Integrated Regional Resource Plan

Barrie/Innisfil
May 2022

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Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

APO	Annual Planning Outlook
BKF	Breaker Failure
CEP	Community Energy Plan
CDM	Conservation and Demand Management
DER	Distributed Energy Resource
DESN	Dual Element Spot Network
DG	Distributed Generation
GHG	Greenhouse Gas
HONI	Hydro One Networks Inc.
IESO	Independent Electricity System Operator
IRRP	Integrated Electricity Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
LMC	Load Meeting Capability
LTE	Long Term Emergency
LTR	Limited Time Rating
MW	Megawatt
NA	Needs Assessment
NERC	North American Electric Reliability Corporation
NPCC	Northeast Power Coordinating Council
NWA	Non-Wires Alternatives
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PPWG	Planning Process Working Group
RIP	Regional Infrastructure Plan
RO	Reliability Outlook
SIA	System Impact Assessment

SGBM	South Georgian Bay Muskoka
TS	Transformer Station

This Integrated Regional Resource Plan (IRRP) was prepared by the Independent Electricity System Operator (IESO) pursuant to the terms of its Ontario Energy Board licence, EI-2013- 0066.

This IRRP was prepared on behalf of the Technical Working Group of the Barrie/Innisfil sub-region which is composed of the following members:

- Independent Electricity System Operator
- Hydro One Networks Inc. (Distribution)
- Hydro One Networks Inc. (Transmission)
- Alectra Utilities
- InnPower Corporation

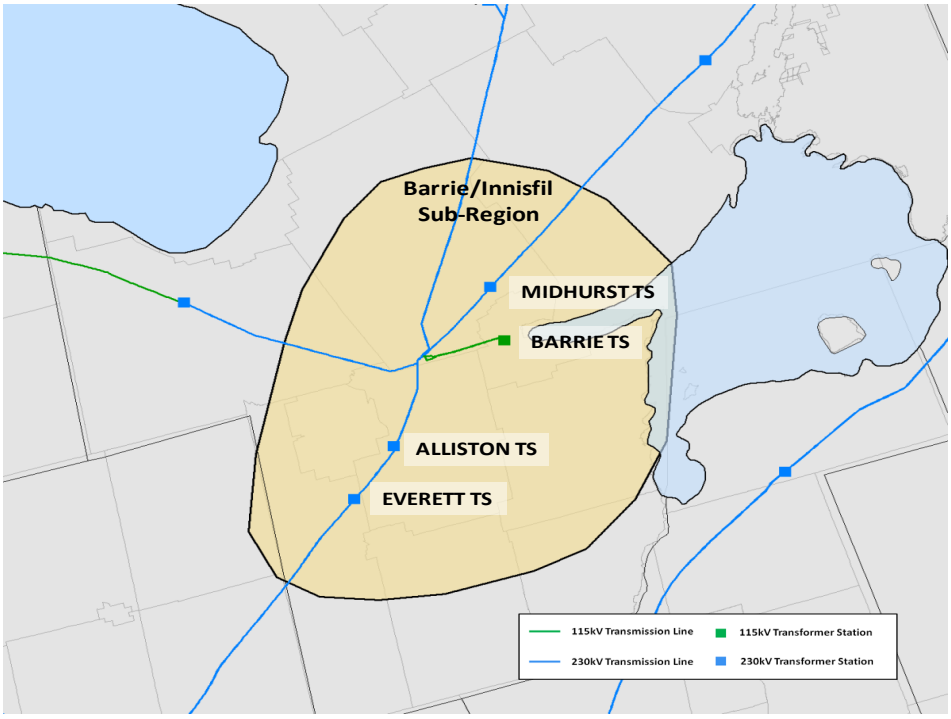
The Technical Working Group assessed the adequacy of electricity supply to customers in the Barrie/Innisfil sub-region over a 20-year period beginning in 2021; developed a plan that considers opportunities for regional coordination in anticipation of potential demand growth and varying supply conditions in the region; and developed an implementation plan for the recommended options, while maintaining flexibility in order to accommodate changes in key conditions over time.

The Barrie/Innisfil Technical Working Group members agree with the IRRP's recommendations and support implementation of the plan, subject to appropriate community engagement and consultations and obtaining necessary regulatory approvals.

1. Introduction

This IRRP for Barrie/Innisfil sub-region addresses the regional electricity needs over the study period, i.e., from 2021 to 2040. The Barrie/Innisfil sub-region is located in the South Georgian Bay Muskoka region and it encompasses the City of Barrie, the towns of Innisfil, New Tecumseth and Bradford West Gwillimbury, and the townships of Essa, Springwater, Clearview, Mulmur and Adjala-Tosorontio. Figure 1 shows the overview of the Barrie/Innisfil sub-region.

Figure 1 | Overview of the Barrie/Innisfil Sub-Region and Transmission System[1]



The sub-region is electricity supplied by the following three local distribution companies (LDC), namely: Hydro One Networks Inc. (Distribution), Alectra Utilities and Innpower Corporation. The transmission asset owner is Hydro One Networks (Transmission). This IRRP report was prepared by the IESO on behalf of the Technical Working Group composed of the three Local Distribution LDCs and transmitter.

[1] Barrie TS is currently being upgraded to 230 kV supply

In Ontario, planning to meet the electrical supply and reliability needs of a large area or region is conducted through regional electricity planning, a process that was formalized by the Ontario Energy Board (OEB) in 2013. In accordance with this process, transmitters, distributors and the IESO are required to carry out regional planning activities for each of the province's 21 electricity planning regions, including the South Georgian Bay Muskoka region, at least once every five years.

This is the second cycle of regional planning for the Barrie/Innisfil sub-region. This cycle began in 2020 with the publication of the South Georgian Bay Muskoka Needs Assessment Report. This was followed by a Scoping Assessment which identified needs that should be addressed through the IRRP process and recommended two IRRPs; one for Parry Sound/Muskoka sub-region and another for Barrie/Innisfil sub-region. A Technical Working Group was then formed for Barrie/Innisfil to gather data, identify electricity needs and develop options and recommendations which are included in this IRRP.

This IRRP report is organized as follows:

- A summary of the recommended plan for the Barrie/Innisfil sub-region is provided in Section 2;
- The process and methodology used to develop the plan is discussed in Section 3;
- The context for electricity planning in the Barrie/Innisfil sub-region and the study scope are discussed in Section 4;
- The demand forecast and conservation and demand management (CDM) and distributed generation (DG) assumptions are described in section 5;
- Electricity needs in the Barrie/Innisfil sub-region are presented in Section 6;
- Alternatives and recommendations for addressing needs are described in Section 7;
- A summary of engagement activities is provided in section 8; and
- The plan conclusion is provided in Section 9.

2. The Integrated Regional Resource Plan

The Barrie/Innisfil IRRP provides recommendations to address the electricity needs of the sub-region over the next 20 years. The needs were identified based on the sub-region's demand forecast and the capability of the existing transmission system as evaluated through application of the IESO's Ontario Resource and Transmission Assessment Criteria (ORTAC) and reliability standards governed by North American Electric Reliability Corporation (NERC). The IRRP's recommendations are informed by an evaluation of options, representing alternative ways to meet the needs, that considers: reliability, cost, technical feasibility, maximizing the use of the existing electricity system (where economic), and feedback from communities and stakeholders.

The Barrie/Innisfil IRRP recommendations below are organized under a near/medium-term plan and a longer-term plan. The near/medium-term timeframe is seven to ten years out while the longer-term timeframe is beyond ten years. The timeframe distinction reflects the different levels of forecast certainty, lead time for development and planning commitment required over these time horizons. This approach ensures that the IRRP provides clear direction on the investments that will be needed in a near future while remaining flexible to new information.

2.1 Near/Medium-Term Plan

Table 1 below lists the recommended actions to address the sub-region's needs together with the details of their implementation for the near/medium-term. The recommendations are further discussed below.

Table 1 | Summary of Near/Medium-term Plan for Barrie/Innisfil IRRP

Need Description	Recommendation	Lead Responsibility	Required by
Barrie TS to reach its summer 10-day LTR and supply capacity constraint at 44 kV feeder level	Construct a new 230/27.6 kV transformer substation	Hydro One and InnPower	2025
Everett TS to reach its summer 10-day LTR	Adjust the CT ratio of transformer breakers	Hydro One	2025
Sections of E8V/E9V circuits to reach end-of-life	Like for like replacement	Hydro One	2027

2.1.1 Transformer CT Ratio Adjustment at Everett TS and New 230/27.6 kV Transformer at Barrie TS

Everett TS and Barrie TS are both expected to reach their summer 10-day LTR in the near/medium-term timeframe.

Everett TS peak demand forecast will exceed its rating by 2025. The recommended solution for this need is to adjust the CT ratio of the transformer breakers[2]. This will provide the ability to utilize the full supply capability of the transformers at Everett TS and alleviate the need.

Barrie TS peak demand forecast will exceed its rating by 2027. Also, there is a supply constraint on the distribution level at the 44 kV feeder starting in 2025. For this distribution level need, minor capacity increases can be accommodated on the 44 kV system but only on an emergency basis. The recommended solution is to construct a new 230/27.6 kV transformer substation which would connect to the upgraded circuits E28B/E29B that will be in place once the Barrie Area Transmission Upgrade (BATU) reinforcements are in-service[3].

