



# CORPORATE ENERGY AND EMISSIONS MANAGEMENT PLAN

2024-2029



# Corporate Energy and Emissions Management Plan 2024-2029

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## Executive Summary

### Purpose

The Corporate Energy and Emissions Management Plan (CEEMP) supports Burlington's desired vision – as set out in the City's Strategic Plan – of being healthy and greener through environmental leadership, including by making the City's operations net carbon neutral by 2040.<sup>1</sup>

The CEEMP updates the Corporate Energy Management Plan adopted by Council in 2019 and is designed to meet the requirement of Ontario Regulation 25/23, under the *Electricity Act*, that states every public agency shall prepare an energy conservation and demand management plan.

### Requirements

This Plan addresses corporate energy use and Scope 1 and Scope 2 greenhouse gas (GHG) emissions from buildings, parks, corporate vehicle fleets, transit fleets, and street and traffic lights.<sup>2</sup> The Plan does not address rental properties, joint ventures, or local boards (e.g. Burlington Public Library, the Burlington Performing Arts Centre).

The Plan concerns energy use and emissions from 2019 to 2024 (actual) and 2025 to 2040 (projections). The City's 2019-2024 energy use and greenhouse emissions address the Provincial regulatory requirement, and the City's projected energy use to 2040 updates the work determined to achieve the goal set out in the City's Strategic Plan of being net carbon neutral in the City's operation by 2040.

### Assumptions & Sources of Data

#### Major Projects and Facility Growth

The Plan assumes that no assets will be removed entirely from the City's facility inventory without being replaced. Corporate facility growth has been included and is consistent with the City's Asset Management Plan.

#### Costs of Utilities, Construction, and Carbon Throughout the Plan

Costs of utilities are assumed to increase by 3% per year. Carbon costs align with the Federal Carbon Charge and will increase to \$170/tonne in 2030, which will then be held at a consistent rate.

Project costs and emissions reduction estimates are extrapolated from recently completed Deep Energy Retrofit Studies and have been modified for some building types that were not studied.

#### Data Sources

Historic data for facilities are from utility bills and are deemed accurate.

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<sup>1</sup> “Net zero” or carbon neutral means that any carbon emissions released are offset, either by providing an equivalent amount of carbon-free energy to the market, or by buying an equivalent number of offsets. In the case of electricity, ‘net zero’ could be achieved by sending to the grid a quantity of electricity with zero emissions equal to the quantity of electricity taken from the grid.

<sup>2</sup> Scope 1 emissions are the direct emissions associated with fuel use by Burlington. Scope 2 emissions are the emissions associated with generating the electricity used by Burlington. Other emissions not included are upstream oil and gas emissions, methane associated with the transportation and distribution of natural gas, emissions embedded in products used by the City, and employee commuting emissions, for example.

Fleet data are collected from fueling facilities. This data has limitations, including how fuel is attributed to specific vehicles and the duty cycle of those vehicles. The 2023 Green Fleet Strategy Update has provided the projections for fleet values.

Projected emission values are from The Atmospheric Fund's (TAF) latest emissions projections (2021).

### Main Findings

The main findings relate to energy and greenhouse gas trends, data management, staffing, policies and procedures, and technologies over the last five years.

The City experienced considerable reductions in energy use and corporate emissions in 2020 and 2021 due to COVID-19. These reductions were due to facility closures and a reduction in services to the public and not reflective of improved building operation. The energy use in 2022 and 2023 reflects regular building use and increased service levels to the public.

### Energy And Greenhouse Gas Emission Trends 2018-2023

In 2023, the City of Burlington used 54,052 eMWh of energy. This energy use resulted in releasing 6,907 t CO<sub>2</sub>eq of greenhouse gases, contributing to climate change<sup>3</sup>. The cost of utilities, such as electricity, natural gas, and water, is significant to the City at just shy of \$6 million.

The City of Burlington uses energy in many ways, such as: heating, cooling, lighting, and process loads in buildings, outdoor lighting in parks and street lighting, and the powering of vehicles. The distribution of energy used for these purposes between 2019 and 2023 and the associated greenhouse gas emissions are presented in

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<sup>3</sup> “t CO<sub>2</sub>eq” is tonnes of carbon dioxide equivalent. A tonne is one thousand kilograms. Carbon dioxide equivalents is a way of measuring the climate forcing (contribution to climate change) of all greenhouse gases – most significantly carbon dioxide, methane and nitrous oxide – as if they were all carbon dioxide (CO<sub>2</sub>). This is done by multiplying the releases by the “Global Warming Potential” (GWP) for each gas. GWPs differ depending on the time period considered. The default assumption is a 100-year forcing. (Environment and Climate Change Canada, 2019)

Figure 1 and Figure 2.

