Kitchener/Waterloo/Cambridge/ Guelph Scoping Assessment Outcome Report

July 2024

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1. Introduction

This Scoping Assessment Outcome Report is part of the Ontario Energy Board's (OEB or Board) regional planning process, as defined through the Transmission System Code, Distribution System Code, and IESO license.

This is the third cycle of planning in the Kitchener-Waterloo-Cambridge-Guelph (KWCG) region. It was initiated in December of 2023 with the Needs Assessment (NA). The NA is the first step of a regional planning cycle and was completed by the Technical Working Group (TWG) led by Hydro One Networks Inc. (Hydro One) to determine both the needs of the region and whether the needs require regional coordination. The NA was published on April 9, 2024, and identified needs that may require regional coordination. The information collected from the NA has been included in the scoping assessment to determine the nature of the planning process required to address the regional needs.

During the Scoping Assessment, the TWG reviewed the nature and timing of known needs to determine the most appropriate planning approach, as well as the best geographic grouping of the needs in order to efficiently facilitate further studies. The planning approaches considered include:

- An Integrated Regional Resource Plan (IRRP) – through which a greater range of options, including non-wires alternatives, are to be considered and/or closer coordination with communities and stakeholders is required
- A Regional Infrastructure Plan led by the transmitter – which considers more straight-forward wires only options with limited engagement
- A Local Plan undertaken by the transmitter and affected local distribution company (LDC) – for which no further regional coordination is needed

This Scoping Assessment Report:

- Lists the needs requiring more comprehensive planning, as identified in the NA report
- Reassesses the areas that need to be studied and the geographic grouping of the needs (if required)
- Determines the appropriate regional planning approach and scope where a need for regional coordination or more comprehensive planning is identified
- Establishes a Terms of Reference for an IRRP and/or wires planning, if required
- Establishes the composition of the Technical Working Group, if required

2. Technical Working Group

The Scoping Assessment was carried out with the following participants:

- Hydro One Networks Inc. (Transmission)
- Independent Electricity System Operator (IESO)
- Enova Power Corp.
- Alectra Inc.
- GrandBridge Energy
- Centre Wellington
- Wellington North
- Halton Hills Hydro Inc.
- Hydro One Networks Inc. (Distribution)
- Milton Hydro

3. Categories of Needs, Analysis, and Results

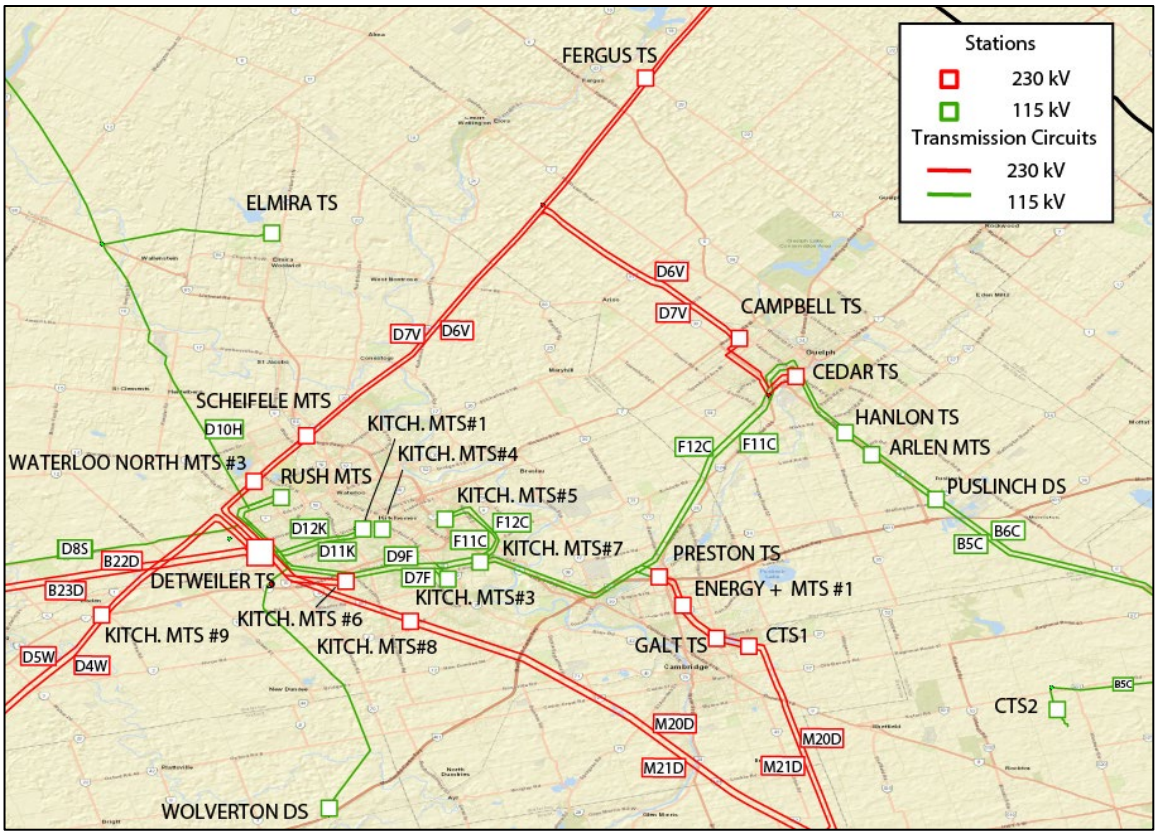
3.1 Overview of the Region

The KWCG region is in southwestern Ontario. The region includes the cities of Kitchener, Cambridge, Waterloo, and Guelph, the townships of Wellesley, Woolwich, Wilmot, North Dumfries, and portions of Oxford and Wellington counties.

