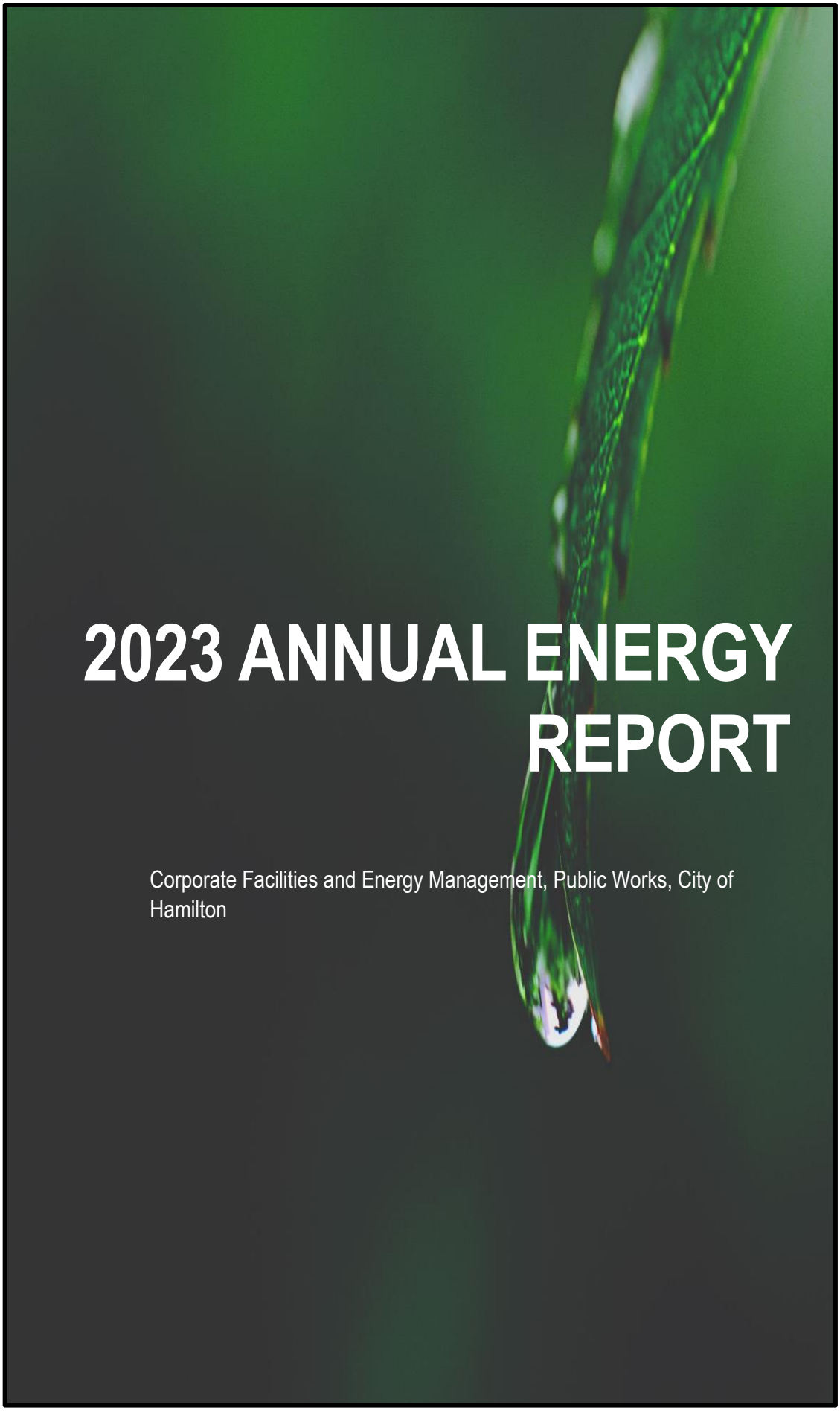


2023 ANNUAL ENERGY REPORT

Corporate Facilities and Energy Management, Public Works, City of Hamilton

Results of energy usage, energy savings and avoided energy costs, conservation and generation activities. commodity hedging comparisons and GHG emissions inventory

CONTENTS

EXECUTIVE SUMMARY

The City of Hamilton has been reporting on its annual energy data and related energy reductions, conservation activities and emissions data for several years. Over the past several years, climate change and climate action has been embedded in many of the decisions made by the City, both in its development of the Office of Climate Initiatives and its community policies, as well as with the already established policies, plans and projects across its corporate building and fleet assets.

In August 2024, the City also released its five year Conservation Demand Management Plan[1] as per O.Reg 25/23 that highlight the key areas of focus for next five years to continue moving corporate facilities toward its targets. These actions include energy generation, conservation and GHG mitigation.

Reducing energy use and emissions has been the catalyst for the City's Pathway to Net Zero activities and resulting conservation and generation projects.

The 2023 Annual Energy Report is presented in 3 parts:

1) PART 1: ANNUAL ENERGY REPORT RESULTS
2) PART 2: CORPORATE REPORT ON COMMODITY HEDGING AND RATE ACTIVITIES
3) PART 3: CORPORATE GREENHOUSE GAS (GHG) EMISSIONS INVENTORY REPORT

The Annual Energy Report provides data for the City's corporate energy and fleet usage, utilities and fuel costs, energy intensity results, conservation, and a variety of other key performance indicators (KPIs). These KPIs include savings and avoided costs for different energy and cost reduction programs, strategies, and benchmarks.

The 2023 Annual Energy Report will now also include the Corporate Report on Commodity Hedging and Rate Activities outlining the results on commodity hedging, utility rate optimization and related comparisons to set benchmarks. Previously this data had been provided in a separate report, *Annual Report on Energy Commodity Price Hedging.* The Corporate Energy and Sustainability Policy (PW14050(a)) stipulates those details on energy commodity hedging agreements, other utility and commodity contracts and results be reported at least once annually. Recognizing the overlap of energy details in both reports, inclusion of this information as a section within the Annual Energy Report aligns the requirements of the policies with an effort to eliminate redundancy.

Also included in this report is the Corporate Greenhouse Gas (GHG) Emissions Inventory Report for 2023. Previous reporting on the corporate emissions inventory were one year behind other reporting metrics. However, the data timelines have now aligned with the annual reporting and the information is now available. These timelines also align with the newly updated Broader Public Sector reporting requirements outlined as Ontario Regulation 25/23. Results submitted as part of that reporting is included in the appendices of this report.

[1] City of Hamilton Conservation and Demand Management Plan is available: https://www.hamilton.ca/home-neighbourhood/environmental-stewardship/environmental-plans-strategies/office-energy

2023 RESULTS HIGHLIGHTS

Overall annual Utility Energy Spend of $46.7 M for Electricity, Natural Gas, and Fuels	$4.3M in Conservation Savings and Incentives for 2023
Electricity use increased by 2% and Natural Gas use increased by 3% compared to 2022	Active energy efficiency projects reduced emissions by 1,546 t CO2e in 2023
Energy Intensity reductions decreased to 29% lower than 2005 base year	Fuel costs fell by 24% while Fuel usage rose by 7% compared to 2022

Figure 1: Lister Block facility

CORPORATE ENERGY AND SUSTAINABILITY POLICY

One of the tools used to guide decision making around energy use reduction, sustainability, emissions and reporting for corporate assets and operations is the Corporate Energy and Sustainability Policy[2]. The policy was revised in 2020 and was accepted by Council in February 2021. The Policy revisions aimed to further re-iterate the importance of considering energy and sustainability decisions in capital planning, and to align it with other City-wide initiatives including other corporate and community-based plans, such as addressing climate change, renewable energy and Fleet and Transit policies.

The existing policy confirms Corporate energy intensity targets and GHG emissions reduction targets to achieve Net Zero emissions by 2050. In addition, further actionable items are defined in the areas of building operations efficiency, sustainable building and Net Zero new construction, and operational set points and improvement measures.

The targets in the 2020 policy include:

Table 1: Corporate Energy Intensity and Emissions Reduction Targets

Year	Energy Intensity Reduction Targets	Emissions Reduction Targets
2020	20%	20%
2030	45%	50%
2050	60%	100%*

*Net zero emissions

The policy document is revised every five years to ensure that it remains relevant to the existing regulatory environment and to other City-endorsed policies or initiatives on energy reduction and sustainability. The policy will begin its 5-year review in 2024. The review will look to incorporate more specific policies around the Pathway to Net Zero initiatives, green building for new construction of City facilities and inclusion of recently developed policies and best practices.

[2] Corporate Energy & Sustainability Policy is available: https://www.hamilton.ca/home-neighbourhood/environmental-stewardship/environmental-plans-strategies/office-energy

PART 1: ANNUAL ENERGY REPORT RESULTS

ENERGY STRATEGIES & PROGRAM KPI RESULTS

The City continually tracks and reports on a variety of the key performance indicators (KPI) to measure the City's successes and identify areas for improvement. These metrics have been instrumental in the evaluation of results from decisions made or strategies developed to meet different City goals and targets.

Although costs may be impacted by many outside factors, cost reduction and the avoidance of costs are a result of specific energy-related strategies and programs implemented by the City. Energy conservation projects, utilizing incentive programs, bill recovery from reviewing utility invoices or tax rebate programs, and utility rate optimization are a few of the methods used to contribute to annual cost savings or mitigation of energy costs for the City.

Overall, the total results from implementing the various energy strategies and programs in 2023 has resulted in a cumulative savings and avoided costs of $10.5M. This is calculated from utility rates, cost recovery and energy conservation project incentives.

UTILITY RATES AND COMMODITIES STRATEGY

This category reports the results of the electricity and natural gas costs that would have been incurred by the City had no action been initiated to reduce costs. Actions include procurement strategies, natural gas hedging strategies and optimizing utility rates including switching rate class to increase benefits from Global Adjustment (GA) savings opportunities. Natural gas hedging strategies amounted to an avoided cost of $854K for 2023 when compared to its benchmark. GA strategies resulted in an avoided cost of $5.2M for 2023. The total avoided costs under this category $6.1M in 2023. This category is discussed in greater detail under Part 2: Corporate Report on Commodity Hedging and Rate Activities as it pertains directly to the risk management activities for utility rates and commodities.

COST RECOVERY

This category reports on the results of costs recovered due to the City's continuous efforts to review its utility accounts to correct any billing errors, as well as recover credits from fuel tax recovery programs. In 2023, the consistent review of the City's accounts and of corrected estimated billings resulted in $145K of savings for this metric.

ENERGY CONSERVATION AND INCENTIVE PROGRAMS

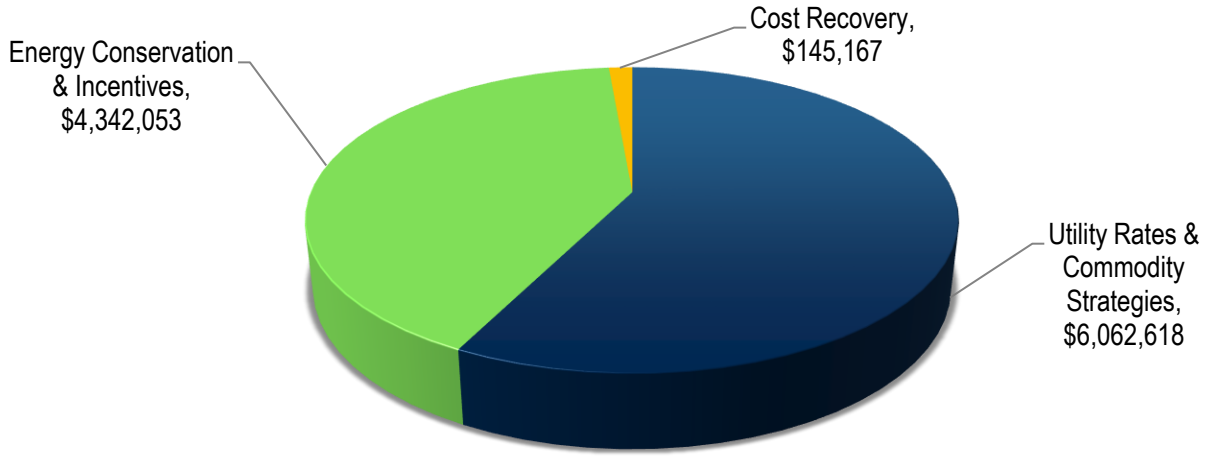
This category reports the results of the savings achieved from implementing energy efficiency measures, equipment and processes within the City's building assets that lead to reductions in energy consumption as well as financial incentives received for completing those projects. Incentives in this context refers to those from utility providers, the Independent Electricity System Operator (IESO) or provincial or federal funding options that are provided to eligible energy efficiency projects. The energy efficiency project savings for 2023 was $4.2M, with incentives received of $98K, for a total savings of $4.3M in this category. Project savings include projects completed in previous years as the project benefits continue. Any incentives

applied for, but not confirmed or received by the City, will be reported in the following year's report. Table 2 below shows the annual savings for the past three years reported for this category.

Table 2: Annual Project Savings 3 Years (2021-2023)

	Past 3 Years			2021-2023 Cumulative
	2021	2022	2023	
Energy Conservation (Projects)	$3,853,812	$4,353,341	$4,243,615	$12,450,768
Incentives	$73,292	$215,504	$98,438	$387,233
Totals	$3,927,104	$4,568,845	$4,342,053	$12,838,002

Chart 1: 2023 Breakdown of Cumulative Savings and Avoided Costs



OVERALL UTILITY COSTS

The City tracks costs and consumption to evaluate energy performance, but also to help prepare utility budget for upcoming years. Costs for electricity, natural gas and fuels are compiled and measured against the previous year and compared to the baseline year of 2005. The costs are normalized for usage in the 2023 year. In addition, for the purposes of this report, costs for sites connected to the district energy system (and supplied by HCE Energy Inc.) are included in electricity and natural gas costs.

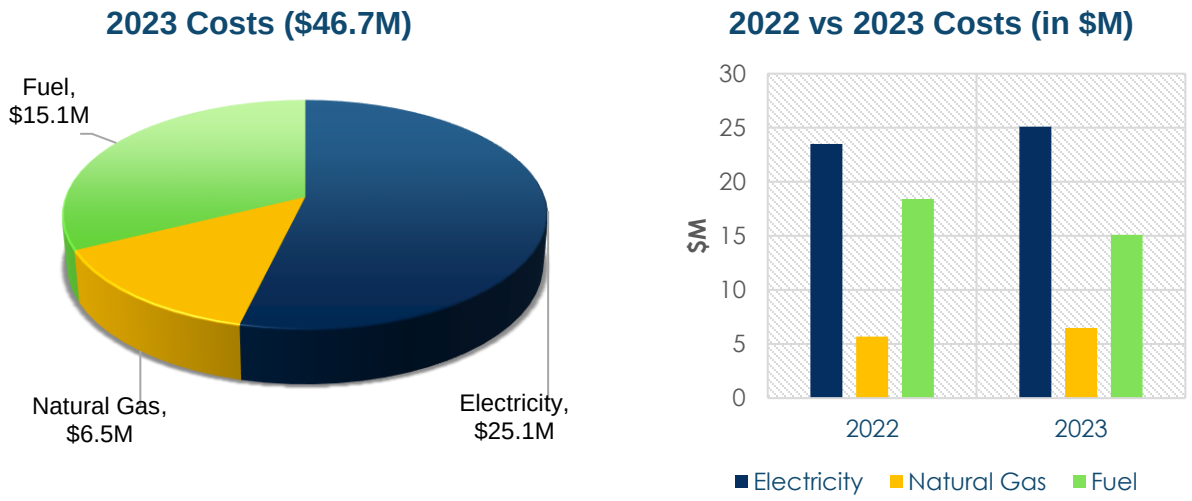
Energy costs are a significant operating budget item for corporate buildings and vehicle assets. Although cost mitigation actions from energy efficiency projects that reduce consumption can have a positive impact on costs, costs themselves are impacted by much more than usage. Regulatory changes, rate changes, inflation, global markets and weather can all impact costs despite reductions in usage. Costs for energy include regulated charges and market-based (commodity) charges.

Costs determined in this report are incurred by City-owned and operated buildings/sites and exclude City Housing Hamilton. Utilities include Alectra Utilities, Hydro One Utilities and Enbridge Gas Inc. Sites linked to the district energy system with utility costs provided from HCE are included in electricity and natural gas

respectively. Fuels include diesel, unleaded gasoline and compressed natural gas (CNG) for all Transit and Fleet operations (excluding Hamilton Police Services or Darts). Sites with partial data may be excluded.

The inclusion of buildings/sites in the report may vary from year to year. In any given reporting period, buildings and vehicles could be added (built or purchased) or removed (sales or demolitions). Major renovations may decommission a site for a time and may be excluded as a full year data set may not be available. As such, square footage is adjusted annually to include only reported sites.

Chart 2: (a) Total Overall Annual Utilities Costs 2023. (b) Compared to 2022



Increased energy use through 2023 and rising carbon tax rates resulted in facility cost increase year-over-year. The City’s hedging strategy limited changes in commodity costs year-over-year, with most of the impact associated with scheduled increases in the carbon tax rate.

Fleet costs declined relative to 2022 as fuel rates declined and the City continued its shift from diesel and unleaded gasoline to lower-cost compressed natural gas (CNG).

Additional information on the impacts will be discussed in upcoming sections of this report. In 2023, the total spend for consumption of electricity, natural gas and vehicle fuels (diesel, unleaded gasoline and compressed natural gas (CNG)) was $46.7 million, a decrease of 2% overall compared to 2022.

ENERGY PERFORMANCE AND KPI RESULTS

Gathering and reviewing data on energy usage and cost is instrumental in understanding trends and decision making for program and project activities within the facilities. This section reviews the comparison results of electricity, natural gas and energy intensity to the prior year (2022) and to the base year (2005).

The energy consumption and costs reported here are period normalized for 2023 and are calculated as usage and cost during the calendar year by site and may or may not coincide with a billing period for any

given account. In addition, the data reported here is for full year data set. If a property is added or removed mid-year it is not included on the reporting.

Additional charts on the results presented in this section are in Appendix A of this report.

ELECTRICITY CONSUMPTION AND COSTS

The table below shows the results for electricity in 2023. Electricity consumption in 2023 was up 2% from 2022 and down -13% from the base year of 2005. The costs and unit price also rose in 2023 when compared to the previous year.

