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NEEDS ASSESSMENT REPORT

Region: London

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Prepared by: London Area Study Team



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Disclaimer

This Needs Assessment Report was prepared for the purpose of identifying potential needs in the London Area 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

REGION	London Area		
LEAD	Hydro One Networks Inc. (“Hydro One”)		
START DATE	February 2, 2015	END DATE	April 3, 2015
1. INTRODUCTION			
<p>The purpose of this Needs Assessment (NA) report is to undertake an assessment of the London Area 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.</p> <p>For needs that require further regional planning and coordination, the Independent Electricity System Operator (IESO) will initiate the Scoping Assessment (SA) process to determine whether an IESO-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution), or whether both are required.</p>			
2. REGIONAL ISSUE / TRIGGER			
<p>The NA for the London Area was triggered in response to the Ontario Energy Board’s (OEB) Regional Infrastructure Planning process approved in August 2013. To prioritize and manage the regional planning process, Ontario’s 21 regions were assigned to one of three groups. The NA for Group 1 Regions is completed and has been initiated for Group 2 Regions. The London Area belongs to Group 2. The NA for the London Area was triggered on January 30, 2015 and was completed on March 31, 2015.</p>			
3. SCOPE OF NEEDS ASSESSMENT			
<p>The scope of the NA study was conducted for the next 10 years as per the recommendations of the Planning Process Working Group (PPWG) Report to the Board. As such, relevant data and information was collected up to the year 2023.</p> <p>Needs emerging over the next 10 years and requiring coordinated regional planning may be further assessed as part of the IESO-led SA, which will determine the appropriate regional planning approach: IRRP, RIP, and/or local planning.</p> <p>This NA included a review of transmission system connection facilities capability, which covers station and line loading, thermal and voltage analysis as well as a review of system reliability, operational issues such as load restoration, and assets approaching end-of-useful-life.</p>			
4. INPUTS/DATA			
<p>Study team participants, including representatives from LDCs, the IESO, and Hydro One Transmission provided information for the London Area. The information included: historical load, load forecast, conservation and demand management (CDM) and distributed generation (DG) information, load restoration data, and performance information including major equipment approaching end-of-useful life. In this region, asset utilization is at the capacity threshold even when LDCs CDM forecast is taken into account. Accordingly, further assessment is required to determine possible targeted CDM activities by feeders and station(s) to ensure CDM will meet load reduction forecasts. See Section 4 for further details.</p>			

5. NEEDS ASSESSMENT METHODOLOGY

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

6. RESULTS

Transmission Capacity Needs

A. 230/115 kV Autotransformers

- The 230/115 kV autotransformers (Buchanan TS and Karn TS) supplying the London Area are adequate over the study period for the loss of a single 230/115 kV autotransformer.

B. 230 kV Transmission Lines

- The 230 kV circuits supplying the London Area are adequate over the study period for the loss of a single 230 kV circuit.
- Under high eastwardly flows and or high generation conditions, W44LC, W45LS, N21W, N22W and S47C may be overloaded under pre-contingency conditions. This issue will be further assessed by IESO as part of bulk system planning.

C. 115kV Transmission Lines

- The 115 kV circuit W8T reaches its continuous rating pre-contingency in 2014 based on the gross load forecast.
- The remaining 115 kV circuits supplying the London Area are adequate over the study period for the loss of a single 115 kV circuit.

D. 230 kV and 115 kV Connection Facilities

- Loadings at Aylmer TS, Strathroy TS and Wonderland TS exceed their transformer 10-Day Long Term Rating (LTR) in 2014 based on the net load forecast. The limitation at Aylmer TS will be addressed through the currently planned sustainment investment. Tillsonburg TS is forecasted to exceed its 10-Day LTR by the end of near term. Clarke TS is forecasted to exceed its 10-Day LTR in 2014 based on the gross load forecast, but is expected to be adequate to meet the net load forecast for the remainder of the study as planned CDM targets and DG contributions continue to offset the load growth.
- Historical data shows that Buchanan DESN power factor may be below Ontario Resource and Transmission Assessment Criteria under peak load conditions.

