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NEEDS ASSESSMENT REPORT

Region: Chatham-Kent/Lambton/Sarnia

Date: June 12, 2016

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 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.

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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	April 13, 2016	**END DATE**	June 12, 2016

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

The Needs Assessment for the Chatham-Kent/Lambton/Sarnia 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 - Group 1 Regions are being reviewed first. The Chatham-Kent/Lambton/Sarnia Region belongs to Group 3. The Needs Assessment for Chatham-Kent/Lambton/Sarnia Region was triggered on April 13, 2016 and was completed on June 12, 2016.

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.

5. ASSESSMENT METHODOLOGY

The assessment's primary objective was to identify the electrical infrastructure needs in the Region over the study period (2015 – 2024). 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 autotransformers 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.

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.

D. 230 kV and 115 kV Connection Facilities

- Loadings at Kent TS exceed their transformer 10-Day Long Term Rating (LTR) in 2016 based on the net load forecast.

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, no bulk power system issue was identified in the Region. The IESO might undertake planning study to access the adequacy of the bulk power system with different system conditions.

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 6.3 of this report.

7. RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team recommends Hydro One transmission and the relevant LDCs to develop a local plan to address thermal overload of transformer T3 at Kent TS.

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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 Needs Assessment report is to: 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

The Needs Assessment for the Chatham-Kent/Lambton/Sarnia 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, where Group 1 Regions are being reviewed first. The Region falls into Group 3. The Needs Assessment for this Region began on April 13, 2016 and was completed on June 12, 2016.

3 SCOPE OF NEEDS ASSESSMENT

This Needs Assessment covers the Chatham-Kent/Lambton/Sarnia Region over an assessment period of 10 years, from 2015 to 2024. 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.

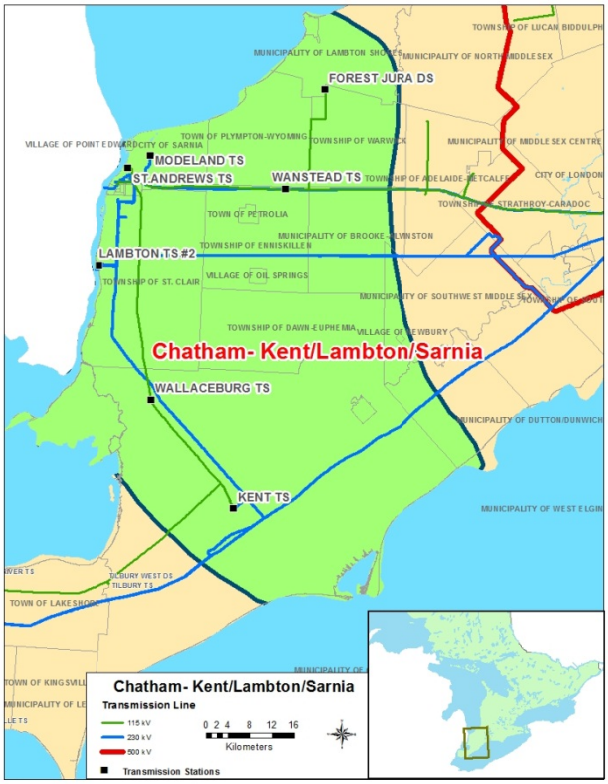

Figure 1: Map of Chatham-Kent/Lambton/Sarnia Region

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) towards Buchanan TS. 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, Customer CTS #1, Customer CTS #2, Customer CTS #3, Customer CTS #4, Customer CTS #5, Customer CTS #6, Customer CTS #7, Customer CTS #8