Figure 1 – Corporate Energy Use, Equivalent Megawatt Hours

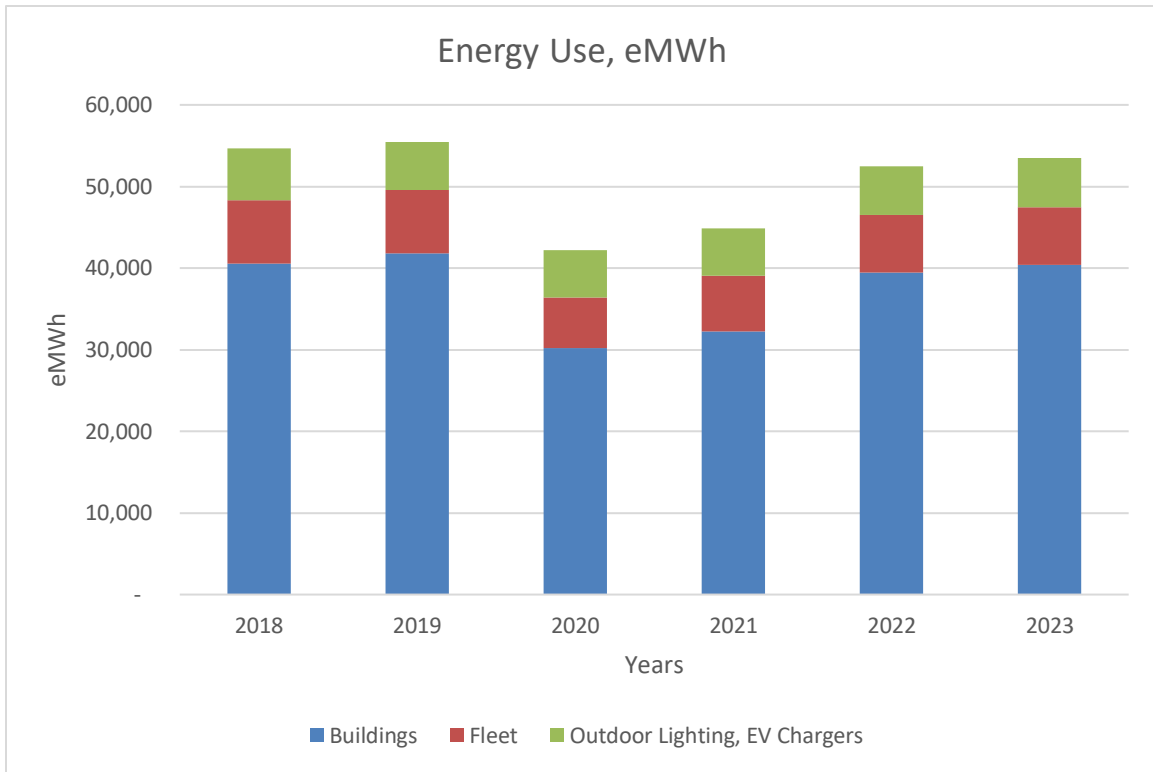
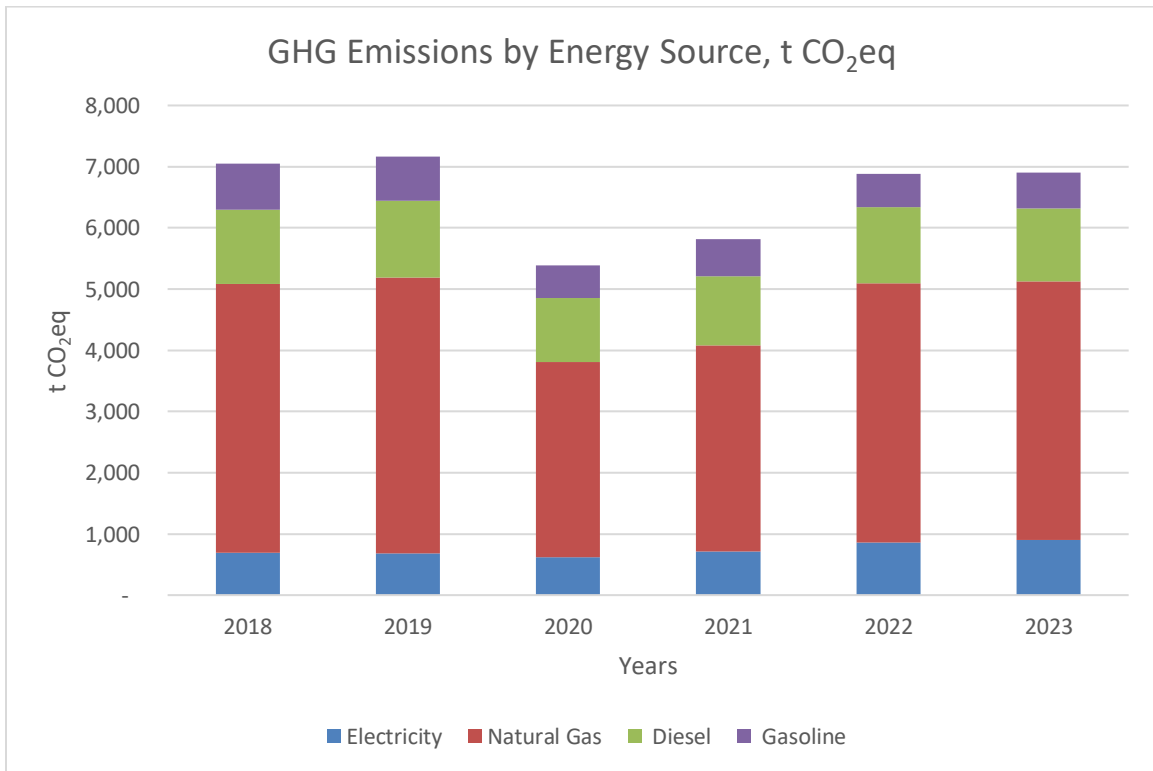


Figure 2 – Greenhouse Gas Emissions By Energy Source, Tonnes Equivalent CO<sub>2</sub>





## Data Management

Burlington has undertaken several initiatives to ensure that energy and emissions data are tracked and managed. On the facilities side, the City has adopted AssetPlanner. This software platform captures monthly energy data from utility bills and can show trends in usage over time in aggregate, by facility type, or by individual facility. In addition, Centrica Power Radar has been introduced into nine buildings and provides more detailed real-time information on facility operations. The City has also adopted a robust profile of over 60 RETScreen energy models for operational reporting and performance tracking on City assets.