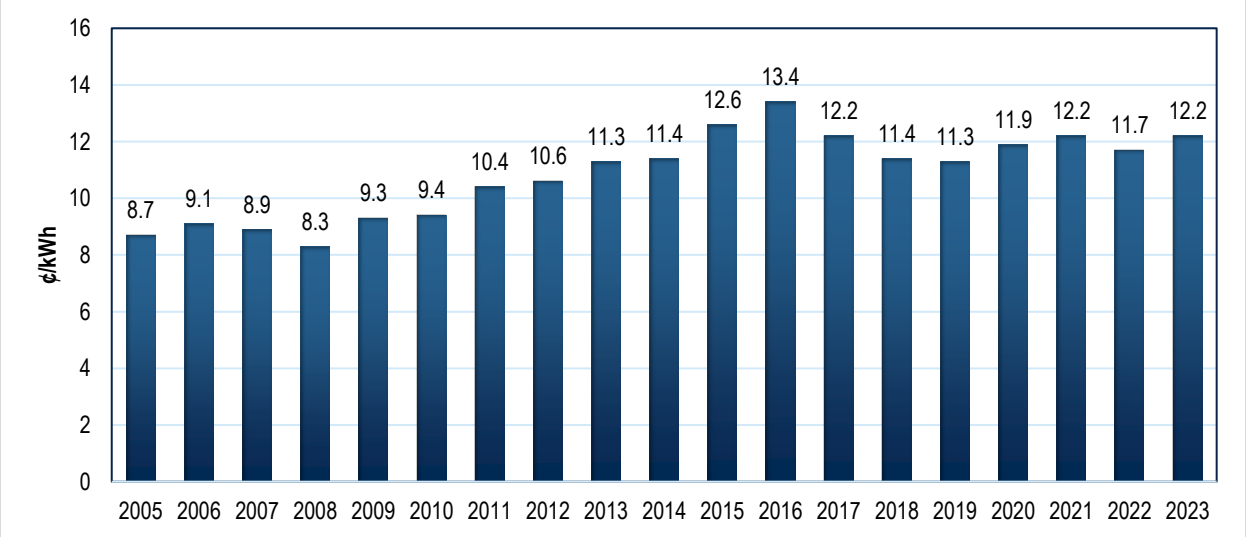
Costs for electricity comprises commodity, delivery, transmission, and other regulatory charges. Commodity includes the Hourly Ontario Energy Price (HOEP) and the Global Adjustment (GA). Both portions of the commodity are determined by market-based factors and are administered by Ontario's Independent Electricity System Operator (IESO). The other charges, delivery, transmission and regulatory are regulated by the Ontario Energy Board (OEB), and any requests by a local utility (also called a local distribution company), to change such rates requires OEB approval. The City of Hamilton operates within two local distribution companies, Alectra Utilities and Hydro One.

Table 3: 2023 Electricity Consumption, Costs and Comparison

	2005	2022	2023	2023 vs 2005	2023 vs 2022
Total Electricity kWh	236,362,045	201,298,489	205,217,111	-13%	2%
Total Electricity Cost $	$20,657,050	$23,501,278	$25,132,616	22%	7%
Total Electricity $/kWh	$0.087	$0.117	$0.122	40%	5%

The City has a variety of rate classes due to the different sizes and needs of power across the City. There are small commercial (or residential) accounts, unmetered or static accounts (i.e. streetlights), large commercial or demand-based rate accounts, and a few high demand (Class A) accounts. The unit cost is a blend of the varying rates and therefore is not necessarily reflective of a specific account.

Chart 3: 2023 City of Hamilton Annual Average Electricity Price (¢/kWh)



The impacts to consumption (and cost) are varying, but typically relate to weather conditions, building capacity, operations, and energy efficiency. The 2% increase in electricity consumption matches a 2% increase in reported square footage for City operations.

NATURAL GAS CONSUMPTION AND COSTS

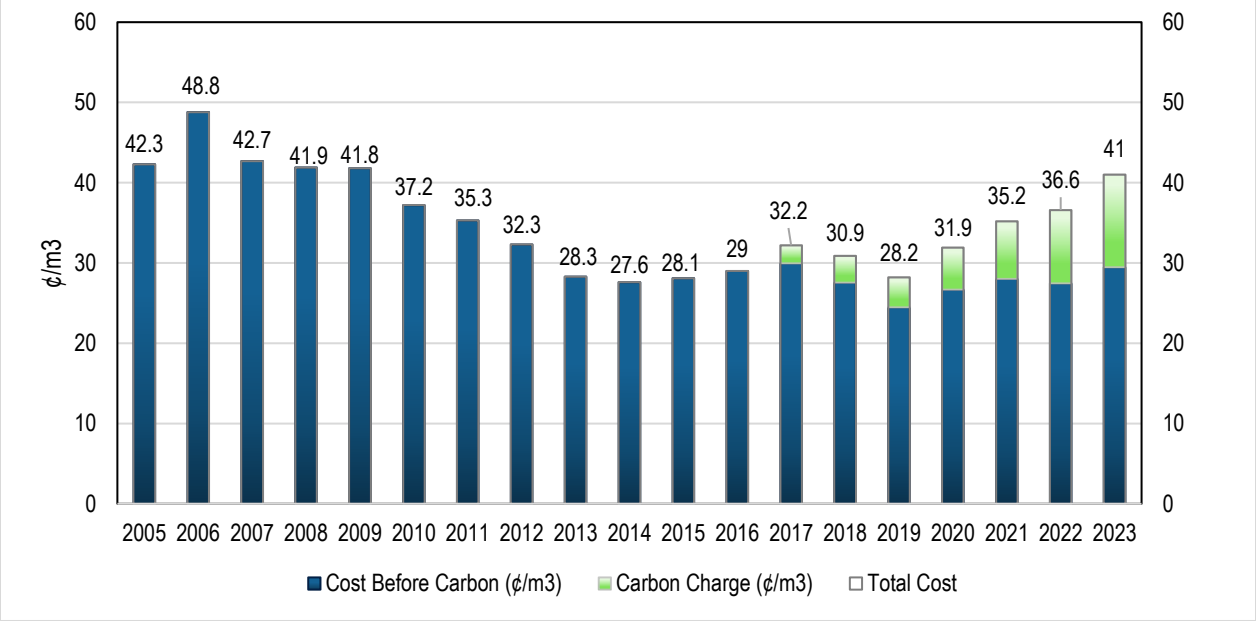
Natural gas results for 2023 are shown in the table below. Natural gas consumption for buildings in 2023 was a 3% increase over both 2022 and the base year of 2005. As with electricity, this consumption increase is largely aligned with the increase in reported square footage for City operations. The heating degree days (HDD) in 2023 for Hamilton were -12% lower than in 2022, which would typically result in lower natural gas consumption. Increases in consumption are in part due to additions in volume for the biosolids production program at the Hamilton Water Woodward site.

Table 4: 2023 Natural Gas Consumption, Costs and Comparisons

	2005	2022	2023	2023 vs 2005	2023 vs 2022
Total Natural Gas m3	15,403,956	15,480,459	15,868,796	3%	3%
Total Natural Gas Cost $	$6,520,253	$5,664,625	$6,492,806	0%	15%
Total Natural Gas $/m3	$0.423	$0.366	$0.409	-3%	12%

Costs for natural gas in 2023 were 15% higher when compared to 2022, and level with the 2005 base year. Costs for natural gas include the commodity charges, which the City purchases on the wholesale market via purchasing agreements, and distribution and transportation charges, which are provided by Enbridge Gas. The gas is delivered to the end user by Enbridge Gas regardless of where the commodity is purchased. A detailed breakdown of the City's natural gas commodity purchases is covered later in this report under Natural Gas Hedging.

Chart 4: City of Hamilton Annual Average Natural Gas Cost – All in (¢/m3)



The largest impact to costs continues to be the annual increase to the Federal Carbon Charge (FCC). The FCC, mandatory for provinces without a designated carbon reduction plan, was implemented in Ontario starting August 2019. The FCC is charged per cubic meter of consumption and is included on Enbridge Gas bills. The FCC increases annually every April and does increase costs as a result. The charge for the January to March 2023 period was 9.79 ¢/m3 and increased to 12.39 ¢/m3 as of April 2023.

COMBINED ENERGY CONSUMPTION AND COSTS

The combined consumption of electricity and natural gas converted to equivalent kilo-watt hours (ekWh) represents a 2% increase over 2022. There is a -8% decrease in consumption when compared to the base year of 2005. Overall, the cost for electricity and natural gas combined increased by 8% over 2022 and increased by 16% compared to the base year.

Table 5: 2023 Combined Energy Consumption, Costs and Comparisons[3]

	2005	2022	2023	2023 vs 2005	2023 vs 2022
Total Combined Energy (ekWh)	400,722,256	361,676,039	369,617,838	-8%	2%
Total Energy Cost $	$27,177,303	$29,165,903	$31,625,422	16%	8%
Total Energy $/ekWh	$0.068	$0.081	$0.086	26%	6%

Collectively, the total numbers show increases in consumption in line with square footage increases as staff are returning back to work. A detailed review of combined consumption information shown by facility grouping in the table below shows declines in 10 City groups. Hamilton Water saw 2023 energy consumption rise by 5% as compared to 2022, due in part to increasing natural gas consumption at the Woodward Biosolids facility which came in operations in 2020.

Table 6: 2023 Combined Energy Consumption by Facility Grouping (000's of ekWh)

	2005	2022	2023	2023 vs 2005	2023 vs 2022
City/Town Halls	13,775	8,662	7,570	-45%	-13%
Corporate Facilities	17,188	10,936	10,900	-37%	0%
Street Lighting	33,602	17,465	17,510	-48%	0%
Traffic Lighting	5,688	1,216	1,218	-79%	0%
Other City Operations	5,618	4,276	4,061	-28%	-5%
Hamilton Water	121,040	162,930	171,765	42%	5%
Yards	39,589	27,935	24,601	-38%	-12%
Arenas	39,904	28,967	33,743	-15%	16%
Community/Senior Centers	3,834	3,622	3,536	-8%	-2%
Rec Centres/Pools	26,789	30,043	29,621	11%	-1%
Tim Horton's Field	0	8,885	8,223	n/a	-7%

[3] Combined usage is electricity in kWh plus natural gas in m3 converted to ekWh.

Rec Parks/Stadiums/Golf	8,332	5,296	5,250	-37%	-1%
Lodges (Macassa, Wentworth)	24,938	13,699	14,861	-40%	8%
Culture	5,383	3,975	3,715	-31%	-7%
Fire/ EMS	10,698	12,181	11,565	8%	-5%
Hamilton Public Libraries	9,343	10,351	9,595	3%	-7%
First Ontario Centre	10,122	n/a	n/a	n/a	n/a
First Ontario Concert Hall	5,466	n/a	n/a	n/a	n/a
Hamilton Convention Centre	4,656	n/a	n/a	n/a	n/a
Hamilton Police Services	14,757	11,238	11,884	-19%	6%
City Wide Total	**400,722**	**361,676**	**369,618**	**-8%**	**2%**

ENERGY INTENSITY

Energy intensity is one of the key metrics used across the industry as a measure of energy consumption in facilities and for the City, and it measures usage in equivalent kilowatt hours per square foot (ekWh/sqft) of operated space. Each year, the City reviews the electrical and natural gas usage and updates the square footage of occupied space to reflect changes in building portfolios. The forward targets outlined in the Corporate Energy & Sustainability Policy are a reduction in energy intensity of 45% by 2030 and 60% by 2050 as compared to the base year of 2005.

In 2023, the energy intensity represents a reduction of 29% as compared to the base year. Compared to 2022, there was a decrease of -2% in energy intensity.

Table 7: 2023 Energy Intensity Comparison by Portfolio

	2005	2022	2023	2023 vs 2005	2023 vs 2022
City Total (ekWh/sqft)	45.69	33.21	32.40	-29%	-2%
City Total ($/sqft)	$2.67	$2.44	$2.63	-1%	8%
Reported Square Footage	5,138,852	5,293,497	5,403,803		

The categories of Operational and Maintenance (O&M) and Hamilton Water are excluded from the energy intensity calculations. The O&M category includes such things as usage related to street lighting, traffic lighting, parking structures/lots, and park or path lighting. Hamilton Water includes usage related to pump stations, reservoirs, wells, or water towers. Both categories may have significant usage, but do not represent occupiable space or "building" usage.

The following table shows the energy intensity results for specific facilities groupings.

Table 8: 2023 Energy Intensity Comparison by Portfolio[4]

	2005	2022	2023	2023 vs 2005	2023 vs 2022
City/Town Halls	39.6	26.5	23.2	-42%	-13%
Corporate Facilities	44.6	23.1	23.0	-49%	0%
Street Lighting	n/a	n/a	n/a	n/a	n/a
Traffic Lighting	n/a	n/a	n/a	n/a	n/a
Other City Operations	n/a	n/a	n/a	n/a	n/a
Hamilton Water	n/a	n/a	n/a	n/a	n/a
Yards	38.1	27.7	24.7	-35%	-11%
Arenas	51.3	35.9	36.3	-29%	1%
Community/Senior Centers	31.1	21.9	21.1	-32%	-4%
Rec Centres/Pools	78.6	59.0	57.8	-26%	-2%
Tim Horton's Field	0.0	27.2	25.1	n/a	-7%
Rec Parks/Stadiums/Golf	36.5	26.2	26.6	-27%	1%
Lodges (Macassa, Wentworth)	113.6	39.4	42.8	-62%	8%
Culture	35.5	30.2	28.3	-20%	-6%
Fire/ EMS	45.2	34.2	32.5	-28%	-5%
Hamilton Public Libraries	25.1	28.7	26.6	6%	-7%
First Ontario Centre	22.5	n/a	n/a	n/a	n/a
First Ontario Concert Hall	57.8	n/a	n/a	n/a	n/a
Hamilton Convention Centre	37.2	n/a	n/a	n/a	n/a
Hamilton Police Services	59.8	40.5	42.8	-28%	6%
City Wide Total	**45.7**	**33.2**	**32.4**	**-29%**	**-2%**

Additional detailed energy intensity per facility site for the categories above is included in the Appendix A of this report.

VEHICLE FUELS

FUELS CONSUMPTION AND COSTS

Fuel for the City's fleet of vehicles is purchased on the wholesale market for all of the City's own fleet vehicles, including, but not limited to heavy vehicles for Roads, Waste, Hamilton Water, Fire and EMS and Transit, as well as smaller departmental vehicles, like small trucks and SUVs for Building and Bylaw. Fuels include diesel, unleaded gasoline and compressed natural gas (CNG).

2023 gasoline consumption was unchanged from 2022. Diesel consumption declined by -19% year-over-year as Transit continued its transition to CNG-powered buses. This resulted in a corresponding 38% increase in CNG use compared to the prior year. An increase in CNG usage is expected to continue as

[4] Operational accounts (street lighting, traffic lighting, park lighting, and Hamilton Water) are not included in Energy Intensity calculations. Square footage by division is adjusted for any building not included in the calculation of energy intensity.

Transit replaces all its Diesel bus fleet to CNG over the next few years. An estimated 64% of the bus fleet was CNG by the end of 2023, with plans to increase the fleet to 90% CNG by 2025.

Table 9: 2023 Fuel Consumption and Costs

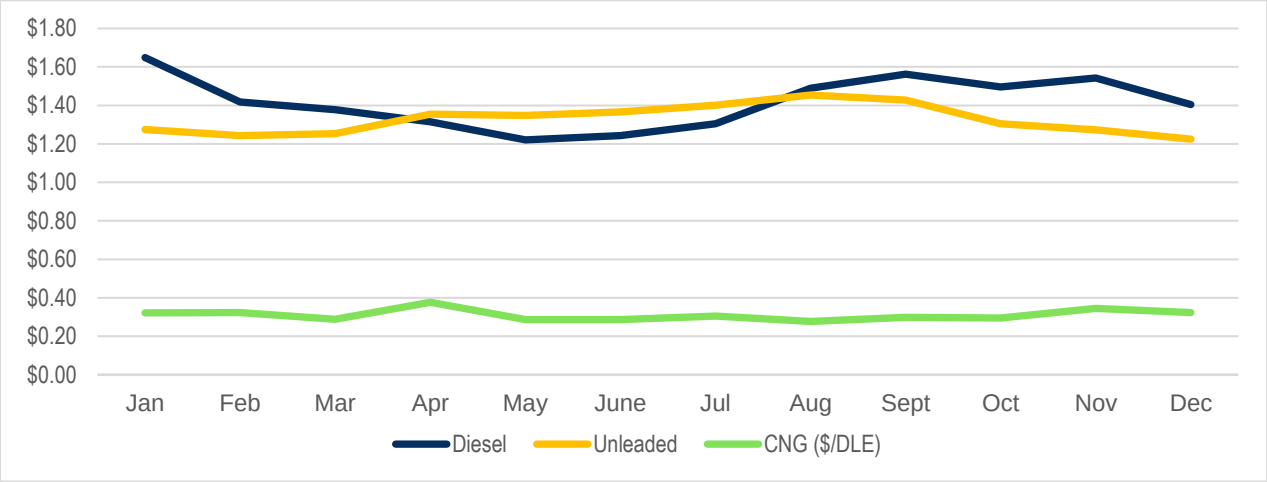
Fuel Type	Consumption Litres	Cost	Average $/L	Consumption 2023 vs 2022	Average Price 2023 vs 2022
Diesel	6,237,613	$8,848,289	$1.42	-19%	-15%
Unleaded Gasoline	2,533,250	$3,366,545	$1.33	0%	-9%
CNG (DLE)	9,502,086	$2,845,721	$0.30	38%	3%
Total	18,272,949	15,060,555	$0.82	7%	-24%

The 2023 budget prices for diesel and gasoline were both set at $1.55 per litre. The actual average diesel and gasoline unit prices ended 2023 under budget. Prices for diesel and gasoline declined early in 2023 and stabilized as markets moved past 2022's political unrest and eased pressure on prices for oil and global demand for fuels. Diesel consumption was slightly lower than budgeted. The variance of actual to budget was -$1.9 M in 2023. Table 10 shows the 2023 results as compared to budget.

Table 10: 2023 Actual Diesel and Gasoline Consumption and Costs Compared to Budget

Fuel Type	2023 Budget	2023 Actual	2023 Variance (Actual – Budget)
Diesel Consumption (L)	6,692,476	6,237,613	-454,863
Diesel Cost ($)	$10,373,341	$8,848,289	-$1,525,052
Diesel Unit Price ($)	$1.55	$1.42	-$0.13
Gasoline Consumption (L)	2,435,706	2,533,250	97,544
Gasoline Cost ($)	$3,775,348	$3,366,545	-$408,803
Gasoline Unit Price ($)	$1.55	$1.33	-$0.22
Total Consumption (L)	9,128,181	8,770,863	-357,319
Total Costs ($)	$14,148,689	$12,214,834	-$1,933,855

Chart 5: 2023 Fuel Cost Comparison ($/DLE)



While CNG is a lower cost fuel compared to diesel and gasoline, the buses operate at approximately 74% efficiency per diesel litre equivalent (DLE) when compared to diesel fueled buses. Despite a lower fuel efficiency, when converted to diesel equivalent dollars and adjusted for efficiency, Transit avoided spending $7.3M with their fleet of CNG buses than they would have using only diesel buses. In addition, the lower GHG emissions from using CNG fuel versus diesel is of benefit to the City overall and positively impacts the City’s corporate GHG emissions inventory.

