Kitchener-Waterloo-Cambridge-Guelph Integrated Regional Resource Plan DRAFT

Draft Forecast Methodology Document

January 6, 2025

Connecting Today.
Powering Tomorrow.

Appendix B – Demand Outlook and Methodology

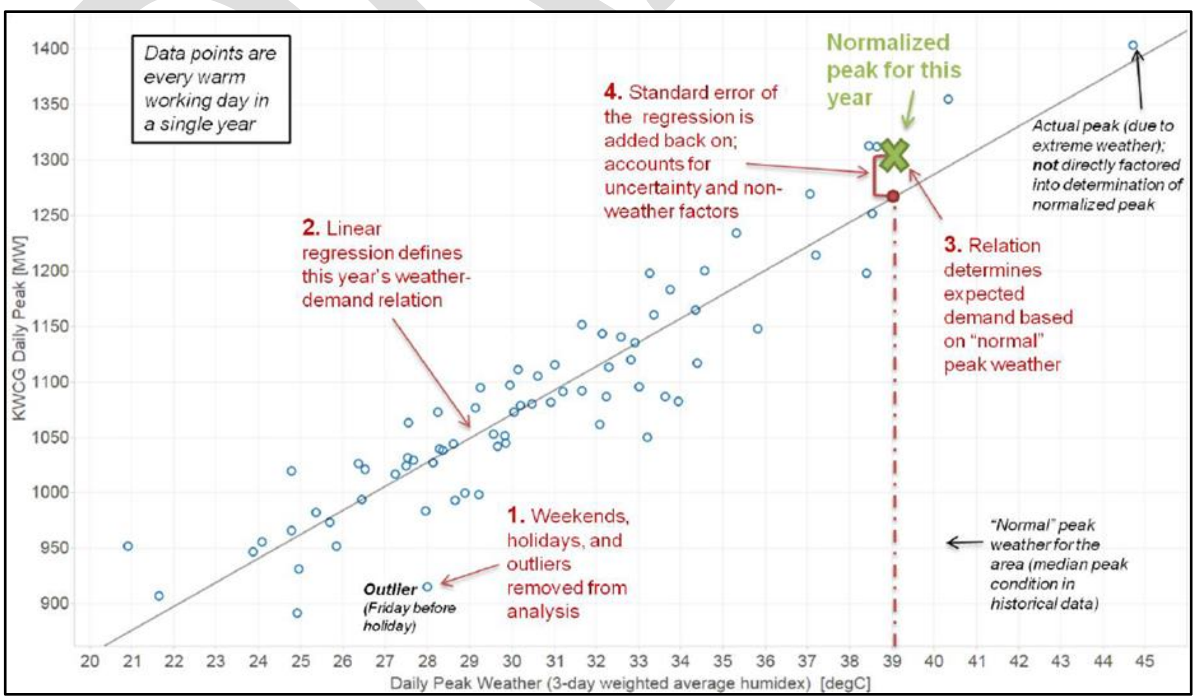
Appendix B describes the methodologies used to develop the demand forecast (peak and duration) for the Windsor-Essex Region IRRP studies. Forward-looking estimates of electricity demand were provided by each of the participating LDCs and informed by the forecast base year and starting point provided by the IESO. The sections that follow describe the weather correction methodology, the approaches and methods used by each LDC to forecast demand in their respective service area, the conservation and distributed generation (DG) assumptions.

B.1 Method for Accounting for Weather Impact on Demand

Weather has a large influence on the demand for electricity, so to develop a standardized starting point for the forecast, the historic electricity demand information is weather-normalized. This section details the weather normalization process used to establish the starting point for regional demand forecasts.

First, the historical loads were adjusted to reflect the median peak weather conditions for each transformer station in the area for the forecast base year (i.e., 2023 for the KWCG IRRP). Median peak refers to what peak demand would be expected if the most likely, or 50th percentile, weather conditions were observed. This means that in any given year there is an estimated 50% chance of exceeding this peak, and a 50% chance of not meeting this peak. The methodological steps are described in Figure 1 and were undertaken for both the summer and winter seasons.

Figure 1: Method for Determining the Weather-Normalized Peak (Illustrative)



