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Vice President, Reliability Standards and Chief Regulatory Officer

BY RESS AND EMAIL

November 1, 2021

Ms. Christine E. Long
Board Secretary
Ontario Energy Board
Suite 2700, 2300 Yonge Street
P.O. Box 2319
Toronto, ON M4P 1E4

Dear Ms. Long,

EB-2011-0043 – 2021 Regional Planning Status Report of Hydro One Networks Inc.

Section 3C.3.3 of the Transmission System Code requires transmitters to submit an annual report to the Ontario Energy Board, on November 1st of each year, that identifies the status of regional planning for all regions.

Please find attached Hydro One Networks Inc.'s 2021 Regional Planning Process Annual Status Report, pursuant to the above noted Code section.

Sincerely,

Frank D'Andrea

Frank D'Andrea

Regional Planning Process

Annual Status Report

2021

November 1st, 2021

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EXECUTIVE SUMMARY

Transmitters are required under Section 3C.3.3 of the Transmission System Code[1] (TSC) to submit an annual report to the Ontario Energy Board (OEB or Board) on November 1st of each year which identifies the status of the regional planning for their respective regions. This is the seventh Annual Status Report produced by Hydro One Networks Inc. (Hydro One) and provides an update to the status of regional planning activities, recommended regional plans and accomplishments between November 2020 and October 2021.

Progress to Date

The first cycle of the regional planning for the 21 regions was completed in 2017 as per the process developed by the Planning Process Working Group (PPWG)[2]. During the first regional planning cycle, several lessons were learned to undertake improvements to the process with respect to replacement of major transmission assets to include justification and documentation with respect to "right sizing" of equipment. Another area where Hydro One has improved the process is with respect to engagement and consultation with key stakeholders such as Local Distribution Companies (LDCs) through one on one pre-Regional Planning meetings to better understand their emerging needs and collect relevant information. In addition, as a Lead Transmitter, Hydro One also sent formal communications to LDCs to seek feedback on prioritization and scheduling of regional planning for the regions, as well as seeking suggestions for enhancements in the second cycle of regional planning. These enhancements, described further in Section 2, have been incorporated into the process, thereby significantly enhancing the quality of the planning process and reports. At this time, no significant changes to the prioritization to initiate regional planning were proposed by the stakeholders or required. However, Hydro One is keeping abreast of the needs in the province on a regional basis and has advanced regional planning for several regions based on emerging needs in these areas. The enhancements mentioned above were first introduced in the Regional Infrastructure Planning (RIP) report of the first cycle (February 2017) and the Needs Assessment (NA) report of the second cycle (May 2017) of the regional planning process for the Burlington to Nanticoke Region. Subsequently, these enhancements were further refined and incorporated by Hydro One into the NA and RIP reports for all regions.

Since the beginning of the second cycle of regional planning process, the following are the significant milestones that have been accomplished (see Table 1):

- Regional Infrastructure Planning (RIP) reports completed for eight (8) regions with twelve (12) reports currently underway.
- Needs Assessment (NA) reports completed for all twenty (20) regions where Hydro One is the lead transmitter. Note that St. Lawrence NA was initiated two (2) month over the five (5) year period because of an error in oversight.
- Integrated Regional Resource Planning (IRRP) reports completed for nine (9) regions with eight (8) currently underway.

The status of regional planning for each region is summarized in Table 1.

Table 1. Regional Planning Status Summary

Region	Sub-region	1st Cycle (2013-2017)				2nd Cycle (2017→)			
		NA [2]	SA [2]	IRRP [2]	RIP [2]	NA [2]	SA [2]	IRRP [2]	RIP [2]
Burlington to Nanticoke	Brant	May, 2014	Sep, 2014	Apr, 2015	Feb, 2017	May, 2017	Aug, 2017	Feb, 2019	Oct, 2019
	Bronte			Jun, 2016					
	Greater Hamilton			*Not Required*					
	Caledonia-Norfolk		*Not Required*	*Not Required*					
Toronto Area	Central Downtown	Jun, 2014	*Note1*	Apr, 2015	Jan, 2016	Oct, 2017	Feb, 2018	Aug, 2019	Mar, 2020
	Northern		*Not Required*	*Not Required*					
Windsor-Essex		*Note1*		Apr, 2015	Dec, 2015	Oct, 2017	Mar, 2018	Sep, 2019	Mar, 2020
GTA North	York	Jun, 2014	*Note1*	Apr, 2015	Feb, 2016	Mar, 2018	Aug, 2018	Feb, 2020	Oct, 2020
	Western		*Not Required*	*Not Required*					
Greater Ottawa	Ottawa	Jul, 2014	Nov, 2014	Apr, 2015	Dec, 2015	Jun, 2018	Sep, 2018	Mar, 2020	Dec, 2020
	Outer Ottawa		*Not Required*	*Not Required*					
Kitchener-Waterloo-Cambridge-Guelph		*Note1*		Apr, 2015	Dec, 2015	Dec, 2018	May, 2019	May, 2021	Dec, 2021
GTA West	Northwestern	May, 2014	Sep, 2014	Apr, 2015	Jan, 2016	May, 2019	Aug, 2019	Jul, 2021	Q1, 2022
	Southern			*Not Required*					
Greater Bruce/Huron		May, 2016	*Not Required*	*Not Required*	Aug, 2017	May, 2019	Sep, 2019	Sep, 2021	Mar, 2022
East Lake Superior		Dec, 2014	*Not Required*	*Not Required*	Dec, 2014	Jun, 2019	Sep, 2019	Apr, 2021	Oct, 2021
GTA East	Pickering-Ajax-Whitby	Aug, 2014	Dec, 2014	Jun, 2016	Jan, 2017	Aug, 2019	*Not Required*	*Not Required*	Feb, 2020
	Oshawa-Clarington			*Not Required*					
Peterborough to Kingston		Feb, 2015	*Not Required*	*Not Required*	Jul, 2016	Feb, 2020	May, 2020	Q4,2021	Mar, 2022
South Georgian Bay/Muskoka	Barrie/Innisfil	Mar, 2015	Jun, 2015	Dec, 2015	Aug, 2017	Apr, 2020	Nov, 2020	June, 2022	Dec, 2022
	Parry Sound/Muskoka			Dec, 2015					
London Area	Greater London	Apr, 2015	Aug, 2015	Jan, 2017	Aug, 2017	May, 2020	*Not Required*	*Not Required*	Dec, 2021
	Alymer-Tillsonburg			*Not Required*					
	Strathroy			*Not Required*					
	Woodstock			*Not Required*					
	St. Thomas			*Not Required*					
Sudbury/Algoma		Mar, 2015	*Not Required*	*Not Required*	Jun, 2016	Jun, 2020	*Not Required*	*Not Required*	Dec, 2020
Northwest Ontario	North of Dryden	*Note1*	Jan, 2015	Jan, 2015	Jun, 2017	Jul, 2020	Jan, 2021	Sep, 2022	Mar, 2023
	Greenstone-Marathon			Jun, 2016					
	Thunder Bay			Dec, 2016					
	West of Thunder Bay			Jul, 2016					
Chatham/Lambton/Sarnia		Jun, 2016	*Not Required*	*Not Required*	Aug, 2017	Sep, 2021[4]	Dec, 2021	Mar, 2023	Jul, 2023
Niagara		Apr, 2016	*Not Required*	*Not Required*	Mar, 2017	May, 2021	Aug, 2021	Q1 2023	Q3 2023

North/East of Sudbury	Apr, 2016	*Not Required*	*Not Required*	Apr, 2017	May, 2021	Aug, 2021	Feb, 2023	Aug, 2023
Renfrew	Mar, 2016	*Not Required*	*Not Required*	Jul, 2016	May, 2021	Aug, 2021	Dec, 2022	Apr, 2023
St. Lawrence (3)	Apr, 2016	*Not Required*	*Not Required*	Jul, 2016	Sep, 2021	Jul, 2021	Jan, 2023	Jun, 2023
North of Moosonee	*Hydro One Transmission is not the lead transmitter in this region. Status to be provided by lead transmitter.*							

Notes: (1): The planning activity in the region was already in progress prior to the commencement of the regional planning process; hence the NA/SA was deemed to be already completed by the Technical Working Group.
(2): NA: Needs Assessment; SA: Scoping Assessment; IRRP: Integrated Regional Resource Plan; RIP: Regional Infrastructure Plan
(3): Note that St. Lawrence NA was initiated two (2) months over the five (5) year period because of an error in oversight.
(4): Note that 2nd cycle NA date for this region is September 2021. This date is within the five (5) years window, 120 days completion date.

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1. INTRODUCTION

The process for electric power system planning in the Province of Ontario underwent a procedural change in 2013. A new regional planning process, which enables transparent, coordinated and cost-effective planning of regional transmission and distribution systems, was mandated by the Ontario Energy Board (OEB or Board) on August 26, 2013 through amendments to both the Transmission System Code[1] (TSC) and the Distribution System Code[3] (DSC). This process is outlined in the Planning Process Working Group's (PPWG) Report to the Board, titled "The Process for Regional Infrastructure Planning in Ontario"[4], revised May 17, 2013.

As per Section 3C.3.3 of the TSC, transmitters are required to submit an annual report to the Board on November 1st of each year, which identifies the status of the regional planning process and its deliverables in their respective regions. This eighth (2021) Annual Status Report, produced by Hydro One Networks Inc. (Hydro One), provides an update to the accomplishments and progress status of the regional planning activities from November 2020 to October2021. It also identifies plans and projects already in execution to address new and previously identified needs.

The Report is structured as follows:

- Section 2 provides a brief overview of the regional planning process.
- Section 3 identifies lessons learned and improvements made to the regional planning process.
- Section 4 discusses the various regional planning activities and plans or projects completed or being undertaken.
- Section 5 provides a brief summary of the status of regional planning and its accomplishments over the last year.
- Section 6 lists all reference documentation.

2. REGIONAL PLANNING PROCESS OVERVIEW

Bulk System Planning, Regional Planning and Distribution Planning are the three levels of planning for the electricity system in Ontario. Bulk system planning typically looks at issues that impact the system on a provincial level, and requires longer lead time and larger investments. Comparatively, planning at the regional and distribution levels look at issues on a more regional or localized level. Typically, the most essential and effective regional planning horizon is the near- to medium-term (1-10 years), whereas long-term (10-20 years) regional planning mostly provides a future outlook with little details about investments because the needs and other factors may vary over time. On the other hand, bulk system plans are developed for the long term because of the larger magnitude of the investments.

The regional planning process begins with a Needs Assessment (NA) which is led by the transmitter to identify, assess and document which of the needs a) can be addressed directly between the customer and the transmitter along with a recommended plan, and b) that require further regional coordination and identification of Local Distribution Companies (LDCs) to be involved in further regional planning activities for the region.

At the end of the Needs Assessment, a decision is made by the Technical Working Group as to whether further regional coordination is necessary to address some or all of the regional needs. If no further regional coordination is required, recommendation to implement the recommended option and any necessary investments are planned directly by the LDCs (or customers) and the transmitter. The Region's Technical Working Group can also recommend to the transmitter and LDCs to undertake a local planning process for further assessment when needs a) are local in nature, b) require limited investments in wires (transmission or distribution) solutions, and c) do not require upstream transmission investments.

If coordination at the regional or sub-regional levels is required for identified regional needs, then the Independent Electricity System Operator (IESO) initiates the Scoping Assessment (SA) phase. During this phase, the IESO, in collaboration with the transmitter and impacted LDCs, reviews the information collected as part of the Needs Assessment phase, along with additional information on potential non-wires or resource alternatives, e.g., Conservation and Demand Management (CDM), Distributed Generation (DG), etc., in order to make a decision on the most appropriate regional planning approach including Local Plan (LP), Integrated Regional Resource Plan (IRRP) and/or Regional Infrastructure Plan (RIP).

The primary purpose of the IRRP is to identify and assess both resource and wires options at a higher or macro level, but sufficient to permit a comparison of resource options vs. wire infrastructure to address the needs. Worth noting, the LDCs' CDM targets as well as contracted DG plans provided by IESO and LDCs are reviewed and considered at each step in the regional planning process.

If and when an IRRP identifies that resource and/or wires options may be most appropriate to meet a need, resource/wires planning can be initiated in parallel with the IRRP or in the RIP phase to undertake a more detailed assessment, develop specific resource/wires alternatives, and recommend a preferred wires solution.

As a final step of the regional planning process, Hydro One as the lead transmitter undertakes to develop a RIP with input from the Technical Working Group for the region and publishes a RIP report. The RIP reports include a complete discussion of all options and recommended plans and wire infrastructure investments within each region identified in earlier phases. As a result, RIP reports are also referenced as supporting evidence in a cost of service or Leave-to-Construct approval application.

Figure 1 illustrates the various steps of the regional planning process that include NA (also known as Needs Screening), SA (also known as Scoping Process), LP, IRRP, and RIP.

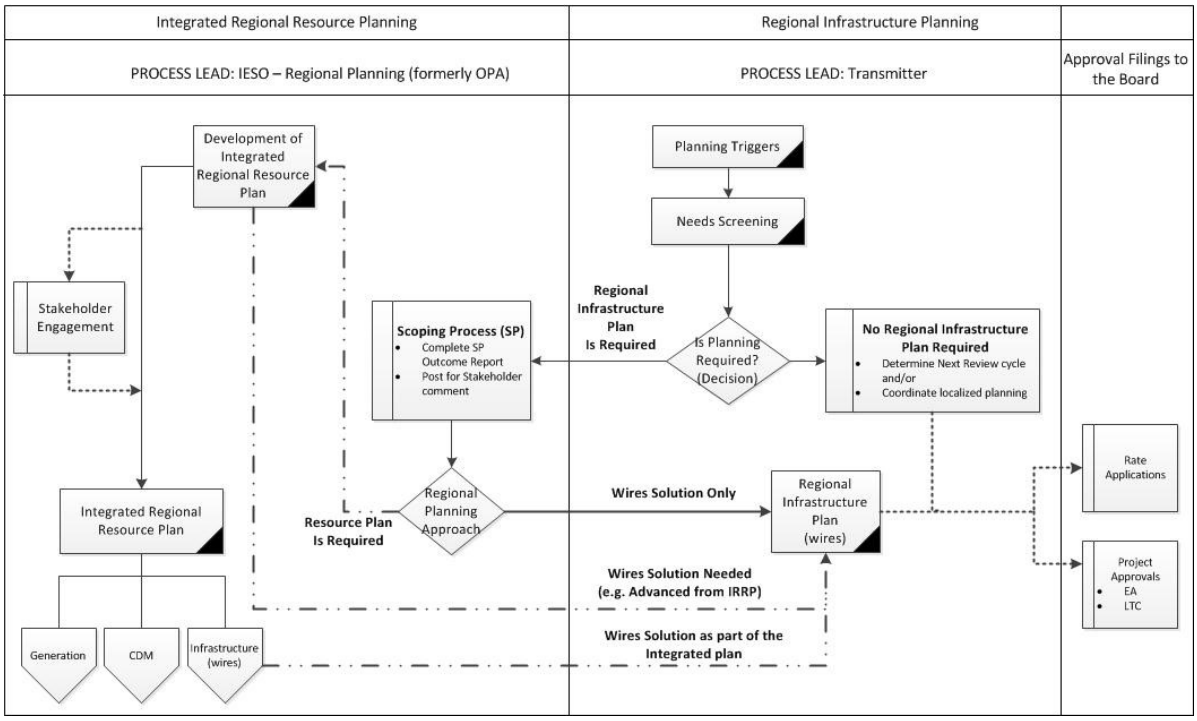

Figure 2-1. Regional Planning Process Flowchart

2.1 Regions

The province has been divided into 21 regions to undertake regional planning. In first cycle, 21 regions were placed into 3 groups to manage and prioritize regional planning activities. Moving forward, regional planning will be initiated every five (5) years or earlier if required to meet emerging needs.

Hydro One is the lead transmitter in all regions, except the East Lake Superior[1] and North of Moosonee Regions. For each regional planning activity at the regional or sub-regional level, a Technical Working Group is established for each region with representatives from the IESO, Hydro One, and respective LDCs of the area. During the regional planning process, the Technical Working Group may further divide a region into two or more sub-regions based on electrical characteristics, contiguity and for efficient and effective assessment.

The planning regions are listed in Table 2 and shown pictorially in Figure 2.

