KITCHENER-WATERLOO-CAMBRIDGE-GUELPH REGION SCOPING ASSESSMENT OUTCOME REPORT

MAY 9, 2019

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Table of Contents

KWCG Scoping Study Team

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Independent Electricity System Operator
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Hydro One Networks Inc. (Distribution)
Guelph Hydro Electric Systems Inc. (Alectra)
Centre Wellington Hydro
Waterloo North Hydro Inc.
Energy + Inc.
Kitchener-Wilmot Hydro
Wellington North Power Inc.
Halton Hills Hydro
Milton Hydro

Scoping Assessment Outcome Report Summary			
Region:	KWCG		
Start Date	February 8, 2019	**End Date**	May 8, 2019

1. Introduction

This Scoping Assessment Outcome Report is part of the Ontario Energy Board (OEB)'s regional planning process. The Board endorsed the Planning Process Working Group's Report to the Board in May 2013 and formalized the process and timelines through changes to the Transmission System Code and Distribution System Code in August 2013.

The first cycle of the regional planning process for the KWCG region was completed in April 2015. Needs were identified in the near- to medium-term timeframes, and solutions were recommended to address them, including the Guelph Area Transmission Reinforcement Project that is now in service.

The second cycle of the regional planning process for the KWCG region was initiated in September 2018 with the Needs Assessment (NA) – the first step in the regional planning process – carried out by the study team led by Hydro One Networks Inc. (Hydro One). This report was issued on December 19, 2018 and concluded that a number of needs did not require regional coordination, while others required regional coordination. The need information from the Needs Assessment has been input into the scoping process to determine the nature of the planning process to address the identified needs.

During the scoping assessment, participants reviewed the nature and timing of all known needs in the region to determine both the most appropriate planning approach and the best geographic grouping of needs to facilitate an efficient study. Planning approaches discussed include an Integrated Regional Resource Plan (IRRP), where non-wires options have potential to address needs; a Regional Infrastructure Plan ("RIP"), which considers wires-only options; or a local plan undertaken by the transmitter and affected Local distribution company (LDC) where no further regional coordination is needed.

Additional information on selecting a planning approach can be found in Appendix B.

This Scoping Assessment Report:

- Lists the needs requiring more comprehensive planning, as identified in the Needs Assessment Report;
- Reassesses the areas that need to be studied and the geographic grouping of the needs;

- Determines the appropriate regional planning approach and scope for each sub-region where a need for regional coordination or more comprehensive planning is identified;
- Establishes terms of reference for an IRRP if one is required;
- Establishes the composition of the Working Group for the IRRP.

2. Team

The scoping assessment was carried out with members of the study team:

- Independent Electricity System Operator (IESO)
- Hydro One Networks Inc. ("Hydro One Transmission")
- Hydro One Networks Inc. ("Hydro One Distribution")
- Guelph Hydro Electric Systems Inc. (Alectra)
- Centre Wellington Hydro
- Waterloo North Hydro Inc.
- Energy + Inc.
- Kitchener- Wilmot Hydro Inc.
- Wellington North Power
- Halton Hills Hydro
- Milton Hydro

3. Categories of Needs, Analysis and Results

I. Overview of the region

The Kitchener-Waterloo-Cambridge-Guelph (KWCG) region in southwestern Ontario includes the Region of Waterloo,[1] the City of Guelph, Wellington County and the Township of Blandford-Blenheim (Oxford County).

Located in this region are the Grand River Métis Council, and two First Nation communities: Six Nations of the Grand River and Mississaugas of the New Credit.

A summer-peaking region, KWCG is supplied by a network of 230 kV and 115 kV regional transmission and distribution infrastructure. Electricity to the region is primarily supplied by five major bulk transmission stations: Middleport TS, Buchanan TS, Detweiler TS, Orangeville TS and Burlington TS. Customers in the area are supplied via a number of LDCs: Guelph Hydro Electric Systems Inc., Hydro One Distribution, Centre Wellington Hydro, Waterloo North Hydro Inc., Energy + Inc., Kitchener Wilmot Hydro Inc., Halton Hills Hydro and Milton