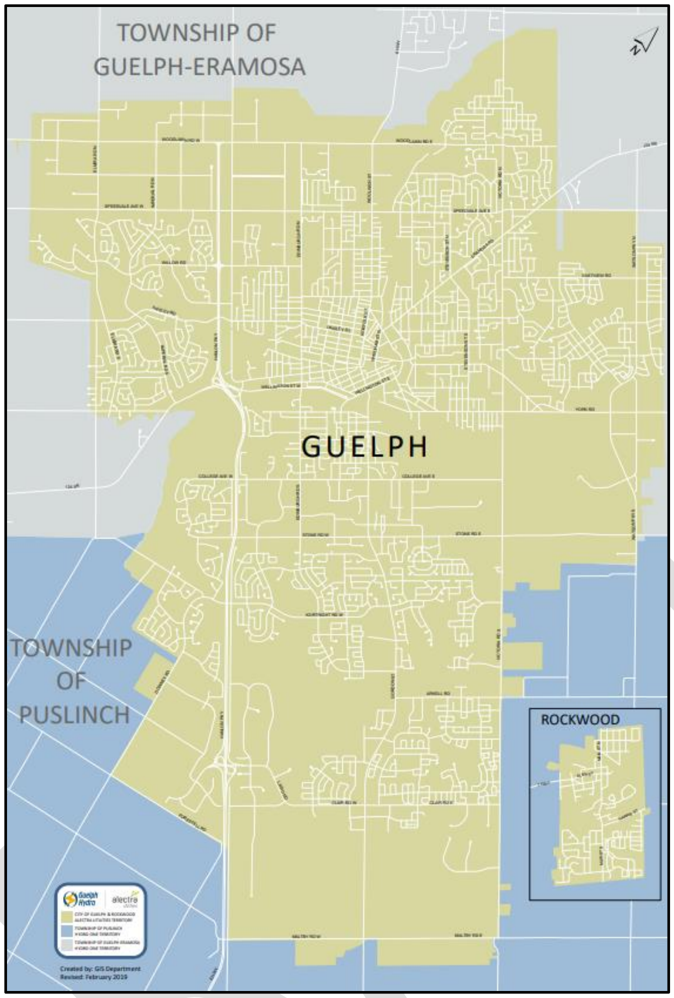
The station-level 2023 median weather summer and winter peaks were provided to each LDC. This data was used as a starting point from which the LDCs could develop 20-year gross median demand forecasts using their preferred methodologies (described in the next sections).

Once the 20-year, median peak demand forecasts were submitted to the IESO, the normal weather forecast was adjusted to reflect the impact of extreme weather conditions on electricity demand, and forecast demand savings from CDM and contracted DG were accounted for. The studies used to assess the adequacy and reliability of the electric power system are generally required to be based on extreme weather demand – typically the expected demand under the hottest (or coldest) weather conditions that can be reasonably expected to occur. Peaks that occur during extreme weather (i.e., summer heat waves in southern Ontario) are generally when the electricity system infrastructure is most stressed.

B.2 Alectra Inc: Gross Forecast Methodology and Assumptions

Alectra Inc., through its subsidiary Alectra Utilities Corporation, serves approximately one million homes and businesses across a 1,924 square kilometre service territory comprising 17 communities which includes Guelph and Rockwood. Alectra Utilities merged with Guelph Hydro on January 1, 2019, and provides a reliable supply of electricity and innovative energy solutions for families and businesses in Guelph and Rockwood. The service territory for Alectra Utilities in the KWCG region is shown below in Figure 2. For the KWCG IRRP, Alectra Utilities developed forecasts for Arlen MTS, Campbell TS, Cedar TS, Fergus TS, and Hanlon TS.

Figure 2: Guelph and Rockwood Service Territory Map



B.2.1 Factors that Affect Electricity Demand

Load growth in the service territory was based on organic growth in the residential and industrial sectors driven by population growth, employment growth, housing activities, industrial and commercial building activity, and consideration of the impact of weather.

The other contributing factors to long-term load projections are Conservation Demand Management (CDM), Distributed Generation (DG) contribution, other government incentives and programs (i.e. Global Adjustment), emerging industrial technologies (i.e. Microgrid, battery storage, CHP, etc.), and newly introduced load types (i.e., electric vehicles, fleets) that are reviewed and assessed in the load forecast procedure.

B.2.2 Forecast Methodology and Assumptions

Alectra Utilities performs a combination of two methods of forecasting to determine the long-term system capacity adequacy assessment. These two methods are end-use analysis using the latest information available from municipal reports, and past system peak performance and trend (statistical) analysis.

Alectra Utilities utilizes end-use analysis to review economic development and outlook for different regions that include Ontario Government development, population growth projections, job growth projections, municipal economic analysis report, past housing completion statistics and future housing projections, industrial and commercial building activities, and news from media.

Historical annual population growth is obtained from Regional Annual Economic and Municipal Development Review Reports. Long-term annual population projection is obtained from provincial and municipal official plan reports published by Ontario government, and regional/municipal government.

Historical employment and economic growth statistics reports published by Provincial and Municipal governments are used to extract the historic economic development and growth rates. Employment growth and structure projections are used to develop long-term employment forecast potentially categorized by the sector, industry, and service types.

The impact of housing activities is incorporated based on a review of the number of housing completions, mix of housing completions, vacancy rates, and building permit activities in the Region and Municipal boundaries and residential developments plan. Plans of subdivision and condominiums are also obtained and analyzed.