Table 2. Regional Planning Regions

Burlington to Nanticoke	Northwest Ontario	Chatham/Lambton/Sarnia
Greater Ottawa	Windsor-Essex	Greater Bruce/Huron
GTA East	East Lake Superior	Niagara
GTA North	London Area	North of Moosonee
GTA West	Peterborough to Kingston	North/East of Sudbury
KWCG	South Georgian Bay/Muskoka	Renfrew
Toronto	Sudbury/Algoma	St. Lawrence

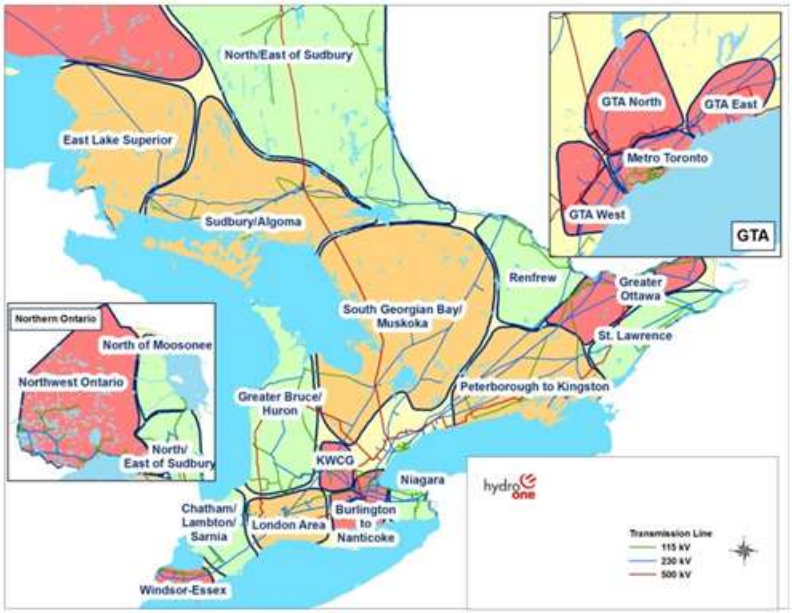

Figure 2-2. Regional Planning Regions

[1] Hydro One Sault Saint Marie, an affiliate of Hydro One Networks, is the lead transmitter for East Lake Superior. This Report includes the status of the regional planning activities in the East Lake Superior Region.

2.2 Conservation & Demand Management (CDM) and Distributed Energy Resources (DER)

CDM is taken into account at each step of the regional planning process. It is based on input from municipalities, requirements of individual LDCs to comply with conservation targets that are to be achieved through the provision of CDM programs to each customer segment in their service territories[5]. The CDM information is provided by the IESO and prepared jointly by the LDCs for regional planning assessments.

Consistent with Section 21.2.2 (g) of the IESO License and Section 3C.3 of the TSC[1], the IESO provides peak demand offsets resulting from LDCs' CDM programs. It is worth noting that peak demand offsets resulting from LDCs' CDM programs are the total offsets to be achieved by the LDC within its service territory and hence may not be limited to or reflective of offsets within the specific region. The IESO also provides total installed and effective capacity of the IESO contracted DG projects which are either in service or are under development for regions or sub-regions for which an IRRP is completed. The CDM and DG summary provided by the IESO is attached in Appendix A.

Both, CDM and DG information is used to develop a net forecast from the gross load forecast provided by the LDCs.

3. LESSONS LEARNED AND PROCESS IMPROVEMENTS

During the first and second cycle of the regional planning process, several lessons and opportunities for improvement were identified pertaining to the regional planning process and its deliverables following a thorough review of the regional planning process, discussions with regional Technical Working Group consisting of LDCs and IESO, and input from the OEB Regional Planning Process Advisory Group ("RPPAG"). Hydro One implemented several measures to improve the existing consultation, planning processes and deliverables. Based on feedback and lessons learned, Hydro One developed and implemented several improvements to the planning process to address asset replacement needs of major high voltage equipment within a 10 year horizon. These needs and their recommended plans for replacement are now documented in the NA and RIP reports..

Managing the replacement of transmission and distribution infrastructure is the primary accountability of asset owners for its safe, secure and reliable operation. Major assets such as, transformers, breakers, and conductors/cables, require specialized expertise to assess and plan replacement. However, sometimes there is a broader planning opportunity and as a result, Hydro One has developed an internal process to collect and share best available information on Major High Voltage Transmission Equipment planned for replacement within the next 10 years with the Regional Planning Technical Working Group (TWG). The major high voltage equipment information shared and discussed as part of this process is listed below.

1) Autotransformers;
2) Load serving step down transformers;
3) Replacement of more than six HV breakers at a station;
4) HV transmission line requiring refurbishment where:
    - Uprating of line may be required to address growth needs and may also require leave to construct (i.e., section 92) approval
5) HV underground cable requiring replacement where:
    - Uprating of cable may be required to address growth needs and may also require leave to construct (i.e., section 92) approval

The data associated with the above equipment will include - asset identification (e.g. station name, line/cable replacement length and associated to/from), and planned year of refurbishment or replacement.
The TWG for each region will review, assess, discuss planning options, and recommend "right sizing" during each phase of the regional planning process, namely during NA, IRRP and RIP as required.

The assessment and documentation is first undertaken in the NA phase by the TWG (i.e., Hydro One, IESO and affected LDCs) for the applicable region. As part of this analysis, different options are evaluated and a preferred replacement plan is recommended along with its rationale. The TWG reviews the load forecast that considers several inputs such as load growth due to changing customer requirements, impact of new technologies, and CDM and DER. to determine the recommended plan for addressing the asset replacement need(s). The assessment includes, but is not limited to downsizing/eliminating equipment by transferring load to other existing facilities; replacing equipment with similar equipment of same or higher ratings; and, consideration of economic and

practical implementation of incremental CDM to defer or eliminate the need while maintaining safe and reliable service to customers. The underlying goal is to "right size" the replacement asset. Consistent with the regional planning process, all affected transmission customers (e.g., LDCs, industrial, etc.) directly connected to the asset(s) being assessed are consulted and coordinated by the transmitter to obtain input regarding their expected needs before a preferred replacement plan is implemented.

Asset replacement needs that do not require further regional coordination (i.e., SA, IRRP, RIP) following the NA phase are addressed by Hydro One, as a transmitter, in coordination with the affected LDC(s) and its customers. In doing so, Hydro One coordinates the replacement plan and related outages.

Asset replacement needs that do require further assessment and regional coordination include those that provide an opportunity for cost effective reconfiguration (e.g. significant rebuild of a station), greater reliability, or better capacity planning to address a broader regional need(s). In such cases, further assessment of these needs will be undertaken in the next phase(s) of the regional planning process (i.e., SA, IRRP, RIP) where the TWG will further review options and develop a preferred replacement plan.

Pre Regional Planning Input

Another area where Hydro One has improved the process is with respect to engagement and consultation. Prior to start of the NA and RIP phase, Hydro One has implemented one on one pre-Regional Planning meetings with key stakeholders such as LDCs to better understand their emerging needs and collect relevant information. These meetings have resulted in enhanced collaboration and efficiency during regional planning meetings with TWG members by having a head start in determining emerging needs, discussing specific LDC issues and concerns that may have an impact on regional planning, and overall report quality enhancements. For example, a pre-Regional Planning meeting held with a TWG member in the Peterborough to Kingston region resulted in advance information collection on emerging needs in the region, which helped deliver a timely and quality report during the NA phase.

The Figures below show in detail how the pre-Regional Planning steps are integrated into the NA and RIP phases:

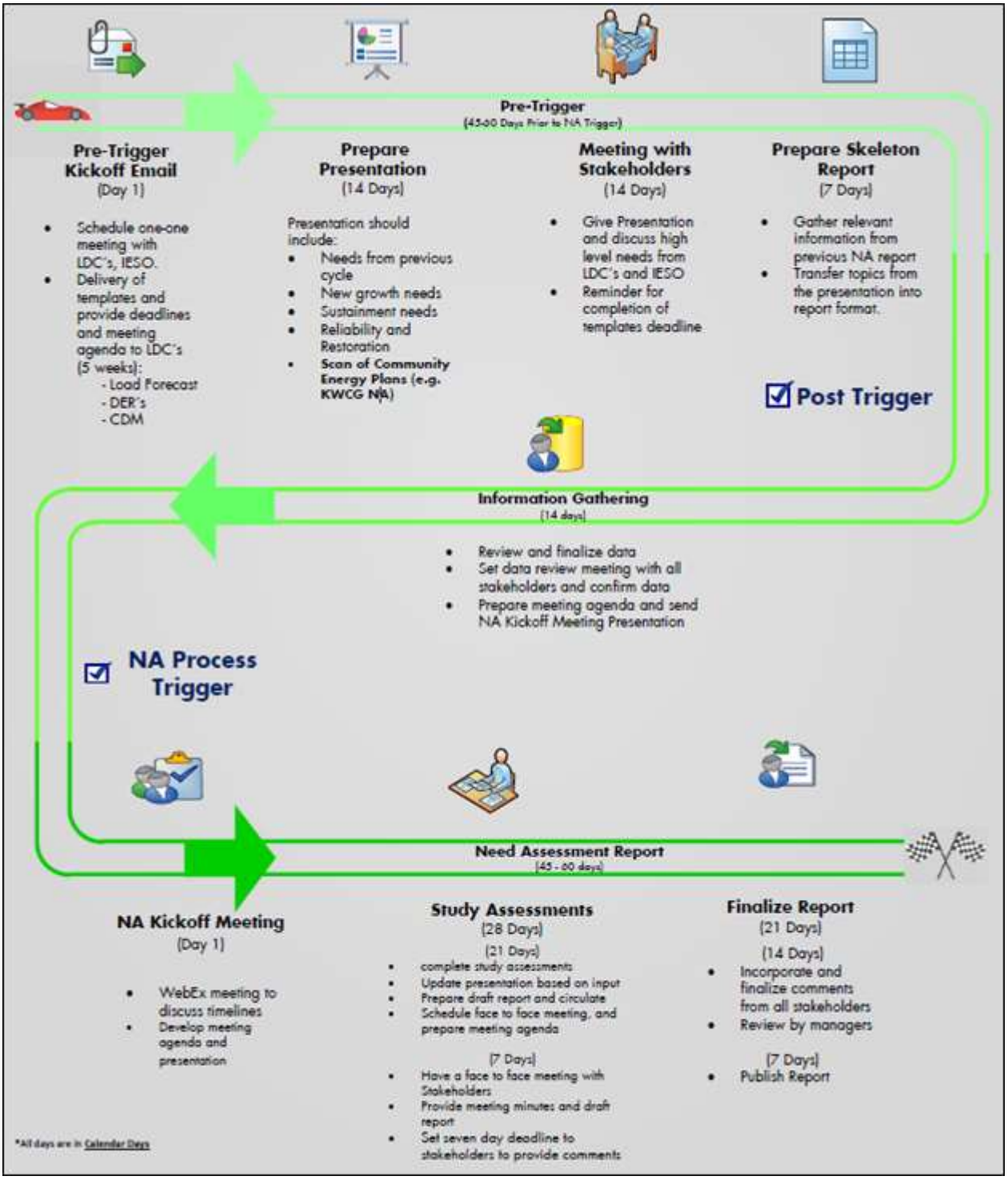

Figure 3-1. Needs Assessment (NA) Phase Diagram

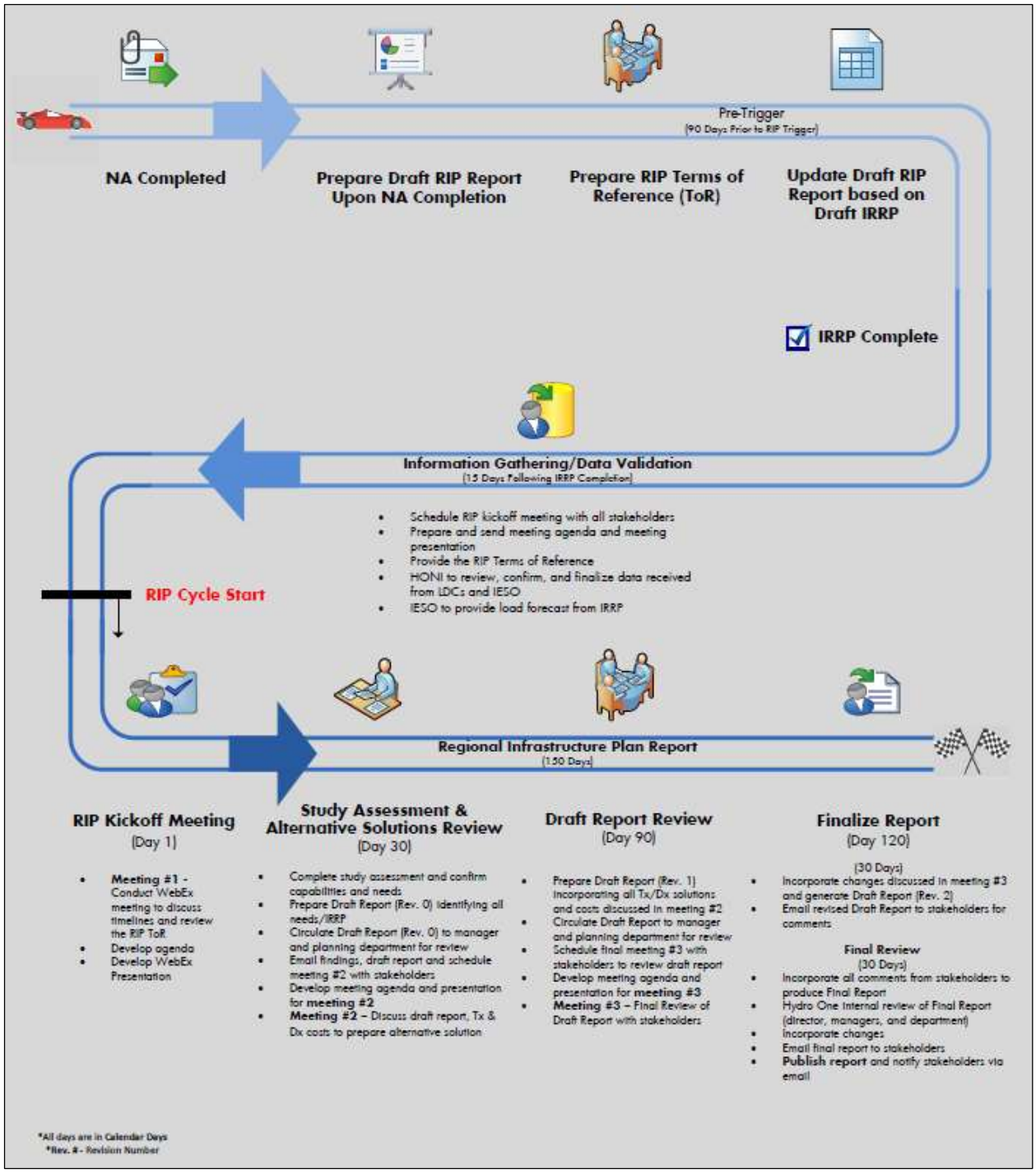

Figure 3-2. Regional Infrastructure Planning (RIP) Phase Diagram

Other Process Improvements:

- Data gathering templates: A clear and consistent approach when requesting data from Technical Working Group members to receive data in a timely manner with accurate information. Advance emails are sent to LDCs to prepare the information.
- Load forecast methodology and development: load forecast methodology is being further enhanced through the RPPAG, including Hydro One's participation in consultation with IESO,

LDCs and other RPPAG members to ensure further consistency in the development of load forecasts by the TWGs.

- Municipal Energy Plans Input: A guideline is currently being prepared through the RPPAG, including Hydro One's participation, to improve regional planning coordination with the municipal planning process. This guideline focuses on the specific information required from municipal energy plans that will better inform electricity infrastructure planning.

- Regional planning report templates – various updates including a section on equipment replacement assessment and a complete RIP report for all regions.
- Utilizing revised local planning guidelines to aid the TWG in determining when specific needs that are local in nature can be more efficiently addressed by Hydro One and affected LDC(s).
- Provided input to the Long Term Energy Plan (LTEP) directive to the IESO and OEB to enhance Regional Planning Process.

4. STATUS OF REGIONS

Regional Infrastructure Plans (RIP) have been completed for all regions for the first cycle of the Regional Planning Process. During the first regional planning cycle, several lessons were learned to undertake improvements to the process, assessment and documentation with respect to replacement of major transmission assets including condition based asset replacement with rationale for "right sizing" the equipment. Another area where Hydro One improved the process is with respect to engagement and consultation with key stakeholders such as Local Distribution Companies (LDCs) through one on one pre-Regional Planning meetings to better understand their emerging needs and collect relevant information. In addition, as a Lead Transmitter, Hydro One also sent formal communication to the LDCs to seek feedback on prioritization of regions to undertake regional planning and suggestions for enhancements in the second cycle. These enhancements have been incorporated in the process and planning reports. LDCs did not suggest any changes to the prioritization to initiate regional planning. However, Hydro One triggered regional planning early for some regions in discussions with the LDCs because of emerging needs.

