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BY EMAIL and RESS

May 2, 2024

Ms. Nancy Marconi
Registrar
Ontario Energy Board
2300 Yonge Street, 27th Floor
Toronto, Ontario
M4P 1E4

Dear Ms. Marconi:

EB-2023-0195 Toronto Hydro-Electric System Limited 2025–2029 Rates Application - Building Owners and Managers Association's Expert Evidence

By letter dated January 26, 2024, the Building Owners and Managers Association (BOMA) indicated its intent to file expert evidence focused on Toronto Hydro Electric System Limited's ("Toronto Hydro") proposed load forecast methodologies and the resulting 2025-2029 load forecast with respect to the commercial buildings' sector. In its February 5, 2024 Decision on Confidentiality, Issues List, and Proposed Expert Evidence and Procedural Order No. 3, the Ontario Energy Board (OEB) approved BOMA's proposal to provide expert evidence by Enerlife Consulting.

Please find attached BOMA's expert evidence with respect to forecasting of commercial building sector conservation and demand management (CDM) savings, electrification trends from 2025-2029 and related matters.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Clement Li
Director, Policy & Regulatory Development
Enerlife Consulting Inc.
cli@enerlife.com

FORM A

Proceeding: EB-2023-0195, Toronto Hydro-Electric System Limited 2025-2029 Custom Rate Application for Electricity Distribution Rates and Charges

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is ....Ian Jarvis...........................(*name)*. I live at ....Toronto......... (*city)*, in the ....province.................. (*province/state*) of ....Ontario.................... .

2. I have been engaged by or on behalf of ....BOMA...................... (name of party/parties) to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

   (a) to provide opinion evidence that is fair, objective and non-partisan;

   (b) to provide opinion evidence that is related only to matters that are within my area of expertise; and

   (c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date ....May 2, 2024..........................

____
Signature

FORM A

Proceeding: EB-2023-0195, Toronto Hydro-Electric System Limited 2025-2029 Custom Rate Application for Electricity Distribution Rates and Charges

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is ....Clement Li.........................(*name)*. I live at ....Toronto......... (*city)*, in the ....province.................. (*province/state*) of ....Ontario.................... .

2. I have been engaged by or on behalf of ....BOMA...................... (name of party/parties) to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

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Date ....May 2, 2024..........................

Signature

Date: May 2nd, 2024

EB-2023-0195 Toronto Hydro-Electric System Limited 2025–2029 Rates Application - Building Owners and Managers Association's Expert Evidence

Building towards a sustainable future

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1 Introduction and Summary of The Report

1.1 Procedural Matters

Toronto Hydro-Electric System Limited (Toronto Hydro) filed an application with the Ontario Energy Board (OEB) on November 17, 2023, under section 78 of the Ontario Energy Board Act, 1998, seeking approval for changes to the rates that Toronto Hydro charges for electricity distribution, beginning January 1, 2025, and for each following year through to December 31, 2029.

In its Procedural Order (PO) No. 1, issued on January 15, 2024, the OEB approved BOMA's request as an intervenor in this proceeding. By letter dated January 26, 2024, BOMA indicated its intent to file expert evidence focused on Toronto Hydro's proposed load forecast methodologies and the resulting 2025-2029 load forecast with respect to the commercial building sector. In its February 5, 2024 Decision on Confidentiality, Issues List, and Proposed Expert Evidence and PO No. 3, the OEB approved BOMA's proposal to provide expert evidence by Enerlife Consulting (Enerlife) and also indicated that it would find it beneficial for BOMA's evidence to include the number of Toronto Hydro customers by rate class and the associated volumes that BOMA represents.

BOMA Toronto's members represent over 85% of the Commercial Real Estate (CRE) Industry (which includes mainly condominium and apartment buildings, office space, retail and light industrial buildings) in the Toronto Hydro service area. Considering Toronto Hydro's General Service rate classes (GS <50kW, GS 50–999kW, GS 1,000–4,999kW and Large Users) include both CRE and institutional buildings (such as hospitals, government buildings, schools and colleges/university), it is estimated that BOMA Toronto members represent about 60% of Toronto Hydro's General Service and CSMUR rate classes.

BOMA Toronto requested the number of customers of the building types that BOMA represents by rate class through this proceeding's interrogatory (IR) process and other data sources. In its IR responses (3-BOMA-4), Toronto Hydro stated that it does not have the market categorizations required to perform this analysis. This was further confirmed by Toronto Hydro during the Technical Conference[1] and therefore BOMA Toronto is not able to provide this information.

1.2 Background

During the 2025-2029 period, the commercial building sector will undergo substantial changes in electricity consumption and load shape due to the energy transition. Electricity load growth due to customer additions will be offset by expected higher efficiency of new buildings and increased take-up of conservation and demand management (CDM) measures. Electrification of existing and new buildings is already beginning, with planning and installation of heat recovery chillers in large commercial and institutional buildings and air source heat pumps in smaller buildings.

[1] See Day 4 transcript p155 -157

Traditional load forecasting methodologies relying primarily on historical trends may not be well suited to project the individual or cumulative effect of these new emerging trends.

This evidence presents results of analysis of electricity consumption for different commercial building types that are based on recent empirical data from various sources[2], together with comparative electricity usage and load profiles for highly efficient offices, hospitals and school buildings, with which Enerlife has direct working experience. These results are then used to establish archetype models to quantify the impacts of CDM and electrification in the commercial building sector's demand forecast and load shape. The modelling results, and the known plans of a number of commercial and institutional building owners, are utilized to prepare and explain alternative commercial building sector load forecast scenarios and their implications over the period of the Toronto Hydro 2025-2029 Rates Application. As such, this evidence is particularly relevant to issue 4 - Load and Other Revenue Forecast (Prefiled evidence Exhibit 3).

Ian Jarvis, P.Eng, president of Enerlife is the project lead for this work, with support from Clement Li, Enerlife's Director of Policy and Regulatory Development, and engineering staff. The authors' CVs are provided in Appendix E.

1.3 Summary and Key Findings

1.3.1 CDM Savings in Commercial Buildings

Enerlife estimated the expected CDM savings in commercial buildings in Toronto during the 2025-2029 period and compared its results with the commercial sector CDM savings included in the Toronto Hydro load forecast proposed in this rebasing rate application. <u>While Enerlife and Toronto Hydro's methodologies to forecast CDM savings are different, the results are materially the same.</u> Enerlife's methodology (discussed in Section 2) utilizes statistical analysis of electricity consumption for different commercial building types based on the most recent empirical data, and its industry knowledge working directly with building owners on both strategic and technical projects, to establish achievable savings targets. Toronto Hydro's forecast savings (discussed in Section 3) are based on CDM variables (with historical and forecast CDM savings) included in its multivariate regression forecast model.

Both Enerlife and Toronto Hydro's projected CDM savings are generally consistent with the Independent Electricity System Operator's (IESO) 2019 Achievable Potential Study (2019 APS), its subsequent 2022 APS Refresh and the 2024 Annual Planning Outlook.

1.3.2 Electrification in Commercial Buildings

Enerlife estimated the adoption of electrification (primarily switching from natural gas heating to electric heat pump technology) and its impact on commercial buildings in Toronto during the 2025-2029 period based on its knowledge of installations already in operation or development and involvement in energy transition planning for a number of major owners. In commercial buildings, almost all current electrification installations and planning use "hybrid" solutions (with

[2] Ontario's Energy and Water Reporting and Benchmarking (EWRB) and Broader Public Sector (BPS) listed under Appendix A, Archetype models listed under Appendix B

natural gas backup), and Enerlife expects this trend to continue during the 2025-2029 period (discussed in Section 2).

In hybrid electrification, natural gas heating remains as a supplementary heating source, with electric heat pumps and heaters displacing a large share of previous fossil fuel consumption, but gas-fired boilers or furnaces continuing to provide a significant part of demand during peak heating periods. The hybrid solution is generally the most cost effective for all types of commercial buildings with current utility rates. For most commercial buildings, it also avoids major costs for electrical service upgrades and associated upstream electrical capacity investments. In most cases, commercial buildings' electrical infrastructure is sized for the air conditioning load in the summer. Since the impact of electrification is primarily seen in winter (natural gas heating replaced by electric heat pumps), existing electrical infrastructure provides enough capacity for hybrid electrification. Therefore, significant investment in electrical infrastructure upgrade on site or upstream at the electric utility level is not required. A summer peaking distributor's (e.g. Toronto Hydro) overall system peak is not substantively impacted.

In its prefiled evidence, and further confirmed in the Technical Conference, Toronto Hydro indicated that the potential load impacts of electrification in commercial buildings, such as heat pumps, installation of heat recovery chillers and connection to district energy, are not incorporated in its 2025 – 2029 load forecast. Enerlife believes that significant electrification of commercial buildings will occur during this period and recommends that Toronto Hydro should review the analysis provided in this report and assess its potential impact on the proposed load forecast, capital investment plan and revenue requirement in Toronto Hydro's current and future rate applications.

1.3.3 Commercial Customer Information

The market is rapidly evolving and a growing number of public- and private-sector commercial building owners are planning, setting targets and taking actions towards conservation and reducing carbon footprint. The strategies, methods and market dynamics of conservation and low carbon energy transition in the commercial sector are very different from the residential or industrial sectors. There are also great differences between commercial building types, where, for example, office buildings, grocery stores, community centres, hospitals and schools have entirely different ownership, building systems, energy profiles and decarbonization opportunities. Conservation and electrification planning and forecasting for this broad and diverse sector require in-depth, disaggregated customer information, including customer connections, commercial building types, and interval meter data. BOMA requested some of this information in interrogatories, which was not provided. The analysis for this report has been limited by the lack of reliable and consistent commercial customer information, including customer breakdown by rate class, sector and building types. It is recommended that Toronto Hydro (and other local distribution companies (LDCs)) should greatly expand their efforts on collecting commercial customer information and make information accessible to their customers and other interested parties, as well as their own planning departments.

1.3.4 Coordination Among Stakeholders

The low carbon transition which is just beginning will see a massive transformation in all aspects of the commercial buildings' sector which has to navigate great uncertainties including government policy, market demand, economic factors and technology. It requires active involvement from many stakeholders. Policy setting, planning and implementation require coordination and collaboration among different levels of government, energy regulators, utility companies, owner groups and industry. New regulations can be expected similar to EU Directive 2023/1791, requiring data centres over 1MW to recover their waste heat, and New York City's local law 97 putting carbon caps on buildings. Enerlife believes district energy is likely to be an important part of the low carbon future, enabling large-scale solutions which are impractical at the individual building level.

Recovery and recycling of process heat from buildings, which is now rejected to atmosphere through cooling towers and air-cooled condensers, is also a large potential contributor to decarbonization. Owners/Operators of buildings with high internal heat gains, including commercial offices, hospitals, grocery stores, arena facilities and data centres, should be supported in implementing waste heat recovery. Toronto Hydro indicated that it connected approximately 102 MW of incremental demand load from new hyperscale data centres during the 2020-2024 period and approximately 198 MW is forecasted to be connected during the 2025-2029 period.

These kinds of transformative change require planning and coordination among many parties. <u>It is recommended that Toronto Hydro engage in a formal collaboration with the other stakeholders, Including the City of Toronto, Enbridge Gas and Enwave, to set specific goals, targets and timelines for quantifying and delivering on this waste heat recovery potential. BOMA would be a willing partner in such a collaboration.</u>

2 Commercial Sector Electricity Consumption and Demand Trends in Toronto

2.1 Conservation and Electrification in Commercial Buildings – Myths and Facts

Myths: Common perception is that higher commercial building energy efficiency is all about technology, retrofitting and capital expenditure. It is often believed that electrification of space heating in commercial buildings requires much higher electricity demand leading to costly on-site and upstream electrical service upgrades.

Conservation Facts: The predominant differences that set the top energy performance commercial buildings apart are operational, such as maintenance, scheduling and controls. In most cases, limited capital investment is required, with high rates of return, to achieve management and operational excellence.

Electrification Facts: In most commercial buildings, hybrid electrification[3] can reduce fossil fuel consumption and related emissions by 90% or more without costly in-building and upstream electrical service upgrades.

2.2 Empirical Data - Gaining Insight into Commercial Building Energy Usage

2.2.1 CDM Potential in Commercial Buildings

Figure 2-1 below presents electricity intensity data in kWh/sqft for over 700 K-12 (Kindergarten to 12th Grade) schools in Toronto. This dataset (2020-2021 school year) was constructed from publicly available Top Boards Report[4] and has been weather normalized to Toronto City weather station. All these buildings provide similar functions, yet their electricity intensity varies by more than 3:1. There is little correlation with age – a few recently built schools are at the top of the chart, while other new schools are below the median, and many older schools are found in the top quartile. Adjustments for electrically heated portable classrooms, heating system types and air conditioning account for only a small part of the differences.

[3] Hybrid electrification – While a significant amount of space heating requirement will be supplied by waste heat recovery (e.g. heat recovery chillers in large commercial buildings) or heat pumps (e.g. air source heat pumps in small commercial buildings) with reduced carbon emissions, a fossil fuel back-up system is available to provide supplementary space heating when it is cost effective and when the additional heating capacity is needed. This approach ensures that costly on-site and upstream electrical service upgrades can be avoided.

[4] Top Energy Performing School Boards Report is a Sustainable Schools program under the Climate Challenge Network that reports on the energy performance of school boards in Ontario, based on publicly reported annual data from the broader public sector (BPS).

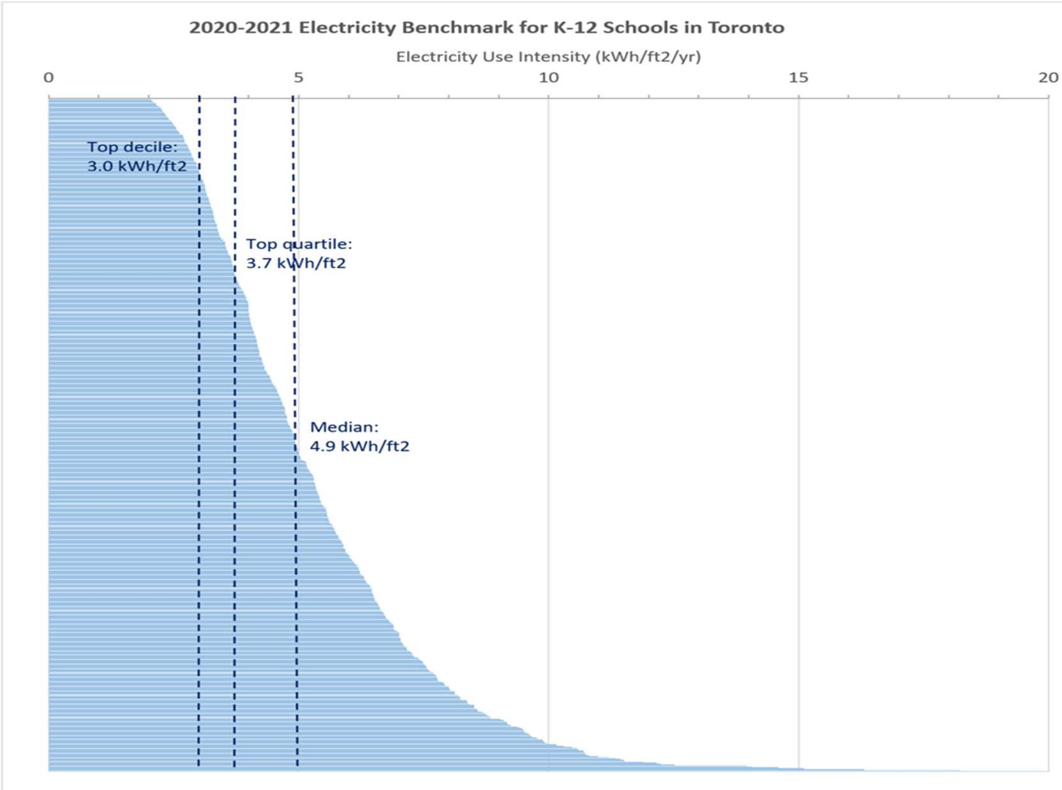

Figure 2-1 2020 – 2021 Electricity use (kWh/sqft/year) for Toronto K-12 Schools

The main differences between the high performers and the rest are operational – equipment condition, scheduling and controls – and cost-effective lighting and motor drive retrofits which are supported by current CDM programs. While absolute electricity intensities vary, this story can be found repeated across all commercial building types.

Similar benchmarking for Mult-Residential (Condominium/Apartment), Retail, Offices, Hospitals and Lodging are provided in Appendix A.

Enerlife applies data-driven performance-based conservation to estimate achievable electricity savings potential for individual buildings, portfolios and sectors. Empirical targets are set, typically at the top-quartile level of the benchmark charts. Target adjustments are applied to account for material differences between individual buildings, including weather and heating/cooling system types. Achievable savings are then determined for each building as the difference between its actual and target electricity use. The methodology is applied by commercial landlords and large-scale programs in Ontario's hospital, municipal, K-12 schools, multi-residential and post-secondary sectors for planning and directing energy efficiency programs.

Table 2-1 presents top quartile target electricity consumption savings potential for a range of commercial building types derived from a number of data sources[5]. This top quartile standard is

[5] See Appendix A for more detailed information

considered readily attainable through improved operations, maintenance and controls along with targeted cost-effective retrofits, and offers positive financial ROIs (Return on Investment) and TRCs (Total Resource Cost Test). A number of leading owners are committing to higher levels of savings than these top quartile targets. In most cases, little capital investment is required to achieve management and operational excellence.

Table 2-1Potential Electricity Consumption Savings from CDM/Operation Optimization

Commercial Building Types	kWh Savings	Data Source
Multi-Residential (Condo/Apartment)	-23%	EWRB data - top-quartile targets
Retail	-31%	EWRB data - top-quartile targets
Education	-24%	BPS data, top-quartile targets
Offices	-16%	EWRB data - top-quartile targets
Hospitals	-15%	BPS data, Top-quartile targets
Lodging	-38%	EWRB data, top-quartile targets
Warehouses	-34%	EWRB data, top-quartile targets

2.2.2 Expected CDM Savings in Commercial Buildings – 2025 to 2029 Period

In response to the climate crisis and budgetary pressures, Enerlife is seeing a marked acceleration of interest and action on CDM across the commercial buildings' sector. All public sector building owners are preparing their 5-year ECDM Plans which are required by regulation to be posted by July 1st, 2024. New CDM and DSM frameworks are coming, promising higher targets for energy and emissions reductions.

