supplied by Gardiner TS DESN 1 T1/T2 exceeded its summer 10 day Limited Time Rating (LTR) of 125 MW. As recommended in the previous NA, Hydro One Distribution has completed the transfer of load from DESN 1 to lightly loaded DESN 2 with excess capacity resulting in a load relief for Gardiner TS DESN 1.

II. Newly identified needs in the region

a. Line / Station Capacity

i. The 2018 summer peak loading on Frontenac TS was 113 MW, which is above its 10 day summer LTR of 111 MW. Based on the submitted load forecast, the Frontenac TS will be loaded more than 125 MW by year 2028. Load relief is required at the Frontenac TS in the near term.

ii. As per submitted load forecast, the loading on Gardiner TS DESN 1 will be exceeded by its 10 day summer LTR of 125 MW by year 2025. However the combined capacity of Gardiner TS DESN 1 and DESN 2 is 209 MW and total current load is 154 MW.

iii. The 2018 summer peak loading on Belleville TS is 159 MW, which is close to its 10 day summer LTR of 161 MW. In addition to normal load growth in the area, Elexicon Energy Inc. has recently received approximately 30 MW of load connection inquiries to be connected at the Belleville TS. There is insufficient existing capacity in the area to supply these potential future connections.

b. Aging Infrastructure Transformer replacements

- **i.** Lennox TS – 230kV & 500kV Breaker Replacements (2020)
- **ii.** Port Hope TS: Transformer Replacement (2023)
- **iii.** Havelock TS: Transformer Replacement (2027)
- **iv.** Belleville TS: Transformer Replacement (2021)

7. RECOMMENDATIONS

The Study Team recommends the following -

a. Over loading at Frontenac TS shall be managed by Hydro One Transmission by coordinate with Hydro One Distribution and Kingston Hydro to undertake distribution load transfers between Gardiner TS and Frontenac TS over the near term.

b. An integrated regional resource planning (IRRP) and/or Regional Infrastructure Planning (RIP) process should be undertaken for the Peterborough-Kingston region to further assess the needs discussed above in section a.i), a.ii), and a.iii) as well as any addition needs identified in the area.

c. Replacement of end of life asset with similar equipment does not require further regional coordination (see further details in Section 7.1). The implementation and execution plan for these needs will be coordinated by Hydro One with affected LDCs:

i. Lennox TS: 230kV & 500kV Breaker Replacements (Bulk System)
ii. Port Hope TS: Transformer Replacement - EOL replacement of transformers T3 / T4
iii. Havelock TS: Transformer Replacement – EOL replacement of transformers T1 / T2
iv. Belleville TS: Transformer Replacement - EOL replacement of transformer T2

d. IRRP and/or RIP should monitor the potential impact of Federal, Provincial and/or Municipal climate change and/or energy plans for this region.

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1 INTRODUCTION

The first cycle of the Regional Planning process for the Peterborough to Kingston Region was completed in July 2016 with the publication of the Regional Infrastructure Plan ("RIP"). The RIP provided a description of needs and recommendations of preferred wires plans to address near- and medium-term needs.

The purpose of this Needs Assessment ("NA") is to identify new needs and to reconfirm needs identified in the previous PtoK regional planning cycle. Since the previous regional planning cycle, some new needs in the region have been identified.

This report was prepared by the Peterborough to Kingston Region Study Team ("Study Team"), led by Hydro One Networks Inc. Participants of the Study Team are listed below in Table 1. The report presents the results of the assessment based on information provided by the Hydro One, the Local Distribution Companies ("LDC") and the Independent Electricity System Operator ("IESO").

Table 1: PtoK Region Study Team Participants

Company
Elexicon Energy Inc.
Kingston Hydro
Peterborough Distribution Inc.
Lakefront Utilities Inc.
Eastern Ontario Power Inc.
Hydro One Networks Inc. (Distribution)
Independent Electricity System Operator ("IESO")
Hydro One Networks Inc. (Lead Transmitter)

2 REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least every five years. In light of Regional Planning cycle timelines and new needs in the PtoK region, the 2nd Regional Planning cycle was triggered for the PtoK region.

3 SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the PtoK region and includes:

- Review the status of needs/plans identified in the previous RIP; and
- Identification and assessment of any new needs (e.g. system capacity, reliability, operation, and aging infrastructure)

The Study Team may identify additional needs during the next phases of the regional planning process, namely Scoping Assessment ("SA"), Local Planning ("LP"), IRRP, and/or RIP.

4 REGIONAL DESCRIPTION AND CONNECTION CONFIGURATION

The PtoK Region includes Frontenac County, City of Kingston, Hasting County, Northhumberland County, Peterborough County, and Prince Edward County. The boundaries of Peterborough to Kingston Region is shown below in Fig. 1.