The Needs Assessment (second cycle – May 2017) and RIP (first cycle – Feb 2017) for the Burlington to Nanticoke region were the first reports to include some of these enhancements, which were duly incorporated in the second cycle of the regional planning process. Each subsequent Needs Assessment (NA) and/or RIP reports for all 20 regions led and developed by Hydro One on behalf of the Technical Working Group have incorporated these changes. These reports are available on the Hydro One's Regional Planning website. The second cycle of regional planning is currently underway, with NAs for twenty (20) regions, SAs for fifteen (15) regions, IRRPs for nine (9) regions, and RIPs for nine (9) regions completed to date.

4.1 Burlington to Nanticoke

Burlington to Nanticoke Region comprises the municipalities of Burlington, Hamilton, Oakville, Brantford, and the Counties of Brant, Haldimand, and Norfolk.

The second cycle Needs Assessment phase was completed in May 2017. The Technical Working Group determined that an IRRP was required for the Hamilton sub-region. The Technical Working Group completed and published a RIP report in October 2019. Updates to the regional plans are discussed below:

- **Brant Switching Station: 115 kV B12/B13 – Transmission Line Capacity**
  Brant IRRP and the RIP for the region identified an immediate need for additional transmission supply capacity in the Brant-Power line 115 kV subsystem. The 2017 SA recommended this to be addressed directly between Hydro One and the LDC, as non-wires options were not feasible. The preferred option involves construction of a new switching facility that consists of three (3) new 115 kV breakers and associated disconnect switches. This will provide approximately 61 MW of additional supply capacity by providing a third 115 kV supply circuit (B8W) from Karn TS. The project was put in-service in August 2019.

- **Bronte TS - T5/T6 Transformers and Switchgear Replacement**
  The recommended plan is to replace T5/T6 93 MVA transformers with standard 83.3 MVA units and refurbish low voltage switchgear. This will address the needs at Bronte TS by maintaining the station's operability and reliability of supply. The project was put in-service by Q4 2019.

- **115 kV Circuit B7/B8 Section (Burlington TS x Nelson JCT)**
  The 115kV double circuit line B7/B8 supplies around 130 MW to Burlington and Oakville area loads through Bronte TS. The line section from Burlington TS to Nelson junction (approximately 2.3 km) was built in 1920's and it was assessed that it needs to be replaced. This project is expected to be in-service by Q4 2024.

- **Cumberland TS - Power Factor**
  The power factor at Cumberland TS under peak load conditions is lagging slightly below the requirement of 0.9. Burlington Hydro has installed capacitor banks on the distribution system supplied by Cumberland TS to improve power factor. Hydro One and Burlington Hydro will continue monitoring the power factor at this station and will take appropriate actions as required.

- **Burlington TS – T12 Autotransformer and LV Switchgear Replacement**
  Burlington TS is a major switching and transformer station in the city of Burlington. The facilities at this station include a 230 kV switchyard, four 230/115 kV autotransformers, a 115 kV switchyard and a 230/27.6 kV Dual Element Spot Network (DESN). Hydro One has identified that the autotransformer T12 and its DESN's LV Metalclad switchgear required replacement due to their age and asset condition assessment. The DESN LV switchgear and the T12 autotransformer are currently planned to be replaced by 2027 and 2031 respectively.

- **Beach TS - T3/T4 Transformers**
  The recommended plan was for Hydro One to proceed with reconfiguring the 115 kV T3/T4 DESN to a 230 kV configuration by replacing non-standard transformers with standard 100 MVA 230/13.8 kV units due to their age and asset condition assessment. The project was put in-service in Q3 2018.

- **Horning TS - T1/T2 Transformers and LV Switchgear**
  The recommended plan was for Hydro One to proceed with replacement of T1/T2 transformers with similar 100 MVA 230/13.8 kV units and refurbishing low voltage metalclad switchgears due to their age and asset condition assessment. The project was put in-service in Q4 2018.

- **Mohawk TS - Station Capacity and T1/T2 Transformers**
  The recommended plan was for Hydro One to proceed with replacement of the existing non-standard supply transformers at Mohawk TS with standard 75 MVA units to address the poor asset condition and providing sufficient station supply capacity. The project was put in-service in Q4 2018.

- **115 kV Circuit B3/B4 Section (Horning Mountain Jct. to Glanford Jct.)**
  The 115 kV B3/B4 line supplies Dundas TS (T1/T2 DESN) and Mohawk TS. The 11 km long section of this line from Horning Mountain Jct. to Glanford Jct. is approximately 100 years old. The recommended plan is to refurbish this line section from Horning Mountain Jct. to Glanford Jct. This refurbishment project was placed in service by Q4 2020.

- **Elgin TS - T1/T2/T3/T4 Transformers and LV Switchgear Replacement**
  The recommended plan is for Hydro one to reconfigure the station and replace the four smaller transformers with two larger units supplying two switchgears. Under this plan, the T1/T2 and T3/T4 DESNs will be replaced by a single T5/T6 DESN with two 100 MVA 115kV-14.2/14.2kV standard units and a single new MVGIS switchyard. This project is expected to be in service by Q4 2021.

- **Newton TS - T1/T2 Transformers Replacement**
  The recommended plan in the first and second cycle RIP was for Hydro One to proceed with the replacement of the existing non-standard T1/T2 transformers at Newton TS with new standard 75 MVA units due to age and condition of the existing transformers. Recently the transformer T2 failed and is being replaced on an emergency basis and transformer T1 replacement has been accelerated and is expected to be replaced by Q2 2021. To maintain system reliability in 2020 Hydro One initiated preliminary cost estimation activities relating to an investment at Newton TS that will address HV breakers with a planned in-service date by Q4 2025.

- **Kenilworth TS - Transformers and Switchgears Replacement and Power Factor**
  The recommended plan is for Hydro One to proceed with the reconfiguration of the station reducing from two DESNs to a single DESN with two transformers supplying two switchgears. The recently replaced transformer and one of the existing metalclad switchgear will be utilized while one transformer and switchgear will require to be replaced. The new transformer will be a unit similar to standard unit replaced in 2014. This refurbishment project is expected to be in service by 2022.

  The power factor at Kenilworth TS is also lagging below the requirement of 0.9. The LDC is addressing this need by installing a capacitor bank at Kenilworth TS following the completion of above Kenilworth TS refurbishment and reconfiguration work in 2021. The power factor correction project is currently planned to be in service by 2022.

- **Dundas TS - Load Transfers**
  Dundas TS has two DESN units; one of the two units has loads in excess of its supply capacity while the other DESN has spare capacity to accommodate these excess loads. The recommended plan is for the LDC to balance the load between the two Dundas TS DESNs. This project is currently planned to be completed by 2021.

- **Gage TS - T3/T4/T5/T6 Transformers and LV Switchgear Replacement**
  The recommended plan for Hydro One is to reconfigure the station and reduce it from 3 DESNs to 2 DESNs due to age and condition of the existing transformers. Under this plan, the two DESNs, T3/T4 and T5/T6 made up of 56 MVA transformers will be replaced by a single

T10/T11 DESN with two 100 MVA standard units, and switchgear currently supplied by T5/T6 transformers will also be replaced. This project is expected to be in service by 2021.

- **Birmingham TS – T1 Transformer and LV Switchgears Replacement**
  The recommended plan is to replace T1 transformer with a similar unit and the three 13.8 kV LV metalclad switchgears at Birmingham TS to meet the unique connection needs of the customer at this station. This refurbishment project is expected to be in service by Q4 2026.

- **Nebo TS – T3/T4 Transformers Asset Replacement**
  Nebo TS has two DESN units T1/T2 and T3/T4 supplying Hamilton area loads at 27 .6 kV and 13.8 kV respectively. The T3/T4 transformers at this station have aged and are in poor condition and have been identified to be required to be replaced by 2025- 2029 timeframe. These non-standard 75 MVA transformers are to be replaced with 100 MVA standard units. This project is planned to be in service by Q4 2026.

- **115 kV HL3/HL4, K1G/K2G, H5K/H6K Cable Replacement**
  Further investigation as reveled that these cables are in decent condition and would not require replacement over the next ten (10) years.
    - 115 kV H5K/H6K Cable (Beach TS to Kenilworth TS)
    - 115 kV K1G/K2G Cable (Kenilworth TS to Gage TS)

    However, given that the replacement of high voltage underground cables will be very challenging and costly, it is required that alternatives be developed and assessed ahead of time. Hydro One has developed tentative options to address the replacement needs of these cables. The Technical Working Group recommends that the options developed by Hydro One should be further assessed by Hydro One and the IESO to develop a recommended plan.
    - 115 kV HL3/HL4 Cable (Newton TS to Elgin TS to Stirton TS)

    This project is estimated to be in service by Q3 2033

- **Beach TS - T1/T7/T8 Autotransformers and T5/T6 Transformers Replacement**
  Beach TS is a major switching and transformer station in East Hamilton. Station facilities include a 230 kV switchyard, three 230/115 kV autotransformers (T1/T7/T8), a 115 kV switchyard and two 230/13.8 kV DESNs. Hydro One has identified that the autotransformers T1, T7 and T8; and the T5/T6 DESN transformers require replacement due to their age and condition. The autotransformers T1, T7 and T8 and the T5/T6 DESN transformers are schedules to be in service by Q1 2028 and Q4 2028 respectively..

- **Lake TS - T1/T2 Transformers and LV Switchgears Replacement**
  Lake TS is located in the city of Hamilton, and has two DESN: T1/T2 and T3/T4, supplying Hamilton sub-region loads at 27.6 kV and 13.8 kV respectively. The T1/T2 and T3/T4transformers; and both 13.8 kV and 27.6 kV LV switchgears have been identified to be required to be replaced due to age and condition. The T1/T2 and T3/T4 are planned to be in service by Q2 2026. The 13.8 kV and 27.6 kV LV switchgears are scheduled to be in service by Q3 2029.

- **115 kV C9/C12 – Norfolk Area Supply Capacity**
  Norfolk area is currently supplied by Norfolk TS and Bloomsburg DS through 115 kV double circuit supply (C9/C12) from Caledonia TS autotransformers. The area supply capacity is limited by voltage decline limit in the event of loss of one the two (C9 or C12) supply circuits. This area has recently seen a significant interest from greenhouse developers and loads in this area are expected to grow significantly. The Technical Working Group recommends in the near term the load growth need will be met through load transfers from Norfolk area to Jarvis TS and by installing capacitor bank(s) at Norfolk TS. Hydro One plan is to have the capacitor bank connected in 2023.

  Hydro One has developed options to address the forecasted needs in the mid-to long term. The Technical Working Group recommends further assessment be carried out by the IESO and Hydro One to review the options identified above and/or other non-wires solutions, to address the capacity needs for the Norfolk Area in advance of the next planning cycle.

- **Norfolk TS - LV Switchgear Replacement**
  The recommended plan is to refurbish the Norfolk TS LV switchgear due to age and condition. This project is currently expected to be in service in Q4 2011.

- **Caledonia TS (T1) and Jarvis TS (T3/T4) Transformer Replacement**
  The Caledonia TS T1 and Jarvis TS T3/T4 transformers are aged by the 2025- 2029 timeframe and they are planned to be replaced. The Caledonia TS T1 and the Jarvis TS T3/T4 transformers are planned to be in service by Q3 2029 and Q3 2030 respectively.

4.2 Toronto

The Toronto (formerly referred to as Metro Toronto) Region comprises the area within the municipal boundary of the City of Toronto. In the first regional planning cycle, the region was divided into two sub-regions: Central Toronto and Northern Toronto sub-regions. In the second Regional Planning cycle, the Toronto Region was assessed as a whole and no sub-regions were created.

The second cycle Needs Assessment report for this region was completed and published by Hydro One in October 2017. An IRRP was completed by the Technical Working Group and report was published in August 2019. The second cycle RIP was completed in March 2020. Updates to the needs and plans recommended in this region are provided below.

The following active projects were developed to address near- and medium-term needs identified in the first cycle of RIP:

- **West Toronto Area Station and Line Capacity**
  This project was completed and the station was in service in Q4 2018. This project includes adding a new 115/27.6kV DESN at the Runnymede TS site and upgrading the respective 115kV circuits, K1W/K3W/K11W/K12W.

- **Southwest Toronto Station Capacity**
  The planned in-service date is currently scheduled for Q1 2022. This project includes adding a new 230/27.6kV DESN at the Horner TS site. New distribution feeder ties are also required to be built between Manby TS and Horner TS by THESL to accommodate load transfer out of Manby TS to Horner TS as the loading at Manby TS exceeds its capacity.

- **Downtown District Station Capacity (Copeland MTS)**
  Phase 1 has been in service since Q1 2019. Phase 2 of the project includes adding a second 115/13.8kV DESN at the Copeland MTS site. Based on the station capacity consideration for the Downtown District stations, the need date for Phase 2 is in the medium to long term and shall be completed by 2024.

- **Richview TS to Manby TS Corridor Line Capacity**
  Reinforcement of the Richview TS to Manby TS 230 kV corridor based on changes in assumptions and up to date load forecast. The recommended plan is staged as follows:

  Stage 1: Rebuild existing 115kV idle line to 230kV and reconfigure two existing circuits R2K and R15K into "Super-circuits". Stage 1 is currently expected to be in-service in Q3 2023.

  Stage 2: Unbundle the super–circuits and tap them to the existing VxR circuits to Claireville at Richview TS, and terminate the circuits at Manby TS (3 new breakers). The work shall be completed coincident with Manby TS replacement work, both of which are planned for completion in Q3 2025.

- **Manby TS SPS Load Rejection (L/R)**
  This project was completed in 2019. The breaker failure contingency at Manby TS caused outage of two of the three autotransformers. The purpose of this investment was to ensure that loading on in-service equipment at Manby TS is not exceeding the Short Term Emergency (STE) rating for loss of two out of three autotransformers in the Manby TS East and West switchyards.

Below are the updates for the new needs identified in the second cycle Needs Assessment, IRRP and RIP reports:

- **East Harbor / Port Lands Area Transformation Capacity**
  The LDC has identified an emerging area of load growth in the East Harbor and Port Lands in Toronto. The current load in the area is supplied from Esplanade TS and Basin TS. Transformation capacity in the area is sufficient with present day loading; however, due to the potential growth in area load, there may be a need for increased capacity around 2030+. This need will be further assessed in the next regional planning cycle to review options and to develop a preferred plan.

- **Load Restoration – C14L+C17L, C5E+C7E, and K3W+K1W**
  For the loss of circuits, C14L+C17L, C5E+C7E, and K3W+K1W, the load interrupted by configuration can exceed 150 MW and/or 250 MW and are required to be restored within the prescribed timelines as described in the ORTAC[6]. This need has been assessed in the IRRP

phase, which determined that there is sufficient low voltage load transfer and switching capabilities to meet the load restoration requirements.

- **Main TS Transformers Replacement**
  The Technical Working Group recommends that the existing 45/75 MVA transformers be replaced by larger 60/100 MVA transformer units, given the longer term potential of load growth and additional system resiliency and flexibility provided. The replacement is expected to be completed by the end of 2021.

- **Bermondsey TS –T3/T4 Transformers Refurbishment**
  The Technical Working Group recommends that Hydro One proceed with the refurbishment of the T3/T4 DESN of Bermondsey TS as per current standard. The refurbishment is expected to be completed by 2025.

- **John TS –Transformers, 115 kV breakers, and LV Switchgear Replacement**
  Replacement of transformers with 60/100 MVA units in a similar connection arrangement was determined to be the most feasible and economic solution. Existing oil filled breakers will be replaced with SF6 breakers. The transformers and breakers replacement will be coordinated with Toronto Hydro's work to replace their LV switchgear in several stages. This project is expected to be in service by 2026.

- **Manby TS – T7, T9, T12 Autotransformers, T13 Step-down Transformer and Rebuild 230kV Yard**
  The Technical Working Group recommends replacement of Manby East T7, T9, and Manby West T12 autotransformers with 250 MVA units. Also, Manby T13 DESN transformers will be replaced with 75/93 MVA unit along with 230 kV oil breakers and modify 230 kV switchyard. Three new breakers will be installed to accommodate the new circuits to Richview TS (as part of the Richview TS to Manby TS Corridor Reinforcement). The project is expected to be completed by 2025.

- **115kV C5E/C7E Underground Cable Esplanade TS to Terauley TS**
  The refurbishment of sections of the 115 kV underground cables C5E/C7E is expected to be completed by 2024.

- **115 kV Overhead Line H1L/H3L/H6LC/H8LC (Bloor St. JCT to Leaside JCT) and L9C/L12C (Leaside TS to Balfour JCT)**
  The Technical Working Group recommends the refurbishment of the overhead section as per current standard. These projects are expected to be completed by 2023.

4.3 Windsor-Essex

The Windsor-Essex region includes the most southerly portion of Ontario, extending from Chatham southwest to Windsor. It consists of the City of Windsor, the Municipality of Leamington, the Town of Amherstberg, the Town of Essex, the Town of Kingsville, the Town of Lakeshore, the Town of

LaSalle, the Town of Tecumseh, and the Township of Pelee, as well as the western portion of the Municipality of Chatham-Kent.