Drawing from this direct experience with many commercial building owners/managers, Enerlife forecasts that, in the Toronto Hydro service area, 50% of this electricity consumption savings potential shown in Table 2-1 will be achieved by the end of this proceeding's period (i.e. by the end of 2029). This adoption rate is supported by:

- Cost effectiveness and economics: Operational and management optimization in commercial buildings is a proven approach[6] that results in significant CDM savings with minimum capital investment;

[6] Many major commercial building owners, including Cadillac Fairview, Toronto hospitals and the Toronto District School Board, have reported publicly on energy savings achieved.

- Flexibility: While equipment replacement/renewal is often only feasible at equipment's end of life, building operations and management optimization can be implemented any time, without replacing equipment which may be in good working condition and not fully depreciated; and
- Consistency: This adoption rate is largely consistent with the Independent Electricity System Operator's (IESO) 2019 Achievable Potential Study[7] (2019 APS), its subsequent 2022 APS Refresh and the 2024 Annual Planning Outlook[8].

The expected CDM electricity consumption cumulative savings during the 2024 to 2029 period are listed in Table 2-2 below, based on 50% of the potential savings shown in Table 2-1 being achieved by 2029. Enerlife's projected average commercial sector CDM savings of 1.7% (annual reduction) is generally consistent with what was included in the Toronto Hydro load forecast and the APS targets.

[7] 2019 Integrated Ontario Electricity and Natural Gas Achievable Potential Study (prepared by Navigant) updated on December 10, 2019 Figure ES-5 page viii.
[8] 2024 Annual Planning Outlook, issued on March 2024, section 2.4.7.2, page 26.

Table 2-2 2024 to 2029 Expected CDM Cumulative Savings (Electricity Consumption) by Commercial Building Type

	Expected kWh Savings from Operation & Management Optimization					
Commercial Building Types	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Multi-Residential (Condo/Apartment)	-1.9%	-3.8%	-5.8%	-7.7%	-9.6%	-11.5%
Retail	-2.6%	-5.1%	-7.7%	-10.3%	-12.9%	-15.4%
Education*	-2.0%	-4.0%	-6.0%	-8.1%	-10.1%	-12.1%
Offices	-1.3%	-2.6%	-4.0%	-5.3%	-6.6%	-7.9%
Hospitals	-1.2%	-2.5%	-3.7%	-4.9%	-6.1%	-7.4%
Lodging	-3.2%	-6.4%	-9.6%	-12.8%	-16.0%	-19.1%
Warehouses	-2.8%	-5.7%	-8.5%	-11.3%	-14.2%	-17.0%
Average* Commercial Sector CDM savings (Annual)	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Average* Commercial Sector CDM savings (Cumulative)	1.7%	3.4%	5.2%	6.9%	8.6%	10.3%

* Weighted by kWh share by building type

2.2.3 Impact of Electrification in Commercial Buildings

Electrification in commercial buildings has already started. A growing number of new buildings including CIBC Square and Humber River Hospital have heat recovery chillers and other heat pump technology. Many public- and private-sector commercial building owners are planning, setting targets and taking action towards net zero greenhouse gas emissions. The strategies, methods and market dynamics of the low carbon energy transition in the commercial sector are very different from the residential or industrial sectors. While there are significant differences between commercial building types, most differ from residential buildings (single family homes) in two major ways:

- Large ventilation systems, which account for as much as half of building heating loads (natural gas) and have the potential for highly efficient heat reclaim from exhaust air to preheat outside air makeup where feasible, or boost it to a higher heat grade through the use of water source heat pump for use in building heating, which can significantly and cost effectively reduce peak as well as annual natural gas demand.

- Large internal process heat gains which are currently rejected to atmosphere but are increasingly being recycled to offset heating requirements (natural gas) in winter. For example, there is a large-scale national program underway for retrofitting arena facilities to displace fossil fuels used for space and water heating with heat recovered from the ice plant condensers.

Leading commercial building owners are going beyond cost-effective energy efficiency measures (i.e. moving from median to top quartile performance through CDM) to retrofit building systems for heat recovery – 1) in ventilation systems, reclaiming heat from exhaust air in winter to preheat incoming outside air or other uses as described above and 2) reclaiming internally generated heat from sources such as computer equipment, ice making (in arenas) and refrigerated storage (grocery stores and warehouses) which is now rejected to atmosphere in winter through cooling towers and air-cooled condensers and can be upgraded to heat the building.

Figure 2-2 below presents the progression of natural gas and electricity energy use intensities (EUIs) for a representative small size office building in Toronto from its 2010 baseline, through its 2018-19 performance, to the cost-effective energy efficient target (improved from median to top quartile performance through operation and management optimization). The final two decarbonization steps are then application of ventilation and process heat recovery. In this case, 50% energy reductions come from CDM.

Error! Reference source not found. shows the corresponding impacts of CDM, heat recovery and heat pumps on electricity demand in the winter and summer (i.e. winter peak and summer peak), showing a modest increase in annual peak demand. Importantly, Figure 2-4 highlights the >95% reduction in natural gas use and associated emissions for this example, with the residual occurring in the coldest occupied hours of the year.

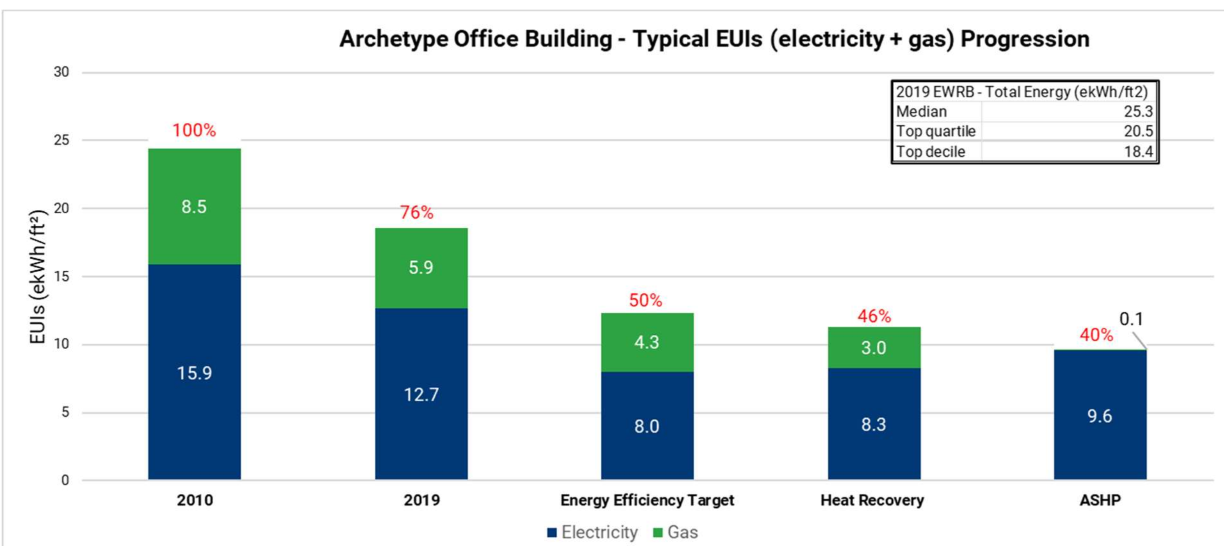

Figure 2-2 Toronto Office Building's Progression to Electrification

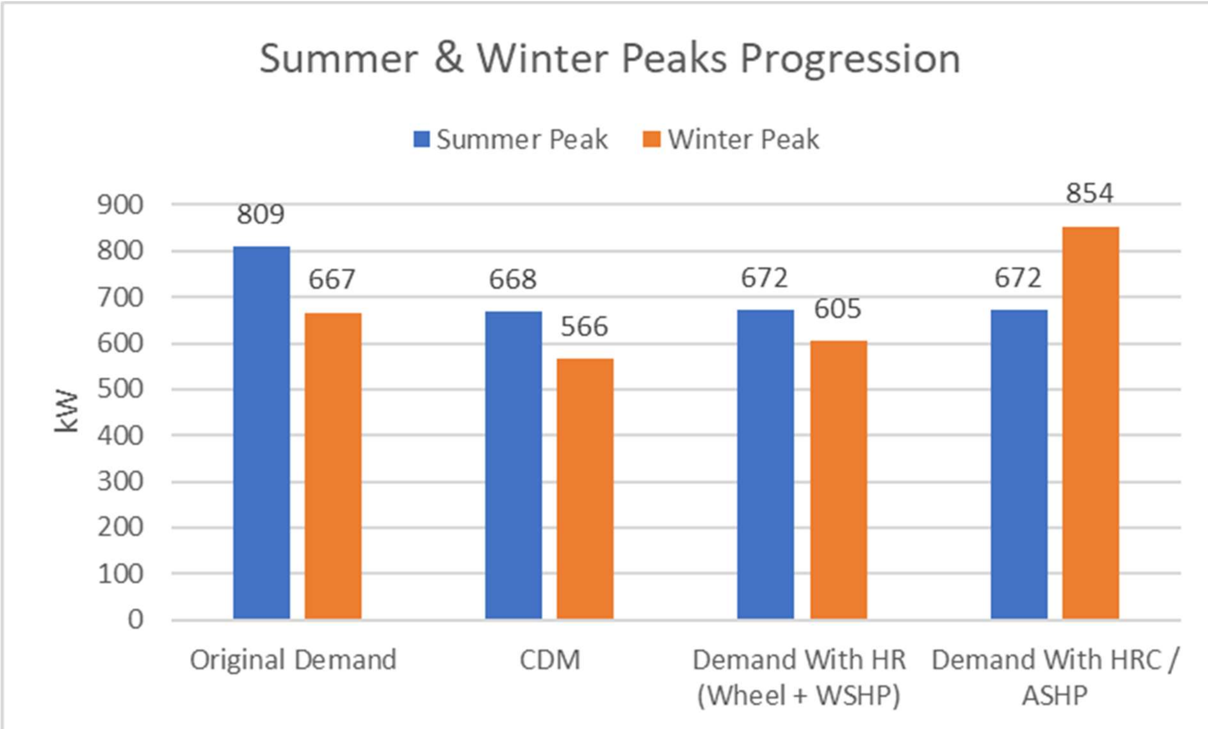

Figure 2-3 Impact of CDM, Heat Recovery, and ASHPs on Electricity Winter and Summer Peak Demands

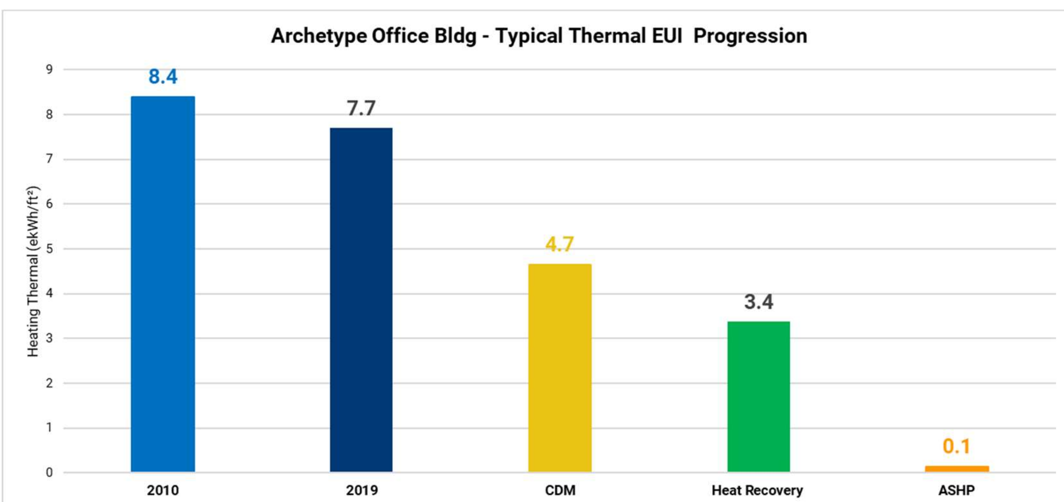

Figure 2-4 Impact of CDM, Heat Recovery, and ASHPs on Gas Use

Key observations from the above figures are:

- This is a cost-effective hybrid solution – the relatively small residual natural gas heating requirement could be addressed in the future with renewable energy and carbon offsets;
- In the next 5 to 10 years, leaving the existing natural gas heating equipment (most still in good working order and not fully depreciated) as the back-up or supplementary heating

source provides operational flexibility, and addresses periods when the air source heat pump does not have enough heating capacity or is too expensive to operate;
- The building's electrical service is sized for summer operations (air conditioning load), and (including the effects of DSM) electrification can be achieved within the building's existing electrical capacity, avoiding significant investment in upgraded electrical infrastructure by the owner or the electricity distributor;
- The increases in electricity consumption from electrification is relatively small when compared to the savings due to CDM and the reduction in natural gas consumption; and
- The percentage decrease in electricity consumption through CDM is consistent with figures listed in Table 2-1.

While absolute electricity and natural gas intensities vary, and the type of equipment used to recover waste heat also varies (e.g. while roof-top air-source heat pumps are commonly used in schools and smaller buildings, heat recovery chillers and ASHP boilers are used in large buildings and hospitals), the same electrification progression steps and results are appliable to most commercial building types.

Analyses for representative office buildings, K-12 schools and hospitals are provided in Appendix B. Table 2-3 below summarizes the results of these analyses and shows the electrification progression steps and their impact on electricity and natural gas usage (consumption and peak demand) for different commercial building types.

Table 2-3 Archetype Commercial Buildings Electrification Progression Steps and Their Impact on Electricity and Natural Gas Usage

	Building Category	Large Office			Small Office			K-12 School			Hospital		
		Usage	CDM Savings*	Electrification Impact**	Usage	CDM Savings*	Electrification Impact**	Usage	CDM Savings*	Electrification Impact**	Usage	CDM Savings*	Electrification Impact**
Electricity Consumption (kWh per year)	Original Consumption	17,273,294	-	-	3,267,564	-	-	339,615	-	-	33,619,916	-	-
	With Operational & Management Optimization (CDM)	14,509,567	-16%	-	2,707,742	-17%	-	258,108	-24%	-	28,576,929	-15%	-
	With 1st-Stage Heat Recovery	14,926,877	-	3%	2,788,376	-	3%	259,398	-	0%	-	-	-
	With Final-stage Heat Recovery + Electrification	15,113,765	-	4%	3,191,461	-	18%	382,680	-	48%	34,092,276	-	19%
Summer Peak Electricity Demand (kW)	Original Summer Peak	3,139	-	-	809	-	-	57	-	-	6,955	-	-
	With Operational & Management Optimization (CDM)	2,668	-15%	-	668	-17%	-	48	-15%	-	6,260	-10%	-
	With 1st-Stage Heat Recovery	2,668	-	0%	672	-	1%	49	-	2%	-	-	-
	With Final-stage Heat Recovery + Electrification	2,668	-	0%	672	-	1%	49	-	2%	6,992	-	12%
Winter Peak Electricity Demand (kW)	Original Winter Peak	3,036	-	-	667	-	-	101	-	-	7,031	-	-
	With Operational & Management Optimization (CDM)	2,581	-15%	-	566	-15%	-	86	-15%	-	6,328	-10%	-
	With 1st-Stage Heat Recovery	2,791	-	8%	605	-	7%	87	-	1%	-	-	-
	With Final-stage Heat Recovery + Electrification	2,825	-	9%	854	-	51%	115	-	34%	7,068	-	12%
Annual Natural Gas Usage (m^3)	Original Consumption	559,374	-	-	154,158	-	-	28,463	-	-	3,958,427	-	-
	With Operational & Management Optimization (CDM)	389,884	-30%	-	107,448	-30%	-	19,070	-33%	-	3,166,742	-20%	-
	With 1st-Stage Heat Recovery	259,619	-	-33%	77,652	-	-28%	16,718	-	-12%	-	-	-
	With Final-stage Heat Recovery + Electrification	223,921	-	-43%	3,335	-	-97%	8,992	-	-53%	1,662,539	-	-48%

* Percentage change from Original Consumption/Demand

** Percentage change from Consumption/Demand post Operational & Management Optimization

2.2.4 Electrification Adoption in Commercial Buildings – 2025 to 2029 Period

Based on discussions with a number of clients, Enerlife expects a steady increase in market penetration over the 2024-2029 period, averaging 2% per year, for commercial buildings in Toronto, predominantly "hybrid" electrification with existing fossil-fuel-fired heating continuing in use during peak demand periods. By this estimate, 12% of commercial buildings in Toronto would have adopted electrification by the end of 2029 as described above. It is recommended that Toronto Hydro examine this alternative scenario in its demand forecasting and capital planning for this rebasing application.

3 Toronto Hydro's 2025-2029 Load Forecast – Alternative Scenarios

Section 2 of this report presents the expected impact of CDM and electrification on commercial buildings' electricity usage in the 2025 to 2029 period, based on recent empirical data and industry insights. Section 3 describes how the results from section 2 are incorporated into Toronto Hydro's 2025 to 2029 load forecast, producing two alternative load forecast scenarios:

Alternative Load Forecast Scenario One - In this scenario, the estimated impact of commercial sector CDM impact included in the original Toronto Hydro load forecast is replaced by the expected commercial sector CDM impact based on Enerlife's analysis.

Alternative Load Forecast Scenario Two - In this scenario, the expected commercial electrification impact is added to Alternative Load Forecast Scenario One. As such, Alternative Load Forecast Scenario Two includes the expected commercial CDM and electrification impact based on Enerlife's analysis as described in section 2 of this report.

The impact of Load Forecast Scenarios One and Two on Toronto Hydro's distribution system peak is also discussed in this section.

3.1 Toronto Hydro Evidence - 2025-2029 Load Forecast by Rate Class

Toronto Hydro submitted an updated load forecast with the OEB on April 2, 2024. Figures extracted from Toronto Hydro's Exhibit 3, Tab 1, Schedule 2, Appendix 2-IB (dated April 2, 2024), are listed in Table 3-1 and Table 3-3 below.