The region also encompasses the Métis Nation of Ontario, Grand River Métis Council, Six Nations of the Grand River, Mississaugas of the Credit First Nation, Chiefs of Ontario, Anishinabek Nation and Association of Iroquois and Allied Indians.

The KWCG region is summer peaking and serviced electrically by 230 kV and 115 kV circuits originating from Detweiler TS and Burlington TS as well as load stations which tap double-circuit 230 kV lines connecting to Detweiler from Orangeville TS (D6V & D7V), Middleport TS (M20D & M21D), and Buchanan TS (D4W & D5W). Customers are served by numerous LDCs including Enova Power Corp., Alectra Inc., GrandBridge Energy, Centre Wellington, Wellington North, Halton Hills Hydro Inc., Milton Hydro, and Hydro One Networks Inc. Distribution. Figure 1 provides a map of the electrical infrastructure in the KWCG region.

Figure 1 | Electricity Infrastructure of the KWCG Region



3.1.1 Electricity Demand in the KWCG Region

Electricity demand in the KWCG region is driven by various factors, including population growth, industrial sector changes, intensification of the Kitchener downtown area, and rising awareness of renewable energy generation development, and conservation and demand management. The region's population and accompanying employment are expected to grow steadily, which will drive electricity demand for the next 20 years. The Region of Waterloo installed a light rail transit system between Waterloo and Kitchener with plans to extend to Cambridge, which is spurring development along the train route in both the residential and commercial sectors.

The Region of Waterloo is internationally known for its leading-edge technology and advanced manufacturing industries, innovative educational institutions, vibrant agricultural communities, and the historically significant Grand River.

The city of Cambridge is seeing a rapid increase in the electricity demand that is driven by large industrial developments in the northwest area and large data center loads. In addition to the large loads, GrandBridge Energy continues to experience a steady demand growth in the residential, commercial, and industrial developments.

The City of Kitchener is currently experiencing a conversion from being a manufacturing-oriented economy to a more diversified and balanced economy.

As directed by the OEB, Enova Power Corp is currently participating in multiple provincial renewable energy programs and conservation and demand management (CDM) programs, which help control and reduce the electricity demand. Time-of-Use is also shifting demand and conserving energy as customers manage their electricity use and control their costs.

3.1.2 Background of the Previous Planning Process

The first cycle of regional planning in the KWCG region was completed in December 2015 with the publication of the Regional Infrastructure Planning (RIP) report by Hydro One Inc. In the second cycle, completed in 2021, the TWG had decided that an IRRP was required for the region because a range of options (including non-wires alternatives) had to be considered for the needs, and engagement with communities and stakeholders was required. The IRRP identified near-, mid-, and long-term needs of the KWCG region and provided recommendations for addressing these needs. Some projects initiated in response to the second planning cycle are still underway and provide a foundation for the current planning cycle. Recommendations from the second cycle put focus on necessary End-of-Life (EOL) transformer replacements, growing capacity needs at numerous transmission stations and supply capacity needs along multiple transmission circuits.

3.1.3 Projects and Plans Underway

The previous IRRP used a 20-year demand forecast and made recommendations to monitor long-term needs in the region while providing clear direction on actions required in the near-term. Recommendations made in the IRRP and subsequent plans are summarized in the sections below.

Table 1 below summarized the needs identified in the previous regional planning cycle, recommendations made and the status of the projects implemented to address the needs identified in the previous planning cycle.

Table 1 | Needs Identified in the Previous Cycle with Implementation Plan Update

Circuit/Station	Need	Recommended Action	Status
B5C/B6C 115 kV transmission line	EOL Replacement	Line section replacement; line tap section from Harper's JCT to CTS1	Expected completion 2025
Hanlon TS (T1 & T2)	EOL Replacement	Transformer replacement	Complete
Kitchener MTS #5 (T9 & T10)	EOL Replacement	Transformer replacement	Expected completion 2025
Preston TS (T3 & T4)	EOL Replacement	Transformer replacement	Expected completion 2027
Campbell TS (T1 & T2)	EOL Replacement	Breaker replacement	Expected completion 2032
Scheifele MTS (T1, T2, T3 & T4)	EOL Replacement	Transformer replacement	Expected completion between 2029-2033
Galt TS	EOL Replacement	Breaker and component replacement	Hydro One will continue to monitor and take appropriate action
Fergus TS (T3 & T4)	EOL Replacement	Transformer replacement	Hydro One will continue to monitor and take appropriate action

Cedar TS (T7 & T8)	EOL Replacement	Transformer replacement	EOL has extended past 10 years. Transformer will continue to be monitored
Energy+ MTS #1 (T1 & T4)	Station Capacity	Load transfer to Galt TS and Preston TS	Underway
Preston TS	Station Capacity	Load transfer to Galt TS and Energy+ MTS #1	Underway
Scheifele MTS (T1+T3)/(T2+T4)	Station Capacity	Load transfer to Waterloo North Hydro MTS #3, Rush MTS, and Elmira TS	Underway
Campbell TS (T3 & T4)	Station Capacity	Load transfer to Cedar TS and Campbell TS T1/T2	Underway
Kitchener MTS #7 (T13 & T14)	Station Capacity	Load transfer to Kitchener MTS #3 or #5	Need date of 2028
Kitchener MTS #8 (T15 & T16)	Station Capacity	Load transfer to Kitchener MTS #3	Need date of 2028

The following long-term needs were identified in the previous IRRP. These needs have been monitored and will be re-evaluated as part of the IRRP.

- Supply capacity needs along the B5C and D10H circuits
- Station capacity needs at Arlen MTS, Hanlon TS, Rush MTS, Elmira TS, Kitchener MTS #1, and Waterloo North MTS #3
- Load restoration need for M20D/M21D double circuit line

3.2 Needs Identified

The most recent NA report for the KWCG region identified upcoming and currently present capacity and load security/restoration needs based on the 10-year demand forecast. The needs identified in the report are summarized in the sections below.

