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

NEEDS ASSESSMENT REPORT

Region: Chatham-Kent/Lambton/Sarnia

Date: September 30, 2021

Prepared by: Chatham-Kent/Lambton/Sarnia Study Team

This report is prepared on behalf of the Chatham-Kent/Sarnia/Lambton regional planning study team with the participation of representatives from the following organizations:

Organizations
Hydro One Networks Inc. (Lead Transmitter)
Independent Electricity System Operator
Bluewater Power Distribution Corporation
Entegrus Inc.
Hydro One Networks Inc. (Distribution)

Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the Chatham-Kent/Lambton/Sarnia 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 re-evaluated 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.

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NEEDS ASSESSMENT EXECUTIVE SUMMARY

NAME	Chatham-Kent/Lambton/Sarnia Study Team		
LEAD	Hydro One Networks Inc.		
REGION	Chatham-Kent/Lambton/Sarnia		
START DATE	June 4, 2021	**END DATE**	September 30, 2021

1. INTRODUCTION

The purpose of this Needs Assessment report is to undertake an assessment of the Chatham-Kent/Lambton/Sarnia 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, the Independent Electricity System Operator (IESO) will initiate the Scoping Assessment 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

In response to the Ontario Energy Board's (OEB) Regional Infrastructure Planning process approved in August 2013, the first cycle of regional planning process for the Chatham-Kent/Lambton/Sarnia Region began with Needs Assessment in April 2016 and was completed in August 2017 with the Regional Infrastructure Plan. In accordance with the Regional Planning process, the regional planning cycle should be triggered at least every five years. In light of this mandate, the Needs Assessment for the 2nd Regional Planning cycle for Chatham-Kent/Lambton/Sarnia Region was triggered on June 4th 2021 and completed on September 30, 2021.

3. SCOPE OF NEEDS ASSESSMENT

The scope of this Needs Assessment was limited to the next 10 years as per the recommendations of the Planning Process Working Group Report to the OEB.

The scope of the Needs Assessment includes a review of transmission system capability which covers transformer station capacity, transmission circuit thermal capacity, voltage performance and load restoration. System reliability, operational issues and asset replacement plans were also briefly reviewed as part of this Needs Assessment.

Needs emerging over the next 10 years and requiring coordinated regional planning may be further assessed as part of the IESO-led Scoping Assessment and/or IRRP, or in the next planning cycle. If required, an IRRP will develop a 20-year strategic direction for the Region.

4. INPUTS/DATA

Study team participants, including representatives from LDCs, the IESO, and Hydro One transmission provided information for the Chatham-Kent/Lambton/Sarnia Region. The information included: planning activities already underway, historical load, load forecast, conservation and demand management (CDM) and distributed generation (DG) information, system reliability performance, operational issues and major equipment approaching end-of-life (EOL).

5. ASSESSMENT METHODOLOGY

The assessment's primary objective was to identify the electrical infrastructure needs in the Region over the study period (2021 – 2030). The assessment reviewed available information and load forecasts and included single contingency analysis to identify needs.

6. RESULTS

Transmission Capacity Needs

A. 230/115 kV Autotransformer Capacity

- Based on the gross regional-coincident load forecast, the 230/115 kV autotransformer capacity (Scott TS) supplying the Region is adequate over the study period for the loss of a single 230/115 kV autotransformer in the Region.

B. 230 kV Transmission Lines

- Based on the gross regional-coincident load forecast, 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, under the assumption that an IESO bulk system study is recommending reinforcement of the 230 kV Lambton-by-Chatham corridor to resolve thermal violations with additional load growth at Dresden and in Windsor-Essex.

C. 115 kV Transmission Lines

- Based on the gross regional-coincident load forecast, the 115 kV circuits supplying the Region are adequate over the study period for the loss of a single 115 kV circuit in the Region. However, if we consider the drastic load growth that could occur at Wallaceburg TS in the absence of a new Dresden area station, the 115kV circuit supplying Wallaceburg TS would exceed its thermal rating.

D. 230 kV and 115 kV Connection Facilities

- Large customer connection requests at Wallaceburg TS would result in the Limited Time Rating (LTR) being exceeded in 2022, however facilitating these connections on the proposed Dresden TS would result in adequate supply at Wallaceburg TS over the study period. A separate study team was formed in October 2019 to work on the Dresden area load connection requests that proposed that the best connection point for additional load would be a new load station is in the Dresden area (Dresden TS), however the results were deferred until the IESO's bulk study was conducted, which was recently published on September 23, 2021.

System Reliability, Operation and Restoration Needs

A. Load Security

- Based on the gross regional-coincident load forecast and the existing transmission configuration, load security criteria can be met over the study period.