The second cycle of regional planning was triggered in 2017 and the Needs Assessment report for the region was completed and published by Hydro One in October 2017. The IRRP was completed and report was published by IESO in September 2019. The RIP was completed and RIP report was published by Hydro One in March 2020.
Implementation plans to address some of these needs are already completed or are underway. Since the first regional planning cycle, the following projects have been completed and underway:

- **J3E/J4E Load Restoration**
  During the first cycle, it was identified that SECTR project might not fully address the load restoration challenges in the J3E/J4E sub-system following the loss of C23Z/C24Z. The Technical Working Group has further assessed load restoration need in IRRP and confirmed that existing transmission reconfiguration options are sufficient to restore the interrupted load. Hence, there are no additional load restoration requirements for the study period of the second cycle of Regional Planning.

- **Supply to Essex County Transmission Reinforcement:**
  Build new 13 km double-circuit 230 kV transmission lines to Leamington area tapped to existing C21J/C22J circuits, the project was completed in 2017.

- **Leamington TS Capacity**
  The RIP report was completed in March 2020 for this region. As per this report, the updated load forecast shows that by 2021 the load demand in the Leamington area will exceed the capacity of the existing Leamington TS by about 200 MW. As a consequence, Hydro One built the second DESN at Leamington TS with the addition of 2 x 75/125 MVA, 230/27.6 kV transformers. Furthermore, additional SPS component was also added to the project scope. . The recommended SPS is for use during system restoration following the loss of any of the following circuits: L28C, L29C, W44LC, W45LS or S47C. The SPS would monitor the status of these circuits and trip load, as required, at Leamington TS, Aphria CTS and Mastron II CTS following the loss of any one of the circuits. The implementation of this SPS would avoid the need for load curtailment at these stations during this system restoration. This project was completed in Q2 2021.

- **Kingsville TS – T1/T2/T3/T4 Transformers Replacement**
  As the result of significant load increase in the Kingsville area, consistent with the recommendations in the NA and IRRP, Hydro One is planning to replace the existing 4x42MVA units with 2x83MVA units. The first 83MVA unit was in service in 2018, while the second unit is expected to be in service in Q4 2022.

- **Keith TS – T11/T12 Autotransformers Replacement**
  T11 and T12 are to be replaced with larger 250MVA units to improve load supply and restoration capability for the 115kV J3E/J4E subsystem. This work is currently planned to be completed by 2023.

- **Keith TS- Reconfiguration Of 230 kV and 115 kV Circuits and 27.6 kV Feeders**
  To accommodate the construction of Gordie Howe International Bridge reconfiguration on station equipment within Keith TS was required. In addition, reconfiguration on transmission circuits J5D (230 kV), C21J/C22J (230 kV), J3E/J4E (115 kV), connection facilities for customer owned circuit J2N (115 kV), and Distribution feeders 23M3, 23M4, and 23M5 (27.6 kV) was performed. The project was completed in 2019.

- **Crawford TS – T3 Transformer Replacement**
  T3 was replaced with similar 83MVA unit in May 2018.

- **Lauzon TS Transformers Replacement**
  At Lauzon TS, there are two autotransformers T1/T2, and two DESNs – DESN #1 supplied by step-down transformers T5/T6, and DESN #2 supplied by step-down transformers T7/T8. T5 and T6 are currently planned for replacement with larger size units by 2024. Step-down transformers T7 and T8, and autotransformers T1 and T2 are expected to be replaced by 2029.

- **Tilbury TS Decommissioning**
  Decommissioning of Tilbuy TS station and transfer serviced load to Tilbury West DS supply is in progress and it is expected to be completed by 2024.

- **Lakeshore SS and South Middle Road TS**
  The recommended plan to address supply capacity need to the Kingsville-Leamington area includes building a new switching station at Leamington Junction (Lakeshore TS), and a new DESN station (South Middle Road TS) and building 230 kV double-circuit transmission line from Chatham SS to the new Lakeshore TS. The planned in-service date for this project is in2023.

The second cycle RIP has concluded that the following needs require further assessment:

- Capacity needs at Kent TS, install new feeder positions to supply load growth at Kent TS, and further evaluate the plan for a new DESN south of Chatham as part of the Chatham-Lambton-Sarnia regional planning process
- Belle River TS station capacity, monitor load growth and re-evaluate the need in the next regional planning cycle

The RIP has confirmed K6Z, and C23Z/C24Z can meet the load security and restoration needs and no further actions are required.

4.4 GTA North

The GTA North Region is approximately bounded by the Regional Municipality of York, and also includes parts of the Cities of Toronto, Brampton, and Mississauga.

The Needs Assessment led by Hydro One for the second cycle was completed and the report was published in March 2018. The IRRP was then completed, and the report was published by IESO in February 2020. The RIP has also been completed published in October 2020. Below updates have been identifies as needs in this region:

Below updates to this region needs were identified during the first cycle of Regional Planning:

- **Load Security On V71P/V75P – Parkway to Claireville**
  In the first planning cycle, the Technical Working Group recommended the installation of in-line switches at the Vaughan MTS #1 junction in order to improve the capability of the system to restore load in the event that both 230 kV circuits V71P/V75P are lost (700MW at summer peak loading). Although this will improve load restoration, this does not address the load security need on V71P/V75P.

  During the second cycle the Technical Working Group accepted that the load security criteria is not met, but agrees that no further action is required at this time since the switches permit quick restoration of the load. Hydro One completed this project in 2018.

- **Vaughan MTS Transformation Capacity**
  Based on the current extreme summer weather non-coincident peak net load forecast, the need for additional transformation capacity was identified beyond 2027. During the second cycle RIP the Technical Working Group recommended to build a new Vaughan #5 MTS, by 2030.

- **Markham MTS Transformation Capacity**
  In the first cycle RIP, the Technical Working Group recommended to continue the assessment of wires and non-wires options to address the need for additional transformation capacity in the Markham-Richmond Hill area and to refine the need timing. Based on the latest extreme summer weather non-coincident peak net load forecast, the need for additional transformation capacity is projected to be in 2025. The IESO has issued a letter of support to Hydro One Transmission and Alectra to begin wires planning for a new 230/27.6kV DESN (Markham MTS#5). Hydro One and Alectra are currently in the process of selecting a preferred location to connect to 230 kV circuits P45/P46. During the second cycle, the Technical Working Group also identified a need to increase the thermal capacity of the existing lines by changing the conductors. The new Markham MTS#5 is expected to be built by 2025 and upgrading the supply capability of 230 kV circuits P45/P46 is expected to be completed by 2029.

- **Station Service Supply to York Energy Centre**
  In the first cycle RIP, a need for addressing station service supply to York Energy Centre (currently supplied from Holland TS) in the event of a (i) low-voltage breaker failure at Holland TS; or (ii) double circuit 230 kV contingency, was identified. These events can result in an interruption to the station service supply to York Energy Centre and therefore the loss of all generation output until the station service can be restored from the alternate source. This need has been reaffirmed in the second cycle and currently the IESO and Technical Working Group are pursuing alternative station service configurations at YEC as soon as possible to enable faster restoration of load on H82V/H83V, consistent with the load restoration criteria.

- **Northern York Area Transformation Capacity**
  In the first cycle RIP, the Technical Working Group recommended the need for additional transformation capacity in the Northern York Area, along with associated transmission capacity. The latest electricity demand growth forecast shows that the transformer stations capability (Holland TS/Armitage TS) will be exceeded post 2027.
  Additional step down transformation capacity is needed for the areas supplied by Armitage TS and Holland TS. There is transfer capability between these stations, so their combined LTR of 485 MW is used to determine the need. Based on the load forecast, it is expected that additional step down transformation capacity will be needed by 2027.

- **Load Restoration for 230 kV Circuit V43 and V44**
  V43 and V44 circuits supply Woodbridge TS, Vaughan #3 MTS, and Kleinburg TS. The need was identified in 2016 during the first cycle Needs Assessment for the GTA North – Western Sub-Region because the load restoration timelines as per the ORTAC[6] may not be met. During the second cycle, the Technical Working Group agreed that no further action is required at this time. The Kleinburg to Kirby option to address the supply capacity needs in the long term would improve the load restoration capability for these circuits. Until a preferred long-term solution is identified for the Claireville to Minden corridor, the Technical Working Group determined that there is no need to pursue other alternatives.

The second cycle of NA and RIP has identified the following new needs in this region:

- **Woodbridge TS Transformer T5 Replacement**
  Woodbridge TS supplies both Alectra and THESL. Woodbridge TS comprises one DESN unit, T3/T5 (75/125 MVA), with two secondary winding voltages at 44 kV and 28 kV. T5 is currently about 46 years old and has been identified to be replaced. The Technical Working Group recommended to replace the transformer with a similar type and size unit as per current standard. Replacement will be led by Hydro One and coordinated with the affected LDCs and no further regional co-ordination is required. Currently, Transformer T5 is expected to be replaced in 2027.

- **High Voltages on M80B/M81B**
  Post-contingency voltages on M80B/M81B may exceed 250 kV during future high load conditions. High voltages at Beaverton TS and Lindsay TS may occur following contingencies that leave these stations radially connected to Minden TS. These high voltages are observed when low voltage capacitor banks at Beaverton TS and Lindsay TS are dispatched under heavy load. The IRRP recommends identifying and implementing the solution no later than 2025 to mitigate the voltage rise issue. Two alternatives were explored during the second cycle by the Technical Working Group – manual remote operator switch of the LV capacitor banks and SPS modification to automatically remove capacitor banks at Lindsey TS and Beaverton TS. The Technical Working Group agreed that Alternative 1 would meet the need as the system can withstand the expected voltages and manual action is adequate.

4.5 Greater Ottawa

Greater Ottawa Region covers the municipalities bordering the Ottawa River from Stewartville in the West to Hawkesbury in the East and North of Highway 43.

Following the completion of the RIP for this region in December 2015, the second cycle Needs Assessment led by Hydro One was completed and published in June 2018. The IRRP was completed and report was published by IESO in March 2020. The Hydro One led RIP was completed and the report published in December 2020, after the publishing of the IRRP report.
Updates to previously identified needs from the last Regional Planning cycle are as follows:

- **Merivale TS T22 – LTR Exceeded**
  The need for additional 230/115kV auto-transformation capacity at Merivale TS was assessed by Technical Working Group as part of the broader South West Area's need for capacity (described below) in the IRRP phase. Hydro One will replace transformer T22 at Merivale TS with one that is approximately equal to T21 as a first step to address the need for increased supply to the 115 kV system. The current plan is to have the replacement completed by 2025-2026.

- **South West Area – Capacity**
  To reinforce electricity supply to southwest Ottawa: a 230 kV in-line breaker at Almonte TS was installed (2015), a section of the S7M circuit was upgraded (2017), and development work for a new South Nepean MTS and 230 kV connection line ensued, expected in-service date is 2022. A double circuit 230kV line (1.3km) from Cambrian JCT to Cambrian MTS to supply the new MTS will be built by Hydro Ottawa.

- **Hawthorne TS T5 and T6 – LTR Exceeded**
  To reinforce the overall regional supply: Hawthorne transformers T5/T6 are in the process of being replaced, due to age and condition of the assets, with higher rated transformers, T6 has been completed, T5 is expected to be completed in 2021.
  Transformers T7/T8 at Hawthorne TS were replaced with higher rated (125 MVA) transformers in 2019.

- **Russell TS and Riverdale TS (Part of Ottawa Center 115kV Area – Station Capacity)**
  The loading on these stations will be kept within equipment limits through the construction of feeder ties by Hydro Ottawa to transfer excess loads to other area stations.

- **Overbrook TS (Part of Ottawa Center 115kV Area – Station Capacity)**
  To reinforce electricity supply to central Ottawa, Overbrook TS transformers were replaced and reconfigured in 2018. The station transformers have been replaced with standard sized units that resulted in an increase in the station capacity from 72MW to 130MW.

- **Riverdale TS 13.8kV Switchgear Replacement**
  Riverdale TS is a 115/13.8kV station connected to 115kV circuits A3RM, A5RK, and A6R. Switchgears on Riverdale TS 13.8kV side have been identified approaching their end of service life. The Technical Working Group recommended that Hydro Ottawa continue with the 13.8kV switchgear replacement plan. The station is expected to be in-service by 2024.

- **Bilberry Creek TS – Refurbishment & Orleans TS – Reliability**
  Bilberry Creek TS consists of a 115/27.6 kV step-down transformer in East Ottawa, supplying up to 85 MW of load to both Hydro Ottawa and Hydro One Distribution. The station was built in 1964 and a number of its key components have been identified for replacement by Hydro One. A decision on whether to refurbish the station and keep the load on the 115 kV systems or to retire the station and move the load over to the 230 kV systems by supplying it from the newly built Orleans TS was made during the second cycle IRRP process. The Technical Working Group recommends that Hydro One proceed with the like-for-like refurbishment of Bilberry Creek TS, with expansion to accommodate two additional breaker positions to supply Hydro Ottawa customers. The two options that were considered have similar estimated costs, however only the refurbishment option results in sufficient capacity to supply the combined demand forecast at Bilberry Creek TS and Orleans TS.

- **King Edward TS – Station Capacity**
  The capacity at King Edward TS is limited to 71MW. Station assessment identified station equipment that is at end of life and requires replacement, including the replacement of the T3 power transformer, protection, control and telecom (PCT) equipment along with disconnect switches. The T3 power transformer is being replaced with a larger size unit rated 115-14.2-14.2kV, 60/80/100MVA that is similar with the companion T4 unit ratings. The project is currently under execution, and the expected in-service date is Q4 2021.

- **Almonte TS/Terry Fox MTS – Voltage Regulation**
  Circuit E34M/T33E is a 290 km line between Clarington TS in Oshawa, and Merivale TS in Ottawa. If the circuit E34M is open at the Merivale TS end, Terry Fox MTS and Almonte TS will need to be supplied radially by Clarington TS. However, studies have shown that Clarington TS will not be able to provide adequate support for Almonte TS and Terry Fox MTS during peak loading period, which would in turn result in voltages below the minimum allowable levels.
  Hydro Ottawa's new station, Cambrian MTS, will implement a scheme to remove the station load from circuit E34M and move it to its alternate supply S7M in the event of a line end open (LEO). A LEO at Merivale TS can results in load loss at Almonte TS and Terry Fox MTS. Terry Fox MTS is part of the Ottawa Area under voltage load rejection scheme ("UVLS"). This scheme is designed to shed the station load if the 230 kV supply voltage to the station drops below 204 kV when it is activated. The combined load of both stations is less than 150 MW and can be restored within 8 hours as mandated by the ORTAC[6]. As the load restoration criteria can be met, no further action is recommended by the Technical Working Group.

- **A4K Supply Capacity**
  This need was addressed by providing an additional supply to Overbrook TS from a tap to circuit A6R. Riverdale JCT x Overbrook TS: Build New A6R Tap project was completed and in-service in Q2 2019.

The second cycle Needs Assessment report has identified new needs in this region that require further regional co-ordination. The following needs were also confirmed in the IRRP phase:

- **S7M 115kV Line Refurbishment**
  The 115 kV conductors, spread across multiple S7M line sections totaling 6.5 km, have been identified at or near their end of service life. As suggested by Hydro One, refurbishment of these line sections is recommended by the Technical Working Group, to replace conductors, wood poles, insulators, and other components. The refurbishment is expected to be completed in Q2 2023.

- **Albion TS – T1/T2, Switchgears and Circuit Breakers Replacement**
  Albion TS is a 230/13.8/13.8kV station connected to 230kV M30A and M31A circuits, supplying Hydro Ottawa. The transformers T1 and T2 rated at 45MVA each, were built in the 1970s, and have been identified for replacement due to their age and condition. As per the recommendation from Needs Assessment and further assessed in the IRRP, Albion T1 and T2, along with associated metal-clad switchgears and breakers are currently scheduled for replacement and in-service by late 2026. No increase in the transformation capacity is recommended.

The Needs Assessment identified that the following new EOL needs in this region do not require further regional coordination:

- **Slater TS –Transformers T1/T2/T3**
  Slater TS is an 115/13.8/13.8kV station connected to 115kV A3RM, M4G, and A5RK circuits, supplying Hydro Ottawa. The station has three transformers T1, T2, and T3, rated at approximately 65MVA each, built in the 1960s. In 2018 T1 failed and was replaced with a 100MVA unit. Currently Hydro One is in process of replacing and upsizing the remaining T2 and T3. This additional LMC would provide Hydro Ottawa with flexibility to transfer load from other stations in the downtown Ottawa area, where there are limited options for siting new supply stations. The replacement of the equipment is expected to be completed by 2023.