3.2.1 Needs to be Addressed in Current Planning Cycle

For this third cycle of regional planning, the NA report provided an update on needs identified in the previous planning cycle and the implementation of projects recommended to address them. It also identified new needs in the KWCG region based on a 10-year station level load forecast for the region developed by the LDCs, expected transmission and distribution investments, updated asset condition information, as well as the CDM and distributed generation (DG) forecasts provided by the IESO.

The needs identified in the NA were determined to require further regional planning (See **Table 2**). These needs mainly address transmission system capacity constraints, station capacity constraints and various needs associated with the M20D/M21D double circuit.

Table 2 | Needs Identified in the Needs Assessment as Requiring Further Study

Need #	Station/Circuit	Description of Need	Timeline
1	230 kV M20D/M21D: Galt JCT to Cambridge #1 JCT	Supply Capacity Need	Near term
2	115 kV D11K/D12K: Detweiler to Kitchener #1 &#4 JCT	Supply Capacity Need	Mid term
3	230 kV M20D/M21D Circuit	Load Security Need	Mid term
4	230 kV M20D/M21D Circuit	Load Restoration Need	Near term
5	230kV M20D/M21D Circuit	Voltage Violation Need	Near term
6	Preston TS (T3 & T4)	Station Capacity Need	Near term
7	Energy+ MTS #1 (T1 & T2)	Station Capacity Need	Near term
8	Campbell TS (T3 & T4)	Station Capacity Need	Near term
9	Cedar TS (T7 & T8, T1 & T2)	Station Capacity Need	Near term,mid term
10	Kitchener MTS #7	Station Capacity Need	Mid term
11	Rush MTS	Station Capacity Need	Mid term
12	Waterloo North MTS #3	Station Capacity Need	Mid term

3.2.2 Analysis of Needs and Identification of Region

The TWG has discussed the needs in the KWCG region and potential planning approaches to address them. The preferred planning approach is generally informed by:

- Timing of the need, including lead time to develop solutions
- Potential linkages between needs and their required coordination, particularly if the span LDC territories or planning regions
- Opportunity for public engagement to inform outcomes
- Potential for exploring multiple types of options to meet the needs (including non-wire alternatives)
- Potential for regional changes having implications on the upstream bulk power system

In general, the more complex a series of needs are and the greater the need for regional coordination and engagement, the more likely an IRRP will be selected. If the needs are relatively straightforward, there are few feasible alternatives to address them, and solutions can be implemented without affecting neighbouring areas or the bulk power system, then a more streamlined planning approach with a narrower scope may be appropriate.

The TWG agreed that numerous needs identified in the NA require regional planning, and have opportunities for integrated solutions involving both wires and non-wires solutions. Thus, the TWG agreed upon the initiation of an IRRP to address the needs in the KWCG region.

The participants agree that the IRRP for the KWCG region should not be divided into sub-regions. The needs identified are concentrated in the Cambridge area and connecting circuits, making further division unnecessary.

The needs identified in the NA directly impact GrandBridge Energy and Enova Power Corp., but additional needs may emerge during the development of the 20-year demand forecasts. For example, at the end of the NA, Alectra indicated that they will be updating their forecast to better account for their community's decarbonization activities. Thus, all LDCs in the KWCG region will contribute 20-year demand forecasts for system studies in the IRRP to refine the needs. If, after analysis of the needs, some LDCs are not affected by the regional needs, they may choose to not actively participate in further regional planning this cycle. These LDCs will be informed and invited to participate if any needs or proposed solutions may affect their facilities or customers.

3.3 Analysis of Needs

The TWG has outlined the new needs in the KWCG region and potential planning approaches to address them.

Preston TS Capacity Need

Currently at the Preston TS, a replacement of the station supply transformers is scheduled for completion in 2027. This replacement will increase the long-term rating (LTR) of the station to 180 MW. The 10-year demand forecast suggests that by the end of the study period, the demand at the Preston TS will reach 242 MW. Following the publication of the NA report, GrandBridge Energy received a large load request of 80 MW to connect near Preston TS over the next few years. Therefore, addressing the imminent capacity need at the Preston TS is a near term need that must be addressed by the TWG through the IRRP.

The TWG recommends that the capacity need at Preston TS be further reviewed in an IRRP based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

Energy+ MTS #1 Capacity Need

The Energy+ MTS #1 has a current LTR of 102 MW. The need is imminent – historical demand for the station has already exceeded the station rating – and the load forecast shows that demand will grow beyond these levels. In response, GrandBridge Energy is preparing measures for a transfer of load from Energy+ MTS #1 to Galt TS to address the near-term need. However, Energy+ MTS #1 is near Preston TS where a potential integrated solution could address the needs at both stations.

The TWG recommends that the capacity need at Energy+ MTS #1 be further reviewed in an IRRP based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

Campbell TS Capacity Need

Campbell TS has two sets of transformers, T1 & T2 with a LTR of 94 MW and T3 & T4 with a LTR of56 MW. These transformers currently supply 81 MW and 45 MW of load at peak, respectively. The demand forecast shows the combined load at Campbell TS exceeding the current loading capabilities.

The TWG recommends that the capacity need at Campbell TS be further reviewed in an IRRP, due to the proximity to other stations with identified needs to assess the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

Cedar TS Capacity Need

Cedar TS has two sets of transformer T1 & T2, with a LTR of 103 MW and T7 & T8 with a LTR of 40 MW. These transformers currently supply 82 MW and 40 MW of load at peak, respectively. The demand forecast shows the combined load at Cedar TS exceeding the current loading capabilities. Transformers T7 & T8 have been identified as reaching EOL in the long term, with a planned EOL replacement that will increase the capacity of station. Advancing the EOL replacement to upsize the transformers is being considered as an option.