Fuel purchases are tracked in a database (Winfuel) on the fleet side, and telemetrics have been collected from all licensed vehicles. However, numerous Staff reported that they could not access energy information in a readily understandable format, and the data on fleets is difficult to access and analyze.

## Staffing

Burlington has dedicated Staff committed to providing high-quality service to Burlington residents and businesses. Two staff members in the City have specific responsibilities for energy use in facilities. This function is less resourced than in some other Ontario municipalities. With only two staff members, the corporate energy and emissions team has constraints that limit their ability to undertake additional actions. These restraints include time to plan, manage, monitor, and evaluate projects, assist with commissioning processes, and operate and expand the City's electric vehicle charging network.

## Policies And Procedures

The City has one of the most aggressive targets in Ontario municipalities regarding emissions reductions. Since the previous CEEMP, policies have been updated to align with the City's overall goal of being net carbon neutral in its operation by 2040. The most notable change was to the Corporate Energy and Sustainable Buildings Policy requirement that all new buildings and significant renovations align with the Canada Green Building Council's Zero Carbon Building Design Standard.

## Technologies

Over the last five years, numerous technologies have been installed in facilities to make them more energy efficient and reduce greenhouse gas emissions. These include upgrades to heat pumps, renewable technologies, automated control systems, HVAC systems, lighting, vehicle downsizing, and purchasing plug-in hybrid and fully electric vehicles. Through consultation with Staff and consultants, experience in other jurisdictions, and a literature review on opportunities, it is clear that numerous additional opportunities remain to be captured. Technologies continue to emerge rapidly in the energy and carbon reduction sector. Some of the suggested technologies for fleet have not yet been realized in the phase 2 and phase 3 portions of the Green Fleet Strategy. Successful, proven, cost-effective solutions for heavy-duty vehicle fleet assets are anticipated in later phases.

## Conclusions And Recommendations

The preferred state of energy management is much the same as in the previous Corporate Energy and Emissions Management Plan.

The preferred state consists of ten elements:

- The commitment to net carbon zero and the use of renewable energy,
- Information availability,
- Collaboration within the City and with others outside,
- Awareness of actions in other jurisdictions,
- Piloting innovative solutions,
- Decision-making based on multiple criteria, including life-cycle costs,
- Measuring and monitoring energy and emissions,
- Information reporting to City Council and senior management, and
- Leveraging expenditures.

Original targets were set to move towards the preferred state for 2020, 2024 and 2040. They are shown in Table 1.<sup>4</sup>

*Table 1 – Original Targets*

	<b>2018 Baseline</b>	<b>% Reduction</b>	<b>2020 Target</b>	<b>% Reduction</b>	<b>2024 Target</b>	<b>% Reduction</b>	<b>2040 Target</b>
<b>Grid Electricity (kWh)</b>	23,249,286	3%	22,550,000	25%	17,436,960	100%	0
<b>Natural Gas (m<sup>3</sup>)</b>	2,285,968	0%	2,290,000	21%	1,805,910	100%	0
<b>Gasoline (L)</b>	325,532	5%	310,000	22%	253,920	100%	0
<b>Diesel (L)</b>	442,755	3%	430,000	4%	425,050	100%	0
<b>Renewables Capacity (MW)</b>	0				4		21
<b>GHG Emissions (t CO<sub>2</sub>eq)</b>	7,048	1%	6,980	21%	5,570	100%	0

This update identifies twenty-eight actions to help reach the City's preferred state. The primary actions driving progress toward the target are the electrification of buildings (replacing natural gas) and fleets (replacing gasoline and diesel) and the installation of renewable electricity generation to replace grid electricity. Other actions support these initiatives through data management, training, staffing, and policies and procedures.

<sup>4</sup> Greenhouse gas reductions are somewhat dependent on the characteristics of electricity from the Ontario grid, over which the City has no control. The focus of attention should be on the specific energy targets.

More detailed, project-specific modelling was completed during the preparation of this Plan, and targets were set to move toward the preferred state for 2029 and 2040. Considering square footage changes, energy and greenhouse gas emissions are shown as energy intensity. These are shown in Table 2.

*Table 2 – Updated Targets*

	<b>2018 Baseline</b>	<b>% Reduction</b>	<b>2020 Target</b>	<b>% Reduction</b>	<b>2024 Target</b>
<b>Grid Electricity (kWh / ft2)</b>	18.8	3%	18.2	25%	11.7
<b>Natural Gas (m3 / ft2)</b>	1.8	0%	1.8	21%	1.2
<b>Renewables Capacity (MW)</b>	0				4
<b>GHG Emissions (kg CO2eq / ft2)</b>	5.69	1%	5.63	21%	3.73
<b>Gasoline (L)</b>	325,532	5%	310,000	22%	253,920
<b>Diesel (L)</b>	442,755	3%	430,000	4%	425,050

Table 3 – Updated and New Targets

	<b>2018 Baseline</b>	<b>% Reduction</b>	<b>2023 Actual</b>	<b>% Reduction</b>	<b>2029 Target</b>	<b>% Reduction</b>	<b>2040 Target</b>
<b>Grid Electricity (kWh / ft<sup>2</sup>)</b>	18.76	15%	16.04	7%	17.48	6%	17.73
<b>Natural Gas (m<sup>3</sup> / ft<sup>2</sup>)</b>	1.85	19%	1.49	55%	0.82	100%	0.00
<b>Solar Generation (MWh)</b>	0		34		6,959		12,154
<b>Facility GHG Emissions (kg CO<sub>2</sub>eq / ft<sup>2</sup>)</b>	4.10	16%	3.47	31%	2.83	89%	0.44
<b>Fleet GHG Emissions (t CO<sub>2</sub>eq)</b>	1,963	-13%	2,225	5%	1,872	90%	201

## Background and Context

### About the City of Burlington

The City of Burlington is located at the western end of Lake Ontario within the Greater Golden Horseshoe in Southern Ontario. Burlington is one of the four area municipalities in the Halton Regional Municipality (Halton Region). In 2021, the population of Burlington was 186,948 (Statistics Canada, 2021). Burlington has a firm urban/rural boundary and plans modest population growth. Burlington expects to increase its population and employment base by 2031.