2.1.2 E8V/E9V Like-for-Like Replacement

Sections of circuits E8V/E9V will reach end-of-life by 2027. A like-for-like approach is recommended for the replacement of these assets from a regional perspective.

2.2 Longer-Term Plan

In addition to the near/medium-term plan above there are the following items to monitor and develop in the longer-term.

2.2.1 Monitor Growth at Midhurst TS and Alliston TS

Midhurst TS and Alliston TS are expected to reach capacity by 2035 and 2037 respectively. Given the timing of the need, no firm recommendation is required at this time. The Technical Working Group will continue to monitor demand growth in the area and revisit these needs in the next cycle of regional planning.

2.2.2 Consider CDM in Next Cycle of Regional Planning for M6E/M7E Essa x Midhurst circuit

There is a thermal capacity need on one MxE 230 kV circuit section between Essa and Midhurst for the loss of the companion MxE circuit starting in 2034. While this need is expected to arise in the longer-term, potential options were contemplated to inform future plans.

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[2] Current transformers are instrument transformers used for measurements for metering/loading data or for generating signals for protective devices. Since the current on the actual system is usually too high to be either economically or practically measured or to supply a signal to a protective device, the current transformer lowers the current to an acceptable level. The ratio between these two current values is the "CT ratio"

[3] The BATU project involves rebuilding and uprating Barrie TS and the E3/4B circuits to 230 kV circuits E28/29 and retiring Essa T1/T2

The analysis showed that incremental, cost-effective CDM is potentially a good candidate to defer this need, when considering the need characteristics. Given the time of the need, no firm recommendation is required at this time; however, it is recommended to continue to consider incremental, cost-effective CDM as an option in between planning cycles and bring these insights into the next cycle of regional planning for the region.

2.2.3 Supporting Community Energy Plans and Monitoring Energy Efficiency and Electrification Trends

There are two Community Energy Plans (CEP) identified in the Barrie/Innisfil sub-region. The first is the Barrie Community Energy and Green House Gas (GHG) Emission Reduction Plan which was presented to Council in March 2022. This plan will help the community better understand current energy consumption, identify energy efficiency opportunities and help meet the community's climate priorities.

The second plan is for the Town of Innisfil. The Community Strategic Plan: Innovative Innisfil 2030 was approved by Council in October 2019. This plan will guide projects across the Town of Innisfil over the next ten years to help Innisfil become a unique and innovative community.

While the IRRP seeks to align with these plans where possible, not all of the objectives fall within the scope of the regional planning nor the IESO's mandate. For example, absent of provincial government policy, the IESO is technology agnostic and will generally choose the most economic option that adequately resolves the need and meets applicable reliability standards. Greenhouse gas emissions are considered in the IRRP's options analysis by accounting for the carbon price associated with emitting resources, but the IESO does not have emission reduction targets unless directed by government policy. Furthermore, while regional planning is responsible for ensuring electricity ratepayer value and minimizing electricity costs, the IESO relies on government policy for broader socioeconomic considerations.

There are three CEP objectives that the IESO and regional planning can play a role in supporting. First, the IESO recognizes that distributed energy resources (DER) are becoming increasingly prevalent and features prominently in many CEPs. DERs can provide benefits to both customers as well as the distribution and transmission systems. By enabling DERs to provide wholesale services, system costs can be reduced and opportunities for customers and investors can be increased. The IESO's Enabling Resources Program (ERP) will produce a 5-10 year plan to enable resources to provide services they cannot or cannot fully currently provide. The ERP has identified storage, hybrids, and DERs as high-priority opportunities. The IESO developed a DER roadmap in the fall of 2021 to provide clarity on IESO objectives, initiatives, and timing for DER integration and is completing a DER Potential Study by June 2022. More information can be found on the Distributed Energy Resource Roadmap engagement page.

Second, the Technical Working Group will continue to support and monitor energy efficiency uptake. Conservation expected to be achieved through codes, standards, and program delivery has already been included in the planning forecast as described in Section 5.4. On September 30, 2020, the IESO received a Ministerial directive to implement a new 2021-2024 CDM Framework. The new CDM Framework will contribute to lowering the net demand as seen on the transmission system and ensures energy efficiency can continue to play a role in meeting the region's needs. The Technical Working Group will monitor uptake of the CDM framework as well as energy efficiency initiatives in CEPs and assess the impact of these additional savings on the timing of local reliability needs.

Finally, the Technical Working Group will monitor electrification trends and their impact on the demand forecast. The Technical Working Group recognizes that many CEPs are calling for ambitious electrification targets as a means to achieve carbon emission reductions. It is not yet clear how impactful electrification will be to the load forecast in the near-term but it could drive significantly higher demand in the long term that will necessitate new electricity supply into the area. While it is still difficult to establish when firm investments or infrastructure reinforcements will be needed, it is prudent to prepare for a future where electricity demand could potentially be significantly higher than forecast.

2.3 Bulk Area Needs

One of the needs identified as part of this IRRP is linked to the bulk transmission system in the broader region. This need is a thermal capacity need on one of the Essa 500/230 kV autotransformers for loss of the companion autotransformer arising in 2022. For loss of Essa T4, Essa T3 is at 100% of its 10-day summer Limited Time Rating (LTR) in 2022. This will be considered as part of IESO's bulk planning process.

3. Development of the IRRP

3.1 The Regional Planning Process

In 2013, the OEB created a formal process for regional planning which is carried out by the IESO, in collaboration with the transmitters and LDCs in each planning region. The regional planning formal process sets out 21 different electricity planning regions for the province. Regional planning assesses the interrelated needs of a region over the near, medium, and long term and develops a plan to ensure cost-effective, reliable electricity supply. Regional plans consider the existing electricity infrastructure in an area, demand forecast growth and customer reliability, evaluate options for addressing needs, and recommend actions to be undertaken.

The process consists of four main components:

1. A Needs Assessment, led by the largest transmitter in the region, which completes an initial screening of a region's electricity needs and determines if there are electricity needs requiring regional coordination;

2. A Scoping Assessment, led by the IESO, which identifies the most appropriate planning approach to address identified needs;

3. An IRRP, also led by the IESO, which proposes recommendations to meet the identified needs requiring coordinated planning; and/or

4. A Regional Infrastructure Plan (RIP), led by the transmitter, which provides further details on recommended wires solutions.

Further details on the components of the regional planning process in Ontario and the IESO's approach to regional planning can be found in Appendix A.

In addition to regional planning, there are also bulk system planning and distribution network system planning processes. Bulk system planning typically considers the 230 kV and 500 kV network and examines province-wide system issues whereas distribution network planning considers the supply of electricity within an LDC's system Regional planning is the intersection of those two.

A review of the regional planning process was finalized in 2021 following the completion of the first cycle of regional planning for all 21 regions. The Regional Planning Process Review Final Report is published on the IESO's website.

3.2 Barrie/Innisfil and IRRP Development

The process to develop the Barrie/Innisfil IRRP was initiated following the publication of Hydro One's South Georgian Bay Muskoka Needs Assessment report in April 2020 and the IESO's Scoping Assessment report in November 2020. The Scoping Assessment report recommended that the needs identified for the Barrie/Innisfil sub-region be considered through an IRRP in a coordinated regional

approach. The Technical Working Group was then formed to develop the terms of reference for this IRRP, gather data, identify needs, develop options and recommend solutions in the sub-region.

4. Background and Study Scope

This is the second cycle of regional planning for the Barrie/Innisfil sub-region. During the first cycle of regional planning, a Needs Assessment was conducted for the South Georgian Bay Muskoka Region in March 2015 that was led by Hydro One Networks Inc. Transmission. After reviewing the needs identified in the report, the Technical Working Group recommended that further regional coordination should be considered and a Scoping Assessment was published in June 2015 which recommended coordinated planning through an IRRP. Subsequently, the IRRP for Barrie/Innisfil was published in December 2016 and the RIP was published in August 2017.

This regional planning cycle started with a Needs Assessment published by Hydro One in April 2020, which identified several needs requiring further regional coordination. This was followed by a Scoping Assessment published in November 2020. The report recommended that an IRRP be initiated. This report presents an integrated regional electricity plan for the next 20-year period starting from 2021.

4.1 Study Scope

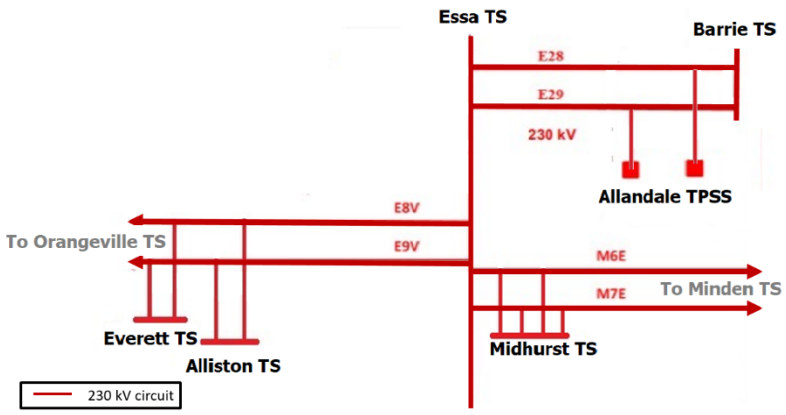
This IRRP develops and recommends options to meet the electricity needs of the Barrie/Innisfil sub-region. The plan was prepared by the IESO on behalf of the Technical Working Group. The plan includes consideration of forecast electricity demand growth, CDM, DG, transmission and distribution system capability, relevant community plans, condition of transmission assets and developments on the bulk transmission system. The needs addressed in this IRRP include adequacy, security and relevant end-of-life asset considerations.