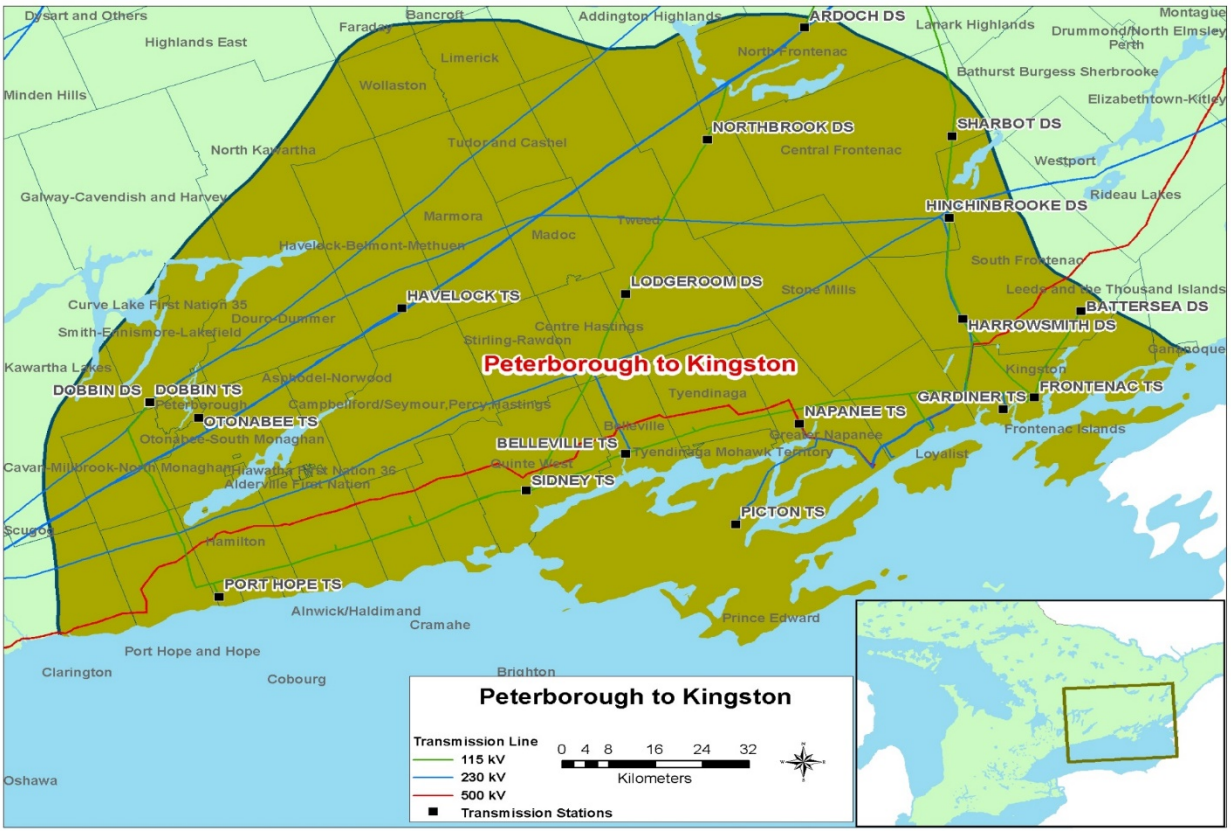

Figure 1: Geographical Area of PtoK Region with Electrical Layout

Electrical supply to the Peterborough to Kingston Region is provided through a network of 230 kV and 115 kV circuits supplied by 500/230 kV autotransformers at Lennox Transformer Station (TS) and 230/115 kV autotransformers at Cataraqui TS and Dobbin TS. There are ten Hydro One step-down TS's, eight high voltage distribution stations (HVDS), and five other direct transmission connected load

customers in the Region. The main generation facility in the Region is the 2000 MW Lennox Generation Station (GS) connected to Lennox TS.

The existing facilities in the Region are summarized below and depicted in the single line diagram shown in Figure 2. The 500kV system is part of the bulk power system and is not studied as part of this Needs Assessment:

- Lennox TS is the major transmission station that connects the 500kV network to the 230kV system via two 500/230 kV autotransformers.

- Cataraqui TS and Dobbin TS are the transmission stations that connect the 230kV network to the 115kV system via 230/115 kV autotransformers.

- Ten step-down transformer stations supply the Peterborough to Kingston load: Dobbin TS, Port Hope TS, Sidney TS, Picton TS, Otonabee TS, Havelock TS, Belleville TS, Napanee TS, Gardiner TS, and Frontenac TS. There are also eight HVDS that supply load in the Region: Dobbin DS, Ardoch DS, Northbrook DS, Lodgeroom DS, Hinchinbrooke DS, Harrowsmith DS, Sharbot DS, and Battersea DS.

- Five Customer Transformer Stations (CTS) are supplied in the Region: TransCanada Pipelines Cobourg CTS, TransCanada Pipelines Belleville CTS, Enbridge Pipelines Hilton CTS, Lafarge Canada Bath CTS, and Novelis CTS.

- There are 7 existing Transmission connected generating stations in the Region as follows:
    - Lennox GS is a 2000 MW natural gas-fired station connected to Lennox TS
    - NPIF Kingston GS is a 130 MW gas-fired cogeneration facility that connects to 230 kV circuits X1H and X2H near Lennox TS
    - Wolfe Island GS is a 198 MW wind farm connected to circuit X4H near Gardiner TS
    - Napanee GS is a 910 MW gas-fired plant connected to Lennox TS at the 500 kV system.
    - Kingston Solar CGS is a 100 MW solar generation facility connected to 230 kV circuit X2H
    - Stone Mills CGS is a 60 MW solar generation facility connected to 230 kV circuit H23B
    - Amherst Island CGS is a 76 MW wind farm connected to 115kV circuit Q6S