The City of Burlington has a total area of 185.6 km<sup>2</sup>. Burlington plans to concentrate new development in mixed-use intensification areas, major transit station areas, and major corridors, as well as accommodate new jobs in employment corridors.

Burlington Hydro supplies the City's electricity and water, and Enbridge Gas Distribution supplies natural gas. All fleet refuelling and electric vehicle charging is done at City-owned fueling facilities.

### Progress Since the Previous Plan

Since adopting the Corporate Energy and Emissions Management Plan in 2019, annual reports to City Council highlighted the significant progress made through various projects and initiatives, some of which are summarized below.

#### Lighting Upgrades

The City's dedication to providing the best lighting solutions for our facilities is evident through several recently completed lighting upgrades at several facilities, including Appleby Ice Centre, Brant Hills Community Centre, Burlington Seniors Centre, Nelson Recreation Centre, Fire Station 2, 6 and 7, and Mainway Recreation Centre. Lighting retrofits completed at Nelson Recreation Centre included replacing all fluorescent fixtures with LED fixtures and installing new dimming controls in the rink space to ensure appropriate lighting levels during various facility activities.

Fire Station 2, 6 and 7's lighting upgrades included replacing all interior and exterior lighting with LEDs and a state-of-the-art lighting control system to decrease energy consumption and increase occupant comfort.

Mainway Recreation Centre's project included converting the remaining fluorescent lighting to LED.

#### Building Systems Upgrades

Several building system upgrades have been completed at City facilities to demonstrate the City's commitment to improving energy efficiency and reducing carbon emissions. One notable upgrade was the installation of a hybrid air source heat pump at the downtown Burlington Transit Terminal. This new system uses a cold-climate heat pump and a high-efficiency gas furnace to balance operating costs and carbon footprint.

Another project involved replacing the five central air handling units (AHUs) at City Hall. Although this project did not significantly impact carbon reduction, the new AHUs are much more efficient and consume less electricity than their predecessors.

At the Appleby Ice Centre, a new heat recovery unit was installed to replace the make-up air unit and exhaust fans that served the "A-side" of the building's changeroom. This new unit reclaims as much heat

as possible from the exhaust air and pre-heats the supply air, reducing its natural gas capacity by almost half.

Fire Station 8 has a new HVAC and Building Automation system, providing more direct control to the City operations staff. This system allows variable capacity cooling and appropriate fresh air to control the building's humidity.

In 2023, a new air source heat pump was installed at the BurlingtonGreen Eco Hub facility, which is being used as a demonstration for homeowners to promote the benefits of heat pumps. An EV charging station will also be set up near the Eco Hub, promoting electric mobility and supported with NRCan funding.

### Metering Systems

The City has expanded its real-time utility submetering system since the first CEEMP to include nine facilities. This system provides minute-by-minute data on 240 loads in those buildings, allowing operations and energy management staff to monitor the facility's performance in real time. With this system, Staff can easily access up-to-date information on the building's energy usage and make informed decisions about energy management and conservation.

### Solar PV

Energy and emissions staff have completed a study to assess the feasibility of installing solar PV systems at various City assets. This study included a shading analysis, potential system sizing, financial calculations, electrical infrastructure review within facilities, and preliminary discussions with Burlington Hydro to assess possible local grid connections.

In 2024, a net-metered solar photovoltaic (PV) array was installed at Fire Station 5 in Kilbride. The system is estimated to offset more than 100% of the building's electricity usage, allowing the City to offset a portion of the increased electricity consumption of future electrification of the heating systems in the facility when they are up for capital renewal.

### EV Charging

As of June 1, 2024, the City has expanded its EV charging system to include 20 sites, providing 65 charging ports in public areas, such as parking lots, garages, and community centers.

### Facility Benchmarking

After the 2019-2024 Corporate Energy and Emissions Management Plan was approved, corporate energy and emissions staff developed regular reports that were and continue to be shared with every operational team. These reports provide updates on facility performance. Through this engagement process, City operations staff better understand the effects of weather, operational decisions, and capital improvements on their facilities. These reports have helped our operational teams to comprehend how their buildings respond to these influence factors.

### Energy Project Planning

City Council has set an ambitious goal of achieving net carbon neutrality in City operations by 2040. As part of this effort, Staff successfully applied for funding from the Federation of Canadian Municipalities (FCM) - Green Municipal Fund (GMF) - GHG reduction feasibility studies funding stream in 2021. The City conducted Deep Energy Retrofit Studies at Appleby Ice Centre, Brant Hills Community Centre, Fire Station 2, and Fire Station 7.

In addition, the City participated in The ReCover Initiative along with a few other municipalities across Canada. The program used Burlington Seniors Centre to assess the feasibility of implementing energy-efficient systems in older buildings. This initiative is administered by QUEST, a non-government organization that facilitates the adoption of efficient and integrated community-scale energy systems in Canada. Once a long-term plan for the Central Park campus has been established, the pathway established through the ReCover program for the Seniors Centre could be incorporated into the capital plan.