The impact of industrial and commercial building activity on the long-term forecast is established based on the development rate, commercial vacancy rate, industrial sale prices per square feet, total construction, and building permits.

To consider impact of weather, Alectra uses weighted three-day moving average temperature to correlate the peak demand and weather. Peak demand weather normalization is the process for estimating the peak demand that would have occurred in a given time period if the weather had been normal (1 in 2). The weather normalized peak demand is used as the starting point for the forecast. Alectra uses "1-in-10" (extreme) weather scenario for system planning purposes to contemplate the impact of extreme weather (i.e. high temperatures) on peak demand.

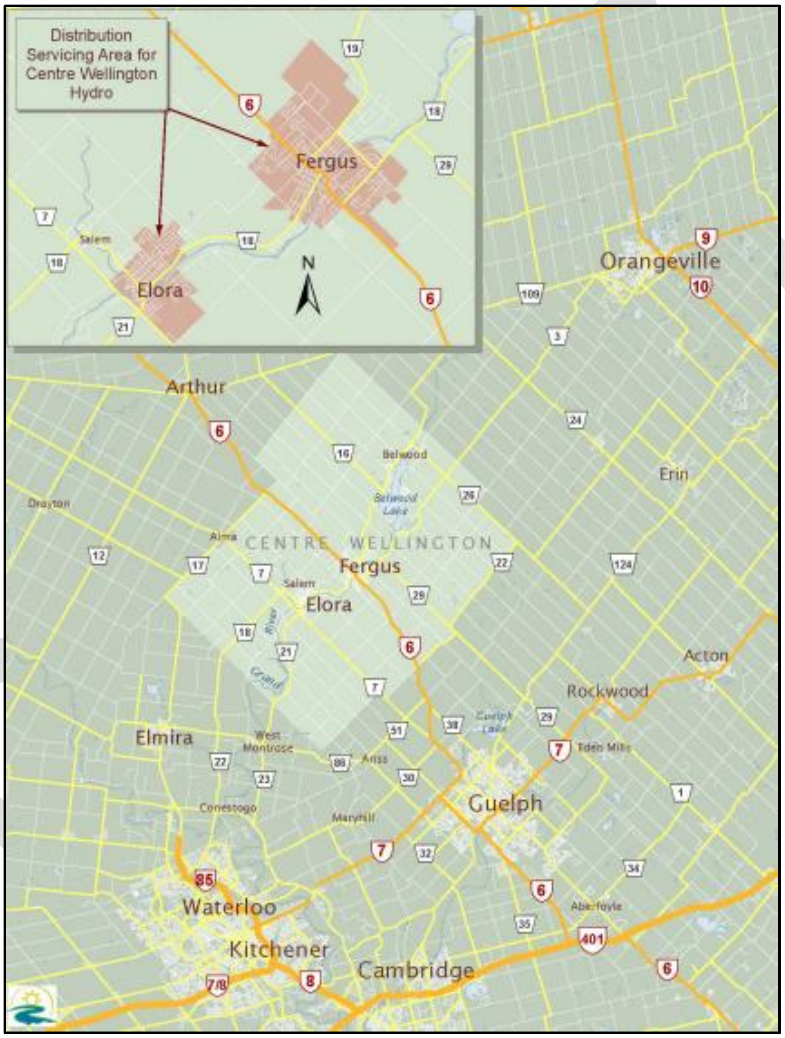
To better understand the impact of electrification on local electricity needs, Alectra Utilities continues to monitor the uptake of electric vehicles (EVs) and projects related to electrification of transportation. Alectra Utilities uses the available information on EV adoption and evaluates the impact of the EVs at the peak. The impact of existing and new buildings decarbonization and adaptation of electric vehicles in Alectra's service area are also considered.

Trend analysis is performed to forecast the system peak from historical peak demand results. The purpose of the trend analysis is to compare the results with the end-use method to obtain more realistic long-term load projections considering the historical demand peak.

B.3 Centre Wellington Hydro: Gross Forecast Methodology and Assumptions

Centre Wellington Hydro (CWH) works to provide reliable delivery of electrical energy for the former Town of Fergus and former Village of Elora, both now in the Township of Centre Wellington. CWH serves 7,500 customers, has 160 km of electrical lines, and its service territory covers approximately 11 square kilometers, which is shown below in Figure 3. The distribution system is supplied by Hydro One Networks Inc., primarily from Fergus TS via two dedicated feeders within the CWH service area. For the KWCG IRRP, CWH developed forecasts for these feeders.

Figure 3: Centre Wellington Hydro Service Territory Map



B.3.1 Factors that Affect Electricity Demand

Load growth within CWH's service area is expected from intensification, electrification, new commercial and industrial development, and the redevelopment of lands currently used for industrial purposes when their operations cease.

The Ontario government recently approved [Wellington County's Official Plan] which details population growth in the Township of Centre Wellington from 34,100 in 2021 to 58,200 in 2051, or a growth of 70.7%. The County's official plan also projects employment growth from 43,000 in 2021 to 70,000 in 2024 over the same period, or a growth of 62.8%.

