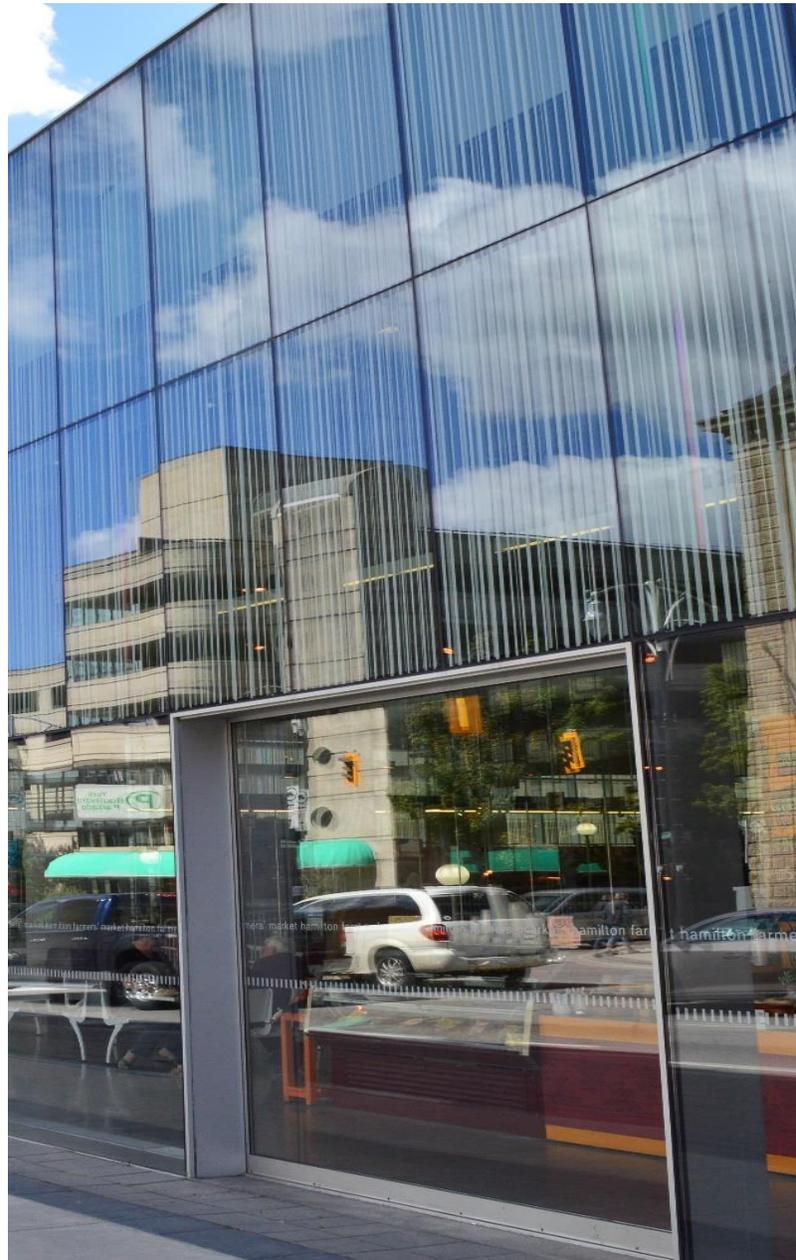


# ANNUAL ENERGY REPORT 2018

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CITY OF HAMILTON



Hamilton

## Table of Contents

Introduction .....	2
Corporate Energy Policy (CEP) .....	3
Energy Strategies and Program KPIs .....	4
Utility Rates and Commodity Strategies .....	5
Cost Recovery.....	5
Energy Conservation and Incentive Programs .....	6
Overall Energy Costs .....	6
Energy Performance KPIs .....	8
Electricity Consumption and Cost.....	9
Natural Gas Consumption and Cost .....	10
Combined Consumption and Cost (Electricity & Natural Gas) .....	11
Energy Intensity (City-Owned Sites).....	11
Vehicle Fuels .....	13
Corporate Average Fuel Economy .....	13
Fuel Consumption and Cost .....	14
Energy Conservation .....	15
2018 Project Highlights .....	17
Listing of Upcoming Projects for 2019 .....	18
Renewable Energy .....	19
Greenhouse Gas Emissions 2017 Report .....	20
Final Comments.....	23
Appendix A .....	25
Glossary .....	46

## Introduction

The City continues to demonstrate its commitment in managing its corporate energy portfolio. The Strategic Plan for 2016-2025 outlined several strategic priorities to support and align with the Hamilton's overall mission ***to provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community in a sustainable manner.***

Measuring and reporting on the annual results is key in recognizing how far we've come and how far we still must go to meet our corporate targets and reach our overall strategic goals.

**Clean and Green**  
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

The Clean and Green strategic priority, as part of the overall strategic plan shows commitment to growth in this area for the City of Hamilton. As well, the recent declaration on addressing climate change as a health and wellness emergency pushes Clean and Green priority actions to the forefront.

Corporately, this reinforces the support for conservation projects, demand management efforts, and renewable generation development to reduce energy usage, reduce emissions and contribute to the wellbeing of the citizens of Hamilton.

The Annual Energy Report for 2018 is intended as a detailed review of the past 12 months of activities as they relate to energy usage, costs, energy performance, procurement efforts and conservation initiatives for corporate assets. The greenhouse gas emissions reductions and inventory report for the 2017 calendar year is also included.

As we move forward, the reported results help to assess the performance of the measures we've put in place and focus efforts to meet our long-term targets. The Corporate Energy Policy is one way in which we facilitate energy initiatives and guide decision-making for our corporate sites.



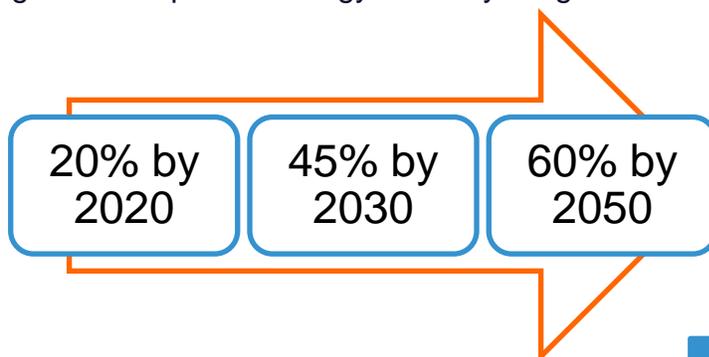
## Corporate Energy Policy (CEP)

The current energy policy (PW14050) was approved by council in 2014. The policy is designed to act as a guideline for making energy-related decisions as it pertains to corporate assets. Policy actions are outlined to support making building and process improvements that lead to energy usage reductions and emissions reductions to benefit the City both environmentally and financially. The CEP also solidifies targets related to energy intensity reduction, greenhouse gas (GHG) emissions reductions, and corporate average fuel economy (CAFE).

The policy aims to:

- Facilitate the achievement of City-wide energy and emission reduction targets;
- Address the legislated reporting requirements;
- Define policies for capital investment related to energy;
- Define policies related to energy procurement and exploring renewable energy opportunities; and
- Address regulations concerning GHG emissions.

Figure 1: Corporate Energy Intensity Targets



One of the key performance measures for the City is the energy intensity reduction targets established within the CEP. Energy intensity is the measurement of energy used

per square foot of facility space. The energy intensity results for 2018 were a reduction of 25% compared to the base year of 2005. Details on energy intensity are under the Energy Performance section on page 11 of this report.

**Energy intensity  
reduction of 25%**

The current targets for meeting the environmental emission reduction were adopted by council and was integrated into the current Corporate Energy Policy. The targets are:

Figure 2: Corporate Emission Reduction Targets

Year	Emission Reduction & Offset Target
2020	20%
2030	50%
2050	80%

The inventory of results of efforts related to GHG emission reductions is shown under the Greenhouse Gas Emissions 2017 Report, on page 19 of this report.

## What's next?

The Corporate Energy Policy is currently undergoing a 5-year review. The intent of the review is to look at the current policies and adjust as required to better align with changes in the regulatory environment and to continue to support energy-related initiatives and improvements that will lead to further reductions in energy consumption and emissions. Engaging all corporate stakeholders during this review process will allow input from staff on what actions can be taken to improve processes, building operations and services as it pertains to energy and environment. With effective policies and plans in place, meeting the upcoming targets for energy intensity and for emissions reduction become easier to obtain. Continuous improvement is key for continued success.



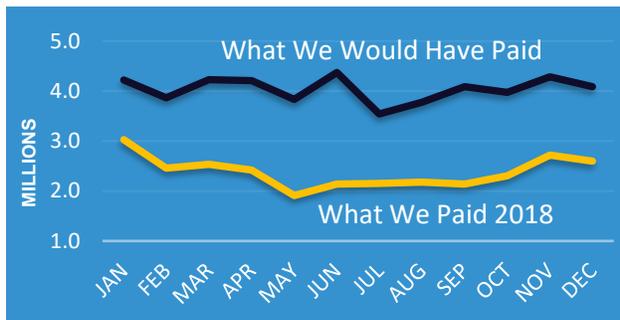
## Energy Strategies and Program KPIs

The City has made a commitment to measure and track performance of its varying programs and initiatives across the City. As part of a broader initiative to increase communication and performance goals to its citizens, several key performance indicators have been established to evaluate the City's efforts in energy reduction and GHG reduction.

Every year the City takes steps to reduce or mitigate rising costs, but simply measuring changes in cost is not a true reflection of the impacts of the variety of energy strategies and programs that are carried out year over year. Energy conservation projects that reduce usage, incentive programs, recovering dollars from bill review or optimizing utility rates are all contributing factors that can save or mitigate costs for the City.

**Energy Strategies & Programs resulted in \$9.9M savings and avoided costs for 2018.**

Energy conservation projects that reduce usage, incentive programs, recovering dollars from bill review or optimizing utility rates are all contributing factors that can save or mitigate costs for the City.



The total results from implementing energy strategies and programs undertaken in 2018 were \$9.99 million. The cumulative results from Energy Strategies and Programs for the past 12 years was \$78 million.

The program categories are outlined below:

### Utility Rates and Commodity Strategies

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, hedging strategies and optimizing utility rates including switching rate class to increase benefits from Global Adjustment (GA) savings opportunities. The 2018 results of natural gas commodity and hedging strategies were \$529,700. The 2018 results for GA rates optimization amounted to \$6.4 million, for a total of \$6.9 million for this category.

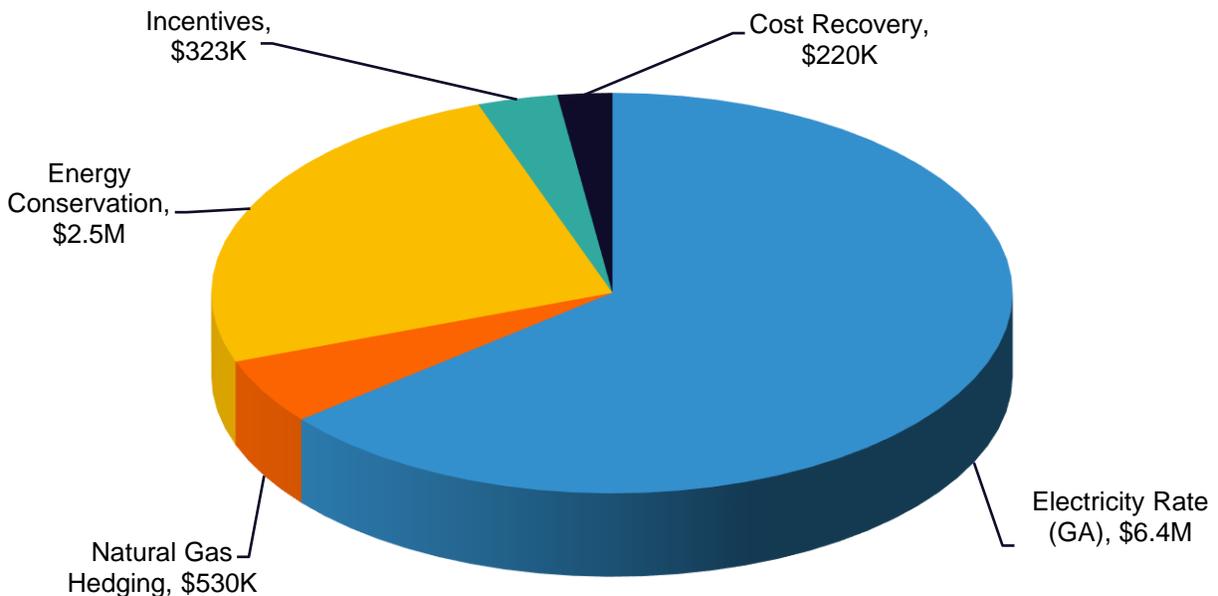
### Cost Recovery

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 tax recovery programs (e.g. Fleet fuel tax credit program). Cost recovery from billing or rate corrections in 2018 were \$220,000.

## 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. In 2018, accumulated energy projects amounted to \$2.5 million in energy efficiency and the incentives received were \$323,300, with the total results in this category of \$2.8 million in 2018.

Figure 3: 2018 Total Breakdown of Energy Programs and Strategies



## Overall Energy Costs

The City tracks costs and consumption to evaluate performance, but also to help budget for upcoming years. Costs for electricity, natural gas and fuels are compiled and

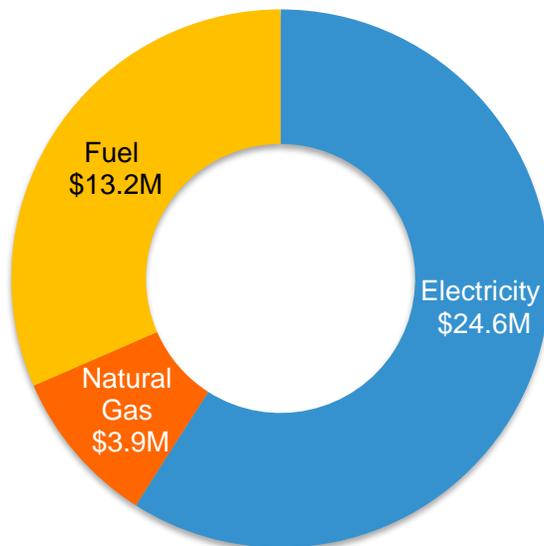
measured against the previous year and compared to the baseline year of 2005. For this report, costs for sites connected to the district energy loop (and supplied by HCE Energy Inc.) are included in electricity and natural gas costs.

Utility costs are a significant operating budget item for corporate buildings. Taking steps to mitigate rising costs through energy efficiency upgrades that reduce consumption can positively impact the overall cost. However, costs themselves are impacted by more than just usage. Utility rates, regulatory changes and legislation, inflation, global markets and weather can all influence costs. Costs for utilities are typically made up of both regulated charges and commodity or market-based charges.