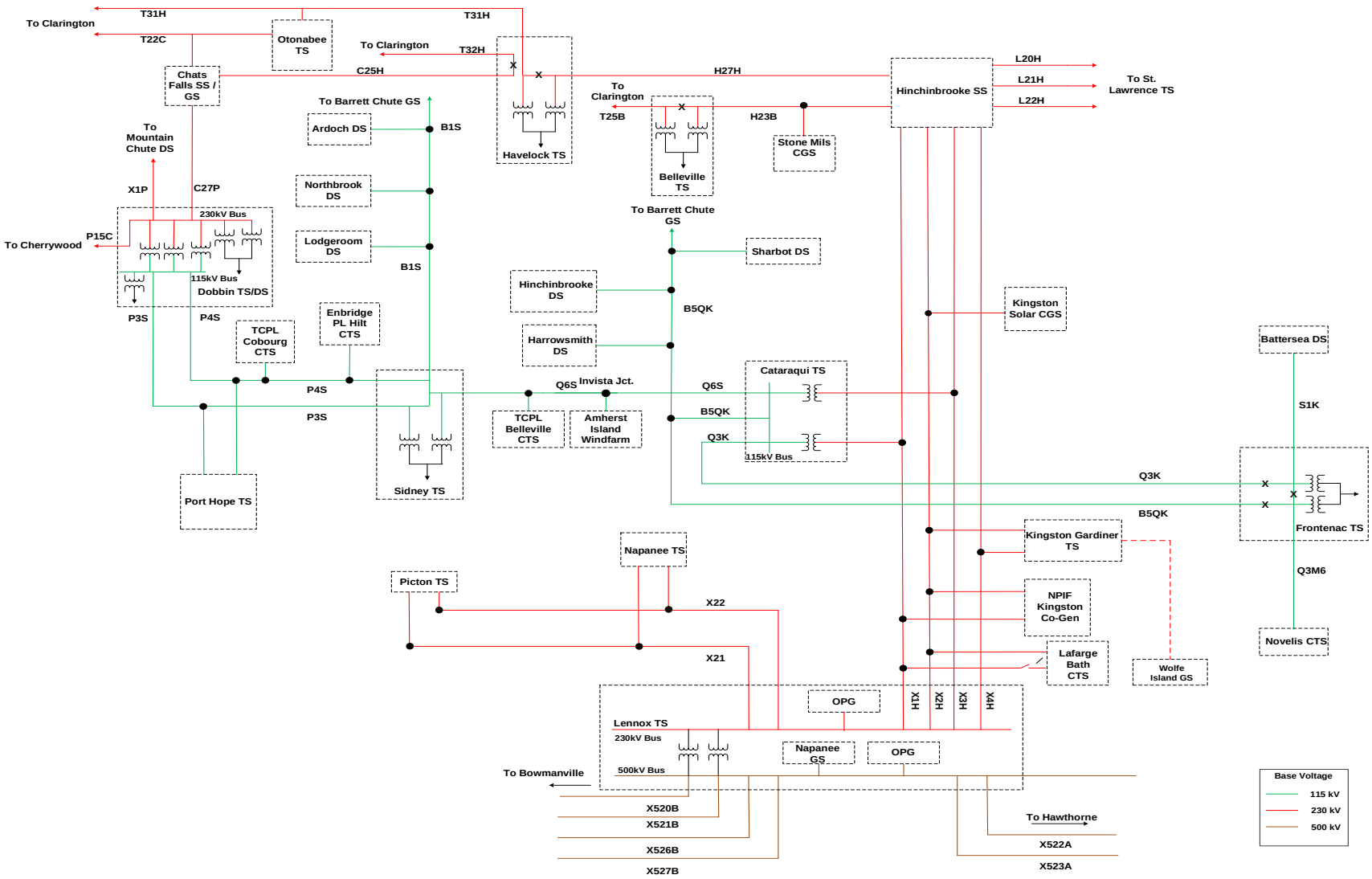

Figure 2: Single Line Diagram of Peterborough to Kingston Region

5 INPUTS AND DATA

Study Team participants, including representatives from LDCs, IESO, and Hydro One provided information and input for the Peterborough to Kingston Region NA. The information provided includes the following:

- Peterborough to Kingston Load Forecast for all supply stations;
- Known capacity and reliability needs, operating issues, and/or major assets approaching the end of life ("EOL"); and
- Planned/foreseen transmission and distribution investments that are relevant to regional planning for the PtoK Region.

6 ASSESSMENT METHODOLOGY

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

Information gathering included:

i. Load forecast: The LDCs provided load forecasts for all the stations supplying their loads in the PtoK region for the 10 year study period. The IESO provided a Conservation and Demand Management ("CDM") and Distributed Generation ("DG") forecast for the PtoK region. The region's extreme summer non-coincident peak gross load forecast for each station were prepared by applying the LDC load forecast load growth rates to the actual 2018 summer and 2018/19 winter peak extreme weather corrected loads. The extreme summer / winter weather correction factors were provided by Hydro One. The net extreme weather summer load forecasts were produced by reducing the gross load forecasts for each station by the % age CDM and then by the amount of effective DG capacity provided by the IESO for that station. It is to be noted that in the mid-term (5 to 10 year) time frame, contracts for existing DG resources in the region begin to expire, at which point the load forecast indicates a decreasing contribution from local DG resources, and an increase in net demand. These extreme weather corrected net summer / winter load forecast for the individual stations in the PtoK region is given in Appendix A;

ii. Relevant information regarding system reliability and operational issues in the region; and

iii. List of major HV transmission equipment planned and/or identified to be refurbished and/or replaced due to the end of life which is relevant for regional planning purposes. This includes HV transformers, autotransformers, HV Breakers, HV underground cables and overhead lines.

A technical assessment of needs was undertaken based on:

- Current and future station capacity and transmission adequacy;

- System reliability and operational concerns; and
- Any major high voltage equipment reaching the end of life.

7 NEEDS

This section describes emerging needs identified in the Peterborough to Kingston Region, and also reaffirms the near, mid, and long-term needs already identified in the previous regional planning cycle. The recent load forecast prepared for this report is higher than that of the previous cycle of regional planning. This is attributed to the load growth in Belleville, Kingston and other parts of the regions as well as lower CDM and DG targets in the region. A contingency analysis was performed for the region and no new system needs were identified.

The status of the previously identified needs is summarized in Table 2 below.

Table 2: Needs Identified in the Previous Regional Planning Cycle

Type of Needs identified in the previous RP cycle	Needs Details	Current Status
Transformation capacity relief at Gardiner TS DESN 1.	Gardiner TS DESN 1 load exceeded its normal supply capacity. Hydro One Dx agreed to transfer load from Gardiner TS DESN 1 to Gardiner TS DESN 2.	The work completed in summer 2019.