The TWG recommends that the capacity need at Cedar TS be further reviewed in an IRRP to identify whether the full need is met over the planning timeframe and to consider the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

Kitchener MTS #7 Capacity Need

Kitchener MTS #7 supplies Enova Power Corp. loads and has a single T13 & T14 DESN with a LTR of 54 MW. The current supply at peak load is 37 MW. The demand forecast shows the load at Kitchener MTS #7 exceeding the current loading capabilities near the end of the 10-year forecast.

Enova Power Corp. will continue to monitor the station and, if required, will manage any near and mid-term overloading through load transfers to Kitchener MTS #3 or #5.

The TWG recommends that the long-term capacity need at Kitchener MTS #7 be further reviewed in an IRRP, due to the potential development of a new supply station, which requires regional planning and integration to best assess where to locate a future station based on the available transmission supply.

Rush MTS Capacity Need

Rush MTS supplies Enova Power Corp. loads and has a single T1 & T2 DESN with a LTR of 68 MW. The current supply at peak load is 50 MW. The demand forecast shows the load at Rush MTS exceeding the current loading capabilities near the end of the 10-year forecast.

The TWG recommends that the capacity need at Rush MTS be further reviewed in an IRRP to be inter-related with the previously identified supply capacity need on the 115 kV circuit, D10H, that supplies Rush MTS and Elmira TS. This, combined with the future potential of a new station in the region, should be explored through an IRRP to consider the opportunity for coordinated and integrated solutions to the various needs.

Waterloo North MTS #3 Capacity Need

Waterloo North MTS #3 supplies Enova Power Corp. loads and has a single T1 & T2 DESN with a LTR of 85 MW. The current supply at peak load is 48 MW. The demand forecast shows the load at Waterloo North MTS #3 exceeding the current loading capabilities near the end of the 10-year forecast.

The TWG recommends that the capacity need at Kitchener MTS #7 be further reviewed in an IRRP. The steep growth in demand expected at the station, paired with the long-term possibility of a new supply station in the region, indicate the need for a regionally coordinated recommendation that holistically considers the various long-term needs in the region.

D11K/D12K Detweiler to Kitchener #1 & #4 JCT – Transmission System Capacity

D11K/D12K is a 115 kV double circuit line that supplies Kitchener MTS #1 and Kitchener MTS #4. By the end of the 10-year forecast, loss of either the D11K or D12K circuit will overload the companion circuit.

The TWG recommends that the transmission circuit supply need of the D11K/D12K 115 kV double circuit line be further reviewed in an IRRP. This recommendation is based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

M20D/M21D

The M20D/M21D circuit is a 230 kV double circuit that supplies Kitchener MTS #6, Kitchener MTS #8, Galt TS, Preston TS, Energy+ MTS #1, and a customer CTS. Three needs are identified related to the M20D/M21D circuits.

- **Circuit section from Galt JCT to Cambridge JCT - Supply Capacity Need**

By 2026, the loss of either the M20D or M21D 230 kV circuit results in the loading on the Galt JCT to Cambridge JCT section exceeding its rating.

The TWG recommends that the transmission circuit supply need of the M20D/M21D 230 kV double circuit between Galt JCT and Cambridge JCT be further reviewed in an IRRP. This recommendation is based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

- **Load Security and Restoration Need**

In 2032, in the event of a loss of the double circuit M20D/M21D, a total peak coincident load of 638 MW will be interrupted. This interrupted load violates ORTAC load security criteria, which states that no more than 600 MW of load may be interrupted.

In addition, with a 638 MW interruption, ORTAC restoration criteria states 388 MW of the load must be restored within 30 minutes. From Galt JCT to Preston TS, only 210 MW of the interrupted load can be restored in 30 minutes.[1] This value does not meet the restoration criteria.

The TWG recommends that the load security and restoration need of the M20D/M21D 230 kV double circuit between Galt JCT to Preston TS be further reviewed in an IRRP. This recommendation is based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

- **Voltage Violation Need**

Within the near-term forecast, the M20D/M21D post contingency voltage change on the low voltage side at Preston TS and Energy+ MTS #1 exceeds the 10% pre-underload tap changer (ULTC) action and 5% post-ULTC action allowable limits. In addition, the post contingency low voltages are below the allowable voltage range. In the midterm, on the high voltage side of Preston TS, Galt TS, and Energy+ MTS #1, the post contingency voltages also violate the allowable voltage change limit and continue to drop.

[1] The Kitchener MTS #6 and MTS #8 load can be restored with the Galt JCT. in-line switches and load can be restored at Preston TS with the back-feed through the Preston TS T2 230-115 kV autotransformer.

The TWG recommends that the voltage violations along the M20D/M21D 230 kV double circuit line be further reviewed in an IRRP. This recommendation is based on the timing of the need, the opportunity for integrated solutions involving both wire and non-wire options, and the opportunity to coordinate the solution to the need.

3.3.1 Near-Term Needs

Of the needs identified, those at Preston TS, Energy+ MTS #1, and along the Galt JCT to Cambridge section of M20D/M21D are the most pressing. This may introduce the need to use a hand-off letter to allow for the expedited initiation of projects aimed towards addressing the imminent needs. A hand-off letter, if required, confirms that these needs and the associated options were assessed by the TWG as part of the regional planning process. Any recommendations included in a hand-off letter would be captured, along with any project updates or advancements, in the final IRRP report and the subsequent RIP prepared by the transmitter.

3.3.2 Powering Ontario's Growth

On July 10, 2023, the Ministry of Energy released the Powering Ontario's Growth (POG) report, which outlines actions to support economic growth, decarbonization, and the ongoing transformation of Ontario's electricity system. The IESO's South and Central Ontario bulk planning study being initiated in 2024 will review the capability of the bulk system to support future generation connections and demand growth in key areas throughout the province, to enable a decarbonized power system in the future. This work will also consider opportunities to preserve new or expanded corridors for future transmission development. Consideration of Potential Loads for the other planning regions of interest identified in the Central-West Bulk Plan will be integrated with POG objectives in the South and Central Ontario bulk planning study to better plan for potential linkages and their cumulative impact.