In Ontario, the political environment over the past two years has led to both increases and decreases in regulatory charges for both electricity and natural gas. Natural gas in particular saw the introduction of Cap & Trade charges in 2017, and the subsequent removal of those charges in October 2018. While the City can do little to control regulatory-driven changes to its utility charges, focusing on conservation efforts is critical to reduce usage and reduce the impact those charges have on overall costs.

In 2018, the City spent \$41.7 million on electricity, natural gas and vehicle fuels. Overall, this represents less than a 1% decrease from 2017.

Figure 4: 2018 Energy Costs in millions (\$M)



Costs incurred by City-owned buildings/sites and exclude City Housing Hamilton. Utilities include Alectra Utilities, Hydro One Utilities and Union Gas (now 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 CNG for all Transit and Fleet operations but does not include Hamilton Police Services or Darts. Sites with partial data may be excluded.

The results are:

- Overall electricity costs were \$24.6 million in 2018, 6.5% lower than 2017.
- Overall natural gas costs were \$3.9 million in 2018, a 0.2% increase over 2017.
- Overall fuels costs were \$13.2 million in 2018, a 14.5% increase over 2017.

The selection of buildings/sites included in the report may vary year over year. In any given year, buildings may be added, either built or purchased, or removed, due to property sales or demolition which could impact their inclusion in the reporting. Major renovations may also decommission a site for a time, and it may be excluded as a full year data set may not be available. As such, square footage numbers are also adjusted.



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## Energy Performance KPIs

Tracking and reviewing costs is important, particularly for setting accurate budgets. However, costs alone cannot determine what might be happening within a building or across the City. Changes to consumption may be an indicator that costs *should* reduce or increase, but cost and consumption are influenced by several other factors that need to be considered.

Regulatory changes have impacted prices greatly over the past few years. Increases to electricity rates for many years outpaced reductions in consumption. However, in the past 2 years, hydro rates have been reduced through a variety of regulated price relief structures. Provincial Cap & Trade legislation, from 2017 and into 2018 automatically increased cost to end-use users of natural gas and fuels. That legislation was repealed in October 2018. However, the Federal carbon tax program, designed to tax emissions from fossil fuels has been mandated for all provinces without a provincial carbon reduction (tax) plan. It is expected to begin in 2019. It is meant to help lower GHG emissions but will also increase the costs to heating and vehicle fuels for Ontario consumers.

Weather has one of the greatest impacts to consumption and costs year over year. With the increase in more extreme weather patterns emerging, hotter summers and colder winters lead to increased consumption for buildings and vehicles, with potentially higher prices, higher emissions and increased strain on energy grids.

Process and equipment improvements, changes in occupancy and programming at the buildings can further impact consumption patterns.

In the section below, we review the energy performance KPIs. Of particular importance is the energy intensity results, which is a KPI outlined specifically in the Corporate Energy Policy. Results in this section allow us to identify and focus on areas of concern and identify opportunities for improvement which support the City's Strategic Plan.

## Electricity Consumption and Cost

Electricity is the largest energy expenditure for the City. Hamilton is served by two local distribution companies (Alectra Utilities and Hydro One). Electricity costs are made up of electrical commodity, distribution, transmission, regulatory and delivery charges. Both Alectra Utilities and Hydro One are regulated by the Ontario Energy Board (OEB) and must get approval for any rate changes.

In 2018 the overall electricity consumption showed a slight increase over 2017 of less than 1%. Although the continued array of energy efficiency projects and peak day reduction activities have helped to mitigate increases to consumption, summer temperatures in 2018 heavily impacted electrical consumption for many sites. The cooling degree days, which are a measure of how much (in degrees) and for how long (in days) the outside temperature was higher than a base temperature, was 67% higher in 2018 versus 2017, and 35% higher than the 5-year average.

**Factors such as implementing efficiency projects, regulatory changes, weather, process improvements, and occupancy changes can all impact cost and consumption.**

Costs, on the other hand, were 6.5% lower than in 2017. One of the major reasons costs decreased was the introduction of Ontario's Fair Hydro Plan in the summer of 2017. For 2018, the City's electricity costs benefited from a full year of reduced rates under the rate relief program. In addition, rates were also impacted by market conditions for both commodity and Global Adjustment.

Figure 5: Electricity Consumption and Cost Comparison

Electricity Overview				Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017.
Total Electricity (kWh)	236,362,045	215,322,168	216,150,047	-9%	0.4%
Total Electricity (\$)	\$20,657,050	\$26,341,588	\$24,637,207	19%	-6.5%
Total Electricity (\$/kWh)	\$0.087	\$0.122	\$0.114	30%	-6.8%

## Natural Gas Consumption and Cost

Hamilton is served by one natural gas distribution company, Union Gas. In January 2019, Union Gas and Enbridge Inc. merged to form one distribution company servicing most of Ontario called, Enbridge Gas Inc. Natural gas costs comprises commodity and transportation, and regulated costs for delivery and storage. Regulated costs for Union Gas are also approved by the OEB. The results for natural gas shown below are for the buildings only. CNG for the vehicle fleet is shown in the Vehicle Fuels section on page 13.

Natural Gas is largely impacted by cold weather, particularly if it is prolonged cold temperatures and prices are typically higher during these peak-consuming periods. The consumption for 2018 was higher by 4.6% over 2017. Heating degree days were 9% higher in 2018 compared to 2017, but in line with the 5-year average.

Costs for 2018 were almost the same as 2017, just slightly higher. One reason costs did not increase despite the increase in consumption is due to the repeal of Ontario's Cap & Trade program. The charge of approximately 3.4 cents per m<sup>3</sup> of use was removed in October 2018. The City has also benefited from relatively stable natural gas costs because of the disciplined hedging strategy purchases of natural gas on the wholesale market. The City will purchase forward terms that meet strategy targets to mitigate the fluctuations in commodity costs during unforeseen high-price events.

Figure 6: Natural Gas Consumption and Cost Comparison

Natural Gas Overview				Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017.
Total Natural Gas (m <sup>3</sup> )	15,403,956	12,227,595	12,788,880	-17%	4.6%
Total Natural Gas (\$)	\$6,520,253	\$3,935,717	\$3,943,736	-40%	0.2%
Total Natural Gas (\$/m <sup>3</sup> )	\$0.423	\$0.322	\$0.308	-27%	-4.2%

### Combined Consumption and Cost (Electricity & Natural Gas)

The total combined energy use for electricity and natural gas is converted to equivalent kilowatt hours. Below, we can see the usage increased by 2% in 2018 over 2017, while costs were down 5.6% for 2018 as compared to 2017. As detailed above, weather was a big factor in the increase in usage overall.

Figure 7: Combined Consumption and Cost Comparison

Total Energy Overview				Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017.
Total Energy (ekWh)	400,722,256	343,345,087	350,049,621	-13%	2.0%
Total Energy Cost (\$)	\$27,177,303	\$30,277,305	\$28,580,942	5%	-5.6%
Total Energy (\$/ekWh)	\$0.068	\$0.088	\$0.082	20%	-7.4%

### Energy Intensity (City-Owned Sites)

One of the KPIs outlined in the Corporate Energy Policy is energy intensity. Energy intensity is the measurement of consumption (in ekWh) per square foot of conditioned space. Conditioned space refers to the useable, occupied space of a site, and not simply the square footage of the overall site. An example would be measuring the energy intensity of a public building within a park, and not the whole of the park. Operational usage is not included. An example is street lighting and traffic lighting. Both use electricity, but there is no building footprint.

Although efforts are undertaken to reduce consumption by implementing energy

efficiency measures, actions may act as mitigation for even higher usage. There was increased usage overall in buildings, largely impacted by the hotter summer and cooler winter. Energy intensity increased 3.8% when compared to 2017. It was a 25% reduction when compared to 2005 base year.

Figure 8: Energy Intensity City-Wide for City-Owned Sites

Energy Intensity				Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017
City Total (ekWh/sqft)	45.69	32.88	34.13	-25%	3.8%
City Total (\$/sqft)	\$2.67	\$2.44	\$2.33	-13%	-4.5%
Reported Square Footage	5,138,852	5,633,585	5,708,246	11%	1.3%

Figure 9: Energy Intensity Comparison by Reporting Portfolio Category

Energy Intensity	ekWh/sqft				
	2005	2017	2018	2018 vs 2005	2018 vs 2017
City/Town Halls	39.6	23.1	24.3	-39%	5%
Corporate Facilities	44.6	20.6	21.7	-51%	5%
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	26.1	29.7	-22%	14%
Arenas	51.3	39.0	43.3	-15%	11%
Community/Senior Centers	31.1	23.4	24.8	-20%	6%
Rec Centres/ Pools	78.6	69.2	66.9	-15%	-3%
Tim Horton's Field	0.0	22.7	21.4	0%	-6%
Rec Parks/Stadiums/Golf	36.5	34.5	31.0	-15%	-10%
Lodges (Macassa, Wentworth)	113.6	45.1	43.5	-62%	-4%
Culture	35.5	30.4	31.4	-12%	3%
Fire/ EMS	45.2	36.0	37.4	-17%	4%
Hamilton Public Libraries	25.2	26.9	31.4	25%	17%
First Ontario Centre	22.5	20.4	22.0	-2%	8%
First Ontario Concert Hall	57.8	49.7	48.2	-17%	-3%
Hamilton Convention Centre	37.2	29.7	32.5	-13%	10%
Hamilton Police Services	59.8	35.2	36.4	-39%	3%
<b>City Wide Total</b>	<b>45.69</b>	<b>32.88</b>	<b>34.13</b>	<b>-25.3%</b>	<b>3.8%</b>

Additional tables detailing energy consumption, cost and energy intensity by portfolio are provided in Appendix A (pages 29 to 37),



## Vehicle Fuels

In addition to reporting on the City’s corporate facilities, there is also the City’s large fleet of corporate vehicles. The fleet includes a variety of vehicle types such as buses, waste collection vehicles, snow removal trucks, street sweepers, department vehicles, and Fire and EMS vehicles. The fuels used are diesel, unleaded gasoline, and compressed natural gas (CNG). The performance of the fleet as it relates to energy usage is reported below.

**CAFE Reduction of 3% compared to base year.**

### Corporate Average Fuel Economy

The Corporate Energy Policy outlines targets for fleet to achieve an improvement in fuel consumption efficiency. The KPI measurement indicator is the Corporate Average Fuel Economy (CAFE), which is the amount of fuel consumed in diesel litre equivalent (DLE) per 100 km of distance travelled. The long-term goals are to reduce the CAFE by 20% by 2030 as compared to the base level. The base year for CAFE is 2012.

Improving and managing fleet efficiency can be achieved by utilizing vehicles with clean drive technology, abiding fit-for-purpose principles, driver behavior and City-supported bylaws (e.g. anti-idling bylaw). As of 2018, there is a 3% reduction as compared to the base CAFE level.

Figure 10: Corporate Average Fuel Economy 2018 to Base Year Comparison

Diesel Litre Equivalent (DLE) per 100 KM	BASE (2012)	2018
Unleaded Gasoline	20.7	19.4
Diesel	54.5	54.1
CNG	66.2	70.7
Total	46.2	44.8
Overall % Changed in DLE/100 KM		-3%

Tracking of vehicle and fuel data used as a measurement for CAFE continues to be an ongoing exercise. Fueling stations are spread throughout the City and capturing real-time accurate data is key in identifying areas for improvement.

## Fuel Consumption and Cost

The City makes wholesale purchases of fuels for its City fleet. The fleet primarily consists of Transit buses, waste collection vehicles, snow removal trucks, street sweepers, departmental vehicles (i.e. medium and light duty vehicles), and Fire and Emergency Services (EMS) vehicles. A good portion is diesel or unleaded gasoline; however, Transit is continually expanding its fleet of CNG buses.

In 2018, the City used 9.1 million litres of diesel fuel, a 2% reduction from 2017. The average cost per litre, was an increase of 17% compared to 2017. The City used 2.2 million litres of unleaded gasoline, a 5% increase over 2017. The average cost per litre was an increase of 11% over 2017.

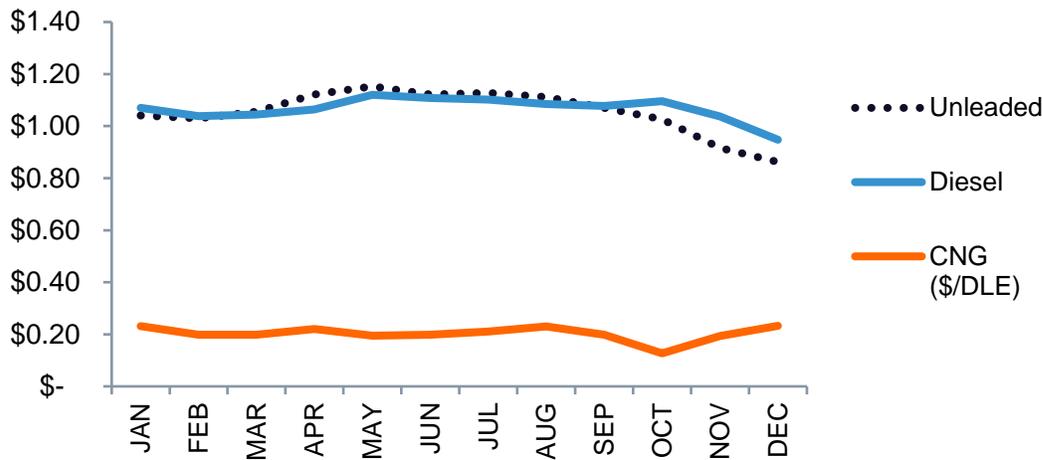
The purchases of CNG increased in 2018 by 22% compared to 2017, with a total of 5.1 million diesel litres equivalent. The primary reason is the increase in CNG-fueled buses in Transit's fleet. The CNG bus fleet increased by 35 buses from 85 in 2017 to 120 in 2018. The bus fleet overall, increased from 251 vehicles in 2017 to 267 vehicles for 2018.

Figure 11: 2018 Consumption and Cost of Fuels

Fuel Type	Consumption Litres	Cost	Average \$/L
Diesel	9,172,662	\$ 9,752,970	\$ 1.06
Unleaded Gasoline	2,248,360	\$ 2,372,824	\$ 1.06
CNG (DLE)	5,104,215	\$ 1,032,545	\$ 0.20
<b>Total</b>	<b>16,525,237</b>	<b>\$ 13,158,339</b>	

CNG is a lower cost fuel for buses compared to diesel and gasoline, but they do operate at approximately 75% efficiency per diesel litre equivalent when compared to diesel fueled bus usage. However, despite a lower fuel efficiency, when converted to diesel equivalent dollars and adjusted for efficiency, Transit spent \$2.9 million less running their fleet of CNG buses than they would have only using 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 GHG emissions inventory.