Table 3-1Toronto Hydro's 2023 to 2029 kWh Forecast by Rate Class

Weather Corrected kWh per year	Actual	Bridge Year	Forecast				
Rate Class	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Residential	4,821,243,888	4,844,831,654	4,854,325,532	4,898,252,484	4,953,291,540	5,031,104,117	5,082,273,885
CSMUR	325,741,867	336,386,377	341,855,436	348,726,395	355,027,390	361,653,183	365,438,177
GS < 50 kW	2,389,020,511	2,349,753,700	2,361,358,052	2,385,394,366	2,407,992,244	2,438,740,085	2,438,678,482
GS 50-999 kW	9,544,666,923	9,529,407,712	9,463,360,432	9,441,088,042	9,422,833,420	9,433,820,768	9,391,367,515
GS 1000-4999 kW	4,232,770,556	4,071,987,161	4,003,003,654	3,979,295,923	3,959,146,845	3,961,643,011	3,881,004,361
Large User	1,770,744,374	1,651,006,373	1,572,179,423	1,562,410,518	1,513,102,973	1,473,456,387	1,412,958,802
Street Lighting Connections	117,771,219	118,298,492	118,212,158	118,551,502	118,890,846	119,603,594	119,569,534
Unmetered Scattered Load Connections	42,090,116	42,205,431	42,090,116	42,090,116	42,090,116	42,205,431	42,090,116
TOTAL Toronto Hydro	23,244,049,452	22,943,876,900	22,756,384,802	22,775,809,346	22,772,375,374	22,862,226,576	22,733,380,873

Table 3-2 Toronto Hydro's 2023 to 2029 kW Forecast by Rate Class

Weather Corrected Billing* kW per year	Actual	Bridge Year	Forecast				
Rate Class	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Residential**	-	-	-	-	-	-	-
CSMUR**	-	-	-	-	-	-	-
GS < 50 kW**	-	-	-	-	-	-	-
GS 50-999 kW	23,570,445	23,450,566	23,208,059	23,066,939	22,936,011	22,876,540	22,687,108
GS 1000-4999 kW	9,133,535	8,793,612	8,630,976	8,557,351	8,490,998	8,473,656	8,277,467
Large User	4,338,192	4,117,090	3,965,275	3,970,923	3,875,600	3,802,516	3,671,843
Street Lighting Connections	383,744	374,580	363,522	354,446	345,448	336,528	327,684
Unmetered Scattered Load Connections**	-	-	-	-	-	-	-

* Billing kW per year = 12 x average monthly peak

** Billing kW not available for CSMUR and GS<50kW rate classes since these classes are not demand billed

As part of its response to JT4.25[9] (Technical Conference undertaking), Toronto Hydro provided a forecast of monthly peak demand (coincident peaks) by rate class in 2025, as shown in Table 3-3 below.

Table 3-3 2025 Weather Normalized Coincident Peaks by Rate Class

	Winter Peak							Summer Peak				
Coincident Peak (kW)	January	February	March	April	May	June	July	August	September	October	November	December
RES	849,763	831,537	815,146	467,176	627,172	977,605	863,112	913,274	674,387	452,300	693,175	727,026
CSMUR	67,409	66,457	70,671	38,787	45,872	53,578	50,312	48,766	46,036	42,661	59,397	56,731
GS<50	507,558	449,086	440,152	480,435	441,601	578,220	617,160	638,780	597,639	595,130	450,865	527,689
GS50-999	1,503,929	1,413,432	1,391,572	1,283,942	1,179,082	1,445,272	1,564,130	1,551,590	1,452,190	1,467,619	1,243,185	1,338,678
GS1-5MW	517,675	465,689	491,244	479,831	481,922	531,729	601,224	615,798	601,165	592,834	486,938	559,179
Large User	227,104	192,233	208,196	237,387	231,291	214,986	245,333	255,329	265,094	257,303	215,894	231,528
Streetlights	28,111	26,711	27,792	-	-	-	-	-	-	-	29,365	28,189
USL	5,474	5,624	5,610	4,533	4,582	4,828	4,404	4,437	4,538	4,429	5,407	5,511
Total	3,707,024	3,450,768	3,450,382	2,992,090	3,011,522	3,806,218	3,945,675	4,027,973	3,641,048	3,412,276	3,184,227	3,474,531

To estimate the impact of Load Forecast Scenarios One and Two on Toronto Hydro's distribution system winter and summer peak demand, a 2025 to 2029 forecast of winter and summer peak demand by rate class (as shown in Table 3-4 below) is estimated based on information provided in Table 3-3 (winter and summer peak by class), Table 3-1 (non demand billed rate classes' 2025 to 2029 kWh growth) and Table 3-2 (demand billed rate classes' 2025 to 2029 kW growth).

[9] EB-2023-0195 Technical Conference Day 4 transcript page 153.

Table 3-4 Toronto Hydro 2025 to 2029 Winter and Summer Peaks

	2025 Winter Peak	2026 Winter Peak	2027 Winter Peak	2028 Winter Peak	2029 Winter Peak	2025 Summer Peak	2026 Summer Peak	2027 Summer Peak	2028 Summer Peak	2029 Summer Peak
Coincident Peak (kW)	January	January	January	January	January	August	August	August	August	August
RES	849,763	857,453	867,087	880,709	889,666	913,274	921,538	931,893	946,532	956,159
CSMUR	67,409	68,764	70,006	71,313	72,059	48,766	49,746	50,645	51,590	52,130
GS<50	507,558	512,725	517,582	524,191	524,178	638,780	645,282	651,395	659,713	659,696
GS50-999	1,503,929	1,494,785	1,486,300	1,482,446	1,470,171	1,551,590	1,542,155	1,533,402	1,529,426	1,516,761
GS1-5MW	517,675	513,259	509,280	508,240	496,472	615,798	610,545	605,811	604,573	590,576
Large User	227,104	227,427	221,968	217,782	210,298	255,329	255,692	249,554	244,848	236,434
SL	28,111	27,409	26,713	26,023	25,340	-	-	-	-	-
USL	5,474	5,474.04	5,474	5,489	5,474	4,437	4,436.72	4,437	4,449	4,437
Total	3,707,024	3,707,296	3,704,411	3,716,193	3,693,658	4,027,973	4,029,396	4,027,137	4,041,132	4,016,194

3.1.1 CDM Assumptions included in Toronto Hydro's Original Load Forecast

The impact of CDM in Toronto Hydro's load forecast has been incorporated by using two sets of CDM variables in its multivariate regression[10]:

- Residential CDM Variable – to drive forecast CDM savings in the Residential Class; and
- Business CDM Variable – to drive forecast CDM savings in the GS<50kW, GS 50-999kW, GS 1,000-4,999kW and Large User rate classes.

No CDM savings have been included in the load forecast for CSMUR rate class because no CDM variable has been applied to this rate class[11]. It is important to note that the Business CDM Variable used in Toronto Hydro's load forecast include estimates of both commercial and industrial CDM programs.

3.1.2 Electrification Assumptions included in Toronto Hydro's Original Load Forecast

In Exhibit 3, Tab 1, Schedule 1, section 11, Toronto Hydro indicated that in preparing the 2025 to 2029 revenue load forecast, it has determined that the impact of heat pumps on overall load and demand is not yet material. As such, the potential load impacts of additional heat pumps were not incorporated in its load forecast.

During the Technical Conference, Toronto Hydro further confirmed that additional building electrification, such as switching from natural gas space heating to electric heat pumps, the installation of heat recovery chiller and connecting district energy, has not been incorporated in its 2025 to 2029 load forecast[12].

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[10] EB-2023-0195 Exhibit 3, Tab 1, Schedule 1, Original, Section 6.1, Page 12 of 28
[11] EB-2023-0195 Exhibit 3, Tab 1, Schedule 1, Original, Section 7, Table 4, Page 17 of 28
[12] EB-2023-0195 Technical Conference Day 4 transcript pages 147 and 149.

3.2 Alternative Load Forecast Scenario One

In this scenario, the estimated impact of commercial sector CDM activities included in the original Toronto Hydro load forecast is replaced by the expected commercial sector CDM impact based on Enerlife's analysis.

Generating this scenario requires three steps:

1. Remove the expected commercial CDM impact incorporated in the original Toronto Hydro load forecast from all the GS rate classes - The Business CDM variable used in Toronto Hydro's multivariate regression includes impacts of both commercial and industrial CDM programs. Only the impact from commercial CDM programs have been removed.
2. Align Enerlife's expected CDM impact as listed in Table 2-2 (2024 to 2029 CDM impact by building type) to two rate class categories: i) CSMUR and ii) Total GS rate classes (which include GS<50kW, GS 50 to 999 kW, GS 1,000 to 4,999 kW and the Large User Rate Classes).
3. Incorporate Enerlife's expected CDM impact by rate class to the CSMUR, GS<50kW, GS 50 to 999 kW, GS 1,000 to 4,999 kW and the Large User Rate Classes.

Table 3-5, Table 3-6, and Table 3-7 below presents the Alternative Load Forecast Scenario One. Enerlife's CDM analysis impacts the multi-residential condo/apartment, commercial and institutional buildings only. As such, only CSMUR, GS<50kW, GS50-999kW, GS1,000-4,999kW and Large User Rate Classes are affected.

A comparison (in percentage variance) between the original Toronto Hydro load forecast and this Alternative Load Forecast Scenario One is provided in Appendix C.

Table 3-5 Alternative Load Forecast Scenario 1 – 2023 to 2029 Weather Corrected kWh

Weather Corrected kWh per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential	4,821,243,888	4,844,831,654	4,854,325,532	4,898,252,484	4,953,291,540	5,031,104,117	5,082,273,885
CSMUR	325,741,867	330,122,111	329,122,200	329,419,017	329,013,735	328,812,078	325,642,203
GS < 50 kW	2,389,020,511	2,348,767,691	2,359,467,349	2,382,401,995	2,403,300,154	2,431,810,981	2,428,809,877
GS 50-999 kW	9,544,666,923	9,525,408,961	9,455,783,265	9,429,244,616	9,404,472,571	9,407,016,795	9,353,363,449
GS 1000-4999 kW	4,232,770,556	4,070,278,465	3,999,798,510	3,974,304,073	3,951,432,254	3,950,386,938	3,865,299,093
Large User	1,770,744,374	1,650,313,574	1,570,920,603	1,560,450,543	1,510,154,618	1,469,269,909	1,407,240,979
Street Lighting Connections	117,771,219	118,298,492	118,212,158	118,551,502	118,890,846	119,603,594	119,569,534
Unmetered Scattered Load Connections	42,090,116	42,205,431	42,090,116	42,090,116	42,090,116	42,205,431	42,090,116
TOTAL Toronto Hydro	23,244,049,452	22,930,226,380	22,729,719,733	22,734,714,346	22,712,645,834	22,780,209,843	22,624,289,137

Table 3-6 Alternative Load Forecast Scenario 1 – 2023 to 2029 Weather Corrected kW

Weather Corrected Billing* kW per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential**							
CSMUR**	-	-	-	-	-	-	-
GS < 50 kW**	-	-	-	-	-	-	-
GS 50-999 kW	23,570,445	23,432,816	23,173,509	23,014,180	22,860,071	22,773,378	22,550,502
GS 1000-4999 kW	9,133,535	8,786,956	8,618,128	8,537,778	8,462,884	8,435,444	8,227,626
Large User	4,338,192	4,113,974	3,959,372	3,961,840	3,862,768	3,785,369	3,649,734
Street Lighting Connections	383,744	374,580	363,522	354,446	345,448	336,528	327,684
Unmetered Scattered Load Connections**	-	-	-	-	-	-	-

* Billing kW per year = 12 x average monthly peak

** Billing kW not available for rate classes that are not demand billed

Table 3-7 Impact of Alternative Load Forecast Scenario 1 on 2025 to 2029 Toronto Hydro Distribution System Peak

	2025 Winter Peak	2026 Winter Peak	2027 Winter Peak	2028 Winter Peak	2029 Winter Peak	2025 Summer Peak	2026 Summer Peak	2027 Summer Peak	2028 Summer Peak	2029 Summer Peak
Coincident Peak (kW)	January	January	January	January	January	August	August	August	August	August
RES	849,763	857,453	867,087	880,709	889,666	913,274	921,538	931,893	946,532	956,159
CSMUR	64,898	64,957	64,877	64,837	64,212	46,950	46,992	46,934	46,906	46,453
GS<50	506,803	511,552	515,868	521,827	521,022	637,829	643,806	649,239	656,738	655,724
GS50-999	1,501,691	1,491,366	1,481,379	1,475,761	1,461,318	1,549,280	1,538,628	1,528,325	1,522,529	1,507,628
GS1-5MW	516,905	512,086	507,594	505,948	493,483	614,881	609,148	603,805	601,847	587,020
Large User	226,766	226,907	221,233	216,800	209,032	254,948	255,107	248,728	243,744	235,011
SL	28,111	27,409	26,713	26,023	25,340	-	-	-	-	-
USL	5,474	5,474.04	5,474	5,489	5,474	4,437	4,436.72	4,437	4,449	4,437
Total	3,700,410	3,697,203	3,690,226	3,697,395	3,669,547	4,021,599	4,019,657	4,013,360	4,022,745	3,992,432

3.3 Alternative Load Forecast Scenario Two

In this scenario, the expected commercial electrification impact based on Enerlife's analysis is added to Alternative Load Forecast Scenario One. As such, Alternative Load Forecast Scenario Two includes the expected commercial CDM and electrification impact based on Enerlife's analysis as described in section 2 of this report.

As discussed in section 3.1.2, Toronto Hydro did not assume any impact from building electrification (such as switching from natural gas to electric space heating) in commercial buildings in its load forecast. Generating the alternative load forecast scenario 2 requires two steps:

1. Align Enerlife's expected electrification impact as described in sections 2.2.3 and 2.2.4 (i.e. 2024 to 2029 electrification impact by building type) to two rate class categories: i) CSMUR and ii) Total GS rate classes (which include GS<50kW, GS 50 to 999 kW, GS 1,000 to 4,999 kW and the Large User Rate Classes).

2. Incorporate Enerlife's expected electrification impact by rate class to the CSMUR, GS<50kW, GS 50 to 999 kW, GS 1,000 to 4,999 kW and the Large User Rate Classes.

Table 3-8, Table 3-9, and Table 3-10 below present the Alternative Load Forecast Scenario Two. Enerlife's electrification analysis impacts the multi-residential condo/apartment, commercial and institutional buildings only. As such, only CSMUR, GS<50kW, GS50-999kW, GS1,000-4,999kW and Large User Rate Classes are affected.

A comparison (in percentage variance) between the Alternative Load Forecast Scenario One and this Alternative Load Forecast Scenario Two is provided in Section 4.1.2 below.

Table 3-8 Alternative Load Forecast Scenario 2 – 2023 to 2029 Weather Corrected kWh

Weather Corrected kWh per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential	4,821,243,888	4,844,831,654	4,854,325,532	4,898,252,484	4,953,291,540	5,031,104,117	5,082,273,885
CSMUR	325,741,867	331,285,940	331,465,509	332,938,233	333,709,918	334,683,780	332,688,704
GS < 50 kW	2,389,020,511	2,355,700,011	2,373,427,873	2,403,443,460	2,431,609,780	2,467,519,334	2,472,016,007
GS 50-999 kW	9,544,666,923	9,553,522,929	9,511,731,354	9,512,524,061	9,515,252,368	9,545,148,040	9,519,750,551
GS 1000-4999 kW	4,232,770,556	4,082,291,774	4,023,464,565	4,009,405,277	3,997,978,072	4,008,393,836	3,934,058,948
Large User	1,770,744,374	1,655,184,427	1,580,215,444	1,574,232,501	1,527,943,454	1,490,844,451	1,432,274,407
Street Lighting Connections	117,771,219	118,298,492	118,212,158	118,551,502	118,890,846	119,603,594	119,569,534
Unmetered Scattered Load Connections	42,090,116	42,205,431	42,090,116	42,090,116	42,090,116	42,205,431	42,090,116
TOTAL Toronto Hydro	23,244,049,452	22,983,320,659	22,834,932,552	22,891,437,633	22,920,766,094	23,039,502,583	22,934,722,152

Table 3-9 Alternative Load Forecast Scenario 2 – 2023 to 2029 Weather Corrected kW

Weather Corrected Billing* kW per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential**							
CSMUR**	-	-	-	-	-	-	-
GS < 50 kW**	-	-	-	-	-	-	-
GS 50-999 kW	23,570,445	23,499,004	23,304,799	23,209,049	23,118,498	23,094,620	22,936,219
GS 1000-4999 kW	9,133,535	8,811,775	8,666,953	8,610,071	8,558,555	8,554,434	8,368,356
Large User	4,338,192	4,125,594	3,981,803	3,995,387	3,906,435	3,838,765	3,712,161
Street Lighting Connections	383,744	374,580	363,522	354,446	345,448	336,528	327,684
Unmetered Scattered Load Connections**	-	-	-	-	-	-	-

* Billing kW per year = 12 x average monthly peak

** Billing kW not available for rate classes that are not demand billed

Table 3-10 Impact of Alternative Load Forecast Scenario 2 on 2025 to 2029 Toronto Hydro Distribution System Peak

	2025 Winter Peak	2026 Winter Peak	2027 Winter Peak	2028 Winter Peak	2029 Winter Peak	2025 Summer Peak	2026 Summer Peak	2027 Summer Peak	2028 Summer Peak	2029 Summer Peak
Coincident Peak (kW)	January	January	January	January	January	August	August	August	August	August
RES	849,763	857,453	867,087	880,709	889,666	913,274	921,538	931,893	946,532	956,159
CSMUR	66,220	66,941	67,519	68,137	68,134	46,961	47,009	46,957	46,934	46,487
GS<50	511,887	519,249	526,218	534,914	536,701	638,502	644,825	650,609	658,471	657,800
GS50-999	1,516,754	1,513,806	1,511,099	1,512,770	1,505,294	1,550,915	1,541,063	1,531,550	1,526,545	1,512,401
GS1-5MW	522,090	519,791	517,777	518,636	508,334	615,530	610,113	605,079	603,435	588,878
Large User	229,041	230,321	225,671	222,237	215,322	255,218	255,511	249,253	244,387	235,755
SL	28,111	27,409	26,713	26,023	25,340	-	-	-	-	-
USL	5,474	5,474.04	5,474	5,489	5,474	4,437	4,436.72	4,437	4,449	4,437
Total	3,729,339	3,740,443	3,747,558	3,768,915	3,754,265	4,024,836	4,024,497	4,019,778	4,030,753	4,001,917

4 Comparisons, Key Findings and Recommendations

4.1 Load Forecast Comparison and Key Findings

4.1.1 Alternative Scenario One vs. Toronto Hydro Original Evidence

Key Findings

Enerlife estimated the expected CDM savings in commercial buildings in Toronto during the 2025-2029 period and compared its results with the commercial sector CDM savings included in the Toronto Hydro load forecast proposed in this rebasing rate application. While Enerlife and Toronto Hydro's methodologies to forecast CDM savings are different, the results are materially the same. Enerlife's methodology (discussed in Section 2) utilizes statistical analysis of electricity consumption for different commercial building types based on the most recent empirical data, and its industry knowledge working directly with building owners on both strategic and technical projects, to establish achievable savings targets. Toronto Hydro's forecast savings (discussed in Section 3) are based on CDM variables (with historical and forecast CDM savings) included in its multivariate regression forecast model.