7.1 End-Of-Life (EOL) Equipment Needs

Hydro One and LDCs have provided high voltage asset information under the following categories that have been identified at this time and are likely to be replaced over the next 10 years:

- Autotransformers
- Power transformers
- HV breakers
- Transmission line requiring refurbishment where an uprating is being considered for planning needs and require Leave to Construct (i.e., Section 92) application and approval
- HV underground cables where an uprating is being considered for planning needs and require EA and Leave to Construct (i.e., Section 92) application and approval

The end-of-life assessment for the above high voltage equipment typically included consideration of the following options:

1. Replacing equipment with similar equipment and built to current standards (i.e., "like-for-like" replacement);
2. Replacing equipment with similar equipment of higher / lower ratings i.e. right sizing opportunity and built to current standards;
3. Replacing equipment with lower ratings and built to current standards by transferring some load to other existing facilities;
4. Eliminating equipment by transferring all of the load to other existing facilities;

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

Accordingly, following major high voltage equipment has been identified as approaching its end of life over the next 10 years and assessed for right sizing opportunity.

a. Lennox TS – 230 kV & 500 kV Breaker Replacement

This project is outside the scope of regional planning being part of part of Bulk System. A description is provided for information purpose only. Lennox Transformer Station (TS) is located in Eastern Ontario and is a major hub for 500 kV Central-East power flow that forms part of the Hydro One Bulk Power System (BPS). The station also connects 2000 MW of generation from Lennox GS on both the 500 kV and 230 kV systems. Furthermore, it also connects 900 MW of Napanee GS. The 230 kV and 500 kV switchyard at Lennox TS contain 14 X Air Blast Circuit Breakers (ABCBs) and 2 X OIL Circuit Breakers (OCBs). The existing 500kV and 230kV ABCBs are obsolete and at end of life. The age, condition and very poor performance present significant difficulties in maintaining these breakers and the associated high pressure air system.

The scope of this project is to replace the existing six (6) 500kV and eight (8) 230kV air-blast circuit breakers. In addition, 2 X 230 kV oil circuit breakers, AC/DC station service and associated protection, control and telecom facilities will be replaced to meet current standards and to fully comply with NPCC BPS requirements. The targeted in-service for the final phase is in year 2020.

b. Port Hope TS – Transformers Replacement

Port Hope Transformer Station supplies the City of Port Hope, City of Cobourg and other surrounding area via two DESN, T1/T2 & T3/T4. Each transformer is 50/83 MVA in size and step down 115 kV to 44 kV voltages. The Port Hope TS DESN 1 and DESN 2 summer 10 day LTR is 125 MW and 104 MW, respectively. The stations 2018 actual non-coincident summer peak load (adjusted for extreme weather) was about 114 MW and is forecasted to be 136 MW in the next 20 years. Transformer T3 / T4 are 61 years old and have reached their end of life. In addition, 44 kV switchyard associated with transformer T3 / T4 is also at the end of life and need to be replaced.

The scope of this project is to replace transformers T3 and T4 and associated 44 kV switchyard assets with the current standard equipment. Replacing transformer with lower size rating is not recommended as the load is increasing. Moreover, the current LTR rating of the transformers is adequate to serve the forecasted load for the next 20 years and therefore, the preferred option is to replace the transformer with the similar size transformer. The targeted in-service for this project is in year 2023.

The Study Team recommended continuation of these end of life asset replacement as per the plan.

c. Havelock TS – Transformers Replacement

Havelock TS is located into Central East Ontario and supplies the surrounding area via T1/T2 DESN. Each transformer is 83.3 MVA in size and step down 230 kV to 44 kV feeder voltages. The station summer 10 day LTR is 88 MW. The stations 2018 actual non-coincident summer peak load (adjusted for extreme weather) was about 75 MW and is forecasted to be 90 MW in the next 20 years. Transformers T1/T2 are 56 years old and have reached their end of life and need to be replaced.

The scope of this project is to replace transformers T1 and T2 with new transformers. The newer similar size 50/83 MVA transformer will have a 10 day LTR rating greater than 100 MW and would serve the expected load forecast for the next 20 years

Transformer cost difference based on its size only is minimal. Hence, replacing transformer with lower size rating is not recommended as the load is increasing and downsizing the capacity today and then later upgrading it with larger transformers will be significantly more costly. Moreover, the current LTR rating of the transformers is adequate to serve the forecasted load. Therefore, the preferred option is to replace the transformer with the similar size transformer. The targeted in-service is in year 2027.

The Study Team recommended continuation of these end of life asset replacement as per the plan.

d. Belleville TS – Transformer Replacement

Belleville TS supplies City of Belleville and surrounding area via T1/T2 DESN. Each transformer is 125 MVA in size and step down 230 kV to 44 kV feeder voltages. The station summer 10 day LTR is 161 MW. The stations 2018 actual non-coincident summer peak load (adjusted for extreme weather) was about 158 MW and is forecasted to be 189 MW in the next 20 years. Transformer T2 and T1 are 52 years and 45 years old respectively, and have reached their end of life and requires to be replaced. In addition, Station Service Transformers (SSTs), 230 kV switches and associated EOL equipment with transformer T2 and T1 are also require to be replaced.

The scope of this project is to replace the transformer T2 and T1. Replacing them with lower size transformer rating is not recommended as the load is increasing and downsizing the capacity today and then later upgrading it with larger transformers will be significantly more costly. Moreover, these transformers are already the highest standard size transformer, 75/100/125 MVA size, and since the load at Belleville

TS is not expected to decrease in future, the preferred option is to replace these transformer with the similar size transformer. The targeted in-service for transformer T2 is year 2021 and transformer T1 is in year 2025.

The Study Team recommended continuation of these end of life asset replacement as per the plan.

7.2 Station and Transmission Capacity Needs in the Peterborough to Kingston Region

The following Station and Transmission supply capacities needs have been identified in the PtoK region during the study period of 2019 to 2028.

7.2.1 230/115 kV Autotransformers

The 230/115 kV autotransformers (Dobbin TS and Cataraqui TS) supplying the Region are within the thermal limits of the circuits and within the voltage range as per Ontario Resource and Transmission Assessment Criteria (ORTAC) over the study period for the loss of a single 230/115 kV autotransformer in the Region.

