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Toronto, Ontario
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NEEDS ASSESSMENT REPORT

Region: St Lawrence

Date: September 15, 2021

Prepared by: St Lawrence Region Study Team

Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the St Lawrence 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.

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Executive Summary

REGION St Lawrence Region (the "Region")

LEAD Hydro One Networks Inc. ("HONI")

START DATE: JULY 15, 2021 **END DATE:** September 15, 2021

1. INTRODUCTION

The first cycle of the Regional Planning process for the St Lawrence Region was completed in April 2016 with the publication of the Needs Assessment Report. As no further regional coordination or planning was required, the NA identified needs to be addressed between relevant Local Distribution Companies (LDCs) and Hydro One and other parties as required.

This is the second cycle of regional planning and the purpose of this Needs Assessment ("NA") is a) to identify any new needs and/or to reaffirm needs identified in the previous St Lawrence Regional Planning cycle and b) recommend which need may be i) addressed by developing a preferred plan as part of NA phase and ii) 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 St Lawrence 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 NA; 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.

The planning horizons of regional planning is considered over a 20 year time period; however, focus of this NA assessment is over the next 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"). Hydro One has also researched to find community energy plans in the region. No energy plans have been identified that would impact the assessment undertaken as part of this report. The working group will monitor and take them into consideration as they are developed.

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 of identified needs from previous cycle

a. Chesterville TS was identified to have missed customer delivery point target (frequency of interruption) due to momentary outages. After reviewing the root causes, it is recommended that no immediate action is required and the delivery point performance will continue to be monitored. Update is provided in Section **7.**

II. Newly identified needs in the region

a. Line / Station Capacity

No new transmission line or station capacity issues identified for the area.

b. Aging Infrastructure Transformer Station and Transmission Circuit Replacements

i. L22H: replacement of conductor, shieldwire, insulator and tower work (2026)

7. RECOMMENDATIONS

The Study Team recommends that Replacement of end of life asset identified in above in 6 II b. 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 and/or customers. This assessment did not identify any other needs, therefore no further regional coordination required.

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1 INTRODUCTION

The first cycle of the Regional Planning process for the St Lawrence Region was completed in April 2016 with the publication of the Needs Assessment ("NA") Report [1].

The purpose of this Needs Assessment ("NA") is to identify new needs and to reconfirm and update any needs identified in the previous St Lawrence regional planning cycle.

This report was prepared by the St Lawrence 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: St Lawrence Region Study Team Participants

Niagara Study Team
Hydro One Networks Inc. (Lead Transmitter)
Cooperative Hydro Embrun Inc.
Hydro One Distribution
Rideau St Lawrence Distribution Inc.
Independent Electricity System Operator

2 REGIONAL ISSUE/TRIGGER

In accordance with the Regional Planning process, the Regional Planning cycle should be triggered at least every five years. As such, the 2nd Regional Planning cycle was triggered for the St Lawrence region

3 SCOPE OF NEEDS ASSESSMENT

The scope of this NA covers the St Lawrence region and includes:

- Review the status of needs/plans identified in the previous NA 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 St Lawrence Region covers the southeastern part of Ontario bordering the St Lawrence River. The region starts at the Gananoque in the West and extends to the inter-provincial boundary with Quebec in the East.

The western part of the region is supplied from Hydro One owned stations connected to the 230kV network. The reminder of the region is supplied from Hydro One stations connected to the 115kV network except for St Lawrence TS which is supplied from 230kV.

The City of Cornwall is supplied by Fortis Ontario with transmission lines from Quebec and is not included in this Region. A map of the region is shown below in Figure 1.