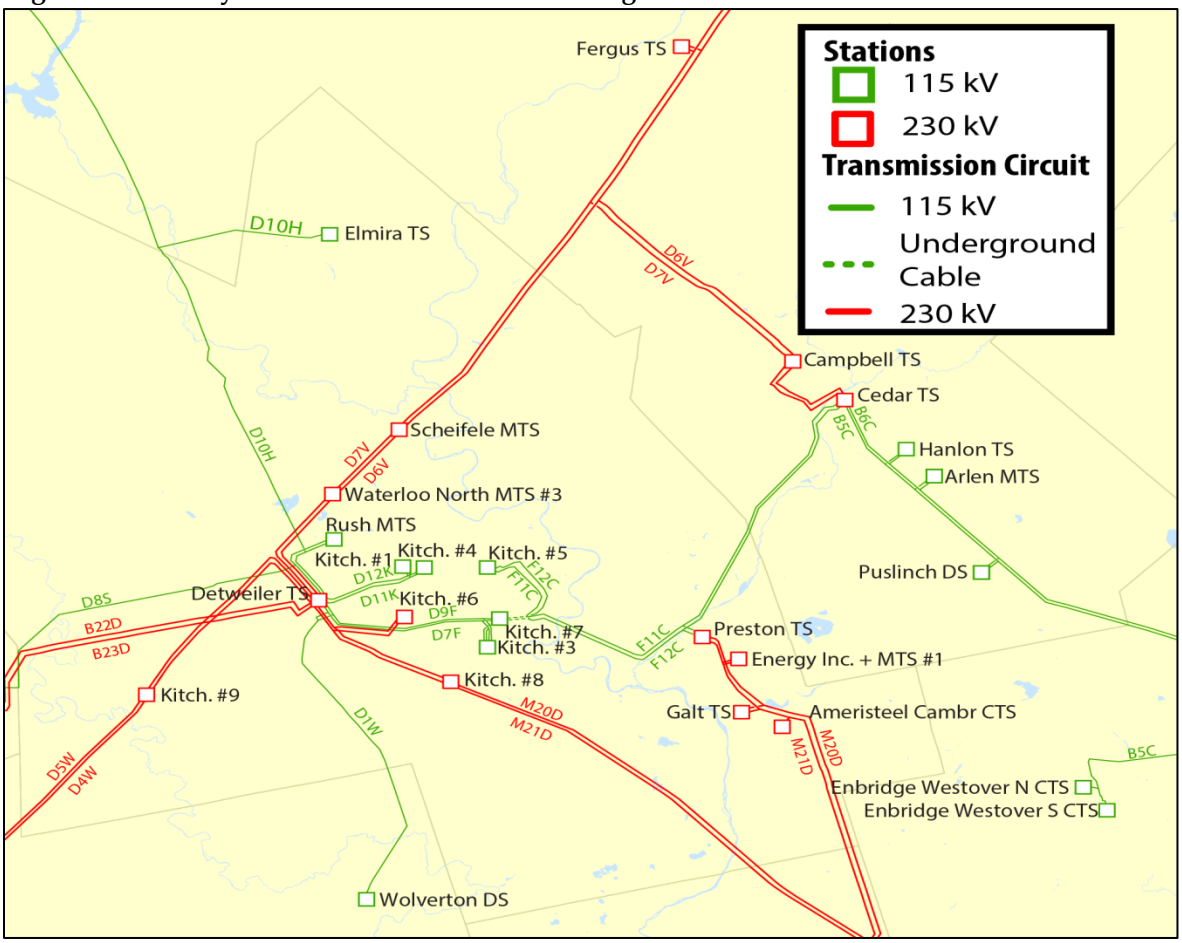
[1] The Region of Waterloo includes the cities of Kitchener, Cambridge, Waterloo and the townships of North Dumfries, Wellesley, Wilmot and Woolwich.

Hydro.

The summer 2018 non-coincident regional demand was approximately 1390 MW. Economic activities contributing to electrical demand in the Region of Waterloo and the City of Guelph include a mix of educational institutions, manufacturing, and high-tech industries. For Wellington County and the Township of Blandford-Blenheim, the agriculture and manufacturing sectors play a key role in economic development.

The electricity infrastructure supplying the KWCG Region is shown in Figure 1.

Figure 0 Electricity Infrastructure in the KWCG Region



II. Background: previous planning process

In 2013, to prioritize and manage the regional planning process, Ontario was organized into 21 regions, each of which was assigned to one of three groups. KWCG became one of the Group 1 planning regions; however, at that time regional planning activities in this region led by the former Ontario Power Authority (now the IESO) were already underway, involving Hydro One, the IESO and LDCs.

In October 2013, the KWCG planning electricity supply study was transitioned to align with the OEB's new regional planning process. The Working Group revised the terms of reference to reflect the new process, and updated the study information, including demand forecasts and conservation and distributed generation (DG) data, to confirm the region's reliability and supply needs.

To meet these needs, the Working Group recommended implementation of:

- The Guelph Area Transmission Reinforcement (GATR) project
  - Installation of two new 230/115kV autotransformers at Cedar TS to reinforce supply to the 115 kV sub-systems in the region; and upgrading of the 5km idle 115 kV line B5G/B6G between Campbell TS and Cedar TS to 230 kV
  - Installation of two new 230 kV in-line switches on D6V/D7V circuits to improve restoration capability of the Waterloo-Guelph 230 kV sub-system
- In-line switches at Galt Junction
  - Installation of two new 230kV in-line switches on M20D/M21D circuits to improve restoration capability of the Cambridge-Kitchener 230 kV sub-system

These projects are complete and in service.

Following the IRRP, a regional infrastructure plan (RIP) was published in December 2015 to address transmission needs identified in the needs assessment and the IRRP. Plans to address some of these needs were further developed in the RIP, with some in the medium- to longer-term timeframe to be confirmed in the next regional planning cycle.

This second regional planning cycle started with the Needs Assessment Report published by Hydro One in December 2018. The needs identified in this report form the basis of the analysis for this scoping assessment and are discussed in further detail in section III.

III. Identified needs

Hydro One's NA identified a number of needs in the KWCG region based on the most up-to-date sustainment plans and a 10-year demand forecast. These needs are outlined in Table 1-1, which summarizes both the projects underway to address near-term needs, and the needs to be addressed in this regional planning cycle.

Projects and Plans Underway

The NA completed recently by Hydro One listed projects currently underway to meet near-term needs. Table 1-1 below lists these needs and the plans to address them.