7.2.2 230 kV Transmission Lines

The 230 kV circuits supplying the Region are within the thermal limits of the circuits and within the voltage range as per ORTAC over the study period for the loss of a single 230 kV circuit in the Region.

7.2.3 115kV Transmission Lines

The 115 kV circuits supplying the Region are within the thermal limits of the circuits and within the voltage range as per ORTAC over the study period adequate over the study period for the loss of a single 115 kV circuit in the Region.

7.2.4 230 kV and 115 kV Connection Facilities

A station capacity assessment was performed over the study period for the 230 kV and 115 kV TSs in the Region using either the summer or winter station peak load forecasts as appropriate that were provided by the study team. The results are as follows:

a. Frontenac TS

The 2018 actual non-coincident summer peak load on Frontenac TS was 113 MW which is above its 10 day summer LTR of 111 MW. Based on the submitted load forecast, the Frontenac TS will be loaded more than 125 MW in the mid term.

Upgrading the transformers at Frontenac TS is not economically feasible as the transformers are already the largest size for a 115 kV connection. In addition, preliminary studies indicate that there is voltage and thermal constraints on 115 kV line circuits when adding a new DESN on these lines. Also, the cost of upgrading 115 kV transmission line to 230 kV has been a deterrent due to low load growth in the area. As per the current configuration, Kingston Hydro indicated to Hydro One that it may have up to 12 MW of emergency load transfer capability between Gardiner TS DESN 1 T1/T2 and Frontenac TS T3/T4.

Based on the above, the Study Team recommends that in the near term, Hydro One Transmission work with the Hydro One Distribution and Kingston Hydro for load transfer options to Gardiner TS to provide load relief at Frontenac TS.

b. Gardiner TS DESN 1

The 2018 actual non-coincident summer peak for Gardiner TS DESN 1 T1/T2 was 129 MW. The summer peak for year 2019 was reduced from 129 MW to 119 MW due to load transfer work completed by Hydro One Distribution. As per submitted load forecast, the loading on Gardiner TS DESN 1 will be exceeded by its 10 day summer LTR of 125 MW by year 2025.

Gardiner TS DESN 2 is located in the same area and has 10 day summer LTR of 84 MW. Based on the submitted load forecast, Gardiner TS DESN 2 will have at least 42 MW of excess capacity available by year 2028.

Based on the above, the Study Team recommends that the mid to long-term area supply capacity for city of Kingston and nearby area should be further assessed as part of the IRRP and/or RIP.

c. Belleville TS

The 2018 actual non-coincident summer peak load (adjusted for extreme weather) on Belleville TS T1/T2 was about 159 MW and is at close to its 10 day summer LTR of 161 MW. In addition to normal load growth in the area, Elexicon Energy Inc. has recently received approximately 30 MW of load connection inquiries to be connected at the Belleville TS.

Belleville TS has space for second DESN. However, preliminary studies undertaken by Hydro One indicate that there may be voltage and/or thermal constraints on the transmission lines supplying Belleville TS. Based on these assessments, following options may be available to address the need for additional capacity at Belleville TS -

- Install an additional 3rd 75/125 MVA transformer at Belleville TS and assess transmission line capacity
- Install a new DESN with two 75/125 MVA and assess transmission line capacity

In addition, reactive support may also be required at the station. Study team recommends that further assessment should be undertaken as part of the integrated regional resource planning process and/or RIP to develop a preferred plan. The integrated regional resource planning process, which includes stakeholder and community engagement activities, will examine the technical feasibility, economic implications and required timing of options for long-term, reliable electricity supply to the area based on a demand forecast prepared by the Working Group at the outset of the process.

d. Other TSs and HVDSs in the Region

All the other TSs and HVDSs in the Region are forecasted to remain within their normal supply capacity during the study period and therefore, the capacity needs for these TSs and HVDSs will be reviewed in the next planning cycle.

7.3 System Reliability, Operation and Restoration Review

No new significant system reliability and operating issues identified for this Region. Based on the net coincident load forecast, the loss of one element will not result in load interruption greater than 150MW. The maximum load interrupted by configuration due to the loss of two elements is below the load loss limit of 600MW by the end of the 10-year study period.

For the loss of circuits X2H and X4H, the load interrupted by configuration at Gardiner TS will exceed 150 MW threshold marginally based on the coincident load forecast. As per the current configuration, Kingston Hydro indicated to Hydro One that it may have up to 12 MW of emergency load transfer capability between 230 kV connected Gardiner TS DESN 1 and 115 kV connected Frontenac TS T3/T4. As such, no action is required at this time and this will be reviewed in the next planning cycle.

There are other operating considerations on the Bulk System related to the 230 kV that may need further assessment as part of Bulk System Planning in the region. For example , the Dobbin TS Auto Transformers are legacy transformers and the tap changers on all 3 units are limited in their voltage regulation capability that prevents the voltage on the 230kV tap of the transformer to be operated at higher voltages up to 264 kV.

7.4 Other Planning Considerations in the Peterborough to Kingston Region

In addition, community energy plans in the region have also been scanned and reviewed (Section 9 for references). Federal and Provincial agencies either operate and/or subsidize facilities, such as Canadian Forces Bases, Corrections Institutions and Post-Secondary Institutions in the region and similarly, municipal agencies operate many facilities in the study region; water, wastewater and recreation arenas to name a few. All these agencies are contemplating to reduce Green House Gas (GHG) emissions and to achieve carbon neutrality by no later than 2050 through renewable resources, energy efficiency and/or electrification of heating and transportation. At this time, there is insufficient data available for input into the load forecast for this Needs Assessment study however, the Study Team should monitor the evolving

climate action plans of federal, provincial and municipal agencies as they are expected to lead climate action over the next five years.

8 CONCLUSION AND RECOMMENDATIONS

In conclusion, the Gardiner TS DESN 1 station capacity need identified in the previous planning cycle has already been addressed. It is recommended that the newly identified needs shall be assessed in the current cycle of regional planning.