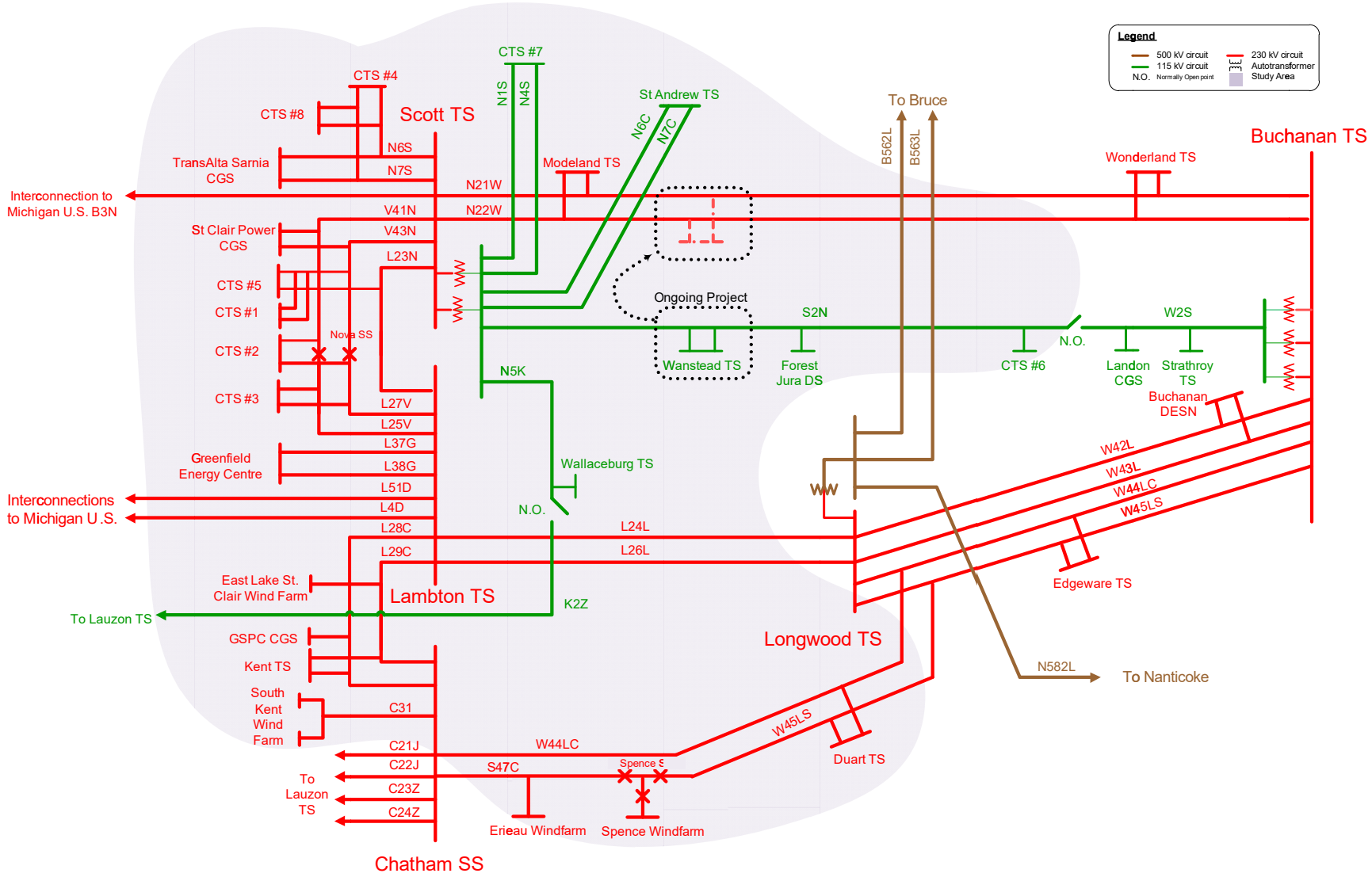

Figure 2: Single-Line diagram – Chatham-Kent/Lambton/Sarnia Region

4 INPUTS AND DATA

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

- LDCs provided historical summer (2012 – 2014) as well as summer gross load forecast (2015 – 2024)
- IESO provided:
  a. Historical regional coincident peak load and station non-coincident peak load
  b. List of existing reliability and operational issues
  c. Gas generation assumptions (See Table 3)
  d. Conservation and Demand Management (CDM) and Distributed Generation (DG) data
- Hydro One (Transmission) provided transformer, station and circuit ratings
- Hydro One (Transmission) provided existing reliability and operation issues
- Any relevant planning information, including planned transmission and distribution investments are provided by Hydro One (Transmission) and LDCs

Table 3 : Gas-fired generation output levels assumed for Needs Assessment

Gas Generators in Chatham-Kent/Lambton/Sarnia area	Maximum continuous summer outputs (MW)
Greenfield Energy Centre	1001
TransAlta Sarnia	435
St. Clair Power CGS	484
Greenfield South Power Corporation (GSPC)	283

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 studies conditions. Further, as part of Hydro One's regular sustainment assessment, Wanstead TS has been identified as reaching end-of-life and is scheduled for a complete station rebuild. Prior to launch of the Needs Assessment study, LDCs connected to the existing Wanstead TS and Hydro One had committed to rebuilding the existing Wanstead TS from the current 115 kV supply to 230 kV supply. The project is currently being assessed by the IESO as part its System Impact Assessment process (CAA ID 2015-545). As such, the Needs Assessment assumed Wanstead TS will be converted to a 230 kV station. Please refer to Section 6.3 for more details about this conversion project.