B. Load Restoration

- Based on the gross regional-coincident load forecasts with the use of existing transmission infrastructure, restoration criteria can be met over the study period.

C. Voltage Performance

- Under gross regional-coincident peak load conditions, post-contingency voltage at all transformer stations in the region meet Market Rule requirements.

D. Bulk Power System Performance in the Region

- Based on the assumed system study conditions and needs in neighbouring regions, a bulk power system issue was identified in the Region. Reinforcement of the 230kV corridor between Lambton TS and Chatham TS is required.

Aging Infrastructure / Replacement Plan

During the study period, plans to replace aged equipment at stations and several transmission circuits will take place. Further details of these investments can be found in Section 6.4 of this report.

7. RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team recommends that regional planning is required to develop a plan to address the high demand for capacity near Wallaceburg TS as well as a plan to coordinate the connection of the proposed Dresden TS with bulk recommendations in the area.

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1 INTRODUCTION

This Needs Assessment report provides a description of the analysis to identify needs that may be emerging in the Chatham-Kent/Lambton/Sarnia (the Region) over the next ten years. The development of the Needs Assessment 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 OEB.

The purpose of this second cycle Needs Assessment report is to: review the status of needs identified in the previous Regional Planning cycle; consider the information from planning activities already underway; undertake an assessment of the Chatham-Kent/Lambton/Sarnia Region to identify 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 LDCs or other connecting customer(s) will further undertake planning assessments to develop options and recommend solution(s). For needs that require further regional planning and coordination, the Independent Electricity System Operator (the IESO) will initiate the Scoping Assessment 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.

This report was prepared by Hydro One (Lead Transmitter) with input from the Chatham-Kent/Lambton/Sarnia Region Needs Assessment study team listed in Table 1. The report captures the results of the assessment based on information provided by LDCs and the IESO.

Table 1: Study team participants for Chatham-Kent/Lambton/Sarnia Region

No.	Organizations
1.	Hydro One Networks Inc. (Lead Transmitter)
2.	Independent Electricity System Operator
3.	Bluewater Power Distribution Corporation
4.	Entegrus Power Lines Inc.
5.	Hydro One Networks Inc. (Distribution)

2 REGIONAL ISSUE / TRIGGER

In response to the Ontario Energy Board's (OEB) Regional Infrastructure Planning process approved in August 2013, the first cycle of regional planning process for the Chatham-Kent/Lambton/Sarnia Region began with the Needs Assessment in April 2016 and was completed in August 2017 with the Regional Infrastructure Plan. In accordance with the Regional Planning process, the regional planning cycle should be triggered at least every five years. In light of this mandate, the Needs Assessment for the 2nd Regional Planning cycle for Chatham-Kent/Lambton/Sarnia Region was triggered on June 4th 2021 and completed on September 30, 2021.

3 SCOPE OF NEEDS ASSESSMENT

This Needs Assessment covers the Chatham-Kent/Lambton/Sarnia Region over an assessment period of 10 years, from 2021 to 2030. The scope of the Needs Assessment includes a review of transmission system connection facility capability which covers transformer station capacity, transmission circuit thermal capacity, voltage performance and load restoration. System reliability, operational issues and asset replacement plans were also briefly reviewed as part of this Needs Assessment.

3.1 Chatham-Kent/Lambton/Sarnia Region Description and Connection Configuration

The region includes the municipalities of Lambton Shores and Chatham-Kent, as well as the townships of Petrolia, Plympton-Wyoming, Brooke-Alvinston, Dawn-Euphemia, Enniskillen, St. Clair, Warwick, and Villages of Oil Springs and Point Edward. The area is bordered by the London area to the east and Windsor-Essex to the southwest.
Figure 1 illustrates the approximate study area.