Corporate energy and emissions staff collaborate with the asset management team to integrate low-carbon and energy reduction initiatives into the 10-year capital plan.

### Major Project Updates

City View Park Pavilion is the City's first facility to achieve net carbon neutrality in its on-site operation. Net carbon neutrality at City View was made possible by incorporating occupancy-based HVAC (heating, ventilation, and air conditioning) systems, lighting control systems, and a 30kW AC net-metered solar array designed to produce the same amount of electricity the facility will use throughout the year.

The Skyway Arena and Community Centre is currently under construction. It will be a shining example of a low-carbon arena. The design incorporates a geothermal system and heat recovery from the ice-making equipment used to heat the facility, meaning it uses no natural gas. The facility is also ready for solar panels to be installed on the majority of its roof space.

The redevelopment of Robert Bateman High School into the Robert Bateman Community Centre is another project that is paving the way for the City to transform the facility from a 1960s-era low-efficiency high school to a net carbon-neutral facility. With construction underway in the first phase of the redevelopment project, the construction team will implement many energy and carbon-reducing measures in the facility, making it an example to the community and municipalities nationwide.

### Asset Inventory Expansion

Since adopting the 2019 CEEMP, the City has expanded its portfolio of buildings, as noted in Table 4.

*Table 4 – New and Increased Facility Area Facility*

Facility	Size (sq ft)
<b>847 Cumberland</b>	7,000
<b>City View Park Pavilion</b>	4,305
<b>Fairview Street Bus Pads and Shelter</b>	200
<b>Forestry Operations Building (at Burlington Hydro)</b>	3,560
<b>LaSalle Park Pavilion (no tenant – City takes responsibility for emissions)</b>	17,804
<b>Robert Bateman High School (not including Centennial Pool)</b>	185,760
<b>Skyway Arena (additional square footage)</b>	28,294
<b>Teen Tour Way Bus Pads and Shelter</b>	200
<b>Transportation Operations Building (at Burlington Hydro)</b>	3,400
<b>Transportation Storage Building (at Burlington Hydro)</b>	3,622
<b>Total</b>	254,145