Table 1-1 Projects Underway

Need	Facilities	Status	In-service date
End of Life	Campbell TS (T1/T2 DESN): T1 supply transformer 230/13.8 kV	T1 is being replaced with a 100 MVA unit similar to T2 replacement in 2017. There are plans to replace secondary equipment limiting station LTR to achieve LTR of 130 MVA at the DESN.	I/S 2021-2022
	Detweiler TS: 230/115 kV T2/T4 auto-transformers	Autotransformers T2 and T4, built in 1959 and 1963 respectively, were declared at end of life and are being replaced with similar units.	I/S 2021-2022
	115 kV circuits B5/6C: Burlington TS to Westover CTS (27 km)	Line section of B5/6C from Burlington TS to CTS is currently under refurbishment.	I/S 2019-2020

Needs to be Addressed in the new Planning Cycle

Table 1-2 below includes needs that must be met in the next five years and are designated as near term and those in the five-to-10-year timeframe, which are classified as medium term.

Table 1-2 Projects Underway

Need	Facilities	Need Date
Near-term needs identified through needs assessment		
Equipment end of life	230 kV circuits D6V/D7V: Guelph North Jct. to Fergus Jct. (9.5 km)	2019-2020
	115 kV circuits D7F/D9F: Tower # 157 to Freeport SS (0.5 km)	2019-2020
	Kitchener MTS #5: T9/T10 supply transformers	2023-2024
	Hanlon TS: T1/T2 supply transformers	2023-2024
	Cedar TS: T7/T8 supply transformers	2024-2025
	Scheifele MTS:T1/T2 supply transformers	2024-2026

Capacity	Campbell TS (T3/T4) DESN overloading	2021-2022
Supply performance	Elmira TS and 115 kV circuit D10H	Existing

Need	Facilities	Need Date
Medium-term needs identified through the needs assessment		
Equipment end of life	Preston TS: T3/T4 supply transformers	2025-2026
Capacity	Waterloo North Hydro MTS #4	2026
	Energy + MTS #2	2026

IV. Analysis of needs and identification of sub-regions

A number of factors were considered in recommending a planning approach for the needs identified in the needs assessment, and the overall approach for further study in this area. Broadly speaking, where there is the potential for a wide range of solutions to meet the needs of an area, including conservation, generation, new technologies, and wires infrastructure, an integrated planning approach is optimal.

In the case of the KWCG region, the Working Group recommended an integrated approach to address the medium-term capacity needs of Waterloo North Hydro and Energy+, and to complete a comprehensive load restoration review of the region in the context of recent infrastructure investments and a new 20-year demand forecast. Additionally, planning for replacement of end-of-life facilities and documentation of rationale will also benefit from the integrated view afforded by an IRRP.

The section below provides additional details on needs recommended to move to the IRRP process.

Integrated capacity planning for medium-term need for capacity for Energy + and Waterloo North Hydro

Both Waterloo North Hydro (WNH) and Energy + have identified the need for new capacity in the next five to 10 years, tied, in part, to demand from development of the "East Side Development Lands." The two new potential stations for each LDC, as well as Preston TS (if

expansion is possible) are all theoretically positioned to service future load growth. New capacity in the area could be optimized to address the growth needs of both LDCs. The integration exercise will also consider Preston TS end-of-life replacement plans and potential optimization with incremental capacity needs. This capacity study will consider whether the Preston TS can be expanded to supply future load growth rather than deferring the end-of-life transformer replacement plans slated to be in service for 2025-2026. The study group recommends that need for new capacity for WNH and Energy + be addressed in the IRRP in consideration of capacity at Preston TS.

Opportunities to optimize end-of-life investments

Re-examining the current use and configuration of facilities reaching end of life in the context of the latest load forecast and generation data can help ensure that any new assets installed in their place will continue to appropriately service both the impacted LDCs and their customers, over the new assets' lifetime. In this instance, there are three stations in series on circuits B5C/B6C, two of which have supply transformers identified at end of life over the next five years. Cedar TS is connected to the region's 230 kV system via 230 kV/ 115 kV auto-transformers, and also supplies load via the 115 kV supply transformers. Just downstream of Cedar TS is Hanlon TS, followed by Arlen MTS. Supply transformers at both Cedar and Hanlon have been identified for end-of-life replacement in the next five years. End-of-life investments regarding these three stations could be optimized via consolidation of load to be supplied by two stations of a larger size. The Needs Assessment Report identified, at a high level, why further optimization of load between Hanlon and Arlen stations was not feasible. The study team recommends documenting in the IRRP why no further optimization is feasible at this point for these stations.

Load restoration review

Broadly speaking, a load restoration review studies the ability of the electricity system in the area to minimize the impacts of potential supply interruptions to customers in the event of major transmission outages within specific timeframes and defined magnitude of load lost. In the past planning cycle, a partial solution was developed to improve the restoration ability for load supplied off the Preston tap and M20/21D supply. The study group recommends that a load restoration review be completed for the entire region as part of an IRRP. This review will also recommend the responsible parties to undertake application to the IESO for ORTAC restoration criteria exemptions as necessary.

Two other issues raised during the needs assessment and scoping assessment meetings are also recommended for study in the IRRP.