The following transmission facilities were included in the scope of this study:

- 230/115 kV autotransformers at Essa Transformer Station (TS)
- Stations: Alliston TS, Barrie TS, Everett TS, Midhurst TS
- Transmission circuits: E8V/9V, E28/29, M6/7E (Essa to Midhurst section)

The single line diagram of the Barrie/Innisfil sub-region studied is shown in Figure 2 below.

Figure 2 | Single Line Diagram of Barrie/Innisfil Sub-Region



The Barrie/Innisfil sub-region is supplied from the two 500/230 kV autotransformers at Essa TS. These transformers form part of the bulk transmission system, as they are impacted by changes in the broader Ontario electricity system, in addition to the local distribution system. Specifically, the autotransformers are impacted by bulk power system flows on the north-south transmission interface, driven by changing generation and demand patterns in northern and southern Ontario. Therefore, regional needs pertaining to these autotransformers must also be considered from a bulk system perspective and coordinated accordingly.

The Barrie/Innisfil IRRP was developed by completing the following steps:

- Preparing a 20-year electricity demand forecast and establishing needs over this timeframe;
- Examining the Load Meeting Capability (LMC) and reliability of the existing transmission system, taking into account facility ratings and performance of transmission elements, transformers, local generation, and other facilities such as reactive power devices. Needs are established by applying ORTAC and NERC planning criteria;
- Assessing system needs by applying a contingency-based assessment and reliability performance standards for transmission supply in the IESO controlled grid as described in section 7 of ORTAC;
- Confirming identified end-of-life asset replacement needs and timing with LDCs;
- Establishing alternatives to address system needs, including, where feasible and applicable, possible energy efficiency, generation, transmission and/or distribution, and other approaches such as non-wires alternatives;
- Engaging with the community on needs, findings and possible alternatives;
- Evaluating alternatives to address near and long-term needs; and
- Communicating findings, conclusions and recommendation within a detailed plan.

4.2 Related Bulk System Planning Studies

The adequacy of the bulk system supplying the area (i.e., the 500/230 kV autotransformers at Essa TS) will be assessed by the IESO through a separate bulk system planning process, and assumptions will be coordinated between the regional and bulk plans.

5. Electricity Demand Forecast

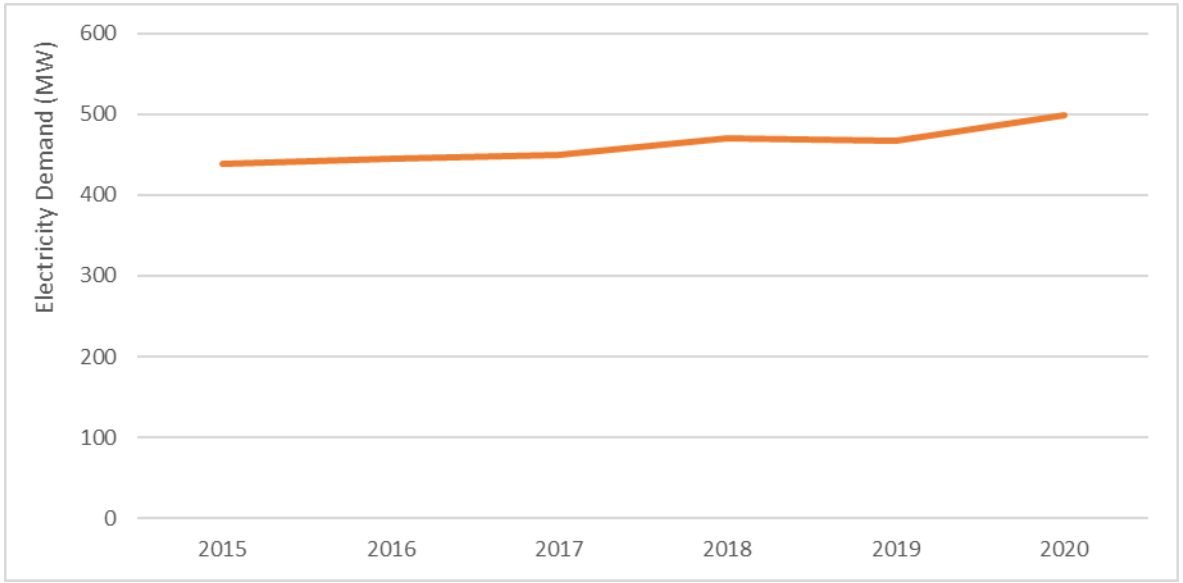
Regional planning in Ontario is driven by the need to meet peak electricity demand requirements in the region under study. This section describes the specific details of the development of the demand forecast for the Barrie/Innisfil sub-region. It highlights the assumptions made for peak demand forecasts including the contribution of CDM and distributed generation to reducing peak demand. The resulting net demand forecast, termed the planning forecast, is used in assessing the electricity needs of the area over the planning horizon.

To evaluate the reliability of the electricity system, the regional planning process is typically concerned with the coincident peak demand for a given area. This is the demand observed at each station for the hour of the year in which overall demand in the study area is at a maximum. This differs from a non-coincident peak, which refers to each station's individual peak, regardless of whether these peaks occur at different times. Within the Barrie/Innisfil sub-region, the peak loading hour for each year occurs in the summer.

5.1 Historical Electricity Demand

In the Barrie/Innisfil sub-region, electricity demand is primarily driven by residential and commercial customers and typically peaks during the summer months. In the summer, air conditioning plays a significant role in contributing to peak electricity demand. The historical demand is shown in Figure 3 and has been adjusted for weather-related impacts. The figure below shows a steady increase in the summer electricity demand needs of the sub-region, reaching a peak of 500 MW in 2020; notably, there is a significant increment from 2019 to 2020 impacted primarily by the weather conditions. The Technical Working Group determined 2020 to be the base year to be used for developing the planning demand forecast.

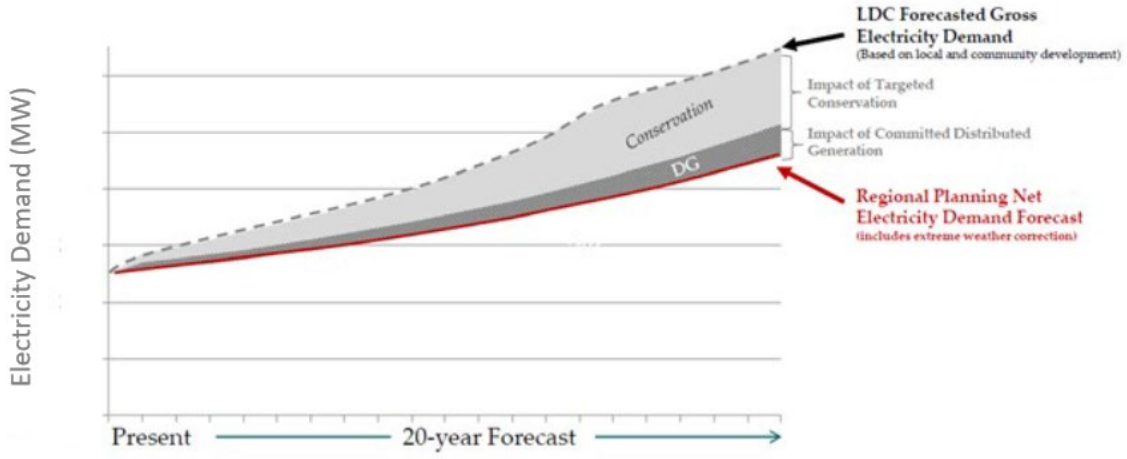
Figure 3 | Historical Summer Peak Demand – Barrie/Innisfil Sub-region



5.2 Demand Forecast Methodology

A 20-year regional peak demand forecast was developed to assess reliability needs for the Barrie/Innisfil sub-region; Figure 4 shows the steps taken to develop this. Gross demand forecasts, which assume the weather conditions of an average year based on historical weather conditions i.e., normal weather, were provided by the LDCs. These forecasts were then modified to reflect the peak demand impacts of provincial conservation savings and DG contracted through previous provincial programs such as FIT and microFIT. The forecasts were then adjusted to reflect extreme weather conditions in order to produce a reference forecast for planning assessments to assess the electricity needs in the region. Additional details related to the development of the demand forecast are provided in Appendix B.