Figure 3 – Natural Gas Progress

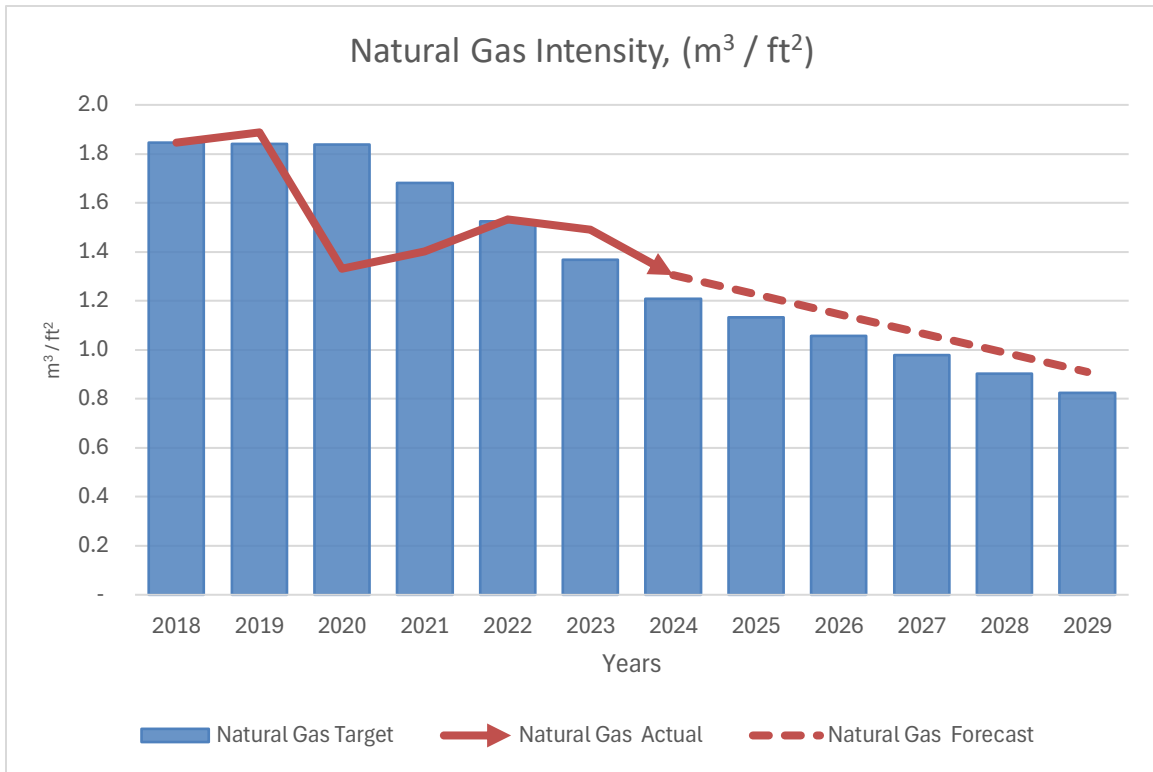


Figure 4 – Electricity Progress

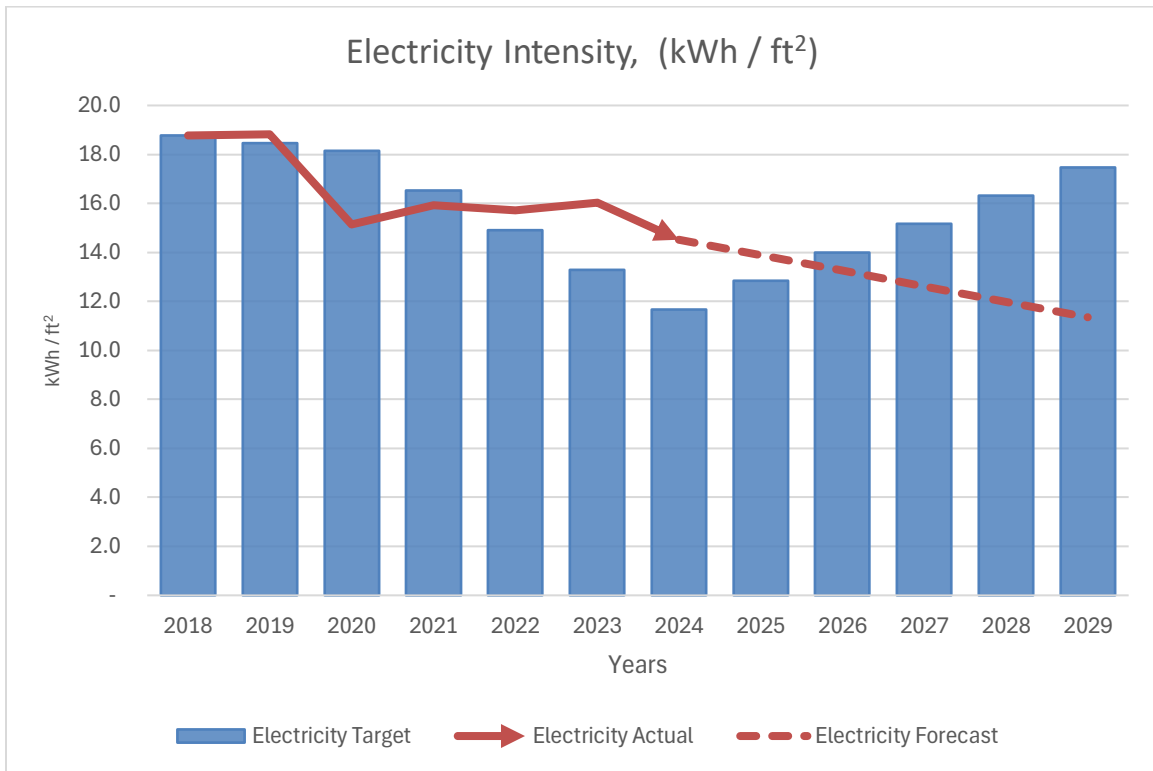
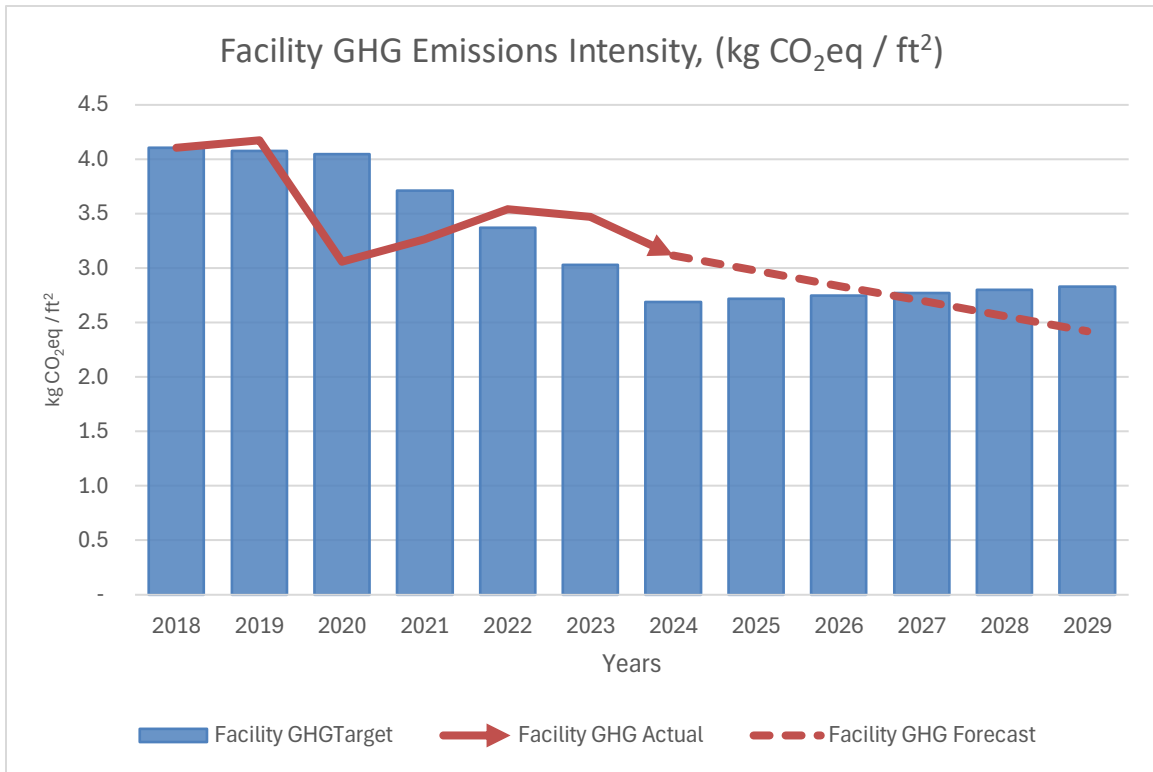




Figure 5 – GHG Emissions Progress



## Present State of Energy Management

### Corporate Energy and Emissions Inventory

The previous Corporate Energy and Emissions Management Plan was adopted in 2019. Since then, the City has undertaken several energy efficiency initiatives, both technological and operational. This section assesses changes in energy use over time due to these initiatives. The data reported in this section draws on utility data for 2018 (baseline year) through 2023. The City experienced considerable reductions in energy use and corporate emissions in 2020 and 2021 due to COVID-19, and these drops in data usage do not reflect the reduction in energy use that can be sustained in City facilities. Electricity, natural gas (thermal energy), gasoline and diesel fuel can be seen in Figure 6 and Figure 7.