Table 11: 2023 Cost-Benefit of CNG as Compared to Diesel

Fuel Type	Consumption Litres
Diesel Litre Equivalent (L)	9,502,086
Number of DLE Litres of Diesel Required*	7,126,564
DSL cost at $1.42/L (Average Fuel Price)	$10,119,721
2023 CNG Cost	$2,845,721
Avoided fuel cost by using CNG	$7,274,000

Figure 2: Carbon Neutral Bus

The City continued to operate a fully carbon-negative bus through 2023. The goal of the original pilot in 2021 and 2022 with Enbridge was to demonstrate reduced emissions from the City’s public transit operations. The pilot was a success and its extension for the further year continued help to displace approximately 36,000 liters of diesel. RNG is a practical option that enables Transit to reduce emissions without compromising performance or reliability while using its existing fleet.

ENERGY CONSERVATION

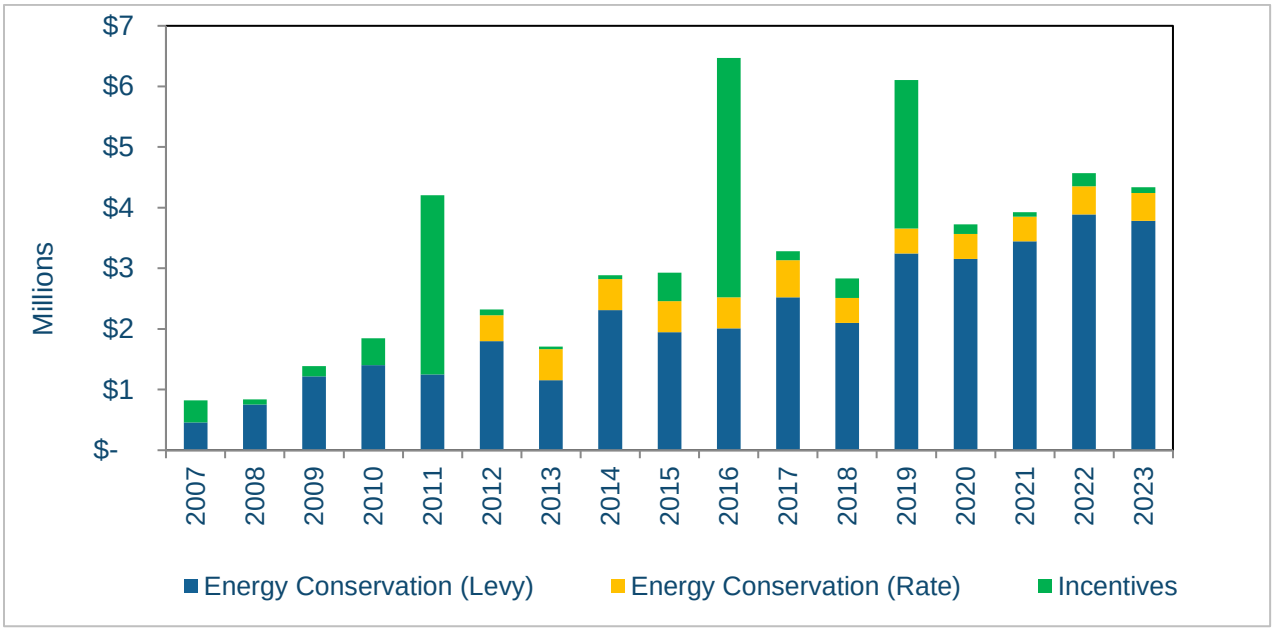
Project activities at the City play an important role toward meeting the energy reduction and emissions targets and improving efficiencies within City buildings. Every year, these projects are evaluated using specific criteria to identify energy and emissions savings. Upgrades to existing corporate buildings by installing energy efficient lighting and equipment or utilizing new technologies can help to improve operational efficiencies, cost effectiveness, and help meet corporate targets for energy intensity and GHG reductions, including the goal of net zero emissions by 2050.

The City’s project teams work closely with consultants, engineers, utility personnel and industry experts to retrofit existing buildings, construct new buildings, and upgrade equipment and processes. In addition,

securing funding and incentives for efficiency and GHG-reducing projects and the post project monitoring and verification of savings is an important process in reporting and tracking the efforts.

The City tracks the energy savings achieved from projects once they are complete. Annual savings from all completed projects totaled $4.2M in 2023. The City received $98K in incentives in 2023 from Enbridge and the IESO. As noted previously, annual project savings are captured from projects completed in prior years .

Chart 6: Annual project Savings (Rate & Levy) and Incentives



ENERGY EFFICIENCY PROJECTS

A variety of projects are undertaken annually with the intentions of reducing both energy usage and GHG emissions to help achieve the targets in place. Some highlights on energy efficiency projects that have been completed in 2023 are:

Wentworth Ops Centre LED Lighting Upgrade:

- This project converted existing indoor and select outdoor lighting to energy efficient LED technology.
- Benefits included energy efficiency, reduced GHG emissions, better light levels, and reduced operations and maintenance costs.
- Electricity reduction of 214,228 kWh with associated cost savings of $27,864 annually.
- Combined GHG emissions reduction of over 10 Tonnes of CO2 annually.
- The City received total energy incentives of $9,672 from the IESO program.

Wentworth Ops Centre Boiler and Condensers Upgrade Project:

- This project included the lifecycle replacement of space heating plant as well as the condensers for office space cooling with energy efficient condensing boilers and new condensers respectively.
- These retrofits helped reduce both natural gas and electricity consumption as part of the facility's Pathway to Net Zero.
- Benefits included energy efficiency, reduction in natural gas consumption, reduced GHG emissions, and reduced maintenance costs.
- Energy reduction in 22,915 m3 of natural gas and 4,620 kWh of electricity respectively, with combined utilities operational savings of $10,000 annually.
- Combined GHG emissions reduction of 43.5 Tonnes of CO2 annually.
- The City received combined total energy incentives of $13,057 from Enbridge Gas and IESO programs.

Glanbrook Town Hall Heating/Cooling Replacement Project

- This project included the lifecycle replacement of five existing, natural gas furnaces, central air conditioning and controls. These heating/cooling systems were replaced with five new energy efficient air source heat pumps (heating & cooling) with gas fired back-up and new smart thermostats.
- The installation of heat pump technology helps reduce natural gas consumption putting the facility on a pathway to net zero.
- Benefits included better energy efficiency, a reduction in natural gas consumption, reduced GHG emissions, and reduced maintenance costs.
- GHG emissions are expected to be reduced by 14 tonnes of CO2 annually.

Stoney Creek Municipal Service Centre Cooling Tower Replacement Project

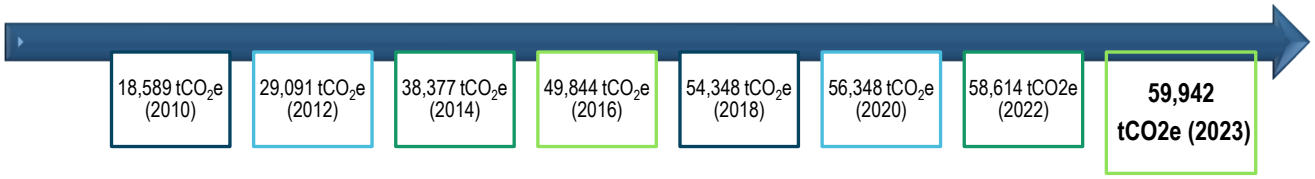
- This project included the lifecycle replacement of the building's cooling tower and associated pumps, motors, piping and controls. A new tower was installed with energy efficient fans, motors, a variable frequency drive and new controls.
- Benefits included reduced electricity consumption, reduced equipment wear and tear, and reduced maintenance costs.
- Annual electricity savings are estimated at 21,600 kWh with a cost savings of $3,200 per year.
- The City received incentives of $ 2,875.20 from the IESO SaveOnEnergy program.

Replacement of Two Environmental Control Units (ECUs) for the IT Room / Datacenter:

- This project included the lifecycle replacement of two Environmental Control Units in the IT room with newer, higher-capacity units.
- The primary focus of this retrofit was life cycle replacement and cooling system reliability for the data room. There were no significant energy savings because the newer units were higher capacity than the existing ECUs.
- Benefits included better operational control, better cooling system reliability with full back up redundancy, better operational efficiency, and reduced maintenance costs.

The goal of energy efficiency projects is not only to achieve energy use reductions and save money, they are also key instruments in reducing GHG emissions that would have otherwise been emitted into the atmosphere. The various efficiency measures completed on projects in 2023 resulted in 1,443 tCO2e, with a cumulative total of 59,942 tCO2e reduction from project activities since 2005. This is the equivalent of removing approximately 12,700 cars from the road.

Chart 7: Cumulative GHG Savings from Project Activities



RENEWABLE ENERGY GENERATION

The City's biogas renewable generation operations are owned and managed through Hamilton Renewable Power Inc. (HRP Inc.). There are three 1.6 MW biogas-fueled systems. Two of the units are located at the Glanbrook landfill site. The third unit, a cogeneration unit, producing electricity and heat, is located at the Hamilton Water site at Woodward Avenue.

The three units use raw biogas as a renewable fuel source to produce electricity for the power grid through a long-term contract with the province. Using renewable fuel contributes to a more efficient and sustainable process, and further offsets GHG emissions.

Renewable natural gas is also produced at Woodward Avenue using a Biogas Purification Unit (BPU). The BPU captures excess methane gas from the anaerobic digestion process in the wastewater process. The raw biogas is purified, treated, and conditioned to yield the utility grade renewable natural gas that can be injected into Enbridge Gas distribution system.

The City of Hamilton currently has two facilities with solar generation. Hamilton Public Library installed a 30-kW rooftop solar PV on the Valley Park Library and Community Centre as part of its LEED Gold certification. The City also leases roof space to Alectra Utilities for a 250-kW rooftop solar PV installation at the Wentworth Operations Centre.

As the City moves forward to achieve its goals of net zero by 2050, renewable energy will need to play a key role in achieving those targets. A variety of feasibility studies are underway to propose the best way forward in utilizing the City’s existing renewable assets through expansion of generation capacity as well as implementing additional renewable energy options. Staff will be working on new plan to explore renewable energy generation opportunities in all corporate facilities including Hamilton Water and its waste processing facilities. With the broader community strategies around solar, the City has been exploring solar opportunities for corporate sites, including at the new Transit facility currently under construction. There are various sites in the feasibility stage, The Pathway to Net Zero process has identified 8 potential solar PV opportunities totaling 2,140 kW of generation potential so far.

NET ZERO INITIATIVE

In 2019, City council declared a climate change emergency. As a response to this declaration, the City committed to becoming a net zero emissions city by 2050. This target was solidified in the five-year review of the Corporate Energy and Sustainability Policy document in 2020 which supports corporate goals. Additionally, the City created a Climate Change Office to help achieve these long-term targets by guiding overall City policy (community and corporate). There is no one clear route to achieving net zero emissions. It requires a broad combination of various projects and programs, operational changes, renewable energy generation and electrification. To facilitate all that must be accomplished, a forward-looking plan or “pathway” is required.

PATHWAY TO NET ZERO

To meet its net-zero goals, the City of Hamilton engaged an external consultant to prepare a portfolio-scale Net Zero Carbon Plan (“Pathway to Net Zero for Corporate Buildings” or PNZ) to provide recommendations and direction for actions necessary to achieve net-zero carbon across the City’s corporate facility portfolio in alignment with the City’s net-zero 2050 objective. The pathway includes four tiers of measures (all percentages based on 2050 Annual Emissions Reduction):

Tier 1: Scheduled Load Reductions – 20%

Enclosure improvements (and other select load reductions measures) in alignment with replacement schedules already planned by the City (at equipment and component end of life).

+Tier 2: Scheduled Load Reductions with Mechanical Measures – 72%

Rescheduling of mechanical equipment replacements to align with the enclosure improvements: creating more comprehensive retrofit project opportunities. Mechanical measures focus heavily on electrification, in addition to efficiency.

+Tier 3: Additional Electrification – 88%

Identification of additional electrification measures beyond mechanical system replacements already scheduled. After Tier 3 measures are applied this portfolio will be nearly all-electric (low carbon).

+Tier 4: Offsets – 100%

Application of existing City waste gas capture (“renewable” natural gas) to offset remaining emissions.

The City has developed site-specific Pathway to Net-Zero plans for the following facilities, focusing on the highest-emitting portfolios, namely Arenas, Pools, and Lodges:

Table 12: Current Pathway to Net Zero Plans by Portfolio

Pools	Arenas	Yards	Other Facilities
Kanétskare Recreation Centre	Chedoke Twin Pad Arena	Mountain Transit Centre	Fire Complex 5 (Fire)
Stoney Creek Recreation Centre Pool	Harry Howell Arena	Traffic Operations Centre	Macassa Lodge (Lodges)
Bennetto Recreation Centre Pool	Morgan Firestone Arena	Wentworth Operations Centre	Dundas Town Hall (Corporate)
Westmount Recreation Centre Pool	Inch Park Arena		Discovery Centre (Corporate)
Jimmy Thompson Pool			Central Library (Libraries)

By focusing on specific portfolios, the City is streamlining the planning process to ensure identified measures can be applied to similar facilities within the portfolio. Going forward, the City plans to add five to ten site-specific PNZ plans per year, prioritized by emissions’ impact and alignment with existing plans.

The Pathway to Net Zero Initiative also featured heavily in the City’s Conservation and Demand Management Plan for 2024-2029[5]. The CDM plan was required as part of O. Reg. 25/23. The Plan, which outlines the City’s activities and initiatives highlights the pathway approach of achieving the set targets already established in the Corporate Energy and Sustainability Policy and with the broader community actions of the Office of Climate Change Initiatives. A focus on efficient equipment, operational improvements and on developing future renewables generations opportunities will continue to drive the City toward its net zero targets.

[5] O. Reg 25/23 Conservation and Demand Management Plan 2024 posted to City Hamilton website: Hamilton.ca/energy

Table 13: Projected Pathway to Net Zero Project Timeline[6]

Project Start Year	Project Type	Portfolio(s)	# of Projects	Emissions Savings (t CO2e)	Estimated Capital Cost ($)
2023	Solar PV Installation	Arenas	1	26.6	$1.8 M
	Heating Retrofits	Yards	1	23.2	
	Waste Heat Recovery	Rec Centres	2	19.6	
	LED Retrofits	Corporate, Yards, Fire	5	10.4	
	VFD Upgrades	Indoor Pools	1	1	
2024	Building Envelope Improvements	Yards	1	86.9	$7.3 M
	Condensing Boiler Retrofits	Lodges	2	85.7	
	Solar Heating and Heating Electrification	Arenas, Rec Centres	3	76.5	
	Waste Heat Recovery	Lodges, Rec Centres	3	62.8	
	Solar PV Installation	Arenas, Rec Centres	3	37.2	
	Low-flow Water Installations	Arenas, Indoor Pools, Rec Centres	5	18.9	
	LED Retrofits	Yards	1	2.4	
2025	Solar PV Installation	Rec Centres, Yards	3	30.8	$8.2 M
	Solar Heating and Heating Electrification	Arenas, Lodges, Rec Centres, Yards	10	279	
	Ground-source heat pump	Arenas	1	189.7	
	Waste Heat Recovery	Lodges, Yards	2	54.5	
	VFD Upgrades	Rec Centres	1	6.7	
	Building Envelope Improvements	Yards	1	4.2	
2026	Solar PV Installation	Fire	1	8.7	$5.4 M
	Solar Heating and Heating Electrification	Fire, Rec Centres	6	241.6	
	Waste Heat Recovery	Yards	1	465.3	
2027	Solar PV Installation	Rec Centres, Yards	2	45.1	$5.7 M
	Solar Heating and Heating Electrification	Indoor Pools	3	264.1	
	Building Envelope Improvements	Corporate, Yards	3	88.9	
Total			62	2,130	$28.4 M

[6] Pg 16-17 of City of Hamilton *Conservation and Demand Management Plan 2024*

PART 2: CORPORATE REPORT ON COMMODITY HEDGING AND RATE ACTIVITIES

BACKGROUND

This section was previously presented as its own separate report to communicate the various hedging and rate optimization activities. The requirement, stipulated in the Corporate Energy and Sustainability Policy is that this information is presented annually. The information had overlapped with the energy costs and consumption reported in the annual energy reporting and often duplicated information. To align the information and streamline the reporting process, the annual results of hedging and rate optimization will be included here. The required Treasurer's Annual Statement on Commodity Price Hedging is attached as Appendix B to this report.

Hedging is a risk management strategy to reduce price volatility by entering into energy supply contracts direct with commodity suppliers to fix the price for specific volumes and terms in the future. Rate optimization ensures that the correct utility rate class is selected for each account to reduce utility-related commodity costs (e.g. global adjustment for Class A customers).

OVERALL RESULTS

The utility rates and commodity strategies the City participated in for 2023 include Global Adjustment (GA) rate changes and natural gas hedging programs. For the 2023 calendar year, there was a total of $6.1 M cost benefit; $5.2 M as a result of global adjustment savings for Class A rate customers and $0.9 M from hedging of natural gas when compared to the agreed benchmark.

Table 14: 2023 Utility Rates and Commodity Strategies Results

2023 Results	$M	Levy	Rate
Global Adjustment	$5.2M	11%	79%
Natural Gas Hedging	$0.9M	70%	30%
Total	$6.1M	72%	18%

Further breakdown of these results can be found below in the Electricity Rate Optimization and Natural Gas Risk Management sections in the report.

ELECTRICITY RATE OPTIMIZATION

The electricity market in Ontario itself is complex and volatile. The commodity portion of the electricity price is made up of the Hourly Ontario Electricity Price (HOEP) and the Global Adjustment (GA). Most of the GA costs are from contracts that the Independent Electricity System Operator (IESO) has with generators, many of which are fixed price or guaranteed revenue agreements.