Figure 4 | Development of the Demand



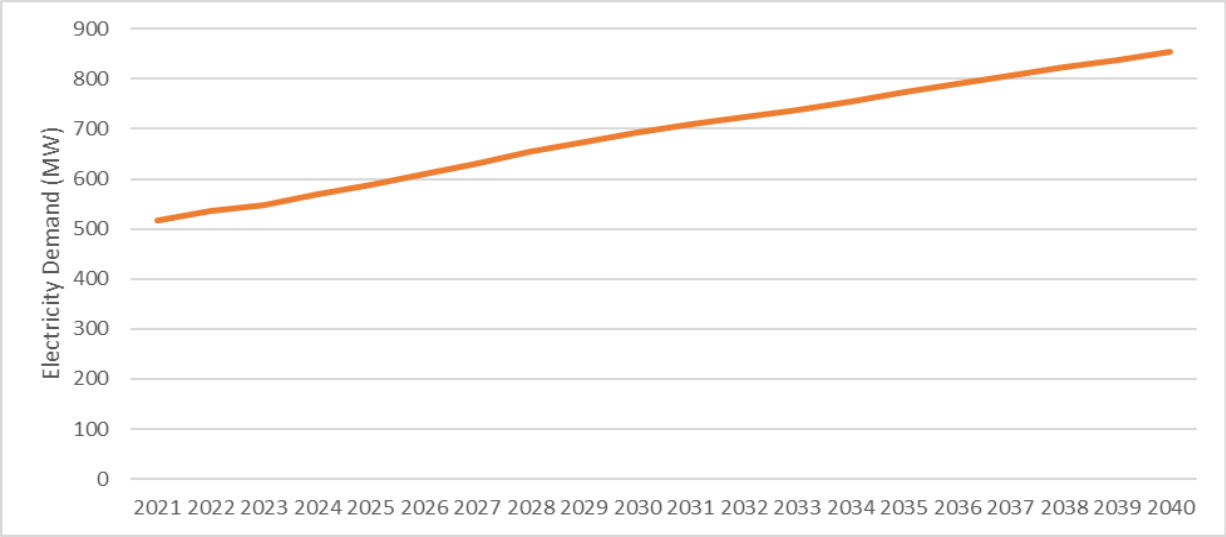
5.3 Gross LDC Forecast

All participating LDCs in the Barrie/Innisfil sub-region provided a gross demand forecast at the station level or at the station bus level for multi-bus stations. LDCs have a better understanding of future local demand growth and drivers than the IESO since they have more direct involvement with their customers. The LDC gross demand forecasts include known connection applications and account for increases in demand due to new or intensified development, economic growth, changes in consumer behaviour, etc. Increases in demand due to new or intensified development were captured through a sensitivity analysis. An example of this is the new Allandale Traction Power Substation (TPSS) (47.2 MW), which will be supplied from uprated circuits E28/E29.

Most LDCs cited alignment with municipal and regional official plans and credited them as a primary source for input data. LDCs are also expected to account for changes in consumer demand resulting from typical efficiency improvements and response to increasing electricity prices, but not for the impact of future DG or new conservation measures, such as codes and standards and CDM programs, which are accounted for later in the process. The gross LDC forecast assumes median on-peak weather conditions. More information on the LDCs' demand forecast methodology can be found in Appendix B.

The total gross coincident LDC forecast in the next 20 years for both summer and winter weather is shown in Figure 5 below.

Figure 5 | LDC Coincident Gross Summer Demand Forecast – Median Weather



5.4 Contribution of Conservation to the Demand Forecast

CDM helps in meeting Ontario's electricity needs by reducing demand. This is achieved through a mix of codes and equipment standards amendments as well as CDM program-related activities.

Demand reduction due to codes and standards are based on expected improvement in the codes for new and renovated buildings and through regulation of minimum efficiency standards for equipment used by specified categories of consumers. Program-related activities include Save on Energy programs, as well as those that are being implemented as part of the 2021-2024 CDM framework.

For the Barrie/Innisfil sub-region, the total forecast conservation savings at the time of summer peak are shown in Table 2 for a selection of the forecast years. These savings are subtracted from the gross median demand forecast as described in Section 5.6. Additional information is provided on Appendix B.

Table 2 | MW Savings from Conservation and Demand Management

Year	2022	2024	2026	2028	2030	2032	2034	2036	2038	2040
Summer Savings (MW)	12	25	32	37	41	42	43	44	46	47

5.5 Contribution of Distributed Generation to Demand Forecast

In addition to conservation resources, DG in the Barrie/Innisfil sub-region is also forecasted to offset peak demand requirements. The resources that were included in the DG forecast reflect resources that have contracts with the IESO as a result of previous procurement programs, such as the FIT and microFIT programs. In the Barrie/Innisfil sub-region, the contracted DG resources are all solar projects. The effective capacity, i.e., the MW output at the time of regional peak, was determined at a resource level, and the data was aggregated at a station level in order to put together a forecast specifying the estimated peak demand reduction due to DG output.

From 2021 to 2033, the expected annual peak demand contribution of contracted DG in the Barrie/Innisfil sub-region is 5.8 MW, going down to 2.35 MW in 2034 and 0 MW in 2040.

The DGs included in the Barrie/Innisfil IRRP are distributed connected from the following stations:

- Alliston TS
- Barrie TS
- Everett TS
- Midhurst TS

5.6 Net Extreme Weather Planning Forecast

The net extreme weather planning forecast, also known as the "planning" forecast, is the coincident peak demand forecast for the sub-region and is used to carry out system studies for identifying potential needs in the Barrie/Innisfil sub-region. This forecast is created in three steps:

1. The gross median weather forecast, provided by the LDCs, is adjusted to extreme weather conditions, according to the methodology described in Appendix B. The result is the gross extreme weather forecast.
2. The impacts of forecast CDM savings and DGs output are added to the gross extreme weather forecast which results in a net extreme weather forecast, or planning forecast.
3. A coincidence factor is applied to convert the forecast to non-coincident. The coincidence factor is based on the contribution of each station to the group's coincident peak over the past five years. Non-coincident station forecasts are utilized for assessing the capacity adequacy of each transformer station in the sub-region.

Figure 6 and Figure 7 below show the net extreme weather winter and summer forecasts for the Barrie/Innisfil sub-region. The figures also show the median gross weather forecast and the extreme gross forecast.

Figure 6 | Summer Net Extreme Weather Demand Forecast

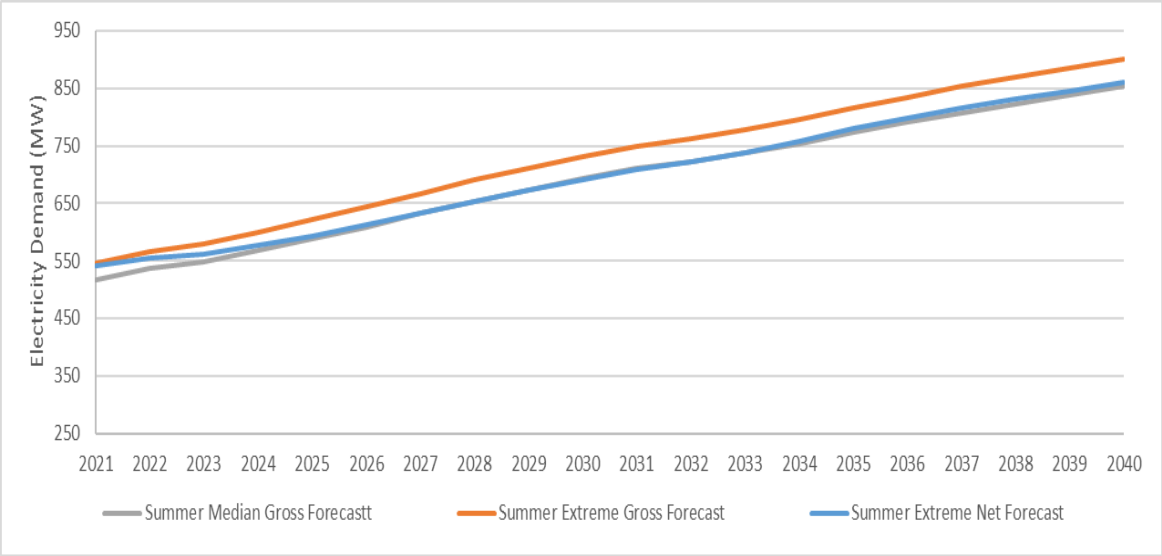
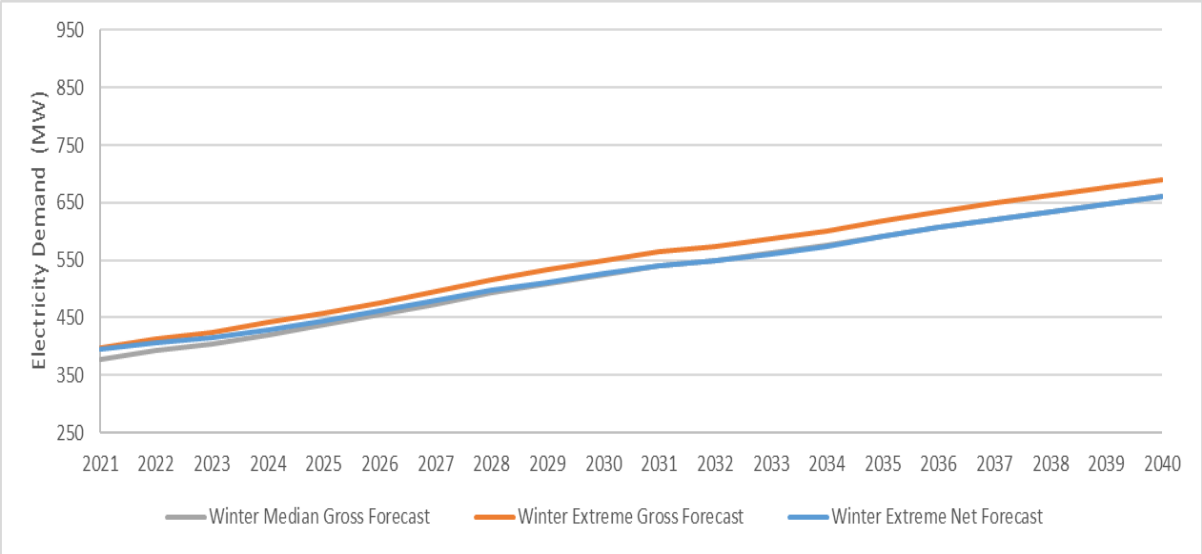


Figure 7 | Winter Net Extreme Weather Demand Forecast



5.7 Load Profiling

In addition to the annual peak demand forecast, hourly load profiles (8,760 hours per year over 20 year forecast horizon) for a number of stations or group of stations with identified needs were developed to characterize their needs with finer granularity. The profiles are based on historical data adjusted for variables that impact demand such as calendar day (e.g. holidays and weekends) and weather (e.g. extreme weather events like ice storms or heat waves) impacts. The profiles are then scaled to match the annual peak forecast for each year. These profiles are used to quantify the magnitude, frequency and duration of needs to better evaluate the suitability of non-wires alternatives options.