Figure 6 – Energy Use, Equivalent Megawatt Hours

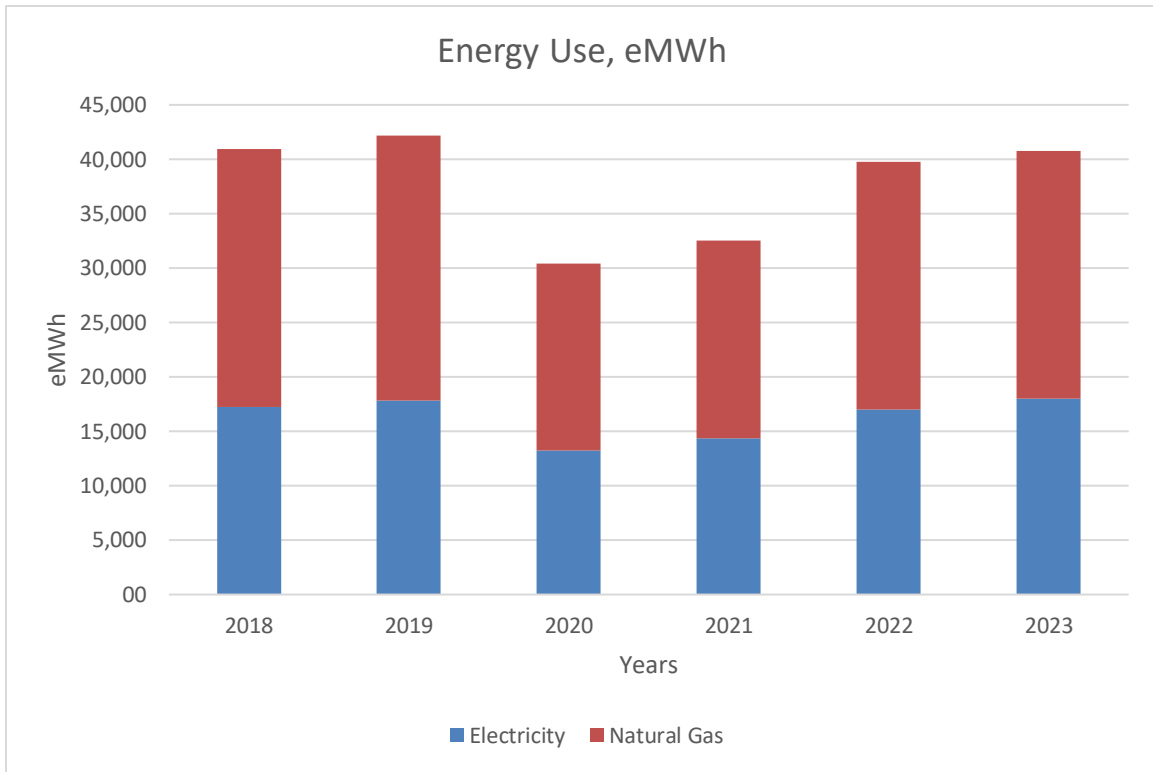
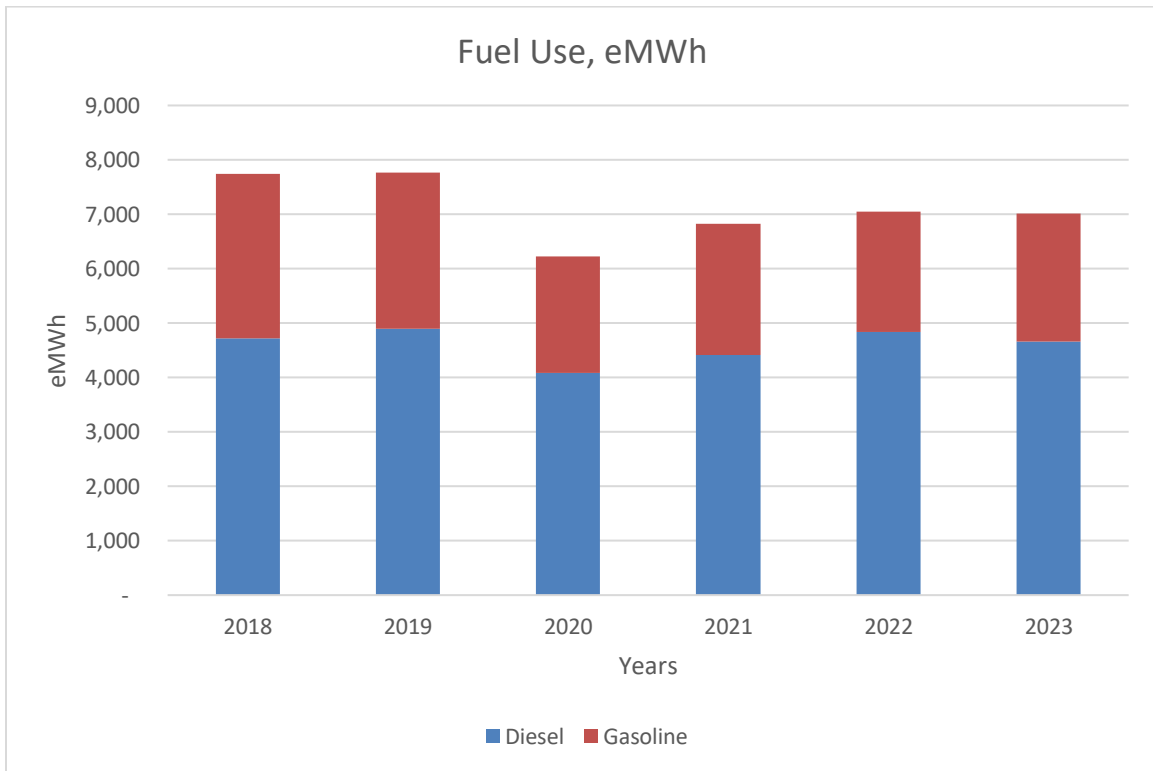