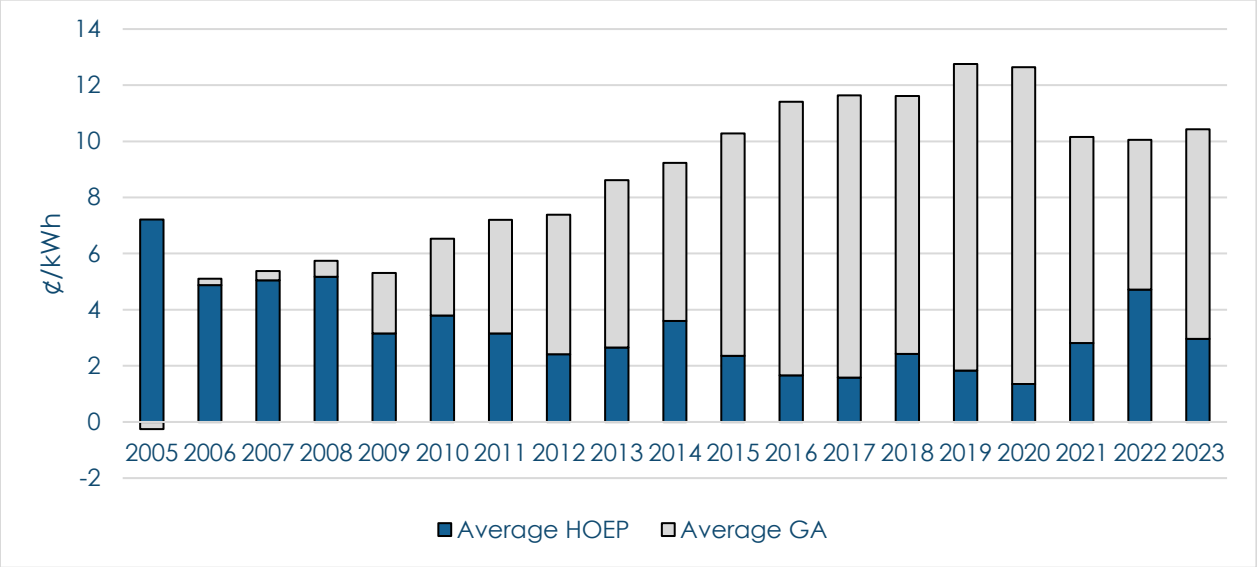
When spot prices (HOEP) are lower, the generator does not earn enough revenue to meet its revenue guarantees. In that case, the IESO pays the generator to make up this difference and the costs are

recovered from consumers through the GA. Therefore, in a month when the market price of electricity is low, the GA will be higher and conversely when market prices are high, the GA will be lower.

It is possible to fix the price on forward terms for the HOEP. However, doing so does little to protect against the greater fluctuations of the GA rate. Staff recommendations have been to not hedge against the HOEP due to unfavorable market conditions.

For billing of the GA costs, most commercial consumers are on a Class B rate. Class B consumers pay a regulated GA rate set monthly and posted by the IESO. There is no market mechanism to hedge against the regulated GA rate. In 2023, Class B customers paid a combined average of $0.1044/kWh, an increase of 4% from 2022, a result of a -37% decline in the HOEP and 40% increase in the GA rate.

Chart 8: Annual Average Price of HOEP and Class B GA (2006-2023)



Eligible, high electrical demand customers can opt for a Class A[7] rate. Class A rate customers pay the GA costs based on their percentage contribution to the total monthly provincial GA costs, calculated on the top five peaks during a peak setting period. This is called the peak demand factor (PDF). Class A customers can impact their GA costs by reducing demand during peak periods, resulting in lower costs.

Class A sites within the City include 900 Woodward Avenue, 700 Woodward Avenue, 850 Greenhill Avenue, 78 Kenilworth North, Tim Hortons Field, and CUP Operations. The results for 2023 was a cost benefit (avoided costs) of $5.2M as shown in Table 15.

[7] Class A also referred to as Industrial Conservation Initiative (ICI), eligibility details located here: https://ieso.ca/Sector-Participants/Settlements/Global-Adjustment-Class-A-Eligibility.

Table 15: 2023 Global Adjustment Class A Results[8]

Global Adjustment Class A Results	2023 Results	Cumulative Results
Levy (Tax) Supported Budget	$1,099,794	$13,244,414
Rate Supported Budget	$4,108,398	$42,297,702
Total	$5,211,445	$55,542,116

NATURAL GAS RISK MANAGEMENT (HEDGING)

Natural gas can be a volatile commodity. There are many factors that can influence prices in natural gas markets including weather, supply, demand, world political events and changes to refining and extraction technologies for the gas itself. To maintain control of costs and minimize the degree of price volatility, the City has purchased its natural gas directly from the wholesale market (since June 2006). The City has supply agreements with multiple parties to allow for competitive purchasing.

Overall, the strategy is dynamic and adapts to changes in market conditions. For example, a portion of natural gas supply may be purchased as much as two to three years in advance to protect against market volatility while other portions are purchased just a month or two in advance. Fixing the price on a portion of the City's natural gas volumes results in better budget predictability and protection against market fluctuations, particularly during extreme weather conditions or unforeseen events.

The City purchases natural gas for City-owned facilities (excluding CityHousing Hamilton) and for the Transit natural gas bus fleet, which is then compressed (CNG) for fueling. The average 2023 price for the natural gas (commodity only) was $3.96 per gigajoule (GJ) ($0.154/m3) including a blend of hedged and unhedged (variable) volumes. This does not include any Enbridge Gas charges such as delivery, storage or federal carbon charge which make up the total price.

The City fully hedged an average of 70% of natural gas supply in 2023, based on 2023 volume requirements across all contracts. A portion of volumes for forward terms have also been hedged. See A-5 in Appendix A for a detailed profile of the completed hedges covering 2023 shown with volumes (GJs) and prices.

The natural gas market declined steadily in 2023, particularly with next-day or next-month terms. Mild weather through the winter and summer months resulted in declining North American demand for natural gas and rising natural gas inventories. Declining demand globally also eased the impact of economic disruption and global unrest which had driven pricing volatility in 2022. Forward terms for purchases into 2024 and 2025 also increased to provide cost certainty with the lower rates. Staff monitors the market and continues to develop strategies for purchasing into the forward terms to capture agreeable market opportunities and help mitigate volatile and uncertain periods.

The City benchmarks its natural gas hedging performance against the procurement program that is offered by the Association of Municipalities of Ontario / Local Authority Services (AMO/LAS)[9]. The AMO/LAS purchasing program is available for municipalities that do not have their own hedging programs. The

[8] Annual global adjustment Class A cumulative benefits are shown from 2011-2023
[9] Association of Municipalities of Ontario business services Natural Gas services offering here: https://www.las.on.ca/naturalgas

comparison is shown in Chart 9 with overall results shown in Table 16. In 2023, the City's actual commodity costs were 18% lower than the posted AMO rate.

Chart 9: Annual Average Price Comparison of City to AMO/LAS10 Natural Gas Program

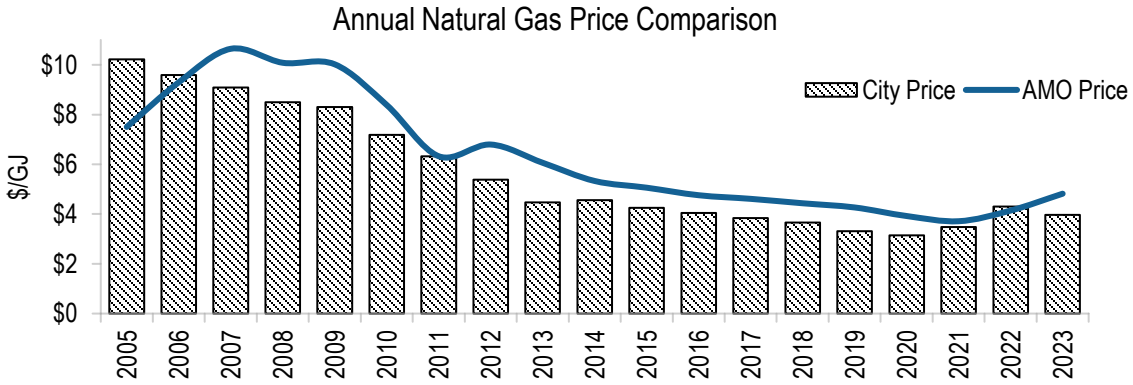


Table 16: 2023 Natural Gas Hedging Performance Results[10]

Natural Gas Hedging Performance Results	2023 Results	Cumulative Results
Levy (Tax) Supported Budget	$600,529	$8,321,216
Rate Supported Budget	$253,897	$1,633,656
Total	$854,426	$9,954,872

NATURAL GAS AGREEMENTS FOR SUPPLY, TRANSPORTATION, STORAGE AND DELIVERY

The City manages its portfolio by utilizing contract management of varying tools for supply, delivery and storage and transportation of natural gas. In 2023, the City had master agreements for natural gas supply in place with Shell Energy North America (Canada) Inc., Tidal Energy Marketing Inc., Royal Bank of Canada and Twin Eagle Resource Management Canada LLC. All current supply counterparties have credit ratings that are compliant with the Corporate Energy Policy.

In addition, the City has contracts in place with Enbridge Gas that are required to facilitate the transportation, delivery, and storage of the City's natural gas supply. The utility agreements include direct purchase agreement (DPAs) for a pool of City sites, two T1 rate storage contracts for managing the Transit CNG and Hamilton Water biosolids plant and an M13 rate contract for production of renewable natural gas.

The agreements outline the terms of service for delivery of natural gas, including designated delivery points, contract volumes and storage. The parameters are shown below in gigajoules (GJ) which is the unit in which gas is purchased to meet the requirements. Prices and consumption data on Enbridge Gas bills are reported in cubic metres (1 GJ = ~26 cubic metres (m3)). In 2023, the agreements and parameters on contract renewal were:

[10] Performance relative to AMO/LAS natural gas annual hedging program

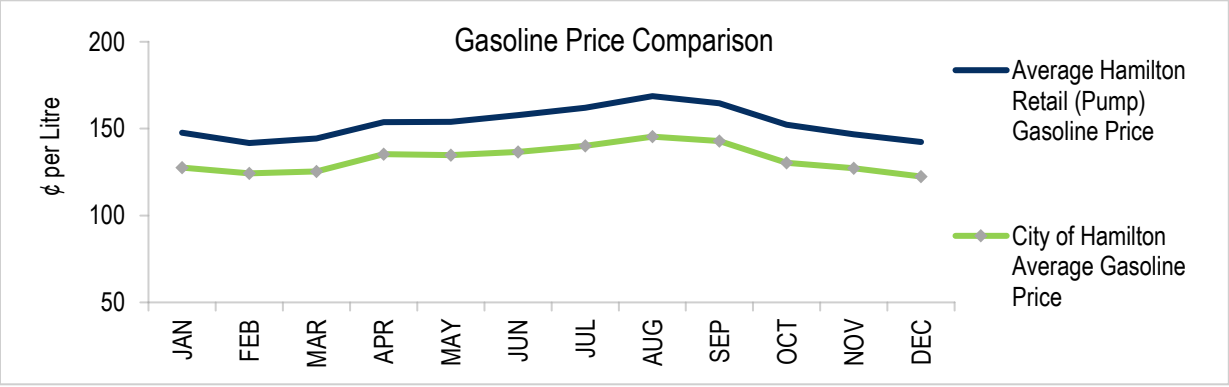
- SA7020 (pool) for 1,028 GJ/day (increased to 1,087 GJ/d as of June 2023) – 253 miscellaneous City natural gas accounts which run from November 1 to October 31 each year.
- T1 for 832 GJ/day (increased to 1,045 GJ/day as of September 2023) - For Transit's CNG bus fleet and transit site. The contract runs September 1 to August 31 each year.
- T1 for 540 GJ/d (as of May 1, 2023) – For Hamilton Water biosolids production operation. The contract runs from May 1 to April 30 each year.

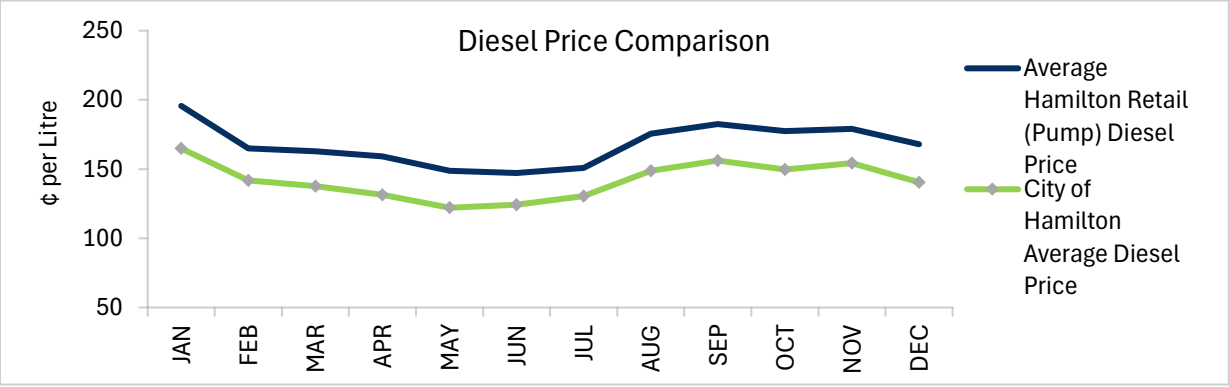
Each DPA has its own specific delivery requirements, at different points along the variety of pipelines within North America and are reviewed and renewed annually. DPAs may also be amended throughout the year or adjusted to meet specific parameters.

FUEL RISK MANAGEMENT

The City of Hamilton purchases diesel and gasoline fuel for its fleet of vehicles including buses, waste collection vehicles, snow removal trucks, street sweepers, forestry and parks vehicles, as well as Fire and Emergency Services vehicles. In addition, the City purchases fuel for Hamilton Police Services. In 2023, the City's fuel procurement strategy was using a bulk supply agreement with Suncor Energy Products Partnership. Fuel contracts are reviewed annually and based on pricing, deliverability and fuel types, the strategy can be adjusted accordingly.

Charts 10 &11: 2023 Monthly Price Comparison of City to Retail Prices[11]





[11] Monthly average retail prices for diesel and gasoline are reported for the Hamilton area.

The pricing for diesel and gasoline for 2023 was the daily “rack” price of each required fuel type from Hamilton terminal with negotiated discounts, delivery charges and taxes. Paying daily rack pricing for fuel assures the City is getting the lowest available price on the market for that day. Suncor Energy Products Partnership has a credit rating that is compliant with the Corporate Energy and Sustainability Policy.

PART 3: CORPORATE GREENHOUSE GAS (GHG) INVENTORY REPORT

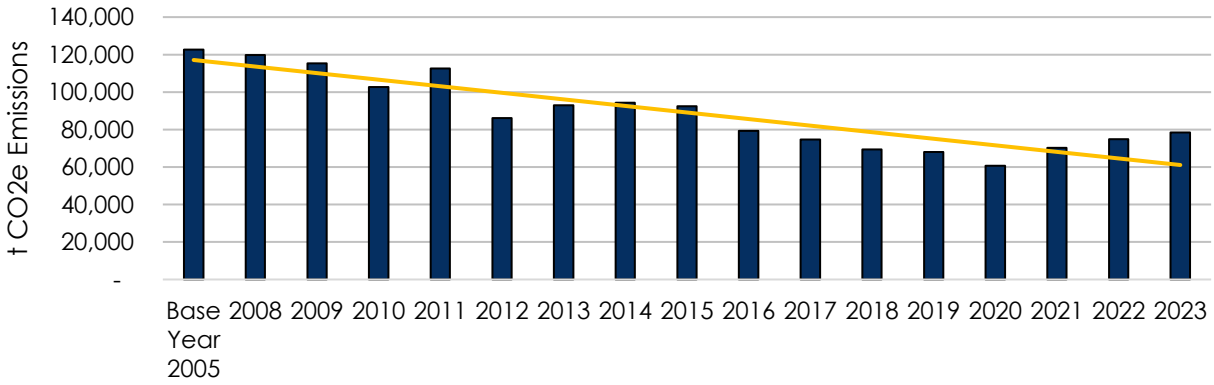
GHG emissions related to corporate operations have been inventoried and reported annually since the adoption of the Corporate Air Quality and Climate Change Strategic Plan (PED06336(a)) in 2008 and the Board of Health Climate Change Actions 2012 report (BOH13024). The original targets were a 50% reduction by 2030 and an 80% reduction in GHG emissions by 2050 from the base year 2005. With the update to the Corporate Energy and Sustainability Policy, the long-term target was updated to net zero emissions by 2050 when compared to the base year 2005.

In past reports, the GHG reporting was a year behind the energy reporting, and the data presented in last year’s annual energy report was for the 2021 annual inventory. This was in line with other required reporting timelines. However, as of the 2023 reporting period, the data has been updated to include both 2022 and 2023 results. This aligns with a change in Ontario Regulation 25/23 that required public entities to submit their energy usage data for facilities for 2022 and 2023 years by July 2024.

2023 INVENTORY RESULTS

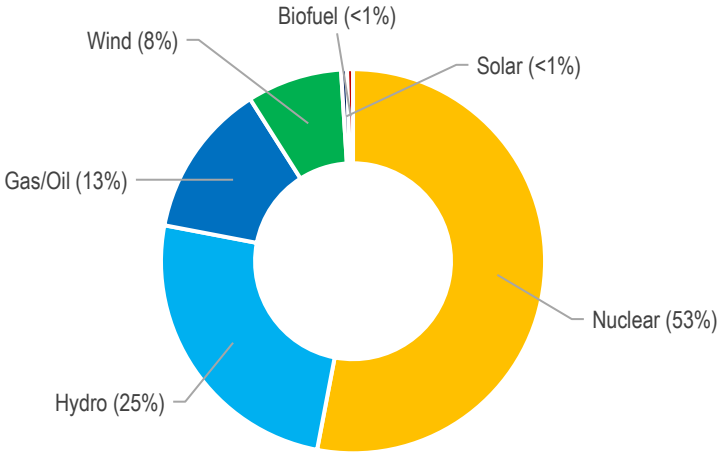
In 2023, the GHG corporate emissions inventory was 78,487 tonnes of CO2e (carbon dioxide equivalent). This represents a -36% reduction from the 2005 base year (122,699 tonnes CO2e) and 5% increase compared to 2022. Entertainment facilities have been removed from the corporate inventory. The inventory does not include HRPI operations.