Figure 12: 2018 Monthly Fuel Prices (\$/DLE)



The natural gas used to fuel the buses is purchased in the same manner as for volumes used to heat buildings, therefore the City can also take advantage of hedging opportunities when market conditions are favorable with the intention of mitigating price fluctuations and stabilizing budgets.



## Energy Conservation

Energy Conservation projects are one of the initiatives the City uses to help achieve reductions in energy usage, energy intensity and GHG emissions. Making upgrades to existing buildings or adopting emerging energy efficiency technologies in new facilities can improve operational efficiencies and cost-effectiveness. Energy efficient spaces and processes are critical for meeting corporate targets but are also expected by workers and citizens that use those spaces. Green building has become a desired state, and the City must continue to move in that direction.

Project teams work closely with consultants, engineers, utility personnel and industry experts to retrofit buildings with energy efficient equipment with an eye on reducing energy consumption and improving building operations. Securing any available incentives and funding opportunities and Monitoring & Verification (M&V) plans are also essential for maximizing the success of any retrofit program.

### Project Spotlight: Anti-Stagnation Valves at Hamilton Water

Hamilton Water is the single largest user of energy in the City at 36%. Finding opportunities to reduce energy, upgrade equipment, increase operational efficiency and make improvements to water and wastewater facilities are key priorities. The installation of anti-stagnation valves in 2018 aimed to reduce energy use and improve operational efficiencies.

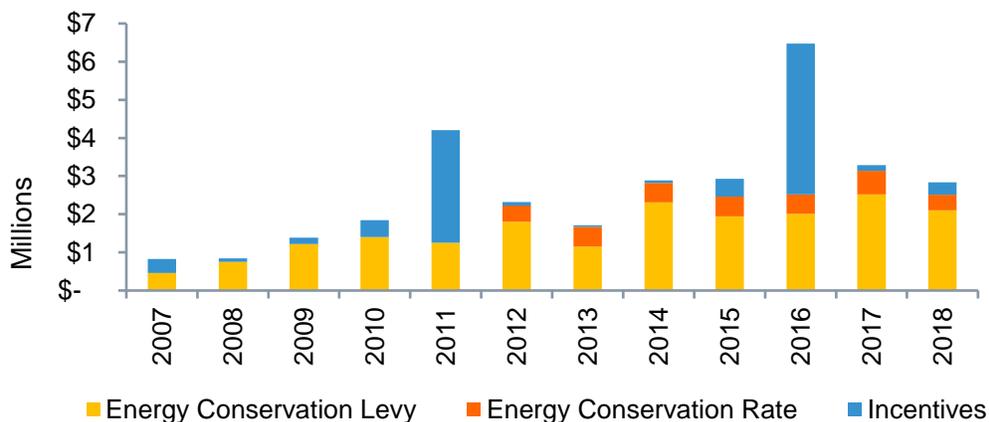
In June 2018, 37 anti-stagnation valves were installed and operational in the water distribution main system. The valves reduce water re-circulation where previously the flow was constant. In addition to the significant annual energy savings of 2.1 million kWh and energy cost savings of over \$150,000 at two pumping stations, it is expected that significant maintenance savings will be achieved because of reduced flow through the pumps.

A further 31 valves were installed in October 2018, yielding an additional projected 1.5 million kWh and \$200,000 in annual savings for another pumping station. This project was also eligible for incentives from the IESO SaveOnEnergy program.

With the success of these projects, the city is planning to implement this technology at other pumping stations.

The City tracks the energy savings from the projects once they are complete. The 2018 energy savings contribution from projects was \$2.5 million, with \$323,300 in incentives, for a total of \$2.8 million in conservation savings. Cumulatively, since 2005, the value of conservation is \$31.3 million in project savings and incentives.

Figure 13: Annual Project Savings & Incentives



## 2018 Project Highlights



### Aquatic Centres - Exterior LED Lighting Upgrades

- Installation of new exterior LED lighting at 9 aquatic centres.
- Benefits include improved lighting conditions, safety and a reduction in lamp maintenance costs.
- \$7,000 in incentives expected from the IESO SaveOnEnergy program.



### Rosedale Tennis Dome LED Lighting Upgrade

- Installation of new interior LED lighting and controls in the Rosedale tennis dome.
- Benefits include improved lighting conditions and a reduction in lamp maintenance costs.
- \$10,570 in incentives received from the IESO SaveOnEnergy program.



### Fire Stations LED Lighting Upgrade

- Installation of new interior LED lighting at 30 fire stations.
- Benefits include improved lighting conditions and a reduction in lamp maintenance costs.
- \$28,300 in incentives received from the IESO SaveOnEnergy program.



### Macassa Lodge Chiller Upgrade

- Installation of three 60 tonne air cooled chillers (life cycle replacement).
- Benefits include improved cooling system reliability during peak summer months and reduce chiller load.
- \$28,500 in incentives are expected from the IESO SaveOnEnergy program.



### **Lighting Asset Modernization Project - LAMP (Completed by the LAMP Project Team, Engineering Services)**

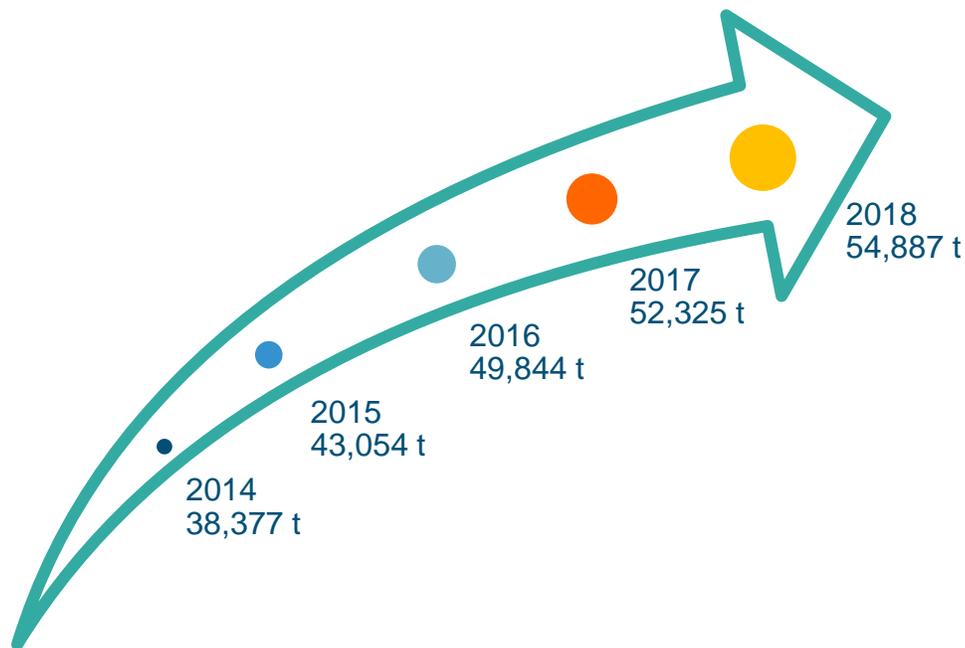
- Converted a further ~27,000 streetlights to LED (targeting cobra-head style street lighting).
- Benefits include improved improved in-service life expectancy and reduced operating costs.
- Approximately \$2 million in incentives are expected from the IESO SaveOnEnergy program.

## **Listing of Upcoming Projects for 2019**

- Ice Arenas - Refrigeration and controls.
- Valley Park Aquatic Centre - Interior LED lighting upgrades.
- Norman Pinky Lewis – Solar wall installation.
- Macassa Lodge – BAS upgrade.
- Wentworth Lodge – HVAC and BAS upgrades.
- Lister Block – Interior LED lighting upgrades.
- Traffic Operations – Interior and exterior LED lighting upgrades.
- Wentworth Street Operations Centre – Interior (office space only) LED lighting upgrades.

The benefits of energy conservation projects extend beyond reducing energy usage, improving efficiency and lowering operating costs; they also reduce GHG emissions. Going forward, projects that lower GHG emissions will further enhance its Clean and Green strategic priority as the City responds to a growing concern around meeting climate change reduction targets at home as well as its contributions to broader global initiatives. To date, the cumulative GHG reductions that have occurred because of energy conservation projects is shown in the diagram below.

Figure 14: Cumulative GHG Reductions from Energy Conservation in tCO<sub>2e</sub>



Although business cases for projects that reduce energy usage have historically had favorable payback as operating costs are typically lowered, projects that focus strictly on or prioritize reducing GHG emissions may have longer payback periods. Funding, affordable new technology and broad support are needed. A listing of projects with reducing GHG emissions as its primary focus can be found in Appendix A on page 44.



## Renewable Energy

Existing renewable generation operations for the City are managed through Hamilton Renewable Power Inc. (HRPI). HRPI owns and operates three 1.6 MW renewable gas fueled units. 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 sources 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. The systems produce 28,000,000 kWh of renewable energy annually, with a

reduction of 100,000 tonnes CO<sub>2</sub>e. In 2018 the net benefit from all HRPI operations was approximately \$1.1 million, with a cumulative total of \$17.5 million from 2006.

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 of the waste water process. The raw biogas is purified, treated and conditioned to yield the utility grade renewable natural gas that can be injected into Union Gas distribution system.

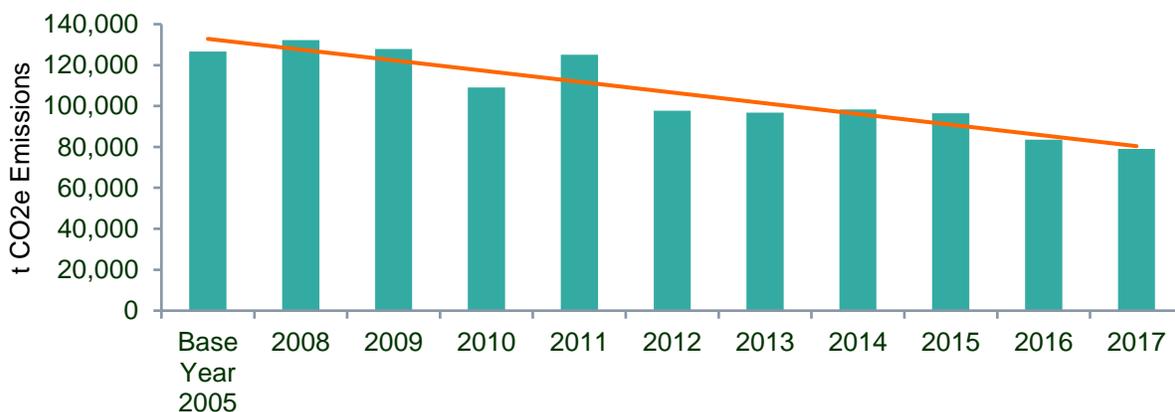


## Greenhouse Gas Emissions 2017 Report

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. Original targets of a 20% reduction by 2020 were then updated and aligned with the Corporate Energy Policy and the Board of Health Climate Change Actions 2012 report (BOH13024), calling for an 80% reduction in GHG emissions by 2050 from the base year 2005.

Reporting data for the GHG emissions report is one year behind the annual report. Therefore, the data presented here is for the 2017 calendar year. In 2017, the GHG emissions inventory was 79,028 tonnes of CO<sub>2</sub>e (carbon dioxide equivalent). This represents a 38% reduction from the base year and 5% reduction from 2016. The inventory does not include HRPI operations.

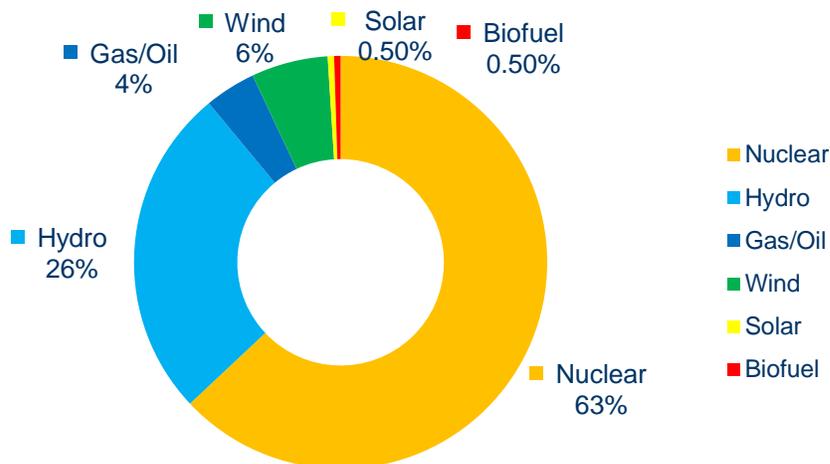
Figure 15: City of Hamilton Corporate GHG Emissions Annual Trends



Since 2005 the inventoried emissions have been on a downward trend. Several factors have contributed to this trend including energy efficiency projects that reduce overall energy usage and fuel conversion in Transit from diesel buses to CNG buses. However, the Ontario electricity emission factor, which is the measurement of the CO<sub>2</sub>e intensity of the electricity generation, has had a significant impact on the reduction in GHGs. As the Ontario electricity supply mix moves towards increasing its cleaner power sources, the lower the City's use of electricity impacts the emissions inventory.

Below, the diagram shows the energy output by fuel type for 2017 as reported at the Independent Electricity System Operator (IESO) for transmission-connected generation. The mix varies annually, depending on what fuel source is being dispatched. This data does not include embedded generation.

Figure 16: 2017 Ontario Energy Output by Fuel Type



Source: [Transmission-Connected Generation - IESO Mix 2017 Output](#)

Our corporate GHG emissions are generated by the following energy sources: electricity, natural gas, diesel and gasoline.