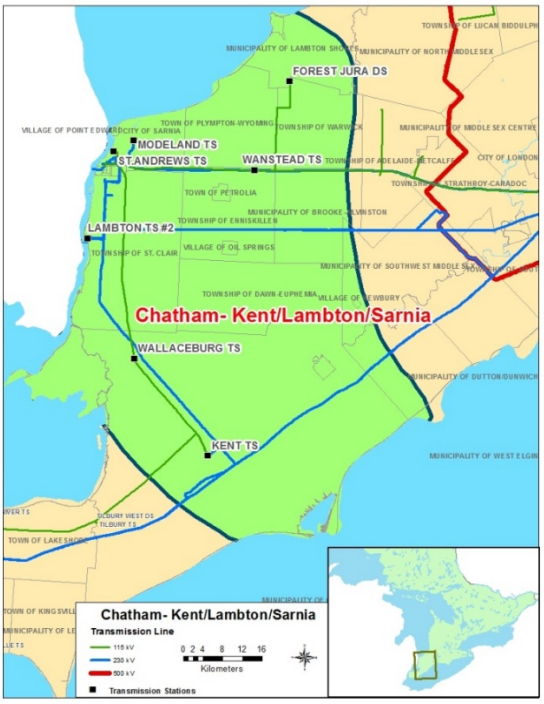

Figure 1: Map of Chatham-Kent/Lambton/Sarnia Region

Electricity supply for the Region is provided through a network of 230 kV and 115 kV transmission lines. The bulk of the electrical supply is transmitted through 230 kV circuits (N21W, N22W, L24L, L26L, W44LC and W45LS) between Longwood TS/Buchanan TS and Lambton TS/Scott TS/Chatham SS, and 230 kV circuits L28C and L29C towards Chatham SS. This Region also contains a number of interconnections with neighboring Michigan State (B3N, L4D and L51D)

Listed in Table 2 and shown in
Figure *2* are Hydro One transmission and transmission-connected customers' assets in the Chatham-Kent/Lambton/Sarnia Region.

Table 2: Hydro One and customer assets in Chatham-Kent/Lambton/Sarnia Region

115 kV Circuits	230 kV Circuits	Hydro One Transformer Stations	Customer Transformer Stations
N1S, N4S, N6C, N7C, S2N, N5K, K2Z	N6S, N7S, V41N, V43N, L23N, L27V, L25V, L37G, L38G, L28C, L29C, C31, W44LC, W45LS, S47C, L24L, L26L, N21W, N22W	Scott TS, Lambton TS, Kent TS, Duart TS, Modeland TS, Wanstead TS, St. Andrew TS, Wallaceburg TS	Forest Jura HVDS, CTS #1, CTS #2, CTS #3, CTS #4, CTS #5, CTS #6, CTS #7, CTS #8, CTS #9