Both Enerlife and Toronto Hydro's projected CDM savings are generally consistent with the Independent Electricity System Operator's (IESO) 2019 Achievable Potential Study (2019 APS), its subsequent 2022 APS Refresh and the 2024 Annual Planning Outlook.

A comparison (in percentage variance) between the original Toronto Hydro load forecast and this Alternative Load Forecast Scenario One is provided in Appendix C.

4.1.2 The Impact of Electrification - Alternative Scenario Two vs. Alternative Scenario One

Table 4-1, Table 4-2, Table 4-3, and Table 4-4 show the percentage variance of Annual kWh, Annual billing kW, Distribution Coincident System Peak in kW and Natural Gas consumption. The difference between Scenario Two and Scenario One is the impact of electrification in multi-residential and commercial buildings expected in the 2025 to 2029 period.

Key Findings

Enerlife estimated the adoption of electrification (primarily switching from natural gas heating to electric heat pump technology) and its impact on commercial buildings in Toronto during the 2025-2029 period based on its knowledge of installations already in operation or development and involvement in energy transition planning for a number of major owners. In commercial buildings, almost all current electrification installations and planning use "hybrid" solutions (with natural gas backup), and Enerlife expects this trend to continue during the 2025-2029 period (discussed in Section 2).

In hybrid electrification, natural gas heating remains as a supplementary heating source, with electric heat pumps and heaters displacing a large share of previous fossil fuel consumption, but gas-fired boilers or furnaces continuing to provide a significant part of demand during peak heating periods. The hybrid solution is generally the most cost effective for all types of commercial buildings with current utility rates. For most commercial buildings, it also avoids major costs for electrical service upgrades and associated upstream electrical capacity investments. In most cases, commercial buildings' electrical infrastructure is sized for the air conditioning load in the summer. Since the impact of electrification is primarily seen in winter (natural gas heating replaced by electric heat pumps), existing electrical infrastructure provides enough capacity for hybrid electrification. Therefore, significant investment in electrical infrastructure upgrade on site or upstream at the electric utility level is not required. A summer peaking distributor's (e.g. Toronto Hydro) overall system peak is not substantively impacted.

In its prefiled evidence, and further confirmed in the Technical Conference, Toronto Hydro indicated that the potential load impacts of electrification in commercial buildings, such as heat pumps, installation of heat recovery chillers and connection to district energy, are not incorporated in its 2025 – 2029 load forecast. Enerlife believes that significant electrification of commercial buildings will occur during this period and recommends that Toronto Hydro should review the analysis provided in this report and assess its potential impact on the proposed load forecast, capital investment plan and revenue requirement in Toronto Hydro's current and future rate applications.

Table 4-1 Annual kWh Consumption - Alternative Forecast Scenario 2 compared to Alternative Forecast Scenario 1 in percentage variance

Weather Corrected kWh per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CSMUR	0.0%	0.4%	0.7%	1.1%	1.4%	1.8%	2.2%
GS < 50 kW	0.0%	0.3%	0.6%	0.9%	1.2%	1.5%	1.8%
GS 50-999 kW	0.0%	0.3%	0.6%	0.9%	1.2%	1.5%	1.8%
GS 1000-4999 kW	0.0%	0.3%	0.6%	0.9%	1.2%	1.5%	1.8%
Large User	0.0%	0.3%	0.6%	0.9%	1.2%	1.5%	1.8%
Street Lighting Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unmetered Scattered Load Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL Toronto Hydro	0.0%	0.2%	0.5%	0.7%	0.9%	1.1%	1.4%

Table 4-2 Annual Billing kW - Alternative Forecast Scenario 2 compared to Alternative Forecast Scenario 1 in percentage variance

Weather Corrected Billing* kW per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential**	-						
CSMUR**	-	-	-	-	-	-	-
GS < 50 kW**	-	-	-	-	-	-	-
GS 50-999 kW	0.0%	0.3%	0.6%	0.8%	1.1%	1.4%	1.7%
GS 1000-4999 kW	0.0%	0.3%	0.6%	0.8%	1.1%	1.4%	1.7%
Large User	0.0%	0.3%	0.6%	0.8%	1.1%	1.4%	1.7%
Street Lighting Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unmetered Scattered Load Connections**	-	-	-	-	-	-	-

** Billing kW not available for rate classes that are not demand billed

Table 4-3 Winter and Summer Peak - Alternative Forecast Scenario 2 compared to Alternative Forecast Scenario 1 in percentage variance

	2025 Winter Peak	2026 Winter Peak	2027 Winter Peak	2028 Winter Peak	2029 Winter Peak	2025 Summer Peak	2026 Summer Peak	2027 Summer Peak	2028 Summer Peak	2029 Summer Peak
Coincident Peak (kW)	January	January	January	January	January	August	August	August	August	August
RES	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CSMUR	2.0%	3.1%	4.1%	5.1%	6.1%	0.0%	0.0%	0.0%	0.1%	0.1%
GS<50	1.0%	1.5%	2.0%	2.5%	3.0%	0.1%	0.2%	0.2%	0.3%	0.3%
GS50-999	1.0%	1.5%	2.0%	2.5%	3.0%	0.1%	0.2%	0.2%	0.3%	0.3%
GS1-5MW	1.0%	1.5%	2.0%	2.5%	3.0%	0.1%	0.2%	0.2%	0.3%	0.3%
Large User	1.0%	1.5%	2.0%	2.5%	3.0%	0.1%	0.2%	0.2%	0.3%	0.3%
SL	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	-
USL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	0.8%	1.2%	1.6%	1.9%	2.3%	0.1%	0.1%	0.2%	0.2%	0.2%

Table 4-4 Annual Natural Gas Consumption - Alternative Forecast Scenario 2 compared to Alternative Forecast Scenario 1 in percentage variance

Weather Corrected kWh per year	Actual	Bridge Year	Forecast				
Rate Class	2023	2024	2025	2026	2027	2028	2029
Residential							
CSMUR		-1.9%	-3.9%	-5.8%	-7.8%	-9.7%	-11.6%
GS < 50 kW		-1.2%	-2.4%	-3.6%	-4.8%	-6.0%	-7.2%
GS 50-999 kW		-1.2%	-2.4%	-3.6%	-4.8%	-6.0%	-7.2%
GS 1000-4999 kW		-1.2%	-2.4%	-3.6%	-4.8%	-6.0%	-7.2%
Large User		-1.2%	-2.4%	-3.6%	-4.8%	-6.0%	-7.2%
Street Lighting Connections							
Unmetered Scattered Load Connections							
TOTAL Toronto Hydro							

4.2 Additional Recommendations

Commercial Customer information

The market is rapidly evolving and a growing number of public- and private-sector commercial building owners are planning, setting targets and taking actions towards conservation and reducing carbon footprint. The strategies, methods and market dynamics of conservation and low carbon energy transition in the commercial sector are very different from the residential or industrial sectors. There are also great differences between commercial building types, where, for example, office buildings, grocery stores, community centres, hospitals and schools have entirely different ownership, building systems, energy profiles and decarbonization opportunities. Conservation and electrification planning and forecasting for this broad and diverse sector require in-depth, disaggregated customer information, including customer connections, commercial building types, and interval meter data. BOMA requested some of this information in interrogatories, which was not provided. The analysis for this report has been limited by the lack of reliable and consistent commercial customer information, including customer breakdown by rate class, sector and building types. It is recommended that Toronto Hydro (and other local distribution companies (LDCs)) should greatly expand their efforts on collecting commercial customer information and make information accessible to their customers and other interested parties, as well as their own planning departments.

Coordination Among Stakeholders

The low carbon transition which is just beginning will see a massive transformation in all aspects of the commercial buildings' sector which has to navigate great uncertainties including government policy, market demand, economic factors and technology. It requires active involvement from many stakeholders. Policy setting, planning and implementation require coordination and collaboration among different levels of government, energy regulators, utility companies, owner groups and industry. New regulations can be expected similar to EU Directive 2023/1791, requiring data centres over 1MW to recover their waste heat, and New York City's local law 97 putting carbon caps on buildings. Enerlife believes district energy is likely to be an important part of the low carbon future, enabling large-scale solutions which are impractical at the individual building level.

Recovery and recycling of process heat from buildings, which is now rejected to atmosphere through cooling towers and air-cooled condensers, is also a large potential contributor to decarbonization. Owners/Operators of buildings with high internal heat gains, including commercial offices, hospitals, grocery stores, arena facilities and data centres, should be supported in implementing waste heat recovery. Toronto Hydro indicated that it connected approximately 102 MW of incremental demand load from new hyperscale data centres during the 2020-2024 period and approximately 198 MW is forecasted to be connected during the 2025-2029 period. According to the information provided by Boyd[13], and assuming the application will mainly range between Cloud Computing and Artificial Intelligence, their expected power usage effectiveness (PUE) range is 1.2 to 1.55. Considering an average PUE of 1.35 for the forecasted 2025-2029 installations of which 0.25 kW is needed for cooling, and given a coefficient of performance (COP) of 0.5-0.6 for the most efficient water-cooled refrigeration system, the extent of heat rate to be recovered ranges between 250 to 290 MW allowing the offset of 24,000 to 28,000 m^3/hr of natural gas off the network peak demand. Given a ballpark figure of 800-900 hrs of peak-equivalent heating consumption and considering an overall efficiency in transmission and heat exchange of 85%, the expected gas yearly savings are around 16.32 to 21.4 million cu.m, offsetting an equivalent of 31,000 to 40,660 tCO2.

These kinds of transformative change require planning and coordination among many parties. It is recommended that Toronto Hydro engage in a formal collaboration with the other stakeholders, Including the City of Toronto, Enbridge Gas and Enwave, to set specific goals, targets and timelines for quantifying and delivering on this waste heat recovery potential. BOMA would be a willing partner in such a collaboration.

[13] Energy Consumption in Data Centers: Air versus Liquid Cooling - Boyd | Trusted Innovation (boydcorp.com)

Appendix A - CDM Savings Potential in Commercial Buildings

Comparative data were obtained from Ontario's Energy and Water Reporting and Benchmarking (EWRB) and Broader Public Sector (BPS). CDM targets were set by comparing the median against the top quartile benchmarks of similar category buildings across Toronto using their best intensity metrics up till 2019. All comparison of buildings were weather normalized to Toronto City weather station. The names of the comparative facilities from BPS are not provided in order to maintain participant confidentiality.

Offices (EWRB Reference)

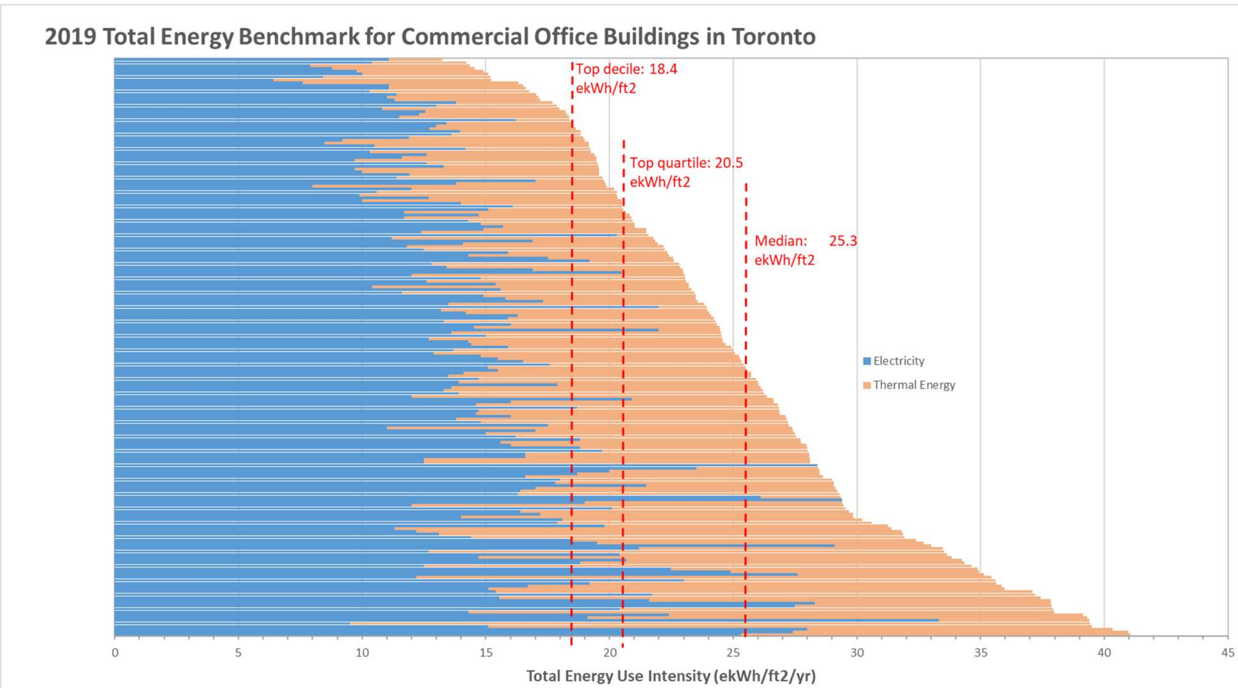


Figure A 1 2019 Total energy benchmark - commercial office buildings

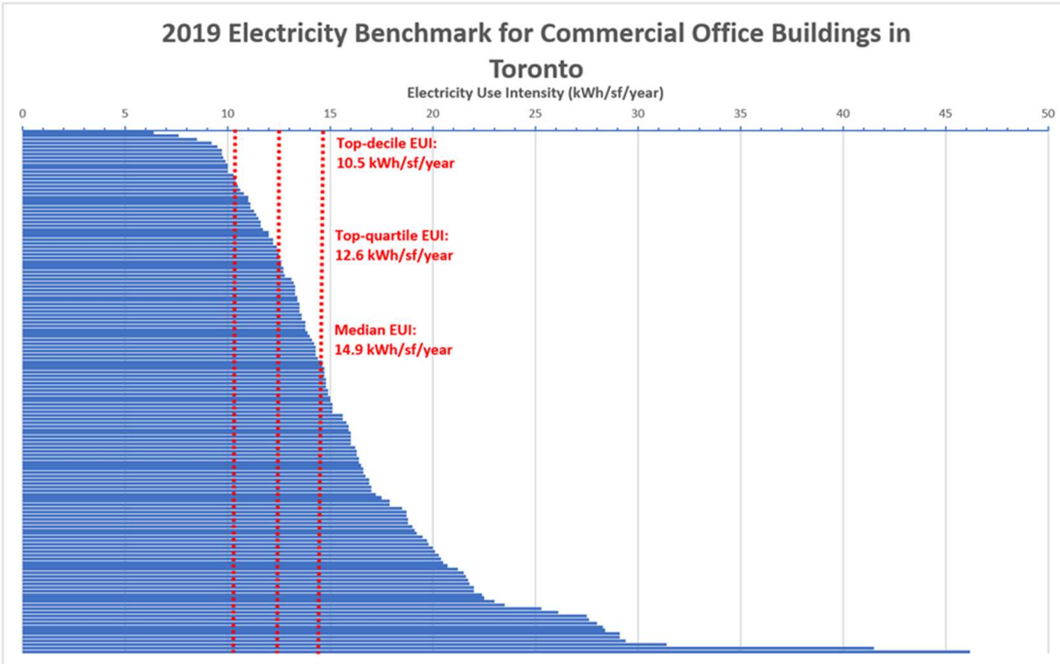


Figure A 2 2019 Electricity benchmark - commercial office buildings

Schools (BPS Reference)