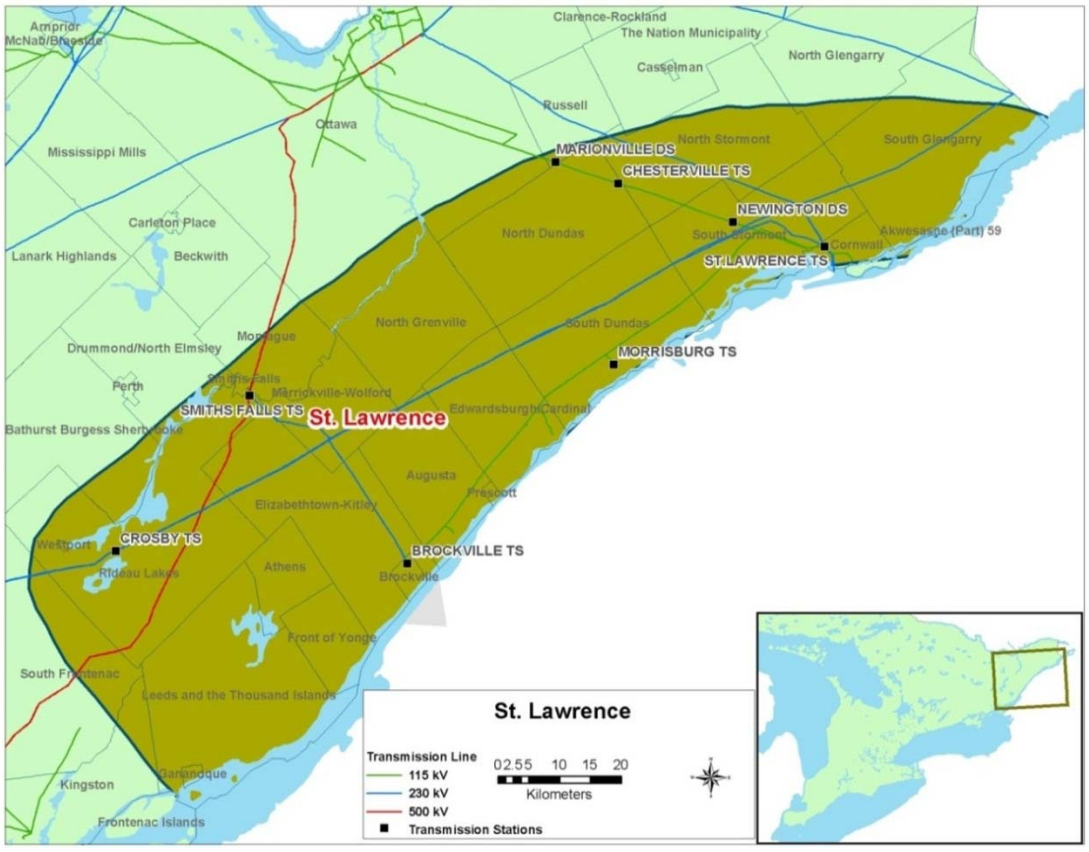

Figure 1: Map of St Lawrence Regional Planning Area

Electrical supply for this region is provided through a network of 230kV and 115kV transmission circuits. The major source of supply for this region is OPG's Saunders Hydro Electric station which connects to St Lawrence TS 230kV yard.

The St Lawrence Region is connected to the Greater Ottawa Region through 230kV circuits L24A and B31L. Circuit B31L also provides an interconnection between the Provinces of Ontario and Quebec. In addition, 115kV circuit L2M also connects St Lawrence to the Greater Ottawa Region, however this connection is normally open and is only used for load transfers between the two areas in case of system need. The Region is also connected to the Peterborough to Kingston Region through 230kV circuits L20H, L21H, and L22H.

The existing facilities in the Region are summarized below and depicted in the single line diagram shown in Figure 2 and 3.

- St Lawrence TS is the major transmission station for the region and connects to the main source of supply for the area, Saunders GS via four 230kV circuits. Also connecting to the 230kV yard of the station are two International Power Lines (IPL). These IPLs connect Ontario to the State of New York and power exchange across the IPLs are regulated using two phase shifting transformers. The station also has two 230kV/115kV 250MVA autotransformers to connect the 230kV and 115kV networks.

- Seven step-down transformer stations supply the St Lawrence Area load. At 230kV: Brockville TS, Crosby TS, Smith Falls TS, and St Lawrence TS. At 115kV: Chesterville TS, Morrisburg TS, and Newington DS.

- Two Customer Transformer Stations (CTS) are supplied in the Region from the 115kV network: Dyno Nobel Nitrogen and Enbridge Pipeline Cardinal.

- Another source of supply to the area is an existing transmission connected generating station, Cardinal Power CGS with maximum output 134MW (summer) and 184MW (winter) [4].