System Reliability, Operation and Restoration Review

Based on the net and gross load forecast, the 115 kV voltages at Tillsonburg TS were found to be less than minimum requirements under pre-contingency conditions in the near term.

Based on the gross and net load forecast, the loss of one element will not result in load interruption greater than 150MW in the London Region. The maximum gross and net load interrupted by configuration due to the loss of two elements is below the load loss limit of 600MW by the end of the 10-year study period.

For the loss of two elements on the 230kV system, the gross and net load interrupted by configuration at peak conditions will exceed 150 MW and 250 MW.

Under peak load conditions with the Buchanan 115 kV capacitor in-service, the 115 kV voltage reaches its maximum limit. Accordingly, switching in any additional 230 kV capacitors at Buchanan becomes

challenging. This is an operational issue and will be discussed between IESO and Hydro One.

Aging Infrastructure / Replacement Plan

During the study period, plans to replace or add equipment do not affect the needs identified.

7. RECOMMENDATIONS

Based on the findings of the Needs Assessment, the study team recommends that:

- a) The following needs should be further assessed as part of the Scoping Assessment to determine if CDM/DG can fully or partly address them or wires planning should be undertaken:
 - Transformation capacity limitations at Strathroy TS, Tillsonburg TS, Wonderland TS, Clarke TS and Talbot TS
 - Thermal and voltage limitations along the 115kV circuit W8T
 - Load restoration concerns following the loss of two elements as described in section 6.2
- b) No further regional coordination is required and following needs should be further assessed as part of local planning :
 - Low power factor at Buchanan DESN

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1 INTRODUCTION

This Needs Assessment (NA) report provides a summary of needs that are emerging in the London Area between 2014 – 2023. The development of the NA report is in accordance with the regional planning process as set out in the Ontario Energy Board’s (OEB) Transmission System Code (TSC) and Distribution System Code (DSC) requirements and the “Planning Process Working Group (PPWG) Report to the Board”.

The purpose of this NA is to undertake an assessment of the London Area to identify any near term and/or emerging needs in the area and determine if these needs require a “localized” wires only solution(s) in the near-term and/or a coordinated regional planning assessment. Where a local wires only solution is necessary to address the needs, Hydro One, as transmitter, with Local Distribution Companies (LDC) or other connecting customer(s), will further undertake planning assessments to develop options and recommend a solution(s). For needs that require further regional planning and coordination, the Independent Electricity System Operator (IESO) will initiate the Scoping Assessment (SA) process to determine whether an IESO-led Integrated Regional Resource Planning (IRRP) process, or the transmitter-led Regional Infrastructure Plan (RIP) process (wires solution), or both are required. The SA may also recommend that local planning between the transmitter and affected LDCs be undertaken to address certain needs.

This report was prepared by the London Area NA study team (Table 1) and led by the transmitter, Hydro One Networks Inc. The report captures the results of the assessment based on information provided by LDCs, and the IESO.

Table 1: Study Team Participants for London Area

No.	Company
1.	Hydro One Networks Inc. (Lead Transmitter, “Hydro One Transmission”)
3.	Independent Electricity System Operator (“IESO”)
4.	Entegrus Power Lines Inc.
5.	Erie Thames Power Lines Corporation
6.	London Hydro Inc.
7.	St. Thomas Energy Inc.
8.	Tillsonburg Hydro Inc.
9.	Woodstock Hydro Services Inc.
10.	Hydro One Networks Inc. (Distribution)

2 REGIONAL ISSUE / TRIGGER

The NA for the London Area was triggered in response to the OEB's Regional Infrastructure Planning process approved in August 2013. To prioritize and manage the regional planning process, Ontario's 21 regions were assigned to one of three groups. The NA for Group 1 Regions is complete and has been initiated for Group 2 Regions. The London Area belongs to Group 2. The NA for this area was triggered on January 30, 2015 and was completed on March 31, 2015.

3 SCOPE OF NEEDS ASSESSMENT

This NA covers the London Area over an assessment period of 2014 to 2023. The scope of the NA includes a review of transmission system connection facility capability which covers transformer station and line thermal capacity and voltage performance. System reliability, operational issues such as load restoration, and asset replacement plans were also briefly reviewed as part of this NA.