Chart 12: City of Hamilton Corporate GHG Emissions Year Trends 2005-2023



The inventoried emissions have risen over the past three years due to several contributing factors. The resumption of normal City operations after the pandemic has resulted in steady increases in emissions from the low reached in 2020.

Chart 13: 2023 Ontario Energy Output by Fuel Type[12]



The refurbishment of Ontario's nuclear fleet has resulted in increased natural gas generation and higher electricity-related emissions since over the past two years. Ontario's reported electricity emissions intensity increased by 40% from 2021 to 2023. Emissions may continue to rise as Ontario's electricity grid is forecast to increasingly rely on natural gas generation through the next five years but is expected to stay below baseline because of the earlier removal of coal-fired generation as part of the generation supply mix.

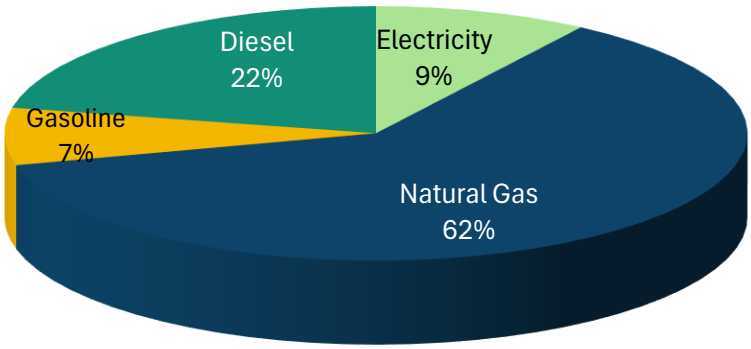
[12] Generation data published by the IESO at: https://ieso.ca/en/Power-Data/Supply-Overview/Transmission-Connected-Generation

Chart 14 depicts the energy output by fuel type for 2023. This is reported by the Independent Electricity System Operator (IESO) for transmission-connected generation. It does not include embedded generation but shows what makes up the supply mix which can vary year to year depending on availability. The provincial emissions factors are impacted by changes to the generation mix.

In addition to electricity emission factors, other impacts to the City's inventory include completion of energy efficiency projects, reductions in usage from operational improvements and fuel switching, such as Transit's ongoing conversion from diesel buses to CNG-powered buses. Future developments around this area, particularly the utilization of renewable natural gas and electric-power transportation for City's fleet and transit vehicles should significantly impact GHG emissions for the City.

The City extended its carbon-negative bus fueled by renewable gas pilot project through 2022 and 2023. The goal of the pilot was to demonstrate reduced emissions from the City's public transit operations.

Chart 14: 2023 Percent of tCO2e Emissions by Fuel Source



Corporately, the generation mix for the City's inventoried emissions is as follows: electricity, natural gas, diesel and gasoline. Ideally, renewable energy sources would be used to offset the higher emissions fuel sources such as diesel, gasoline and natural gas. Of note, the natural gas is used in both buildings and to power 65% of the City's bus fleet.

The emissions from all related fuel sources by sector; buildings, vehicles and processes are shown in Chart 15 and Table 17 below. Of the reported sectors, vehicle fleet remains the largest emitter with 50% of corporate emissions for 2023. Corporate buildings represent 27% and Water and Sewage operations with 20% round out the top 3. The other sectors account for the remaining 3% of emissions in 2021.

Chart 15: 2023 Percent of tCO2e Emissions by Reporting Sector

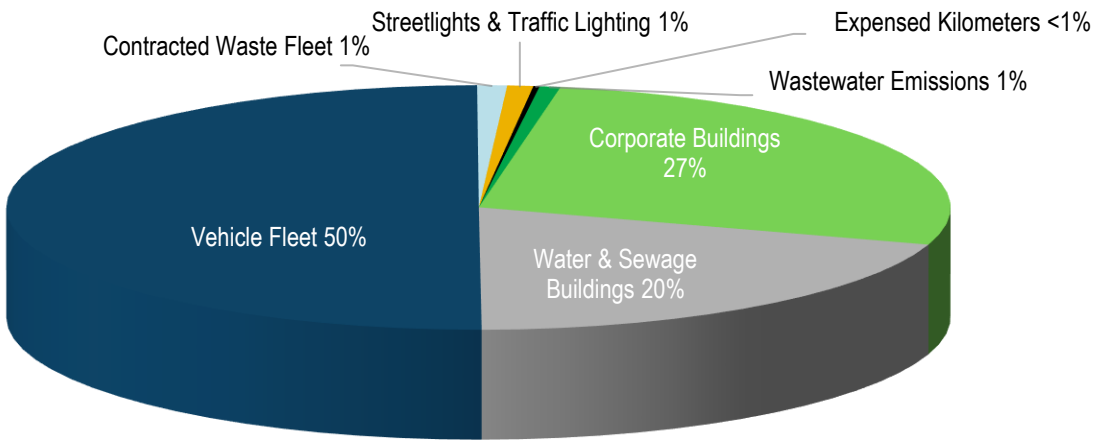


Table 17: 2023 Breakdown of tCO2e by Sector

Sector	2022 Total CO2e	2023 Total CO2e	2023 vs 2005	2023 vs 2022
Corporate Buildings	21,503	21,314	-54%	-1%
Vehicle Fleet	37,821	39,273	9%	4%
Water & Sewage Buildings	13,231	15,674	-38%	18%
Contracted Waste Fleet	698	697	-92%	0%
Streetlights & Traffic Lighting	792	800	-85%	1%
Expensed Kilometers	168	168	-66%	0%
Wastewater Emissions	622	561	7%	-10%
City Wide Total	74,835	78,487	-36%	5%

Corporate buildings show a significant reduction in emissions of 54% compared to 2005. The reductions here are mainly attributed to lower usage from energy efficiency work and lower Ontario emissions factors from changes in the province’s energy supply mix relative to baseline. Vehicle fleet includes emissions from diesel, gasoline and natural gas. The 2023 emissions show an increase when compared to the 2005 base year. While fuel switching from diesel buses to CNG fueled buses has lowered emissions comparatively, Transit has increased its fleet size by 15% over the past two years, resulting in an absolute increase in emissions. However, the emissions were positively impacted by an RNG-fueled bus which utilized RNG that was carbon negative and reduced the emissions by ~222 tCO2e in 2022 and 2023.

The 2023 emissions from Water and Sewage buildings has increased compared to 2022, with the continued expansion of the natural-gas fueled biosolids processing operation at the Woodward site. However, this sector still shows a reduction of 38% when compared to 2005 base year. As the City moves forward to achieve net-zero corporate emissions, a combination of energy efficiency and an increase in renewable fuel sources will be required to meet ambitious targets.

2023 ANNUAL REPORT FINAL COMMENTS

By 2023, City operations had completed their return to pre-pandemic levels. Public services and sites were open for business, and transit operations were running full schedules.

One of Hamilton’s long-term goals is to reduce its energy intensity by 45% by 2030. Despite increased operational load, the data for 2023 showed a decrease in energy intensity compared to 2022, continuing the trend downward. Energy efficient project activity did continue to deliver some energy usage reductions and GHG reductions. At 2023’s energy intensity reduction rate of 2%, the City is on track to fall just short of its 2030 intensity target. The City has developed strategies to further reduce energy intensity and achieve its target by implementing existing Pathway to Net Zero plans, developing new plans and projects for additional facilities, and continuing to make operational improvements.

Environmentally, the City has set a goal to reduce absolute emissions by 50% by 2030 and to become a net-zero city by 2050. Both of those goals are ambitious and will require all City departments to implement actionable plans and policies to actively reduce energy usage and GHG emissions. Many divisions have begun to address the targets by:

- Improving operational efficiencies with equipment and lifecycle replacements;
- Creating green policies for procurement of new equipment;
- Creating resiliency policies around climate change;
- Forming and implementing Pathway to Net Zero plans; and
- Utilizing low or carbon neutral fuels;

Implementing new technology, investing in renewable energy generation and carbon-reducing/carbon-neutral projects and prioritizing climate action is imperative across the City if we hope to meet the 2050 targets.

As always, continued measurement and reporting on results help to identify where the City falls in line with its goals and allows for more targeted decision-making as we move through the ever-changing energy landscape. Additional details on specific reporting items can be found in the Appendix A.

The City of Hamilton’s commitment to energy conservation and environmental sustainability plays an important role in supporting the City’s Strategic Plan by contributing to a prosperous and healthy community; providing valued and sustainable services; and demonstrating innovation and leadership. Ongoing success of the energy program requires engagement of all Five Values of Our Culture - Collective Ownership; Steadfast Integrity; Sensational Service; Engaged, Empowered Employees; and Courageous Change.

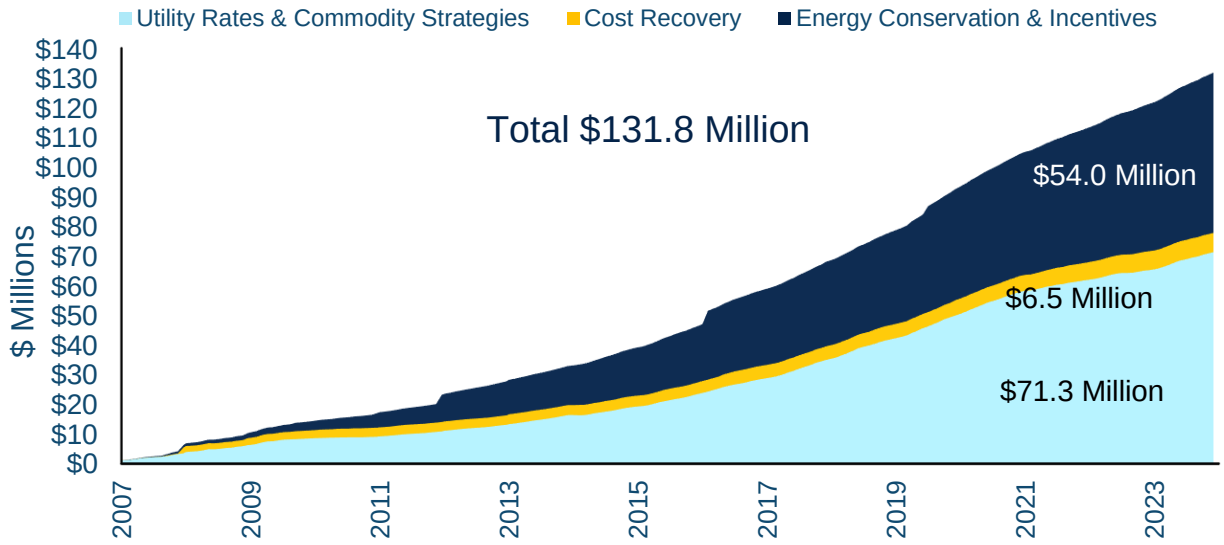
APPENDIX

A. CHARTS

This appendix provides additional information, charts, and graphs for more specific details on KPI results and impacts to various KPIs for 2023 as presented in the report.

ENERGY STRATEGIES AND PROGRAMS

A-1: Cumulative Savings and Avoided Costs 2005-2023



A-2: Three-Year Comparison of Energy Programs and Strategies

	2021	2022	2023	2006-2023 Cumulative
RPP/Interval Change	$0	$0	$0	$5,759,814
Global Adjustment	$3,636,653	$3,557,985	$5,208,191	$55,542,116
Natural Gas Hedging	$226,143	-$127,514	$854,427	$9,954,872
Energy Conservation	$3,853,812	$4,353,341	$4,243,615	$41,861,978
Incentives	$73,292	$215,504	$98,438	$12,134,774
Cash Recovery	$518,976	$507,055	$145,167	$6,523,185
Totals	$8,308,876	$8,506,370	$10,549,838	$131,776,738

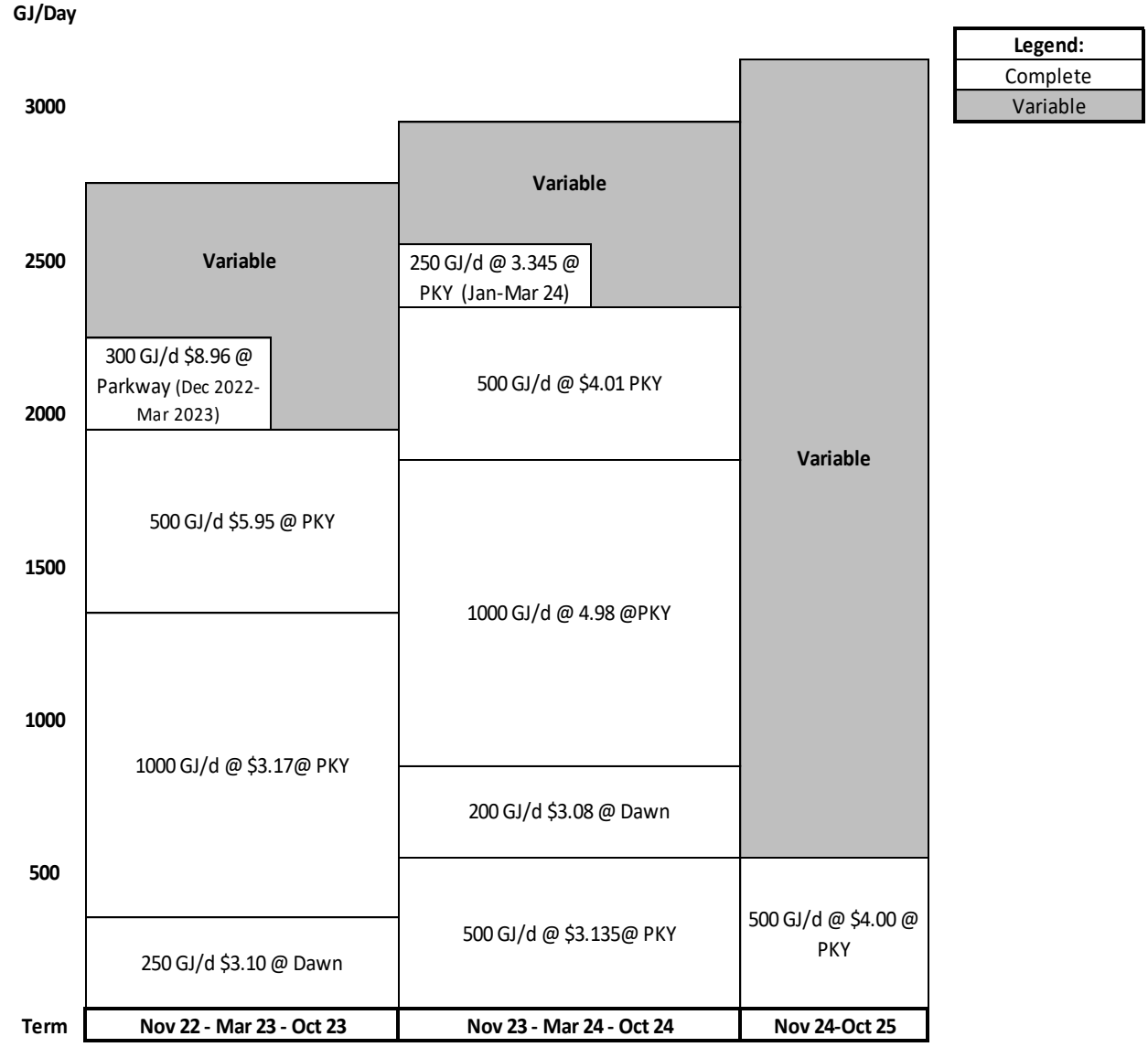
A-3: 2023 and Cumulative Class A Global Adjustment Results

2023	Standard Global Adjustment Charge	Actual Global Adjustment Charge	Cost Benefit	Year	Annual Benefit
Jan	$496,367	$191,897	$304,470	2011	$1,061,230
Feb	$697,992	$273,224	$424,768	2012	$1,511,939
Mar	$782,683	$274,704	$507,980	2013	$2,598,221
Apr	$905,923	$290,111	$615,812	2014	$2,348,577
May	$933,404	$295,626	$637,778	2015	$3,911,299
Jun	$763,470	$261,191	$502,279	2016	$4,682,209
Jul	$461,611	$192,350	$269,261	2017	$5,976,102
Aug	$702,163	$251,961	$450,202	2018	$6,404,572
Sep	$437,968	$177,974	$259,993	2019	$7,248,037
Oct	$738,091	$255,519	$482,572	2020	$7,397,100
Nov	$611,314	$227,035	$384,278	2021	$3,636,653
Dec	$603,993	$235,194	$368,800	2022	$3,557,985
Total	$8,134,978	$2,926,787	$5,208,191	2023	$5,208,191
				CUMULATIVE	$55,542,116

A-4: Top 10 Ontario Verified Peak Demand Days (May 1, 2023-April 30, 2024)

Date	Hour Ending (EST)	ICI Ontario Demand (MWh)
Tuesday, September 5, 2023	17	23,713
Wednesday, September 6, 2023	17	22,966
Wednesday, July 5, 2023	18	22,686
Thursday, July 6, 2023	12	21,882
Monday, September 4, 2023	18	21,725
Tuesday, July 4, 2023	17	21,690
Thursday, July 27, 2023	18	21,558
Friday, July 28, 2023	17	21,551
Friday, June 2, 2023	17	21,463
Thursday, August 3, 2023	17	21,364

A-5: 2023 Natural Gas Hedge Profile as of Jan 1, 2024

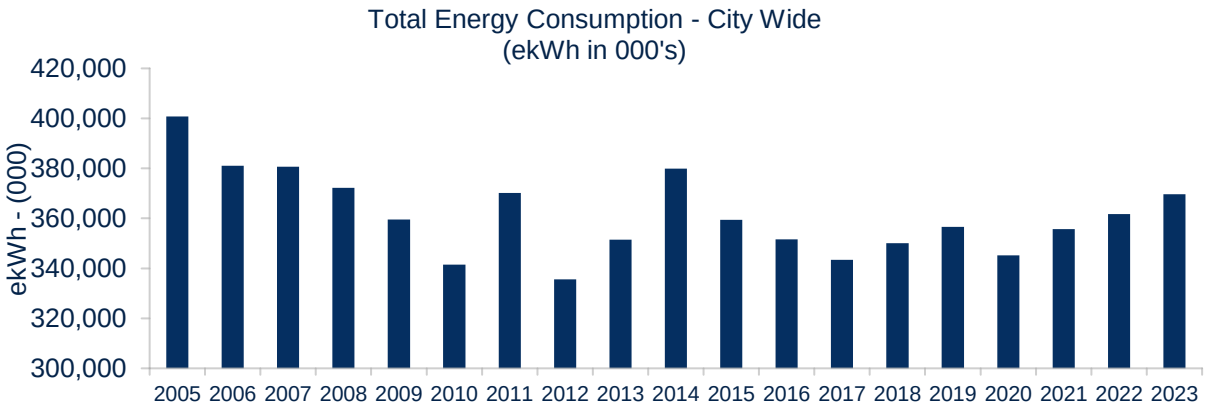


Notes on A-5:

- GJ/Day = Gigajoule per day
- PKY = Parkway Ontario delivery point
- Dawn = Dawn Ontario delivery point

ENERGY CONSUMPTION AND COSTS

A-6: Total Annual Consumption Electricity & Natural Gas (Facilities)



A-7: Electricity Consumption Comparison by Portfolio Category (in 000's of kWhs)

	2005	2022	2023
City/Town Halls	4,736	4,042	3,907
Corporate Facilities	4,669	5,097	5,186
Street Lighting	33,603	17,465	17,510
Traffic Lighting	5,688	1,216	1,218
Other City Operations	5,248	4,206	4,061
Hamilton Water	106,561	104,684	107,243
Yards	11,982	9,170	8,672
Arenas	17,834	12,534	15,333
Community/Senior Centers	1,258	1,329	1,442
Rec Centres/Pools	4,124	7,575	7,777
Tim Horton's Field	n/a	6,046	5,462
Rec Parks/Stadiums/Golf	3,885	2,912	3,075
Lodges (Macassa, Wentworth)	4,673	5,276	5,177
Culture	2,254	1,957	1,909
Fire/ EMS	3,766	4,677	4,528
Hamilton Public Libraries	7,314	7,212	7,029
First Ontario Centre	6,578	n/a	n/a
First Ontario Concert Hall	3,552	n/a	n/a
Hamilton Convention Centre	3,026	n/a	n/a
Hamilton Police Services	5,613	5,899	5,688
City Wide Total	236,362	201,298	205,217

A-8: Natural Gas Consumption Comparison by Portfolio Category (in 000's of m3)

	2005	2022	2023

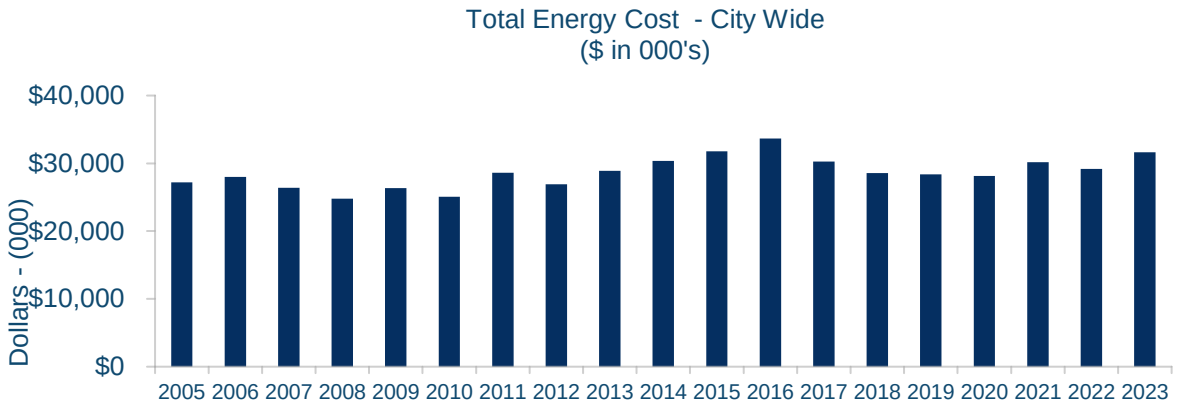
City/Town Halls	847	446	354
Corporate Facilities	1,173	564	551
Street Lighting	0	0	0
Traffic Lighting	0	0	0
Other City Operations	35	7	0
Hamilton Water	1,357	5622	6228
Yards	2,587	1811	1538
Arenas	2,068	1586	1777
Community/Senior Centers	241	221	202
Rec Centres/Pools	2,124	2169	2108
Tim Horton's Field	n/a	274	267
Rec Parks/Stadiums/Golf	417	230	210
Lodges (Macassa, Wentworth)	1,899	813	935
Culture	293	195	174
Fire/ EMS	650	724	679
Hamilton Public Libraries	190	303	248
First Ontario Centre	332	n/a	n/a
First Ontario Concert Hall	179	n/a	n/a
Hamilton Convention Centre	153	n/a	n/a
Hamilton Police Services	857	515	598
City Wide Total	15,404	15,480	15,869

A-9: Combined Energy Consumption Comparison by Portfolio Category (in 000's of ekWh)

	2005	**2022**	**2023**
City/Town Halls	13,775	8,662	7,570
Corporate Facilities	17,188	10,936	10,900
Street Lighting	33,602	17,465	17,510
Traffic Lighting	5,688	1,216	1,218
Other City Operations	5,618	4,276	4,061
Hamilton Water	121,040	162,930	171,765
Yards	39,589	27,935	24,601
Arenas	39,904	28,967	33,743
Community/Senior Centers	3,834	3,622	3,536
Rec Centres/Pools	26,789	30,043	29,621
Tim Horton's Field	n/a	8,885	8,223
Rec Parks/Stadiums/Golf	8,332	5,296	5,250
Lodges (Macassa, Wentworth)	24,938	13,699	14,861
Culture	5,383	3,975	3,715
Fire/ EMS	10,698	12,181	11,565
Hamilton Public Libraries	9,343	10,351	9,595
First Ontario Centre	10,122	n/a	n/a

First Ontario Concert Hall	5,466	n/a	n/a
Hamilton Convention Centre	4,656	n/a	n/a
Hamilton Police Services	14,757	11,238	11,884
City Wide Total	400,722	361,676	369,618

A-10: Total Annual Reported Costs Electricity & Natural Gas (Facilities)

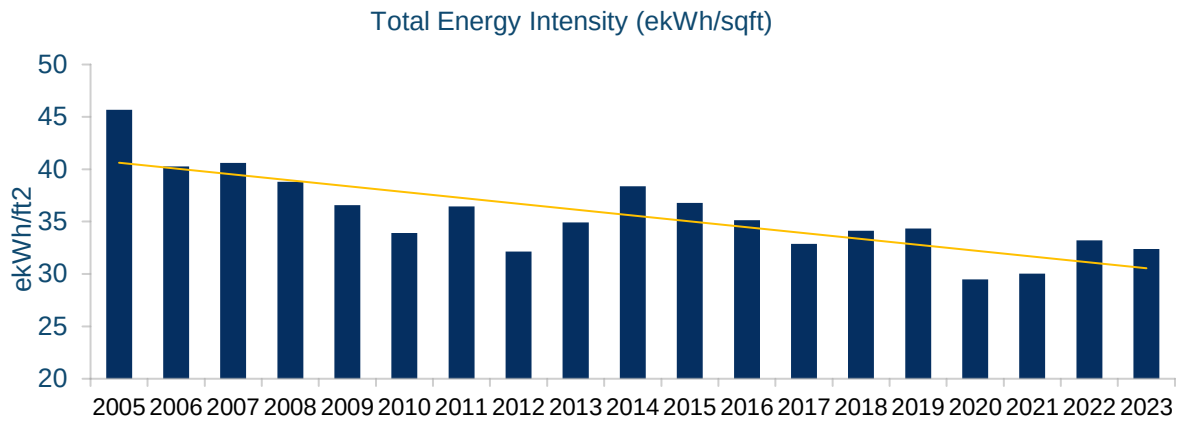


A-11: Total Reported Cost Comparison by Portfolio Category

	2005	2022	2023	2023 vs 2005	2023 vs 2022
City/Town Halls	$860	$826	$846	-2%	2%
Corporate Facilities	$866	$851	$933	8%	10%
Street Lighting	$2,895	$3,266	$3,679	27%	13%
Traffic Lighting	$462	$206	$220	-52%	7%
Other City Operations	$534	$552	$571	7%	4%
Hamilton Water	$9,590	$12,245	$12,916	35%	5%
Yards	$2,205	$1,798	$1,803	-18%	0%
Arenas	$2,455	$2,205	$2,825	15%	28%
Community/Senior Centers	$224	$270	$296	32%	9%
Rec Centres/Pools	$1,192	$1,673	$1,854	56%	11%
Tim Horton's Field	n/a	$836	$853	n/a	2%
Rec Parks/Stadiums/Golf	$564	$495	$561	-1%	13%
Lodges (Macassa, Wentworth)	$1,087	$800	$934	-14%	17%
Culture	$338	$283	$306	-9%	8%
Fire/ EMS	$614	$827	$864	41%	5%
Hamilton Public Libraries	$827	$873	$922	11%	6%
First Ontario Centre	$840	n/a	n/a	n/a	n/a
First Ontario Concert Hall	$454	n/a	n/a	n/a	n/a
Hamilton Convention Centre	$387	n/a	n/a	n/a	n/a
Hamilton Police Services	$783	$1,163	$1,241	59%	7%
City Wide Total	$27,177	$29,169	$31,625	16%	8%

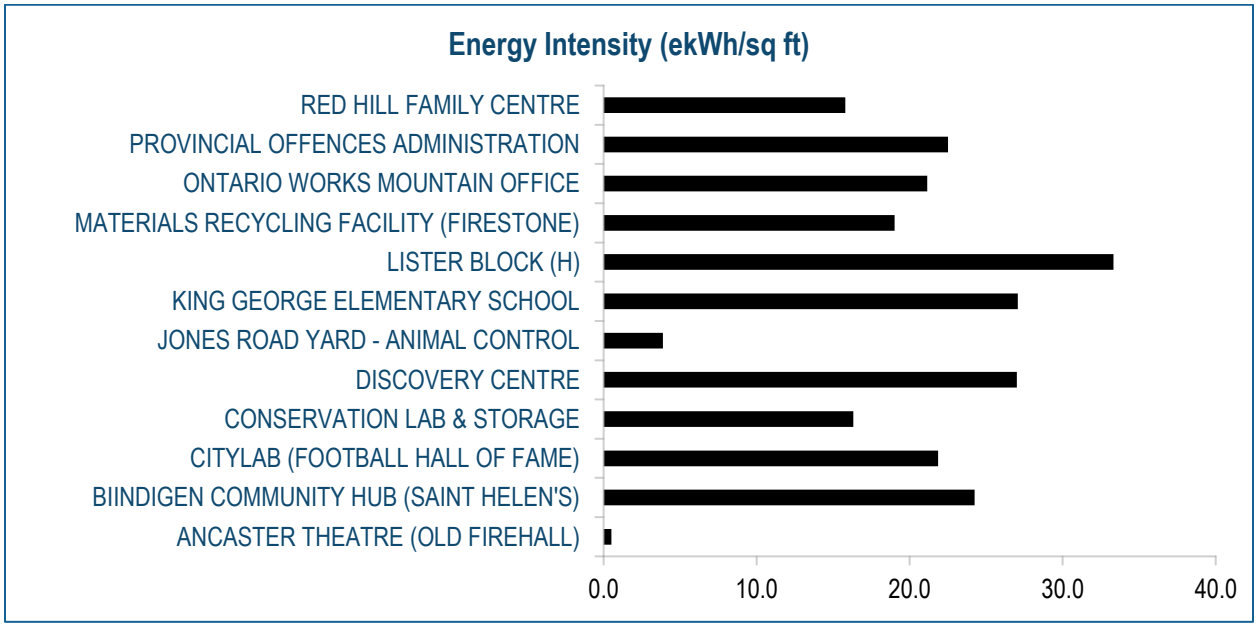
ENERGY INTENSITY

A-12: Total Annual Energy Intensity City-wide (ekWh/sqft)

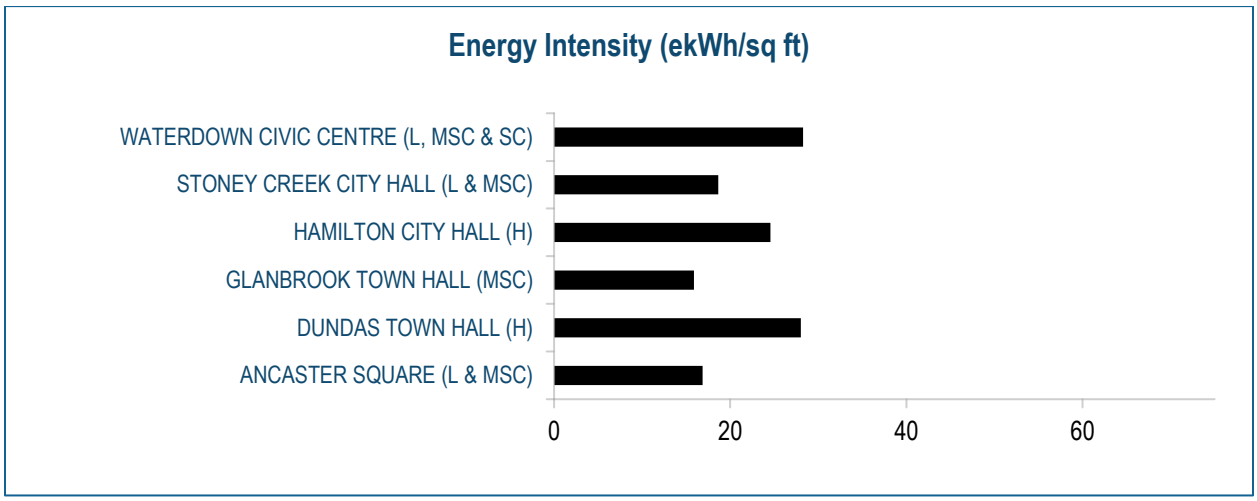


The following series of graphs represent the energy intensity results per site for 2023 within the specific portfolio categories. Sites that did not have square footage were removed but were included in the overall consumption and costs data sets. Sites were only included if there were full data sets for the year. There is no energy intensity data for Hamilton Water and Operational (O&M) sites. Also note that the energy intensity axis value may be adjusted depending on grouping.

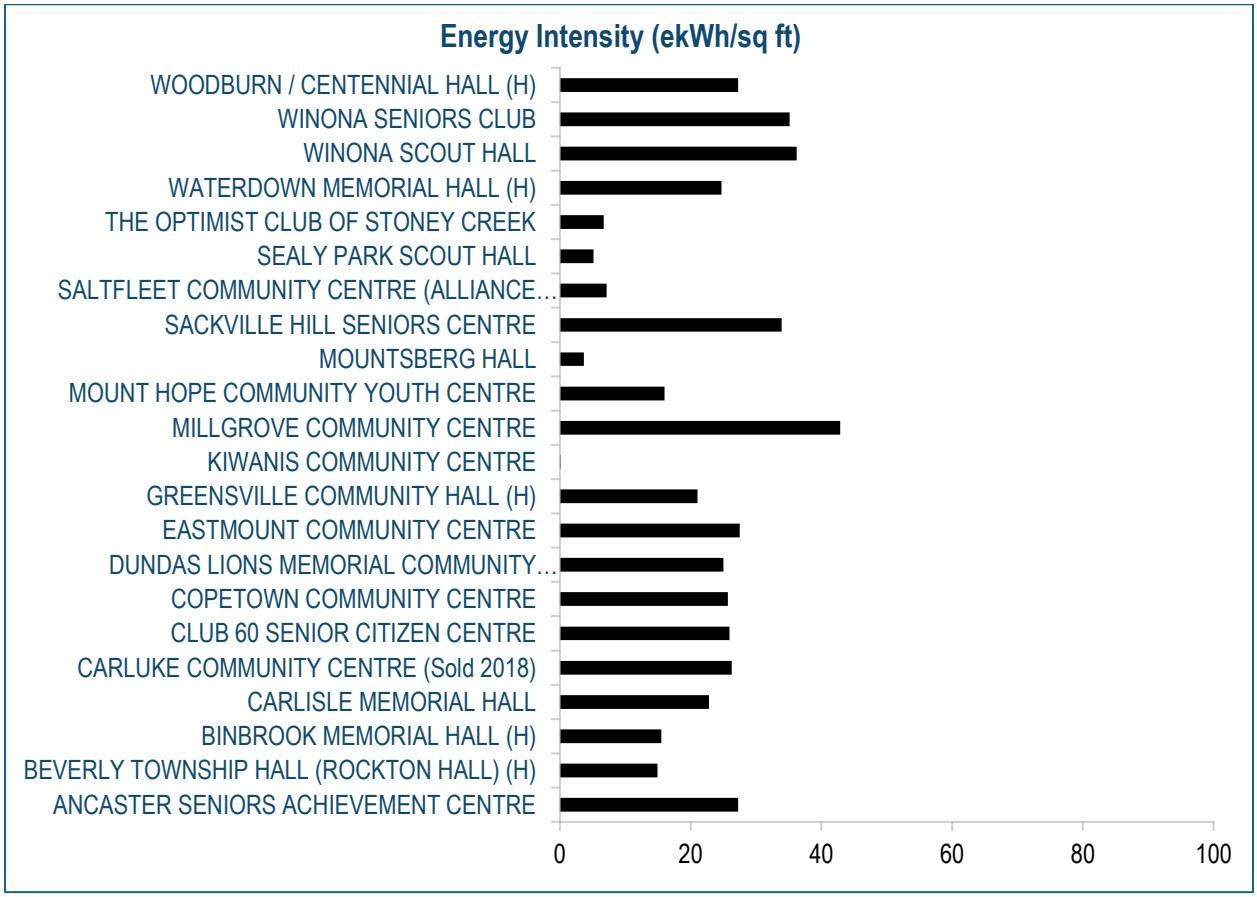
A-13: 2023 Energy Intensity Corporate Facilities