Area short circuit levels forecast

A study team member expressed concern regarding rising short circuit levels on circuits D6V/D7V and D10H/D8S and existing short circuit levels approaching maximum capacity of LDC-owned equipment at a number of stations in Waterloo North Hydro territory. Waterloo North Hydro has requested that the scope of this study be expanded to include analysis of cost-effective ways of managing the rise in short circuit levels on this line to avoid replacement of

equipment that is in good condition and only approximately halfway through its expected service life. This is also an optimal time for a short circuit study as equipment replacement is underway for the D6V/D7V conductors and T2/T4 autotransformers at Detweiler TS.

Connection challenges for behind-the-meter projects

Wellington North Power raised concerns with challenges in connecting behind-the-meter (BTM) projects in its service territory. These projects are treated as any front of the meter resources and subject to the same connection criteria. The ability to connect these (BTM) projects is limited in areas with existing generation that is connected to the system that reduces the capacity to connect additional generation.

The study team recommends that these issues be studied further through an integrated process. This is due to the fact that s both issues concern short circuit levels due to resources in the broader area, and associated limitations of electrical equipment in the area.

The study team recommends that the assessment of needs outlined above will benefit from an integrated view. There are potential opportunities to assess wires and non-wires solutions and to address multiple needs in an optimal manner. Some interactions with bulk system planning of the Middleport system in this area are also expected and will be captured in an IRRP. The study team recommends that these needs be grouped and studied together as one IRRP for the KWCG region.

As described in Table 1-3 below, remaining needs are singular in nature and local planning is recommended to address them, as there is limited opportunity to reconfigure and resize the facilities to align with other regional needs. The team recommends that these needs be studied and addressed as part of local planning between the transmitter and impacted LDCs.

Table 1-3 Needs to be Addressed by Local Planning

Need	Facilities	Need Date	Status
Equipment End of Life	230 kV circuits D6V/D7V: Guelph North Jct. to Fergus Jct. (9.5 km)	2019-2020	Hydro One to undertake replacement
	115 kV circuits D7F/D9F: Tower # 157 to Freeport SS (0.5 km)	2019-2020	Hydro One to undertake replacement
	Preston TS: T3/T4 supply transformers	2025-2026	Hydro One to undertake replacement
	Kitchener MTS #5: T9/T10 supply transformers	2023-2024	Kitchener -Wilmot Hydro and Hydro One to coordinate replacement of transformers with standard units of similar size

	Hanlon TS: T1/T2 supply transformers	2023-2024	Hydro One to undertake replacement of the transformers with standard 42 MVA units*
	Cedar TS: T7/T8 supply transformers	2024-2025	Hydro One to undertake replacement of transformers with standard 42 MVA units*
	Scheifele MTS:T1/T2 supply transformers	2024-2026	Waterloo North Hydro to continue to monitor the condition of these transformers (to be addressed in the next regional planning cycle if necessary)
Capacity	Campbell TS (T3/T4) DESN overloading	2021-2022	Hydro One and Guelph Hydro to monitor the loads and l balance them between the two DESNs when required
Supply performance	Elmira TS and 115 kV circuit D10H	Existing	Hydro One to continue to work with Waterloo North Hydro to address the supply performance issue

*End-of-life replacement plans to continue as planned; IESO to document rationale for not further optimizing these stations in the IRRP.

Additional considerations for further studies in the KWCG region

Changes to provincial energy-efficiency programs may impact the demand forecast. An integrated planning exercise will capture the impact of these changes on the timing and magnitude of needs, and on the consideration of non-wires solutions.

4. Conclusion

The Scoping Assessment concludes that:

- An IRRP be undertaken for the KWCG region to address the following needs:
  - Document optimization of end-of-life replacement plans for transformers at Hanlon TS and Cedar TS
  - Plan for the medium-term capacity needs of Waterloo North Hydro and Energy +
  - Conduct a load restoration review of the area and document exemptions
  - Assess impacts of area short circuit levels and resource connection challenges

- Additional needs identified in the needs assessment (outlined below) will be addressed through local planning between the transmitter and relevant LDC:
    - End-of-life replacements
        - Section of 230 kV circuits D6V/D7V
        - Section of 115 kV circuits D7F/D9F
        - T9/T10 transformers at Kitchener MTS #9
        - T1/T2 transformers at Scheifele MTS
        - T3/T4 transformers at Preston TS
        - T7/T8 transformers at Cedar TS
        - T1/T2 transformers at Hanlon TS
    - Supply performance issue at Elmira TS and supply from D10H
    - Campbell TS DESN overloading

The draft terms of reference for the KWCG IRRP is attached in Appendix A.

List of Acronyms

CDM	Conservation and Demand Management
DG	Distributed Generation
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LDC	Local Distribution Company
MW	Megawatt
NA	Needs Assessment
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
RIP	Regional Infrastructure Plan
TS	Transformer Station

Appendix A: The Kitchener-Waterloo-Cambridge-Guelph IRRP Terms of Reference

1. Introduction and Background

These Terms of Reference establish the objectives, scope, key assumptions, roles and responsibilities, activities, deliverables and timelines for an Integrated Regional Resource Plan (IRRP) for the Kitchener-Waterloo-Cambridge-Guelph (KWCG) region.