3.3.3 Central-West Bulk Plan

In April 2024, the IESO published the Central-West Bulk Plan, which assessed the reliability of a large portion of the bulk transmission system in southwestern Ontario. The Plan focused on firm economic development projects in the London Area region, as well as potential economic development in five planning regions of interest, including KWCG. As part of that assessment, thermal limitations on the transmission paths between Detweiler TS and Orangeville TS, as well as the 115 kV path between Burlington TS and Detweiler TS were identified. In addition, low voltage and eventual voltage collapse at Preston TS was identified after a significant amount of load (approximately 1,110 MW) was added in the region. These two findings should be monitored and inform regional planning as well as the South and Central Ontario bulk planning study.

4. Conclusion and Next Steps

The Scoping Assessment concludes that further coordinated regional planning in the form of an IRRP is required to identify, evaluate, and recommend solutions to address needs in the KWCG region.

This IRRP will include opportunities for engagement with local communities and stakeholders, as well as include discussion of any local initiatives focused on energy, economic development, and/or reducing GHG emissions, and how the IRRP can coordinate with these initiatives. This could include reviewing economic development plans, Community Energy Plans, net-zero strategies, or similar, to understand potential impacts on the electricity demand forecast. Particular attention will be paid to opportunities for information sharing and/or coordination of goals and outcomes.

The draft Terms of Reference for the KWCG region IRRP is attached in Appendix 2.

Appendix 1 – List of Acronyms

Acronym	Definition
CDM	Conservation and Demand Management
DER	Distributed Energy Resource
DESN	Dual Element Spot Network
DG	Distributed Generation
GHG	Greenhouse Gas
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
JCT	Junction
KWCG	Kitchener-Waterloo-Cambridge-Guelph
LDC	Local Distribution Company
MW	Megawatt
OEB	Ontario Energy Board
ORTAC	Ontario Resource Transmission Assessment Criteria
TS	Transformer Station
TWG	Technical Working Group
ULTC	Underload Tap Changer

Appendix 2 - Kitchener/Waterloo/Cambridge/Guelph Integrated Regional Resource Plan (IRRP) Terms of Reference

1. Introduction and Background

Based on the near- and mid-term needs identified within the region, the forecast growth, and opportunities to consider solutions in a coordinated manner, an Integrated Regional Resource Plan (IRRP) should be undertaken for the Kitchener-Waterloo-Cambridge-Guelph (KWCG) region.

These Terms of Reference establish the objectives, scope, key assumptions, roles and responsibilities, activities, deliverables, and timelines for an IRRP of the KWCG region.

1.1 Kitchener/Waterloo/Cambridge/Guelph Region

The KWCG region is composed of the cities of Kitchener, Cambridge, Waterloo, and Guelph, the townships of Wellesley, Woolwich, Wilmot, North Dumfries, and portions of Oxford and Wellington counties.

The region also encompasses the Métis Nation of Ontario, Grand River Métis Council, Six Nations of the Grand River, Mississaugas of the Credit First Nation, Chiefs of Ontario, Anishinabek Nation and Association of Iroquois and Allied Indians.

The region is supplied by five stations: Middleport TS, Buchanan TS, Detweiler TS, Orangeville TS, and Burlington TS. These stations supply either 230 kV or 115 kV to the area, stepping down from 500 kV and 230 kV respectively. The region is supplied by numerous Local Distribution Companies (LDC): GrandBridge Energy, Enova Power Corp, Hydro One Networks Inc. (Distribution), Alectra Inc., Center Wellington Hydro Inc., Halton Hydro Inc., Wellington North Power, and Milton Hydro. The region includes 24 transmission stations as shown in Figure 2.

Electricity demand in the KWCG region is driven by various factors, including population growth, industrial sector changes, intensification of the Kitchener downtown area, and rising awareness of renewable energy generation development, and conservation and demand management. The region's population and accompanying employment are expected to grow steadily, which will drive electricity demand for the next 20 years. The Region of Waterloo installed a light rail transit system between Waterloo and Kitchener with plans to extend to Cambridge, which is spurring development along the train route in both the residential and commercial sectors.