Additional load profile details including summary tables and hourly heat maps for each need can be found in Appendix B.

5.8 Sensitivity Scenario

A sensitivity scenario was performed for higher demand. This higher demand scenario is to take into account a variety of factors that could drive demand higher; these include but are not limited to electric vehicles charging infrastructures and electrified space heating installations in the sub-region. For this, a growth factor of 5% was applied equally to each LDC's station in the sub-region to determine the impact this would have on the need dates identified in system studies.
The higher demand scenario will not be used to drive any firm recommendations for this IRRP; however, it will help the Technical Working Group identify where the future pinch points may be and when they could materialize. This information can be useful for communities conducting Community Energy Plans, for the TWG in determining areas to monitor in future cycles of regional planning, and for communities and stakeholders as they think about various projects in the sub-region.

6. Electricity System Needs

6.1 Needs Assessment Methodology

Based on the net extreme weather planning demand forecast, the transmitter's identified end-of-life asset replacement plans and the application of ORTAC and North American Electric Reliability Corporation (NERC) TPL-001-4 Standard, the Technical Working Group identified electricity needs for the following categories:

- **Station Capacity Needs** describe the electricity system's inability to deliver power to the local distribution network through the regional step-down transformer stations at peak demand. The capacity rating of a transformer station is the maximum demand that can be supplied by the station and is limited by station equipment. Station ratings are often determined based on the 10-day LTR of a station's smallest transformer under the assumption that the largest transformer is out of service. A transformer station can also be limited when downstream or upstream equipment, e.g., breakers, disconnect switches, low-voltage bus or high voltage circuits, is undersized relative to the transformer rating.
- **Supply Capacity Needs** describe the electricity system's inability to provide continuous supply to a local area at peak demand. This is limited by the LMC of the transmission supply to an area. The LMC is determined by evaluating the maximum demand that can be supplied to an area accounting for limitations of the transmission elements, e.g., a transmission line, group of lines, or autotransformer, when subjected to contingencies and criteria prescribed by ORTAC and TPL-001-4. LMC studies are conducted using power system simulations analysis.
- **End-of-life Asset Refurbishment Needs** describe the needs identified by the transmitter with consideration to a variety of factors such as asset age, the asset's expected service life, risk associated with the failure of the asset and its condition. Replacement needs identified in the near-and early mid-term timeframe would typically reflect more condition-based information, while replacement needs identified in the medium to long term are often based on the equipment's expected service life. As such, any recommendations for medium-to long-term needs should reflect the potential for the need date to change as condition information is routinely updated.
- **Load Security and Restoration Needs** describe the electricity system's inability to minimize the impact of potential supply interruptions to customers in the event of a major transmission outage, such as an outage on a double-circuit tower line resulting in the loss of both circuits. Load security describes the total amount of electricity supply that would be interrupted in the event of a major transmission outage. Load restoration describes the electricity system's ability to restore power to those affected by a major transmission outage within reasonable timeframes. The specific load security and restoration requirements are prescribed by Section 7 of ORTAC.

Technical study results can be found in Appendix D. The needs identified are discussed in the section below.

6.2 Needs Identified

Table 3 below summarizes the needs identified for the Barrie/Innisfil sub-region.

Table 3 | Summary of Needs for Barrie/Innisfil Sub-Region

No.	Need	Need Description	Need Date
1	Alliston Station Capacity	Alliston TS demand forecast will exceed summer 10-day LTR	2037
2	Barrie Station Capacity	Barrie TS demand forecast will exceed summer 10-day LTR	2027
3	Everett Station Capacity	Everett TS demand forecast will exceed summer 10-day LTR	2025
4	Midhurst Station Capacity	Midhurst TS demand forecast will exceed summer 10-day LTR	2035
5	M6E/M7E Supply Capacity	After a loss of either M6E or M7E, the remaining circuit will exceed its LTE	2034
6	End-of-Life refurbishments	Sections of M6E/M7E and E8V/E9	various
7	Essa Bulk System Supply	Essa transformer overload of loss of remaining 500/230 kV autotransformer	Today

Figure 8 below summarizes the location of the needs in the Barrie/Innisfil sub-region.

Figure 8| Location of Needs in Barrie/Innisfil Sub-region

6.2.1 Station Capacity Needs

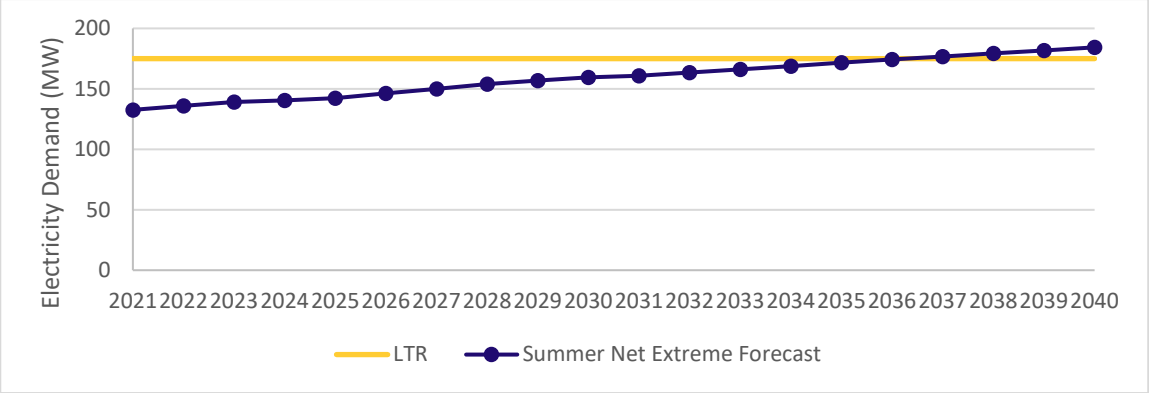
Table 4 and Figure 9 to Figure 12 below show transformer capacity limitations for the Barrie/Innisfil sub-region. In the near/mid-term, there are capacity limitations at Barrie TS and Everett TS. There is also a supply capacity constraint at the 44 kV feeder level for Barrie TS starting in 2025 at the distribution level. The summer demand forecast will exceed the 10-day LTR by 2027 for Barrie TS and 2025 for Everett TS. In the long-term there are capacity needs for Alliston TS in 2037 and Midhurst in 2035.

In the higher demand sensitivity scenario, the station capacity need is advanced by one year for Barrie TS and three years for Everett TS.

Table 4 | Step-down Station Summer 10-day LTR Rating and Peak Demands

Station	10-day LTR Rating (MW)	2022 (MW)	2025 (MW)	2030 (MW)	2040 (MW)
Alliston TS	175.0	136.1	142.3	159.5	184.3
Barrie TS	172.8[4]	105.3	157.2	225.7	254.5
Everett TS	86.0	83.1	86.2	94.8	167.9
Midhurst TS[5]	311.0	275.0	263.2	284.7	339.1