3.1 London Area Description and Connection Configuration

The London Area includes the municipalities of Oxford County (comprising Township of Blandford-Blenheim, Township of East Zorra-Tavistock, Town of Ingersoll, Township of Norwich, Township of South-West Oxford, Town of Tillsonburg, Township of Zorra), City of Woodstock, Middlesex County (comprising Municipality of Adelaide Metcalfe, Municipality of Lucan Biddulph, Municipality of Middlesex Centre, Municipality of North Middlesex, Municipality of Southwest Middlesex, Municipality of Strathroy-Caradoc, Municipality of Thames Centre, Village of Newbury), City of London, Elgin County (comprising Municipality of Town of Aylmer, Municipality of Bayham, Municipality of Central Elgin, Municipality of West Elgin, Municipality of Dutton/Dunwich, Township of Malahide, Township of Southwold), City of St. Thomas. In addition, the facilities located in the London Region supply part of Norfolk County. The boundaries of the London Area are shown below in Figure 1.

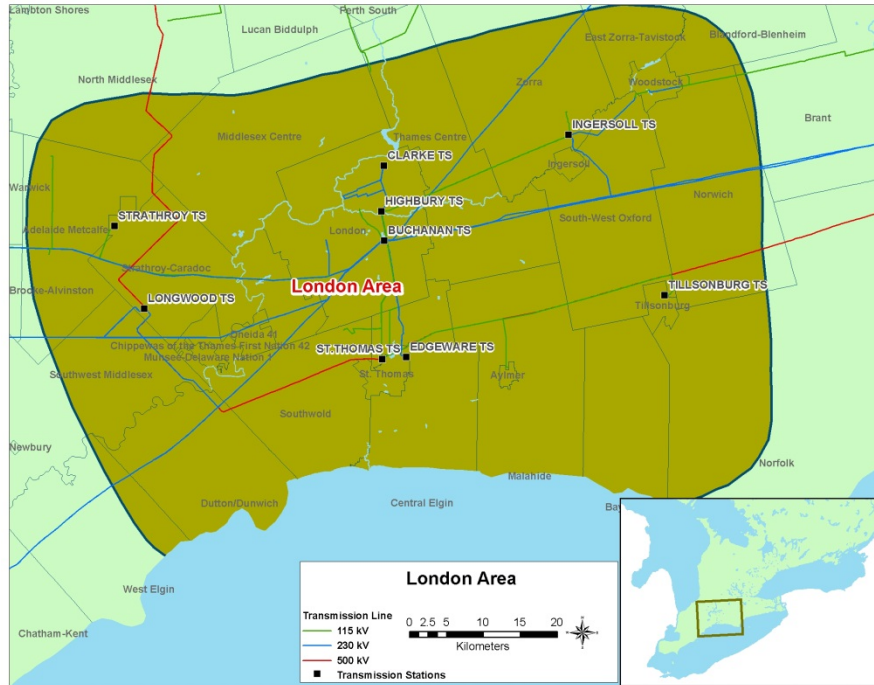


Figure 1: London Area Map

Electrical supply to the London Area is provided through a network of 230 kV and 115 kV circuits supplied by 500/230 kV autotransformers at Longwood Transformer Station (TS) and 230/115 kV autotransformers at Buchanan TS and Karn TS. There are fourteen Hydro One step-down TS's, four direct transmission connected load customers and three transmission connected generators in the London Area. The distribution system consists of voltage levels 27.6 kV and 4.16kV.

The existing facilities in the London Area are summarized below and depicted in the single line diagram shown in Figure 2. The 500kV system is part of the bulk power system and is not studied as part of this Needs Assessment. Also, although depicted, Duart TS is not included in the London Area study and will be studied as part of the Chatham Area Regional Infrastructure Plan.