Based on the needs identified within the region, including opportunities for coordinating demand and supply options with capacity needs in the Waterloo North Hydro and Energy + territories, load restoration capability review, short circuit capability needs, and challenges in connecting behind-the-meter energy storage, an integrated regional resource planning approach for the KWCG region is recommended.

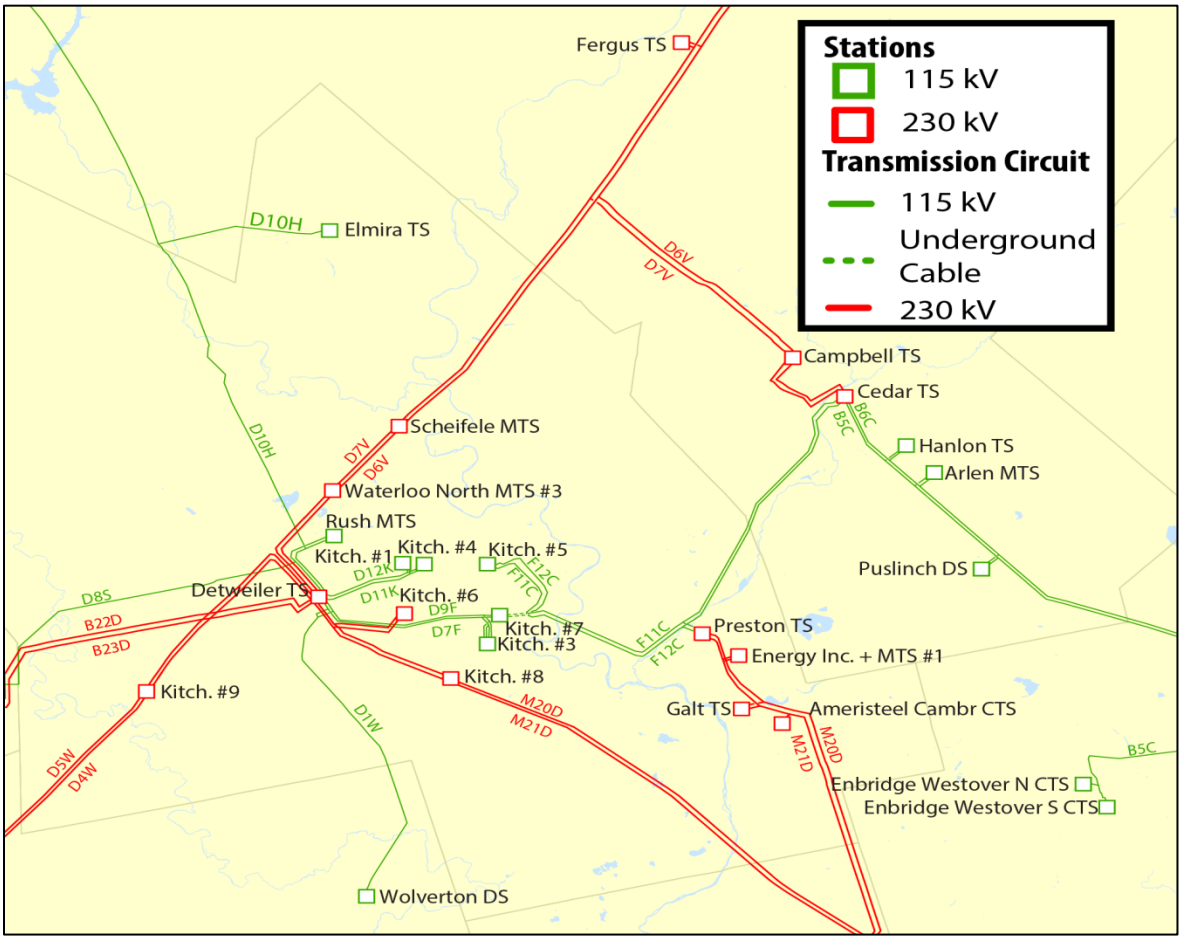
The KWCG Region

The KWCG region in southwestern Ontario includes the Region of Waterloo,[2] the City of Guelph, Wellington County and the Township of Blandford-Blenheim (Oxford County). Under the "Places to Grow" policy, the KWCG area is expected to meet the mandated population growth target set by the province in the coming decades.

The approximate geographical boundaries of the region are shown in Figure A-1.

[2] The Region of Waterloo includes the cities of Kitchener, Cambridge, Waterloo and the townships of North Dumfries, Wellesley, Wilmot and Woolwich.

Figure A-1: Electricity Infrastructure in the KWCG Region[3]



KWCG Region Electricity System

The KWCG region's electricity demand is a mix of residential, commercial and industrial loads, and includes diverse economic activities, such as post-secondary education and automobile manufacturing. It is a summer-peaking region supplied by the bulk system from the 230 kV Orangeville TS, Detweiler TS, Burlington TS, Middleport TS, and Buchanan TS, through local 115 kV and 230 kV step-down transformer stations. The electricity system supplying the KWCG region is shown in Figure A-2.

[3] The region is defined by electricity infrastructure; geographical boundaries are approximate.