Figure 9| Alliston TS Capacity Need



[4] This summer LTR rating is post-BATU

[5] Midhurst TS consists of 2 Dual Element Spot Network (DESN) transformers

Figure 10| Barrie TS Capacity Need

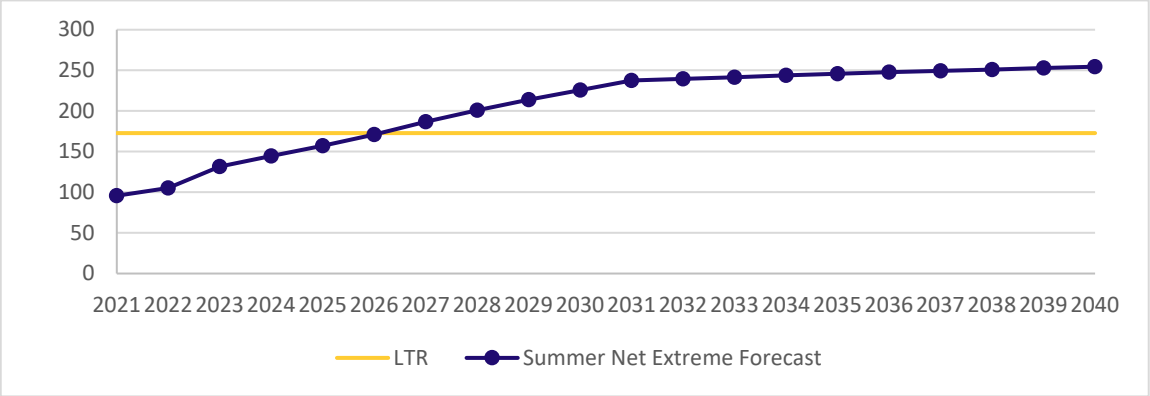


Figure 11| Everett TS Capacity Need

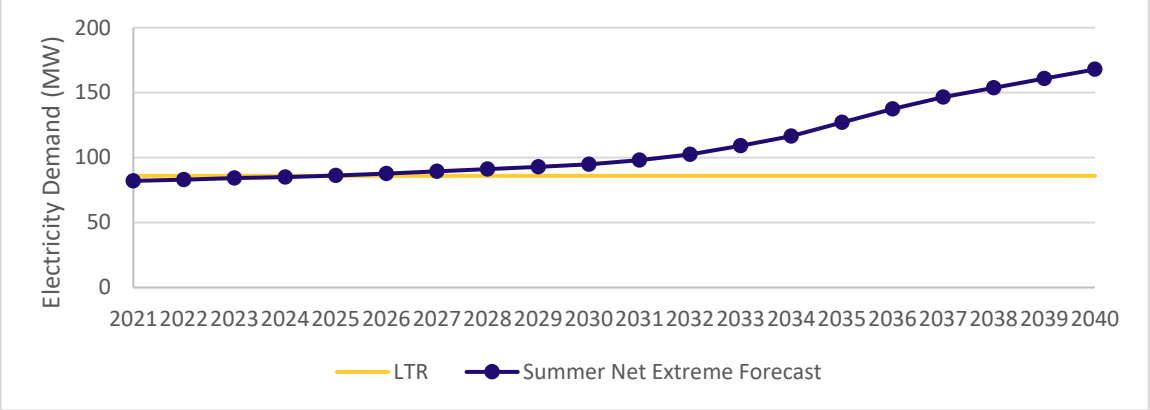
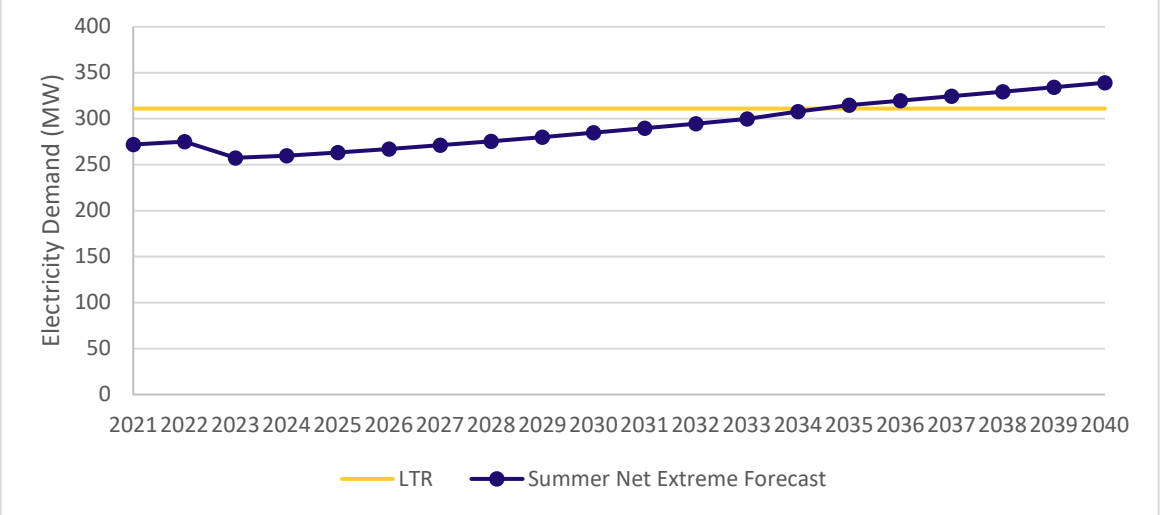


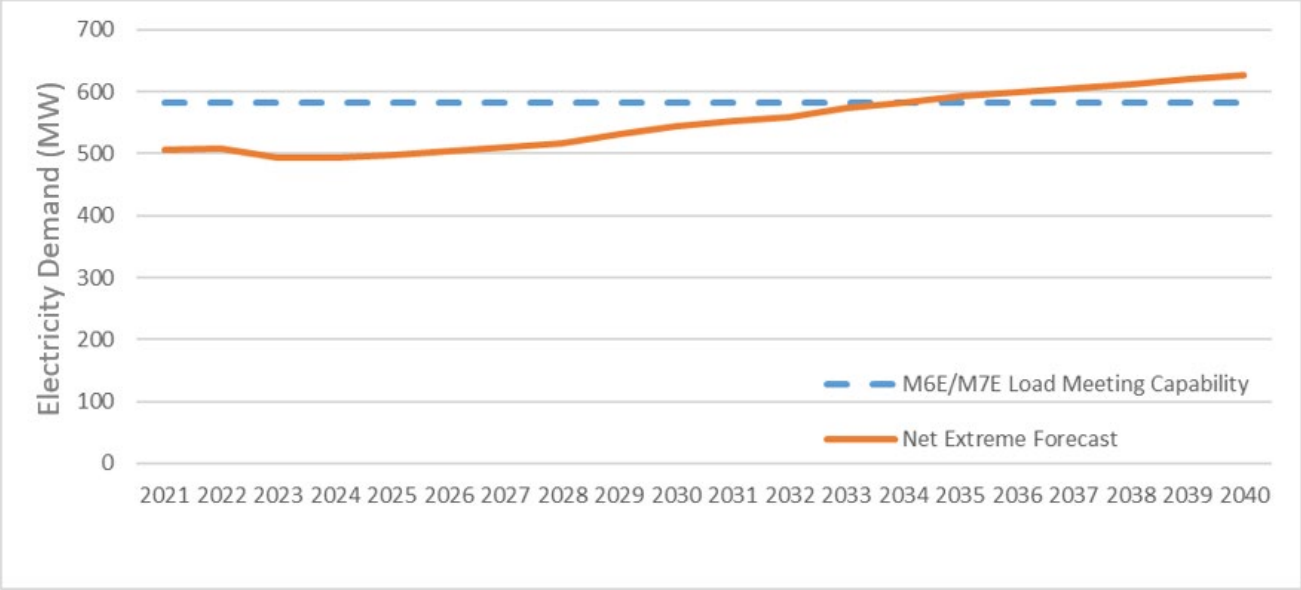
Figure 12| Midhurst TS Capacity Need



6.2.2 Supply Capacity Needs

The circuits M6E and M7E form a 230 kV double circuit from Essa TS to Minden TS. These circuits provide supply to Midhurst, Orillia, Bracebridge and Muskoka. The section between Essa TS to Midhurst TS belongs to the Barrie/Innisfil sub-region. This need occurs for section Essa TS to Midhurst TS. The M6E section between Essa TS to Midhurst TS (10.3 km) will exceed its LTE for loss of M7E or for an Essa HL7 or Essa L7L20 breaker failure starting in 2034. This need is worsened with local generation out of service. Also, the M6E section between Essa TS to Midhurst TS will exceed its LTE with M7E out of service pre-contingency and a contingency to D1M, D3M or D4M. The need is illustrated in Figure 13 below. Note that in the higher demand scenario, this need is advanced by two years.

Figure 13| M6E/M7E Supply Capacity Needs



6.2.3 End-of-Life Refurbishment Needs

Sections of circuits E8V/E9V are reaching end-of-life and need replacement. Information provided by Hydro One Transmission indicated that the in-service date will be 2027 to refurbish 56 km of 230 kV transmission line from Orangeville TS to Essa TS. With no criteria violations identified as part of system studies, there are no needs from a regional perspective that should be coordinated with Hydro One's sustainment plans for a section of circuits E8V/E9V.

6.2.4 Load Security and Restoration Needs

There are no load security or restoration needs identified in the planning time frame.

7. Plan Options and Recommendations

This section describes the options considered and recommendations to address the system needs in the Barrie/Innisfil sub-region. In developing the plan, the Technical Working Group considered a range of integrated options. Considerations in assessing alternatives included maximizing use of existing infrastructure, provincial electricity policy, feasibility, cost, and consistency with longer-term needs in the area.

Generally speaking, there are two approaches for addressing regional needs that arise as electricity demand increases:

- Build new infrastructure to increase the load meeting capability of the area. These are commonly referred to as "wires" options and can include things like new transmission lines, autotransformers, step-down transformer stations, voltage control devices or upgrades to existing infrastructure. Wires options may also include control actions or protection schemes to avoid or mitigate certain reliability concerns.
- Install or implement measures to reduce the net peak demand to maintain loading within the system's existing load meeting capability. These are commonly referred to as "non-wires" alternatives (NWA) and can include things like local utility scale generation, distributed energy resources, or conservation and demand management.