B.3.2 Forecast Methodology and Assumptions

CWH utilized end-use forecasting to develop their demand forecasts. In the near- to medium-term (between 2025 and 2032), CWH's estimates were based on discussions with local developers, planners, and the municipality to project future load within the service area. In the long-term (beyond 2032), a 2% year-over-year load growth was assumed.

B.4 Enova Power Corp.: Gross Forecast Methodology and Assumptions

Enova Power Corp. (formerly Kitchener Wilmot Hydro Inc. and Waterloo North Hydro Inc.) serves more than 160,000 residents and businesses in the City of Kitchener, the City of Waterloo, the Township of Wellesley, the township of Wilmot, and the Township of Woolwich. They operate 3,665 kilometres of electrical lines and cover a service territory of 1,108 square kilometers which is shown below in Figure 4. For the KWCG IRRP, Enova Power Corp. developed forecasts for Elmira TS, Fergus TS, Kitchener MTS #1, Kitchener MTS #3, Kitchener MTS #4, Kitchener MTS #5, Kitchener MTS #6, Kitchener MTS #7, Kitchener MTS #8, Kitchener MTS #9, Waterloo Rush MTS, Waterloo Scheifele MTS, and Waterloo MTS #3.

Figure 4: Enova Power Corp. Service Territory Map

B.4.1 Factors that Affect Electricity Demand

Due to electrification, three load growth rates were assumed – slower increases in 2024-2027 and 2040-2043; moderate increases in 2028-2031 and 2036-2039; and high increases in 2032-2035. Load transfers were executed between stations based on past practices and Enova's practice with sectionalizing and ties between feeders.

Enova contacted stakeholders, including the cities, townships, and large customers, to determine large load growths outside the typical growth rates. While light-rail transit (LRT) is already installed in the area, this forecast includes the large-scale electrification of transit buses. This also includes more significant developments such as large subdivisions, a new hospital, expansion to existing large facilities as well new larger load centers.

B.4.2 Forecast Methodology and Assumptions

In developing the reference forecast, Enova's Kitchener Wilmot Hydro station used trend analysis to extend past growth rates of electricity demand into the future. A linear-trend method that uses the historical data of demand growth to forecast future growth has been applied. A long-term 7 MW annual gross demand growth has been projected, with 60% of the annual load growth (4.12 MW) attributable to residential customers, and 40% (2.74 MW) attributable to commercial and industrial customers. The annual demand growth was allocated to each transformer station based on the municipal development plan, available vacant lands and other local knowledge.

Over the past ten years, Enova's Waterloo North Hydro stations had an average growth of 1.2%, with some variability due to impacts of COVID-19. For these stations, a standard growth rate of 1% was used for the reference scenario and 2% was used for the high growth scenario. A separate factor was used to account for electrification (e.g., EV chargers, electric based heating systems, and electric water heaters), based on the customer segmentation for each station.