- Longwood TS is the major transmission station that connects the 500kV network to the 230kV system via two 500/230 kV autotransformers.
- Buchanan TS and Karn TS are the transmission stations that connect the 230kV network to the 115kV system via 230/115 kV autotransformers.
- Fourteen step-down transformer stations supply the London Area load: Aylmer TS, Buchanan TS, Clarke TS, Commerceway TS, Edgeware TS, Highbury TS, Ingersoll

TS, Nelson TS, Strathroy TS, St. Thomas TS, Talbot TS, Tillsonburg TS, Wonderland TS, and Woodstock TS.

- Four Customer Transformer Stations (CTS) are supplied in the London Area: Ford Talbotville CTS, Enbridge Keyser CTS, Lafarge Woodstock CTS, and Toyota Woodstock CTS.
- There are 3 existing Transmission connected generating stations in the London Area as follows:
 - Suncor Adelaide GS is a 40 MW wind farm connected to 115 kV circuit west of Strathroy TS
 - Port Burwell GS is a 99 MW wind farm connected to 115kV circuit near Tillsonburg TS
 - Silver Creek GS is a 10 MW solar generator connected to 115kV circuit near Aylmer TS
- There are a network of 230 kV and 115 kV circuits that provide supply to the London Area, as shown in Table 2 below:

Table 2: Transmission Lines in London Area

Voltage	Circuit Designations	Location
230 kV	N21W, N22W	Scott TS to Buchanan TS
	W42L, W43L	Longwood TS to Buchanan TS
	W44LC	Longwood TS to Chatham TS to Buchanan TS
	W45LS	Longwood TS to Spence SS to Buchanan TS
	W36, W37	Buchanan TS to Talbot TS
	D4W, D5W	Buchanan TS to Detweiler TS
	M31W, M32W	Buchanan TS to Ingersoll TS to Middleport TS
	M33W	Buchanan TS to Brantford TS
115 kV	W2S	Buchanan TS to Strathroy TS
	W5N	Buchanan TS to Nelson TS
	W6NL	Buchanan TS to Highbury TS to Nelson TS
	W9L	Buchanan TS to Highbury TS
	W7, W12	Buchanan TS to CTS
	WW1C	Buchanan TS to CTS
	W8T	Buchanan TS to ESWF JCT
	WT1T	ESWF JCT to Tillsonburg TS
	W3T, W4T	Buchanan TS to St. Thomas TS
WT1A	Aylmer TS to Lyons JCT	
K7, K12	Karn TS to Commerce Way TS	