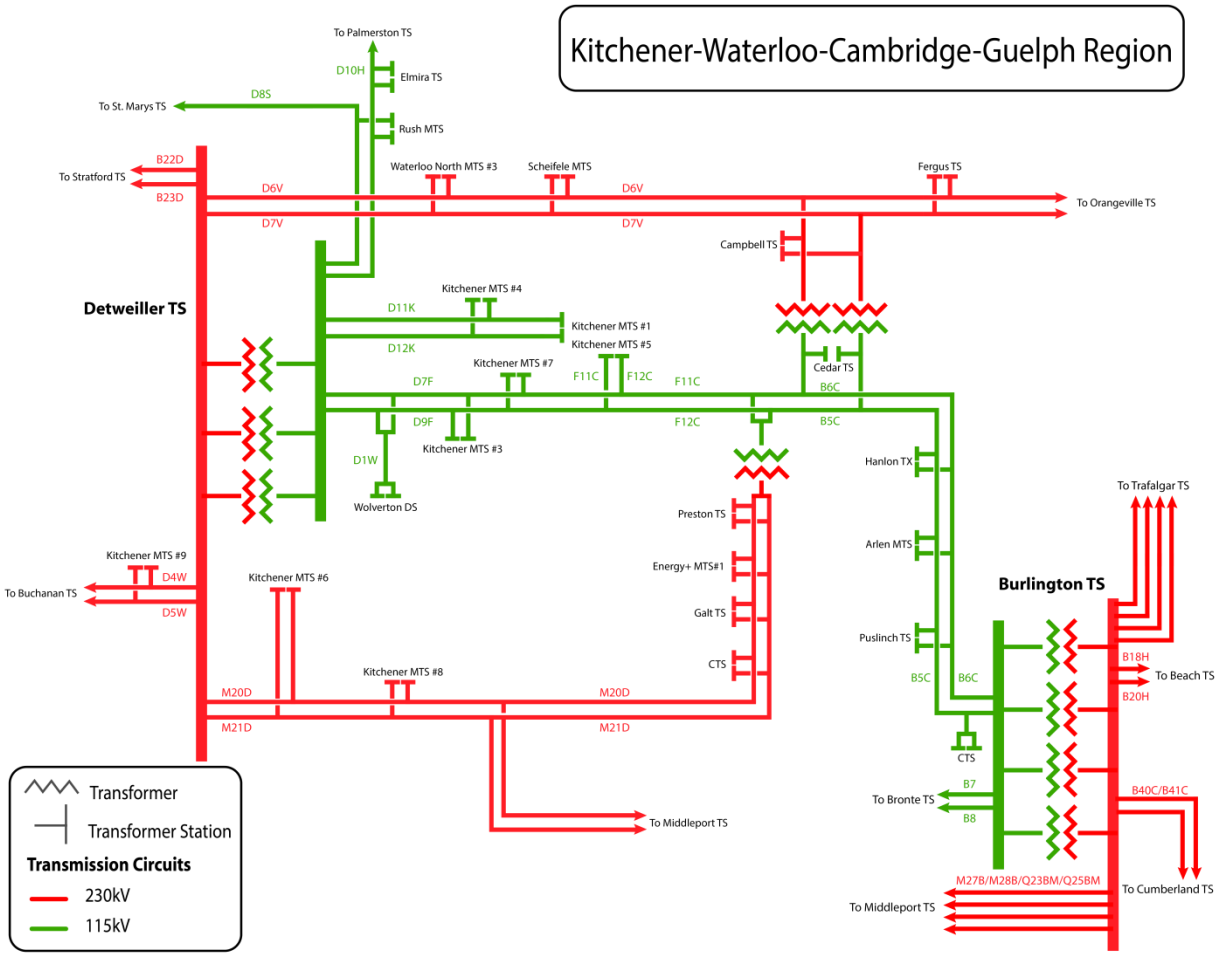


Figure A-1: Single-Line diagram of electricity system supplying the KWCG region[4]

Background

In May 2013, the OEB endorsed the Planning Process Working Group's report, formalizing the regional planning process. As regional planning in KWCG was already underway at that time, the KWCG region became one of the first to undergo the new regional planning process. As planning for the region had progressed significantly before the OEB process was implemented, no formal needs assessment or scoping assessment was published in the region's first planning cycle. The Working Group revised the terms of reference to reflect the new process, updated the study information, and re-confirmed reliability and supply needs in the KWCG region.

[4] Burlington TS is not included in the KWCG study area.

In April 2015, the IESO published an IRRP for the KWCG region recommending conservation and distributed generation to help meet peak demand growth. The plan also recommended the implementation of Guelph Area Transmission Refurbishment (GATR) that focused on addressing supply needs in the south-central Guelph and Kitchener area, and minimizing the impact of potential supply interruptions to customers in Waterloo, Guelph and surrounding areas. The plan also called for the installation of two circuit switches at Galt Junction to further improve restoration capability in the Cambridge and Kitchener area. Both the GATR project and Galt Junction in-line switches have been completed and are in service.

Subsequently, and in accordance with the OEB's process, in December 2015 Hydro One Transmission published a regional infrastructure plan (RIP) to address transmission needs identified in the IRRP.

The second cycle of KWCG regional planning launched in late 2018, and Hydro One published the Needs Assessment Report in December of the same year. Because a number of needs identified in the report require integrated regional consideration, the scoping assessment led by the IESO with Hydro One and LDCs recommended an integrated regional resource plan (IRRP) be undertaken to address these needs.

2. Objectives

The KWCG IRRP will assess the adequacy of electricity supply to customers in the region and will develop a set of recommended actions to maintain reliability of supply to the region over the next 20 years.