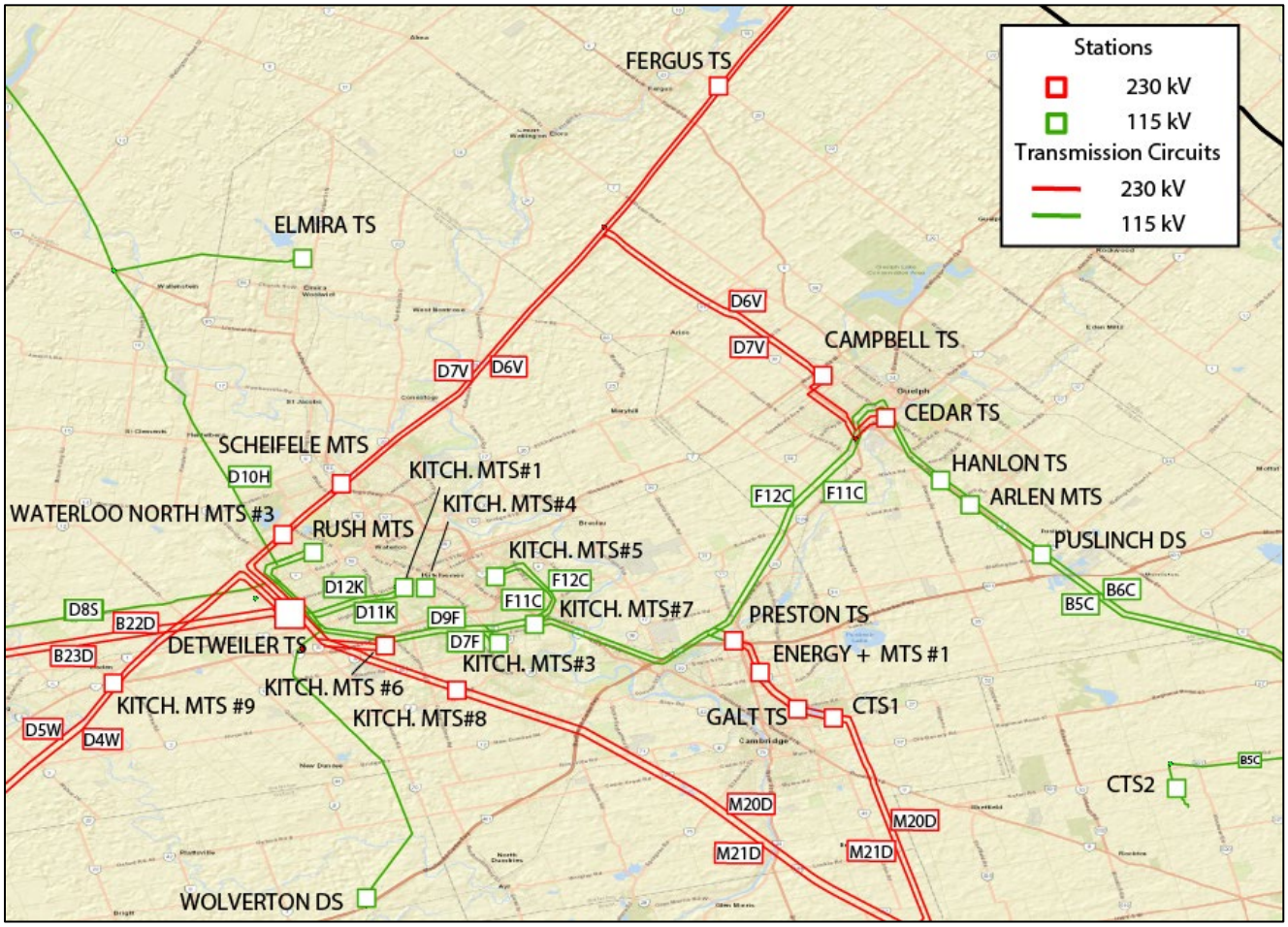
The Region of Waterloo is internationally known for its leading-edge technology and advanced manufacturing industries, innovative educational institutions, vibrant agricultural communities, and the historically significant Grand River.

The City of Kitchener is currently experiencing a conversion from being a manufacturing-oriented economy to a more diversified and balanced economy.

As directed by the OEB, Enova Power Corp is currently participating in multiple provincial renewable energy programs and conservation and demand management (CDM) programs, which help control and reduce the electricity demand. Time-of-Use is also shifting demand and conserving energy as customers manage their electricity use and control their costs.

Based on the needs of the region, no divisions are proposed that would create any sub-regions for this IRRP.

Figure 1 | Electricity Infrastructure of the KWCG Region



1.2 Background

This is the third regional planning cycle for the KWCG region. Hydro One completed the Needs Assessment (NA) report for the region in December 2023. The IESO-led SA process reviewed the results of the NA to identify a preferred planning approach for the region. An IRRP was recommended based on the nature of the regional needs; the forecast demand growth and the potential for diverse types of solutions considering both wire and non-wire possibilities.

2. Objectives

1. To assess the adequacy of the electricity supply to customers in the Kitchener-Waterloo-Cambridge-Guelph region over the next 20 years.
2. Account for major asset renewal needs, capacity needs, enhancing reliability and resilience, uncertainty in the outlook for electricity demand, and local priorities in developing a comprehensive plan.
3. Consider potential impacts of electrification targets and other policy decisions on needs identified and recommended outcomes, consistent with provincial direction.
4. Evaluate opportunities for cost effective non-wires alternatives, including conservation and demand management (CDM) and distributed energy resources (DER), as well as wires approaches for addressing the needs identified.
5. Develop an implementation plan that maintains flexibility to accommodate changes in key assumptions over time. The implementation plan should identify actions for near-term needs, preparation work for medium-term needs, and planning direction for the long term.

3. Scope

3.1 Needs to be Addressed

The IRRP will develop and recommend an integrated plan to meet the needs of the KWCG region. The plan is a joint initiative led by the IESO and completed by the members of the Technical Working Group (TWG) – Hydro One Transmission, the IESO, GrandBridge Energy, Enova Power Corp., Alectra Inc., Central Wellington Hydro, Halton Hills Hydro Inc., Hydro One Distribution, Wellington North Power, and Milton Hydro. The plan will consider the demand forecast for the region, the CDM, DER uptake, transmission, and distribution system capabilities, and align with relevant community plans, bulk system developments, and policy direction as applicable.

The KWCG IRRP aims to address the following needs identified in the Needs Assessment:

Table 4 | Needs Identified in the Needs Assessment as Requiring Further Study

Station/Circuit	Description of Need	Timeline
230 kV M20D/M21D: Galt JCT to Cambridge #1 JCT	Transmission System Capacity Need	Near term
115 kV D11K/D12K: Detweiler to Kitchener #1 &#4 JCT	Transmission System Capacity Need	Mid term
230 kV M20D/M21D Circuit	Load Security Need	Mid term
230 kV M20D/M21D Circuit	Load Restoration Need	Near term
230kV M20D/M21D Circuit	Voltage Violation Need	Near term
Preston TS (T3 & T4)	Transformer Capacity Need	Near term
Energy+ MTS #1 (T1 & T2)	Transformer Capacity Need	Near term
Campbell TS (T3 & T4)	Station Capacity Need	Near term
Cedar TS (T1 & T2)	Station Capacity Need	Mid term
Cedar TS (T7 & T8)	Station Capacity Need	Near term
Kitchener MTS #7	Station Capacity Need	Mid term
Rush MTS	Station Capacity Need	Mid term
Waterloo North MTS #3	Station Capacity Need	Mid term

3.1.1 Expansion of the needs

Each LDC in the KWCG region is required to provide a 20-year forecast. The results of this forecast may introduce more needs for the region than recognized in the 10-year forecast, especially given at the end of the NA, Alectra indicated their forecast will be updated to better account for their community's decarbonization activities. Thus, the needs studied in the IRRP may be refined to reflect the new insight provided by the 20-year demand forecasts to be completed.