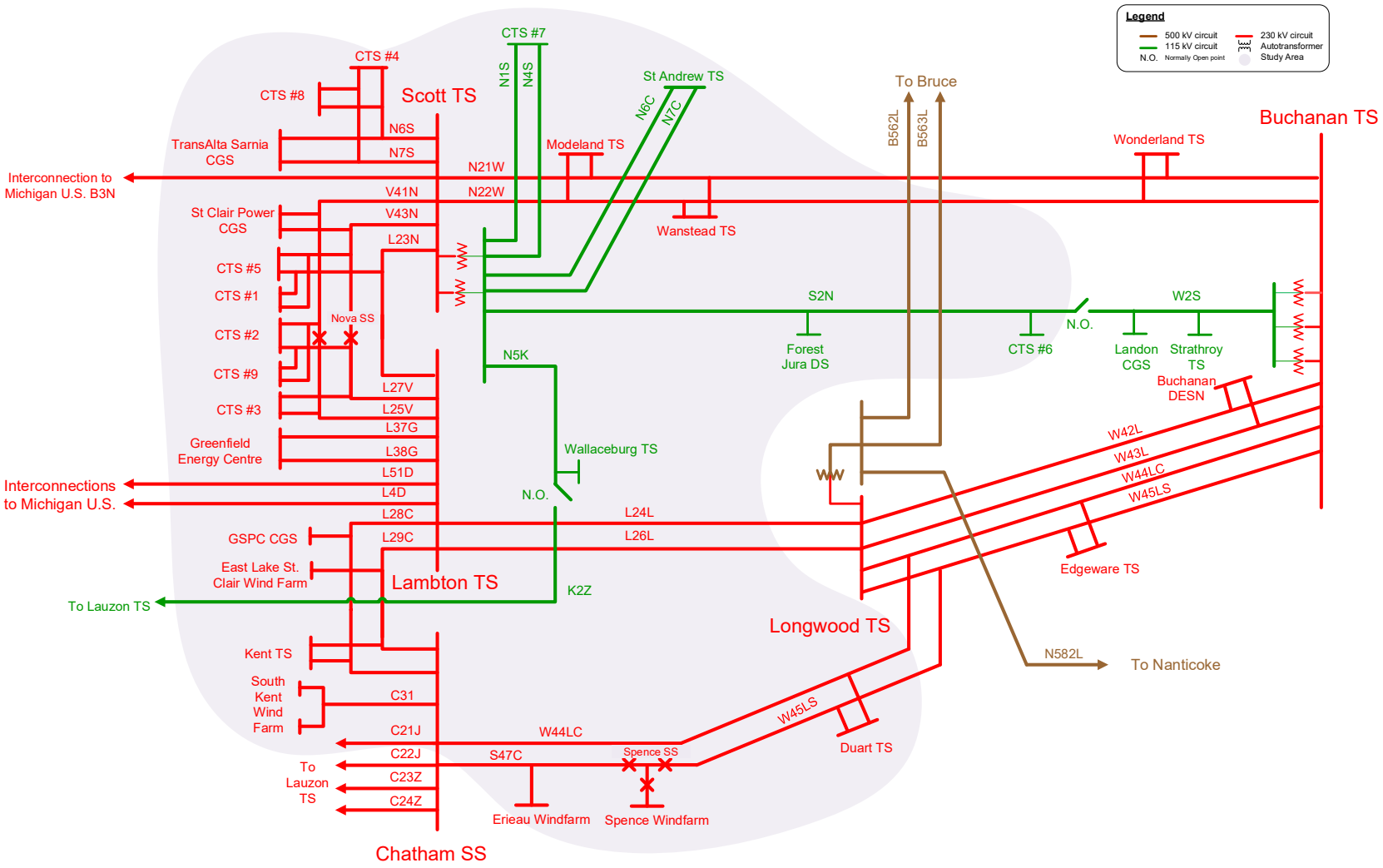

Figure 2: Single-Line diagram – Chatham-Kent/Lambton/Sarnia Region

4 INPUTS AND DATA

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

- LDCs and transmission-connected industrial customers provided historical summer and winter peak load (2018 – 2020) as well as summer and winter gross load forecast (2021 – 2030). In cases where industrial customers did not provide data, the historical peaks and forecasts were provided by Hydro One's forecasting group.
- IESO provided:
  a. List of existing reliability and operational issues
  b. Gas generation assumptions
  c. Conservation and Demand Management (CDM) and Distributed Generation (DG) data
- Hydro One (Transmission) provided:
  a. Transformer, station and circuit ratings
  b. Historical regional coincident peak load and station non-coincident peak load (IESO-verified data)
  c. Existing reliability and operation issues
- Any relevant planning information, including planned transmission and distribution investments are provided by Hydro One (Transmission) and LDCs

Based on the historical information provided, Chatham-Kent/Lambton/Sarnia Region is a summer peaking region. As such, the Needs Assessment was conducted based on summer peak load and study conditions. Further, as Hydro One Distribution has received a significant number of new customer connection requests in the area close to Kent TS and Wallaceburg TS (both stations have very limited available capacity), a new proposed station (Dresden TS) connected to 230kV circuits L28C/L29C was modelled to supply these new customer connections totaling up to 129 MW of new load. Since Dresden TS load is expected to be winter-peaking and coincides with the winter-peaking Windsor-Essex region, a winter assessment was undertaken to identify thermal violations that are expected to arise on circuits L28C/L29C. The location and connection of a new station will require further regional coordination.

4.1 Load Forecast

Based on data provided by the study team, the load in the Region is expected to grow at an average rate of approximately 2.2% annually from 2021 – 2030, with a strong average

growth rate of 3.6% from 2021 to 2025 that steps down to 1.1% for the remaining 5 years of the forecast.

Initially, the load forecast for Wallaceburg TS included large customer connection requests and resulted in the station exceeding its 10-day LTR in 2022. This initial forecast reached 112 MW by 2030 at Wallaceburg TS where the summer LTR is 51.8MVA. The study team agreed that assuming such an aggressive load growth at Wallaceburg TS was not realistic, and determined that a separate forecast be created to capture the potential new customer connections that could be supplied by the proposed new Dresden TS. The forecast for the proposed Dresden TS was included in this study.

Please refer to Appendix A for the load forecasts utilized for this Needs Assessment.

5 ASSESSMENT METHODOLOGY

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

1. The assessment considered summer and winter peak loads.
2. Load forecasts are provided by the Region's LDCs and industrial customers using historical 2020 summer peak loads as reference points.
3. The historical peak loads at Hydro One's stations are adjusted for extreme weather conditions according to Hydro One methodology.
4. The LDC and industrial customer load forecast is translated into load growth rates and is applied onto the historical, extreme weather adjusted, reference points.
5. The DG contribution is not applied to the forecast because the historical peaks used as reference points, which already accounts for existing DGs and no additional contracted DGs are forecast to connect in the planning horizon..
6. Accounting for (2), (3), (4), and (5) above, and applying CDM reductions, a net non-coincident load forecast and a net coincident load forecast are developed.
   - A net non-coincident peak load forecast was used to perform the analysis for sections 6.2.4
   - A net regional coincident peak load forecast was used to perform the analysis for sections 6.2.1 to 6.2.3, 6.3.1, 6.3.2 and 6.3.4
7. Review impact of any on-going and planned development projects in the Region during the study period.
8. Review and assess impact of any critical/major elements planned/identified to be replaced at the end of their useful life such as transformers, cables, and stations.
9. Station capacity adequacy is assessed by comparing the non–coincident peak load with the station's normal planning supply capacity by assuming a 90% lagging power factor for stations without low-voltage capacitor banks and 95% lagging power factor for stations having low-voltage capacitor banks. Normal planning supply capacity for

transformer stations in this Region is determined by the summer 10 – Day Limited Time Rating (LTR).