The Study Team recommends the following -

a. Over loading at Frontenac will be managed by Hydro One Transmission by coordinate with Hydro One Distribution and Kingston Hydro to undertake distribution load transfers between Gardiner TS and Frontenac TS over the near term.

b. An integrated regional resource planning (IRRP) and/or Regional Infrastructure Planning (RIP) process should be undertaken for the Peterborough-Kingston region to further assess the needs discussed above in section 7.2.4 a, b, and c as well as any addition needs identified in the area.

c. Replacement of end of life asset with similar equipment does not require further regional coordination (see further details in Section 7.1). The implementation and execution plan for these needs will be coordinated by Hydro One with affected LDCs:

i. Lennox TS: 230kV & 500kV Breaker Replacements (Bulk System)
ii. Port Hope TS: Transformer Replacement - EOL replacement of transformers T3 / T4
iii. Havelock TS: Transformer Replacement – EOL replacement of transformers T1 / T2
iv. Belleville TS: Transformer Replacement - EOL replacement of transformer T2

d. IRRP and/or RIP should monitor the potential impact of Federal, Provincial and/or Municipal climate change and/or energy plans for this region. .

9 REFERENCES

[1] RIP Report – Peterborough to Kingston Region – July 2016

[2] Local Planning Report – Gardiner TS Load Balancing – October 2015

[3] Planning Process Working Group Report to the Ontario Energy Board - May 2013

[4] Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0 -August 2007

[5] 2017 Long Term Energy Plan – Ontario Government

[6] Government of Canada – Excerpts from Greening Government Strategy Website (as of Nov 7, 2019)

[7] Queen's University - Climate Action Plan dated January 2016

[8] St. Lawrence College 2018-2019 Business Plan & Energy Plan

[9] City of Kingston Municipal Energy Study – June 2018

[10] City of Kingston Declares Climate Emergency – March 2018

[11] City of Kingston – October 2019 Report to Council Number 19-261

Appendix A: Extreme Weather Adjusted Non-Coincident Summer / Winter Load Forecast

Table A.1: Peterborough to Kingston Region Summer Non-Coincident Load Forecast

Transformer Station		Summer 10 Day LTR (MW)	Type	Actual	Forecasted									
Name	DESN ID			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Ardoch DS	T1	12	Gross	3	3	3	3	3	3	3	3	3	3	3
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	3	3	3	3	3	3	3	3	3	3	3
Battersea DS	T1/T2	12	Gross	8	8	8	9	9	9	9	9	9	9	9
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	8	8	8	8	8	8	8	8	8	8	8
Belleville TS	T1/T2	161	Gross	159	159	160	161	162	163	164	167	168	170	172
			CDM	0	2	3	3	4	5	5	6	6	7	8
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	159	157	157	158	158	158	159	161	162	163	164
Dobbin DS	T1/T2	24	Gross	10	15	15	15	15	15	15	15	15	16	16
			CDM	0	0	0	0	0	0	0	0	0	1	1
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	10	15	15	15	15	15	15	15	15	15	15
Dobbin TS	T3/T4	160	Gross	95	96	98	99	100	101	102	103	104	104	105
			CDM	0	1	2	2	2	2	3	3	3	4	4
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	95	95	96	97	98	99	99	100	100	101	101

Frontenac TS	T3/T4	111	Gross	113	115	118	120	123	124	124	125	125	126	126
			CDM	0	1	2	2	2	3	3	4	4	5	5
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	113	114	116	118	121	121	121	121	121	121	121
Gardiner TS	T1/T2	125	Gross	119*	119	122	123	125	127	128	129	130	131	132
			CDM	0	1	2	2	3	3	3	4	4	5	5
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	119*	118	120	121	122	124	125	125	126	126	127
Gardiner TS	T3/T4	84	Gross	35*	35	41	41	42	42	43	43	43	44	44
			CDM	0	0	1	1	1	1	1	1	1	2	2
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	35*	35	40	41	41	41	41	42	42	42	42
Harrowsmith DS	T1/T2	12	Gross	14	14	15	15	15	15	15	16	16	16	16
			CDM	0	0	0	0	0	0	0	0	1	1	1
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	14	14	15	15	15	15	15	15	15	15	15
Havelock TS	T1/T2	88	Gross	75	76	78	79	80	81	81	82	83	84	84
			CDM	0	1	1	1	2	2	2	2	3	3	3
			DG	0	1	1	1	1	1	1	1	1	1	1
			Net	75	74	75	76	77	78	78	78	79	79	80
Hinchinbrooke DS	T1	6	Gross	6	6	6	6	7	7	7	7	7	7	7
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	6	6	6	6	6	6	6	6	6	7	7
Lodgeroom DS	T1/T2	11	Gross	8	8	8	8	8	8	8	8	9	9	9
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG M	0	0	0	0	0	0	0	0	0	0	0
			Net	8	8	8	8	8	8	8	8	8	8	8

Napanee TS	T1	104	Gross	62	63	65	66	67	69	69	70	71	72	73
			CDM	0	1	1	1	1	2	2	2	2	3	3
			DG	0	0	0	0	0	0	0	0	0	0	-7
			Net	62	62	64	65	66	67	68	68	69	70	78
Northbrook DS	T1	12	Gross	6	6	7	7	7	7	7	7	7	7	7
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	6	6	6	6	7	7	7	7	7	7	7
Otonabee TS	T1/T2 (44kV)	97	Gross	65	60	61	61	66	70	71	73	74	75	76
			CDM	0	1	1	1	1	2	2	2	2	3	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	65	59	59	60	64	68	69	70	71	72	73
Otonabee TS	T1/T2 (27.6kV)	105	Gross	51	53	54	55	51	47	47	48	49	49	50
			CDM	0	0	1	1	1	1	1	1	2	2	2
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	51	53	53	54	50	45	46	47	47	48	48
Picton TS	T1/T2	78	Gross	59	60	62	63	64	65	66	67	68	69	70
			CDM	0	1	1	1	1	2	2	2	2	2	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	59	60	61	62	63	64	64	65	65	66	67
Port Hope TS	T1/T2	125	Gross	44	45	46	46	47	48	48	48	49	49	50
			CDM	0	0	1	1	1	1	1	1	2	2	2
			DG	0	0	1	1	1	1	1	1	1	1	1
			Net	44	44	45	45	46	46	46	46	47	47	47
Port Hope TS	T3/T4	104	Gross	70	70	72	73	73	74	75	76	76	77	78
			CDM	0	1	1	1	1	2	2	2	2	3	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	70	70	71	71	72	73	73	73	74	74	75