Figure 17: 2017 Percentage of tCO<sub>2e</sub> Emissions by Fuel Source

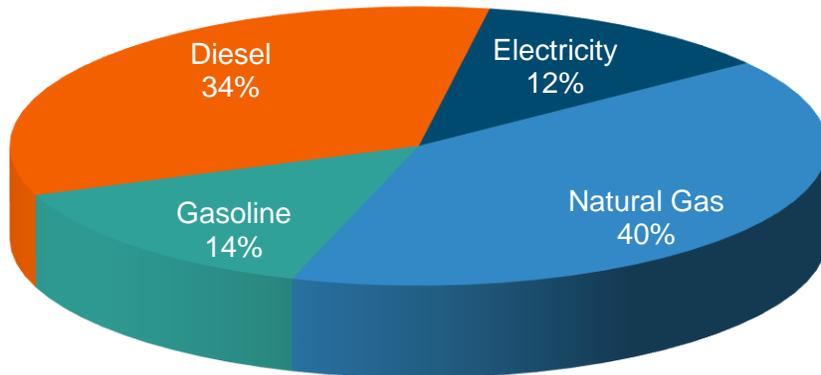
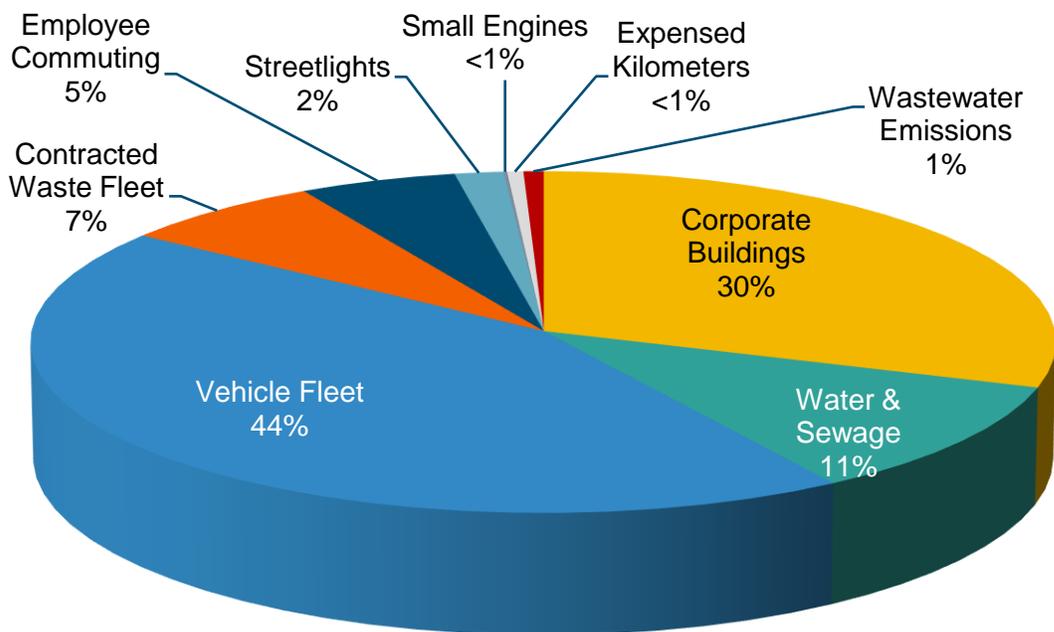


Figure 18: 2017 Percent Tonnes CO<sub>2e</sub> of Total by Sector



Of the above reported sectors, the largest emitter is Vehicle Fleet (34,671 t CO<sub>2e</sub>) at 44%. For 2017, this is a 4% decrease to the base year and a 9% decrease from 2016. While 2017 is lower, the emissions for vehicles have varied over the years. Vehicles have become more efficient and many of the buses have been switched to CNG, which has lower emissions than diesel, but in general the vehicle fleet size has increased. In addition, year over year usage can be impacted by weather conditions. An example

would be the varying demand for large winter-related vehicles (snow-removal, salters and sanders).

Corporate buildings (23,916 t CO<sub>2</sub>e) makes up 30% of the total inventory and is 49% less than the base year and 2% less than 2016. A large part of this reduction is the completion of energy efficiency initiatives at many corporate sites over the past several years. Some examples include LED lighting installations, BAS controls systems and equipment upgrades.

Water and Sewage, which includes the Woodward Water and Wastewater plant, pump stations, wells and reservoirs throughout the City make up the third largest emission sector, with 11% of the total inventory for 2017. It is a 66% decrease from 2005, and a 5% decrease from 2016. Process efficiencies have had a large impact on this reduction. The Water and Sewage sector is the largest user of electricity in the City.

Street lighting, although not a large overall emitter, has had an impressive reduction of 85% when compared to the base year. The LAMP program (Lighting Asset Modernization Project) has made a large impact to both reducing electrical usage but also in reducing its GHG emissions over the past 3 years.

Continued efforts must be made to further reduce the City's corporate emissions to meet the targets laid out in the Corporate Energy Policy. Investments in renewable energy, retrofit projects that reduce both usage and emissions, greener vehicles and behavioral changes will be necessary to achieve the long-range target of 80% reduction by 2050.

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## Final Comments

Several factors can impact the success of the energy programs and initiatives that the City measures each year. Regulatory changes, available funding, market factors and budget constraints are among the biggest barriers to that success. The key is to keep targets in sight and focus on making strides to reduce the energy use and the environmental footprint of corporate facilities.

Despite the difficulties in operating in an ever-changing energy environment, implementing energy conservation initiatives that improve efficiency, reduce consumption and/or reduce emissions continues to be a priority. Having a framework

like the Corporate Energy Policy is an effective guideline in championing energy-related programs.

Meeting the targets laid out for reducing consumption and energy intensity, reducing GHG emissions and improving the efficiency of the vehicle fleet, requires behavioral changes and support from all levels of staff. The recent Mayoral declaration to address climate change as an emergency priority in Hamilton shows commitment from the top and empowers staff to re-focus efforts to endorse programs and projects that aim to reduce energy use, reduce corporate emissions and improve the City's carbon footprint overall.

## Appendix A

This appendix provides additional tables, charts and graphs to further illustrate the information provided throughout the report.

### Energy Strategies and Program KPIs

Figure A-1: Cumulative Results of Energy Programs and Strategies KPIs (2006-2018)

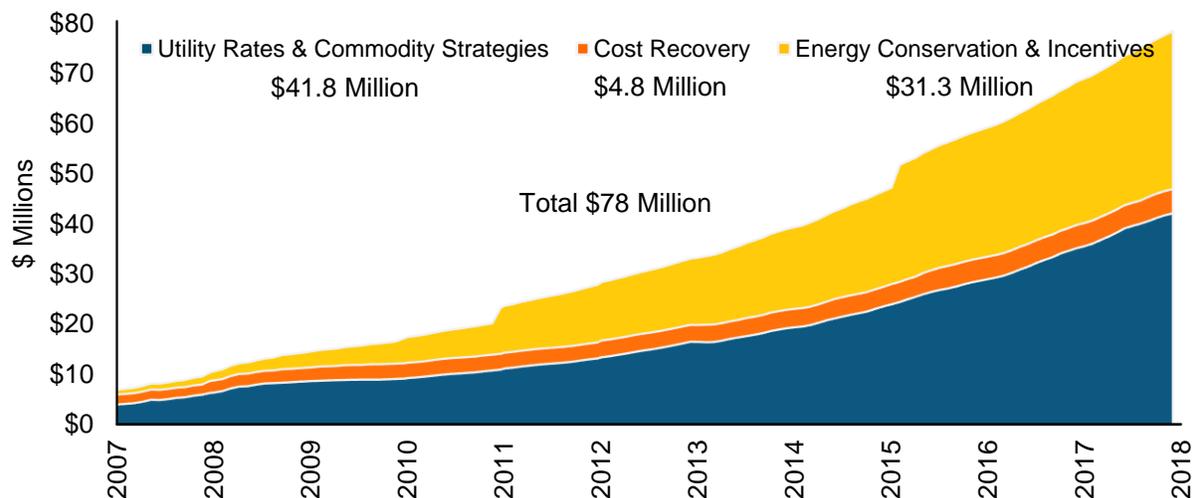


Figure A-2: Three Year Comparison Energy Programs and Strategies

Category	Past 3 Years			2006-2018 Cumulative
	2016	2017	2018	
Levy RPP/Interval Change	\$ -	\$ -	\$ -	\$ 2,886,651
Rate RPP/Interval Change	\$ -	\$ -	\$ -	\$ 2,873,163
Levy Global Adjustment	\$ 1,279,622	\$ 1,344,340	\$ 1,953,610	\$ 7,092,074
Rate Global Adjustment	\$ 3,402,587	\$ 4,631,762	\$ 4,450,962	\$ 21,402,075
Levy Natural Gas	\$ 365,430	\$ 446,304	\$ 465,571	\$ 6,491,454
Rate Natural Gas	\$ 63,111	\$ 66,946	\$ 64,126	\$ 1,131,095
Energy Conservation Levy	\$ 2,008,166	\$ 2,286,392	\$ 2,101,419	\$ 18,681,958
Energy Conservation Rate	\$ 513,415	\$ 616,098	\$ 410,732	\$ 3,506,691
Incentives	\$ 3,948,039	\$ 147,841	\$ 323,354	\$ 9,139,539
Cash Recovery Levy	\$ 593,832	\$ 118,099	\$ 220,046	\$ 4,584,077
Cash Recovery Rate	\$ -	\$ -	\$ -	\$ 235,375
<b>Totals</b>	<b>\$ 12,174,202</b>	<b>\$ 9,657,782</b>	<b>\$ 9,989,820</b>	<b>\$ 78,024,152</b>

## Overall Consumption, Costs and Performance (Electricity and Natural Gas)

Figure A-3: Total Annual Consumption Electricity and Natural Gas (Facilities)

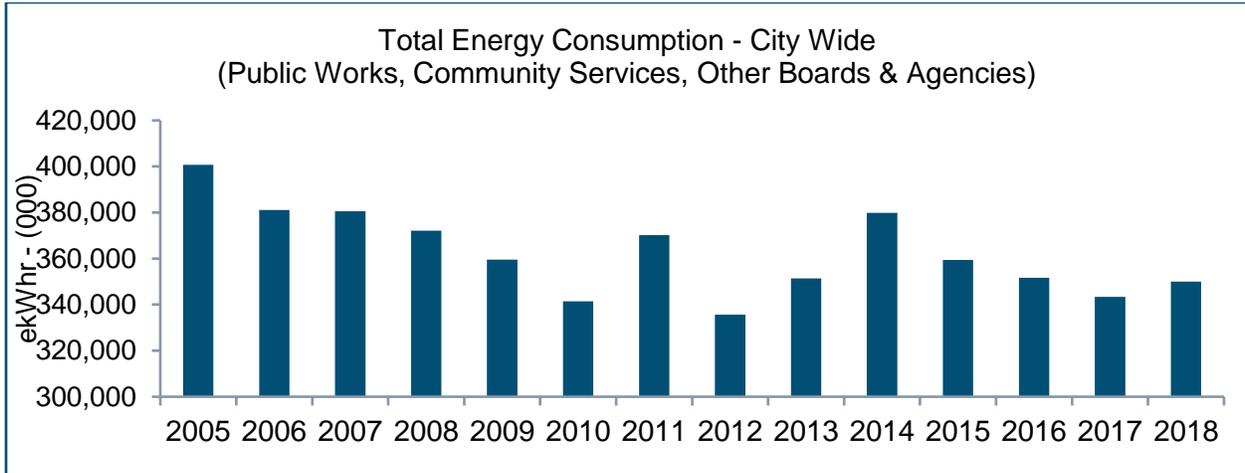


Figure A-4: Total Annual Reported Costs Electricity and Natural Gas (Facilities)

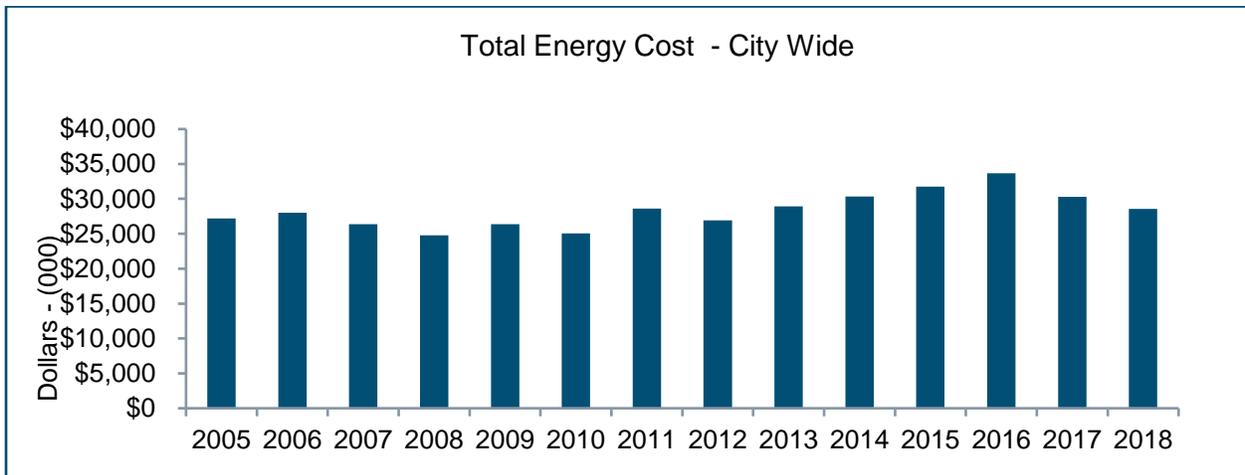


Figure A-5: Total Consumption Comparison by Portfolio Category

Total Energy Consumption	in 000's of ekWhs			Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017
City/Town Halls	13,775	8,271	8,706	-37%	5%
Corporate Facilities	17,188	6,394	9,404	-45%	47%
Street Lighting	33,602	26,920	20,050	-40%	-26%
Traffic Lighting	5,688	2,067	2,069	-64%	0%
Other City Operations	5,618	4,689	6,349	13%	35%
Hamilton Water	121,040	124,461	126,764	5%	2%
Yards	39,589	25,104	28,503	-28%	14%
Arenas	39,904	34,204	36,345	-9%	6%
Community/Senior Centers	3,834	3,337	3,536	-8%	6%
Rec Centres/Pools	26,789	26,986	25,130	-6%	-7%
Tim Horton's Field	0	7,424	6,995	0%	-6%
Rec Parks/Stadiums/Golf	8,332	4,666	5,063	-39%	9%
Lodges (Macassa, Wentworth)	24,938	15,672	15,113	-39%	-4%
Culture	5,383	4,728	4,932	-8%	4%
Fire/ EMS	10,698	12,346	12,814	20%	4%
Hamilton Public Libraries	9,343	10,479	11,211	20%	7%
First Ontario Centre	10,122	9,160	9,904	-2%	8%
First Ontario Concert Hall	5,466	4,658	4,517	-17%	-3%
Hamilton Convention Centre	4,656	3,712	4,068	-13%	10%
Hamilton Police Services	14,757	8,067	8,573	-42%	6%
<b>City Wide Total</b>	<b>400,722</b>	<b>343,345</b>	<b>350,050</b>	<b>-13%</b>	<b>2%</b>