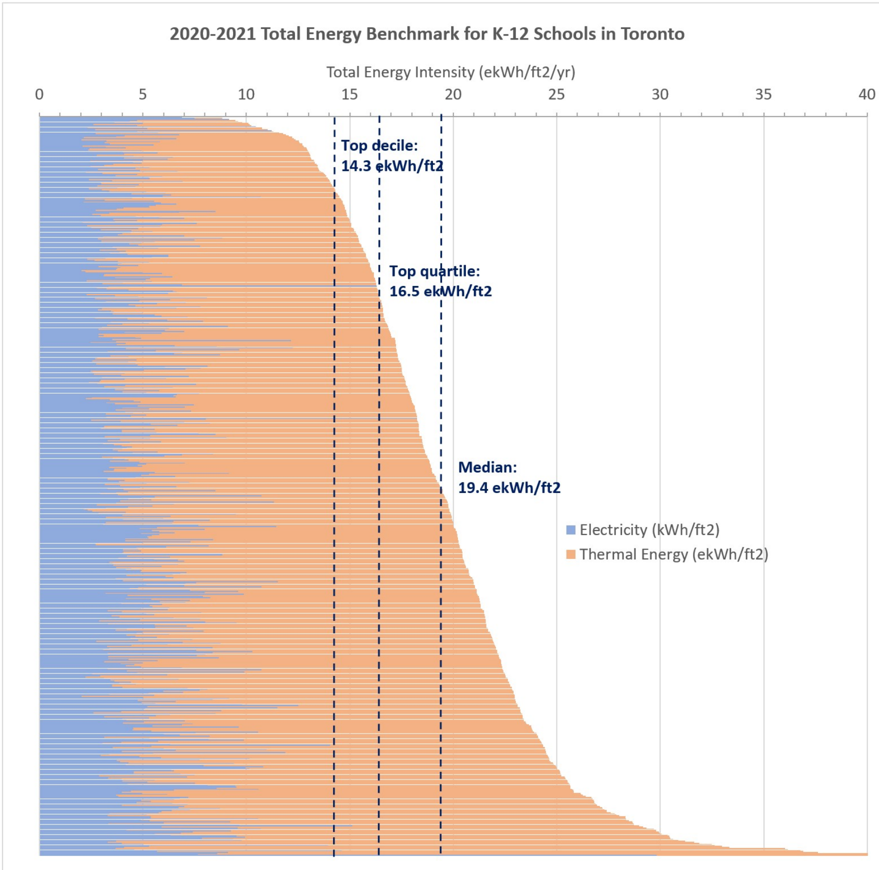


Figure A 3 2020 – 2021 Total energy benchmark for K12 schools

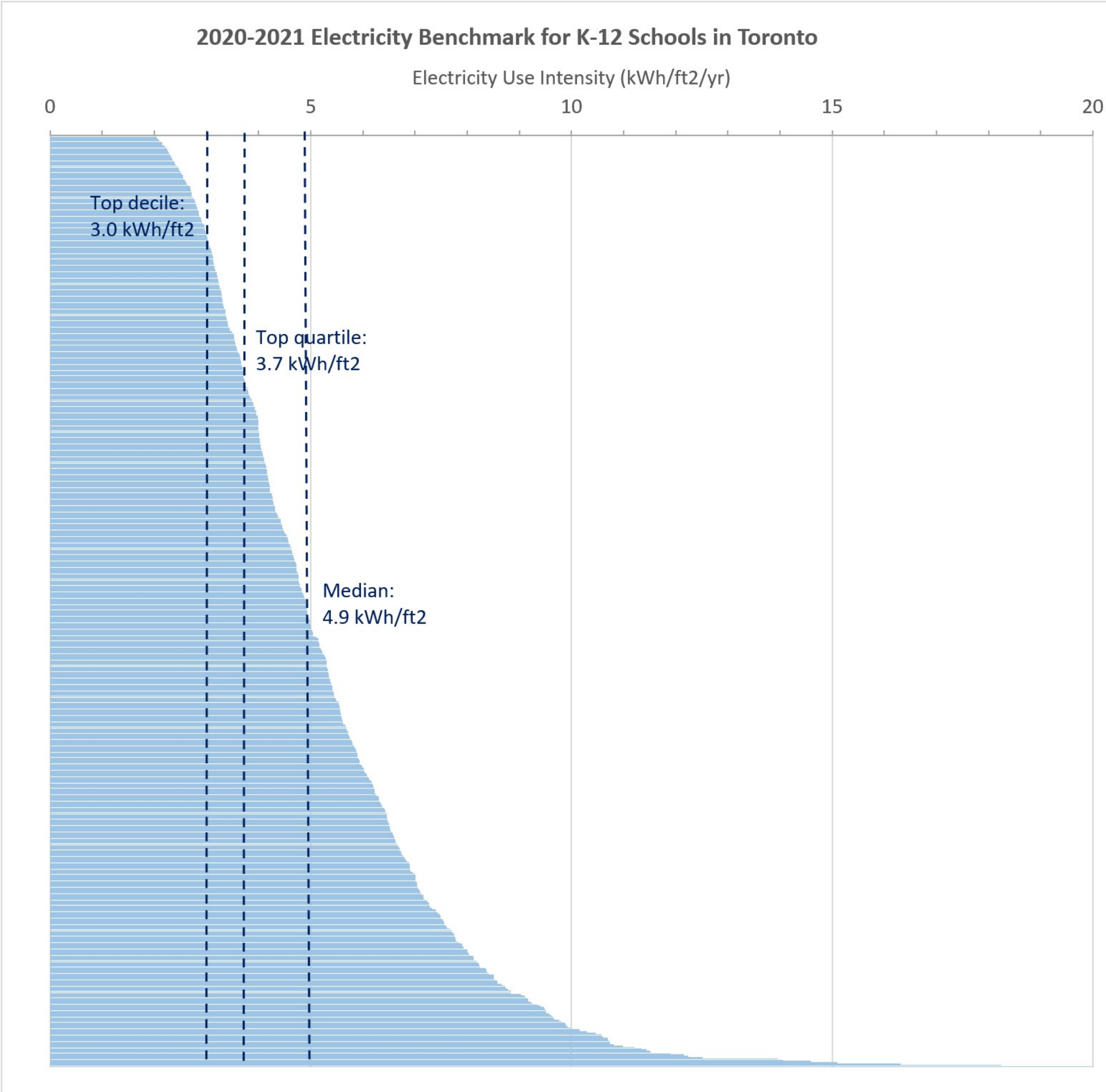


Figure A 4 2020 – 2021Electricity benchmark for K12 schools

Hospitals (BPS Reference)

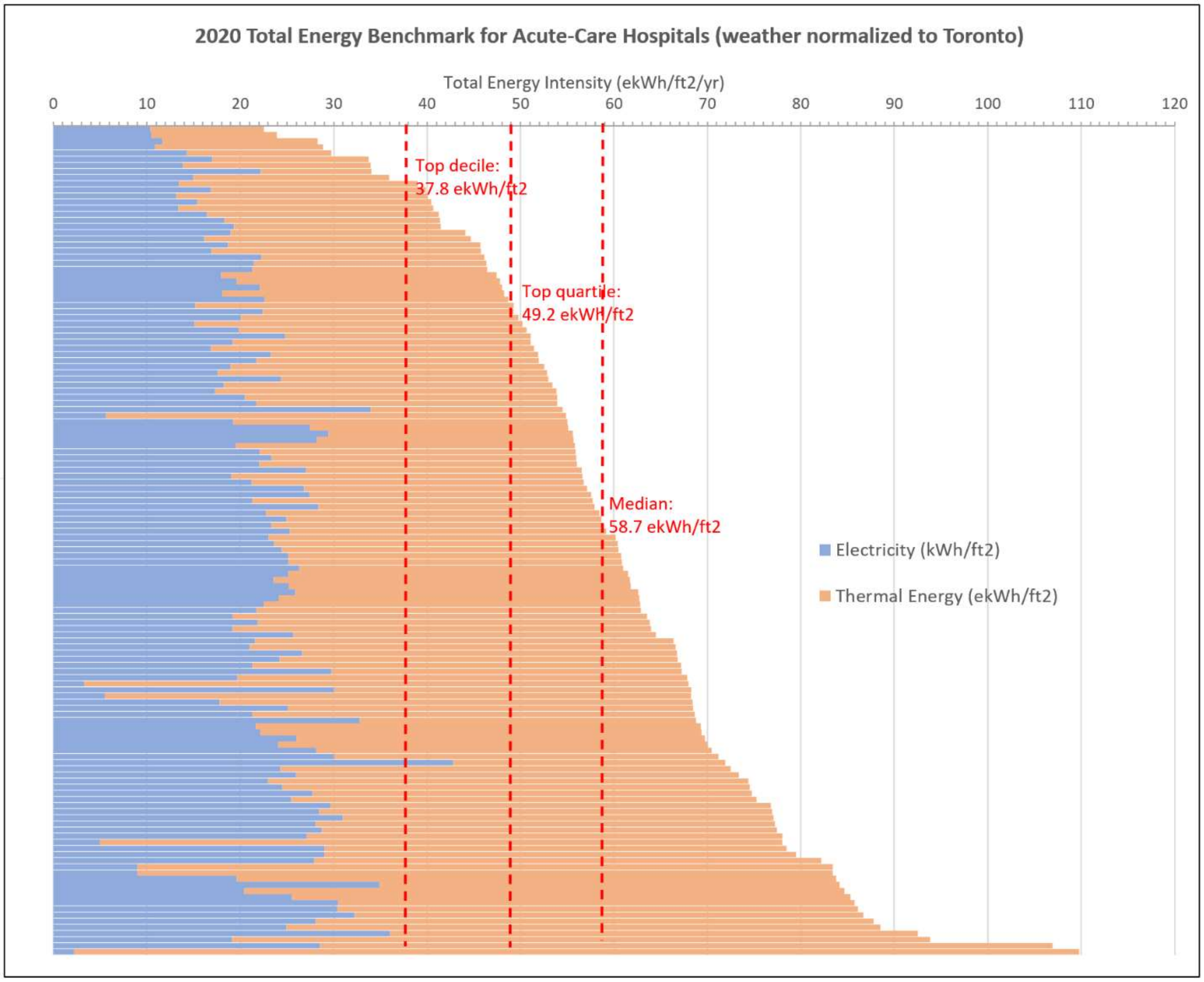


Figure A 5 2020 Total energy benchmark for acute-care hospitals

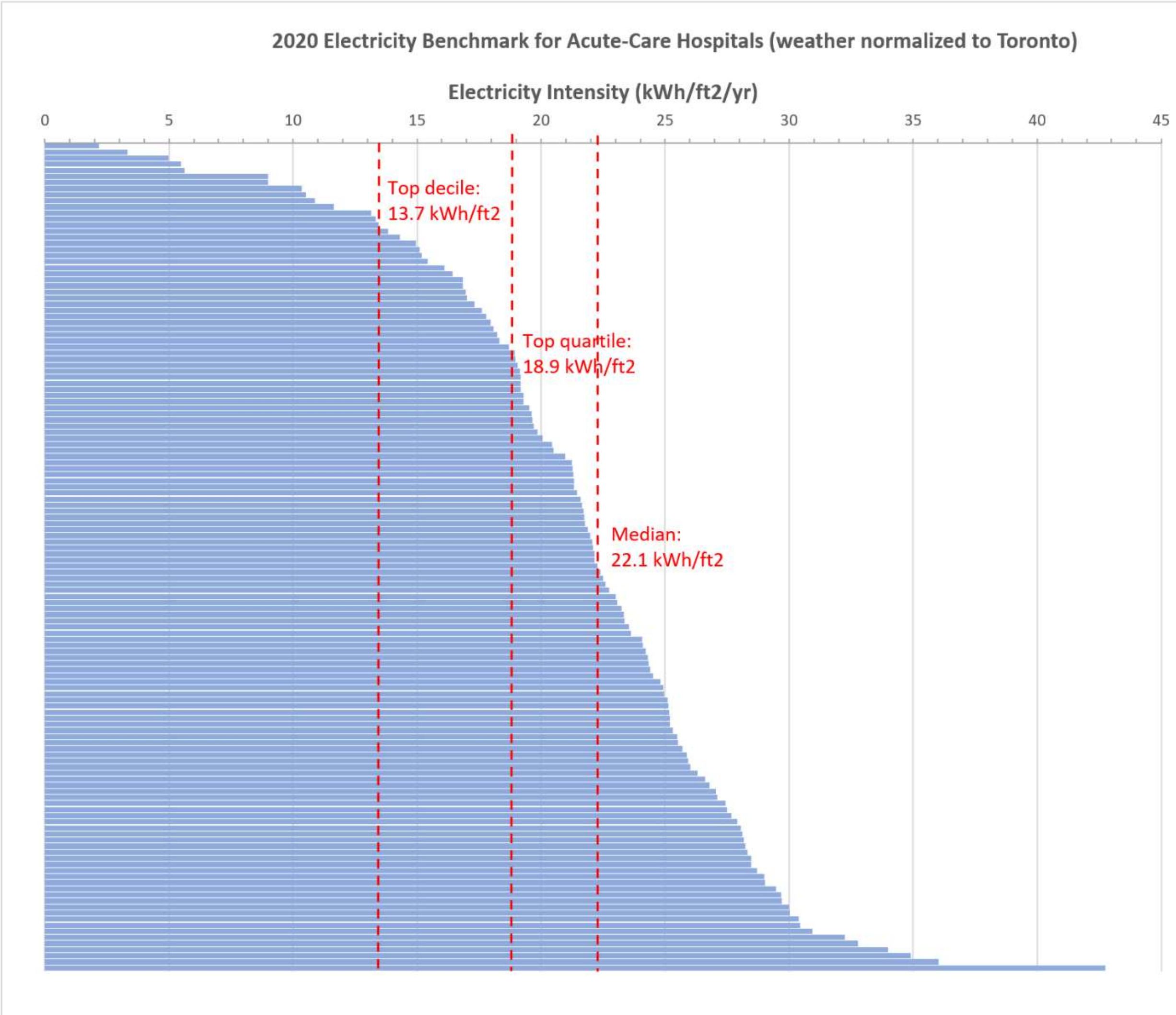


Figure A 6 2020 Electricity benchmark for acute care hospitals

Multi-Unit Residential MUR (EWRB Reference)

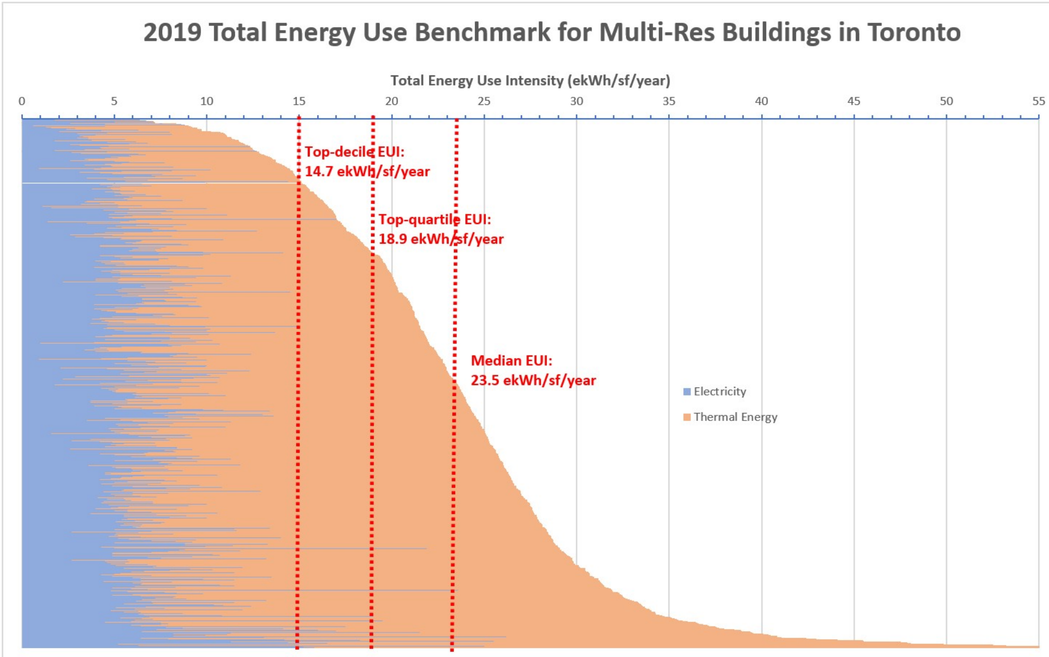


Figure A 7 2019 Total energy benchmark for multi-res buildings

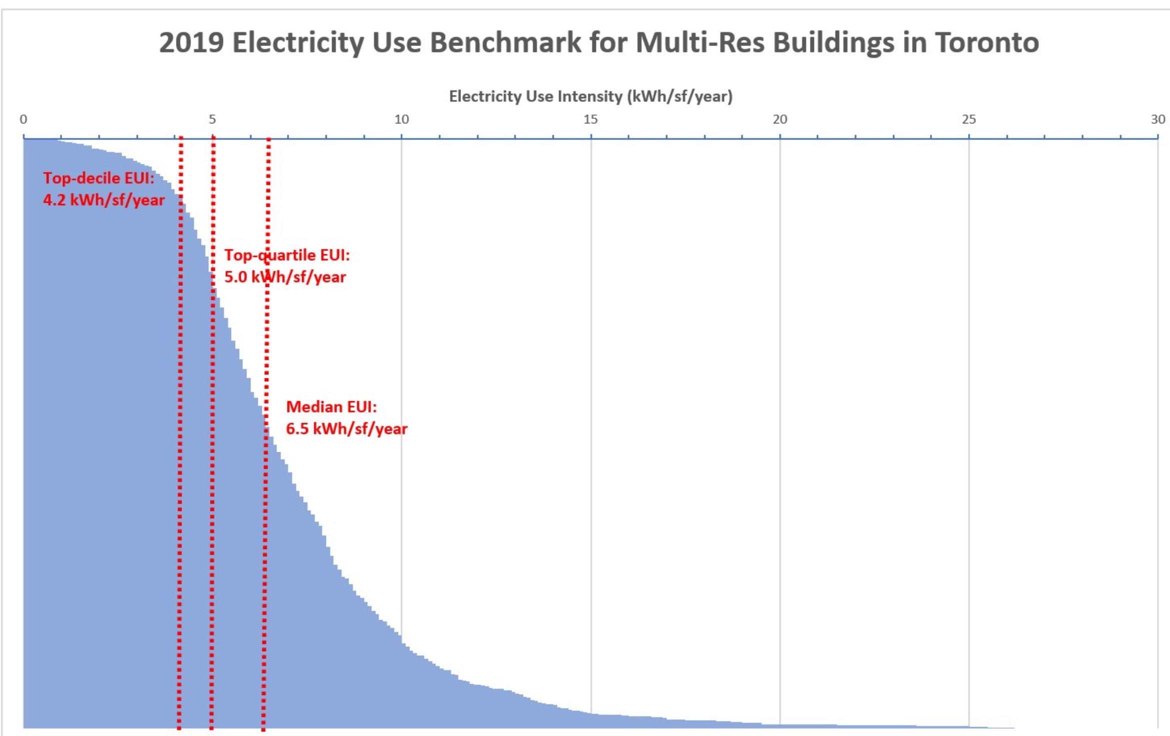


Figure A 8 2019Electricity benchmark for multi-res buildings

Hotels (EWRB Reference)

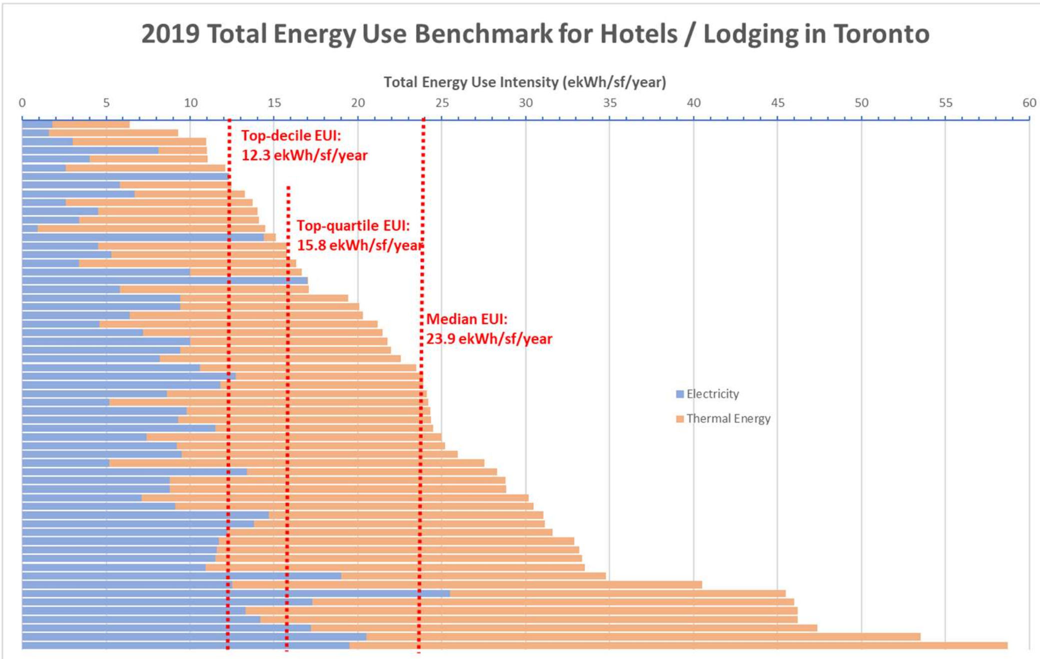


Figure A 9 2019 Total energy benchmark for hotels

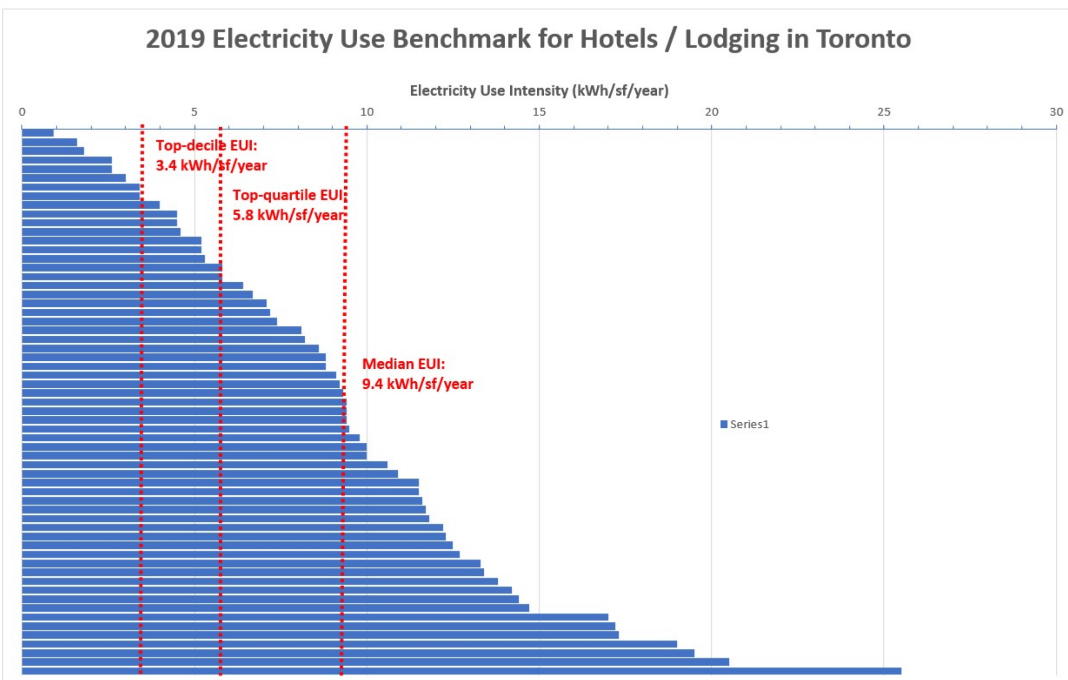


Figure A 10 2019 Electricity benchmark for hotels

Retails (EWRB Reference)