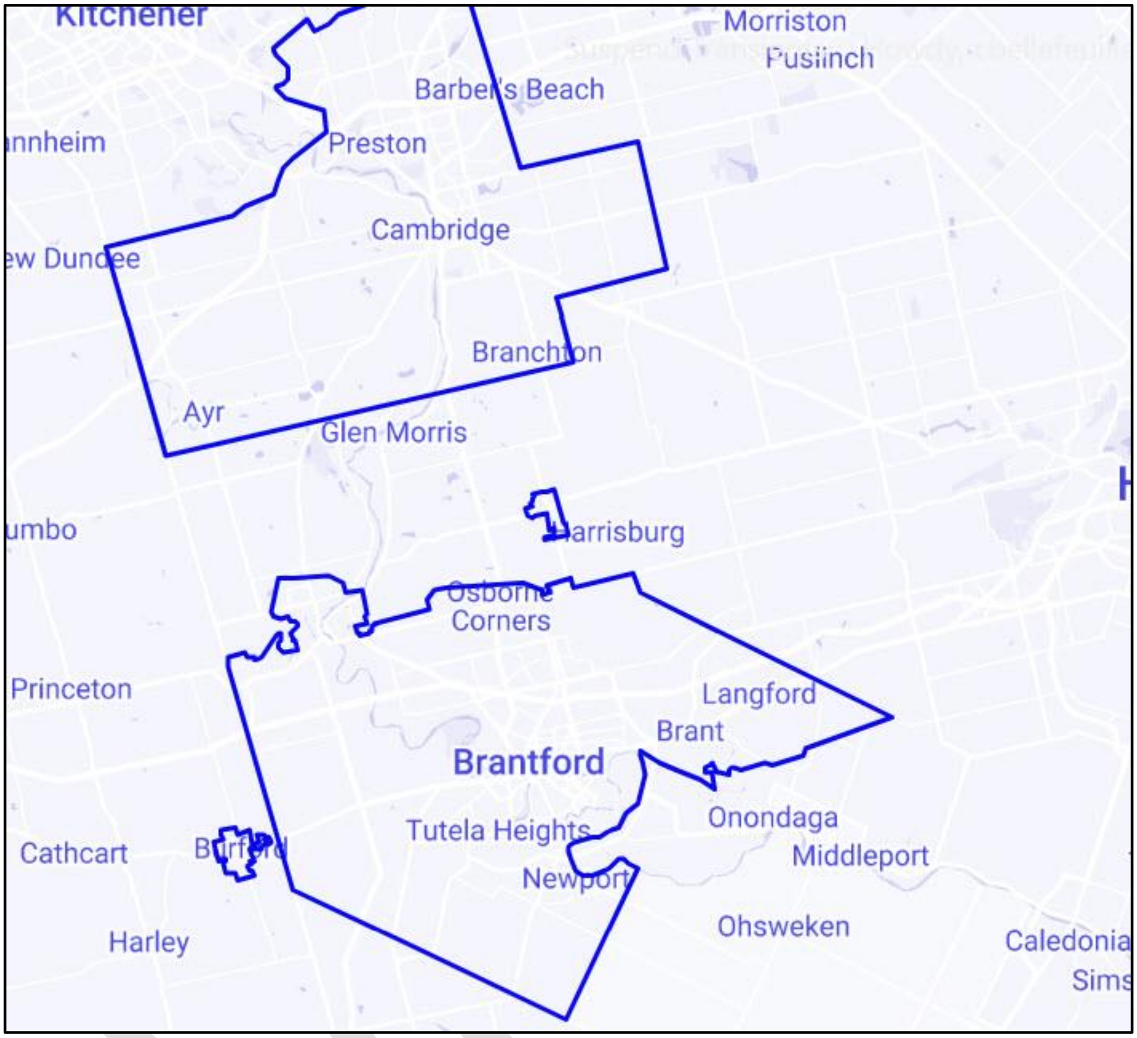
Using the Electrification Strategy Report prepared by Hatch for GridSmartCity, electrification adaption rates were determined for each station separately. While the report provides an adaption rate for three years, 4-5 years, and 6-7 years, this has been adjusted to provide more of an S curve over the 20-year forecast. This represents more realistic electrification growth based on the political landscape and incentives, resulting in a ramp-up in the middle of the 20-year forecast, followed by a gradual slowdown as it becomes saturated, closing in on 2050. This resulted in three load growth rates due to electrification: slower increases in years 2024-2027 and 2040-2043, moderate increases in years 2028-2031 and 2036-2039, and high increases in years 2032-2035.

For large new developments and facilities, load forecasts were requested from customers. Based on load uncertainty loading, a 50% factor was applied to customer-provided loading for normal scenarios, and 100% was taken for high-growth scenarios. If load forecasts are not available for new subdivisions, Enova used an assumption of 3.3 kW per residential units.

B.5 GrandBridge Energy: Gross Forecast Methodology and Assumptions

GrandBridge Energy (GBE) delivers reliable electricity to 113,000 customers in the City of Brantford, the City of Cambridge, the Township of North Dumfries, and the County of Brant. The service territory for GBE is shown below in Figure 5. Cambridge and North Dumfries are part of the KWCG region and is 52.5% of GBE's total load. For the KWCG IRRP, GBE developed forecasts for Energy+ MTS, Galt TS, Preston TS, and Wolverton DS.

Figure 5: GrandBridge Energy Service Territory Map



B.5.1 Factors that Affect Electricity Demand

Most of the growth in the study area was in the northwest section of Cambridge. A large customer will be connected within the next couple of years, which is driving the system growth. Additionally, electrification and net-zero targets were incorporated into the growth percentages.