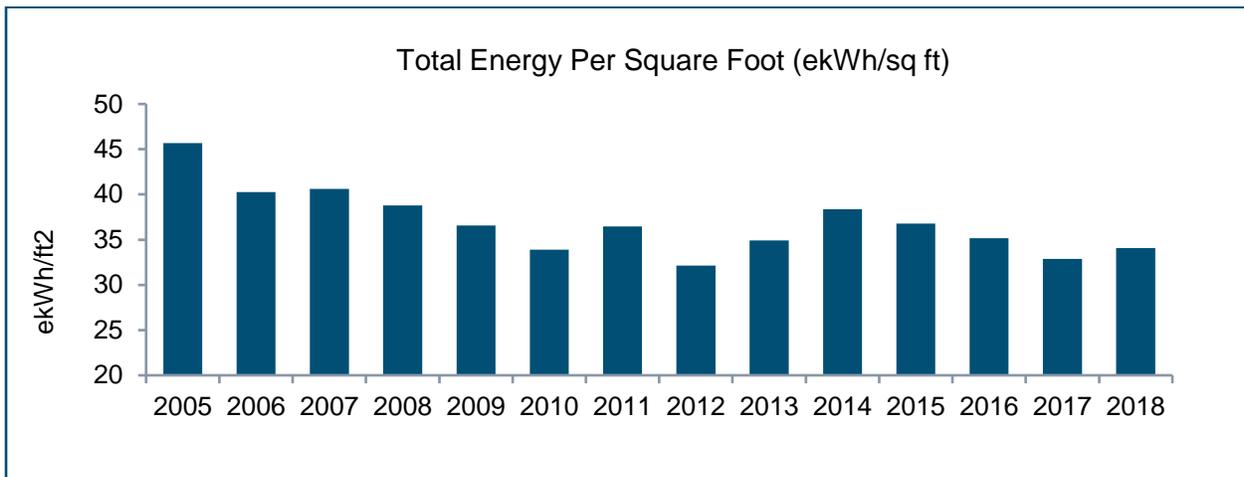
\*\*values are shown in 000's, does include full values in calculation

Figure A-6: Total Cost Comparison by Portfolio Category

Total Energy-\$ Cost	in 000's of \$			Comparisons	
	2005	2017	2018	2018 vs 2005	2018 vs 2017
City/Town Halls	\$860	\$690	\$653	-24%	-5%
Corporate Facilities	\$866	\$554	\$790	-9%	43%
Street Lighting	\$2,895	\$5,010	\$3,728	29%	-26%
Traffic Lighting	\$462	\$358	\$323	-30%	-10%
Other City Operations	\$534	\$700	\$813	52%	16%
Hamilton Water	\$9,590	\$10,488	\$10,436	9%	0%
Yards	\$2,205	\$1,636	\$1,686	-24%	3%
Arenas	\$2,455	\$2,896	\$2,718	11%	-6%
Community/Senior Centers	\$224	\$248	\$246	10%	-1%
Rec Centres/Pools	\$1,192	\$1,468	\$1,405	18%	-4%
Tim Horton's Field	\$0	\$704	\$661	0%	-6%
Rec Parks/Stadiums/Golf	\$564	\$401	\$434	-23%	8%
Lodges (Macassa, Wentworth)	\$1,087	\$877	\$695	-36%	-21%
Culture	\$338	\$281	\$257	-24%	-9%
Fire/ EMS	\$614	\$896	\$819	33%	-9%
Hamilton Public Libraries	\$827	\$851	\$734	-11%	-14%
First Ontario Centre	\$840	\$880	\$961	14%	9%
First Ontario Concert Hall	\$454	\$324	\$257	-43%	-21%
Hamilton Convention Centre	\$387	\$268	\$243	-37%	-9%
Hamilton Police Services	\$783	\$749	\$723	-8%	-3%
<b>City Wide Total</b>	<b>\$27,177</b>	<b>\$30,277</b>	<b>\$28,581</b>	<b>5%</b>	<b>-6%</b>

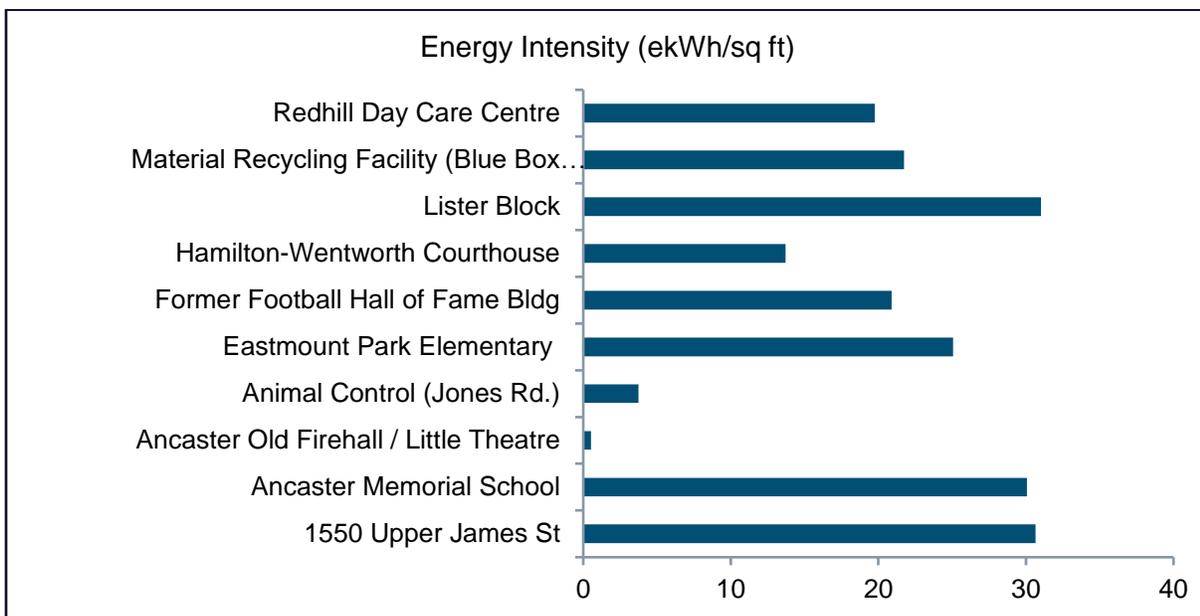
\*values are shown in 000's, does include full values in calculation

Figure A-7: Total Annual Energy Intensity City-wide (ekWh/sqft)



The following series of graphs breaks down the energy intensity results per site for 2018 within the specific portfolio category. Energy intensity is calculated by using equivalent kilowatt hours (ekWh) divided by the reported square footage (sqft) for the site. Sites that did not have square footage were removed from the graphs below but were included in overall cost and consumption data sets. There is no energy intensity data for Hamilton Water and Operational sites (i.e. street lights). Also note that the energy intensity axis may have been adjusted depending on grouping.

Figure A-8: Corporate Facilities Energy Intensity



A-9: City and Town Halls Energy Intensity

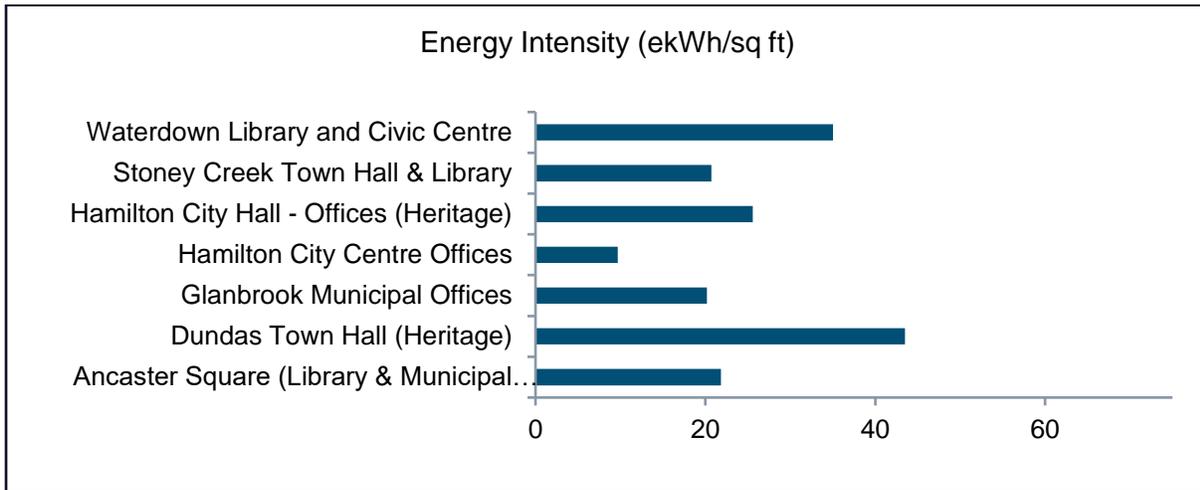


Figure A-10: Arenas Energy Intensity

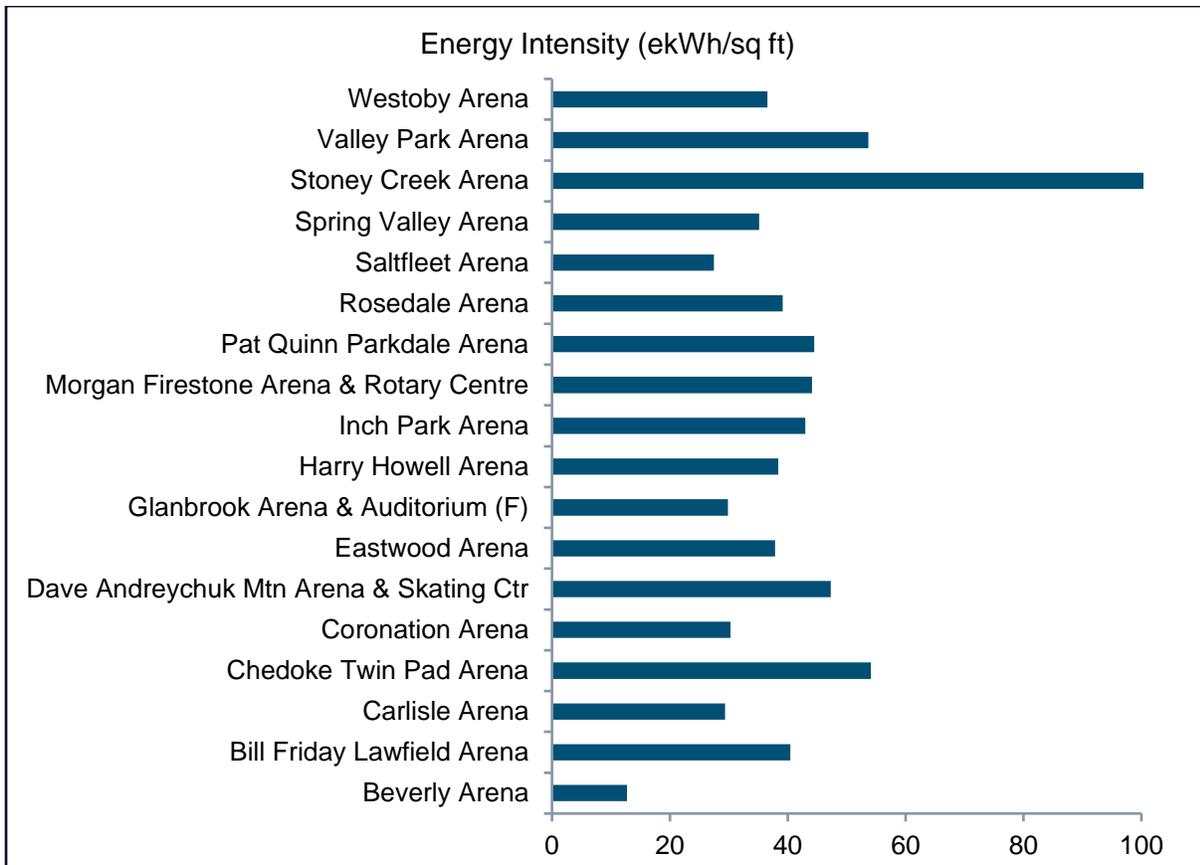
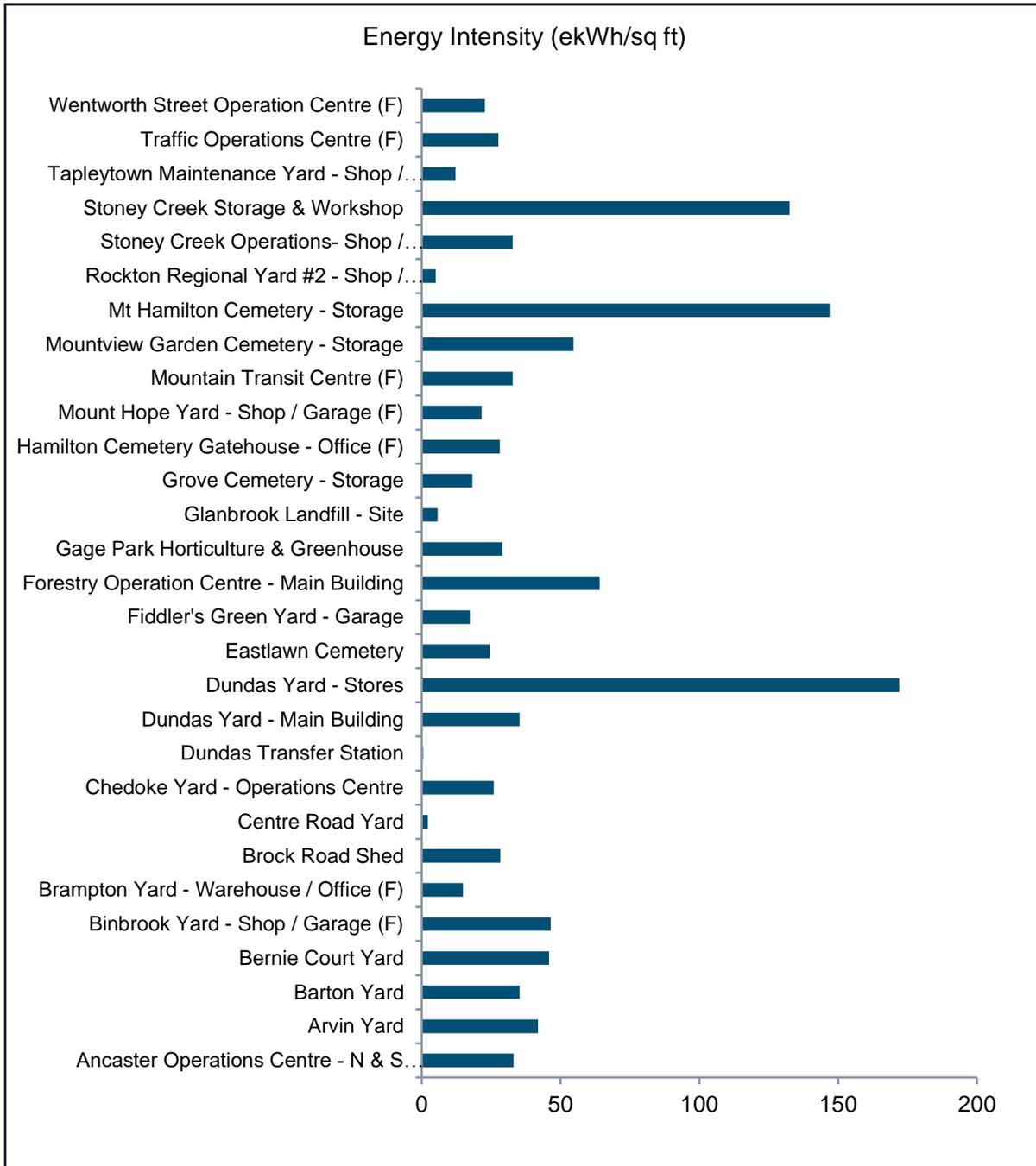