- **Arnprior TS –Transformers T1/T2**
  Arnprior TS is a 115/44 kV DESN connected to W6CS and C7BM 115 kV circuits, supplying Hydro One Distribution. Transformers T1 and T2, built in 1960 and 1957, respectively, rated at 42MVA each, have been identified to be at the end of their service life. The Technical Working Group recommended that this need is to be addressed by Hydro One Transmission and Distribution to co-ordinate the replacement plan. The replacement of these equipment is expected to be completed by 2023.

- **Longueuil TS –Transformers T3/T4**
  Longueuil TS is a 230/44kV DESN connected to 230kV B5D and D5A circuits, supplying Hydro One Distribution. Transformers T3 and T4, built in 1965 and 1964, respectively, are rated at 93MVA each. Considering the relatively flat load growth rate at the station, replacing these transformers with similar size units is recommended in the Needs Assessment. The Technical Working Group recommended that this need is to be addressed by Hydro One and Hydro One Distribution to coordinate the replacement plan. The replacement of these equipment is expected to be completed by 2024.

- **Voltage Regulation at Stewartville TS**
  The load on the Stewartville TS was previously expected to increase significantly as a result of the connection of a large utility load forecasted for 2018. However, the most recent forecast revealed that loading on Stewart TS is expected to remain at around 25MW over the next 10 years. No further actions are required at this time.

- **79M1 Circuit – Voltage Regulation**
  There is low voltage observed on this circuit and the voltage regulation is dependent on the amount of load being supplied by the circuit. In addition, it is impacted by load supplied by 115kV circuit H9A within the Ottawa Area sub-region. This voltage regulation need is being reviewed during the IRRP phase along with load forecast for stations supplied by 79M1 and will also be addressed in the RIP.

4.6 Kitchener-Waterloo-Cambridge-Guelph (KWCG)

The KWCG region includes the municipalities of Kitchener, Waterloo, Cambridge and Guelph, as well as portions of Perth and Wellington Counties and the Townships of Wellesley, Woolwich, Wilmot and North Dumfries.
The first RIP was completed in December 2015 and recommended regional plans are being monitored by Hydro One for timely completion. The second Cycle Needs Assessment phase was completed and the report was published in December 2018. The IRRP phase was completed in May 2021 and the report published by IESO. The second cycle RIP work is in progress and is expected to be completed by December 2021.
The following needs were identified in the NA report:

- **Waterloo North Hydro – Step-down Transformation Capacity**
  During the first regional planning cycle a need for a new MTS #4 DESN was identified in the 2024 timeframe. The current load forecast defers this need beyond the study period of the current Regional Planning cycle.

- **Energy+ MTS #2**
  Energy+ initially identified a future need for a new DESN station (MTS #2) in the city of Cambridge near Preston TS. This station need is due to a potential new load center growth in their service territory. The additional supply capacity due to planned transformer replacement and available new feeder positions at Preston TS, will defer this new MTS need beyond the study period of current regional planning cycle.

- **Waterloo North Hydro – Supply Reliability at Elmira TS**
  Hydro One, in consultation with Waterloo North Hydro, has developed a supply reliability improvement plan for Elmira TS loads. The plan to improve supply reliability of Elmira TS loads will be included in the second cycle RIP report.

- **Campbell TS T3/T4 DESN Overloading**
  At Campbell TS, there are two DESNs – T1/T2 DESN and T3/T4 DESN. The T3/T4 DESN is expected to exceed its supply capacity during the study period. After replacement of T1 transformer and addressing the secondary equipment limitations there will be sufficient

spare supply capacity on T1/T2 DESN to accommodate T3/T4 DESN excess loading. Hydro One and Alectra Utilities will work together to balance loads between the two Campbell TS DESNs, when required.

- **Transformers Replacement**
  The implementation and execution plan for these needs will be coordinated by Hydro One with affected LDCs:
  - Campbell TS (T1/T2)
  - Hanlon TS (T1/T2)
  - Cedar TS (T7/T8)
  - Kitchener MTS #5
  - Preston TS (T3/T4)
  - Detweiler TS (T2/T4 Auto Transformer)
- **Refurbishment of line sections:**
  - 115 kV lines B5C/ B6C and D7F/ D9F
  - 230 kV lines D6V/D7V

  Hydro One will coordinate and proceed with refurbishment of these line sections with affected LDCs and customers.

Hydro One will continue working closely with LDCs to develop preferred plans to address these needs in the second cycle RIP.

4.7 GTA West

The GTA West Region covers the Regional Municipalities of Halton and Peel, and comprises the municipalities of Brampton, South Caledon, Halton Hills, Mississauga, Milton, Oakville and parts of Burlington.

The first cycle of regional planning for this region was completed in January 2016. The second cycle of Regional Planning for the GTA West Region is currently underway. The Needs Assessment Report was completed and published in May 2019. The IRRP was also completed in July 2021. The second cycle RIP work is in progress and is expected to be completed by Q1 2022. An update based on GTA West NA findings is provided below:

- **Additional Station Capacity need at Halton TS**
  Halton TS supplies Halton Hills Hydro and Milton Hydro. The recommendations were to build two new step-down stations as follows: Halton Hills Hydro to construct, own and operate a new step-down station at the Halton Hills Gas Generation facility with an anticipated in-service year of 2020. In parallel, Hydro One is developing Halton TS #2, at the site of the existing Halton TS. Engineering work for Halton TS #2 project has commenced in 2020, with an anticipated in-service date of Q2 2022.

- **H29/H30 Transmission Circuit Supply**
  There is a thermal capacity limitation for circuits H29/H30 in the medium-term As identified in first cycle RIP report & 2nd cycle NA report, Hydro One is planning to replace the existing conductor with a larger size conductor with targeted in-service date of Q2 2027.

- **T38B/T39B – Thermal Capacity Limitations**
  Circuits T38B/T39B supplies Halton TS, Trafalgar TS, Meadowvale TS, and Tremaine TS and provides connection to upcoming Halton Hills MTS. The supply security and thermal capacity limitations in the medium-term of circuits T38B/T39B under a single-circuit contingency with Halton Hills GS out of service is being addressed in the second cycle GTA West regional planning. This need is being assessed in the IRRP phase and will be further followed in the RIP to develop a preferred plan.

- **Richview X Trafalgar Transmission Circuit Capacity**
  Loading limitations on 230 kV circuits between Richview TS and Trafalgar TS was assessed as part of the IESO-led Bulk System Planning study. This conductor is planned to be upgraded and in service in Q1 2026.

- **Northwest Greater Toronto Area (NWGTA) Electricity Corridor Need**
  In February 2018, the IESO and the Ministry of Transportation have announced a joint corridor identification study on a proposed land corridor in the Northwest Greater Toronto Area (NW GTA). The purpose of this study was to identify land to be protected for future multi-purpose linear infrastructure (such as transmission lines and transportation infrastructure) to ensure it can be accommodated when the need arises. This long-term need will continue to be studied as part of the second cycle of Regional Planning.

- **Asset Replacement**
  The implementation and execution plan for these needs will be coordinated by Hydro One and affected LDCs:
    - Halton TS - PCT and Component Replacements (2027)
    - Pleasant TS - Breakers, PCT and Component Replacements (2034)
    - Bramalea TS - PCT and Component Replacements (2030)
    - Trafalgar TS - Component Replacement (2022)
    - Erindale TS - PCT and Component Replacements (2025)
    - Palermo TS - T3 / T4 Supply Transformer (2026)

4.8 Greater Bruce/Huron

The Greater Bruce/Huron area is located to the west of the Kitchener-Waterloo region in southwestern Ontario. The region includes the municipalities of Arran–Elderslie, Brockton, Kincardine, Northern Bruce Peninsula and South Bruce. It also includes the township of Huron-Kinloss.

Hydro One completed the first cycle for the region with the publishing of the RIP report in August 2017. At the time the Technical Working Group determined that no regional coordination was required for the identified needs. However, with increased load requests in the region, regional planning was triggered in early 2019. The second cycle Needs Assessment report was published in May 2019 by Hydro One. This was followed by a Scoping Assessment report published by IESO in September 2019. The IRRP for this region was completed in September 2021. The second cycle of RIP is scheduled to be issued in March 2022.

In the current regional planning cycle, the Technical Working Group has reaffirmed the needs identified in the first cycle along with identifying new needs associated with asset replacement in the region. Below is an update to the needs reaffirmed or identified during the current cycle Needs Assessment:

- **115kV L7S Circuit – Capacity Increase**

  L7S is a single 115 kV circuit transmission line operated radial from Seaforth TS to St. Mary's TS, suppling municipalities of Bluewater, South Huron, Lambton Shores, Lucan Biddulph, Middlesex Centre, North Middlesex, Thames Centre, Zorra, Perth South, Town of St. Marys, and West Perth. It is approaching its thermal loading limits during peak load conditions.

  Under contingency, L7S is overloaded. Options to mitigate the near-term need of upgrading the emergency thermal ratings of L7S are outlined in the Local Plan, prepared in the last Regional Planning cycle. Hydro One Transmission and the LDCs will revisit and assess the viability of the options proposed in the Local Plan.

  Based on the current load forecast, overloading of 115 kV circuits L7S (all in-service condition) continuous rating will be exceeded by 2027, and emergency rating under contingency (with one element D8S out) will be exceeded by 2022. Further assessment in the IRRP phase is required for the limited capacity of circuit L7S. In the IRRP phase, the Technical Working Group will assess possible wires and non-wires options to develop a recommendation to address expected load growth in the sub-region supplied by the circuit. The RIP will follow and will reconfirm the need and develop a preferred plan.

- **Age and Condition based Asset Replacement**

  The Technical Working Group determined that no further regional coordination was required to address the following age and condition based asset replacement needs. It was recommended that the implementation and execution for the replacement of these transmission assets be coordinated by Hydro One and the affected LDCs and/or customers, where required.

  - Wingham TS – T1/T2, PCT and Component Replacement (2023)
  - Stratford TS – T1 and Component Replacement (2021)
  - Seaforth TS – T1/T2/T5/T6, PCT & Component Replacement (2023)
  - Hanover TS – T2 and Component Replacement (2028)

4.9 East Lake Superior

Hydro One has completed the acquisition of transmission assets from the former Great Lake Power Transmission on Oct 31, 2016 under the new name Hydro One Sault Ste. Marie, and therefore became the lead transmitter in the East Lake Superior (ELS) Region. The ELS Region includes all of Hydro One Sault Ste. Marie's 560km of high-voltage transmission lines as well as ties to the rest of the provincial grid at Wawa TS in the northwest and Mississagi TS in the northeast. The region also includes Hydro One's 115kV W2C circuit supplying the Town of Chapleau from Wawa TS.

During the first cycle of regional planning (led by the former Great Lakes Power Transmission), only local needs were identified and they did not require further regional coordination. The second cycle

of Regional Planning was initiated by Hydro One in 2019, with the NA report published in June 2019 and the IRRP was completed in April 2021. The RIP work is in progress and was completed in October 2021.

Since the previous regional planning cycle, the following projects are underway or completed:

- **Wood Pole Replacements**:
  Multiple wood pole replacement projects were completed on a number of 115kV and 230kV circuits. These circuits consisted of wood pole structures that were assessed at being at their end of life and in need of replacements. The following circuits have their end of life wood pole structures replacement completed between 2014 to 2019:
  - No.2 and No.3 Algoma (completed in 2014)
  - Northern Ave 115kV circuit (completed in 2014)
  - No.1 Garshore (completed in 2015)
  - Hogg (completed in 2015)
  - P21G (completed in 2019)

- **Hwy 101 TS**:
  Installed a new control building completed with new protection relays, batteries, chargers, automatic transfer schemes and RTU to replace components such as electro-mechanical relays and batteries. This project was completed and in-serviced in 2015.

- **Anjigami TS**:
  Performed electrical and civil upgrade, including the installation of a new 44kV breaker, redundant battery and chargers, and replacement of protection equipment and other outdated AC/DC system. It also includes ground grid improvements. This project was completed in 2017.

- **Echo River TS**:
  Improve transmission reliability with the installation of an additional 230/34.5kV 25MVA Transformer (T2) as an on-site spare. This project is underway with a targeted in-service date of 2023 Q2.

- **Age and Condition based Asset Replacement**
  The Technical Working Group determined that no further regional coordination was required to address the following age and condition based asset replacement needs. It was recommended that the implementation and execution for the replacement of the following transmission assets be coordinated by Hydro One Sault Ste. Marie and the affected LDCs and/or customers, where required.
  - Echo River TS – Install 'hot' spare transformer and replace breakers (2023/2024)
  - No. 3 Sault Conductor and Structure Replacement (2024)
  - Third Line TS –Autotransformer T2 (2025)
  - Third Line TS –Protection Replacement (2022)
  - Patrick St TS – HV Breaker Replacement (2024)
  - Batchawana TS / Goulais Bay TS – Station Refurbishment (2024)
  - Northern Ave TS – Transformer T1 Replacement (2025)

  - DA Watson TS – Metalclad Switchgear Replacement (2026)
  - Clergue TS – Switchgear Replacement (2026)
  - Hollingsworth TS – Protection Replacement (2025)
  - Goulais TS - Station Refurbishment with MUS provision (2024)

- **Patrick St. TS, Algoma No.1 overload**
  Implementation of Automatic Load Rejection Scheme. This project is estimated to be in service by 2023.
- **Anjigami/Hollingsworth TS –** Transformer overload
  The Technical Working Group determined that it is needed to build a new 115/44kV Station - HOSSM to work with API to continue to develop solutions for resolving the transformer overload. This project is scheduled to be completed by 2024/2025.

- **Third Line Instantaneous Load Rejection Scheme**
  Eliminate/Minimize manual communication between IESO and OGCC by enabling remote arming of Third Line Instantaneous Load Rejection Scheme via ICCP line between IESO's EMS and HONI's NMS. This project is scheduled to be completed by 2021.

4.10 GTA East

GTA East Region comprises the municipalities of Pickering, Ajax, Whitby, Oshawa, and parts of Clarington and other parts of Durham Region.

The first cycle RIP for GTA East Region was completed in January 2017 and recommended regional plans are being monitored by Hydro One for timely completion. The second cycle RIP was completed and report published in February 2020. The report identified ongoing work at Seaton MTS with targeted in-service date of June 2020 and completed work of new Enfield TS in 2019. Furthermore, the second cycle NA concluded that there were no additional needs other than the age and condition based asset replacement work in the region.

The Technical Working Group determined that no further regional coordination was required to address the following needs. It was recommended that the implementation and execution for the replacement of the transmission assets be coordinated by Hydro One and the affected LDCs and/or customers, where required.

Below are the updates of previously identified needs:

- **Cherrywood TS 230kV & 500kV Breaker Replacements**
  Cherrywood TS is a major Bulk Electricity System (BES), Northeast Power Coordination Council (NPCC) station, located at east end of Greater Toronto Area (GTA). The existing 500kV and 230kV Air Blast Circuit Breaker (ABCBs), with an average age of 48 years are obsolete and at end of life. The age, condition and lack of parts present significant difficulties in maintaining these breakers and the associated high pressure air system. The project has been divided into multiple phases. Phase 1 of this project is currently underway. The whole project is expected to be completed by 2027.

- **Cherrywood TS LV Switchyard Refurbishment**
  The LV DESN switchyard, with the exception of step-down transformers T7 and T8, at Cherrywood TS is at end of life due to age and condition. This project is expected to be in-service in 2025.

- **Wilson TS T1/T2 & Switchyard Refurbishment**
  Wilson TS is located in Oshawa and it contains 4 X 75/100/125 MVA, 230/44 kV, transformers that supplies city of Oshawa through Oshawa Power feeders and surrounding areas of Oshawa through Hydro One Distribution owned feeders. The T1 and T2 transformers and majority of assets within 44 kV BY switchyard have reached end of life. Replacement of these assets is expected to be completed by 2022.

- **Seaton MTS**
  The construction of the MTS is in progress and is expected to be in service by 2021.

4.11 London Area

The London Area includes the Cities of Woodstock, London and St. Thomas as well as the Counties of Middlesex, Elgin and Oxford. The RIP for the region was completed in August 2017. The second cycle NA was completed and report published in May 2020. The NA determined that identified needs in the region are local in nature and can be addressed directly by Hydro One and affected LDCs, and therefore further regional coordination is not required. The second cycle of the RIP document is scheduled to be issued in December 2021.
Below needs are identified in this region:

- **Wonderland TS upgrade**
  In 2017, condition assessment of Wonderland TS identified it as in poor condition and assessment of replacement is being done in consultation with LDC load forecast. It will be replaced with a similar unit to match the ratings of transformer T6. The project is currently underway, and the expected completion date is Q2 2023.

- **Loss of W36/W37 (Clarke TS and Talbot TS)**
  For the loss of W36/W37, the Technical Working Group recommended the implementation of automated switching devices on distribution feeders and feeder extensions on the distribution system to improve the load restoration capability.