10. Transmission adequacy assessment is primarily based on the following criteria:
    - Regional load is set to the forecasted regional coincident peak load. Large load increases in neighbouring regions are also considered as they affect the thermal loading of circuits in CKLS region.
    - With all elements in service, the system is to be capable of supplying forecast demand with equipment loading within continuous ratings and voltages within normal range.
    - With one element out of service, the system is to be capable of supplying forecast demand with circuit loading within their long term emergency (LTE) ratings and transformers within their 10 – Day LTR.
    - All voltages must be within pre and post contingency ranges as per the Ontario Resource and Transmission Assessment Criteria (ORTAC).
    - The system to meet load security criteria as per the ORTAC, specifically, 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.
    - The system is capable of meeting the load restoration timeframes as per the ORTAC.

6 NEEDS

This section assesses the adequacy of regional infrastructure to meet the forecasted load in the Chatham-Kent/Lambton/Sarnia Region and identifies needs. The section also reviews and/or reaffirms needs already identified in the last regional planning cycle.

6.1 Review of Identified Needs in the Last Regional Planning Cycle

This section reviews the status of needs identified in the previous cycle of Regional Planning.

Kent TS T3/T4 was forecasted to exceed its 10-day LTR in 2016 and resulted in a capacity need that was addressed by implementing a permanent distribution load transfer to nearby stations with available spare capacity.

No other needs were identified.

6.2 Transmission System Capacity Needs

6.2.1 230 kV and 115 kV Autotransformers

The 230/115 kV autotransformers (Scott TS) supplying the Region are adequate over the study period for the loss of a single 230/115 kV autotransformer in the Region.

6.2.2 230 kV Transmission Lines

The 230 kV circuits are adequate over the study period for the loss of a single 230 kV circuit in the Region, however, the capacity needs in the Windsor Essex region and the Dresden area are resulting in voltage violations on circuits L28C/L28C and require the construction of another 230 kV double circuit supply between Lambton TS and Chatham SS. The recommendation for constructing the new double circuit is a result of IESO's bulk system study.

6.2.3 115 kV Transmission Lines

The 115 kV lines supplying the Region are radial single circuit lines. These 115 kV circuits have adequate capacity over the study period. However, considering drastic load growth due to new customer connection requests near Wallaceburg TS in absence of new Dresden TS, the 115 kV N5K circuit supplying Wallaceburg TS may be violating its capacity limits and risking the power system security.

6.2.4 230 kV and 115 kV Connection Facilities

A station capacity assessment was performed over the study period for the 230 kV and 115 kV transformer stations in the Region using the summer station non- coincident peak load forecasts.

In the absence of the proposed Dresden TS, there is a very high demand for available capacity at Wallaceburg TS. Assuming the load materializes as forecasted, Wallaceburg TS would be exceeding it summer LTR in 2022 and its winter LTR in 2024. However, if the proposed Dresden TS is built to supply 129MW of new customer connections, Wallaceburg TS would have 5-10 MW of spare capacity available toward the end of the study period, assuming organic load growth at the station.

A separate study team was formed in October 2019 to work on the Dresden area load connection requests that proposed the optimal location of a new supply station (proposed Dresden TS) would be in the vicinity of existing Wallaceburg TS, connected to the Lambton-to-Chatham corridor. However, this would result in bulk transfer violations, and

as a result a recommendation was deferred until after the IESO's West of London bulk plan was finalized. That bulk plan recommended a Lambton-to-Chatham reinforcement in 2028. Actions to facilitate the connection of Dresden TS ahead of that reinforcement in 2028 will require further regional coordination. With large demand for capacity in the Wallaceburg TS and Kent TS area starting in 2022, and at least 4-5 years before Dresden TS is constructed and 7 years until the Lambton-to-Chatham reinforcement is constructed, there is approximately 30-35 MW of available capacity at Kent TS (T1/T2) to facilitate the more immediate requests for capacity. This does not satisfy the forecasted demand in the area, so further regional planning is required to identify potential interim measures.

St. Andrews TS is expected to approach and exceed its existing LTR in the medium-term (5-10 years), however, the planned like-for-like replacement of the transformers and switchyard (2025 in-service) will increase the station capacity by 20 MVA and address the medium-term capacity need.

Forest Jura DS is approaching its LTR in the near-term. Loading at the station will be monitored by Hydro One Distribution to determine when the future need for additional capacity will be required.