Figure A-11: Yards Energy Intensity



(F) City Fueling Station

Figure A-12: Community Centres Energy Intensity

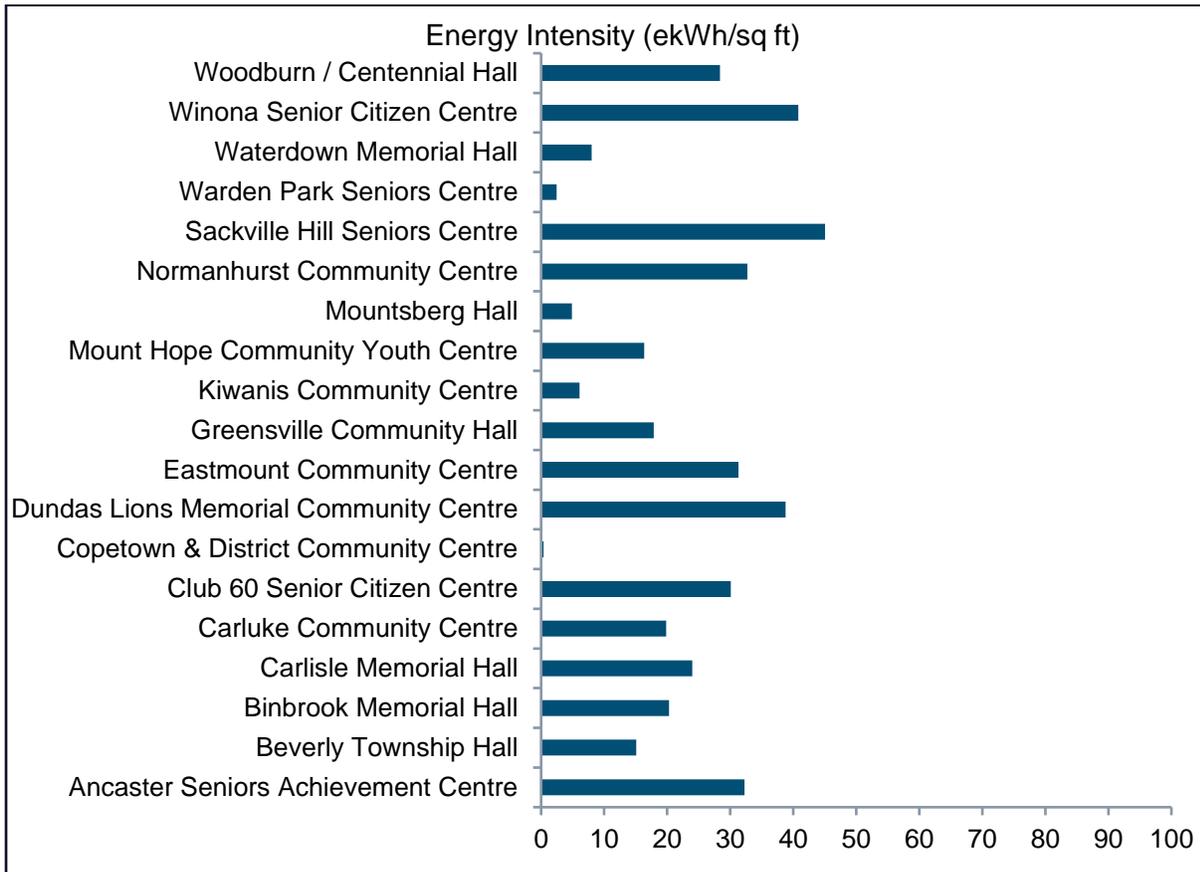


Figure A-13: Lodges Energy Intensity

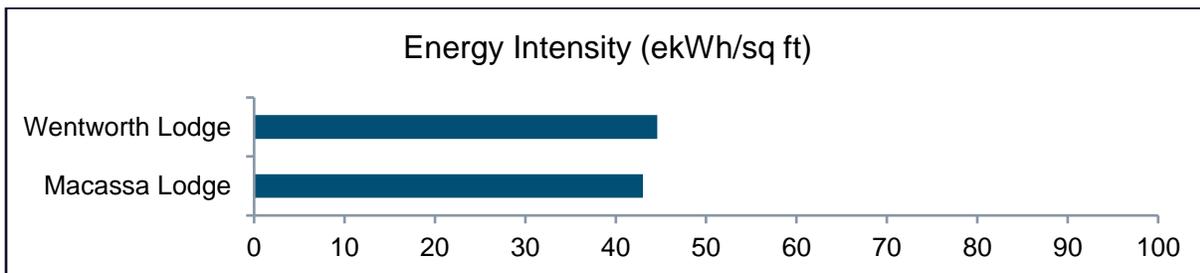
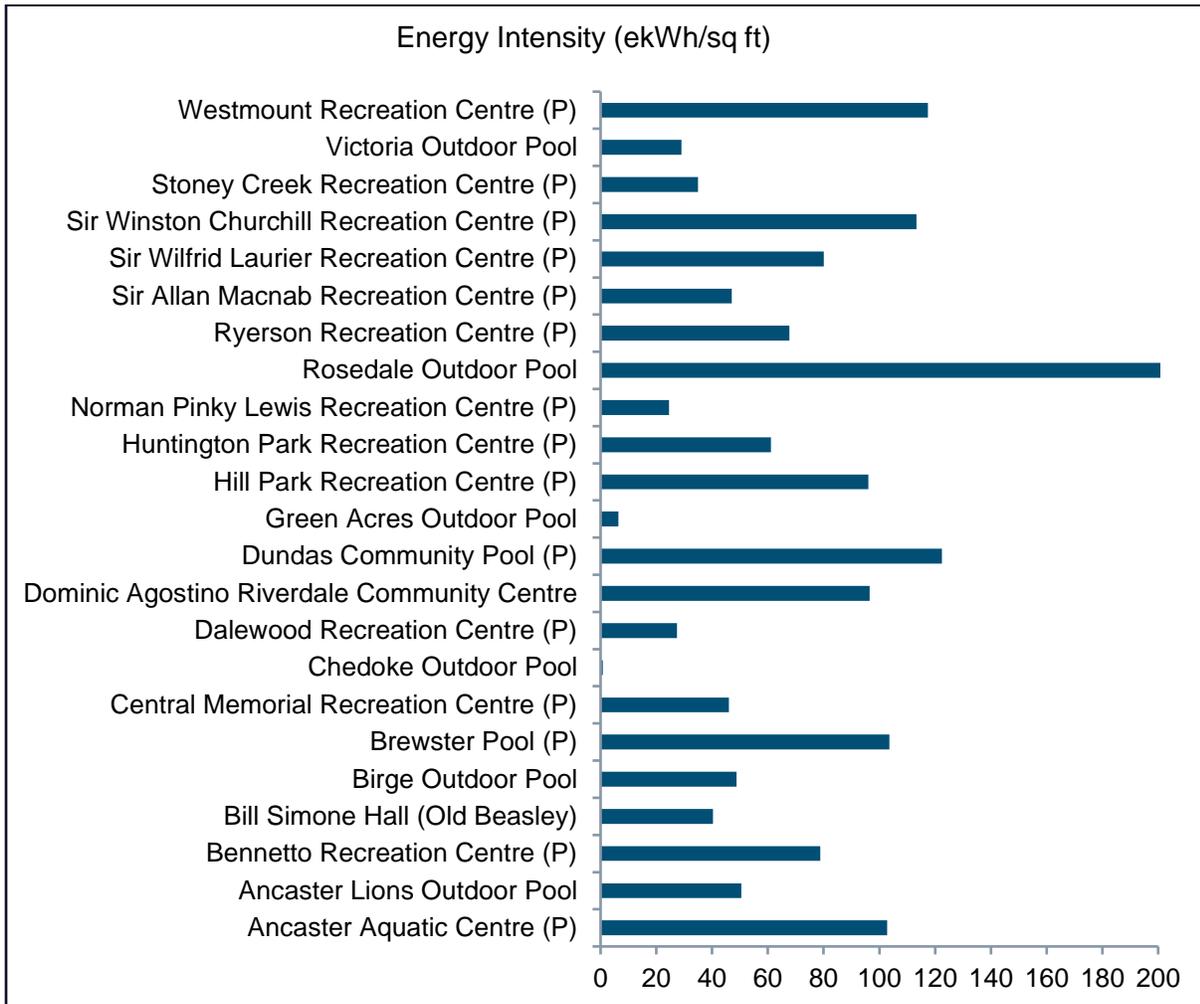


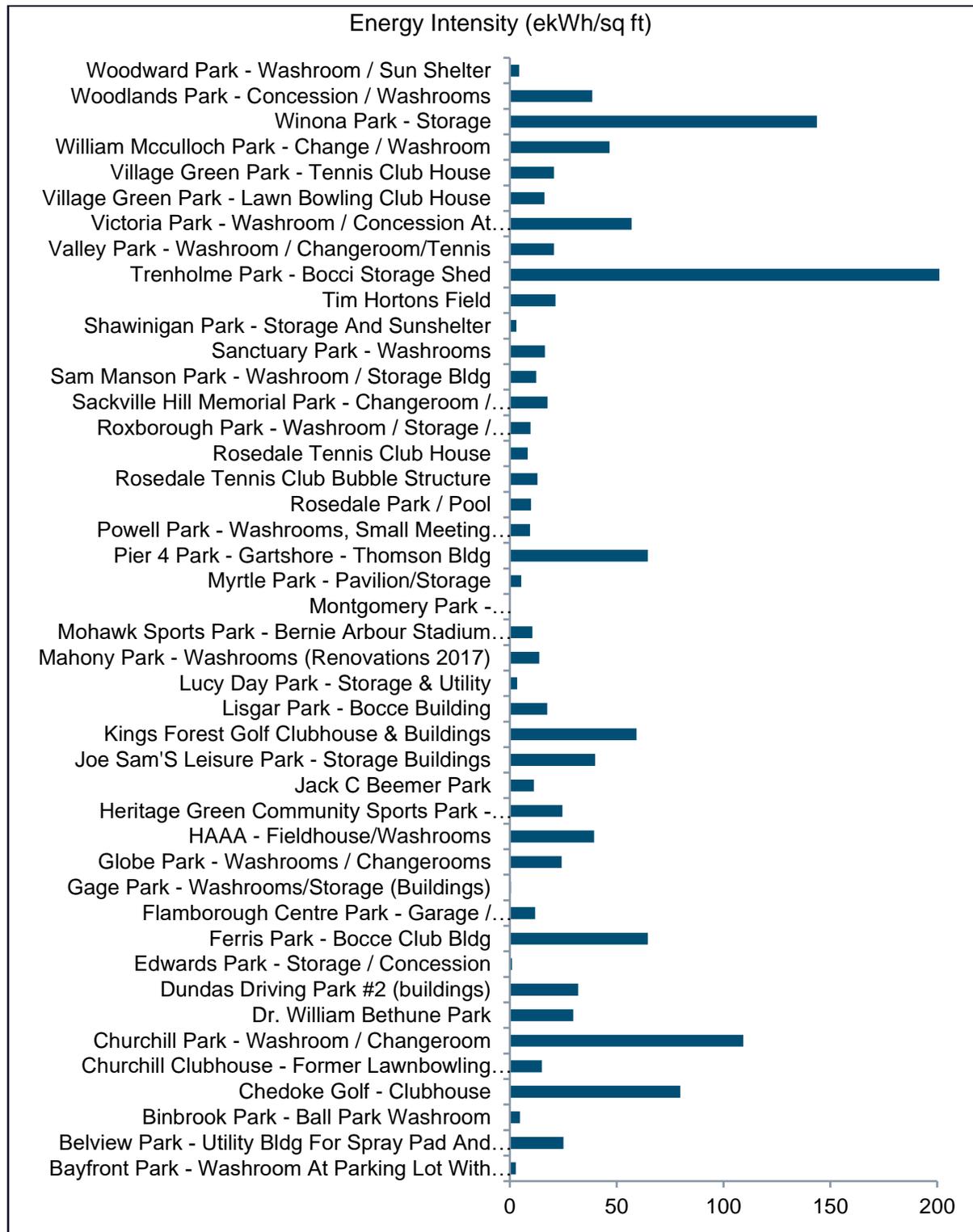
Figure A-14: Recreation Centres and Pools Energy Intensity