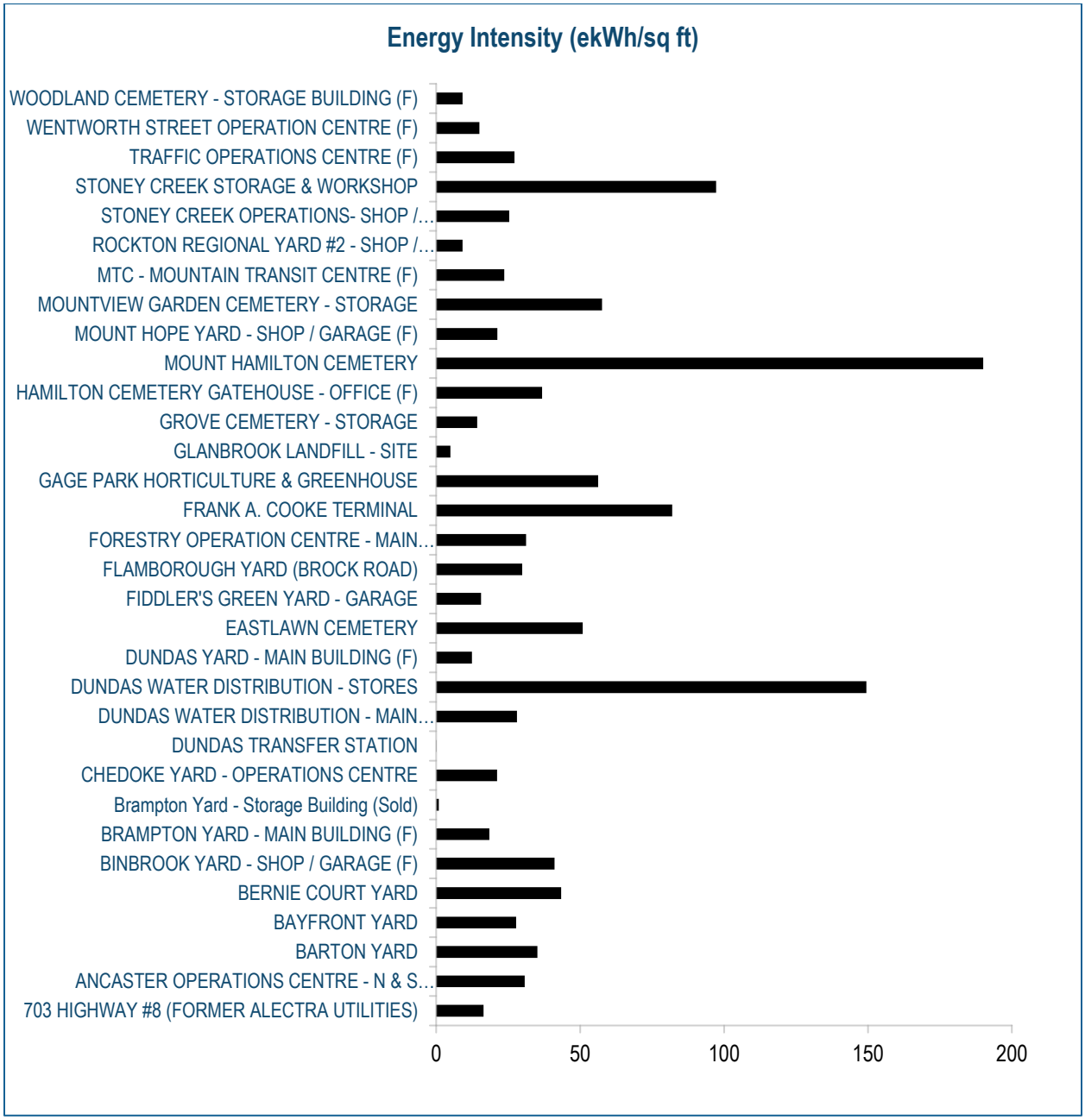
A-14: 2023 Energy Intensity Corporate Facilities



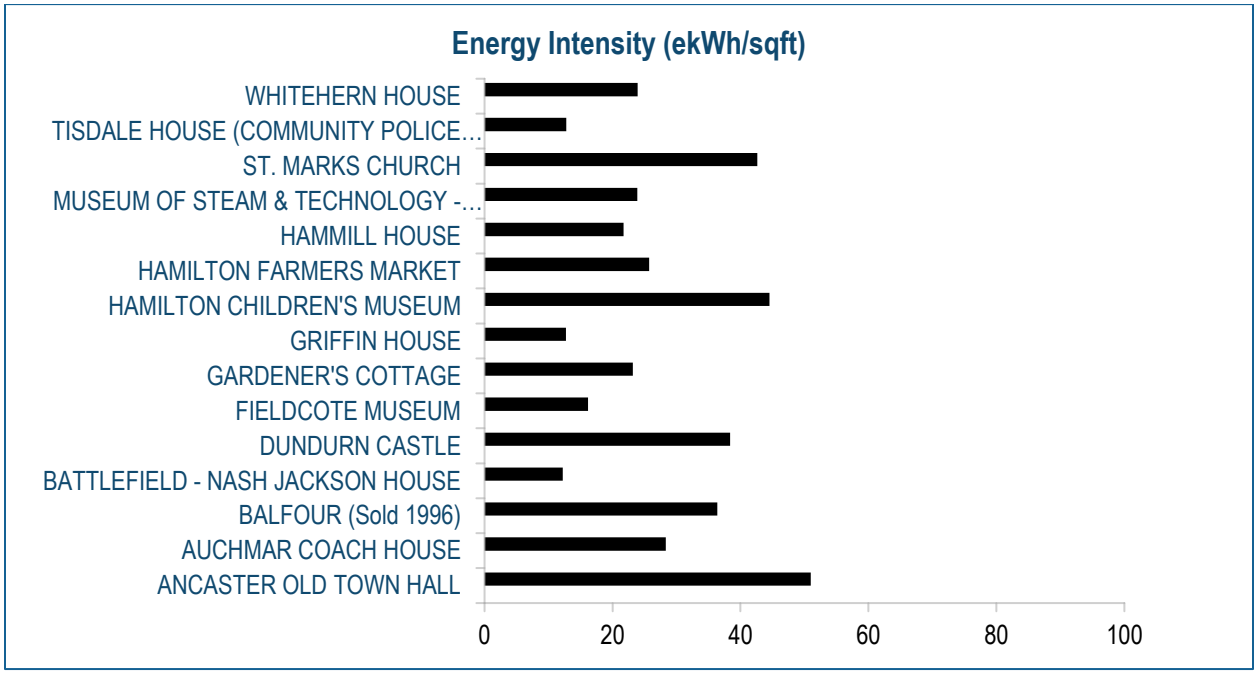
A-15: 2023 Energy Intensity Community Centres



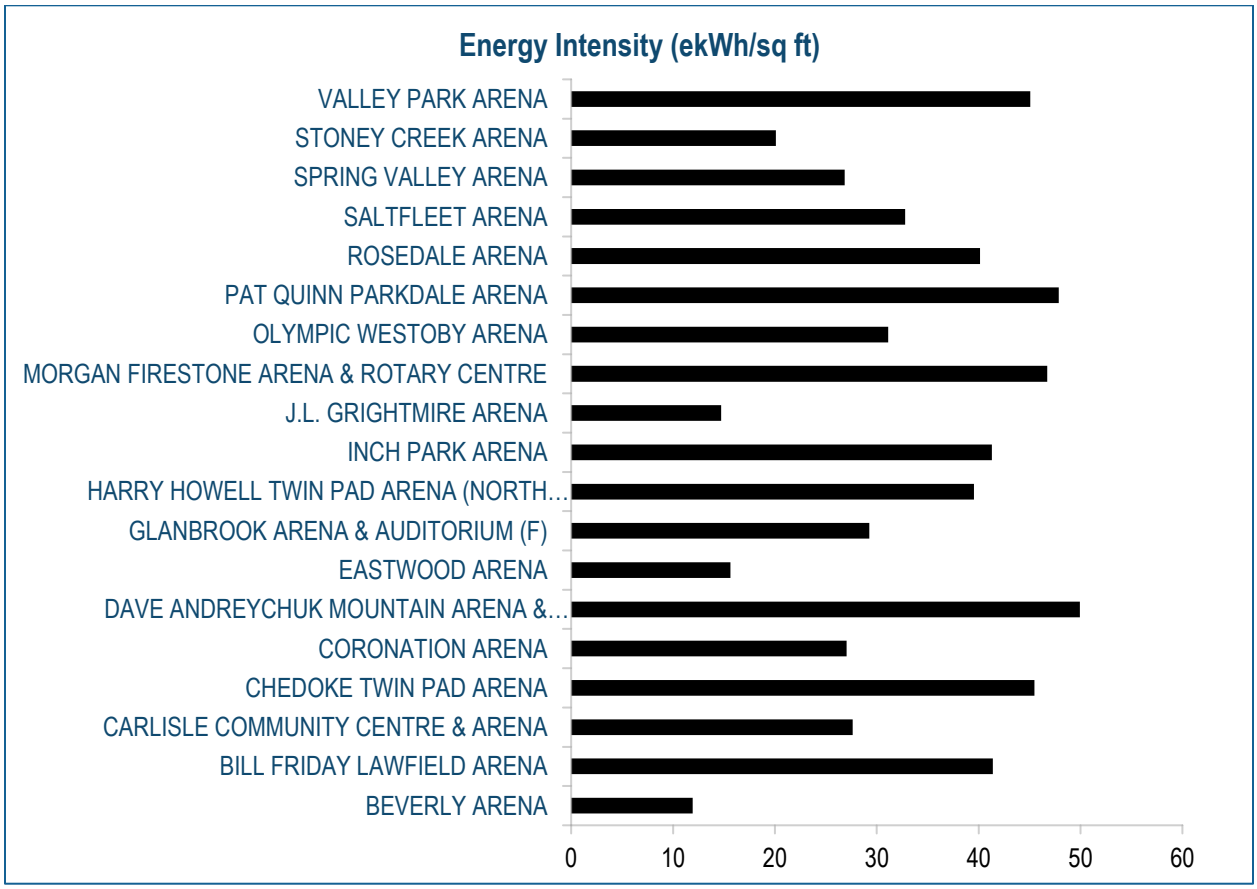
A-16: 2023 Energy Intensity Yards



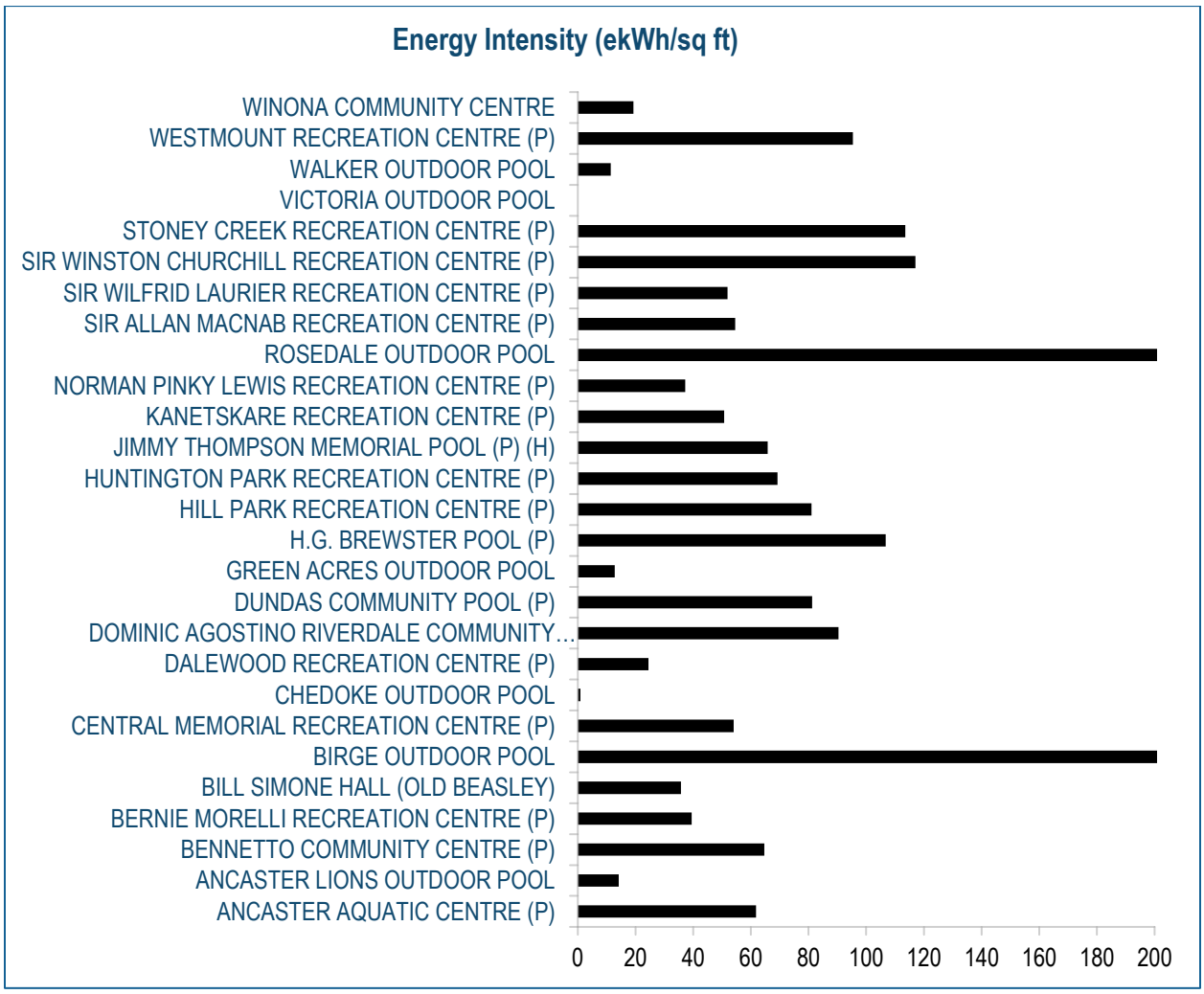
A-17: 2023 Energy Intensity Culture and Museums



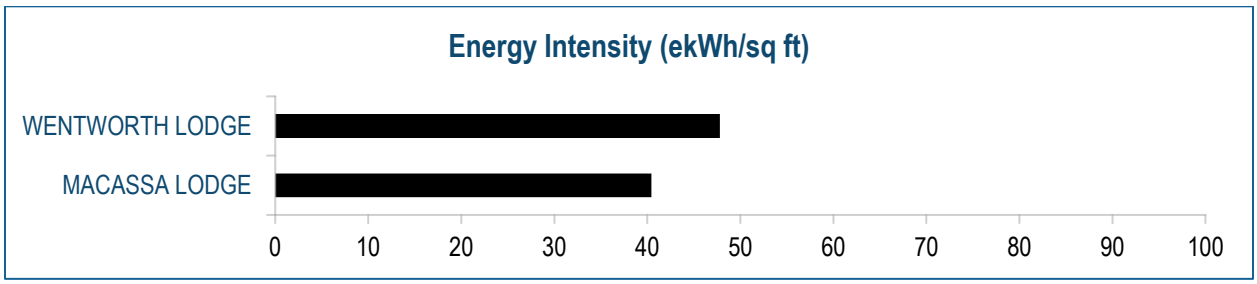
A-18: 2023 Energy Intensity Arenas



A-19: 2023 Energy Intensity Recreation Centres and Pools

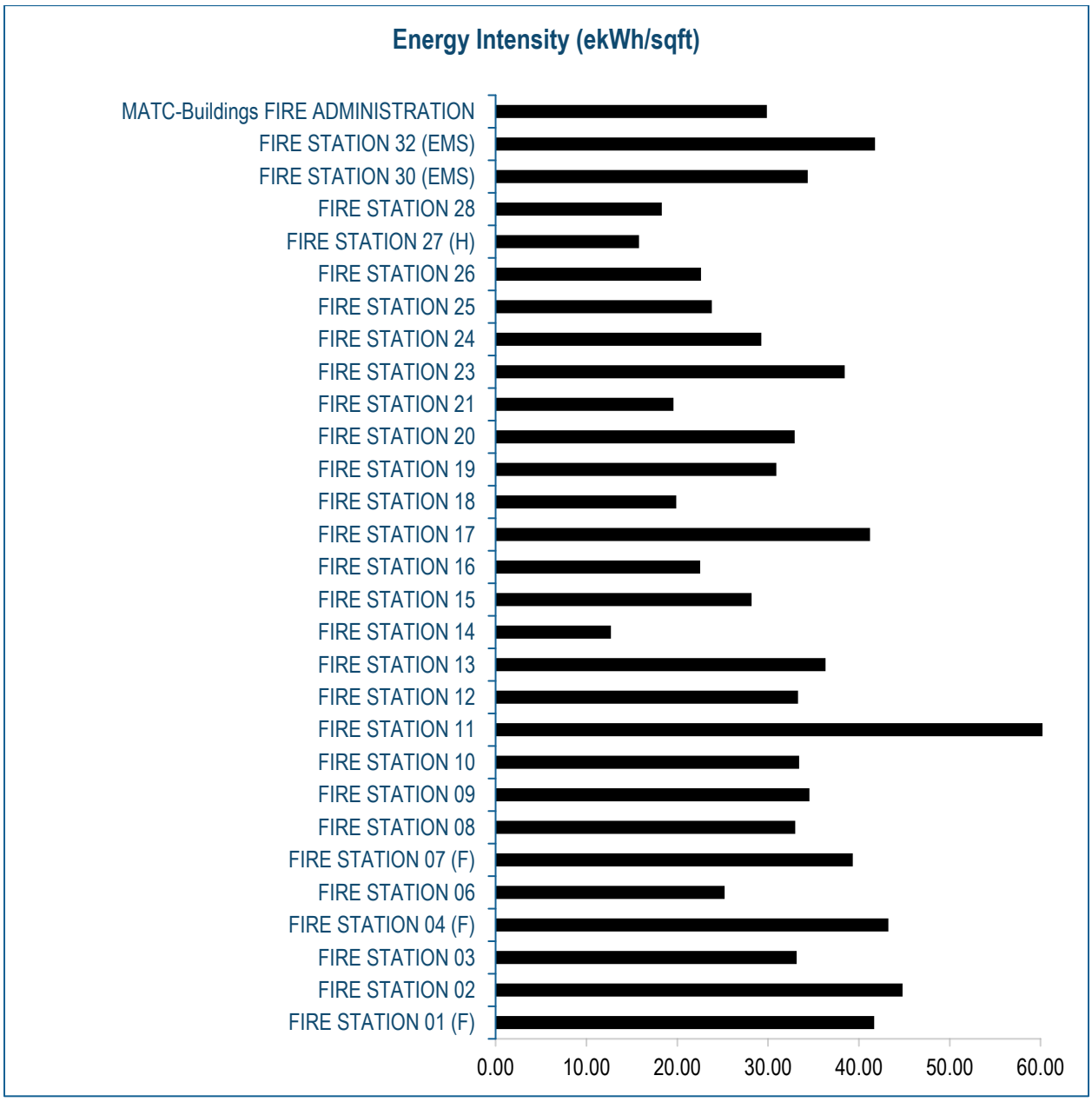


A-20: 2023 Energy Intensity Lodges

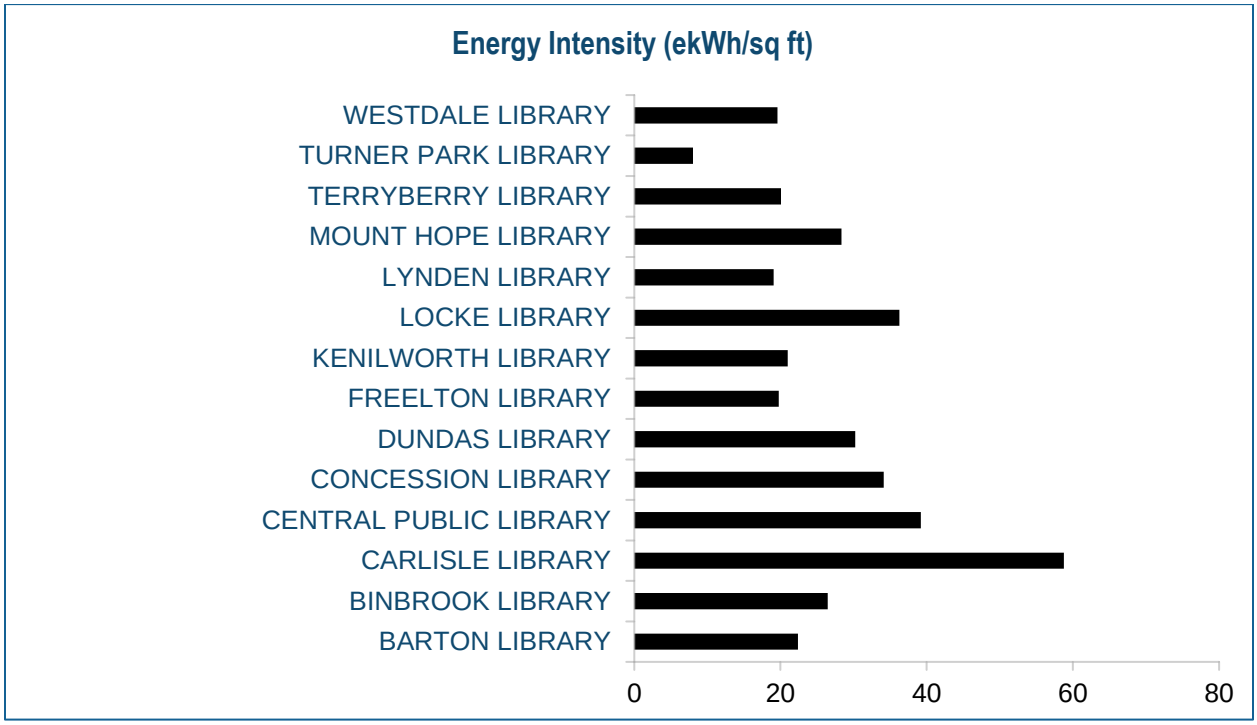


A-21: 2023 Energy Intensity Stadium, Golf Course Facilities and Recreation Parks Facilities