- **230 kV Transmission Lines**
  Under peak load condition and with standard power factor assumption of 0.9, for (N-1) contingency of W36/W37 and breaker failure contingencies at Buchanan TS that involve loss of either W36 or W37, the companion circuit will be loaded close to its LTE rating (96% to 99%) by the end of study period. The circuit loadings improve when power factor of 0.97 as provided by London Hydro is assumed for the transformer stations connected to W36 and W37, namely Talbot TS and Clarke TS. The Technical Working Group recommended that the

load restoration need following the loss of W36 and W37 be further assessed as part of Local Planning by Hydro One and the affected LDC(s).

- **In addition to above, the Needs Assessment identified the following**
  - Voltage constraint at Tillsonburg TS
  - Thermal constraints at 115kV circuit W8T (Buchanan TS x Edgeware JCT)
  - Sub-standard customer delivery performance at Tillsonburg TS.

  As per the Technical Working Group recommendation, Hydro One completed cost and feasibility assessments of different alternatives to above needs, and in June 2019, the Technical Working Group agreed to proceed with decoupling supply to Tillsonburg TS and Aylmer TS by reconfiguring existing normally open points as well as installing two new low-voltage capacitors at Tillsonburg TS. The project is currently undergoing detail cost estimating and expected to be in service in 2022.

- **Strathroy TS upgrade**
  Strathroy TS supplies the Middlesex County and townships of Adelaide-Metcalfe, Warwick, Strathroy-Caradoc via Entegrus and Hydro One Distribution.
  The Technical Working Group determined that there were no needs and/or no further regional coordination required for Strathroy TS.

- **230kV circuit M31W/M32W load restoration**
  Town of Ingersoll, City of Woodstock and rest of northern part of Oxford County are supplied by Ingersoll TS, Woodstock TS, Commerce Way TS, and Karn TS.
  A load restoration need was identified as the result of simultaneous loss of 230kV circuit M31W/M32W and this need has been further assessed in a Local Plan completed in May 2017. Based on load forecast and transfer capability information, it was determined that there is sufficient transfer capability in the existing system, and therefore no further action is required.

- **St. Thomas TS Decommissioning and W3T/ W4T/ T11T Reconfiguration**
  City of St. Thomas and surrounding areas are supplied by Edgeware TS and St. Thomas TS via distribution network of St. Thomas Energy Inc., London Hydro, and Hydro One Distribution. As recommended in the first Regional Planning cycle St. Thomas TS is decommissioned since there is no load connected at the station. This TS is reconfigured into a Junction and it is called ST. Thomas Junction. Furthermore, the 115kV circuits W3T and W4T from Buchanan TS are reconfigured and connected as a single circuit between Buchanan TS and the new St Thomas junction. These circuits will then be tied to T11T that supplies Aylmer TS and Tillsonburg TS thereby providing dual 115kV circuit supply to the area. This project was completed in Q4 2020.

- **Age and Condition based Asset Replacement**
  During the second cycle the following assets were identified for replacement:
  - The existing 115 kV switchyard in Buchanan TS will be replaced on a like-for-like basis and is scheduled to be completed in 2028.

- The existing Clarke TS DESN T3/T4 transformers will be replaced on a like-for-like basis and is scheduled to be completed in 2028.
- The existing Wonderland TS 27.6 kV switchyard will be replaced on a like-for-like basis and is scheduled to be completed in 2023.
- Protection equipment replacement projects will take place at Edgeware TS, Longwood TS, and Tillsonburg TS.

4.12 Peterborough to Kingston

The Peterborough to Kingston Region includes the area roughly bordered geographically by the municipality of Clarington on the West, North Frontenac County on the North, Frontenac County on the East and Lake Ontario on the South. The region includes Frontenac County, Hasting County, Northhumberland County, Peterborough County, and Prince Edward County and related municipalities.

The first cycle of Regional Planning was concluded with a RIP report published in July 2016. During the first cycle, there were no major needs identified in the region that required coordinated regional planning.

The second cycle of Needs Assessment was completed and report was published in February 2020. The second cycle IRRP is currently underway with expected completion date of Q4 2021 and the RIP document is scheduled to be ready in March 2022.

During the first cycle Needs Assessment, the Technical Working Group identified that the load supplied by Gardiner TS DESN 1 exceeded its summer 10 day LTR of 125 MW. As recommended in the first cycle NA, Hydro One Distribution has completed the transfer of load from DESN 1 to lightly loaded DESN 2 with excess capacity resulting in a load relief for Gardiner TS DESN 1.

The following needs were identified by the Technical Working Group in the second cycle Needs Assessment:

- **Overloading at Frontenac TS**
  Based on the submitted load forecast, the Frontenac TS will be loaded more than the station LTR by year 2028. The Technical Working Group recommended Hydro One Transmission to coordinate with Hydro One Distribution and Kingston Hydro to undertake distribution load transfer between Gardiner TS and Frontenac TS over the near term.

- **Belleville TS load connection inquiries**
  The summer peak loading on Belleville TS is close to its 10-day summer LTR of 161 MW. In addition to normal load growth in the area, Elexicon Energy Inc. has recently received approximately 30 MW of load connection inquiries to be connected at the Belleville TS. There is insufficient existing capacity in the area to supply the potential future connections.
  Hydro One plan is to replace these transformers with the similar size transformers, the maximum available standard units. The targeted in-service for transformer T2 is year 2021 and transformer T1 is in year 2022.

To address the future capacity requirements two options are assessed at the moment, to add a third unit, or to add a full new DESN station. During the IRRP and RIP phases, a preferred plan will be recommended.

- **Age and Condition based Asset Replacement**
  During the second cycle, the following assets were identified for replacement:
  - Lennox TS – 230kV & 500kV Breaker Replacements (2026)
  - Port Hope TS: Transformer Replacement (2025)
  - Havelock TS: Transformer Replacement (2028)
  - Belleville TS: T1 / T2 Transformer Replacement (2022)

An IRRP and RIP will be undertaken for the Peterborough to Kingston region to further assess the needs in the region.

4.13 South Georgian Bay/Muskoka

The geographical area of the South Georgian Bay/Muskoka Region is the area roughly bordered by West Nippising on the North-West, the Algonquin Provincial Park on the Northeast, Scugog on the South, Erin on the South-West and Grey Highlands on the West.

The second cycle Needs Assessment of this region was completed and report was published in April 2020. The IRRP work for this region is in progress with expected completion time in June 2022. The second cycle RIP document is scheduled to be issued in December 2022.

Updates to the previously identified needs in this region are as follows:

- **Transformation Capacity Need in Barrie/Innisfil**
  Barrie/Innisfil is forecasted to experience significant load growth, limiting station and line capacity and the end of life equipment. As per the first cycle of regional planning, the Technical Working Group recommended to rebuild and uprate Barrie TS as the best solution to meet the transformation capacity need in the Barrie/Innisfil area. Hydro One is currently executing this plan, named 'Barrie Area Transmission Upgrade project'. The plan includes uprating 115kV lines E3/4B to 230 kV, upgrading existing DESN transformers from 115/44 kV, 55/92 MVA to 230/44 kV, 75/125 MVA. The project is planned for an expected in-service in June 2022.

- **Transformation Capacity Need at Uprated Barrie TS**
  The Barrie Area Transmission Project (BATU) will be completed in 2022, and help to address existing capacity, and end of life issues that have been identified in the first regional planning cycle. Although supply capacity appears to be available post- BATU, Hydro One Distribution and its embedded LDC (InnPower) will be constrained at the 44kV feeder supply level in 2025. A plan is required to address the supply capacity need for InnPower beyond what Barrie TS can provide. The Technical Working Group continues to develop supply capacity solution(s) to address this need in the next phases of the second regional planning cycle.

- **Transformation Capacity Need in Parry Sound/Muskoka**
  Based on the load forecasts, additional transformation capacity relief is required for both Parry Sound TS and Waubaushene TS to accommodate the load growth:

  - **Parry Sound TS**: As per the first cycle of regional planning, the Technical Working Group has determined that replacing both transformers at Parry Sound TS with two standard 50/83MVA units will address the capacity need as well as age and condition based component replacement needs at the station. The project is currently in execution, and expected to be in-service in Q4 2022.

  - **Waubaushene TS**: This station will exceed its normal supply capacity at the end of 2020 based on the summer demand forecast. An immediate solution is required to address the summer loading concern and shall be coordinated with a permanent solution to address long-term supply capacity needs. As well, the transformers are expected to be at the end of the study period and require replacement by Q3 2027.

  - **Everett TS**: Load growth at this station is restricted due to a setting on a limiting component within the low voltage yard. This setting will be adjusted by 2026 to allow load to continue growing as per demand forecast.

- **M6E/M7E Load Restoration**
  For the loss of M7E/M6E transmission lines, the load interrupted with the existing circuit configuration during peak periods will not be able to meet load restoration criteria as described in the ORTAC[6]. Technical Working Group recommended to install motorized disconnect switches at the Orillia TS JCT in order to address this need. This project is currently in the execution phase, and expected to be in-service date in Q4 2020.

- **Minden TS – Asset Replacement**
  Since the first cycle of regional planning, Minden T1 and T2 transformers are being replaced with standard 50/83 MVA units. The project is expected to be in service in 2021.

- **Orangeville TS –Asset Replacement**
  Orangeville TS has two DESN switchyards 230/44kV and 230/27.6kV. Station transformers and associated low voltage equipment has been assessed at being end of life and in need of replacement due to asset condition. To address both the condition and the capacity needs, existing 230/44kV 83MVA transformers (T3/T4) will be replaced and upgraded with new 125MVA units. Also the existing nonstandard three winding 230/44/27.6 125MVA transformers (T1/T2) will be replaced and upgraded with new dual winding 230/27.6 83MVA units. Reconfiguration of the low voltage equipment and feeders will be transferred from T1/T2 DESN to the T3/T4 DESN to maximize the load capacity. The project is expected to be completed by 2023.

Needs identified during the second cycle include lines that require refurbishment over the next few years. These lines include 230 kV transmission lines D1M/D2M, E8V/E9V, and M6E/M7E. Currently the work is planned to be completed from 2023 (M6E/M7E) to 2028 (D1M/D2M).

4.14 Sudbury/Algoma

The Sudbury/Algoma region includes the municipalities of Greater Sudbury and Espanola and surrounding areas. There are municipal LDCs serving each of those municipalities and Hydro One Distribution serves the remainder of the Region. The area is supplied from transformer stations Clarabelle TS, Coniston TS, Elliot Lake TS, Larchwood TS, Manitoulin TS and Martindale TS.

Hydro One had developed and published a RIP report in June 2016. The Technical Working Group at the time determined that no further regional coordination was required.

The second cycle of Needs Assessment was completed in June 2020. The NA has determined that identified needs in the region can be addressed directly by Hydro One along with relevant LDCs, and therefore Scoping Assessment and/or IRRP is not required. The RIP report for the second cycle was completed in December 2020.

Needs Identified from the First Regional Planning Cycle and Implementation Plan

- **Coniston TS**
  The previous Regional Planning cycle Needs Assessment makes mention of the removal of the Coniston TS and its load being transferred to a newly built Hanmer TS DESN. Due to customers's changing system needs, this plan was reviewed and it evolved into the removal of the station in concurrence with the conversion of the legacy 22kV loads to 27.6kV and their transfer onto one of the feeders originating from Martindale TS. The project is currently planned to be completed in Q3 2021.
- **Espanola TS**
  Transformers T1 and T2 115/44kV 15MVA units were replaced and upgraded with new 115/44kV 42MVA units. This project was successfully carried out and in serviced in Q4 2016.
- **Martindale TS**
  230/115kV 115MVA T21 and T23 autotransformers are being replaced with new 230/115kV 125 MVA units. This investment is currently underway with a planned in service date scheduled in2022.
- **Manitoulin TS**
  Voltage Regulation – pre-contingency voltages at Manitoulin TS 115kV can at times be below the ORTAC criteria of 113kV. Hydro One and the LDC reviewed this need as part of a local plan, and agreed to monitor supply voltages and take corrective action if needed.

The following needs were identified by the Technical Working Group in the second cycle Needs Assessment:

- **Manitoulin TS**
  Full utilization of the station transformer capacity is restricted by a setting of a series limiting component and will need to be addressed as soon as practically feasible. A CT ratio setting on the low voltage bushing of the transformer breaker can be modified to allow full transformer LTR capability. Hydro One in collaboration with the LDCs is coordinating this implementation. This project is planned to be impelemented in 2021.

- **Martindale TS**
  This station will exceed its normal winter supply capacity in 2028. Hydro One is planning to replace the two 230/44kV 125MVA (T25/T26) power transformers in 2028 with new 230/44kV 125MVA units to address the needs. A plan is required to address the supply capacity need beyond what the new transformers units will be able toprovide. Should the need materializes sooner than anticipated at Martindale TS, a station specific needs assessment will be carried out to determine the best course of action for meeting the station supply capacity needs.

4.15 Northwest Ontario

The Northwest Ontario region encompasses a large geographic area, stretching from the town of Marathon to the western and northern borders of the province, with diverse characteristics.

The first cycle RIP for this region was completed in June 2017 with the publication of the RIP report. The second cycle Needs Assessment was completed and the report was published in July 2020. The IRRP work is in progress and expected to be completed by September 2022. The second cycle of the RIP is also scheduled to be issued in March 2023.

Below projects have been identifies as Needs in this region:

- **230kV Watay Line between Pickle Lake SS and Dinorwic Jct (Developed by Wataynikaneyap Power Limited Partnership (WPLP))**
  This project involves building a new 230 kV transmission line from a new 230kV switching station at Dinorwic Junction in the Dryden area to Pickle Lake SS, a new 230/115kV transformer station, along with a radial network of 115 kV system to be developed by WPLP in order to connect the Remote Communities north of Pickle Lake. Hydro One will connect these facilities to the existing transmission system through a new junction on the 230 kV transmission line D26A at Dinorwic and a new 115 kV switching station at Pickle Lake.

  This project will off-load the existing 115 kV transmission lines E4D and E1C (which are currently supplying the Pickle Lake area load), resulting in increased capacity for supply in the Red Lake area, without the need for upgrade to E4D at this time.

  WPLP is also developing a network of 115 kV system to connect the Remote Communities north of Red Lake. Hydro One will connect these facilities to the existing transmission system through a new junction on the 115 kV transmission line E2R in the Red Lake area.

  The Board has granted Leave-to-Construct for the Pickle Lake and Red Lake projects. Hydro One is in the process of design and construction of its new facilities to connect the new WPLP transmission facilities to Hydro One's transmission system. The anticipated in-service date is Q2 2022.

- **Ring of Fire Sub-System Need**
  The North of Dryden IRRP indicated that since the Ring of Fire area is remote from the existing transmission system, any additional capacity needs would require new facilities. It

indicated that transmission system connection, either from Pickle Lake or from the Marathon area, is the most economic option when compared to diesel generation. Development in the area is still in the early stages and no firm recommendations are made at this time.

To meet the forecast demand from LDCs, as reported in 2016, with the cancellation of the Energy East pipeline project and the current plans of new mine for embedded generation to meet their supply requirements, no new system enhancements were identified. Accordingly, new industrial and/or mining loads will be monitored and investments will be initiated once formal connection requests are received from the customer(s).

The second cycle Needs Assessment identified new needs in this area:

- **Marathon TS**
  With the sizable load increase in the Greenstone-Marathon Sub-Region, under loss of both auto-transformers at Marathon TS contingency, Marathon Sub-Region system experiences voltage collapse. The Technical Working Group recommends moving forward to the SA phase of Regional Planning in order to determine a suitable approach, IRRP and/or RIP, to address this issue.

- **Port Arthur TS - Transformation Capacity**
  The limiting low voltage equipment at Port Arthur is being replaced and upgraded and shall be completed by 2025. This upgrade would bring the total station capacity up to 59 MW from the current 55MW, sufficient to meet the demand beyond 2029. Port Arthur TS load growth will be actively monitored, and potential supply options will be re-evaluated in the next regional planning cycle. No further actions are required at this time.

- **Lakehead TS Capacity Need**
  With the projected sizable load growth and substantial decrease in dependable generation output assumption in the Thunder Bay Sub-Region, voltage support will be required, while at the same time mitigation is required to prevent overloading of the 115kV circuits A5A, A1B, and T1M under loss of T7 and T8 outage condition. The Technical Working Group recommends moving forward to the SA phase of Regional Planning in order to determine a suitable approach, IRRP and/or RIP, to address this issue.

- **Sapawe DS**
  This station is a 115/12.5kV distribution station owned by Hydro One Distribution. The station is anticipated to reach its winter and summer Planned Loading Limit (PLL) levels by year 2028 and 2026 respectively. Sapawe DS capacity need will be addressed as part of the Local Planning (LP).