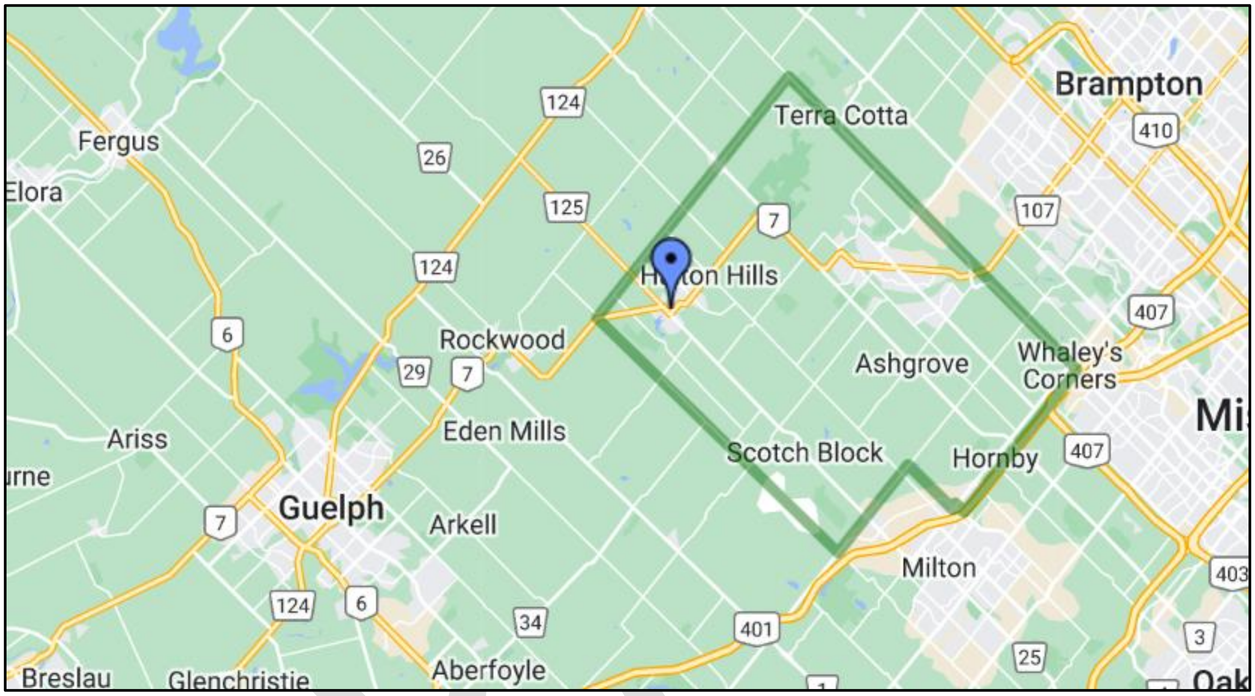
B.5.2 Forecast Methodology and Assumptions

GBE's forecast methodology utilized a mix of historic 5-year average growth percentage and anticipated growth due to electrification and net zero targets. GBE also included spot loads that were identified by customers over the next few years. For years where spot loads are anticipated, the historic growth rate of 2.3% was applied to the remainder of the forecast, otherwise the anticipated growth percentage is used – 4% for the reference scenario and 6% for the high growth scenario. Historic CDM was incorporated into the 5-year historic growth average.

B.6 Halton Hills Hydro Inc: Gross Forecast Methodology and Assumptions

Halton Hills Hydro is owned by Halton Hills Community Energy Corporation, which is wholly owned by the Town of Halton Hills. Halton Hills Hydro serves approximately 23,055 customers, operates 1,700 km of electricity lines, and covers 277 square kilometres of service territory, as shown below in Figure 6. For the KWCG IRRP, Halton Hills Hydro developed forecasts for Fergus TS.

Figure 6: Halton Hills Hydro Inc. Service Territory Map



B.6.1 Factors that Affect Electricity Demand

Halton Hills Hydro participates in development review committees to review all the new developments arising in the service territory. The forecast was developed based on the information in municipal-level growth plans. Halton Hills Hydro primarily serves the community of Acton, which is experiencing minimal load growth.

B.6.2 Forecast Methodology and Assumptions

Halton Hills Hydro utilizes an econometric, multivariable regression model that incorporated weather conditions (cooling degree days and heating degree days) alongside population growth (customer) data. Weather data were sourced from the Climate Atlas and Climate.Weather.gc.ca, while population projections were based on Municipal Energy Plans (MEP) and general census data. Despite the growth from the MEP for Acton, the peak demand will be driven by the forecasted extreme weather condition.

For the reference scenario, the customer growth was assumed to follow the historical trend based on census population data. For the high growth scenario, the population growth was assumed to follow the municipal projections.

B.7 Hydro One Networks Inc. Distribution: Gross Forecast Methodology and Assumptions

Hydro One Networks Inc. Distribution (Hydro One Distribution) serves the rural areas outside the larger cities in the region, such as Guelph, Milton, Kitchener, Waterloo, Cambridge, and Burlington. The demand growth in the Hydro One Distribution service area is largely driven by the economic activities in these large communities and is expected to be modest as the population moves from the urban centers to the rural areas. Hydro One Distribution has embedded distribution points from Alectra Utilities, Centre Wellington Hydro, Halton Hills Hydro, Enova Power, Milton Hydro, and Wellington North Power at Fergus TS. For the KWCG IRRP, Hydro One Distribution developed forecasts for Elmira TS, Fergus TS, Puslinch DS, and Wolverton DS.

B.7.1 Factors that Affect Electricity Demand

Hydro One Distribution's load forecast was driven by several factors. One factor was new housing starts, along with commercial and industrial growth to provide jobs and access to services for these housing starts. Approximately 1,000 residential lots per year are expected based on information for developers in these areas and around 40 small/medium commercial and industrial customers applications are expected in the near term. Municipal plans and Community Energy Plans were also reviewed and incorporated which contributed to the annual growth rates.