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

Table 2. Transmission Station and Circuits in the St Lawrence Region

115kV circuits	230kV circuits	Hydro One Transformer Stations
L1MB, L2M, L5C[1]	L20H, L21H, L22H, L24A[2], B31L[2], L33P[3], L34P[3]	Brockville TS, Chesterville TS, Crosby TS Morrisburg TS, Newington DS, Smith Falls TS St Lawrence TS*

*Stations with Autotransformers installed

[1] L5C is normally o/s, and used as a backup supply for the City of Cornwall.

[2] L24A and B31L connect to St Lawrence TS but do not have load customers connection.

[3] IPLs circuits.

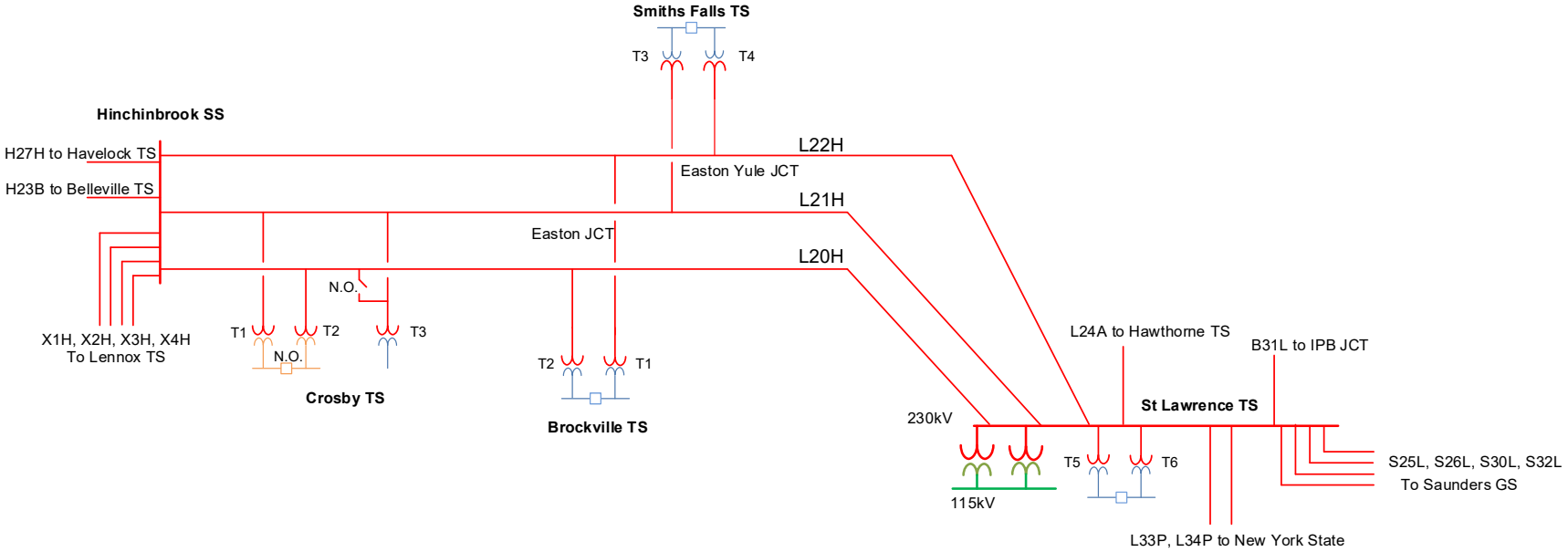

Figure 2: Single Line Diagram 230kV St Lawrence Planning Area

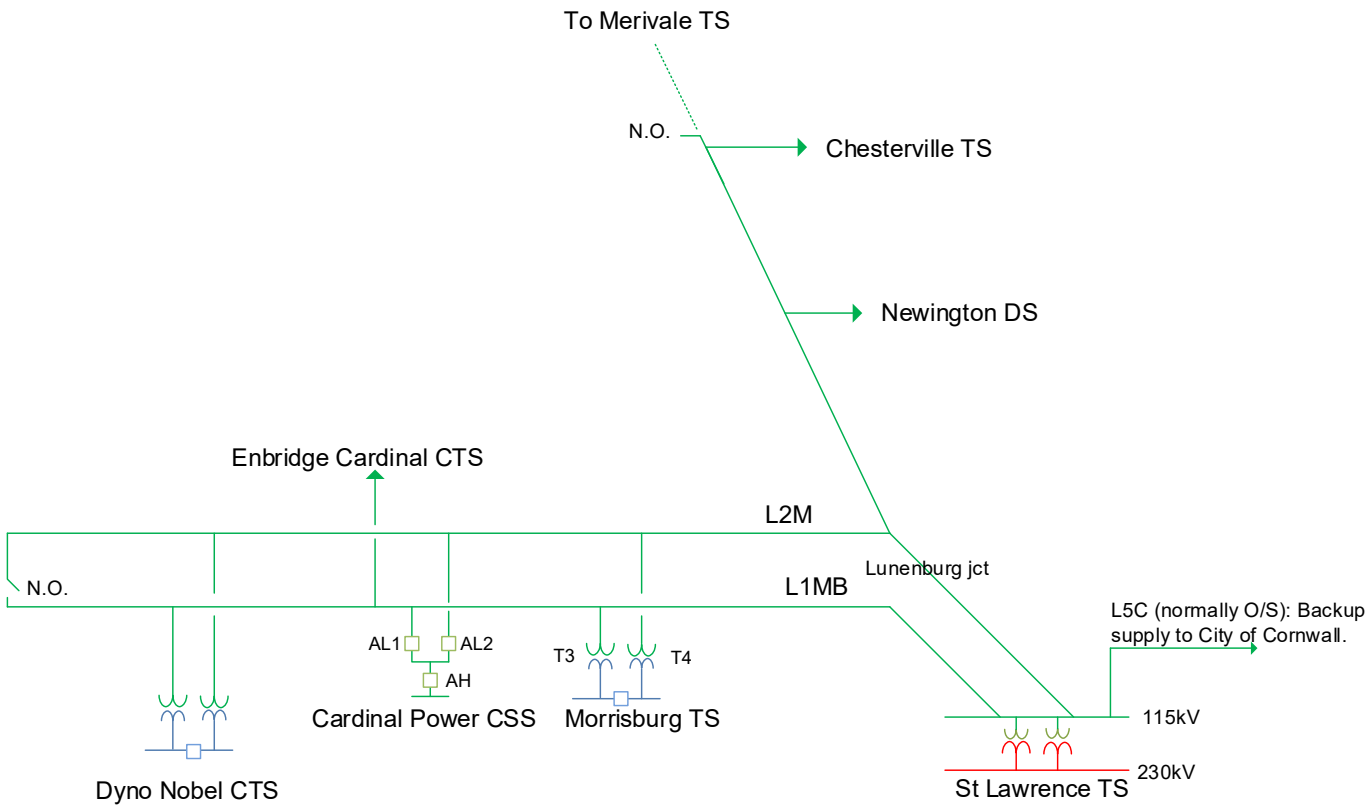

Figure 3: Single Line Diagram 115kV St Lawrence Planning Area

5 INPUTS AND DATA

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

- St Lawrence 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 St Lawrence Region.
- Hydro One has also researched to find community energy plans in the region. No energy plans have been identified that would impact the assessment undertaken as part of this report. The working group will monitor and take them into consideration as they are developed

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 St Lawrence region for the 10 year study period. The IESO provided a Conservation and Demand Management ("CDM") and Distributed Generation ("DG") forecast for the St Lawrence region. The region's extreme winter and summer non-coincident peak gross load forecasts for each station were prepared by applying the LDC load forecast growth rates to the actual 2020 summer and 2020 winter peak extreme weather corrected loads. The extreme summer / winter weather correction factors were provided by Hydro One. The net extreme weather summer / winter load forecasts were produced by reducing the gross load forecasts for each station by the percentage CDM and then by the amount of effective DG capacity provided by the IESO for that station. It is to be noted that in the long-term (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 St Lawrence 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;
- Any major high voltage equipment reaching the end of life;
- Generating station Saunders GS was assumed to generate at its average 98% of time dependable hydro generation level which is 467MW for winter and 511MW for summer.
- No power exchanges on the Ontario Eastern interconnections.
- Load forecast data was requested from industrial customers in the region. Where data was not provided, the load was assumed to be consistent with historical loads.
- The Region is winter peaking so this assessment is based on winter peak loads. However sensitivity analysis was also done using summer peak loads

7 NEEDS

This section describes emerging needs identified in the St Lawrence Region, and also reviews the near, mid, and long-term needs already identified in the previous regional planning cycle. A contingency analysis was performed for the region using the load forecast developed and no new system needs were identified.