The IESO utilized a screening approach for assessing which needs would be best suited to undergoing a detailed assessment for non-wires alternatives, including CDM. The initial screening exercise examined the duration, frequency, timing, and magnitude of the need, as well as cost of traditional wires solutions, for each identified need.

The screening process resulted in NWA being considered for all of the near/medium-term needs to be addressed by the IRRP, except the end-of-life needs. A like-for-like sustainment plan is appropriate for the end-of-life needs given that the system studies did not identify any regional needs related to these assets. Needs characterization was completed for the Barrie TS and Everett TS station capacity needs. While the supply capacity need arising on the M6E/M7E circuits is in the longer-term, needs characterization was completed for this need to inform future options.

7.1 Options and Recommendations for Meeting Near/Medium-Term Needs

The Barrie/Innisfil IRRP will make recommendations to address near/mid-term timeframe needs. An options analysis, including NWA where feasible, has been conducted for these needs.

Barrie TS Station Capacity Need

Barrie TS currently serves two LDCs, Alectra Utilities and Hydro One Distribution with InnPower Corporation as an embedded customer. There are six 44 kV feeders serving Alectra Utilities and two 44 kV feeders serving InnPower Corporation. InnPower Corporation originally had one feeder but the first Barrie/Innisfil IRRP recommended an additional feeder due to the continued development of data centres in the city of Barrie and forecast growth in the Town of Innisfil. Demand growth continues to increase in the Innisfil area with InnPower's demand forecasted to reach 113 MW by 2029 which is more than the supply capability of the two feeders. Also, the overall demand forecast for Barrie TS will reach its 10-day LTR in 2027.

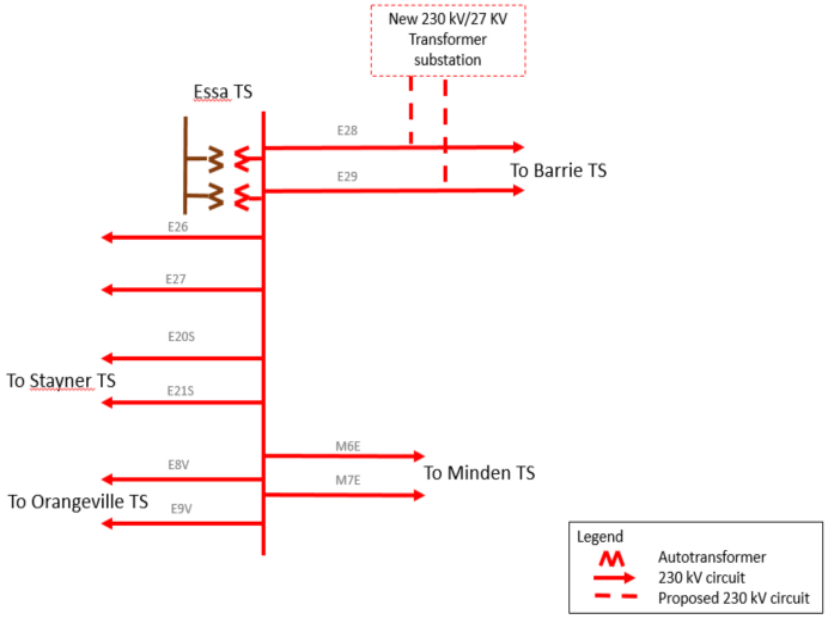
A variety of wires options are considered to address the increased demand growth served by Barrie TS and the supply capacity constraint at the 44 kV feeder level. These wires options are formulated from the detailed options analysis conducted after the Needs Assessment between the transmitter and the LDCs[6]. The following three options were explored and screened out on the basis that they do not fully meet the needs:

- InnPower to connect to existing Alectra feeder as an embedded customer. This requires InnPower to build a distribution tap to the closest Alectra owned feeder. However, there is no available feeder capacity.
- Additional 44 kV feeder position from Barrie TS at a cost of $20M. This solution would provide up to 25 MW of supply capacity which would help the need until 2027. Another solution would still need to be implemented to meet the needs beyond 2027 which would be at an additional cost.
- Load the existing 44 kV supply feeders beyond normal capacity. This alternative would increase each feeder supply capacity by 10 MW per feeder for a total of 20 MW at a cost of $8M. Again, this alternative would help delay the capacity need until 2027 and another solution would have to be implemented beyond 2027.

The wires alternative that is capable of meeting the need includes providing a 230 kV tap connection to the new 230 kV circuits E28/E29 (that will be available post BATU) for a new 230/27.6 kV transformer substation to service the InnPower demand growth. An existing Hydro One Transmission right-of-way (ROW) can be used for this and the length of the tap connection is between 7 to 10 km depending on the location of the transformer substation. This alternative would provide the supply capacity needed beyond the study period and would provide enough capacity for future demand growth in the area. For these reasons, the new transformer substation is chosen as the wires option to be compared against the non-wires alternatives.

[6] Refer to the South Georgian Bay-Muskoka Innisfil Area Supply Alternatives report

Figure 14| Transmission Option for Barrie Station Capacity Need



In terms of non-wires options, the Technical Working Group first reviewed the findings of the Local Achievable Potential Study for the Barrie TS service area that was recommended in the last Barrie/Innisfil IRRP, and subsequently completed between cycles. This study was conducted by Navigant and assessed potential demand-side resources available within the Alectra/InnPower service territories that could defer the need for transmission system investment. The study considered solar PV, CDM and demand response. The forecast technical potential for each non-wires alternative required to meet the need in each year of the forecast was determined and informed the total procurement cost of the non-wires portfolio. The net present value of the costs of the non-wires portfolio was compared to the net present value of the avoided costs associated with the wires solution and it was found that the non-wires portfolio was not cost effective when considering the value streams considered.

As part of the development of this IRRP, the Technical Working Group updated the analysis of non-wires alternatives to ensure it captures the latest information related to option screening, informed by the needs characterization, and option costs. Based on the characteristics of the need, incremental CDM was screened out due to the magnitude of the need as a percentage of the total demand at Barrie TS, and energy storage was considered as it is the least cost of the distributed resource options and serves as a benchmark that can be compared to the wires option.

Table 5 below summarizes the options considered and the net present value of their levelized cost for the Barrie station capacity need arising in 2027 and the supply capacity constraint at the 44 kV feeder level starting in 2025. The new transformer substation is the most cost effective option and the IRRP recommends that the RIP led by Hydro One should further develop and scope this solution.

Table 5 | Options for Barrie TS Station Capacity Needs and Costs

	Option	Cost NPV
Wires	Construct a new 230/27.6 kV transformer substation and connect it to the new 230 kV circuits E28B/E29B available post BATU	$48 M
Non-wires	Construct 81 MW battery storage	$130 M

Everett Station Capacity Need

Everett's near and medium-term needs can be addressed by adjusting the CT ratio of the transformers breakers; the NPV of this option is $ 0.5 M. The estimated costs of non-wires options are orders of magnitude larger and thus screened out from further consideration.

E8V/E9V End-of-Life Needs

When equipment reaches the end of its life and requires replacement, a number of options can be considered.

- Replacement of the equipment with "like-for-like" or closest available standard
- Reconfiguration of existing equipment to "right-size" the replacement option based on:
    - Demand forecast
    - Changes to the use of the equipment since it was originally installed
    - Reliability or other system benefits that an alternate configuration may provide
- Retirement of equipment, considering the impact on load supply and reliability

Since no violations were identified for sections of circuits E8V/E9V in system studies, a like-for-like replacement with the closest available standard is appropriate and can best address the end-of-life needs.

7.2 Options and Recommendations for Meeting Longer-Term Needs

A number of alternatives are possible to meet the region's longer-term needs. While specific solutions do not need to be committed to today, it is appropriate to begin work now to gather information, monitor developments, engage the community, and develop alternatives to support decision making in the next iteration of the IRRP. The long-term plan sets out the near-term actions required to ensure that options remain available to address future needs if and when they arise.

Additionally, the Technical Working Group will monitor changes in growth targets, progress in electrification in the region, and any significant changes in forecast growth. If monitoring activities determine that the region's growth is exceeding the demand forecast, it may be necessary to initiate the next iteration of the regional planning process earlier.

7.2.1 Midhurst and Alliston Station Capacity Needs

Midhurst TS and Alliston TS are expected to have station capacity needs by 2035 and 2037 respectively. Given the timing of the need, no firm recommendation is required at this time. It is advised to monitor the demand growth in the areas and provide enough lead time to capture changes into the next cycle of regional planning where these needs can be revisited.

7.2.2 M6E/M7E circuits Essa x Midhurst System Capacity Need

The IRRP considered a number of options include incremental cost-effective CDM and storage, even though this is a longer-term need. This analysis showed that incremental cost-effective CDM is a potentially well-suited for deferring this need. As such, the Technical Working Group should continue to consider incremental, cost-effective CDM in between cycles and in the next cycle of regional planning in the region.

7.3 Summary of Recommended Actions and Next Steps

Table 6, below, summarizes the specific recommendations that should be implemented to address the electricity supply needs in the Barrie/Innisfil sub-region.