(P) Pool

Rosedale Outdoor Pool has an energy intensity of 246

Figure A-15 Stadiums, Recreation Park Buildings & Golf Energy Intensity



Trenholme Park has an energy intensity of 547

Figure A-16: Libraries Energy Intensity

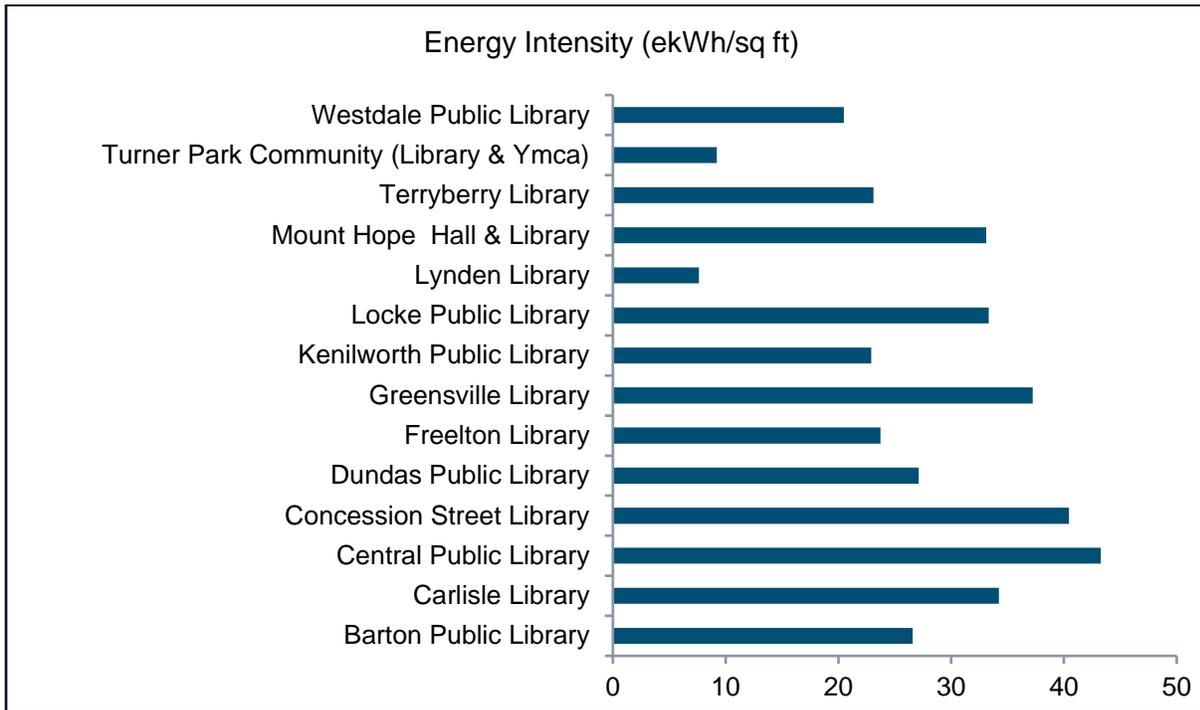


Figure A-17: Culture and Museum Energy Intensity

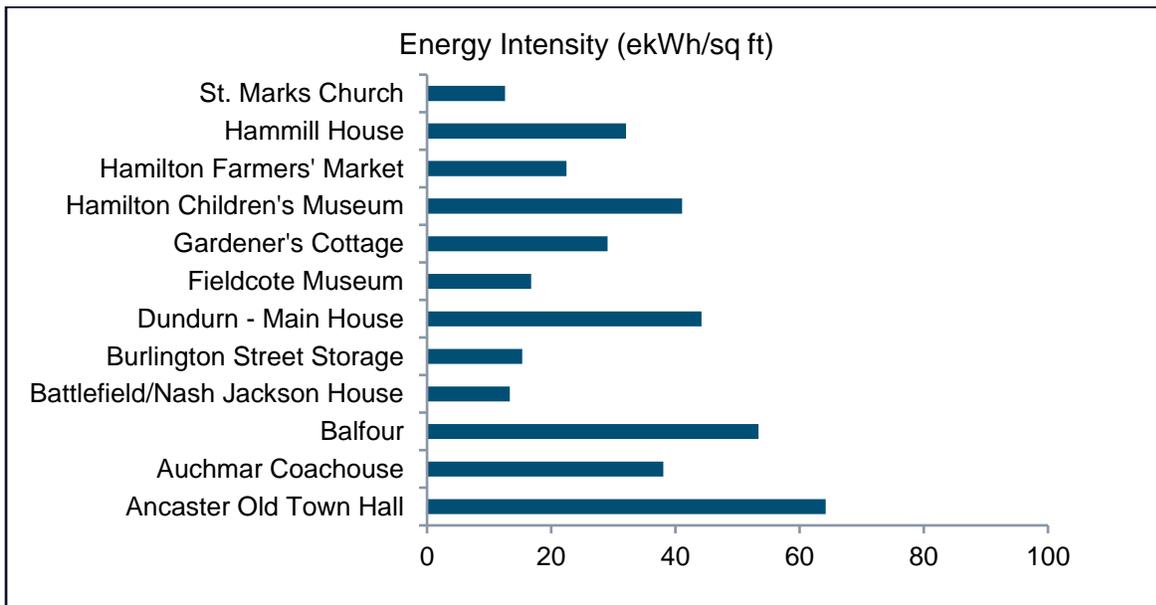


Figure A-18: EMS and Fire Energy Intensity

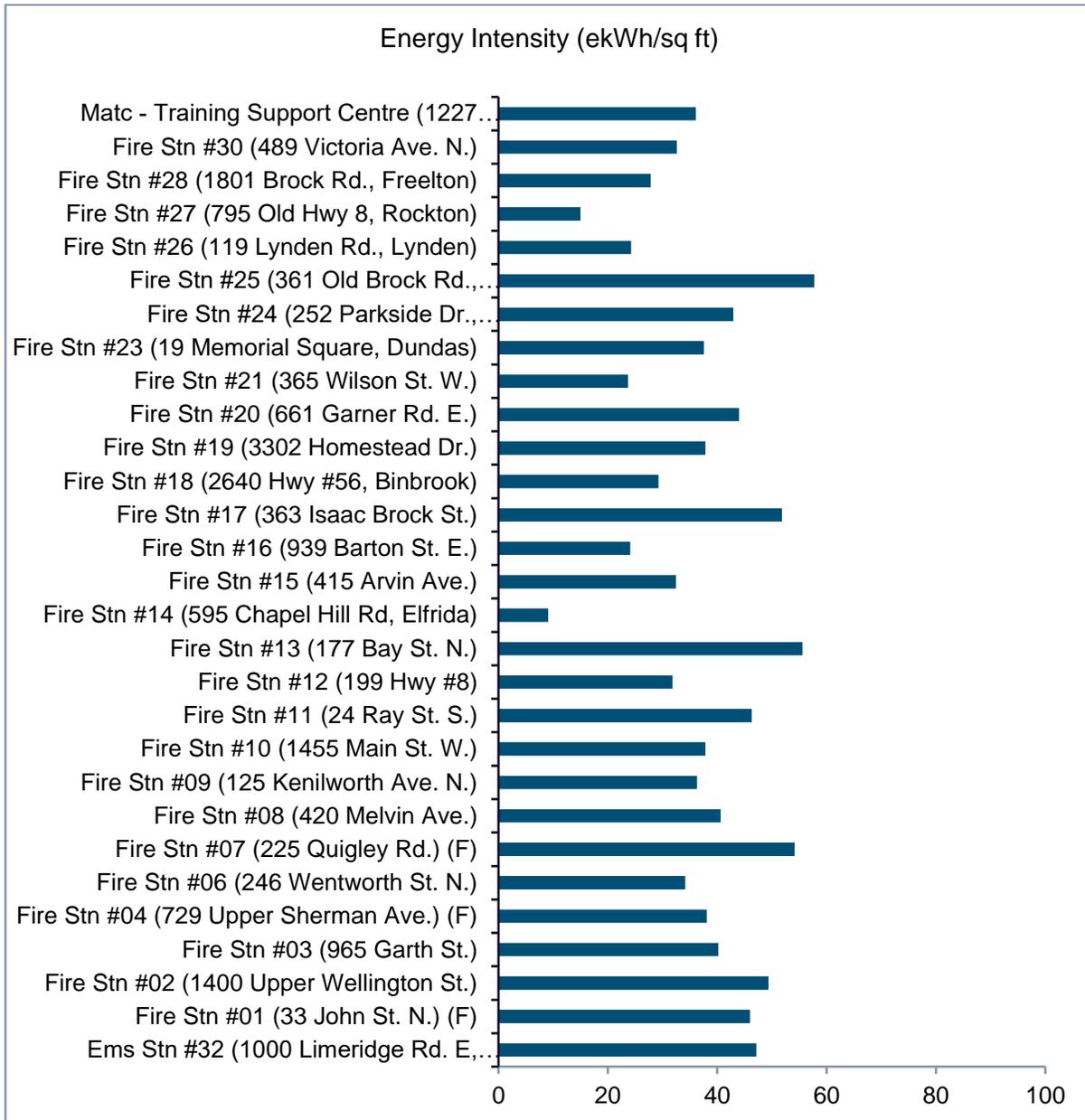


Figure A-19: Entertainment Energy Intensity

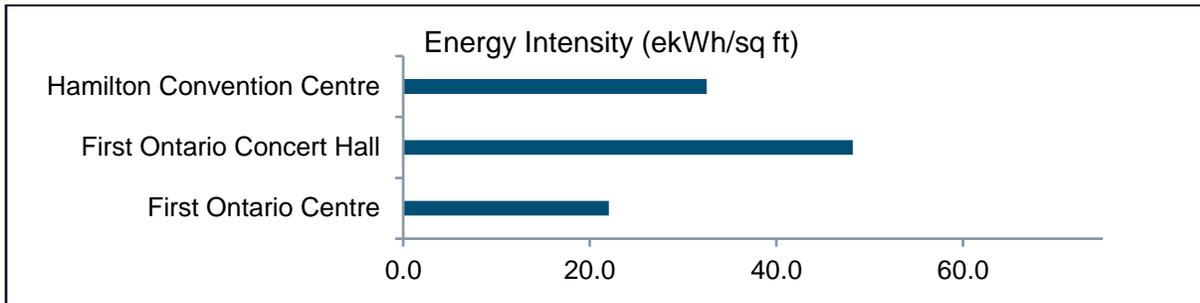
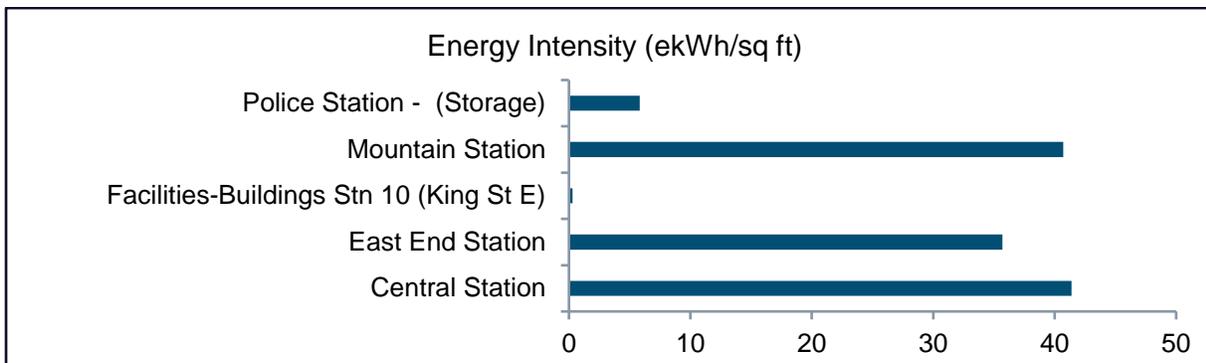


Figure A-20: Police Energy Intensity



## Weather Data

Weather and temperature can impact consumption of electricity, natural gas and fuel. Referencing 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. The City tracks degree day data from Environment Canada.

Figure A-21: 2018 Weather Data from Environment Canada for Hamilton

Month	Mean Temp (°C)	HDD	CDD	2018 vs 2017 HDD	2018 vs 2017 CDD
Jan-18	-6.4	755.2		21%	
Feb-18	-2.3	569		13%	
Mar-18	-0.9	585.6		1%	
Apr-18	2.9	453.8		61%	
May-18	15.9	88.9	26.7	-56%	299%
Jun-18	18.3	34	43.2	3%	-15%
Jul-18	22	0.3	123.5	-57%	61%
Aug-18	21.7	4.5	120.5	-80%	184%
Sep-18	17.9	64.9	61.5	-4%	30%
Oct-18	8.9	291.3	7.5	70%	39%
Nov-18	0.9	512.6	0	21%	
Dec-18	-0.5	574	0	-17%	
<b>2018 Annual Total</b>		<b>3934.1</b>	<b>382.9</b>	<b>9%</b>	<b>67%</b>

\* HDD = Heating Degree Days/ CDD = Cooling Degree Days

\*\* Weather Station YHM

Figure A-22: Heating Degree Days (2014-2018)

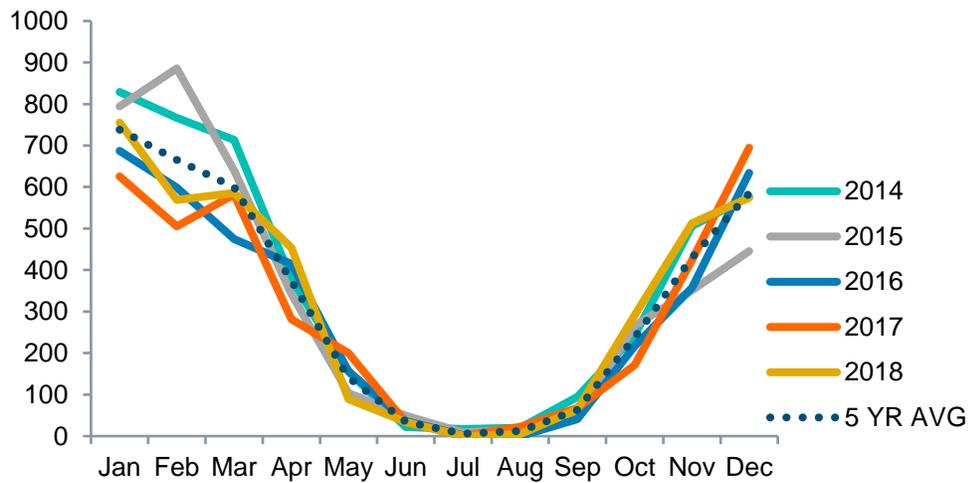
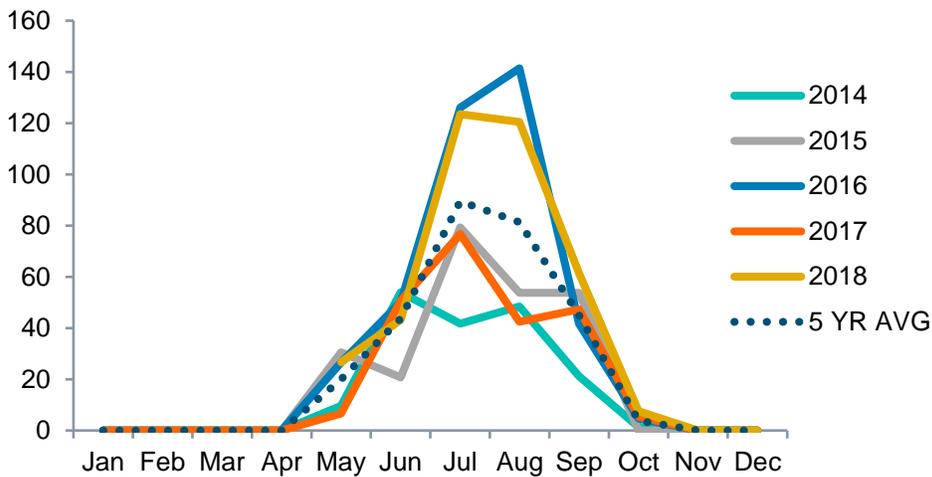


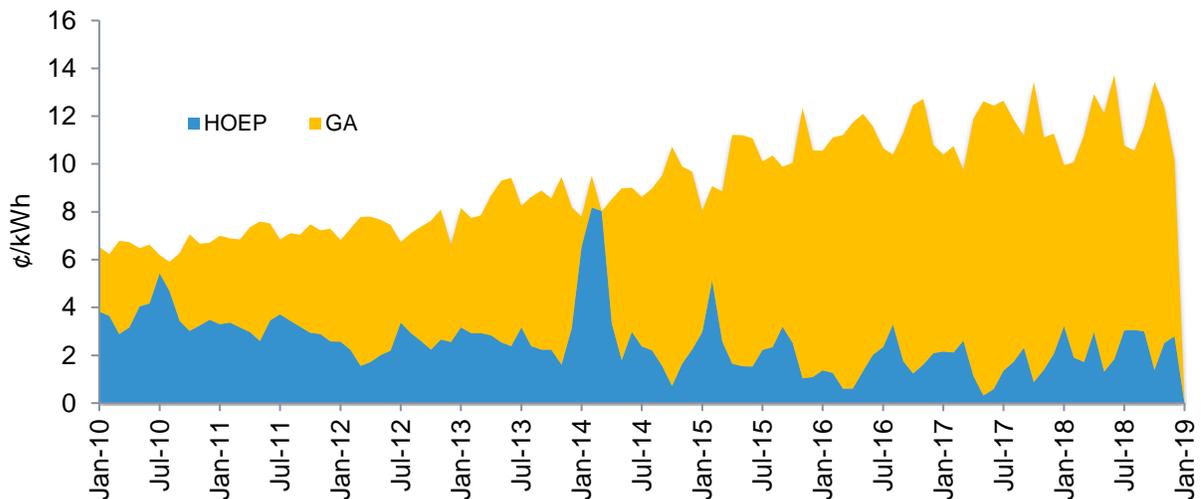
Figure A-23: Cooling Degree Days (2014-2018)



## Global Adjustment

Electricity commodity is made up of two components; the Hourly Ontario Energy Price (HOEP) and the Global Adjustment (GA).