Sharbot DS	T1	6	Gross	4	4	4	4	4	4	4	4	4	4	4
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	4	4	4	4	4	4	4	4	4	4	4
Sidney TS	T1/T2	112	Gross	78	79	81	82	83	84	84	85	85	86	87
			CDM	0	1	1	1	2	2	2	3	3	3	3
			DG	0	0	0	0	0	0	0	-5	-5	-5	-5
			Net	78	78	79	80	81	82	82	88	88	89	89
LaFarge Canada CTS			Net	21	21	21	21	21	21	21	21	21	21	21
Enbridge PL Hilt CTS			Net	2	2	2	2	2	2	2	2	2	2	2
TCPL Cobourg CTS			Net	0	0	0	0	0	0	0	0	0	0	0
TCPL Belleville CTS			Net	0	0	0	0	0	0	0	0	0	0	0
Novelis CTS			Net	9	10	10	10	10	10	10	10	10	10	10

** The 2018 summer peak load adjusted for 10 MW of load transfer from Gardiner TS DESN 1 to DESN 2 by Hydro One Distribution.*

Table A.2: Peterborough to Kingston Region Winter Non-Coincident Load Forecast

Transformer Station		Winter 10 Day LTR (MW)	Type	Actual	Forecasted									
Name	**DESN ID**			**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Ardoch DS	T1	12	Gross	2	2	2	2	2	2	2	2	3	3	3
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	2	2	2	2	2	2	2	2	2	2	2
Battersea DS	T1/T2	12	Gross	11	10	10	10	11	11	11	11	11	11	11
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	11	10	10	10	10	10	10	10	10	10	10

Belleville TS	T1/T2	181	Gross	159	158	160	162	165	167	169	171	173	175	178
			CDM	0	2	3	3	4	5	5	6	6	7	8
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	159	156	157	159	161	162	164	165	167	169	170
Dobbin DS	T1/T2	24	Gross	10	16	17	17	17	17	17	17	17	17	17
			CDM	0	0	0	0	0	0	0	1	1	1	1
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	10	16	16	16	17	17	17	17	17	17	17
Dobbin TS	T3/T4	177	Gross	73	70	72	72	73	74	74	75	75	76	77
			CDM	0	1	1	1	1	2	2	2	2	3	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	73	70	71	71	72	72	72	73	73	73	74
Frontenac TS	T3/T4	122	Gross	117	117	120	123	126	127	128	129	129	130	131
			CDM	0	1	2	2	2	3	3	3	3	4	4
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	117	116	118	121	124	124	125	126	126	126	127
Gardiner TS	T1/T2	143	Gross	128*	128	130	132	133	135	136	137	138	139	140
			CDM	0	1	2	2	3	3	4	4	4	5	5
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	128*	127	128	130	130	132	132	133	134	134	135
Gardiner TS	T3/T4	84	Gross	37*	37	43	43	44	44	44	45	45	45	46
			CDM	0	0	1	1	1	1	1	1	1	2	2
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	37*	37	42	42	43	43	43	43	44	44	44
Harrowsmith DS	T1/T2	12	Gross	18	18	18	18	18	18	19	19	19	19	19
			CDM	0	0	0	0	0	0	0	1	1	1	1
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	18	17	18	18	18	18	18	18	18	18	18

Havelock TS	T1/T2	97	Gross	65	63	64	65	65	66	67	67	68	68	69
			CDM	0	1	1	1	1	2	2	2	2	2	3
			DG	0	1	1	1	1	1	1	1	1	1	1
			Net	65	61	62	62	63	63	64	64	64	65	65
Hinchinbrooke DS	T1	6	Gross	7	6	6	6	7	7	7	7	7	7	7
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	7	6	6	6	6	6	6	6	7	7	7
Lodgeroom DS	T1/T2	11	Gross	10	9	10	10	10	10	10	10	10	10	10
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	10	9	9	9	10	10	10	10	10	10	10
Napanee TS	T1	117	Gross	72	70	72	73	74	75	76	77	78	79	80
			CDM	0	1	1	1	1	2	2	2	3	3	3
			DG	0	0	0	0	0	0	0	0	0	0	-7
			Net	72	69	71	72	73	74	74	75	76	77	85
Northbrook DS	T1	12	Gross	7	6	7	7	7	7	7	7	7	7	7
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	7	6	6	7	7	7	7	7	7	7	7
Otonabee TS	T1/T2 (44kV)	109	Gross	78	75	76	77	77	78	78	79	79	80	80
			CDM	0	1	1	1	2	2	2	2	3	3	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	78	74	75	75	75	76	76	76	76	76	77
Otonabee TS	T1/T2 (27.6kV)	115	Gross	62	60	61	62	62	63	63	63	64	64	64
			CDM	0	1	1	1	1	1	2	2	2	2	2
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	62	60	60	61	61	61	61	61	62	62	62