All the other TSs in the Chatham-Kent/Lambton/Sarnia Region are forecasted to remain within their normal supply capacity during the study period.

6.3 System Reliability, Operation and Restoration Review

6.3.1 Load Security

Based on the gross regional coincident peak load forecast, with all transmission facilities in-service and coincident with an outage of the largest local generation units, all facilities are within applicable ratings. The largest local generation unit is a 230 kV-connected Greenfield Energy Centre unit on the 230 kV.

Based on the gross regional-coincident load forecast, the loss of one element will not result in load interruption greater than 150 MW by configuration, by planned load curtailment or by load rejection. In addition, under these conditions, all facilities are within their applicable ratings.

Based on the gross regional coincident load forecast, the loss of two elements will not result in load interruption greater than 600 MW by configuration, by planned load curtailment or by load rejection. In addition, under these conditions, all facilities are within their applicable ratings.

Therefore, load security criteria for the Region are met.

6.3.2 Load Restoration

Based on the gross coincident load forecast at Modeland TS, Wanstead TS and Wonderland TS, by the end of study period, the load interrupted is expected to approach 300 MW for the loss of double-circuit 230 kV line N21W and N22W. Restoring load loss in excess of 250MW within 30 min can be achieved through distribution load transfers at Modeland TS and Wonderland TS. Furthermore, N21W can be sectionalized and load can be restored from either Scott TS or Buchanan TS by use of existing switches on N21W. With the switching capabilities, magnitude of load loss can be reduced from 250 MW to less than 150 MW within 4 hours. The remaining load can be resupplied within the 4-8 hour timeframe by means of load transfers and/or switching alternate feeder supplies to neighbouring, unaffected transformer stations. Hydro One will continue to monitor load growth at stations connected to N21W/N22W and update the restoration plan on an ongoing basis as appropriate.

Based on the assumed load levels for the transmission-connected industrial customers connected to N6S and N7S, the load interrupted will exceed 150 MW for the loss of double-circuit 230kV line N6S and N7S. Hydro One crews located in Sarnia will be able to respond as quickly as possible to restore load to meet the 4-hour and 8-hour restoration criteria. It is the customer's accountability to ensure that there is onsite emergency supply for essential load or arrange for backup supply from other sources.

Therefore, load restoration criteria for the Region are met.

6.3.3 Voltage Performance

Assuming a large load growth at Wallaceburg TS in the absence of the proposed Dresden TS, there would be voltage violation occurring on the 115kV system supplying the Wallaceburg load. This violation would be mitigated with the proposed Dresden TS in place.

Under gross regional coincident peak load conditions, post-contingency voltage at a11 transformer stations in the region meet Market Rule requirements.

6.3.4 Bulk Power System Performance in the Region

Based on the study assumptions listed in Section 4, and accounting for needs in neighbouring regions, there is a bulk system need to reinforce the 230kV corridor between Lambton and Chatham. There are a number of large scale combined-cycle gas plants in

the Sarnia-Lambton area and gas-fired generation output could vary depending on broader system conditions such as expected load growth in the province or availability of other generation resources. Moreover, as previously noted in Section 3.1, the Chatham-Kent/Lambton/Sarnia Region is connected to the US market through interconnections in Sarnia and Lambton. Import and export generation levels on the interties have a significant impact on the bulk transmission system. Recognizing gas-fired generation output and import/export levels are important parameters for the bulk system performance for this Region and given the needs in neighbouring regions, the IESO undertook a study to assess the bulk system adequacy under different system conditions. As a result, the need to reinforce the Lambton-by-Chatham corridor was identified.

6.4 Aging Infrastructure and Replacement Plan of Major Equipment

Hydro One reviewed the sustainment and development initiatives that are currently planned for the replacement of any autotransformers, power transformers and high-voltage cables.

During the previous Regional Planning cycle, Wanstead TS was refurbished with 50/66/83MVA transformers, and its supply was upgraded from a single 115kV connection to a double 230kV connection. The station was placed in service at the end of 2018.

End-of-life refurbishment work was also completed on certain components at Chatham SS which included a new capacitor along with its associated breaker. This work was completed in 2020.

The following sustainment plans do not affect the results of this Needs Assessment study, but are included for completeness:

- The existing Lambton TS will be undergoing end-of-life asset replacements that include interconnection transformers T7/T8, DESN transformers T5/T6, and the 27.6kV switchyard, and is scheduled to be completed in 2023.
- The existing Scott TS will be refurbished – autotransformer T5 will be replaced like-for-like with a 250MVA unit and the 115kV switchyard will be rebuilt. This refurbishment is scheduled to be completed in 2024.
- The existing St Andrews TS will be refurbished with standard 50/66/83 MVA transformers and is scheduled to be completed in 2025. This refurbishment will result in station capacity increase of approximately 20 MVA.
- The existing Kent TS T1/T2 DESN will be refurbished and will include the replacement of T2 and the 27.6kV switchyard. T1 was replaced on demand due to a transformer failure in 2020. The refurbishment is scheduled to be completed in 2027. As a result of this refurbishment, the station capacity will increase by 35-40 MVA.