4.1 Load Forecast

Based on data provided by the study team, the summer gross coincident load in the Region is expected to grow at an average rate of approximately 1.3% annually from 2015 – 2024. Factoring in the contributions of CDM and DG, the summer net coincident load in the Region is expected to grow at an average rate of approximately 0.2% annually from 2015 – 2024.

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 is based on summer peak loads.
2. Load forecasts are provided by the Region's LDCs using historical 2015 summer peak loads as reference points.
3. For the purpose of Needs Assessment, 2014 historical load levels were assumed for transmission connected industrial customers throughout the study period.
4. The historical peak loads at Hydro One's stations are adjusted for extreme weather conditions according to Hydro One methodology.
5. The LDC's load forecast is translated into load growth rates and is applied onto the historical, extreme weather adjusted, reference points.
6. Accounting for (2), (3), (4), and (5) above, a gross load forecast and a net load forecast are developed. The gross load forecast is used to develop a worst case scenario to identify needs. Where there are issues, the net forecast, which accounts for CDM and DG, is 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 sections 6.1.4
   - A gross and net regional coincident peak load forecast was used to perform the analysis for sections 6.1.1 to 6.1.3, 6.2.1, 6.2.2 and 6.2.4
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 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).

10. Transmission adequacy assessment is primarily based on the following criteria:
    - Regional load is set to the forecasted regional coincident peak load.
    - 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 RESULTS

This section summarizes the results of the Needs Assessment in the Chatham–Kent/Lambton/Sarnia Region.

6.1 Transmission System Capacity Needs

6.1.1 230 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.

6.1.2 230 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.

6.1.3 115 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.

6.1.4 230 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.

Kent TS T3/T4 is forecasted to exceed its 10 – Day LTR in 2016 based on the net load forecast (approximately 119% Summer 10 – Day LTR in 2016).

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

6.2 System Reliability, Operation and Restoration Review

6.2.1 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.

6.2.2 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 240 MW for the loss of double-circuit 230 kV line N21W and N22W. Presently, 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 the peak level of over 240 MW to less than 150 MW within 4 hours. The remaining load can be resupplied within the 4-8 hours 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 hours and 8 hours 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.

6.2.3 Voltage Performance

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

6.2.4 Bulk Power System Performance in the Region

Based on the study assumptions listed in Section 4, no issue was identified for bulk power system in the Region. It is noted that, however, 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, the IESO might undertake further study to assess the bulk system adequacy under different system conditions. At the launch of the said study, Hydro One will work with the IESO and solicit inputs from other entities such as large transmission connected industrial customers as required.

6.3 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. As mentioned in earlier section, the existing Wanstead TS will be refurbished, with standard 50/66/83 MVA transformers and is scheduled to be completed in 2018. Prior to launch of this study, the LDCs connecting to Wanstead TS and Hydro One had discussed and committed to converting the station from 115 kV to 230 kV

connecting to 230 kV circuits N21W and N22W. The Needs Assessment study had included this committed project in the area network setup.

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

- The existing St Andrews TS will be refurbished with standard 50/66/83 MVA transformers 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 is scheduled to be completed in 2022.

7 RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team agrees that Scoping Assessment is not required at this time.

For thermal overload of transformer T3 at Kent TS, considering there is adequate regional supply capacity to accommodate expected load growth, it is the study team's recommendation that no further regional coordination is required. Further, the study team recommends Hydro One transmission and the relevant distributors to develop a local plan ("Kent TS – T3 Capacity Limitation") for this need.

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 4 and it represents the percentage reduction applied to gross peak demand at each station.

Table 4 : CDM forecast for the Chatham- Kent/Lambton/Sarnia Region

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
CDM	0.96%	2.04%	2.74%	3.84%	4.86%	5.68%	6.25%	6.83%	7.22%	7.72%

The DG information shown in Table 5 and Table 6 reflects all generation contracts with the IESO in the Chatham – Kent/Lambton/Sarnia area: FIT, microFIT and CHPSOP. Further, the DG information represents the cumulative, effective capacity to meeting area peak demand.