Picton TS	T1/T2	89	Gross	57	56	57	58	59	60	60	61	62	63	64
			CDM	0	1	1	1	1	1	2	2	2	2	2
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	57	55	56	57	57	58	59	59	60	60	61
Port Hope TS	T1/T2	140	Gross	67	65	66	67	68	68	69	69	70	71	71
			CDM	0	1	1	1	1	2	2	2	2	3	3
			DG	0	0	1	1	1	1	1	1	1	1	1
			Net	67	64	65	65	66	66	67	67	67	68	68
Port Hope TS	T3/T4	116	Gross	76	75	76	77	78	79	79	80	80	81	81
			CDM	0	1	1	1	2	2	2	2	3	3	3
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	76	74	75	76	76	77	77	77	78	78	78
Sharbot DS	T1	6	Gross	4	4	4	4	4	4	4	4	4	4	4
			CDM	0	0	0	0	0	0	0	0	0	0	0
			DG	0	0	0	0	0	0	0	0	0	0	0
			Net	4	4	4	4	4	4	4	4	4	4	4
Sidney TS	T1/T2	112	Gross	84	82	83	84	85	86	87	87	88	89	89
			CDM	0	1	1	1	2	2	2	3	3	3	3
			DG	0	0	0	0	0	0	0	-5	-5	-5	-5
			Net	84	81	82	83	83	84	84	90	90	91	91
LaFarge Canada CTS			Net	21	21	21	21	21	21	21	21	21	21	21
Enbridge PL Hilt CTS			Net	2	2	2	2	2	2	2	2	2	2	2
TCPL Cobourg CTS			Net	0	8	8	8	8	8	8	8	8	8	8
TCPL Belleville CTS			Net	0	5	5	5	5	5	5	5	5	5	5
Novelis CTS			Net	9	9	10	10	10	10	10	10	10	10	10

** The 2018 winter peak load adjusted for 10 MW of load transfer from Gardiner TS DESN 1 to DESN 2 by Hydro One Distribution.*

Appendix B: Lists of Step-Down Transformer Stations

Sr. No.	Transformer Stations	Voltages (kV)
1.	Ardoch DS (T1)	115/12.5
2.	Battersea DS (T1/T2)	115/12.5
3.	Belleville TS (T1/T2)	230/44
4.	Dobbin DS (T1/T2)	115/27.6
5.	Dobbin TS (T3/T4)	115/44
6.	Frontenac TS (T3/T4)	115/44
7.	Gardiner TS (T1/T2)	230/44
8.	Gardiner TS (T3/T4)	230/44
9.	Harrowsmith DS (T1/T2)	115/12.5
10.	Havelock TS (T1/T2)	230/44
11.	Hinchinbrooke DS (T1)	115/12.5
12.	Lodgeroom DS (T1/T2)	115/12.5
13.	Napanee TS (T1)	230/44
14.	Northbrook DS (T1)	115/12.5
15.	Otonabee TS (T1/T2)	230/44
16.	Otonabee TS (T1/T2)	230/27.6
17.	Picton TS (T1/T2)	230/44
18.	Port Hope TS (T1/T2)	115/44
19.	Port Hope TS (T3/T4)	115/44
20.	Sharbot DS (T1)	230/12.5
21.	Sidney TS (T1/T2)	115/44
22.	LaFarge Canada CTS	230/13.8
23.	Enbridge PL Hilt CTS	115/4.16
24.	TCPL Cobourg CTS	115/4.16
25.	TCPL Belleville CTS	115/4.16
26.	Novelis CTS	115/13.2

Appendix C: Lists of Transmission Circuits

Sr. No.	Circuit ID	From Station	To Station	Voltage (kV)
1.	X1H, X2H, X3H, X4H	Hinchinbrooke SS	Lennox TS	230
2.	X21, X22	Picton TS	Lennox TS	230
3.	H23B	Belleville TS	Hinchinbrooke SS	230
4.	H27H	Hinchinbrooke SS	Havelock TS	230
5.	X1P	Dobbin TS	Chenaux TS	230
6.	C27P	Dobbin TS	Chat Falls GS	230
7.	T32H	Clarington TS	Havelock TS	230
8.	C25H	Chat Falls GS	Havelock TS	230
8.	T22C	Clarington TS	Chat Falls GS	230
9.	P15C	Cherrywood TS	Dobbin TS	230
10.	T25B	Clarington TS	Belleville TS	230
11.	P3S, P4S	Dobbin TS	Sidney TS	115
12.	Q6S	Cataraqui TS	Sidney TS	115
13.	B1S	Barrett Chute TS	Sidney TS	115
14.	Q3K	Cataraqui TS	Frontenac TS	115
15.	B5QK	Cataraqui TS	Frontenac TS to Barrett Chute TS	115

Appendix D: Lists of LDCs in the PtoK Region

Sr. No.	Company	Connection Type (TX/DX)
1.	Peterborough Distribution Inc.	TX / DX
2.	Elexicon Energy Inc.	TX / DX
3.	Hydro One Distribution	TX
4.	Kingston Hydro	TX / DX
5	Lakefront Utilities Inc.	DX
6.	Eastern Ontario Power Inc.	DX

Appendix E: Acronyms

Acronym	Description
A	Ampere
BES	Bulk Electric System
BPS	Bulk Power System
CDM	Conservation and Demand Management
CIA	Customer Impact Assessment
CGS	Customer Generating Station
CSS	Customer Switching Station
CTS	Customer Transformer Station
DESN	Dual Element Spot Network
DG	Distributed Generation
DS	Distribution Station
GS	Generating Station
HV	High Voltage
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
LP	Local Plan
LTE	Long Term Emergency
LTR	Limited Time Rating
LV	Low Voltage
MTS	Municipal Transformer Station
MW	Megawatt
MVA	Mega Volt-Ampere
MVAR	Mega Volt-Ampere Reactive
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NGS	Nuclear Generating Station
NPCC	Northeast Power Coordinating Council Inc.
NUG	Non-Utility Generator
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PF	Power Factor
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
SA	Scoping Assessment
SIA	System Impact Assessment
SPS	Special Protection Scheme
SS	Switching Station
STG	Steam Turbine Generator
TS	Transformer Station