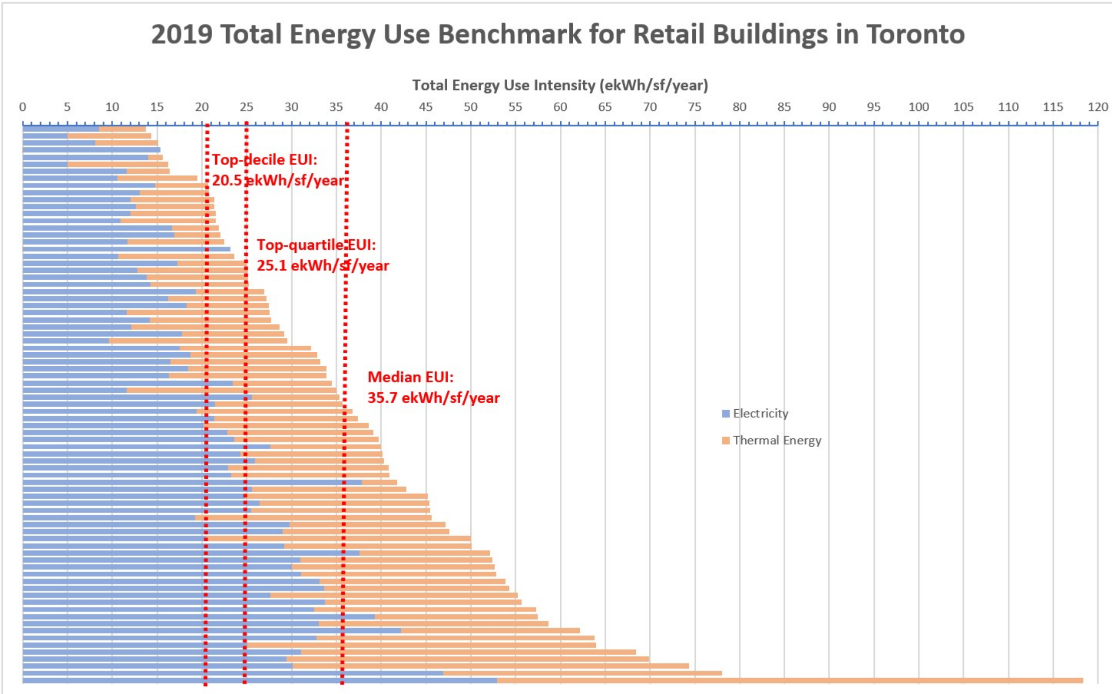


Figure A 11 2019 Total energy benchmark for retail buildings

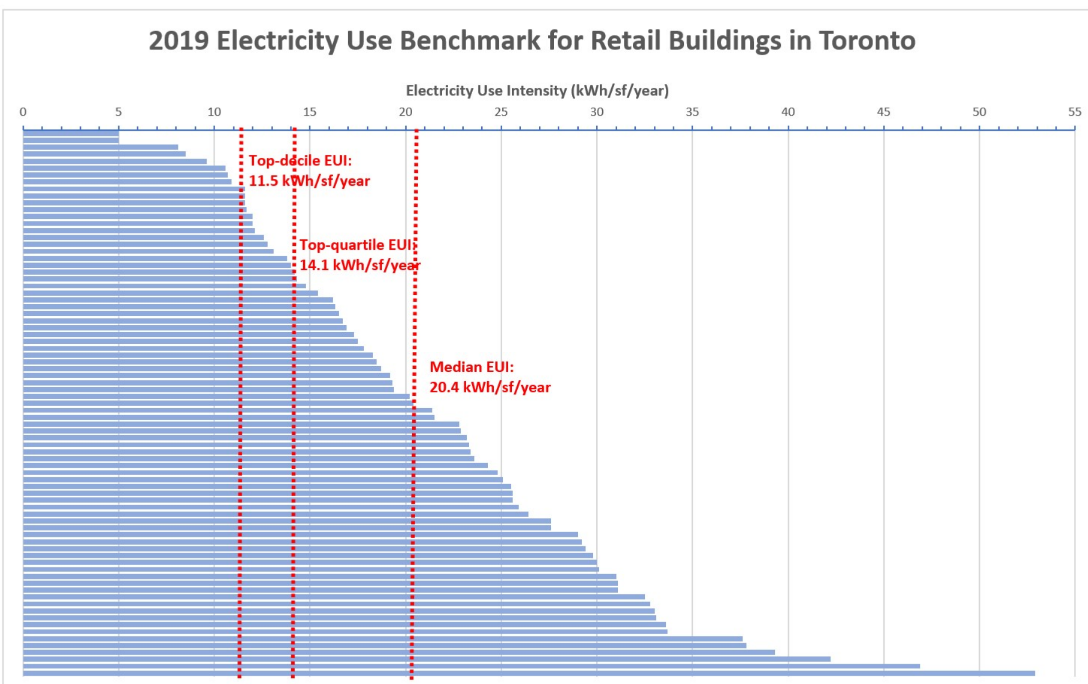


Figure A 12 2019 Electricity benchmark for retail buildings

Non-refrigerated Warehouses (EWRB Reference)

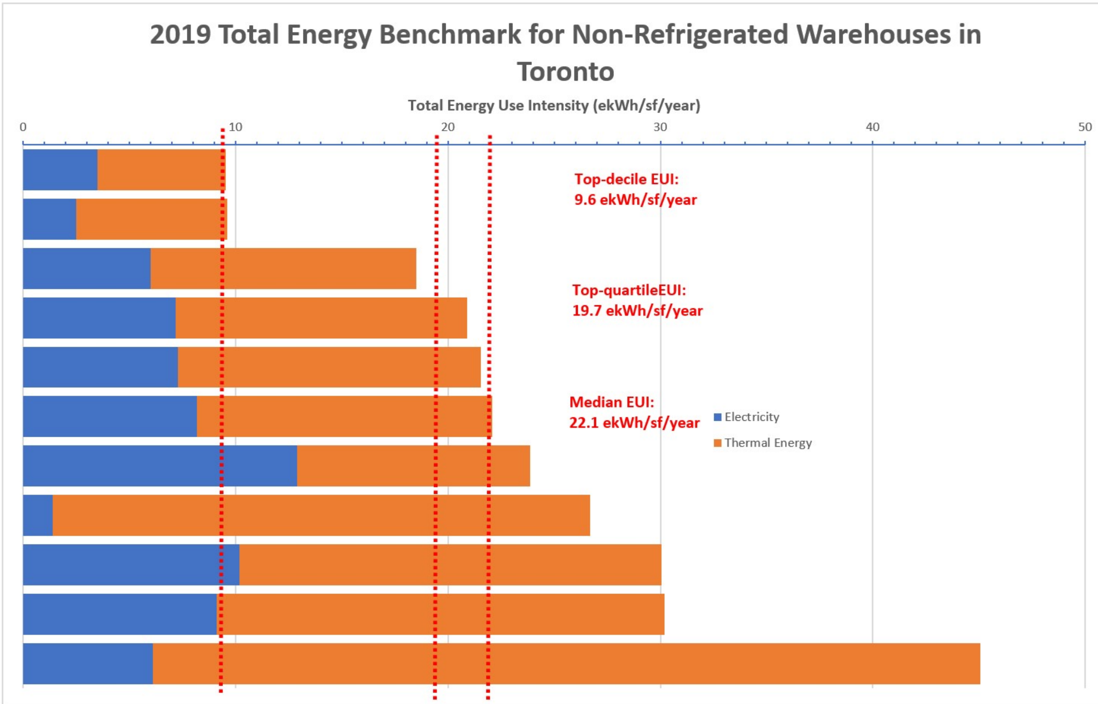


Figure A 13 2019 Total energy benchmark for non-refrigerated warehouses

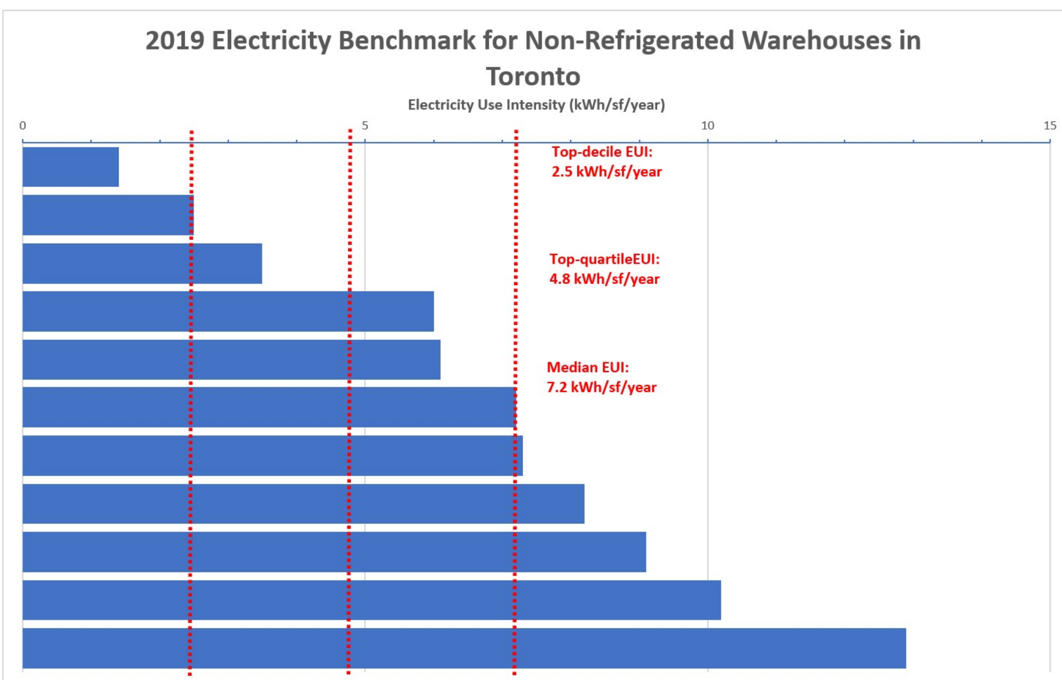


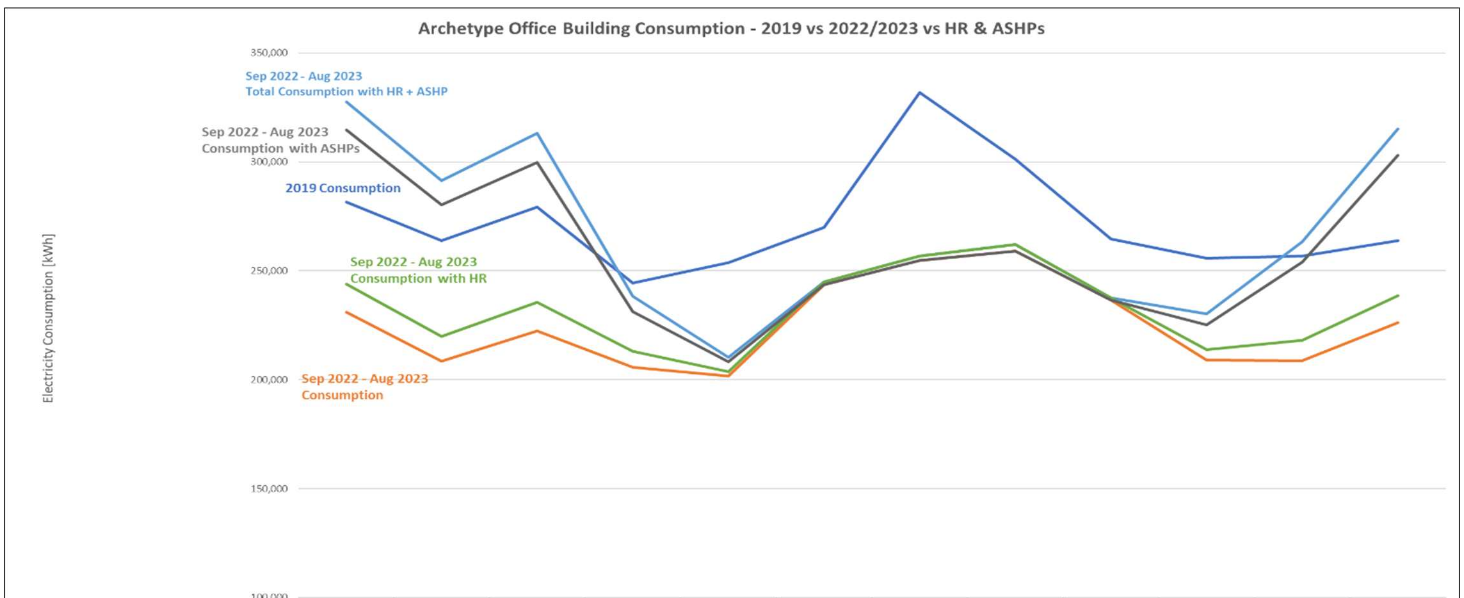
Figure A 14 2019 Electricity benchmark for non-refrigerated warehouses

Appendix B - Electrification Archetypes

Several representative buildings from various building categories have been selected as archetype models based on their typical electrification measures. These encompass heat recovery and renewable energy strategies. Heat recovery includes exhaust air systems using heat recovery wheel and water source heat pumps, tenant cooling tower heat recovery using water-source heat pumps, and heat recovery chillers where simultaneous use of cooling and heating is available (e.g. hospitals). Additionally, air-source heat pumps (ASHPs) in general including ASHP boilers to supplement existing gas boiler plants have been considered as it constitutes a significant electrification and decarbonization measure.

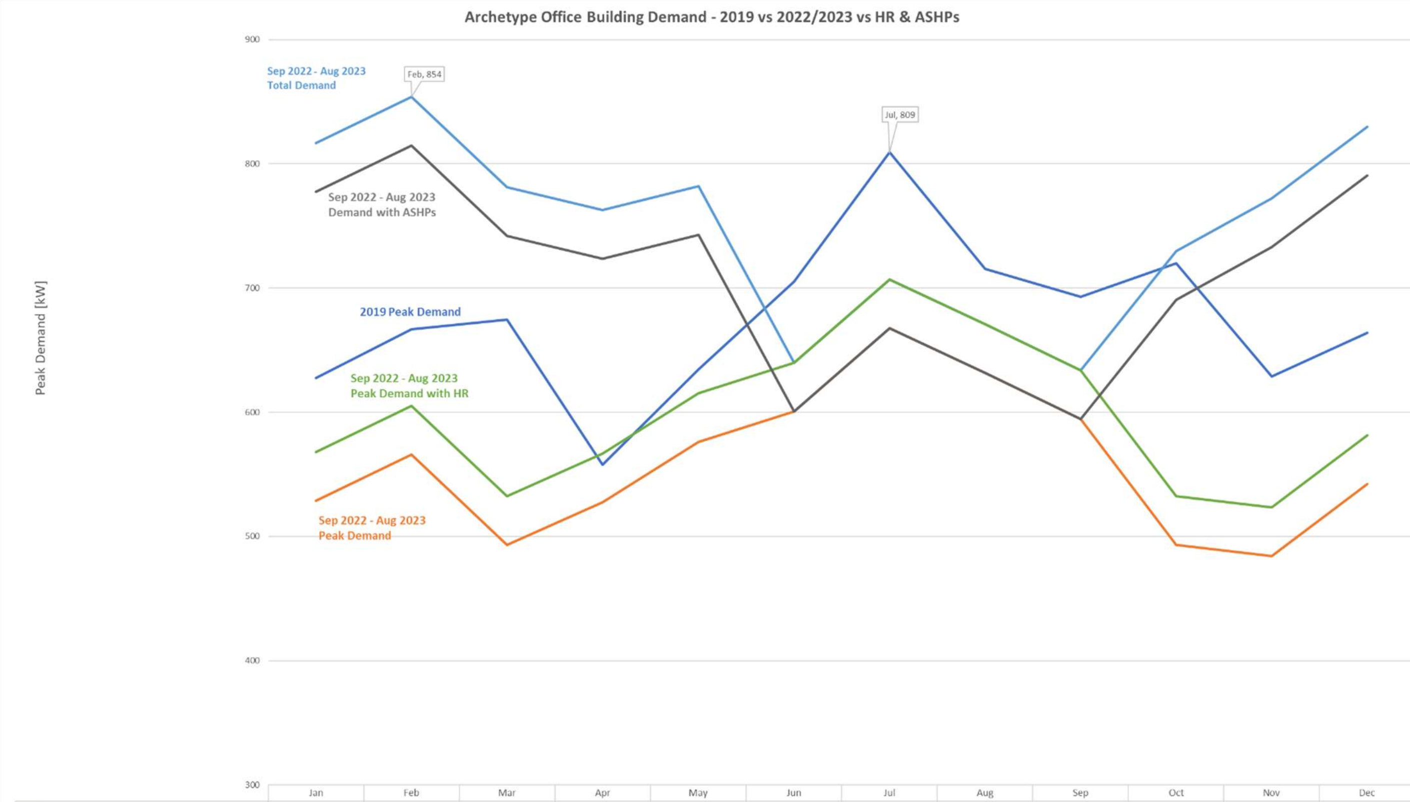
It is to be noted that charts presented in this appendix highlight in general how the original buildings electricity consumptions and demands change with the incorporation of heat recovery and electrification measures, however, do not include the effects of CDM presented under appendix A. However, table 2-3 in the report is all inclusive and does present consumptions and demand variations including CDM, heat recovery, and electrification.