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

Table 3: Needs Identified in the Previous Regional Planning Cycle

Type of Needs identified in the previous RP cycle	Needs Details	Current Status
Chesterville TS delivery point performance	Missed customer delivery point target (frequency of interruption) due to momentary outages (due to severe weather patterns). Action: Hydro One will review and monitor its supply point performance at Chesterville TS to determine if corrective measures are required.	In 2019, there were interruptions due to equipment issues at another station supplied by circuit L2M. Because of the nature of these interruptions, they can be considered as isolated incidents, and performance is expected to return to normal. Hydro One will continue to monitor the performance of delivery points within the region.

7.1 End-Of-Life (EOL) Equipment Needs

Hydro One have reviewed and 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 conductor

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, the 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.

The Study Team recommended continuation of these end of life asset replacement as per the plan. As per Section 7.2, under the assumptions of Regional Planning, circuit L22H is adequate over the study period. However the circuit is also used for bulk power transfers across Ontario. Determination of whether upgrade to the capacity of this section of circuit L22H is required for power bulk transfer will be reviewed as part of Bulk Planning studies completed by IESO and Hydro One.

Station/Circuit	Proposed I/S	Description
Circuit L22H	**2026**	• This investment refurbishes a total of 65 km of 230 kV circuit L22H between Easton JCT X Hinchinbrook North JCT. Work in this project includes the replacement of conductors, shieldwire, insulators and refurbishment of lattice steel structures.

In addition to the plan mentioned above, Hydro One is in the process of replacing the two phase shifting transformers at St Lawrence TS which are used to control the power flow exchange with New York across the IPL circuits.

7.2 Station and Transmission Capacity Needs in the St Lawrence Region

The following Station and Transmission supply capacities have been reviewed and no needs have been identified in the St Lawrence region during the study period of 2021 to 2031.

7.2.1 230/115 kV Autotransformers

The 230/115 kV autotransformers at St Lawrence TS supplying the Region are within their ratings and are adequate to supply the forecasted load over the study period.

7.2.2 230 kV Transmission Lines

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

As discussed in previously Section 4, St Lawrence TS is connected to Saunders generating station, to the State of New York through two IPLs, and to Province Quebec interconnection through circuit B31L (Beauharnois generating station). As a results of these connections, many operating scenarios and system conditions can influence the flows on circuits L20H, L21H, and L22H. These scenarios are evaluated under Bulk planning and are not part of the scope of the Needs Assessment. However it should be noted that there is a generation rejection scheme in place that can runback Saunders GS and/or Beauharnois GS under post-contingency conditions. This scheme ensures that the St Lawrence to Hinchinbrook TS lines are not overloaded under peak summer conditions.

7.2.3 115kV Transmission Lines

The 115kV circuits supplying the Region are adequate over the study period for the loss of a single 115kV circuit in the Region under the study assumptions of the Needs Assessment.

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) Transformer stations

All the transformer stations in the region are forecasted to remain within their normal supply capacity during the study period. Capacity needs for these stations will be reviewed in the next planning cycle.

Depending on the load growth and the future decisions on contracts for distributed energy resources connected to the station, the capacity of some stations could be reached in the long term (10+ years). The Working Group will continue to monitor the load growth at the stations and will re-evaluate the capacity at the next planning cycle.

7.2.5 115kV System

The distributed energy resources (DER) connected to the 115kV stations of the area and the 115kV generating station have resulted in the following identified in the Cardinal Power G3 Expansion SIA/CIA [3, 4]:

a) Reverse Power Flow at Morrisburg TS and Dyno Nobel CTS

At Morrisburg TS, under light load condition with high output for DER and 115kV connected generation, a reverse power flow issue was identified. This situation occurs if one of the line breakers at Cardinal Power has an inadvertent opening (IBO). This IBO results in all of Cardinal Power's generation being sent to one line, which causes reverse power at Morrisburg TS beyond its maximum limit. Additional generation connection has been restricted at Morrisburg TS to manage the reverse power flow at the station.