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

		Historical	Forecast									
Station	Data	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Duart TS	Coincidental Gross Load		14.66	14.87	15.09	15.30	15.52	15.74	15.97	16.20	16.43	16.66
	Coincidental CDM		0.14	0.30	0.41	0.59	0.75	0.89	1.00	1.11	1.19	1.29
	DG		0.07	0.07	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Coincidental Net Load	14.46	14.45	14.50	14.42	14.46	14.52	14.60	14.72	14.84	14.99	15.12
Forest Jura DS	Coincidental Gross Load		19.69	20.03	20.37	20.72	21.07	21.43	21.80	22.17	22.55	22.93
	Coincidental CDM		0.19	0.41	0.56	0.80	1.02	1.22	1.36	1.51	1.63	1.77
	DG		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Coincidental Net Load	19.36	19.49	19.60	19.80	19.91	20.03	20.20	20.42	20.64	20.90	21.14
Kent TS T1/T2	Coincidental Gross Load		71.05	72.70	74.38	76.11	77.88	79.70	81.56	83.46	85.42	87.42
	Coincidental CDM		0.68	1.48	2.04	2.92	3.78	4.53	5.10	5.70	6.16	6.75
	DG		0.53	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Coincidental Net Load	69.45	69.84	70.01	71.14	71.98	72.90	73.96	75.25	76.56	78.05	79.47
Kent TS T3/T4	Coincidental Gross Load		40.82	41.72	42.64	43.58	44.55	45.54	46.56	47.60	48.67	49.76
	Coincidental CDM		0.39	0.85	1.17	1.67	2.16	2.59	2.91	3.25	3.51	3.84
	DG		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	Coincidental Net Load	39.95	40.27	40.71	41.31	41.75	42.23	42.79	43.49	44.19	45.00	45.76
Lambton TS	Coincidental Gross Load		62.25	62.87	63.49	64.12	64.76	65.40	66.05	66.70	67.36	68.03
	Coincidental CDM		0.60	1.28	1.74	2.46	3.14	3.72	4.13	4.55	4.86	5.25
	DG		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Coincidental Net Load	61.64	61.66	61.59	61.75	61.66	61.61	61.68	61.92	62.15	62.50	62.78
Modeland TS	Coincidental Gross Load		82.93	83.27	83.61	83.96	84.30	84.65	84.99	85.34	85.69	86.04
	Coincidental CDM		0.80	1.70	2.29	3.22	4.09	4.81	5.32	5.82	6.18	6.64
	DG		0.02	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	Coincidental Net Load	82.59	82.11	81.41	81.16	80.57	80.05	79.67	79.52	79.36	79.35	79.24
St. Andrews TS	Coincidental Gross Load		63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59	63.59
	Coincidental CDM		0.61	1.30	1.74	2.44	3.09	3.61	3.98	4.34	4.59	4.91
	DG		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Coincidental Net Load	63.59	62.98	62.29	61.84	61.14	60.50	59.97	59.61	59.25	59.00	58.68
Wallaceburg TS	Coincidental Gross Load		27.67	28.32	28.97	29.65	30.34	31.04	31.76	32.50	33.25	34.03
	Coincidental CDM		0.27	0.58	0.79	1.14	1.47	1.76	1.99	2.22	2.40	2.63
	DG		0.43	0.94	0.94	0.94	0.94	6.09	6.09	6.09	6.09	6.09
	Coincidental Net Load	27.05	26.98	26.80	27.24	27.57	27.93	23.18	23.68	24.19	24.76	25.31
Wanstead TS	Coincidental Gross Load		28.70	29.17	29.65	30.14	30.63	31.13	31.64	32.16	32.69	33.22
	Coincidental CDM		0.28	0.60	0.81	1.16	1.49	1.77	1.98	2.20	2.36	2.56
	DG		0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
	Coincidental Net Load	28.24	28.05	28.20	28.46	28.60	28.76	28.98	29.28	29.59	29.95	30.28
CTS #1	Transmission Connected Industrial Customer	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94
CTS #2	Transmission Connected Industrial Customer	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82
CTS #3	Transmission Connected Industrial Customer	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
CTS #4	Transmission Connected Industrial Customer	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95
CTS #5	Transmission Connected Industrial Customer	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89
CTS #6	Transmission Connected Industrial Customer	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
CTS #7	Transmission Connected Industrial Customer	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89
CTS #8	Transmission Connected Industrial Customer	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71