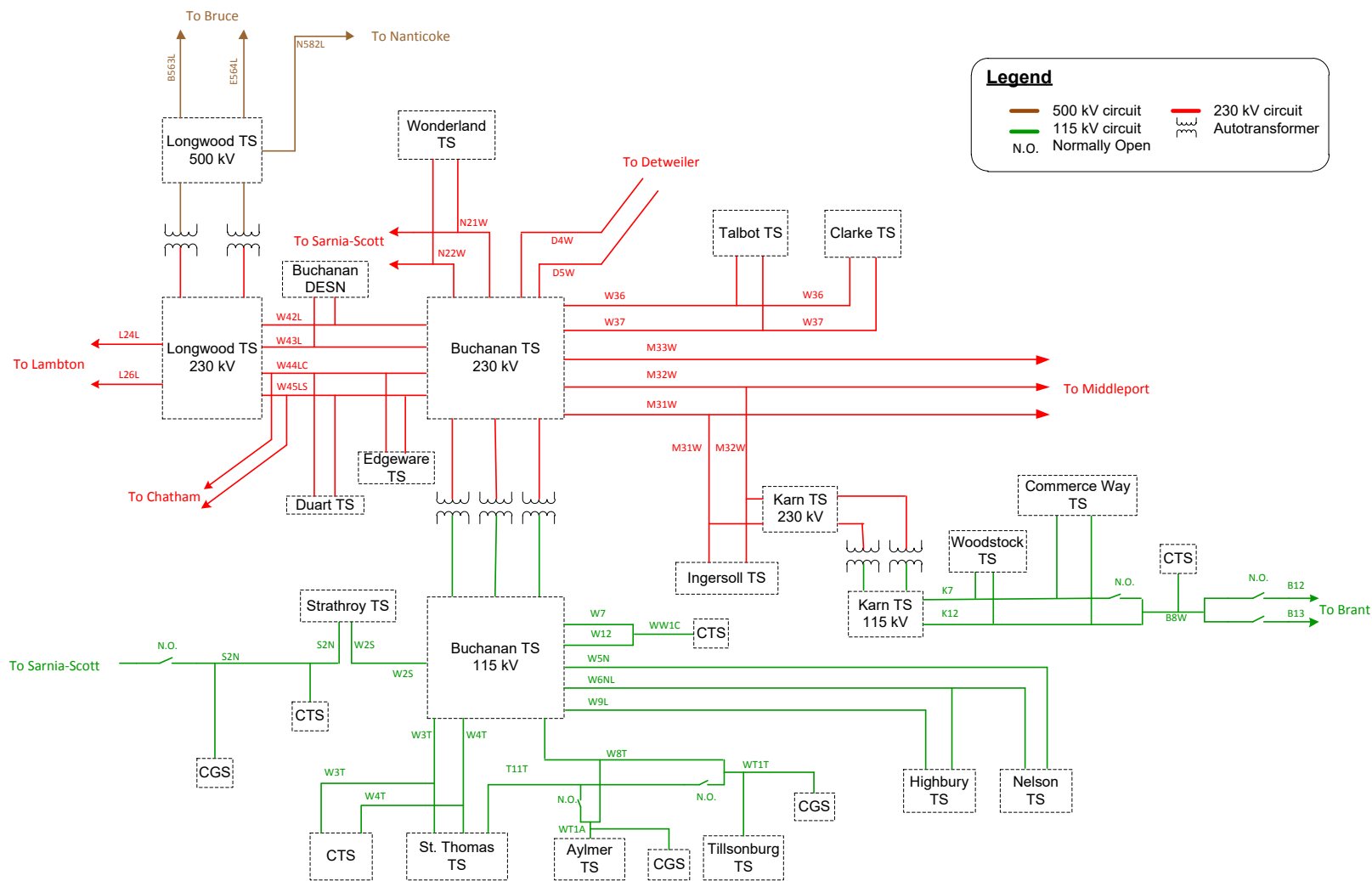


Figure 2: Single Line Diagram – London Area

4 INPUTS AND DATA

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

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

4.1 Gross Load Forecast

The gross load forecast describes the total forecast electrical consumption in the area without considering the combined impact of CDM and DG. As per the data provided by the study team, the gross load in the London Area is expected to grow at an average rate of approximately 0.9% annually from 2014 – 2023.

4.2 Net Load Forecast

The net load forecast builds from the gross load forecast and includes the planned CDM targets and DG contributions. For the London Area, the net load is expected to grow at an average rate of approximately 0.2% annually from 2014 – 2023.

5 NEEDS ASSESSMENT METHODOLOGY

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

1. The assessment is based on summer peak loads.
2. Load data for transmission connected industrial customers in the region was assumed to be consistent with historical peak loads.

3. The LDC's load forecast is translated into load growth rates and is applied onto the 2013 summer peak load as a reference point.
4. Accounting for (2) and (3) mentioned above, the gross load forecast and a net load forecast were developed. The gross load forecast is used to develop a worst case scenario to identify needs. Where there are issues, the net load forecast which accounts for CDM and DG is analyzed to determine if needs can be deferred.

A coincident version of the gross and net load forecast was used to assess the transformer capacity needs (section 6.1.1), 230 kV transmission line needs (section 6.1.2), 115 kV transmission line needs (6.1.3) and system reliability operation and restoration needs (6.2).

A non-coincident version of the net load forecast was used to assess the station capacity as presented in section 6.1.4.

A coincident peak load forecast and a non-coincident peak load forecast were produced for each gross load and net load forecasts.