7 RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team agrees that Scoping Assessment is required at this time.

To address the high demand for capacity due to new customer connection requests at Wallaceburg TS, further regional planning is required to coordinate the connection of a new supply station Dresden TS, which otherwise cannot be accommodated until after the IESO's recommended Lambton-to-Chatham reinforcement in 2028. This plan would eliminate the need for capacity at Wallaceburg TS which is also limited by its connection to a single 115 kV circuit and would provide a more reliable connection supplied by two 230kV circuits at the proposed Dresden TS.

8 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

APPENDIX A: LOAD FORECASTS

As noted in Section 5, conservation and demand management (CDM) and distributed generation (DG) projects forecast information provided by the IESO were used to determine the net load forecast. The forecasted CDM achievement in the Chatham – Kent/ Lambton/Sarnia area is summarized in Table 3 and it represents the percentage reduction applied to gross peak demand at each station.

Table 3: CDM forecast for the Chatham- Kent/Lambton/Sarnia Region

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CDM	0.64%	1.76%	2.73%	3.44%	3.95%	4.15%	4.30%	4.30%	4.30%	4.30%

The net forecast in Table 5 and Table 6 reflects the impact of all existing DG on the area's coincident peak demand. No additional contracted resources are currently forecast to come into service during the study period.

Table 4: Chatham-Kent/Lambton/Sarnia regional net coincidental load forecast

Regional Summer Coincident Peak												
Station	Limited-Time Rating (MVA)	Historical (MW)	Forecast (MW)									
		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Duart TS	200	15.00	15.56	15.63	20.28	20.39	20.52	20.71	20.93	21.16	21.39	21.61
Forest Jura DS	18.8*	19.82	20.00	20.09	20.22	20.40	20.63	20.91	21.22	21.55	21.89	22.24
Kent TS (T1/T2)	155.6**	88.60	89.63	94.23	91.46	91.71	96.05	98.07	98.90	99.85	100.80	101.74
Kent TS (T3/T4)	59.8	41.83	42.10	42.18	42.33	42.59	42.94	43.42	43.93	44.50	45.08	45.67
Lambton TS	103.8***	58.25	58.32	58.13	58.03	58.07	58.23	58.56	58.93	59.39	59.84	60.30
Modeland TS	196.5	98.97	102.38	108.27	114.31	120.60	127.07	130.13	133.23	136.48	139.73	142.97
St. Andrews TS	101.8****	60.67	63.49	63.30	63.19	90.55	90.71	91.06	91.43	91.90	92.36	92.82
Wallaceburg TS	51.8	33.91	34.04	34.16	34.37	34.46	34.59	34.86	35.17	35.52	35.85	36.15
Wanstead TS	118.9	39.25	40.45	40.99	41.62	42.20	49.54	50.41	51.33	52.30	53.25	54.18
CTS #1	N/A	26.67	26.90	27.14	27.37	27.61	27.85	28.10	28.34	28.59	28.84	29.09
CTS #2	N/A	17.80	18.01	18.22	18.43	18.65	18.86	19.09	19.31	19.53	19.76	19.99
CTS #3	N/A	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16
CTS #4	N/A	44.34	44.63	44.92	45.22	45.51	45.81	46.11	46.41	46.71	47.02	47.32
CTS #5	N/A	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53	8.53
CTS #6	N/A	2.69	2.71	2.73	2.75	2.77	2.79	2.81	2.83	2.85	2.87	2.89
CTS #7	N/A	53.79	54.19	54.59	54.99	55.40	55.81	56.22	56.64	57.06	57.48	57.90
CTS #8	N/A	29.57	79.73	80.62	81.57	82.08	82.54	83.07	83.68	84.25	84.80	85.27
CTS #9	N/A	0.00	1.00	10.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00

* Assuming cooling not available. With cooling LTR is 31.25 MVA.