3.1.2 Near-Term Needs

The following needs have been identified by the TWG as priority needs within the IRRP based on the proximity of the expected timing to the period of the IRRP study:

- Preston TS transformer capacity need
- Energy+ Inc MTS #1 transformer capacity need
- 230 kV M20D/M21D Circuit
    - Transmission capacity need
    - Voltage violation need
    - Load restoration and load security need

The solutions developed by the TWG to address the priority needs may be encompassed in a hand-off letter. This letter will allow for projects developed to address the imminent needs to be launched before the conclusion of the IRRP. This allows the needs to be addressed promptly due to the approaching nature of the expected time of the need.

3.1.3 Powering Ontario's Growth

On July 10, 2023, the Ministry of Energy released the Powering Ontario's Growth (POG) report, which outlines actions to support economic growth, decarbonization, and the ongoing transformation of Ontario's electricity system. The IESO's South and Central Ontario bulk planning study being initiated in 2024 will review the capability of the bulk system to support future generation connections and demand growth in key areas throughout the province, to enable a decarbonized power system in the future. This work will also consider opportunities to preserve new or expanded corridors for future transmission development. Consideration of Potential Loads for the other planning regions of interest identified in the Central-West Bulk Plan will be integrated with POG objectives in the South and Central Ontario bulk planning study to better plan for potential linkages and their cumulative impact.

3.1.4 Central-West Bulk Plan

In April 2024, the IESO published the Central-West Bulk Plan, which assessed the reliability of a large portion of the bulk transmission system in southwestern Ontario. The Plan focused on firm economic development projects in the London Area region, as well as potential economic development in five planning regions of interest, including KWCG. As part of that assessment, thermal limitations on the transmission paths between Detweiler TS and Orangeville TS, as well as the 115 kV path between Burlington TS and Detweiler TS were identified. In addition, low voltage and eventual voltage

collapse at Preston TS was identified after a significant amount of load (approximately 1,110 MW) was added in the region. These two findings should be monitored and inform regional planning as well as the South and Central Ontario bulk planning study.

4. Activities

The IRRP process will consist of the activities listed below. The activities and anticipated timelines are summarized in Section 8 of this document. The first major planning activity following preparation of this Terms of Reference is the development of the electricity demand forecast, which serves as the basis for system assessments. The timing for initiating the assessment (Activity 3) and all subsequent plan development activities will be contingent on the TWG first agreeing on the demand forecast to be used.

- Develop an electricity demand forecast for the KWCG region. This may be comprised of a number of electricity demand scenarios that account for uncertain elements that can affect (e.g., raise or lower) the need for electricity in the region:
- Confirm baseline technical assumptions including infrastructure ratings, system topology and relevant base cases for simulating the performance of the electric power system. Collect information on:
    - Transformer, line and cable continuous ratings, long-term and short-term emergency ratings;
    - Known reliability issues and load transfer capabilities;
    - Customer load breakdown by transformer station;
    - Historical and present CDM peak demand savings and installed/effective DER capacity, by transformer station.
- Perform assessments of the capacity, reliability, and security of the electric power system under each demand outlook scenario.
    - Confirm and/or refine the needs listed earlier in this section using the demand outlook; establish the sensitivity of each need to different demand outlook scenarios.
    - Identify additional infrastructure capacity needs and any additional load restoration needs; if new needs are discovered, determine the appropriate planning approach for addressing them.
- Identify options for addressing the needs, including, non-wires and wires alternatives. Where necessary, develop portfolios of solutions comprising a number of options that, when combined, can address a need or multiple needs.
    - Collect information about the attributes of each option: cost, performance, timing, risk, etc.

    - Develop cost estimates for all screened-in options as a means of informing further evaluations of alternatives.
    - Seek cost-effective opportunities to manage growth, by identifying opportunities to reduce electricity demand.
- Evaluate options using criteria including, but not limited to the areas of: technical feasibility and timing, economics, reliability performance, risk, environmental, regulatory, and social factors. Evaluation criteria will be informed through community engagement activities and reflect attributes deemed important to the community-at-large.
- Develop recommendations for actions and document them in an implementation plan, to address needs in the near-term and medium-term.
- Develop a long-term plan for the electricity system in KWCG to address the identified long-term needs, taking into account uncertainty inherent in long-term planning, local and provincial policy goals, commitments, and climate change action plans.
    - Discuss possible ways the power system in KWCG could evolve to address potential long-term needs, support the achievement of local and provincial long-term policy goals and plans, and support the achievement of the long-term vision for the electricity sector.
    - During the development of the plan, seek community and stakeholder input to confirm the long-term vision, expected impacts on the electricity system, and inform the recommended actions through engagement.
- Complete an IRRP report documenting the near-term and medium-term needs, recommendations, and implementation actions, as well as long-term plan recommendations.

To carry out this scope of work, the TWG will consider the data and assumptions outlined in Section 5 below.