5. Review impact of any on-going and/or planned development projects in the London Area during the study period.
6. Review and assess impact of any critical/major elements planned/identified to be replaced at the end of their useful life such as autotransformers, cables, and stations.
7. Station capacity adequacy is assessed by comparing the non-coincident peak load with the station's normal planning supply capacity assuming a 90% lagging power factor for stations having no low-voltage capacitor banks or the historical low voltage power factor, whichever is more conservative. For stations having low-voltage capacitor banks, a 95% lagging power factor was assumed or the historical low-voltage power factor, whichever is more conservative. Normal planning supply capacity for transformer stations in this Region is determined by the summer 10-Day Limited Time Rating (LTR).
8. To identify emerging needs in the Region and determine whether or not further coordinated regional planning should be undertaken, the study was performed observing all elements in service and only one element out of service.
9. Transmission adequacy assessment is primarily based on, but is not limited to, the following criteria:

- With all elements in service, the system is to be capable of supplying forecast demand with equipment loading within continuous ratings and voltages within normal range.
- With one element out of service, the system is to be capable of supplying forecast demand with circuit loading within their long-term emergency (LTE) ratings and transformers within their summer or winter 10-Day LTR, as appropriate.
- All voltages must be within pre and post contingency ranges as per Ontario Resource and Transmission Assessment Criteria (ORTAC) (Section 4.2) criteria.
- With one element out of service, no more than 150 MW of load is lost by configuration. With two elements out of service, no more than 600 MW of load is lost by configuration.
- With two elements out of service, the system is capable of meeting the load restoration time limits as per ORTAC (Section 7.2) criteria.

6 RESULTS

This section summarizes the results of the Needs Assessment in the London Area.

6.1 Transmission Capacity Needs

6.1.1 230/115 kV Autotransformers

The 230/115 kV autotransformers (Buchanan TS and Karn TS) supplying the London Area are adequate over the study period for the loss of a single 230/115 kV autotransformer.

6.1.2 230 kV Transmission Lines

Overall, the 230 kV circuits supplying the London Area are adequate over the study period for the loss of a single 230 kV circuit in the Region.

Under high eastwardly flows and/or high generation conditions, W44LC, W45LS, N21W, N22W and S47C may be overloaded under pre-contingency conditions. This issue will be further assessed by IESO as part of bulk system planning.

6.1.3 115 kV Transmission Lines

The 115 kV circuit W8T from Buchanan TS to Edgware JCT reaches its continuous rating under pre-contingency conditions in the near term based on the gross load forecast. Such thermal overload is deferred to the medium term based on the net load forecast. In addition, the 115kV system is also restricted for any new DG connections at Tillsenburg TS because of capacity limitation.

The remaining 115 kV circuits supplying the London Area are adequate over the study period for the loss of a single 115 kV circuit in the area.

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 TSs in the London Area using the summer station peak load forecasts provided by the study team. The results are as follows:

Aylmer TS

Aylmer TS T2/T3 is forecasted to exceed its 10-Day LTR in 2014 based on the net load forecast (approximately 113% Summer 10-Day LTR in 2014).

Buchanan TS

Historical data shows that Buchanan DESN power factor is below ORTAC criteria under peak load conditions.

Clarke TS

Clarke TS T3/T4 exceeds its 10-Day LTR in 2014 based on the net load forecast (approximately 101% of Summer 10-Day LTR). Although based on the planned CDM targets and DG contributions, the station capacity for Clarke TS T3/T4 is adequate to meet the net forecasted demand over the remainder of the study period, loading at Clarke TS is above its LTR based on gross load.

Strathroy TS

Strathroy TS T1/T2 is forecasted to exceed its 10-Day LTR in 2014 based on the net load forecast (approximately 125% of Summer 10-Day LTR in 2014)

Talbot TS

Talbot TS T1/T2 and T3/T4 DESN is near its 10-Day LTR rating in the near term based on the net load forecast and is above its LTR based on gross load. The load forecast for Talbot TS increases significantly in year 2015 by 17MW based on the ongoing planning activities of the LDC to convert and transfer Nelson TS load to Talbot TS to accommodate the redevelopment plans of Nelson TS. The load transferred to Talbot TS in 2015 is temporary in nature, and will be transferred back to Nelson TS when the redevelopment is expected to be complete in 2019.