Office Buildings (small size)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019 EL Use (kWh)	281695.52	263958.77	279409.8	244341	253753	270056	331970	301339	264644	255852	256764	263781
2022-2023 EL Use (kWh)	230987.1	208548.9	222336.6	205861.2	201652.5	243782.7	254907.3	259091.4	236474.4	208970.7	208867.8	226261.2
Total Electricity Use (kWh)	327687.7465	291560.4579	313234.6849	238242.966	210386.7809	244941.0764	256892.7803	262016.7028	237544.9972	230293.3468	263399.9465	315259.1408
Total 2022/2023 + HR EL Use (kWh)	243987.1679	219897.3305	235657.4943	212948.0785	203832.4479	244941.0764	256892.7803	262016.7028	237544.9972	213943.8614	218185.5351	238528.8902
Total 2022/2023 + ASHP - EL Use (kWh)	314687.6786	280212.0274	299913.7906	231156.0875	208206.8329	243782.7	254907.3	259091.4	236474.4	225320.1853	254082.2115	302991.4506
% kWh Change vs. 2019 (including HR + ASHPs)	16%	10%	12%	-2%	-17%	-9%	-23%	-13%	-10%	-10%	3%	20%

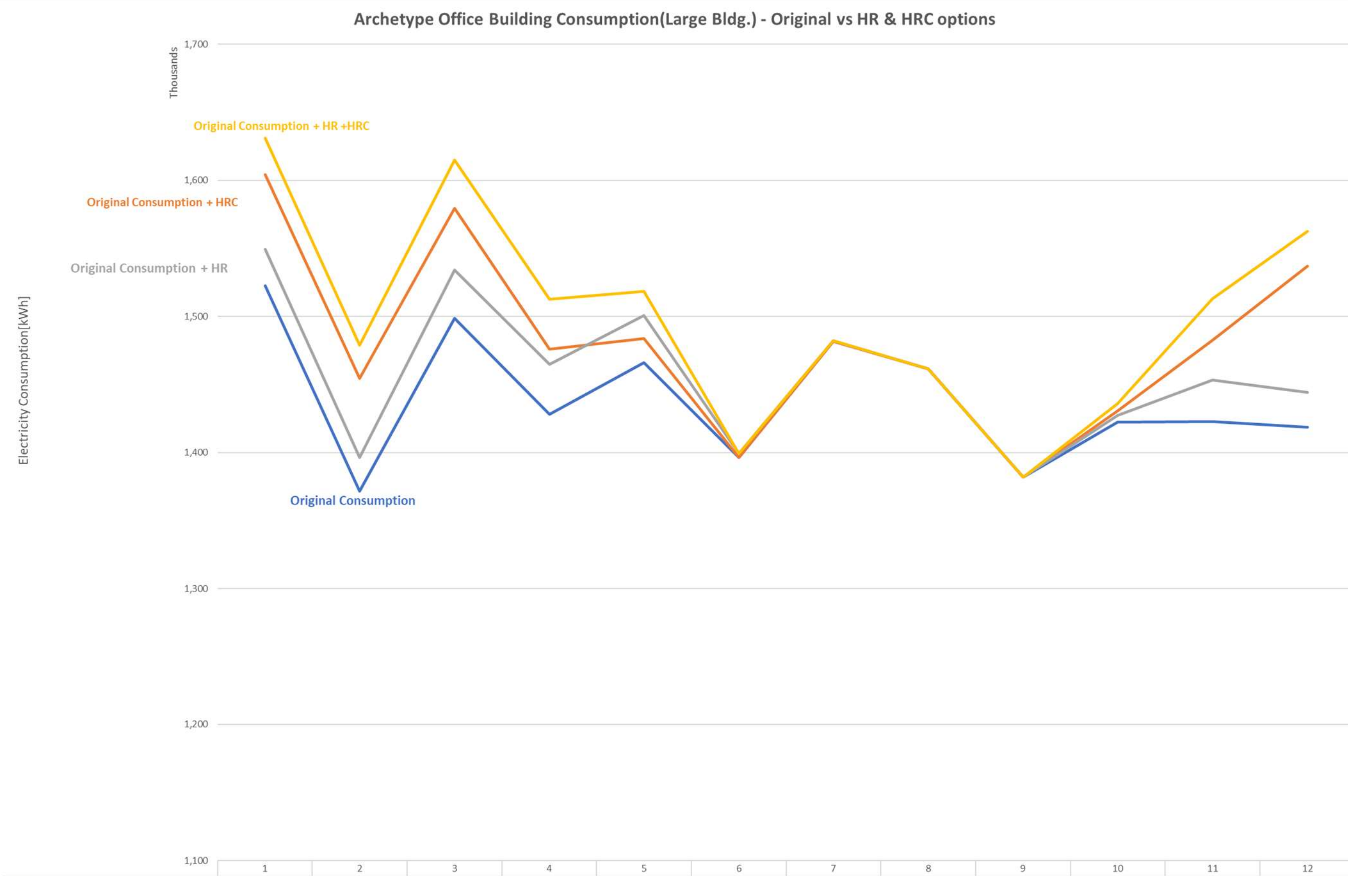
Figure B 1 Archetype office building consumption 2019 vs 2022/2023 vs HR & ASHPS



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019 Electricity Demand (kW)	628	667	675	558	635	705	809	715	693	720	629	664
2022-2023 Electricity Demand (kW)	529	566	493	527	576	601	668	632	595	493	484	542
Total Electricity Demand (kW)	817	854	781	763	782	640	707	671	634	730	772	830
Electricity + HR (kW)	568	605	532	567	615	640	707	671	634	532	523	581
Electricity + ASHP Boilers Demand (kW)	777	815	742	723	743	601	668	632	595	691	733	791
% kW Change vs. 2022/2023 (including HR + ASHPs)	54%	51%	58%	45%	36%	7%	6%	6%	7%	48%	59%	53%

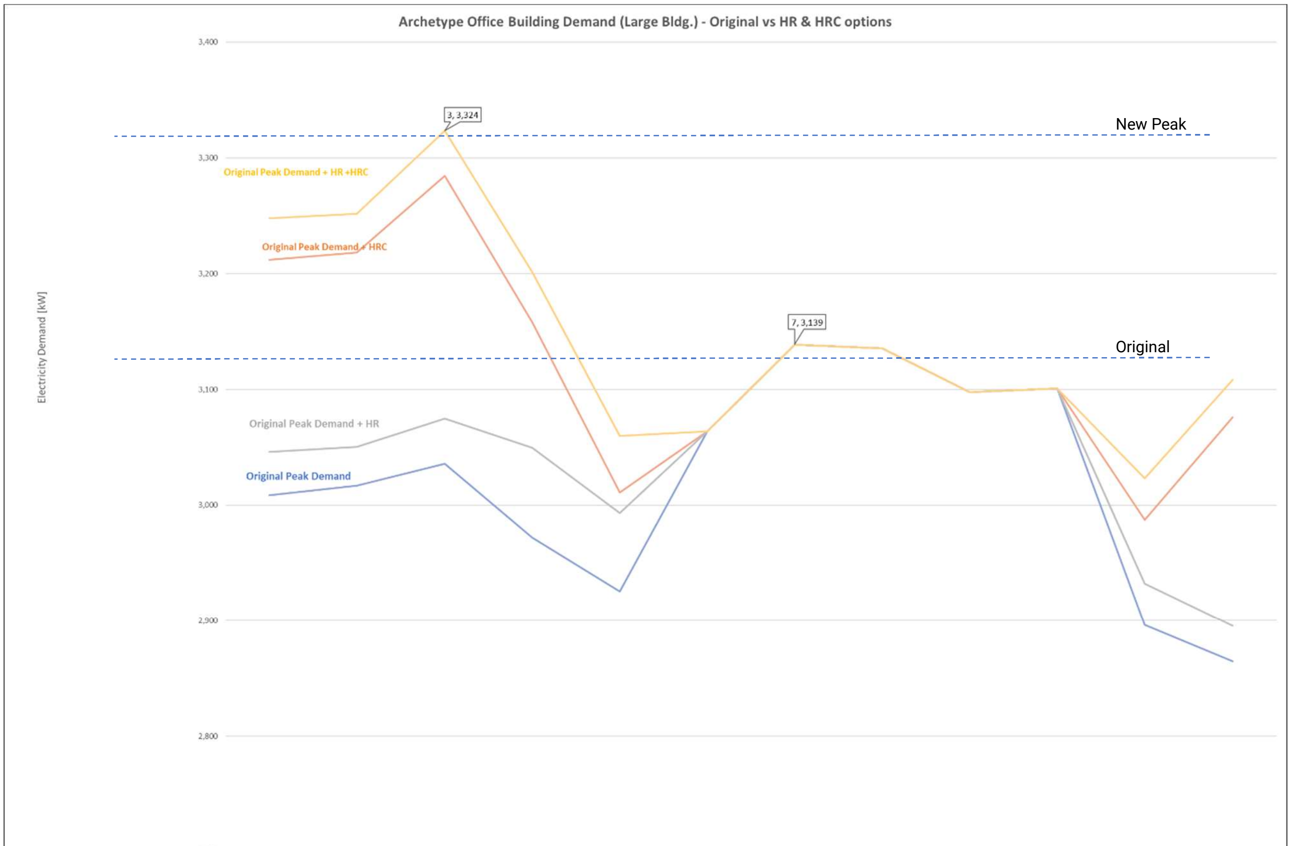
Figure B 2 Archetype office building demand 2019 vs 2022/2023 vs HR & ASHPS

Office Buildings (large size)



	1	2	3	4	5	6	7	8	9	10	11	12
Original Electricity Use (kWh)	1,522,385	1,371,614	1,498,705	1,428,319	1,466,180	1,396,370	1,481,869	1,461,754	1,382,131	1,422,331	1,422,992	1,418,645
Electricity Use (kWh) + HR (Wheel + WSHP)	1,604,090	1,454,374	1,579,387	1,476,182	1,483,687	1,396,370	1,481,869	1,461,754	1,382,131	1,430,758	1,482,612	1,536,879
Electricity Use (kWh) + HRC	1,549,242	1,396,209	1,534,224	1,464,842	1,500,847	1,399,146	1,482,348	1,461,754	1,382,131	1,427,425	1,453,312	1,444,300
New Electricity Use (kWh)	1,630,947	1,478,969	1,614,906	1,512,704	1,518,354	1,399,146	1,482,348	1,461,754	1,382,131	1,435,852	1,512,931	1,562,534

Figure B 3 Archetype office building consumption (large bldg.) - Original vs HR vs HRC options



	1	2	3	4	5	6	7	8	9	10	11	12
Original Electricity Peak Demand (kW)	3,008	3,017	3,036	2,972	2,925	3,064	3,139	3,135	3,097	3,101	2,896	2,865
Electricity Peak Demand (kW) + HR (Wheel + WSHP)	3,212	3,218	3,284	3,158	3,011	3,064	3,139	3,135	3,097	3,101	2,987	3,076
Electricity Peak Demand (kW) + HRC	3,046	3,050	3,075	3,049	2,993	3,064	3,139	3,135	3,097	3,101	2,932	2,896
New Electricity Pead Demand (kW)	3,248	3,252	3,324	3,201	3,060	3,064	3,139	3,135	3,097	3,101	3,023	3,108

Figure B 4 Archetype office building demand (large bldg.) - Original vs HR vs HRC options

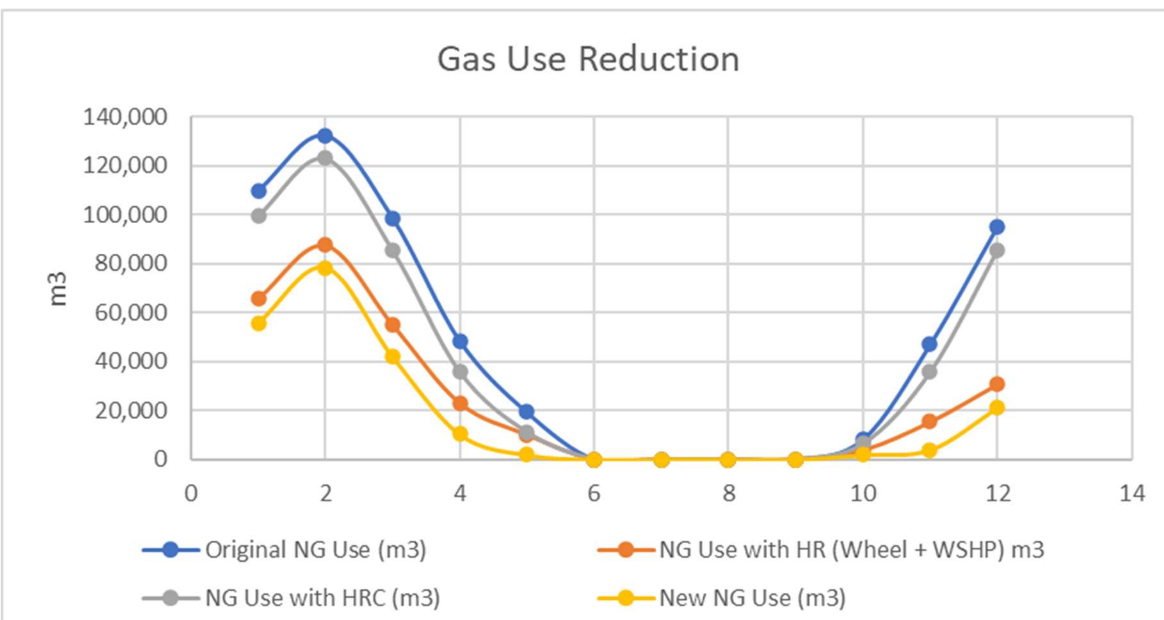


Figure B 5 Archetype office building consumption (large bldg.) - Original vs HR vs HRC options

Gas use reduction

Schools

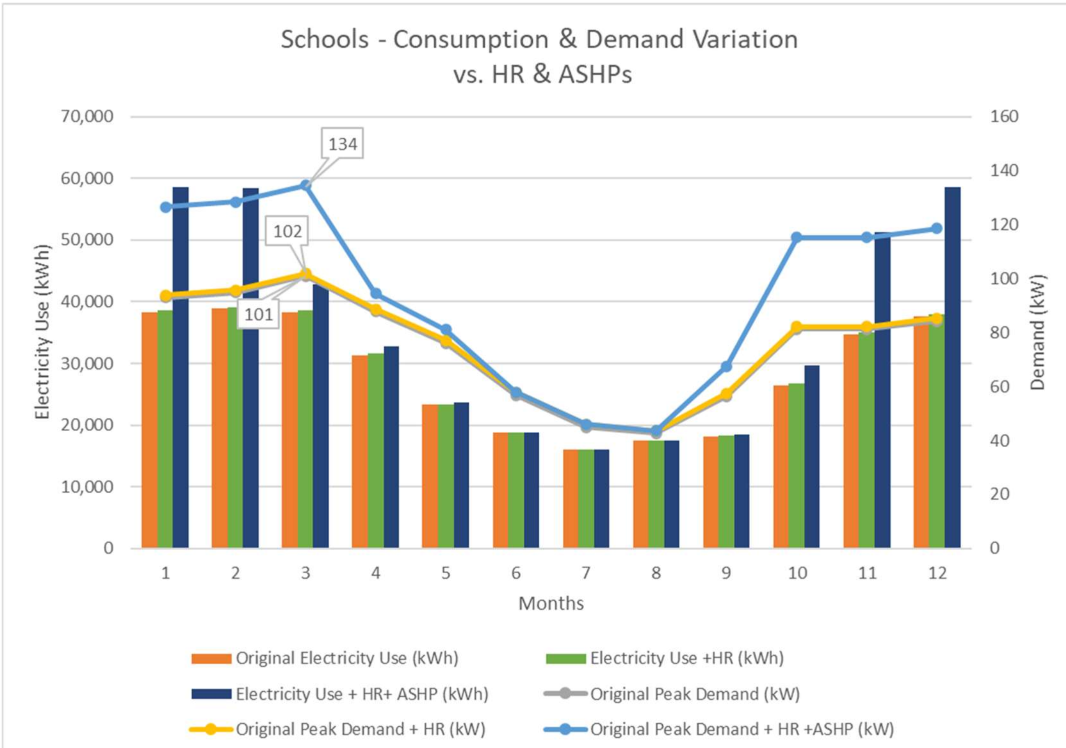


Figure B 6 Schools – Consumption & demand variation vs HR & ASHP

Hospitals

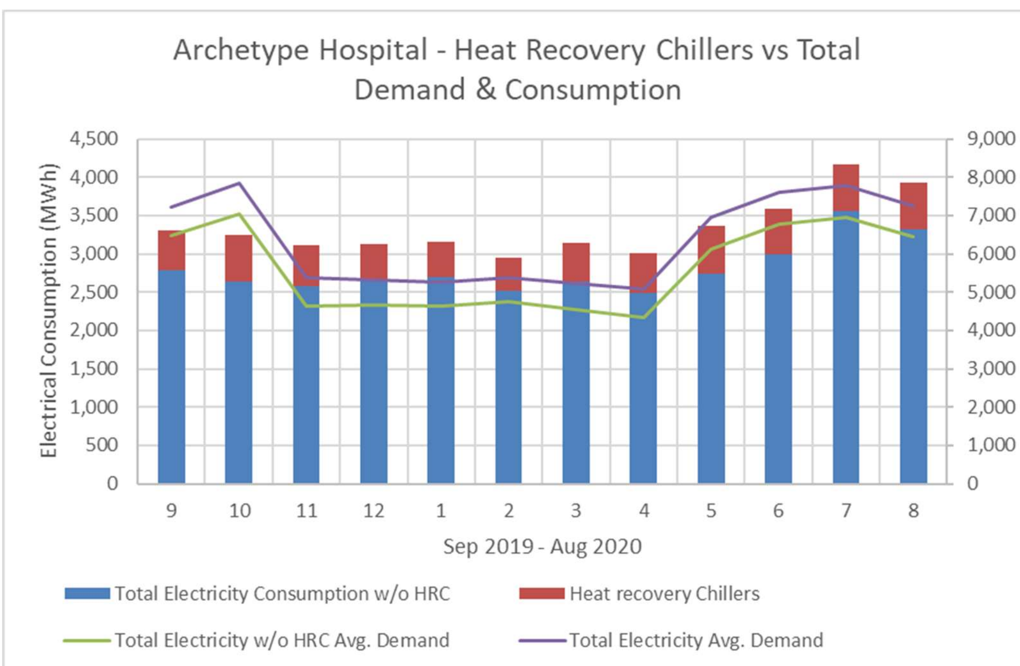


Figure B 7 Archetype hospital – Heat recovery chiller vs total demand & consumption

Appendix C - A Comparison - Original Toronto Hydro Load Forecast vs Alternative Load Forecast Scenario One

Tables C1, C2 and C3 show the percentage variance of Annual kWh, Annual billing kW and Distribution Coincident System Peak in kW.