Table 6 : Chatham-Kent/Lambton/Sarnia regional non-coincidental load forecast

		Historical	Forecast									
Station	Data	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Duart TS	Non-coincidental Gross Load		18.26	18.55	18.72	18.97	19.33	19.69	19.94	20.19	20.43	20.68
	Non-coincidental CDM		0.18	0.38	0.51	0.73	0.94	1.12	1.25	1.38	1.47	1.60
	DG		0.07	0.07	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
	Non-coincidental Net Load	14.46	18.01	18.10	17.96	17.99	18.14	18.32	18.44	18.56	18.71	18.83
Forest Jura DS	Non-coincidental Gross Load		22.58	23.05	23.29	23.70	24.19	24.75	25.09	25.50	25.82	26.22
	Non-coincidental CDM		0.22	0.47	0.64	0.91	1.17	1.41	1.57	1.74	1.86	2.02
	DG		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Non-coincidental Net Load	19.36	22.35	22.56	22.63	22.77	23.00	23.33	23.51	23.75	23.94	24.18
Kent TS T1/T2	Non-coincidental Gross Load		107.57	114.81	117.04	119.46	122.16	124.89	127.48	130.10	132.77	135.49
	Non-coincidental CDM		1.03	2.34	3.21	4.59	5.93	7.10	7.97	8.88	9.58	10.46
	DG		0.53	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
	Non-coincidental Net Load	69.45	106.00	111.26	112.63	113.66	115.02	116.58	118.30	120.02	121.98	123.83
Kent TS T3/T4	Non-coincidental Gross Load		61.87	65.59	66.79	68.11	69.62	71.14	72.55	73.98	75.42	76.90
	Non-coincidental CDM		0.59	1.34	1.83	2.62	3.38	4.04	4.54	5.05	5.44	5.93
	DG		0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	Non-coincidental Net Load	39.95	61.11	64.08	64.80	65.33	66.08	66.93	67.85	68.76	69.82	70.81
Lambton TS	Non-coincidental Gross Load		71.39	72.21	72.55	73.18	74.29	75.37	76.00	76.60	77.15	77.72
	Non-coincidental CDM		0.69	1.47	1.99	2.81	3.61	4.28	4.75	5.23	5.57	6.00
	DG		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Non-coincidental Net Load	61.64	70.71	70.73	70.56	70.37	70.68	71.09	71.25	71.37	71.59	71.72
Modeland TS	Non-coincidental Gross Load		100.71	101.71	102.71	103.71	104.71	104.71	104.71	104.71	104.71	104.71
	Non-coincidental CDM		0.97	2.08	2.81	3.98	5.08	5.95	6.55	7.15	7.56	8.08
	DG		0.02	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
	Non-coincidental Net Load	82.59	99.72	99.48	99.74	99.57	99.47	98.60	98.00	97.40	97.00	96.47
St. Andrews TS	Non-coincidental Gross Load		62.74	62.74	62.74	62.74	62.74	62.74	62.74	62.74	62.74	62.74
	Non-coincidental CDM		0.60	1.28	1.72	2.41	3.05	3.57	3.92	4.28	4.53	4.84
	DG		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Non-coincidental Net Load	63.59	62.13	61.46	61.02	60.33	59.69	59.17	58.81	58.45	58.21	57.90
Wallaceburg TS	Non-coincidental Gross Load		41.86	42.84	43.86	44.80	45.82	46.95	48.10	49.19	50.28	51.40
	Non-coincidental CDM		0.40	0.87	1.20	1.72	2.23	2.67	3.01	3.36	3.63	3.97
	DG		0.43	0.94	0.94	0.94	0.94	6.09	6.09	6.09	6.09	6.09
	Non-coincidental Net Load	27.05	41.04	41.03	41.72	42.15	42.66	38.19	39.00	39.74	40.56	41.34
Wanstead TS	Non-coincidental Gross Load		34.10	34.68	35.29	35.68	36.22	36.99	37.75	38.30	38.83	39.34
	Non-coincidental CDM		0.33	0.71	0.97	1.37	1.76	2.10	2.36	2.61	2.80	3.04
	DG		0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
	Non-coincidental Net Load	28.24	33.40	33.59	33.95	33.94	34.08	34.51	35.01	35.31	35.65	35.93
CTS #1	Transmission Connected Industrial Customer	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94
CTS #2	Transmission Connected Industrial Customer	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82	20.82
CTS #3	Transmission Connected Industrial Customer	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
CTS #4	Transmission Connected Industrial Customer	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95	112.95
CTS #5	Transmission Connected Industrial Customer	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89	30.89
CTS #6	Transmission Connected Industrial Customer	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
CTS #7	Transmission Connected Industrial Customer	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89
CTS #8	Transmission Connected Industrial Customer	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71	46.71

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
GTA	Greater Toronto Area
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Planning
kV	Kilovolt
LDC	Local Distribution Company
LTR	Limited Time Rating
LV	Low-voltage
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