A-22: 2023 Energy Intensity Fire and EMS Facilities



A-23: 2023 Energy Intensity Libraries



FUELS

The following chart breaks down the fuel usage by user group category. For further clarification:

- Transit includes Transit Operations, Route Planning and Transit Yard Support;
- Operations includes Waste Management (non-contracted), Landfill, Roads, and Support Services; and;
- "Other" includes Public Health, Recreation, Tourism, Library, Bi-Law Services, Clerks, Information Services and Fire and EMS.

A-24: 2023 Fuel Usage by User Group

	Diesel (L)	Unleaded (L)	CNG DLE	Total (DLE)
Corporate Asset Management	3,582	10,688		14,270
Corporate Facilities and Energy	4,554	74,230		78,784
Engineering Services	0	30,961		30,961
Environmental Services	358,591	358,527		717,118
Waste Management	631,730	38,731		670,461
Hamilton Water	120,812	223,885		344,697
Operations	897,704	455,182		1,352,886
Transportation	88,677	32,259		120,936
Other	376,884	1,250,668		1,627,552
Transit	3,755,078	58,119	9,502,086	13,315,283
Total	6,237,613	2,533,250	9,502,086	18,272,949

WEATHER DATA

Weather and temperatures can impact energy consumption for electricity, natural gas and fuel. Reviewing cooling degree days (CDD) and heating degree days (HDD) can help identify one reason why consumption could be higher or lower year over year. CDD is a measure of how much (in degrees) and for how long, the outside air temperature was higher than a specific base temperature. HDD is a measure of how much and for how long the outside temperature was lower than a specific base temperature. The base temperature for this reporting is 18 degrees Celsius and is sourced from Environment Canada. According data for Hamilton weather station YHM, the annual Total cooling degree days in 2023 was 212. The total heating degree days in 2023 was 3,110. Details are in the charts below.

A-25: Weather Data for Hamilton (Environment Canada – Station YHM)

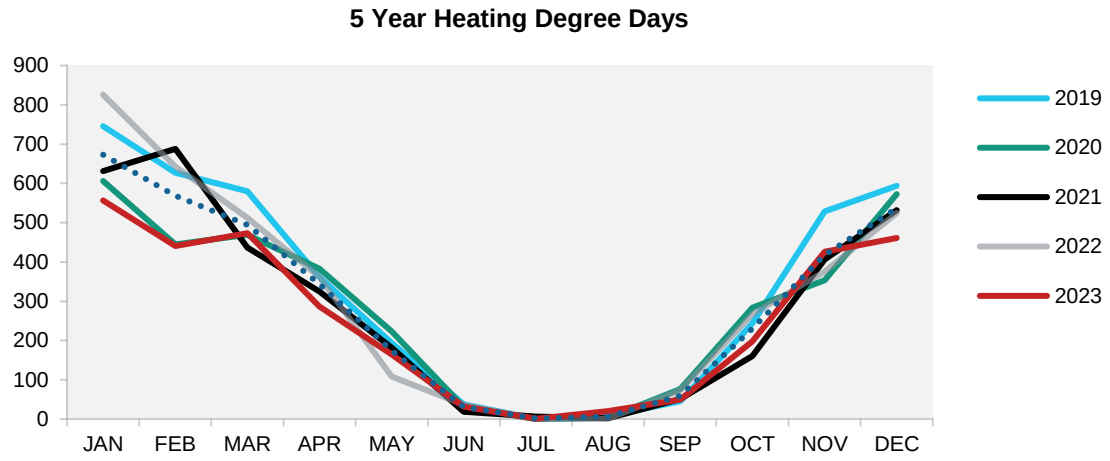
Month	Mean Temp (◦C)	HDD	CDD	2023 vs 2022 HDD	2023 vs 2022 CDD
Jan-23	-1.2	557	0	-33%	
Feb-23	-0.4	440	0	-31%	
Mar-23	0.5	474	0	-8%	
Apr-23	8.2	287	2	-21%	
May-23	12.6	164	6	51%	-75%
Jun-23	18.0	32	33	-13%	-31%
Jul-23	20.8	1	86	800%	-8%
Aug-23	18.8	21	43	4040%	-57%
Sep-23	17.2	50	29	-32%	32%
Oct-23	11.8	198	12	-26%	
Nov-23	3.3	426	0	13%	-100%
Dec-23	2.6	461	0	-12%	
2023 Annual Total		**3110**	**212**	**-17%**	**-27%**

A-26: Weather Data for Hamilton (Environment Canada – Station YHM)

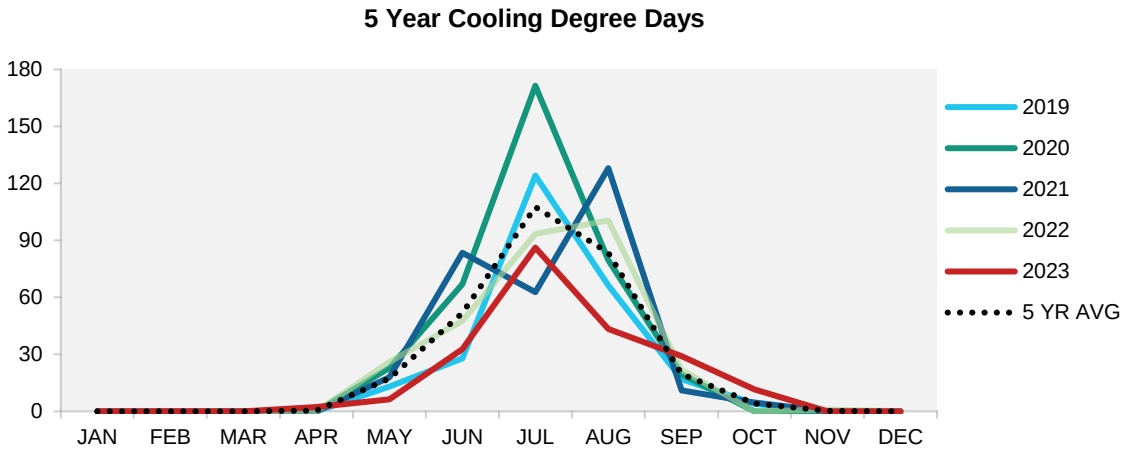
	HDD		CDD	
Month	**5 YR AVG**	**2023 vs 5 Yr Average**	**CDD 5 YR AVG**	**2023 vs 5 Yr Average**
JAN	673	-17%	0	
FEB	569	-23%	0	
MAR	494	-4%	0	
APR	344	-17%	0	
MAY	174	-6%	17	-63%
JUN	31	3%	52	-37%
JUL	2	-42%	108	-20%
AUG	7	200%	84	-48%
SEP	59	-16%	20	48%
OCT	230	-14%	4	186%

NOV	418	2%	0	-100%
DEC	537	-14%	0	
Average	**3538**	**-12%**	**127**	**67%**

A-27: Heating Degree Days (HDD)

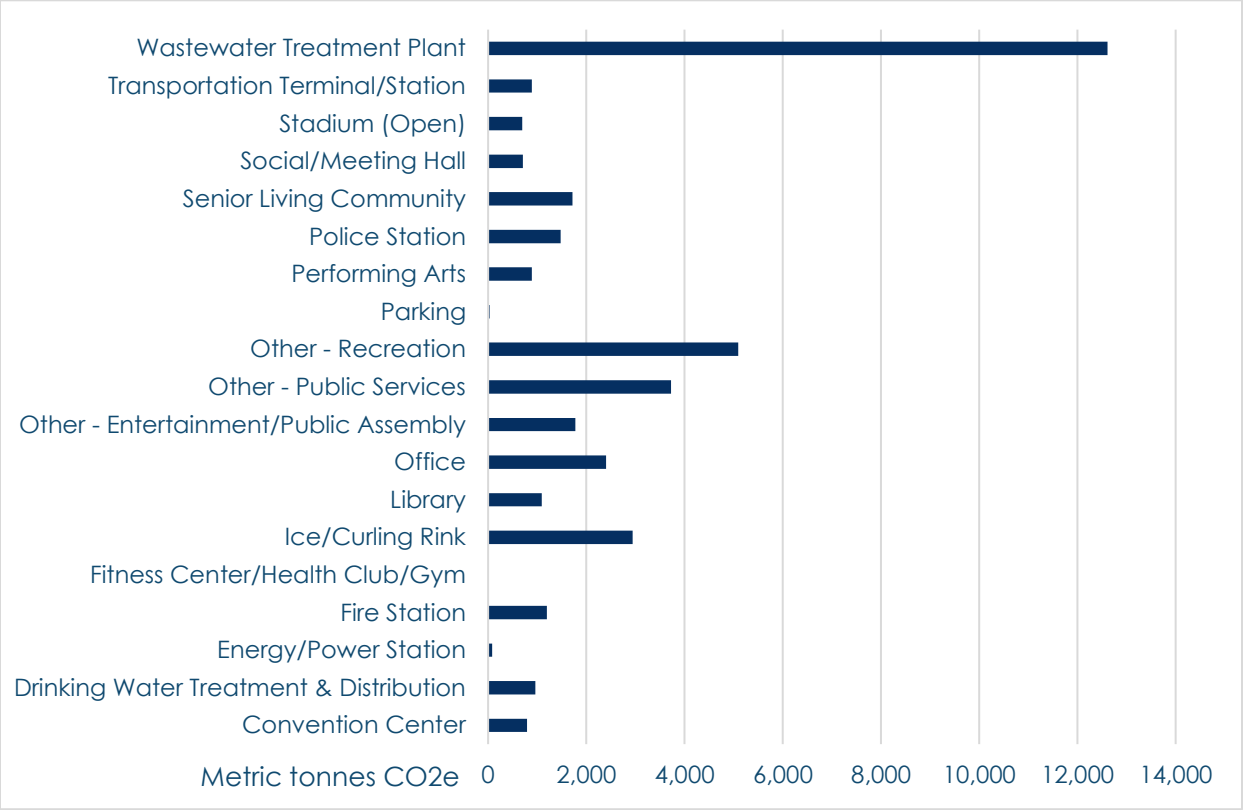


A-28: Cooling Degree Days (CDD)

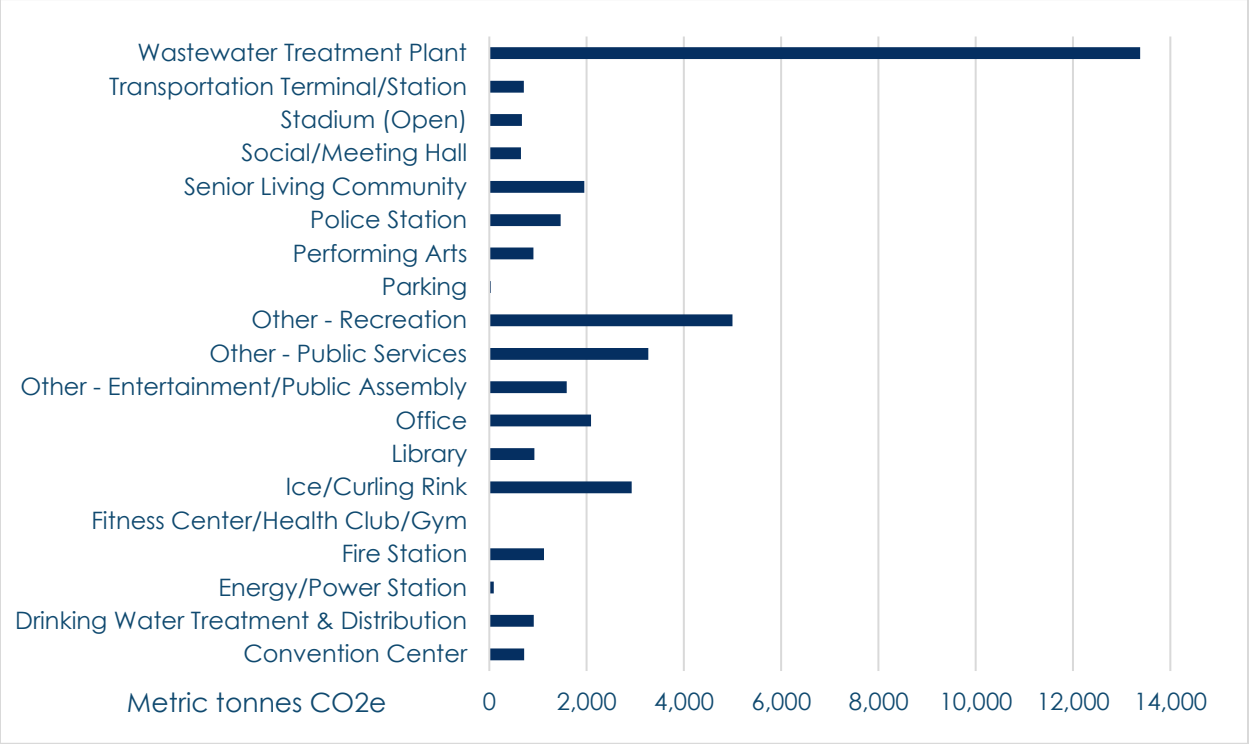


O.REG 25/23: BROADER PUBLIC SECTOR REPORTING

A-29: 2022 GHG Emissions Results Submitted (O. Reg 25/23)



A-30: 2023 GHG Emissions Results Submitted (O. Reg 25/23)



B. GLOSSARY

COMMON ACRONYMNS THROUGHOUT THE REPORT

BPS = Broader Public Sector

CAFE = Corporate Average Fuel Economy

CDD = Cooling Degree Days

CDM – Conservation and Demand Management

CEP = Corporate Energy Policy

CNG = Compressed Natural Gas

CO_2 = Carbon Dioxide

CO_2e = Carbon Dioxide equivalent

DLE = Diesel Litre Equivalent

ekWh = equivalent kilowatt hours

GA = Global Adjustment

GHG = Greenhouse Gas

GJ = Gigajoule

HDD = Heating Degree Days

HOEP = Hourly Ontario Electricity Price

HRPI = Hamilton Renewable Power Inc.

ICI = Industrial Conservation Initiative

IESO = Independent Electricity System Operator

KPI = Key Performance Indicator

kW = Kilowatt

kWh = Kilowatt-hour

LED = Light Emitting Diode

m^3 = Cubic Metres

OEB = Ontario Energy Board

tCO2e = Tonnes Carbon Dioxide equivalent

DEFINITIONS: COMMON TERMS USED THROUGHOUT THE REPORT

Avoided Cost/Cost Avoidance refers to the costs not incurred as a result of some action taken which is outside of status quo.

Commodity Hedging is the process of fixing prices for specific terms for natural gas, fuels or electricity (commodities).

Corporate Energy & Sustainability Policy is the revised and renamed corporate policy (previously the Corporate Energy Policy) governing energy-related decisions for corporately run assets.

Cost Recovery is the value collected by identifying billing errors, billing anomalies or rates corrections that result in a financial adjustment to costs.

Demand Reduction referenced in the report is action taken to reduce electrical demand during forecasted provincial peak events (high demand period) for optimizing Class A customers.

Energy Conservation is the collection of energy efficient measures, equipment or processes that lead to lower consumption.

Energy Intensity is the measurement of energy used per square foot of facility space.

Energy Performance is the collection of performance measurements including consumption, cost and energy intensity as compared against baseline and year over year.

Incentives are monies received from a recognized program including from utility providers, the IESO, Federal or Provincial grant programs where incentives are tied to energy conservation measures.

Net Zero means achieving overall, zero greenhouse gas emissions by balancing any emissions from energy use with carbon removal via a combination of reducing usage, changing to low or zero energy sources (i.e. renewable energy sources) changing processes and carbon offsetting.

Rate Optimization refers to ensuring that utility accounts are assigned to the appropriate rate class to result in best cost benefit.

Unit Cost is the total price of variable and fixed costs per unit. In this report it refers to unit costs of electricity, natural gas and fuels.

Utility Rates refers to the rate classes identified by local utility providers.