- Assess the adequacy of electricity supply to customers in the KWCG area over the next 20 years
- Determine whether there is a need to initiate development work or to fully commit infrastructure investments in this planning cycle
- Identify and coordinate major asset renewal needs with customer needs, and develop a flexible, comprehensive, integrated electricity plan for KWCG
- Develop an implementation plan, while maintaining the flexibility to accommodate changes in key assumptions over time

3. Scope

This IRRP will develop and recommend an integrated plan to meet the needs of the KWCG region. The plan was developed by members of the KWCG IRRP Working Group comprising Centre Wellington Hydro, Energy + Inc., Guelph Hydro Electric Systems Inc. (Alectra), Hydro

One Distribution, Kitchener-Wilmot Hydro, Waterloo North Hydro Inc., Wellington North Power Inc., Hydro One Transmission, and the IESO.

The plan will focus on these items in order of priority:

- Documentation of end-of-life needs optimization at Hanlon/Cedar/Campbell stations
- Medium-term integrated planning for capacity needs of Waterloo North Hydro and Energy+
- Review of restoration capability in the area, including undertaking restoration criteria exemptions as necessary
- Long-term planning for the 115 kV system in this region
- Review of short circuit capability needs associated with rising short circuit levels, including recommendation of integrated solutions
- Review of connection challenges of behind-the-meter energy storage projects, including recommendation of solutions as relevant or recommendation to address in other forums

In its identification or confirmation of any capacity or restoration needs, and analysis of options for addressing end-of-life needs, this plan – like all IRRPs – will integrate forecast electricity demand growth, conservation and demand management (CDM) with transmission and distribution system capability, relevant community plans, other bulk system developments, and the uptake of distributed energy resources (DER).

The IESO will assess the adequacy of the bulk system supplying the area in the Middleport bulk system planning study through a separate process. Results of that study will be shared with the Working Group and incorporated into applicable regional studies as they become available.

Based on the identified needs, the KWCG IRRP process will involve the:

1) Development of an updated 20-year demand forecast for the region.
2) Confirmation of the adequacy of transformer station ratings and the area's load-meeting capability and reliability.
    a. Identify or confirm the transformer station capacity needs and sufficiency of the area's load-meeting capability for the study period using the updated load forecast.
    b. Confirm identified restoration needs using the updated load forecast.
    c. Collect information on known reliability issues and load transfer capabilities from the LDCs.
3) Assessment of options for confirmed needs, using decision-making criteria that includes, but is not limited to, technical feasibility, economics, reliability performance, and environmental and social factors.

The options analysis has been divided into groupings based on the priority/timing of the needs, known lead time information, and the depth of analysis required.

a. Phase 1:
    i. Confirm and document the reasons and conclusion(s) of the optimization of end-of-life Hanlon/Cedar/Campbell stations.
    ii. Identify options for meeting medium-term capacity needs in Waterloo North Hydro and Energy+ territories, with consideration of supply from Preston TS per recommendations from the Working Group.
b. Phase 2:
    i. Review restoration capabilities in the area, and recommend responsible parties to undertake restoration criteria exemption application as necessary.
    ii. Long-term planning for the 115 kV system between Detweiler TS and Cedar TS.
    iii. Review options for managing rising short circuit capability need.
    iv. Review options to address challenges of connecting behind-the-meter energy storage projects, and recommend solutions.
    v. Engage with representatives from the Region of Waterloo, municipalities and Indigenous communities, to review and consider municipal energy plans.

4) Development of the long-term recommendations and the implementation plan.
5) Completion of the IRRP report documenting near-, mid-, and long-term needs and recommendations.

In order to carry out this scope of work, the Working Group will consider the data and assumptions outlined in section 4 below.

4. Data and Assumptions

The plan will consider the following data and assumptions:

- Demand data
    - Historical coincident and non-coincident peak demand information Historical weather correction, for median and extreme conditions
    - Gross peak demand forecast scenarios by region, TS
    - Coincident peak demand data, including transmission-connected customers
    - Identified potential future load customers

- Conservation and demand management (CDM)

- LDC CDM plans
- Verified results and CDM programs/opportunities in the area
- Long-term conservation forecast for LDC customers based on planned provincial CDM activities
- Conservation potential studies, if available
- Potential for CDM at transmission-connected customer facilities
- Load segmentation data for each TS based on customer type (e.g., residential, commercial, industrial, agricultural) and proportion of LDC service territory within the study area

- Local resources
  - Existing local generation, including distributed generation (DG), district energy, customer-based generation, non-utility generators and hydroelectric facilities as applicable
  - Existing or committed renewable generation from feed-in-tariff (FIT" and non-FIT procurements
  - Future resource proposals as relevant

- Relevant local plans, as applicable
  - LDC distribution system plans
  - Community energy plans and municipal energy plans (e.g., Community Energy Investment Strategy for Waterloo Region)
  - Municipal growth plans
  - Any transit plans impacting electricity use or tied to community developments

- Criteria, codes and other requirements
  - Ontario Resource and Transmission Assessment Criteria (ORTAC)
    - Supply capability
    - Load security
    - Load restoration requirements
  - NERC and NPCC reliability criteria, as applicable
  - OEB Transmission System Code
  - OEB Distribution System Code
  - Reliability considerations, e.g., 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 LTR) as per asset owner
  - Load transfer capability
  - Technical and operating characteristics of local generation