Under the same conditions mentioned above, an IBO at Cardinal Power can also result in power flow through the Dyno Nobel CTS transformers to exceed their rating.

For Morrisburg TS and Dyno Nobel CTS transformer loading issues, Cardinal Power run back scheme is triggered to reduce the flows to within equipment ratings as it was outlined in the SIA and CIA [3, 4]. No further action is recommended within the scope of this regional planning.

b) L2M/L1MB

Under light load condition and with all distributed generation in the area and the Cardinal Power generation at maximum output the section of the L1MB/L2M line between St Lawrence to Lunenburg JCT can be loaded beyond its short time emergency (STE) rating for loss of either circuit [3,4].

To manage the situation, Morrisburg TS has been restricted to accept new generation connection. In addition, there is Cardinal Power's runback scheme which will reduce the plant output following the loss of either circuit and hence reduce the post-contingency loading on either of the L1MB/L2M lines. However since the lines could be loaded beyond their STE, measures such generation re-dispatch is implemented by the IESO as per the Cardinal Power G3 Expansion studies [3, 4].

7.3 System Reliability, Operation and Restoration Review

No new significant system reliability and operating issues identified for this Region. Based on the net 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.

8 CONCLUSION AND RECOMMENDATIONS

The Study Team recommends that refurbishment of L22H between Easton JCT X Hinchinbrook North JCT does not require further regional coordination. The implementation and execution plan for this need will be coordinated by Hydro One with affected LDCs. However, IESO led Bulk Planning Studies will review and confirm if there are any changes required to Hydro One refurbishment plan before the end of Q3 2022. No other needs have been identified that require regional coordination.

9 REFERENCES

1. Needs Assessment Report – St Lawrence – April 2016
2. IESO Ontario Resource and Transmission Assessment Criteria (ORTAC) – Issue 5.0
3. Cardinal Power 15MW Plant Expansion SIA (2011-432)
4. Cardinal Power 15MW Plant Expansion CIA