B.7.2 Forecast Methodology and Assumptions

The forecast was developed using macro-economic analysis, which considered the growth of demographic and economic factors. The forecast corresponds to the expected weather impact on peak load under average weather conditions, known as weather normality. Furthermore, the forecast is unbiased such that there is an equal chance of the actual peak load being above or below the forecast. In addition, local knowledge, municipal energy plans, and information regarding the loading and developments in the area were utilized in developing the load forecast.

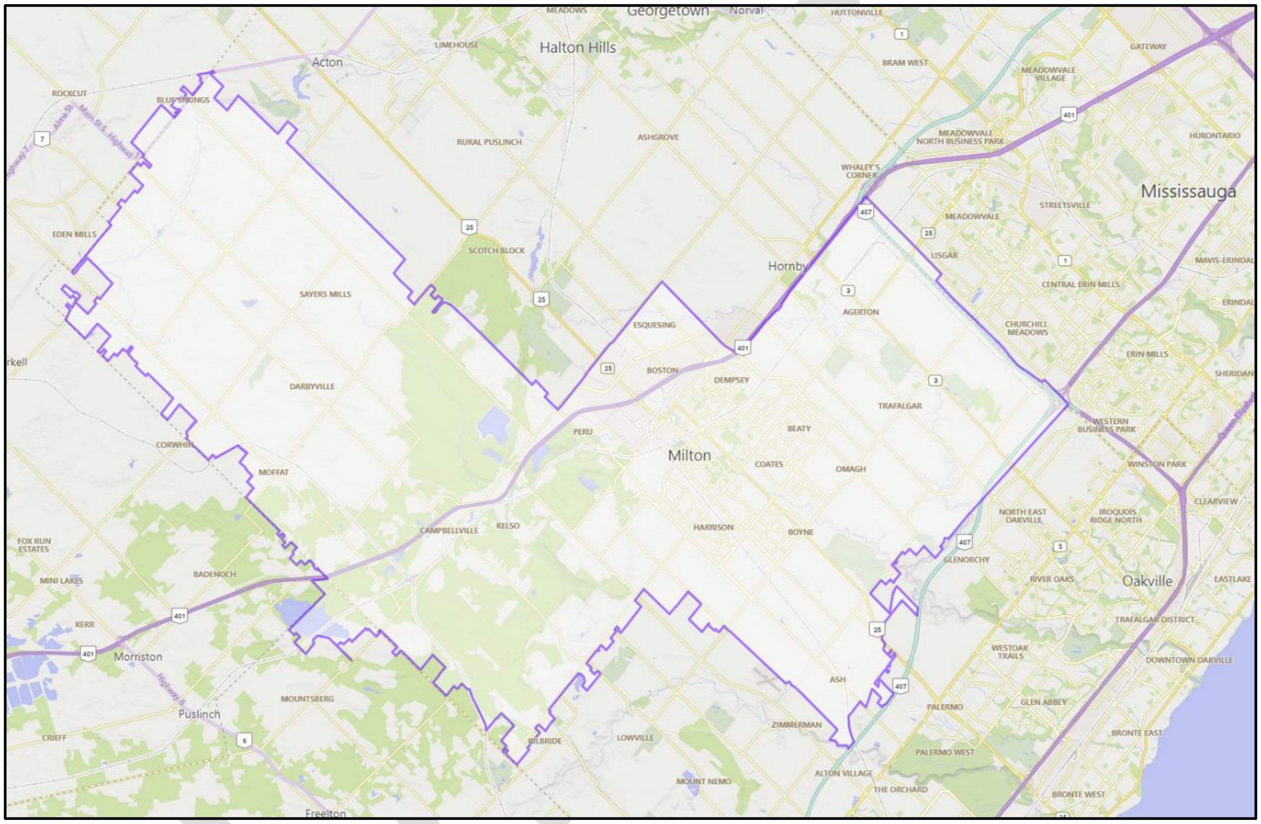
For forecasted years between 2024 and 2026, a combination of econometric forecasting, and end-use forecasting was utilized. A portion of the projected load growth was attributed to detailed forecasts provided by new or expanding customers, based on site-specific, and customer-specific considerations. After 2026, average annual organic growth was projected to be approximately 1%.

Hydro One's high growth forecast included additional information from customers and municipalities regarding growth in the commercial and industrial sectors. The timing and precise loading of these connections was less certain but was included in the high forecast scenario to provide a complete picture of load expected in this region over the study period.

B.8 Milton Hydro Distribution Inc.: Gross Forecast Methodology and Assumptions

Milton Hydro Distribution Inc. is a local distribution company, which is responsible for distributing electricity to 42,000 business and residential customers within the Town of Milton. Milton Hydro Distribution Inc. is a wholly owned subsidiary of Milton Hydro Holdings Inc., owned by the Town of Milton. The load in the KWCG area is supplied by an embedded distribution point, fed from Fergus TS Feeder 73M04. This is 1% of Milton Hydro's total load.