- End-of-life asset considerations and sustainment plans
    - Transmission assets
    - Distribution assets
    - Impact of ongoing plans and projects on applicable facility ratings

- Other considerations, as applicable

5. Working Group

The core Working Group will consist of planning representatives from the following organizations, including embedded LDCs that have identified needs in this region:

- Independent Electricity System Operator *(Team Lead for IRRP)*
- Hydro One Transmission
- Guelph Hydro Electric Systems Inc. (Alectra)
- Centre Wellington Hydro
- Waterloo North Hydro Inc.
- Energy + Inc.
- Kitchener-Wilmot Hydro
- Wellington North Power Inc.
- Hydro One Distribution

Other LDCs in the region are welcome to participate as observers and the study outcome will be shared with all participants.

Authority and Funding

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

5. Engagement

Integrating early and sustained engagement with communities and stakeholders was recommended by the IESO, and adopted by the provincial government to enhance the regional planning and siting processes in 2013. The Working Group is committed to conducting plan-level engagement throughout the development of the KWCG IRRP.

The first step in engagement will consist of meetings with representatives from the region, including municipalities and Indigenous communities within the planning area, Indigenous

communities that may have an interest in the planning area, and the Métis Nation of Ontario to discuss regional planning, the development of the KWCG plan, and integrated solutions.

Municipal and regional level engagement will continue throughout the development and completion of the plan. The Working Group will develop a comprehensive stakeholder engagement plan, in accordance with the Activities Timeline shown in Table A-1.

6. Activities, Timeline and Primary Accountability

Table A-1 Summary of IRRP Timelines and Activities

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
1	**Prepare terms of reference considering stakeholder input**	*IESO*	- Finalized Terms of Reference	Feb - Apr 2019
2	**Develop planning forecast for the sub-region**			
	Establish historical coincident and non-coincident peak demand information	*IESO*	- Long-term planning forecast scenarios	Apr - Jul 2019
	Establish historical weather correction, median and extreme conditions	*IESO*		
	Establish gross peak demand forecast and high-/low-growth scenarios	*LDCs*		
	Establish existing, committed and potential distributed generation (DG)	*LDCs*		
	Establish near- and long-term conservation forecasts based on planned CDM activities	*IESO*		
	Develop planning forecast scenarios, including the impacts of CDM, DG and extreme weather conditions	*IESO*		
3	**Provide information on load transfer capabilities under normal and emergency conditions**	*LDCs*	- Load transfer capabilities under normal and emergency conditions	Apr - Jul 2019
4	**Provide and review relevant community plans, if applicable**	*LDCs and IESO*	- Relevant community plans	Apr - Jul 2019

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
5	**Prioritize planning considering timing of need and coordination with end-of-life replacement plans (will proceed in parallel with information-gathering phase)**			
	Confirm and document the recommended option regarding end-of-life optimization of Hanlon /Cedar/Campbell stations	*All*	- Documentation of optimization rationale of end-of-life facilities at the Hanlon/Cedar/ Campbell stations	Q2 - Q3 2019
	Identify potential options to meet the integrated capacity needs in the Waterloo North Hydro and Energy+ territories, with consideration of capacity at Preston TS		- Documentation of cost, feasibility, and reliability performance of potential wires options - Detailed option development	Q3 2019 – Q1 2020
6	**Complete system studies to identify needs over a 20-year period** - Obtain PSS/E base case, and include bulk system assumptions as identified in the key assumptions - Apply reliability criteria as defined in ORTAC to demand forecast scenarios - Confirm and refine the need(s) and timing/load levels	*IESO, Hydro One Transmission*	- Summary of needs based on demand forecast scenarios for the 20-year planning horizon	Q3 2019 – Q1 2020
7	**Develop options and alternatives**			
	Develop conservation options	*IESO and LDCs*	- Flexible planning options for forecast scenarios	Q4 2019 - Q1 2020
	Develop local generation options	*IESO and LDCs*		
	Develop transmission (see Action 7 below) and distribution options	*Hydro One, and LDCs*		
	Develop options involving other electricity initiatives (e.g., smart grid, storage)	*IESO/ LDCs with support as needed*		
	Integrate with bulk needs	*IESO*		
	Develop portfolios of integrated alternatives	*All*		
	Complete technical comparison and evaluation	*All*		

	Activity	Lead Responsibility	Deliverable(s)	Timeframe
8	**Plan and undertake community & stakeholder engagement**			
	Engage with local municipalities and Indigenous communities within study area, First Nation communities who may have an interest in the study area, and the Métis Nation of Ontario	*All*	- Community and stakeholder engagement plan - Input from local communities	Q3 2019
	Develop communication materials	*All*		Q4 2019 - Q1 2020
	Undertake community and stakeholder engagement	*All*		
	Summarize input and incorporate feedback	*All*		
9	**Develop long-term recommendations and implementation plan based on community and stakeholder input**	*IESO*	- Implementation plan - Monitoring activities and identification of decision triggers - Hand-off letters - Procedures for annual review	Q1-Q2 2020
10	**Prepare the IRRP report detailing the recommended near-, medium- and long-term plan for approval by all parties**	*IESO*	- IRRP report	Q2 2020