- **Sam Lake DS**
  The station is the sole supply for Sioux Lookout Hydro, and this embedded LDC is anticipating to have significant load increase up to 35MW throughout the next 10 year period. The existing transformation facility at Sam Lake DS has already reached its Winter

10-Day LTR, and various options including adding an additional step-down transformer or having a brand new station built in the vicinity are being considered. Due to the significant load increase, additional voltage support will also be needed at this station. Sam Lake DS capacity need will be addressed as part of the Local Planning (LP).

4.16 Chatham/Lambton/Sarnia

The Chatham-Lambton-Sarnia region is located to the west of the Greater Toronto Area in southwestern Ontario. The region includes the municipalities of Lambton Shores and Chatham-Kent. It also includes the Townships of Petrolia, Plympton-Wyoming, Brooke-Alvinston, Dawn-Euphemia, Enniskillen, St. Clair, Warwick and the Villages of Oil Springs and Point Edward.

Hydro One developed and published a RIP in August 2017. The second cycle NA work is in progress and expected to be completed by July 2021 followed by the second cycle of RIP, which is scheduled to be issued on July 2023.

The Technical Working Group determined several needs that are local in nature and updates are provided below:

- **Chatham SS – Component Replacement**
  This investment is targeted towards age and condition based component replacement at Chatham SS. Due to operational requirements, capacitor SC21 and the associated breaker were needed to be replaced. The replacement was completed in Q2 2020.

- **St. Andrews TS – T3, T4 & Switchyard Refurbishment**
  This investment is targeted at age and condition based component replacement at St. Andrews TS. The investment will include a complete air insulated switchyard rebuild and transformer replacement by Q4 2025.

- **Sarnia Scott TS – T5 & Component Replacement**
  This investment includes replacing Transformer T5, and new 115 kV switchyard due to age and condition of the assets. The expected completion date is Q4 2024.

- **Lambton TS Asset Replacement**
  This investment includes replacing 230 kV transformers T7/T8, selected 230kV equipment, and transformers T5/T6 and their associated LV switchyard due to age and condition of the assets. The expected completion date is Q4 2023.

4.17 Niagara

The Niagara Region comprises the municipalities of City of Port Colborne, City of Welland, City of Thorold, City of Niagara Falls, Town of Niagara-On-The-Lake, City of St. Catharines, Town of Fort Erie, Town of Lincoln, Township of West Lincoln, Town of Grimsby, Township of Wainfleet, and Town of Pelham. Haldimand County has been included in the Niagara Region Group 3 for Needs Assessment.

Hydro One developed and published the RIP report in March 2017, and the second cycle of NA on May 2021. The second cycle of IRRP and RIP are scheduled to be issued in Q1 2023 and Q3 2023 respectively.

Below is the update to the needs identified by the Technical Working Group:

- **Thermal Overloading on 115kV Q4N**
  Under high generation scenarios at Sir Adam Beck GS #1, the loading on Q4N (Beck #1 SS x Portal JCT) can exceed circuit ratings. The potential overloading issue will be addressed under sustainment project that is scheduled for completion in 2021.

4.18 North/East of Sudbury

The geographical area of the North/East of Sudbury Region is the area roughly bordered by Moosonee on the North, Hearst on the North-West, Ferris South and Kirkland Lake on the East.
Hydro One developed and published a RIP in April 2017. The Technical Working Group at the time determined that no further regional coordination was required.
The second cycle of Needs Assessment and Scoping Assessments for this region were completed in May 2021 and August 2021 respectively. The IRRP work is currently underway with a tentative completion in February 2023. The second cycle RIP document for this region is also scheduled to be issued in August 2023 as well.

The new needs identified in the North/East of Sudbury are provided below:

- **Area Voltage Control:**
  Both Hydro One and IESO continue to experience operating challenges in maintaining acceptable voltages at high voltage station buses in the region. Of specific concern is the management of high voltages for buses at Hunta, Porcupine, Pinard and Kapuskasing during planned maintenance and outage conditions. Existing operating procedures employ the use of various shunt voltage controlling devices in the system and shall be reviewed to ensure continued effectiveness. Further regional coordination is required.

- **Thermal Limits**
  This region has received significant interest in customer connections in the Kirkland Lake/Dymond and Timmins/Porcupine area. Post contingency load rejection will allow customers to connect in this region; however, increasing loads beyond the applications that presently exist will further stress system capability and thermal limits in the region. System operations also experience increasing challenges in maintaining area circuits within thermal limits during planned outages to the 500kV circuits P502X and D501P. These outages require daily switching of the 500kV circuits affecting customers, and exposes transmission equipment to stresses, which can cause premature failure.
  Existing operating procedures should be reviewed in conjunction with the available equipment to ensure system operations can continue to maintain thermal limits during outage conditions. Further regional coordination is required.

- **Asset Replacement**
  The following stations have transformer and/or high voltage breakers are in need of replacement due to age and condition of the equipment within the study period:
    - Porcupine TS
    - Kapuskasing TS
    - Otto Holden TS
    - Timmins TS
    - Crystal Falls TS
    - Trout Lake TS

  Sections of the following circuits are in need of replacement, due to age and condition of the assets, within the study period:
    - K4 – Kirkland Lake TS x Macassa JCT (2023)
    - A8K/A9K – Ansonville TS x Kirkland Lake TS (2023)
    - T61S – Timmins TS x Shiningtree JCT (2023)
    - K2 – Kirkland Lake TS x American Barrick JCT (2024)
    - D2H/D3H – Pinard TS x Hunta SS (2026)
    - A5H/A5H – Tunis JCT x Fournier JCT (2027)

  Replacement of the assets for D2H/D3H and A4H/A5H identified above, will require further regional coordination.

4.19 Renfrew

The Renfrew Region includes all of Renfrew County that is made up of 17 municipalities and City of Pembroke. The rough boundaries of this Region are Ottawa River on the North-East, Algonquin Provincial Park on the West, and Route 508 on the South.

Hydro One led Technical Working Group developed and published a NA followed with a RIP report in July 2016. There were no needs in the region that required regional coordination.

The second cycle of Needs Assessment and Scoping Assessments for this region are done in May 2021 and August 2021 respectively. The second cycle IRRP and RIP are also scheduled to be issued on December 2022 and April 2023 respectively.

The new needs identified in the Renfrew are provided below:

- **Line / Station Capacity**
  The 2019 summer peak loading on Pembroke TS was 48 MW, which is above its 10 day summer LTR of 47 MW. Based on the submitted load forecast, the Pembroke TS will be loaded 52 MW by year 2029. Load relief is required at the Pembroke TS in the near term. Hydro One Distribution is to undertake load transfer studies to alleviate Pembroke TS overloading concerns in the near term. Alternatively, Hydro One Distribution may also assess the option of building a new distribution transformer station to manage Pembroke TS overloading and to serve future load growth in the area.

- **Aging Infrastructure Transformer and Line Replacements**
  The implementation and execution plan for below asset replacement needs were / will coordinated by Hydro One with affected LDCs
    - Chenaux TS – T3/T4 Auto transformers and 115 kV switchyard refurbishment (2021)
    - D6 - Des Joachims TS to Petawawa DS Line refurbishment (2022)

4.20 St. Lawrence

The St Lawrence Region covers the southeastern part of Ontario bordering the St Lawrence River. The region starts at Gananoque on the eastern end of Lake Ontario and extends to the inter-provincial boundary with Quebec. The City of Cornwall is supplied by Fortis Ontario with transmission lines from Quebec and is not included in this Region.
Hydro One developed and published a NA report followed by RIP report in July 2016. There were no needs in the region that required regional coordination. The second cycle of Needs Assessment for this region is completed in September 2021. Note that St. Lawrence NA was initiated two (2) month over the five (5) year period because of an error in oversight. The second cycle IRRP and RIP are also scheduled to be issued on January 2023 and June 2023 respectively.

The new needs identified in the St. Lawrence is provided below:

- **L22H: Replacement of Conductor, Shieldwire, Insulator and Tower Work**
  65km of 230kV circuit L22H between Easton JCT and Hinchinbrook North JCT needs to be replaced by year 2026. The Technical Working Group recommends that replacement of this line does not require further regional coordination. The implementation and execution plan for these needs will be coordinated by Hydro One with affected LDCs and/or customers. This assessment did not identify any other needs, therefore no further regional coordination required.

4.21 North of Moosonee

The lead transmitter for the region is Five Nations Energy Inc. The regional planning status will be provided by the lead transmitter.

5. CONCLUSION

The first regional planning cycle was successfully completed in Aug 2017, and the second regional planning cycle is currently underway. In the second cycle, Regional Planning for several regions had to be advanced due to emerging needs.

Members from the IESO, LDCs and Hydro One transmission are represented and actively participated on Technical Working Group during the various phases of the regional planning process. The Technical Working Group has been able to undertake the appropriate level of planning based on the needs and able to make efficient and effective decisions. For example, in the Needs Assessment phase, the Technical Working Group identifies needs and options to address them, and recommends plan for one or more of the needs and/or further assessments as part of IRRP or RIP. In addition, the concept of Local Planning is also utilized for further assessment by a smaller Technical Working Group in cases where needs are local in nature, and straightforward wires only options are the obvious and appropriate solution. Accordingly, assessments for these needs do not require further regional coordination and are directly planned for implementation by Hydro One Transmission and affected LDC(s) (or customers). Other needs are further assessed by the Technical Working Group during the IRRP and RIP phases of the regional planning process. Frequently, 'wires' planning is also initiated in parallel with IRRP when the Technical Working Group determines that a wires approach is the best alternative to address a need and allows for efficiencies in the process by starting the planning prior to triggering the RIP phase.

The sharing of information by Technical Working Group members and publishing of reports and other relevant information on Hydro One and IESO websites allows stakeholders to be aware of current and future plans that may influence their planning strategies. This transparency and stakeholder engagement was intended as one of the hallmarks of the regional planning process as envisioned by the Board.

Since the beginning of the second cycle of the regional planning process, Hydro One, LDCs, and the IESO have been able meet mandatory timelines to complete each of the regional planning phases. To summarize, below are significant milestones that have been accomplished in the second cycle:

- Regional Infrastructure Planning (RIP) reports completed for eight (8) regions (Burlington to Nanticoke, Toronto, Windsor-Essex, GTA North, Greater Ottawa, East Lake Superior, GTA East, and Sudbury/Algoma) with twelve (12) reports currently underway (Kitchener-Waterloo-Cambridge-Guelph, GTA West, Greater Bruce/Huron, Peterborough to Kingston, South Georgian Bay/Muskoka, London Area, Northwest Ontario, Chatham/Lambton/Sarnia, Niagara, North/East of Sudbury, Renfrew and St. Lawrence).
- Needs Assessment (NA) reports completed for twenty (20) regions. (Refer to Table 1). Note that St. Lawrence NA was initiated two (2) month over the five (5) year period because of an error in oversight.
- Integrated Regional Resource Planning (IRRP) reports for nine (9) regions (Burlington to Nanticoke, Toronto Area, Windsor-Essex, GTA North, Greater Ottawa, Kitchener-Waterloo-Cambridge-Guelph, GTA West, Greater Bruce/Huron, East Lake Superior), with eight (8) currently underway (Peterborough to Kingston, South Georgian Bay/Muskoka, Northwest

Ontario, Chatham/Lambton/Sarnia, Niagara, North/East of Sudbury, Renfrew and St. Lawrence).

From a wires infrastructure perspective, the RIP report for a region is the most important document as it provides a complete picture of the regional wire infrastructure plan. Specifically, the RIP report provides a report for the region to address all the identified needs in the regions including a consolidated account of wires infrastructure plans developed during earlier phases i.e. Needs Assessment, LP and IRRP for the region.

6. REFERENCES

[1] Ontario Energy Board. "Transmission System Code". Last Revised December 18, 2018 (Originally Issued on July 14, 2000).

[2] Hydro One Networks Inc. "Regional Planning Process – Annual Status Report". November 1, 2016.

[3] Ontario Energy Board. "Distribution System Code". Last Revised March 1, 2020 (Originally Issued on July 14, 2000).

[4] "Planning Process Working Group Report to the Board – The Process for Regional Infrastructure Planning in Ontario". March 13, 2013. Last Revised May 17, 2013.

[5] Ontario Energy Board. "Conservation and Demand Management Requirement Guidelines For Electricity Distributors". Last Revised August 11, 2016.

[6] Independent Electricity System Operator. "Ontario Resource and Transmission Assessment Criteria (ORTAC)". Issue 5.0. August 22, 2007.

APPENDIX A. CONSERVATION, DISTRIBUTED GENERATION, AND OTHER INITIATIVES

A.1 Conservation Achievement

In March 2019, IESO received the following two Ministerial directives that include changes to reduce the cost of energy-efficiency program delivery in Ontario. The first directive of March 21, 2019 directed the IESO to centrally deliver energy-efficiency programs in the province by implementing a new Interim Framework to take effect from April 1, 2019 to December 31, 2020. The second, also received March 21, 2019 directed the IESO to discontinue and wind-down the 2015-2020 Conservation First Framework (CFF) and the Industrial Accelerator Programs.

By Ministerial Directives dated June 22, 2020 and June 10, 2021, the 2015-2020 CFF wind-down period was extended until June 30, 2021 and December 31, 2021 respectively to provide IESO the ability to assist entities delivering CDM programs impacted by COVID-19.

On September 30, 2020, the IESO received a Ministerial directive to implement a new 2021-2024 CDM Framework, which follows the conclusion of the 2019-2020 Interim Framework. The new 2021-2024 CDM Framework focuses on cost-effectively meeting the needs of Ontario's electricity system, including by focusing on the achievement of provincial peak demand reductions, as well as targeted approaches to address regional and/or local electricity system needs.

The table below shows the estimated 2020 peak demand offsets resulting from energy efficiency projects reported to occur within the respective regions due to the delivery of the 2015-2020 CFF and the April 2019 – December 2020 Interim Framework.

Table 3. Conservation Status Update

Region	Verified 2020 Net Peak Demand Savings (MW)*
South Georgian Bay/Muskoka	**1.28**
Burlington to Nanticoke	**3.7**
Northwest Ontario	**0.285**
London Area	**1.44**
KWCG	**2.24**
GTA West	**7.25**
Greater Ottawa	**2.03**
GTA East	**1.067**
Toronto	**7.54**
Windsor-Essex	**0.59**
GTA North	**3.05**
East Lake Superior	**0.345**
Greater Bruce Huron	**0.762**

Note *: This peak demand savings value was estimated based on verified 2020 conservation activity within the respective regions for the Interim Framework only. Results have been mapped to planning region, and more granular results by sub-region and/or TS are not available.

A.2 Distribution Energy Resources

The table below shows the total installed and effective capacity of IESO Distributed Energy Resources ("DER") projects which have come into service or under development since the base year of the region/sub region load forecast. This does not include net or behind the meter generation. This table does not include projects which had already been in service prior to this date, except in cases where a new contract was formed to account for incremental capacity of a facility.

The equivalent effective capacity for these new generation sources is based on capacity factors consistent with the zonal assumptions applied in the region/sub region load forecast. Data is based on the IESO contract list as of August 31, 2021.