Tillsonburg TS

For the loss of T3, Tillsonburg TS T1 is forecasted to exceed its 10-Day LTR towards the end of the near term based on the net load forecast (approximately 102% of Summer 10-Day LTR in 2018) and is above its LTR based on gross load

Wonderland TS

For the loss of T6, Wonderland TS T5 is forecasted to exceed its 10-Day LTR 2014 based on the net load forecast (approximately 112% of Summer 10-Day LTR in 2014).

All the other TSs in the London Area are forecasted to remain within their normal supply capacity during the study period.

6.2 System Reliability, Operation and Restoration Review

Based on the net load forecast, the pre-contingency voltage at Tillsonburg TS 115kV is expected to be less than the minimum voltage level as established in Section 4.3 of the ORTAC.

Under peak load conditions with the Buchanan 115 kV capacitor in-service, the 115 kV voltage reaches its maximum limit. Accordingly, switching in any additional 230 kV capacitors at Buchanan becomes challenging. This is an operational issue and will be discussed between IESO and Hydro One.

Based on the gross and net coincident load forecast, the loss of one element will not result in load interruption greater than 150MW in the London Region. The maximum gross and net 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.

Based on the gross coincident load forecast at Buchanan TS, the load interrupted by configuration will exceed 150 MW for the loss of double-circuit line W42L and W43L. However, based on the net coincident load forecast, which accounts for CDM and DG, the load interrupted by configuration does not exceed 150 MW. Therefore, no action is required at this time and this will be reviewed in the next planning cycle.

Based on the gross and net coincident load forecast for Ingersoll TS and stations connected along the 115 kV circuits K7/K12/B8W, the load interrupted by configuration at peak will exceed 150 MW for the loss of double-circuit 230kV line M31W and M32W. Similarly, based on the gross and net coincident load forecast at Clarke TS and Talbot TS, the load interrupted by configuration will exceed 250 MW for the loss of double-circuit 230kV line W36 and W37. Furthermore, based on the gross and net coincident load forecast at Wonderland TS and Modeland TS, the load interrupted by configuration will exceed 150 MW for the loss of double-circuit 230kV line N21W and N22W.

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. These sustainment plans do not affect the results of this NA study. During the study period:

- The existing Aylmer TS will be replaced with a new DESN with two 25/33.3/41.7 MVA transformer and four feeder positions and is scheduled to be completed in 2019. The replacement plan will address the transformer capacity need identified in section 6.1.4.
- The existing Nelson TS DESN will be redeveloped to maintain supply to the area. Final arrangement will depend on the ongoing discussions between the Hydro One and the LDC. This NA study assumes the LDC's plan to redevelop Nelson TS and convert the station LV from 13.8kV to 27.6kV.

- As part of the Burlington-Nanticoke Area Regional Infrastructure Planning, there is an ongoing plan to replace existing switches on B12/B13 with 115 kV breakers to address the voltage and capacity issue in the Brant area. This project will allow the existing normally-open points on B12/B13 to be operated normally-closed. The breakers cause no adverse impacts to the London Region. As the project is still in its planning phase, the ability to provide backup to the Woodstock area has not yet been confirmed.

7 RECOMMENDATIONS

Based on the findings and discussion in Section 6 of the Needs Assessment report, the study team recommends that the following needs should be further assessed as part of the Scoping Assessment to determine if CDM/DG can fully or partly address them or Wires Planning should be undertaken:

- Transformation capacity limitations at Strathroy TS, Tillsonburg TS, Wonderland TS, Clarke TS and Talbot TS
- Thermal and voltage limitations along the 115kV circuit W8T
- Load restoration concerns following the loss of two elements as described in section 6.2

The following need should be further assessed as part of local planning by Hydro One and relevant LDCs:

- Low power factor at Buchanan DESN

8 NEXT STEPS

IESO and Hydro One will initiate a SA and Local Planning process to address the relevant needs as per the recommendations in Section 7.

9 REFERENCES

- [Planning Process Working Group \(PPWG\) Report to the Board: The Process for Regional Infrastructure Planning in Ontario – May 17, 2013](#)
- [IESO 18-Month Outlook: March 2014 – August 2015](#)
- [IESO Ontario Resource and Transmission Assessment Criteria \(ORTAC\) – Issue 5.0](#)

10 ACRONYMS

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