** LTR will increase to approximately 195 MVA after T2 is replaced (2027)

*** LTR will increase to approximately 120 MVA after T5/T6 are replaced (2023)

**** LTR will increase to approximately 120 MVA after T1/T2 are replaced (2025)

Table 5 : Chatham-Kent/Lambton/Sarnia regional net non-coincidental load forecast

Regional Summer Non-Coincident Peak												
Station	Limited-Time Rating (MVA)	Historical (MW)	Forecast (MW)									
		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Duart TS	200	17.52	18.17	18.25	23.69	23.81	23.96	24.19	24.44	24.72	24.98	25.23
Forest Jura DS	18.8*	26.60	26.84	26.97	27.14	27.38	27.68	28.07	28.47	28.92	29.38	29.85
Kent TS (T1/T2)	155.6**	105.10	106.31	111.78	108.49	108.78	113.94	116.33	117.31	118.45	119.57	120.68
Kent TS (T3/T4)	59.8	46.81	47.11	47.21	47.37	47.67	48.05	48.59	49.16	49.80	50.45	51.11
Lambton TS	103.8***	65.41	65.50	65.28	65.16	65.21	65.39	65.77	66.18	66.69	67.20	67.72
Modeland TS	196.5	114.81	118.76	125.59	132.60	139.89	147.40	150.94	154.54	158.31	162.08	165.84
St. Andrews TS	101.8****	65.06	68.08	67.88	67.77	97.10	97.28	97.65	98.05	98.55	99.04	99.54
Wallaceburg TS	51.8	39.11	39.26	39.41	39.65	39.75	39.91	40.21	40.56	40.97	41.35	41.70
Wanstead TS	118.9	46.42	47.84	48.49	49.23	49.91	58.60	59.63	60.71	61.86	62.98	64.09
CTS #1	N/A	32.20	32.48	32.76	33.05	33.34	33.63	33.92	34.22	34.51	34.82	35.12
CTS #2	N/A	19.35	19.57	19.80	20.03	20.27	20.51	20.75	20.99	21.23	21.48	21.73
CTS #3	N/A	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75	35.75
CTS #4	N/A	48.71	49.02	49.34	49.67	49.99	50.32	50.64	50.98	51.31	51.64	51.98
CTS #5	N/A	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96	9.96
CTS #6	N/A	2.77	2.79	2.81	2.83	2.85	2.87	2.89	2.91	2.93	2.95	2.97
CTS #7	N/A	56.08	56.50	56.92	57.34	57.76	58.19	58.62	59.05	59.49	59.93	60.37
CTS #8	N/A	112.89	113.74	114.59	115.45	116.32	117.19	118.07	118.96	119.85	120.75	121.66
CTS #9	N/A	0.00	1.00	10.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00

* Assuming cooling not available. With cooling LTR is 31.25 MVA.

** LTR will increase to approximately 195 MVA after T2 is replaced (2027)

*** LTR will increase to approximately 120 MVA after T5/T6 are replaced (2023)

**** LTR will increase to approximately 120 MVA after T1/T2 are replaced (2025)

Table 6. Dresden TS Net Summer Non-Coincident Forecast

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Load (MW)	33.45	45	43	56.3	59	59	59	59	59

Table 7. Dresden TS Net Winter Non-Coincident Forecast

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Load (MW)	50.6	60.6	80.6	109.6	128.6	128.6	128.6	128.6	128.6

APPENDIX B: KEY TERMS AND DEFINITIONS

Key terms and definitions associated with this Needs Assessment are cited here.

Normal Supply Capacity
The maximum loading that electrical equipment may be subjected to continuously under nominal ambient conditions such that no accelerated loss of equipment life would be expected.

Coincident Peak Load
The electricity demand at individual facilities at the same point in time when the total demand of the region or system is at its maximum.

Contingency
The prevalence of abnormal conditions such that elements of the power system are not available.

Conservation and Demand Management (CDM)
Programs aimed at using more of one type of energy efficiently to replace an inefficient use of another to reduce overall energy use, and influencing the amount or timing of customers' use of electricity.

Distributed Generation (DG)
Electric power generation equipment that supplies energy to nearby customers with generation capacity typically ranging from a few kW to 25 MW.

Gross Load
Amount of electricity that must be generated to meet all customers' needs as well as delivery losses, not considering any generation initiatives such as CDM and DG. It is usually expressed in MW or MVA.

Limited Time Rating (LTR)
A higher than nameplate rating that a transformer can tolerate for a short period of time

Load Forecast
Prediction of the load or demand customers will make on the electricity system

Net Load
Net of generation (e.g. CDM and DG) deducted from the Gross load

Non-Coincident Peak Load
The maximum electricity demand at an individual facility. Unlike the coincident peak, non-coincident peaks may occur at different times for different facilities.

Peak Load
The maximum load consumed or produced by a unit or group of units in a stated period of time. It may be the maximum instantaneous load or the maximum average load over a designated interval of time.

Weather Corrected Data
Load data that is adjusted to account for extreme weather conditions using an adjustment factor.

APPENDIX C: 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
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
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
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