Table 4. DER Status Update

Sub region	Station	Installed Capacity (MW)	Effective Capacity (MW)	Base Year
Barrie/Innisfil	BARRIE TS	1.10	0.25	2014 Peak
	MIDHURST TS	24	5.30	
	EVERETT TS	2.40	0.50	
	ALLISTON TS	2.40	0.50	
	TOTAL	29.90	6.60	
Brant	BRANT TS	10.70	4.00	2012 Peak
	BRANTFORD TS	7.10	2.80	
	POWERLINE MTS	2.40	0.90	
	TOTAL	20.2	7.6	
Bronte	BRONTE TS	2.13	0.72	2014 Peak
	CUMBERLAND TS	3.23	1.10	
	BURLINGTON DESN	2.24	0.76	
	PALERMO TS	0.00	0.00	
	TRAFALGAR DESN	0.00	0.00	
	TREMAINE TS	1.70	0.58	
	GLENORCHY MTS	1.14	0.39	
	OAKVILLE #2 TS	0.00	0.00	
	TOTAL	10.44	3.55	
Toronto	AGINCOURT TS	0.00	0.00	2019 Peak (Summer)
	BASIN TS	0.00	0.00	
	BATHURST TS	0.00	0.00	
	BERMONDSEY TS	0.00	0.00	
	BRIDGMAN TS	0.00	0.00	
	CARLAW TS	0.00	0.00	
	CAVANAGH MTS	0.00	0.00	
	CECIL TS	0.00	0.00	
	CHARLES TS	0.00	0.00	
	COPELAND TS	0.00	0.00	
	DUFFERIN TS	0.00	0.00	

	DUPLEX TS	0.00	0.00	
	ELLESMERE TS	0.00	0.00	
	ESPLANADE TS	0.00	0.00	
	FAIRBANK TS	0.00	0.00	
	FAIRCHILD TS	0.00	0.00	
	FINCH TS	0.00	0.00	
	GERRARD TS	2.73	2.73	
	GLENGROVE TS	0.00	0.00	
	HORNER TS	0.00	0.00	
	JOHN TS	0.00	0.00	
	LEASIDE TS	0.00	0.00	
	LESLIE TS	0.00	0.00	
	MAIN TS	0.00	0.00	
	MALVERN TS	0.00	0.00	
	MANBY TS	0.00	0.00	
	REXDALE TS	0.00	0.00	
	RICHVIEW TS	0.00	0.00	
	RUNNYMEDE TS	0.00	0.00	
	SCARBORO TS	0.00	0.00	
	SHEPPARD TS	0.00	0.00	
	STRACHAN TS	0.00	0.00	
	TERAULY TS	0.00	0.00	
	WARDEN TS	0.00	0.00	
	WILTSHIRE TS	0.00	0.00	
	WOODBRIDGE TS	0.00	0.00	
	TOTAL	2.73	2.73	
Greenstone-Marathon	BEARDMORE DS # 2	0.00	0.00	2014 Peak
	JELLICO DS # 3	0.00	0.00	
	LONGLAC TS	0.02	0.00	
	MANITOUWADGE DS	0.00	0.00	
	MANITOUWADGE TS	8.01	8.00	
	MARATHON DS	0.00	0.00	
	PIC DS	0.00	0.00	
	SCHREIBER WINNIPEG DS	0.00	0.00	
	WHITE DOG DS	0.00	0.00	
	TOTAL	**8.03**	**8.00**	
Greater London	CLARKE TS	2.77	1.48	2015 Peak
	TALBOT TS	0.53	0.19	
	BUCHANAN DESN	0.77	0.28	
	HIGHBURY TS	1.26	0.47	
	NELSON TS	17.96	14.86	
	WONDERLAND TS	1.29	0.48	
	COMMERCE WAY	0.35	0.13	

	EDGEWARE TS	3.38	1.25	
	INGERSOLL TS	2.29	1.15	
	STRATHROY TS	1.01	0.37	
	TILLSONBURG TS	1.59	0.59	
	WOODSTOCK TS	0.18	0.07	
	TOTAL	33.37	21.33	
Hamilton	DUNDAS TS #2 (T5/T6)	0.10	0.04	2016 Peak
	DUNDAS TS (T1/T2)	9.59	8.68	
	NEWTON TS	0.02	0.01	
	ELGIN TS	1.98	1.94	
	STIRTON TS	0.34	0.13	
	GAGE TS (T3/T4)	0.00	0.00	
	GAGE TS (T5/T6)	0.00	0.00	
	GAGE TS (T8/T9)	0.00	0.00	
	BIRMINGHAM TS (T1/T2)	0.00	0.00	
	BIRMINGHAM TS (T3/T4)	0.00	0.00	
	KENILWORTH TS (T1/T4)	0.00	0.00	
	KENILWORTH TS (T2/T3)	0.00	0.00	
	BEACH TS (T3/T4)	0.02	0.01	
	BEACH TS (T5/T6)	0.54	0.21	
	LAKE TS (T1/T2)	0.00	0.00	
	LAKE TS (T3/T4)	0.37	0.14	
	WINONA TS	0.64	0.24	
	HORNING TS (T1/T2)	0.53	0.20	
	HORNING TS (T3/T4)	0.00	0.00	
	MOHAWK TS	0.56	0.21	
	NEBO TS (T1/T2)	1.21	0.46	
	NEBO TS (T3/T4)	0.79	0.30	
	TOTAL	**16.70**	**12.57**	
KWCG	ARLEN MTS	0.00	0.00	2018 Peak
	CAMBRIDGE #1	0.00	0.00	
	CAMPBELL TS	0.00	0.00	
	CEDAR TS	0.00	0.00	
	DETWEILER TS	0.00	0.00	
	ELMIRA TS	0.00	0.00	
	FERGUS TS	0.00	0.00	
	GALT TS	0.00	0.00	
	HANLON TS	0.00	0.00	
	KITCHENER #1	0.00	0.00	
	KITCHENER #3	0.00	0.00	
	KITCHENER #4	0.00	0.00	

	KITCHENER #5	0.00	0.00	
	KITCHENER #6	0.00	0.00	
	KITCHENER #7	0.00	0.00	
	KITCHENER #8	0.00	0.00	
	KITCHENER #9	0.23	0.09	
	PRESTON TS	0.00	0.00	
	PUSLINCH DS	0.00	0.00	
	RUSH MTS	0.00	0.00	
	SCHEIFELE TS	0.01	0.00	
	WATERLOO #3	0.22	0.08	
	WOLVERTON DS	0.50	0.19	
	TOTAL	0.96	0.36	
North of Dryden	CAT LAKE MTS	0.00	0.00	2014 Peak
	CROW RIVER DS	0.00	0.00	
	EAR FALLS DS	0.01	0.00	
	PERRAULT FALLS	0.00	0.00	
	RED LAKE TS	0.019	0.00	
	SLATE FALLS DS	0.00	0.00	
	TOTAL	**0.001**	**0.00**	
Northwest GTA	BRAMALEA TS	108.57	101.33	2012 Peak
	GOREWAY TS	10.98	4.17	
	CARDIFF TS	0.11	0.01	
	CHURCHILL MEADOWS TS	2.84	0.35	
	COOKSVILLE TS	0.05	0.01	
	ERINDALE TS	13.02	6.55	
	GLENORCHY MTS #1	1.17	0.15	
	GOREWAY TS	11.24	1.40	
	HALTON TS	2.77	0.35	
	JIM YARROW MTS	6.47	0.81	
	LORNE PARK TS	0.69	0.09	
	MEADOWVALE TS	2.36	0.29	
	OAKVILLE TS #2	1.67	0.21	
	PALERMO TS	2.13	2.13	
	PLEASANT TS	18.73	2.34	
	TOMKEN TS	7.63	0.95	
	TREMAINE TS	1.73	0.22	
	TOTAL	181.17	117.17	
Ottawa	ALBION TS	0.40	0.10	2017 Peak
	BILBERRY CREEK TS	0.10	0.00	
	BRIDLEWOOD MTS	0.00	0.00	
	CARLING TS	29.4	10.0	
	CENTERPOINT MTS	0.00	0.00	
	CUMBERLAND DS	0.00	0.00	

	CYRVILLE MTS	0.00	0.00	
	ELLWOOD MTS	0.00	0.00	
	FALLOWFIELD DS	0.10	0.00	
	GREELY DS	0.60	0.20	
	HAWTHORNE TS	0.20	0.10	
	HINCHEY TS	0.00	0.00	
	KANATA MTS	0.00	0.00	
	KING EDWARD TS	0.00	0.00	
	LIMEBANK MTS	0.10	0.10	
	LINCOLN HEIGHTS TS	0.20	0.10	
	LISGAR TS	12.00	4.10	
	MANORDALE MTS	0.30	0.10	
	MANOTICK DS	0.00	0.00	
	MARCHWOOD MTS	0.10	0.00	
	MARIONVILLE DS	0.30	0.20	
	MERIVALE MTS	0.00	0.00	
	MOULTON MTS	0.00	0.00	
	NAVAN DS	0.00	0.00	
	NEPEAN TS	0.30	0.10	
	NEPEAN EPWORTH TS	0.00	0.00	
	OVERBROOK TS	0.10	0.00	
	RICHMOND MTS	0.00	0.00	
	RIVERDALE TS	0.10	0.00	
	RUSSELL DS	0.00	0.00	
	RUSSELL TS	0.00	0.00	
	SLATER TS	0.00	0.00	
	SOUTH GLOUCESTER DS	0.00	0.00	
	SOUTH MARCH TS	0.60	0.20	
	TERRY FOX MTS	0.10	0.00	
	UPLANDS MTS #2	0.00	0.00	
	WILHAVEN DS	0.00	0.00	
	WOODROFFE TS	0.30	0.10	
	TOTAL	45.20	15.70	
Pickering-Ajax-Whitby	THORNTON TS	0.26	0.088	2016 Peak
	WHITBY TS	0.7122	0.242	
	WILSON TS	19.48	1.69	
	TOTAL	**20.45**	**2.02**	
Parry Sound/Muskoka	BRACEBRIDGE TS	0.00	0.00	2014 Peak (Winter)
	MIDHURST TS DESN1	22.00	0.00	
	MIDHURST TS DESN2	1.90	0.00	
	MINDEN TS	5.30	1.50	
	MUSKOKA TS	21.40	1.80	
	ORILLIA TS	33.30	0.50	
	PARRY SOUND TS	3.30	0.00	

	WAUBAUSHENE TS	21.20	0.00	
	TOTAL	108.40	3.80	
Thunder Bay	BIRCH TS	1.044	0.00	2014 Peak (January 20, 2014)
	FORT WILLIAM TS	21.961	3.80	
	MURILLO DS	0.578	0.013	
	NIPIGON DS	0.00	0.00	
	PORT ARTHUR TS	0.324	0.00	
	RED ROCK DS	1.00	0.00	
	TOTAL	1.83	0.073	
Windsor-Essex	No new contracted Distributed Generation			
West of Thunder Bay	AGIMAK DS	0.00	0.00	2014 Peak (January 20, 2014)
	BARWICK TS	25.00	0.00	
	BURLEIGH DS	0.19	0.00	
	CLEARWATER BAY DS	0.00	0.00	
	CRILLY DS (STURGEON FALLS CGS)	0.00	0.00	
	DRYDEN TS	10.06	0.00	
	ETON DS	1.30	0.00	
	FORT FRANCES MTS	0.10	0.00	
	KEEWATIN DS	0.00	0.00	
	KENORA DS	0.00	0.00	
	KENORA MTS	0.34	0.00	
	MARGACH DS	0.00	0.00	
	MINAKI DS	0.00	0.00	
	MOOSE LAKE TS	0.81	0.00	
	NESTOR FALLS DS	0.00	0.00	
	SAM LAKE DS	0.00	0.00	
	SAPAWE DS	0.00	0.00	
	SHABAQUA DS	0.00	0.00	
	SIOUX NARROWS DS	0.00	0.00	
	VALORA DS	0.00	0.00	
	VERMILLION BAY DS	3.60	0.00	
	WHITERIVER DS	0.00	0.00	
	TOTAL	41.40	0.00	
York	HOLLAND TS	1.25	0.42	2017 Peak (Summer)
	ARMITAGE TS	0.61	0.21	
	BROWN HILL TS	0.98	0.33	
	BUTTONVILLE TS	0.17	0.06	
	MARKHAM 1 MTS	0.07	0.02	
	MARKHAM 2 MTS	0.20	0.07	
	MARKHAM 3 MTS	0.30	0.10	
	MARKHAM 4 MTS	0.05	0.02	
	RICHMOND HILL MTS	0.17	0.06	
	VAUGHAN 1 MTS	0.33	0.11	

	VAUGHAN 2 MTS	0.07	0.02	
	VAUGHAN 3 MTS	0.31	0.11	
	VAUGHAN 4 MTS	0.00	0.00	
	TOTAL	**4.5**	**1.7**	
East Lake Superior	ECHO RIVER TS	0.00	0.00	2019 Peak
	BATCHAWANA TS	0.00	0.00	
	GOULAIS BAY TS	0.00	0.00	
	PATRICK ST TS	0.00	0.00	
	ST. MARY'S MTS	0.00	0.00	
	TARENTORUS MTS	0.00	0.00	
	CHAPLEAU DS	0.00	0.00	
	DA WATSON TS	0.00	0.00	
	ANDREWS TS	0.00	0.00	
	MACKAY TS	0.00	0.00	
	NORTHERN AVE. TS	0.00	0.00	
	TOTAL	**0.00**	**0.00**	

A.3 Other Initiatives

Other Electricity System Initiatives, as identified by the IESO, include:

Sub region	Other Electricity System Initiatives
Barrie/Innisfil	A Barrie TS Local Achievable Potential Study was conducted by Guidehouse Canada Ltd. (formerly Navigant Consulting, Inc.) to explore the potential of non-wires alternatives to address Barrie TS needs identified in the 2016 Barrie/Innisfil IRRP.
Central Toronto	Please refer to the Toronto IRRP Report in the link above for all electricity system initiatives in the Toronto area.
Hamilton	An addendum to the Hamilton IRRP is expected to be available in Q1 2021.
Ottawa	There is a Local Achievable Potential Study being developed in the Ottawa area to explore the potential of demand side options to help address the needs identified in regional planning. These studies are a part of the continued efforts to explore non-wires options as part of the integrated solutions to manage identified needs. In addition, the City of Ottawa is developing a comprehensive community energy strategy called Energy Evolution. In 2019, in consultation with IESO staff, Hydro Ottawa submitted two proposals to Save On Energy's Local Program Fund (the "Fund"), a program application stream which allows LDCs to continue to design and deliver energy efficiency programs that serve the needs of their specific customers. Programs approved through the Fund must demonstrate cost-effectiveness based on the resulting net benefit when comparing the program investment (cost) against the provincial average avoided costs of providing electricity (benefit). So while these investments will benefit ratepayers province-wide, these offerings are also expected to help reduce the reliability risk due to heavily loaded stations in Kanata-Stittsville. The IESO approved both of Hydro Ottawa's proposed programs for delivery in 2020, which include the Kanata North Retrofit+ Program and the Kanata North Smart Thermostat Program. Both of these programs leverage the existing delivery infrastructure of current electricity and natural gas province-wide programs, which reduces administrative costs, streamlines customer experiences, and avoids market duplication and confusion. These local programs are an example of using system cost-effective energy efficiency to help address local system needs, and can inform similar approaches in the future. It is forecasted that these two initiatives could combine to offset more than 3 MW or 50% of the near-term peak load growth in the Kanata North area. In doing so, these programs could help address the 60 MW of capacity need in the Kanata-Stittsville region and support reliable supply until a long-term solution for the area is implemented.
Pickering-Ajax-Whitby	The Ontario government is supporting a plan by Ontario Power Generation (OPG) to safely extend the life of the Pickering Nuclear Generating Station. Under its proposed plan, Ontario Power Generation (OPG) will keep Pickering's units 1 and 4 operating until the end of 2024 and units 5 to 8 operating until the end of 2025, allowing for the safe, sequential shutdown of all units while maximizing the economic benefits of the generation station in the community.
Parry Sound/Muskoka	A Parry Sound TS and Waubaushene TS Local Achievable Potential Study is being developed in the Parry Sound/Muskoka area to explore the potential of demand side options to help address the needs identified in regional planning. These studies are a part of the continued efforts to explore non-wires options as part of the integrated solutions to manage identified needs.

Windsor-Essex	The IESO has issued a call for proposals through the Grid Innovation Fund to support projects that have the potential to cost-effectively reduce electricity demand from indoor agricultural facilities during local and provincial peak periods. The successful proponents will help accelerate the adoption of cost-effective demand-side solutions by greenhouse growers, demonstrate the efficacy of demand-side options to address local capacity needs, and explore unknowns in the operationalization of demand-side options and the impact on greenhouse productivity. More information can be found at the IESO's website. The IESO is also offering an increased incentive for enhanced LED grow lights through the Retrofit program to help greenhouses in the Windsor-Essex and Chatham-Kent areas reduce their energy use. The IESO released the Greenhouse Energy Profile Study, which summarizes how energy is used across the sector and provides insight into how greenhouses can utilize energy efficiency and innovative solutions to help their businesses grow.
York	The IESO, with support from Natural Resources Canada, is undertaking a demonstration in York Region to explore market-based approaches to secure energy and capacity services from distributed energy resources (DERs) for local needs, while coordinating across the electricity system. A key objective of the IESO York Region Non Wires Alternatives Demonstration Project is to better understand the potential of using DERs in place of traditional infrastructure by enabling them to operate in real-world applications. The demonstration will leverage both existing and new resources in southern York Region, where electricity demand is growing and is expected to exceed system capability over the next 10 years. Further information on this initiative, including supporting white papers, is available on the IESO's website.
East Lake Superior	The IESO initiated a Northeast Bulk planning study in 2021 to address the potential impact of high industrial load growth in this region on the bulk transmission system.

APPENDIX B. PLANNING STATUS LETTERS

The TSC requires that letters be issued by the transmitter as per Section 3C.2.2 item (h):

(h) within 45 days of receipt of a request to do so, provide a letter to a licensed distributor or a licensed transmitter confirming the status of regional planning for a region, including any Regional Infrastructure Plan that is being developed for the region that includes the distributor's licensed service area or within which the requesting transmitter's transmission system is located, suitable for the purpose of supporting an application proposed to be filed with the Board by the distributor or requesting transmitter.

In compliance with this requirement, Hydro One has provided Planning Status Letters to the following LDCs since November 2020:

- Hydro One Distribution
- Canadian Niagara Power INC (CNPI)
- Brantford Power
- Milton Hydro