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

Station		LTR (MW)	Type	Near Term Forecast (MW)					Medium Term Forecast (MW)					Long Term Forecast (MW)				
				2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2033	2035	2037	2039
Brockville TS	T1/T2	166.2	Load	125.3	130.2	134.6	138.1	140.8	141.9	143.2	144.5	145.7	146.9	148.0	150.2	152.6	154.9	157.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-45.3	-45.3	-45.3
			CDM	0.8	1.8	2.8	3.6	4.2	4.4	4.6	4.7	5.2	5.5	5.6	5.8	7.1	6.8	6.4
			NET	124.5	128.4	131.8	134.5	136.7	137.5	138.6	139.8	140.5	141.4	142.4	144.9	190.8	193.4	196.0
			NET_DG	124.5	128.4	131.8	134.5	136.7	137.5	138.6	139.8	140.5	141.4	142.4	144.4	147.1	149.6	152.2
Chesterville TS	T1/T2	56.7	Load	39.5	39.8	40.1	40.4	40.6	40.9	41.2	41.4	41.7	41.9	42.1	42.6	43.0	43.4	43.8
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.4
			CDM	0.3	0.5	0.8	1.0	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.6	1.6	1.5	1.4
			NET	39.2	39.2	39.3	39.3	39.4	39.6	39.9	40.1	40.2	40.3	40.5	40.9	41.6	42.1	42.8
			NET_DG	39.2	39.2	39.3	39.3	39.4	39.6	39.9	40.1	40.2	40.3	40.5	40.9	41.5	42.0	42.4
Crosby TS	T1/T2	65.6	Load	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	15.0	15.2	15.4	15.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5
			NET	13.7	13.7	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.2	14.3	14.4	14.7	14.9	15.1
			NET_DG	13.7	13.7	13.7	13.8	13.8	13.9	14.0	14.1	14.1	14.2	14.3	14.4	14.7	14.9	15.1
Crosby TS	T3	75.0	Load	22.7	23.0	23.2	23.4	23.6	23.7	24.0	24.2	24.3	24.5	24.7	25.1	25.4	25.8	26.1
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.2	0.3	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	0.9	0.9	0.8
			NET	22.6	22.6	22.7	22.8	22.9	23.0	23.2	23.4	23.5	23.6	23.8	24.1	24.5	24.9	25.3
			NET_DG	22.6	22.6	22.7	22.8	22.9	23.0	23.2	23.4	23.5	23.6	23.8	24.1	24.5	24.9	25.3
Morrisburg TS	T3/T4	127.2	Load	56.3	59.1	62.0	62.6	63.2	63.7	64.4	65.0	65.7	66.3	66.8	68.1	69.3	70.6	71.9
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-11.3	-11.3	-11.3	-11.3
			CDM	0.4	0.8	1.3	1.6	1.9	2.0	2.1	2.1	2.3	2.5	2.5	3.1	2.9	2.8	2.6
			NET	55.9	58.3	60.8	61.0	61.3	61.8	62.3	62.9	63.4	63.8	64.3	76.4	77.8	79.1	80.6
			NET_DG	55.9	58.3	60.8	61.0	61.3	61.8	62.3	62.9	63.4	63.8	64.3	65.5	66.8	68.2	69.6
Newington DS	-	13.5	Load	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
			NET	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4
			NET_DG	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.4	2.4	2.4
Smiths Falls TS	T3/T4	176.4	Load	114.1	117.4	119.7	120.4	121.1	121.9	122.7	123.6	124.4	125.1	125.8	127.3	128.7	130.1	131.5
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.8	1.6	2.5	3.1	3.6	3.8	4.0	4.0	4.4	4.7	4.8	4.9	4.6	4.4	4.2
			NET	113.3	115.8	117.2	117.3	117.5	118.1	118.8	119.5	120.0	120.4	121.0	122.4	124.1	125.7	127.4
			NET_DG	113.3	115.8	117.2	117.3	117.5	118.1	118.8	119.5	120.0	120.4	121.0	122.4	124.1	125.7	127.4
St. Lawrence TS	T5/T6	183.5	Load	40.1	40.4	40.7	40.9	41.1	41.3	41.5	41.8	42.0	42.1	42.3	42.7	43.0	43.3	43.7
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.3	0.5	0.8	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.5	1.5	1.4
			NET	39.8	39.8	39.9	39.8	39.9	40.0	40.2	40.4	40.5	40.6	40.7	41.0	41.5	41.9	42.3
			NET_DG	39.8	39.8	39.9	39.8	39.9	40.0	40.2	40.4	40.5	40.6	40.7	41.0	41.5	41.9	42.3

Table A.1: St Lawrence Region Winter Non-Coincident Load Forecast

Please note: In the table above NET assumes DG contracts begin to expire and NET_DG assumes DGs remain.