The key observations from this comparison are:

- The 2025 to 2029 Commercial CDM savings forecast based on Enerlife's industry expertise and recent empirical data from buildings in Toronto is primarily consistent with Toronto Hydro's load forecast presented in its evidence.
- The noticeable difference in the CSMUR class can be explained by:
  - While Toronto Hydro did not apply any CDM variable to the CSMUR class in its load forecast, Enerlife is expecting that the multi-residential condo/apartment buildings in Toronto will see a 11% reduction in electricity usage by 2029.
  - Given the small size of the CSMUR rate class, the noticeable variance in this class does not change the overall picture – that the two forecast are materially the same.
- The CDM savings embedded in both forecast are generally consistent with the IESO 2019 APS, its subsequent 2022 APS Refresh and the 2024 Annual Planning Outlook (released in March 2024).

C 1 Annual kWh Consumption - Alternative Forecast Scenario 1 compared to Toronto Hydro Original forecast in Percentage Variance

Weather Corrected kWh per year	Actual	Bridge Year			Forecast		
Rate Class	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CSMUR	0.0%	-1.9%	-3.7%	-5.5%	-7.3%	-9.1%	-10.9%
GS < 50 kW	0.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.4%
GS 50-999 kW	0.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.4%
GS 1000-4999 kW	0.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.4%
Large User	0.0%	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.4%
Street Lighting Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unmetered Scattered Load Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL Toronto Hydro	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.4%	-0.5%

C 2 Annual Billing kW - Alternative Forecast Scenario 1 compared to Toronto Hydro Original forecast in Percentage Variance

Weather Corrected Billing* kW per year	Actual	Bridge Year	Forecast				
Rate Class	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Residential**	-						
CSMUR**	-	-	-	-	-	-	-
GS < 50 kW**	-	-	-	-	-	-	-
GS 50-999 kW	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
GS 1000-4999 kW	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
Large User	0.0%	-0.1%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
Street Lighting Connections	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unmetered Scattered Load Connections**	-	-	-	-	-	-	-

** Billing kW not available for rate classes that are not demand billed

C 3 Winter and Summer Peak - Alternative Forecast Scenario 1 compared to Toronto Hydro Original forecast in Percentage Variance

	2025 Winter Peak	2026 Winter Peak	2027 Winter Peak	2028 Winter Peak	2029 Winter Peak	2025 Summer Peak	2026 Summer Peak	2027 Summer Peak	2028 Summer Peak	2029 Summer Peak
Coincident Peak (kW)	January	January	January	January	January	August	August	August	August	August
RES	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CSMUR	-3.7%	-5.5%	-7.3%	-9.1%	-10.9%	-3.7%	-5.5%	-7.3%	-9.1%	-10.9%
GS<50	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
GS50-999	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
GS1-5MW	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
Large User	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%	-0.1%	-0.2%	-0.3%	-0.5%	-0.6%
SL	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	-
USL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	-0.2%	-0.3%	-0.4%	-0.5%	-0.7%	-0.2%	-0.2%	-0.3%	-0.5%	-0.6%

Appendix D - Glossary of Terms

ASHP	Air Source Heat Pump
APS	Achievable Potential Study
BAS	Building Automation System
BOMA	Building Owners and Managers Association
BPS	Broader Public Sector
CDM	Conservation and Demand Management
COP	Coefficient of Performance
CRE	Commercial Real Estate
CSMUR	Competitive Sector Multi-Unit Residential
CT	Carbon Taxes
EUI	Energy Use Intensity
EWRB	Ontario's Energy and Water Reporting and Benchmarking
GBPS	Green Building Performance System
GHC	Greening Healthcare
GHGs	Greenhouse Gases
HR	Heat Recovery
HRC	Heat Recovery Chiller
IESO	Independent Electricity System Operator
K-12	Kindergarten to 12^{th} Grade
LDC	Local Distribution Company
LED	Light Emitting Diode
OEB	Ontario Energy Board
P4P	Pay for Performance
SEM	Strategic Energy Management
SL	Streetlights
TDSB	Toronto District School Board
USL	Unmetered Scattered Load

VFD	Variable Frequency Drive
WSHP	Water Source Heat Pumps

Appendix E – CVs

IAN JARVIS BSc, PEng

President, Enerlife Consulting Inc., 2001 to present
ian.jarvis@enerlife.com 416-915-1530 ext. 203

SUMMARY OF PROFESSIONAL EXPERIENCE

Enerlife's founder and president since 2001, Ian Jarvis is a recognized business leader and authority on energy conservation, green buildings and sustainable communities. Ian has been at the leading edge of practice and research of high-performance buildings for more than three decades. He was the founding Chair of the Canada Green Building council and co-chair of Civic Action's Race to Reduce. Ian provides strategic and technical advice to Enerlife's projects and clients, forms and leads Integrated Building Performance Teams, and brings unique knowledge and experience of achieving and sustaining exceptional performance in individual buildings and portfolios. He is an expert witness in regulatory hearings and advises governments and utility companies on policy and program design and evaluation. Ian has served on advisory boards for the Ontario Energy Board and the Independent Electricity System Operator. He is an accomplished speaker and workshop leader.

Ian is the principal architect of Enerlife's evidence-based building performance diagnostic, management and reporting methodology, tools and online system. His knowledge is grounded in over 30 years of experience designing, implementing and measuring savings in energy efficiency projects in a wide range of building types for clients in the municipal, commercial, school board, healthcare, and multi-unit residential sectors.

Ian co-chaired the working group for Civic Action's Race to Reduce from 2013-2016, a large-scale, collaborative program among landlords and tenants which is substantially improving the energy and environmental performance of office buildings. He has served as an adjudicator of the NAIOP REX Green Award for commercial buildings. In 2015, he received the Leader Award from the Canada Green Building Council's Greater Toronto Chapter.

From 1992 to 1999 Ian was CEO of a leading energy performance contractor responsible for many of the largest energy retrofit projects in North America. Ian served as founding chair of the Canada Green Building Council from 2003-2007, and as a director of Milton Hydro, one of the most progressive local electric distribution utilities in Ontario, from 2000-2007.

Ian represented the energy efficiency industry on the 1998 Team Canada trade mission to South America and was the Canadian Government's invited private sector representative at the 1999 Hemispheric Energy Ministers' Conference in New Orleans. In 2001 he was a member of Premier Hamm's expert panel advising the Nova Scotia Government on energy policy alternatives.

HIGHLIGHTS OF EXPERIENCE

- Over 30 years of experience at the leading edge of energy performance in buildings
- Principal architect of performance-based conservation methodology as an evidence-based approach for achieving and sustaining exceptional energy efficiency in buildings

AREAS OF SPECIALIZATION

- Vision and strategy development
- Authority on evidence-based energy conservation in buildings
- Portfolio and sectoral program design
- Author of thought leadership articles & reports
- Leadership of multi-disciplinary workshops and project teams
- Keynote addresses and speaking engagements

PROFESSIONAL AFFILIATIONS

- Founding Chair, Canada Green Building Council (2003 – 2007)
- Member, National Advisory Council on Energy Efficiency (1999 – 2015)
- Member, Ontario Energy Minister's Advisory Committee (2006 – 2011)
- Professional Engineers Ontario

ACADEMIC QUALIFICATIONS

- Bachelor of Science (Honours), Mechanical Engineering, Imperial College of Science and Technology, University of London

REPRESENTATIVE PROJECTS

Climate Challenge Network Programs

Concept design, development and ongoing executive oversight of large-scale energy conservation potential studies and program delivery, that use actual energy data to drive performance improvement, including:

- Greening Health Care (since 2004) with hospitals
- Mayors' Megawatt Challenge (since 2003) with municipalities
- Sustainable Schools (since 2005) developing and distributing an annual report on the energy and water performance and savings potential of all Ontario school boards
- Post-Secondary Climate Challenge (since 2021) working with colleges and universities across Ontario on identifying and acting on energy savings opportunities

City of Toronto Strategic Energy Management Pilot Program

As part of the City of Toronto's Green Will Initiative, Enerlife developed curriculum to support mid-sized commercial office and multi-residential buildings in reducing greenhouse gas emissions. Together with the project's Executive lead, Ian developed and delivered a series of six workshops and provided one-on-one coaching to program participants, serving to support target-setting and action on reducing emissions.

Hospital Projects

Ian has been directly responsible for all Enerlife assignments related to new hospital development over the past 5 years, including the West Park and South Niagara Hospital design projects, working as specialist advisor to hospital management. Between 2014-2017 he was the project lead for assignments with Baycrest, Muskoka Algonquin and Orillia Soldiers' Memorial leading to resolution of guaranteed savings disputes. He is the principal responsible for the Markham Stouffville, West Park and Alberta Health Services projects.

Oxford Properties

Ian directed the technical content for the Sustainable Intelligence Operations Guide for Office Buildings, their corporate manual for enhancing the environmental performance of Oxford's commercial and multi-residential properties. Ian was the Senior Technical Lead and Project Lead for the development of Net Zero Carbon Analysis for Oxford Properties. He led the development of Oxford Properties Net Zero Model, a structured analytical model that outlined how their global commercial office, retail and hotel portfolio could achieve a global real estate portfolio emissions reduction target aligned with a science-based target.

Town of Halton Hills Corporate Energy Plan

For the Town of Halton Hills Corporate Energy Plan 2019-2024 update, Ian oversaw building performance evaluation and analysis to recommend strategic actions to achieve the Town's overall goals as well as building-specific low-carbon targets based on in-depth review of the municipality's facilities.

Town of Caledon GHG Reduction Plan

Ian provided expert advice and strategic direction on energy efficiency for the Town of Caledon's Conservation Demand Management plan and Corporate GHG Reduction Framework.

Alberta Health Services

Led the development of comprehensive, achievable and actionable multi-year plans for delivering the energy and water consumption, economic and emissions reduction potential for over 200 hospitals across Alberta.

City of Toronto Energy Conservation and Demand Management Plan

Strategic direction for the development of City of Toronto Energy Conservation and Demand Management Plan 2014-2019, applying an evidence-based approach to establishing savings potential across all City of Toronto buildings.

Simcoe County District School Board

Since 2010, Ian has led the multi-year master planning, development and deployment of their comprehensive, data-driven program focused on achieving targeted energy performance standards in high-potential schools. The phases of work included the 2017-18 school ventilation upgrade project for 22 schools which resulted in energy savings of close to $500,000/year and led to the board's steady progress up the Sustainable Schools ranking of Ontario school boards.

Public Sector Energy Conservation and Demand Management Plans

Ian directs the preparation of concise, consistent, evidence-based plans for achieving top-quartile energy performance for hospitals, K-12 schools, municipalities and 615 New York State nursing homes.

Energy Program Design and Regulation

Ian is a recognized authority on measurement and verification of energy savings. He served as a member of the joint IESO/OEB advisory committee examining conservation potential in Ontario and represents building owners in regulatory hearings on energy savings incentive programs. He advised Enbridge and the IESO on development of their performance-based incentive programs and is a member of the OEB's working groups addressing Green Button implementation and Distributed Energy Resources.

PUBLICATIONS & RESEARCH

"High Efficiency Rooftop HVAC Unit Replacements" White paper for IESO and Climate Challenge Network, 2023

"Strategic Energy Management (SEM) for School Board Portfolios: The School Board's Guide to the Biggest Energy and Emissions Reductions" White paper for IESO and Climate Challenge Network, 2023

"Using Performance Metrics to Deliver Highly Energy Efficient Healthcare Facilities" White paper for IESO and Climate Challenge Network, 2022

"SUS Top Energy Performing Boards Report" Annual Report for Climate Challenge Network, supported by IESO and Enbridge, 2009 - 2022

"2022 Update on Energy Performance of Ontario's New Hospitals: Working Towards World-Class Energy Efficiency in Hospitals" White paper for IESO and Climate Challenge Network, 2022

"Humber River Hospital: A Case Study in World-Class Energy Efficiency" Case study for IESO, Enbridge, Thermogenics and Sustainable Buildings Canada, 2021

"Getting to 20: Achieving 20 ekWh/sf/year in Town/City Halls by 2015" White paper for Toronto and Region Conservation Authority, 2013

"Where the Green Jobs Are: Harnessing the Energy Conservation Potential in Buildings" White paper, 2011

"20 by '15: Achieving the Office Building Target of 20 ekWh/ft2/year by 2015" White paper for the Real Property Association of Canada, 2009

"Closing the loops: How real building performance data drive continual improvement" Article for Intelligent Buildings International journal, 2009

"A Deeper Shade of Green" Article for ReNew Canada: The Infrastructure Renewal Magazine, 2007

"Realizing the Electricity Conservation potential in Ontario's Private Rental Housing Sector" Study for the Ontario Power Authority, 2006

National study for Natural Resources Canada into actual versus modeled energy performance of buildings designed under the federal CBIP program, 2004

"Making Ontario the Leader in Energy Efficiency" (Co-author) A study for the Ontario Ministry of Energy, which became the foundation document for Ontario's Green Energy Act, 2003

"Sustainable Peterborough" A guide to sustainable communities sponsored by the Government of Canada, 2002
"The SUMAC System: Relentless Progress Towards Optimum Energy Use in Buildings" Presentation to the CIB Congress in Stockholm, Sweden, 1983.

CLEMENT LI MASc, BEng

Director, Policy & Regulatory Development, Enerlife Consulting Inc.
2024 to present
cli@enerlife.com 416-915-1530

SUMMARY OF PROFESSIONAL EXPERIENCE

With over 30 years of experience in Ontario's electricity industry, Clement has broad knowledge of related regulatory practice and policies, including Ontario Energy Board (OEB) and Canada Energy Regulator (CER) framework, codes and orders, rate setting and leave to construct filing requirements, Independent Electricity System Operator (IESO) market rules and government legislation and regulations. Clement has an outstanding track record of collaboration with all levels in the organization and other stakeholders to achieve results that are aligned with corporate goals and strategies.

In his role as Director, Policy & Regulatory Development at Enerlife, Clement leads the representation of commercial building owners and the Building Owners and Managers Association (BOMA) with the Ontario Government, OEB and the IESO. He plays a crucial role in aligning public policy, codes, regulations and programs with our clients' framework for achieving and sustaining high levels of energy efficiency and decarbonization in commercial, institutional and multi-residential buildings.

Clement's past experience at Hydro One involves providing evidence and testimony for regulatory hearings, special committees and consultation sessions, conservation demand management program design and implementation, transmission and distribution cost allocation and rate design, managing regulatory compliance activities, as well as providing expert guidance and advice to senior management and internal/external stakeholders.

Clement serves on Canadian Standards Association's technical committees (HVAC and Refrigeration, and Residential Equipment), reviewing current and proposing new standards.

RELEVANT PROJECTS

Building Owners and Managers Association (BOMA)

Clement represents BOMA with the Ontario Government, OEB and the IESO.

Cadillac Fairview

Enerlife directs an integrated, multi-year continuous performance optimization project for Cadillac Fairview's commercial office buildings, including Simcoe Place, Yonge Corporate Centre, RBC Centre, and TD Centre. Clement's role includes aligning public policy, codes, regulations and programs with the goals and objectives of the performance optimization project, as part of Cadillac Fairview's larger framework for decarbonization of their portfolio.

HIGHLIGHTS OF EXPERIENCE

- Over 30 years of Ontario electricity industry experience
- Regulatory policy research, development, and analysis
- Conservation and demand management regulatory frameworks, policy and programs

AREAS OF SPECIALIZATION

- Ontario electricity industry regulatory practice and policies: Ontario Energy Board, Canada Energy Regulator, Independent Electricity System Operator
- Conservation and demand management (CDM) analysis
- Transmission and distribution cost allocation, rates and load forecasting models and methodologies
- Expert advice, strategy and guidance

PROFESSIONAL AFFILIATIONS

- Canadian Standards Association Technical Committee Member

ACADEMIC QUALIFICATIONS

- Master of Applied Science, Mechanical Engineering, Dalhousie University
- Bachelor of Engineering, Dalhousie University

Sustainable Schools

With his experience introducing cold-weather heat pumps into Ontario, Clement is providing direction and expert advice for Sustainable Schools' cohort research projects focusing on air-source heat pump research.

Regulatory Affairs and Program Design and Development

In his roles as Senior Regulatory Advisor and Manager, Transmission & Distribution Rates at Hydro One, Clement acquired deep expertise in regulatory and compliance activities. He provided evidence and testimony for numerous regulatory hearings at the Ontario Energy Board, led CDM program design and implementation (including introducing the first cold climate heat pump CDM program in Ontario), and was responsible for producing regulatory reporting and financial disclosures for the Board of Directors, the OEB and the provincial government.

Asset Management Regulation

In his role as Manager of Asset Management Regulation at Hydro One, Clement provided regulatory support for distribution rate applications. He authored the first Green Energy Plan for Hydro One Distribution, provided strategic support to the IESO Technical Panel on market rules related matters, and developed and evaluated an integrated resource planning pilot for Hydro One Distribution planning process.

Load Management

In his role as Senior Advisor at Hydro One, Clement represented Hydro One on the OEB cost allocation study Local Distribution Company (LDC) working group, defined load data requirements for Hydro One and other Local Distribution Companies, and ensured effective implementation of new distribution rates. He successfully developed, implemented and managed the Hydro One load data management/settlement system for the 2002 Ontario electricity market opening.