5. Data and Assumptions

Demand Data

- Historical coincident peak demand information
- Historical weather correction, median and extreme conditions
- Gross peak demand forecast scenarios
- Coincident peak demand data including transmission-connected customers
- Identified potential future load customers
- Customer/load segmentation information (e.g. residential, commercial, industrial) by TS

Conservation and Demand Management

- Conservation forecast for LDC customers, based on region's share of current energy efficiency programs
- Potential for CDM at transmission-connected customers' facilities

Local Resources

- Existing local generation, including distributed generation, district energy, customer-based generation, Non-Utility Generators and hydroelectric facilities, as applicable
- Existing or committed renewable generation from Feed-in-Tariff and non-Feed-in-Tariff procurements
- Future district energy plans, combined heat and power, energy storage, or other generation proposals

Relevant Local Plans, As Applicable

- LDC Distribution System Plans
- Community Energy Plans and Municipal Energy Plans
- Community Climate Action or Adaptation Plans
- Municipal Growth Plans
- Indigenous Community Energy Plans

Criteria, Codes, and Other Requirements

- Ontario Resource and Transmission Assessment Criteria
- North American Electric Reliability Corporation and Northeast Power Coordinating Council reliability criteria, as applicable
- OEB Transmission System Code

- OEB Distribution System Code
- Reliability considerations, such as the frequency and duration of interruptions to customers
- Other applicable requirements

Existing System Capability

- Transmission line ratings as per transmitter records
- System capability as per current IESO PSS/E base cases
- Transformer station ratings (10-day long-term emergency rating) as per asset owner
- Load transfer capability
- Technical and operating characteristics of local generation

End-of-Life Asset Considerations/Sustainment Plans

- Transmission assets
- Distribution assets, as applicable

Other considerations, As Applicable

6. Technical Working Group

The IRRP Technical Working Group will consist of planning representatives from the following organizations:

- Independent Electricity System Operator (Lead for the IRRP)
- Hydro One Networks Inc. (Transmission)
- GrandBridge Energy
- Enova Power Corp.
- Hydro One Networks Inc. (Distribution)
- Alectra Inc.
- Center Wellington Hydro
- Halton Hills Hydro Inc.
- Wellington North Power
- Milton Hydro

6.1.1 Authority and Funding

Each entity involved in the study will be responsible for complying with regulatory requirements as applicable to the actions/tasks assigned to that entity under the implementation plan resulting from this IRRP. For the duration of the study process, each participant is responsible for their own funding.

7. Engagement

Integrating early and sustained engagement with communities and stakeholders in the planning process was recommended to and adopted by the provincial government to enhance the regional planning and siting processes in 2013. These recommendations were subsequently referenced in the 2013 Long Term Energy Plan. As such, the TWG is committed to conducting plan-level engagement throughout the development of the KWCG region IRRP.

The first step in engagement will consist of the development of a public engagement plan, which will be made available for comment before it is finalized. The data and assumptions as outlined in Section 5 will help to inform the scope of community and stakeholder engagement to be considered for this IRRP.

8. Activities, Timeline, and Primary Accountability

Table 3 | Deliverables and timeframe associated with IRRP activities

Activity	Lead Responsibility	Deliverable(s)	Timeframe
1. Prepare Terms of Reference considering stakeholder input	IESO	Finalized Terms of Reference	Q2-Q3 2024
2. Develop the planning forecast for the region		Long-term planning forecast scenarios	Q3-Q4 2024
Establish historical coincident and non-coincident peak demand information	IESO		
Establish historical weather correction, median and extreme conditions	IESO		
Establish gross peak demand forecast	LDCs		
Establish existing, committed, and potential DG	LDCs		
Establish near- and long-term conservation forecast based on planned energy efficiency activities and codes and standards	IESO		
Develop planning forecast scenarios for sensitivity analyses	IESO		
3. Confirm load transfer capabilities under normal and emergency conditions – for the purpose of analyzing transmission system needs and identifying options for addressing these needs	LDCs	Load transfer capabilities under normal and emergency conditions	Q1 2025
4. Provide and review relevant community plans, if applicable	LDCs, Indigenous Communities, and IESO	Relevant community plans	Q1 2025

Activity	Lead Responsibility	Deliverable(s)	Timeframe
5. Complete system studies to identify needs over a 20-year time horizon - Obtain PSS/E base case - Apply reliability criteria as defined in ORTAC to demand forecast scenarios - Confirm and refine the need(s) and timing/load levels The system studies for the imminent needs identified in section 3.3.1 will be prioritized in Q1 2025	IESO, Hydro One Transmission	Summary of needs based on demand forecast scenarios for the 20-year planning horizon	Q1-Q3 2025
6. Develop options and alternatives The development of options and alternatives for the imminent needs identified in section 3.3.1 will be prioritized in Q2 2025		Develop flexible planning options for forecast scenarios	Q2-Q3 2025
Conduct a screening to identify which wires and non-wires options warrant further analysis	IESO		
Verify the LMC of the system to better determine timing of needs and support options development	IESO		
Develop screened-in energy efficiency options	IESO and LDCs		
Develop portfolios of integrated alternatives	All		
Technical comparison and evaluation	All		
7. Plan and undertake community & stakeholder engagement		Community and Stakeholder Engagement Plan Input from local communities, First Nation communities, and Métis Nation of Ontario	Ongoing, as required

Activity	Lead Responsibility	Deliverable(s)	Timeframe
Early engagement including with local municipalities and First Nation communities within study area, First Nation communities who may have an interest in the study area, and the Métis Nation of Ontario	All		
Develop communications materials	All		
Undertake community and stakeholder engagement	All		
Summarize input and incorporate feedback	All		
8. Develop long-term recommendations and implementation plan based on community and stakeholder input	IESO	Implementation plan Monitoring activities and identification of decision triggers Procedures for annual review	Q3-Q4 2025
9. Prepare the IRRP report detailing the recommended near, medium and long-term plan for approval by all parties	IESO	IRRP report	Q4 2025 – Q1 2026

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