Transformer Station		LTR (MW)	Type	Near Term Forecast (MW)					Medium Term Forecast (MW)					Long Term Forecast (MW)				
				2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2033	2035	2037	2039
Brockville TS	T1/T2	145.6	Load	97.3	101.4	105.2	108.0	110.2	111.2	112.1	113.1	114.0	114.9	115.8	117.6	119.5	121.3	123.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.5	-4.6	-49.5	-49.5
			CDM	0.5	1.6	2.8	3.7	4.4	4.6	5.0	5.1	5.3	5.3	5.2	5.2	4.8	6.4	6.4
			NET	96.8	99.8	102.4	104.3	105.9	106.5	107.1	107.9	108.8	109.6	110.6	117.0	119.3	164.3	166.3
			NET_DG	96.8	99.8	102.4	104.3	105.9	106.5	107.1	107.9	108.8	109.6	110.6	112.6	114.9	116.7	118.6
Chesterville TS	T1/T2	52.9	Load	36.1	36.6	37.0	37.2	37.3	37.6	37.9	38.1	38.4	38.6	38.8	39.2	39.6	40.0	40.3
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-3.0	-3.0	-3.2
			CDM	0.2	0.6	1.0	1.3	1.5	1.6	1.7	1.7	1.8	1.8	1.7	1.7	1.7	1.6	1.6
			NET	35.9	36.0	36.0	35.9	35.9	36.0	36.2	36.4	36.6	36.8	37.1	37.6	40.9	41.3	42.0
			NET_DG	35.9	36.0	36.0	35.9	35.9	36.0	36.2	36.4	36.6	36.8	37.0	37.5	38.0	38.5	38.9
Crosby TS	T1/T2	57.6	Load	12.0	12.1	12.3	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.3	13.4	13.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	-3.0	-3.0
			CDM	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
			NET	11.9	11.9	11.9	11.9	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.6	15.6	15.8	16.0
			NET_DG	11.9	11.9	11.9	11.9	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.6	12.8	12.9	13.1
Crosby TS	T3	75.0	Load	21.6	21.9	22.2	22.4	22.5	22.7	22.9	23.1	23.3	23.4	23.6	23.9	24.3	24.6	24.9
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.1	-5.5	-5.5	-5.5
			CDM	0.1	0.4	0.6	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.1	1.1
			NET	21.5	21.5	21.6	21.6	21.6	21.7	21.9	22.0	22.2	22.3	22.5	26.9	28.6	29.0	29.3
			NET_DG	21.5	21.5	21.6	21.6	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.9	23.3	23.7	24.0
Morrisburg TS	T3/T4	115.2	Load	48.7	51.3	53.9	54.4	54.9	55.4	55.9	56.5	57.0	57.5	58.1	59.2	60.3	61.4	62.4
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.8	-6.8	-6.8
			CDM	0.2	0.8	1.4	1.8	2.2	2.3	2.5	2.6	2.6	2.7	2.6	2.5	2.6	2.6	2.6
			NET	48.5	50.5	52.5	52.5	52.7	53.0	53.4	54.0	54.4	54.9	55.5	56.7	64.5	65.6	66.7
			NET_DG	48.5	50.5	52.5	52.5	52.7	53.0	53.4	54.0	54.4	54.9	55.5	56.7	58.0	59.1	60.1
Newington DS	-	13.5	Load	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.2	2.2
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			CDM	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
			NET	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2
			NET_DG	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1	2.2
Smiths Falls TS	T3/T4	154.9	Load	92.9	95.8	97.9	98.5	99.0	99.7	100.4	101.1	101.7	102.3	102.9	104.1	105.3	106.4	107.6
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.8	-7.9	-11.0	-11.2	-11.2
			CDM	0.5	1.5	2.6	3.3	3.9	4.2	4.4	4.6	4.7	4.8	4.7	4.7	4.5	4.4	4.4
			NET	92.4	94.3	95.3	95.1	95.1	95.5	95.9	96.5	97.0	97.6	100.9	107.2	111.7	113.2	114.4
			NET_DG	92.4	94.3	95.3	95.1	95.1	95.5	95.9	96.5	97.0	97.6	98.3	99.7	101.2	102.4	103.6
St. Lawrence TS	T5/T6	168.1	Load	33.3	33.6	33.9	34.1	34.2	34.4	34.6	34.8	35.0	35.1	35.3	35.6	35.9	36.1	36.4
			DG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.9	-8.3	-8.3	-9.7
			CDM	0.2	0.5	0.9	1.2	1.4	1.4	1.5	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7
			NET	33.1	33.1	33.0	32.9	32.9	33.0	33.1	33.2	33.4	33.5	33.7	36.8	42.5	42.8	44.4
			NET_DG	33.1	33.1	33.0	32.9	32.9	33.0	33.1	33.2	33.4	33.5	33.7	34.1	34.5	34.8	35.0

Table A.2: St Lawrence Region Summer Non-Coincident Load Forecast

Please note: In the table above NET assumes DG contracts begin to expire and NET_DG assumes DGs remain.

Appendix B: Lists of Step-Down Transformer Stations

Sr. No.	Transformer Stations	Voltages (kV)
1.	Brockville TS (T1/T2)	230/44
2.	Chesterville TS (T1/T2)	115/44
3.	Crosby TS (T1/T2)	230/27.6
4.	Crosby T3	230/44
5.	Morrisburg TS (T3/T4)	115/44
6.	Newington DS	115/27.6
7.	Smith Falls TS (T3/T4)	230/44
8.	St Lawrence TS (T5/T6)	230/44

Appendix C: Lists of Transmission Circuits

Sr. No.	Circuit ID	From Station	To Station	Voltage (kV)
1	L20H, L21H, L22H	St Lawrence TS	Hinchinbrook TS	230k
2	L1MB	St Lawrence TS	Brockville TS	115kV
3	L2M	St Lawrence TS	Brockville TS/ Merivale TS	115kV

Appendix D: 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