Table 6 | Summary of Barrie/Innisfil IRRP Recommendations

Need Description	Recommendation	Lead Responsibility	Estimated Cost	Timeline
Everett TS to reach its summer 10-day LTR	Adjust the CT ratio of transformer breakers	Hydro One	~0.5M	2025
Barrie TS to reach its summer 10-day LTR and supply capacity constraint at 44 kV feeder level	Construct a new 230/27.6 kV transformer substation and connecting to the new 230 kV E28B/E29B post BATU	Hydro One and InnPower	~48M	2025
Sections of E8V/E9V circuits to reach end-of-life	Like-for-like replacement	Hydro One		2027

Need Description	Recommendation	Lead Responsibility	Estimated Cost	Timeline
M6E/M7E (Essa TS x Midhurst TS) supply capacity	Monitor demand growth in the area; consider CDM option in next cycle of regional planning as a means of deferring transmission upgrade	Technical Working Group		2034
Midhurst TS to reach its summer 10-day LTR	Monitor demand growth to ensure load supplying capability is maintained; consider in the next cycle of regional planning	Technical Working Group		2035
Alliston TS to reach its summer 10-day LTR	Monitor demand growth to ensure load supplying capability is maintained; consider in the next cycle of regional planning	Technical Working Group		2037
Essa TS Bulk System Supply	Will further be studied as part of Essa Bulk Study	IESO		Today

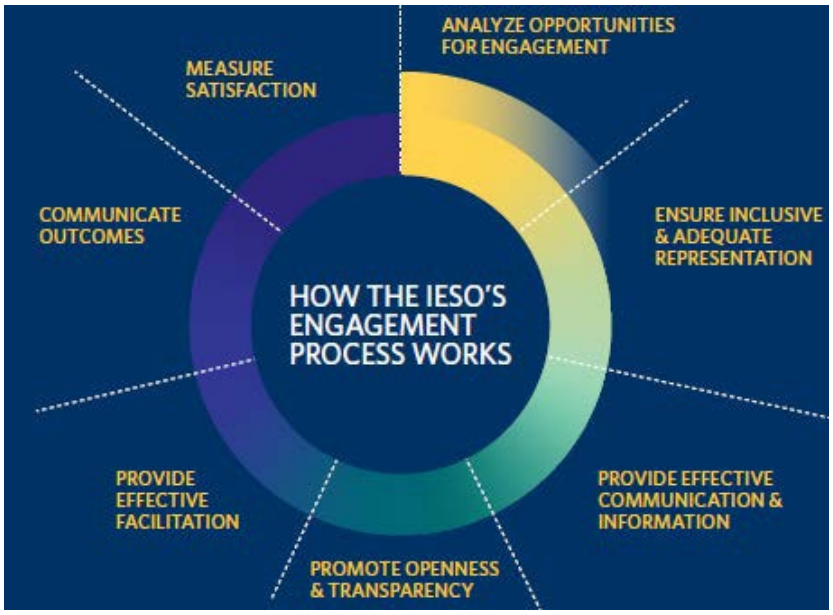
8. Engagement and Consultation

Engagement and consultation are critical in the development of an IRRP. Providing opportunities for input in the regional planning process enables the views and preferences of communities to be considered in the development of the plan, and helps lay the foundation for successful implementation. This section outlines the engagement principles as well as the activities undertaken to date for the Barrie/Innisfil IRRP.

8.1 Engagement Principles

The IESO's engagement principles help ensure that all interested parties are aware of and can contribute to the development of this IRRP. The IESO uses these principles to ensure inclusiveness, sincerity, respect and fairness in its engagements, striving to build trusting relationships as a result.

Figure 15 | The IESO's Engagement Principles



8.2 Creating an Engagement Approach for Barrie/Innisfil

The first step in ensuring that any IRRP reflects the needs of community members and interested stakeholders is to create an engagement plan to ensure that all interested parties understand the scope of the IRRP and are adequately informed about the background and issues in order to provide meaningful input on the development of the IRRP for the region.

- Creating the engagement plan for this IRRP involved:
- Discussions to help inform the engagement approach for the planning cycle;

- Developing and implementing engagement tactics to allow for the widest communication of the IESO's planning messages, using multiple channels to reach audiences; and
- Identifying specific stakeholders and communities that should be targeted for one-on-one consultation, based on identified and specific needs.

As a result, the engagement plan for this IRRP included:

- A dedicated webpage on the IESO website to post all meeting materials, feedback received and IESO responses to the feedback throughout the engagement process;
- Regular communication with interested communities and stakeholders by email and through the IESO weekly Bulletin;
- Public webinars;
- Targeted individual and small group meetings; and
- One-on-one outreach with specific stakeholders to ensure that their identified needs are addressed (see Section 8.3).

8.3 Engage Early and Often

The IESO held preliminary discussions to help inform the engagement approach for this new round of planning and establish new relationships with communities and stakeholders in the region.

An invitation was sent to targeted municipalities, Indigenous communities and those with an identified interest in regional issues to announce the commencement of a new regional planning cycle and invite interested parties to provide input on the draft South Georgian Bay/Muskoka Scoping Assessment Outcome Greater before it was finalized. Feedback received encouraged the IESO to consider renewable technologies to help reduce local demand.

Following a written comment window, the final Scoping Assessment Outcome Report was published in November 2020 that identified the need for a coordinated planning approach done through two sub-regional Integrated Regional Resource Plans (IRRP): Barrie/Innisfil and Parry Sound/Muskoka.

Following these initial discussions and finalization of the Scoping Assessment, the launch of a broader engagement initiative followed with an invitation to subscribers of the South Georgian Bay/Muskoka region, Indigenous communities and municipalities within boundaries of the sub-region to ensure that all interested parties were made aware of this opportunity for input.

Three public webinars were held at major junctures during IRRP development to give interested parties an opportunity to hear about its progress and provide comments on key components. The webinars received cross-representation of stakeholders and community representatives attending the webinar and submitting written feedback during a 21-day comment period.

The three stages of engagement invited input on:

1. The draft engagement plan, the electricity demand forecast and the early identified needs to set the foundation of this planning work.

2. The defined electricity needs for the region and potential options to meet the identified needs.
3. The analysis of options and draft IRRP recommendations.

All interested parties were kept informed throughout this engagement initiative via email to South Georgian Bay/Muskoka region subscribers, municipalities and Indigenous communities as well as the members of the GTA/Central Regional Electricity Network.

Based on the discussions both through the Barrie/Innisfil IRRP outreach activities and broader network dialogue, there appears to be significant community growth planned and broad interest in electrification, net-zero development, and decarbonisation of electricity supply. To that end, ongoing discussions will continue through the IESO's GTA Central Regional Electricity Network to keep interested parties engaged on local developments, priorities and planning initiatives.

All background information, including engagement presentations, recorded webinars, detailed feedback submissions, and responses to comments received, are available on the dedicated regional planning engagement webpage.

8.4 Bringing Municipalities to the Table

The IESO held meetings with municipalities to seek input on local planning and development activities as well as strategic initiative related to electricity to ensure that these plans were taken into consideration in the development of this IRRP. At major milestones in the IRRP process, meetings with the upper- and lower-tier municipalities in the region were held to discuss: key issues of concern, including forecast regional electricity needs; options for meeting the region's future needs; and, other opportunities for broader community engagement. These meetings helped to inform the municipal/community electricity needs and provided opportunities to strengthen this relationship for ongoing dialogue beyond this IRRP process.

8.5 Engaging with Indigenous Communities

To raise awareness about the regional planning activities underway and invite participation in the engagement process, regular outreach was made throughout the development of the plan to Indigenous communities in or near the Southern Huron-Perth electricity planning sub-region or those that may have interests in the sub-region. This includes the First Nation communities of Beausoleil, Chippewas of Georgina Island, Chippewas of Rama, Henvey Inlet, Huron Wendat, Magnetawan, Moose Deer Point, Shawanaga, Wahta Mohawks and Wasauksing, as well as the Métis Nation of Ontario communities of Barrie South-Simcoe Métis Council, Georgian Bay Métis Council and Moon River Métis Council.

9. Conclusion

This report documents an IRRP that has been developed for the Barrie/Innisfil sub-region and identifies regional electricity needs and opportunities to preserve or enhance electricity system reliability for the next 20 years. The IRRP makes recommendations to address near- to medium-term issues, and lays out actions to monitor, defer, and address long-term needs. To support the development of the plan, this IRRP includes recommendations with respect to developing alternatives, and monitoring demand growth and efficiency achievements. Responsibility for these actions has been assigned to the appropriate members of the Technical Working Group.

In the near term, the IRRP recommends the construction of a new transformer substation in or near Innisfil adjusting the CT ratio of transformer breakers at Everett TS, and replacing the E8V/E9V end-of-life with like-for-like. Responsibility for these actions has been assigned to the appropriate members of the Technical Working Group.

In the long term, the IRRP recommends that the Technical Working Group monitor growth for Alliston and Midhurst stations to determine when further reinforcements will be needed. The IRRP also recommends to monitor the demand growth in the area served by the M6E/M7E circuits including Midhurst and to consider incremental cost-effective CDM to defer this need in the next cycle of regional planning given the suitability of this option observed as part of this IRRP. The IESO and the Technical Working Group will also continue to monitor community energy planning and monitor electrification trends.

The Technical Working Group will continue to meet at regular intervals to monitor developments and track progress toward plan deliverables. In the event that underlying assumptions change significantly, local plans may be revisited through an amendment, or by initiating a new regional planning cycle sooner than the five-year schedule mandated by the OEB.

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