Figure A-24: Electricity Monthly Prices (HOEP and GA) 2010-2018



In regard to GA, the majority of commercial consumers are Class B rate. Class B consumers pay a regulated GA rate set monthly. Eligible, high electrical demand customers can opt for a Class A rate. Class A rate customers pay GA based on a percentage contribution to the total monthly GA costs, calculated during a peak setting

period. Class A customers can impact their GA costs by reducing demand during peak periods. Class A sites within the City include 900 Woodward Ave; 850 Greenhill Ave; 1579 Burlington St; FirstOntario Centre; CUP Operations; and Tim Hortons Field.

Figure A-25: 2018 Class A Global Adjustment Results

2018	Standard Global Adjustment Charge	Actual Global Adjustment Charge	Cost Benefit
Jan	\$ 636,572	\$ 273,050	\$ 363,522
Feb	\$ 743,238	\$ 276,332	\$ 466,905
Mar	\$ 954,901	\$ 334,112	\$ 620,789
Apr	\$ 981,648	\$ 326,381	\$ 655,267
May	\$ 1,065,546	\$ 347,408	\$ 718,138
Jun	\$ 1,222,274	\$ 388,542	\$ 833,732
Jul	\$ 777,634	\$ 337,208	\$ 440,426
Aug	\$ 729,672	\$ 324,110	\$ 405,562
Sep	\$ 802,267	\$ 313,317	\$ 488,950
Oct	\$ 999,773	\$ 430,714	\$ 569,059
Nov	\$ 825,871	\$ 346,264	\$ 479,607
Dec	\$ 678,127	\$ 315,514	\$ 362,613
Total	\$ 10,417,523	\$ 4,012,950	\$ 6,404,572

\*values shown rounded, full values used in calculations

Figure A-26: Class A Global Adjustment Results 2011-2018

Year	Standard Global Adjustment Charge	Actual Global Adjustment Charge	Cost Benefit
2011	\$ 2,703,065	\$ 1,640,102	\$ 1,062,963
2012	\$ 3,852,903	\$ 2,354,335	\$ 1,498,568
2013	\$ 5,720,669	\$ 3,220,565	\$ 2,500,104
2014	\$ 5,574,562	\$ 3,127,867	\$ 2,446,695
2015	\$ 7,931,504	\$ 4,020,207	\$ 3,911,297
2016	\$ 9,132,962	\$ 4,450,757	\$ 4,682,206
2017	\$ 10,218,507	\$ 4,242,405	\$ 5,976,103
2018	\$ 10,417,523	\$ 4,012,950	\$ 6,404,572
TOTAL	\$ 55,551,695	\$ 27,069,187	\$ 28,482,508

\*values shown rounded, full values used in calculations

## Peak Days

The GA charges for Class A are calculated based on a percentage of demand during the peak setting period. The peak setting period runs from May to April annually, and the top 5 demand hours are used to calculate each Class A site's demand factor, which is used to calculate the GA charges each month. Public Works personnel work collaboratively to manage peak events and reduce demand during these periods. The Office of Energy Initiatives (OEI) use tools to predict peaks and notify key frontline staff. Staff, such as operators in Hamilton Water and Corporate Facilities may shift processes to off peak times and/or minimize usage during a potential peak event.

Figure A-27: Top 10 Ontario Demand Peaks (May 1, 2018 – April 30, 2019)\*

Rank	Date	Hour Ending	Adjusted AQEW (MW)
1	September 5, 2018	18	22,399
2	July 5, 2018	16	22,377
3	July 4, 2018	19	22,017
4	August 28, 2018	17	21,644
5	September 4, 2018	17	21,379
6	July 3, 2018	19	21,291
7	July 16, 2018	12	20,954
8	July 15, 2018	18	20,924
9	July 24, 2018	17	20,943
10	July 9, 2018	18	20,808

AQEW = Adjusted Allocated Quantity of Energy Withdrawn. Source: [IESO/Settlements/Global Adjustment Class A](#) (as of April 10, 2019)

## Fuels

Figure A-28: 2018 Fuel Usage by User Group

Group	Diesel Litres	Unleaded Litres	CNG DLE	Total (DLE)
Energy, Fleet & Facilities	40,120	119,211	-	159,331
Engineering Services	-	42,511	-	42,511
Environmental Services	1,069,975	392,993	-	1,462,968
Hamilton Water	176,880	187,510	-	364,391
Operations	1,303,828	370,547	-	1,674,376
Transportation	84,945	46,876	-	131,821
Other	362,535	1,001,706	-	1,364,242
Transit	6,134,378	87,005	5,104,215	11,325,598
<b>Totals</b>	<b>9,172,662</b>	<b>2,248,360</b>	<b>5,104,215</b>	<b>16,525,237</b>

Notes for Clarification on the above fuel usage data:

- 1) Transit includes Transit Operations, Route Planning and Transit Yard Support.
- 2) Operations includes Waste Management, Landfill, Roads and Support Services.
- 3) "Other" includes Public Health, Recreation, Tourism and Culture, Library, Bi-Law Services, Mayor's Office, City Clerk's Office and Information Services.

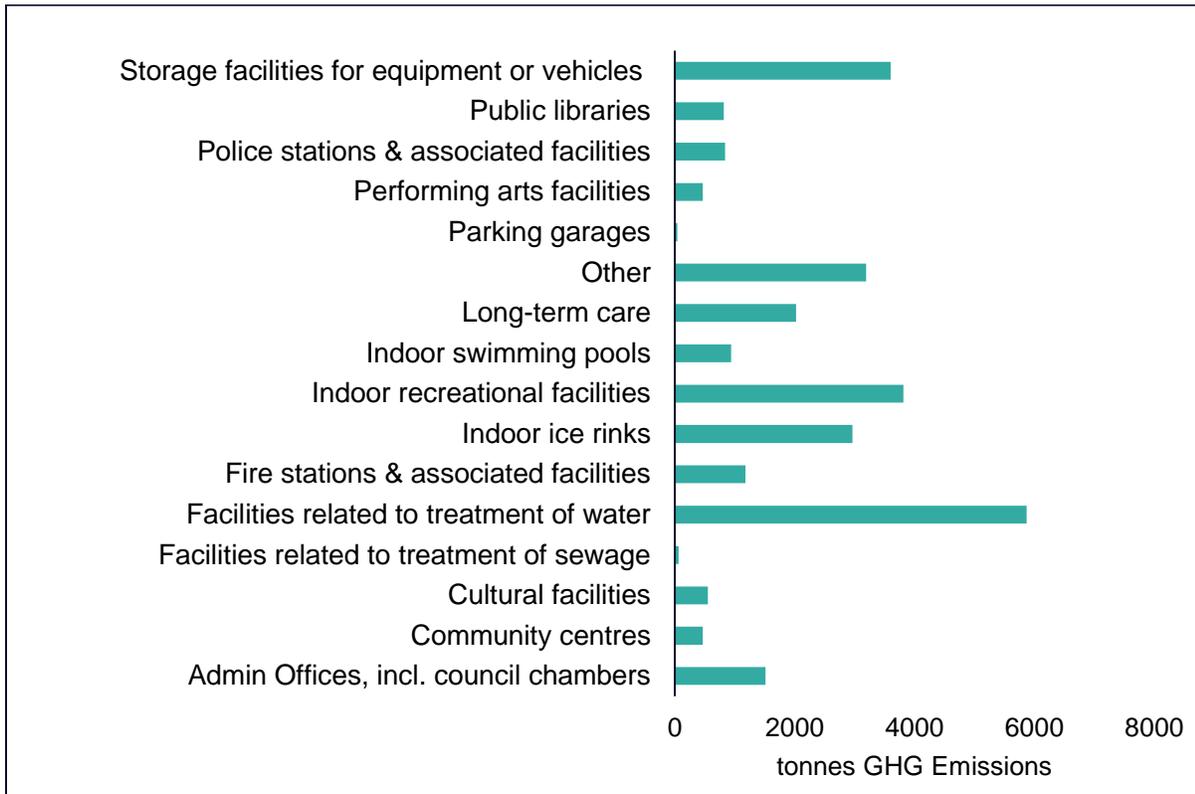
## **Green Energy Act (GEA) Reporting**

The City was required to report to the provincial government on its energy use as part of the adherence to the now-repealed Green Energy Act (GEA). The most recent data set submission was for the 2016 Calendar year. According to the GEA's reporting formula, the City-owned corporate facilities are responsible for emitting 28,347 tonnes of carbon dioxide equivalent (CO<sub>2</sub>e). The GEA facility type reporting categories are pre-set and do vary from the City's internal reporting categories. However, they do continue to represent corporately owned assets only.

Although the GEA was repealed, the City continues to be required to report on its energy use and GHG emissions to the provincial government under the Broader Public-Sector Energy and Reporting Conservation and Demand Management Plan (OReg. 507/18). Figure A-29 below shows the total 2016 GHG Emission tonnes as it was reported in July 2018.

The next reporting period, for 2017 calendar year will be submitted to the provincial government in July 2019.

Figure A-29: 2016 GEA Total GHG Emission tonnes



### Proposed GHG Reduction- Focused Projects

As the City moves toward a focus on GHG reduction to tackle climate change, an effort has been made to look at how energy efficiency and emerging technologies in the energy sector can help achieve long-range targets. Figure A-30 is a snapshot of various proposed projects that will be explored further with business cases, costing and life-cycle analysis for implementation feasibility in the City.

Figure A-30: Project Proposals with GHG Reductions

Project Name	Project Lead	Location	Department/ Division	Project Type	Estimated Project Cost	Estimated GHG Reductions (Tonnes)
Wentworth Ops Boiler Retrofit	OEI	Wentworth St. Operations Centre	PW/EFFM	Mechanical Upgrade	\$137,500	116.62
Wentworth Ops Solar Wall	OEI	Wentworth St. Operations Centre	PW/EFFM	Passive Solar	\$507,529	279.96
MTC Solar Wall	OEI	Mountain Transit Centre	PW/EFFM	Passive Solar	\$1,771,550	484.30
First Ontario Centre Lighting Retrofit	OEI	First Ontario Centre	PW/EFFM	General Lighting	\$216,000	31.48
Central Public Library Mechanical Retrofit	OEI	Central Public Library	Library Board	Mechanical Upgrade	\$330,000	28.49
Battery Electric Buses	HSR	Transit	PW/Transit	Transit	\$10,000,000	700.00
Westdale & Terryberry Library Rooftop Unit Replacement	SPCC	Westdale & Terryberry Libraries	PW/EFFM	Mechanical Upgrade	\$108,000	6.88
Library Branches Lighting Retrofit - Excluding Central Public Library	OEI	Library Branches	Library Board	General Lighting	\$189,000	11.65
Central Public Library Lighting Retrofit	OEI	Central Public Library	Library Board	General Lighting	\$161,843	8.34
Stoney Creek City Hall Lighting Retrofit	OEI	Stoney Creek City Hall	PW/EFFM	General Lighting	\$196,107	8.63
Yards Lighting Retrofit	OEI	Various Yards Across the City	PW/EFFM	General Lighting	\$550,000	24.08
Hamilton City Hall Lighting Upgrade	OEI	Hamilton City Hall	PW/EFFM	General Lighting	\$270,000	11.03
Various Community Centres Lighting Retrofits	OEI	Community Centres/Outdoor Pools/Seniors	PW/EFFM	General Lighting	\$432,000	17.20
Solar PV / Net Metering	OEI	Morgan Firestone & Harry Howell Arena	PW/EFFM	Renewables	\$900,000	20.64
Parkdale Arena Refrigeration Plant Retrofit	SPCC	Parkdale Arena	PW/EFFM	Mechanical Upgrade	\$795,000	6.77
Eastwood Arena Refrigeration Plant Retrofit	SPCC	Eastwood Arena	PW/EFFM	Mechanical Upgrade	\$795,000	0.87
Pool Water Solar & Heat Recovery Project	OEI	Facilities and Rec to confirm ideal location	PW/EFFM	Passive Solar	\$302,100	50.00

For additional information on the City of Hamilton energy policies and previous annual reports, please see: [www.Hamilton.ca/energy](http://www.Hamilton.ca/energy)



# Glossary

## Common Acronyms used throughout the report

CAFE = Corporate Average Fuel Economy  
CDD = Cooling Degree Days  
CEP = Corporate Energy Policy  
CNG = Compressed Natural Gas  
CO<sub>2</sub> = Carbon Dioxide  
CO<sub>2e</sub> = Carbon Dioxide equivalent  
DLE = Diesel Litre Equivalent  
ekWh = equivalent kilowatt hours  
GA = Global Adjustment  
GEA = Green Energy Act  
GHG = Greenhouse Gas  
GJ = Gigajoule  
HDD = Heating Degree Days  
HOEP = Hourly Ontario Electricity Price  
HRPI = Hamilton Renewable Power Inc.  
IESO = Independent Electricity System Operator  
KPI = Key Performance Indicator  
kW = kilowatt  
kWh = kilowatt-hour  
LED = Light Emitting Diode  
M<sup>3</sup> = Cubic Metres  
OEB = Ontario Energy Board  
tCO<sub>2e</sub> = tonnes Carbon Dioxide equivalent

## **Definitions: Common concepts used throughout the report**

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

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

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

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

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

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

*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.

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

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

*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.