Figure 7: Milton Hydro Distribution Inc. Service Territory Map



B.8.1 Factors that Affect Electricity Demand

The area of Milton covered in KWCG is rural. Therefore, electricity demand peaks are primarily driven by rural electric heating loads under normal operating conditions.

B.8.2 Forecast Methodology and Assumptions

Load growth projections are slow and steady growth. No significant projects are currently underway or planned for in this area. To the best of Milton Hydro's knowledge, provincial and municipal growth and energy plans do not result in significant growth on Milton Hydro's distribution system supplied from 73M04. Hence the supplied load forecast shows minimal increases in expected load and is largely based historical growth trends.

B.9 Wellington North Power Inc.: Gross Forecast Methodology and Assumptions

Wellington North Power Inc. (WNP) is a distribution company that works to provide reliable electricity distribution to consumers in the urban areas of Mount Forest, Arthur, and Holstein. Wellington North Power serves approximately 4,243 customers, 234 km of electricity lines, and covers 14 square kilometers of service territory. The KWCG region encompasses 45% of WNP's electrical load, which is fully embedded. For the KWCG IRRP, WNP developed forecasts for Fergus TS.

B.9.1 Factors that Affect Electricity Demand

County and municipal growth reports informed the electricity demand. These reports include the Wellington County Official Plan (Aug 15, 2019), Wellington North Community Growth Plan (Feb 26, 2018), and the Township of Wellington North Strategic Plan 2019-2022. WNP developed forecasts for Fergus TS from which the town of Arthur is serviced. Arthur is experiencing higher than historical residential growth, but development is quite small compared to large population centres. The main driver of electricity growth in Arthur is from industrial customers.

B.9.2 Forecast Methodology and Assumptions

Wellington North Power utilized end-use forecasting to develop its load forecasts. County growth reports, municipal growth reports, and any other known proposed developments with a high confidence of proceeding were considered and incorporated.

B.10 Conservation and Demand Management Assumptions

Demand side management (DSM) measures can reduce the electricity demand, and their impact can be separated into the two main categories: Building Codes & Equipment Standards, and DSM programs. The assumptions used for the KWCG IRRP forecast are consistent with the DSM assumptions in the IESO's 2024 Annual Planning Outlook including the 2021 – 2024 CDM Framework. The savings for each category were estimated according to the forecast residential, commercial, and industrial gross demand. A top-down approach was used to estimate peak demand savings from the provincial level to the Southwest IESO transmission zone and then allocated to the KWCG Region. This section describes the process and methodology used to estimate DSM savings for the KWCG Region and provides more detail on how the savings for the two categories were developed.

B.10.1 Factors that Affect Electricity Demand

Ontario building codes and equipment standards set minimum efficiency levels through regulations and are projected to improve and further contribute to demand reduction in the future. To estimate the impact on the region, the associated peak demand savings for codes and standards by sector were estimated for the Southwest zone and compared with the gross peak demand forecast for each zone. From this comparison, annual peak reduction percentages were developed for the purpose of allocating the associated savings to each station in the region, as further described below.

Consistent with the gross demand forecast, 2023 was used as the base year. New peak demand savings from codes and standards were estimated from 2024 to 2043. The residential annual peak reduction percentages for each year were applied to the forecast residential peak demand at each station to develop an estimate of peak demand impacts from codes and standards. The same is done for the commercial sector. The sum of the savings associated with the two sectors are the total peak demand impact from codes and standards. It is assumed that there are no savings from codes and standards associated with the industrial sector.

B.10.2 Forecast Methodology and Assumptions

In addition to codes and standards, the delivery of DSM programs reduces electricity demand. The impact of existing and planned DSM programs were analyzed, which include the 2021 – 2024 CDM Framework, the existing federal programs, and the assumed continuation of provincial programs beyond 2024 at savings levels consistent with the current framework adjusted for gross demand growth. A top-down approach was used to estimate the peak demand reduction due to the delivery of these programs, from the province to the Southwest zone, and finally to the stations in the region. Persistence of the peak demand savings from energy efficiency programs were considered over the forecast period.

Similar to the estimation of peak demand savings from codes and standards, annual peak demand reduction percentages from program savings were developed by sector. The sectoral percentages were derived by comparing the forecasted peak demand savings with the corresponding gross forecasts in the Southwest zone. They were then applied to the sectoral gross peak forecast of each station in the region.

B.10.3 Estimated Savings from DSM Programs

As described in the above sections, peak demand savings were estimated for each sector and totalled for each station in the region. The analyses were conducted under normal weather conditions. The resulting forecast savings were applied to gross demand to determine net peak demand for further planning analysis.

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