Figure 7 – Fuel Use, Equivalent Megawatt Hours



## Renewable Energy

### Solar Photovoltaic Systems

Since the 2019 CEEMP was approved, renewable energy systems have been installed at City View Park Pavilion and Fire Station 5, as seen in Table 5. In 2024, Fire Station 5's array was energized and will have production data beginning in 2025.

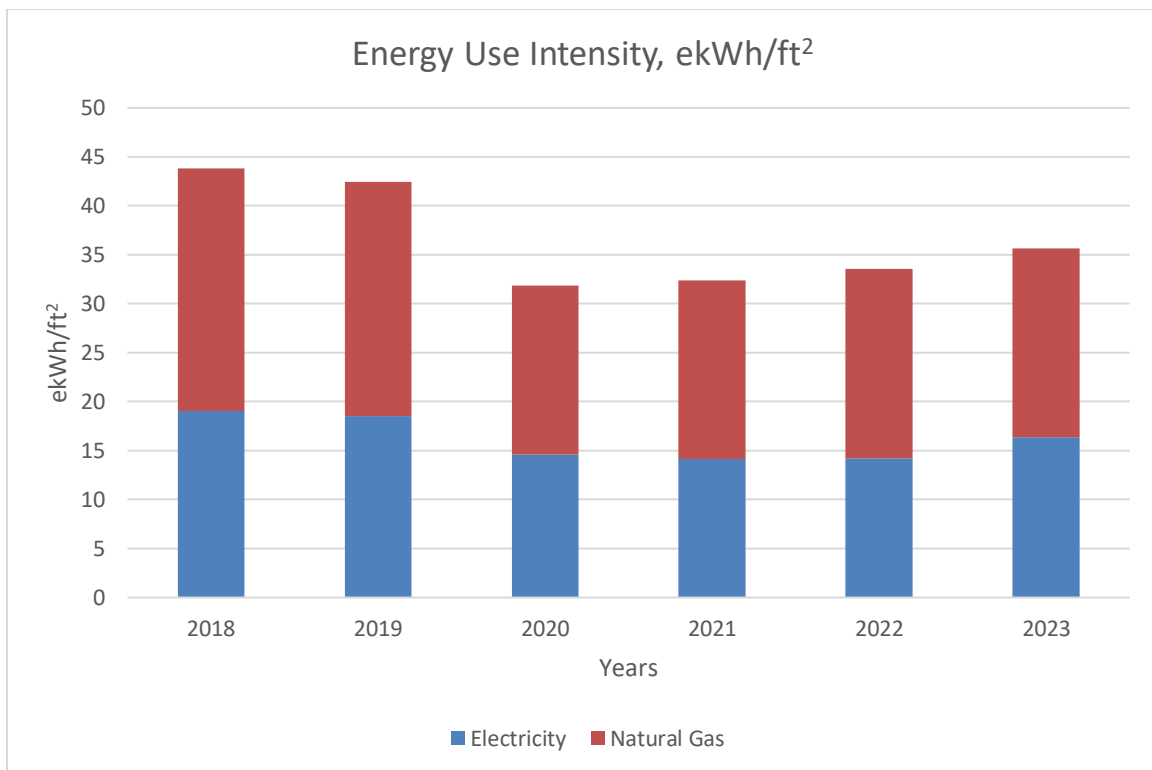
Table 5 – Solar Photovoltaic Systems

Facility	System Size (kW)	2022 kWh Generated	2023 kWh Generated
City View Park Pavilion	30	51,855	49,760
Fire Station 5	25	n/a	n/a

### Energy Use Intensity

Energy use intensity is a measure of the energy use per unit; for buildings, this is typically per square foot or square metre of floor area. By accounting for floor area, comparing buildings of different sizes is possible. This benchmarking helps to identify high-energy-using facilities. It can also be used to show progress toward energy reduction targets while having increasing floor area. Figure 8 shows the overall intensity of corporate energy use between 2018 and 2023.

Figure 8 – Energy Use Intensity



### Corporate Fleet Fuel Consumption

On average, the City's consumption of gasoline and diesel fuels has decreased modestly over the years. Figure 9 demonstrates that since 2018, diesel consumption in corporate vehicles has increased by 1%, and gasoline consumption has decreased by 24%. Conversely, as seen in Figure 10, the fire department's use of diesel has decreased by 11%, and gasoline fuel use has increased by 6%.

Figure 9 – Corporate Fleet Fuel Use, in Litres

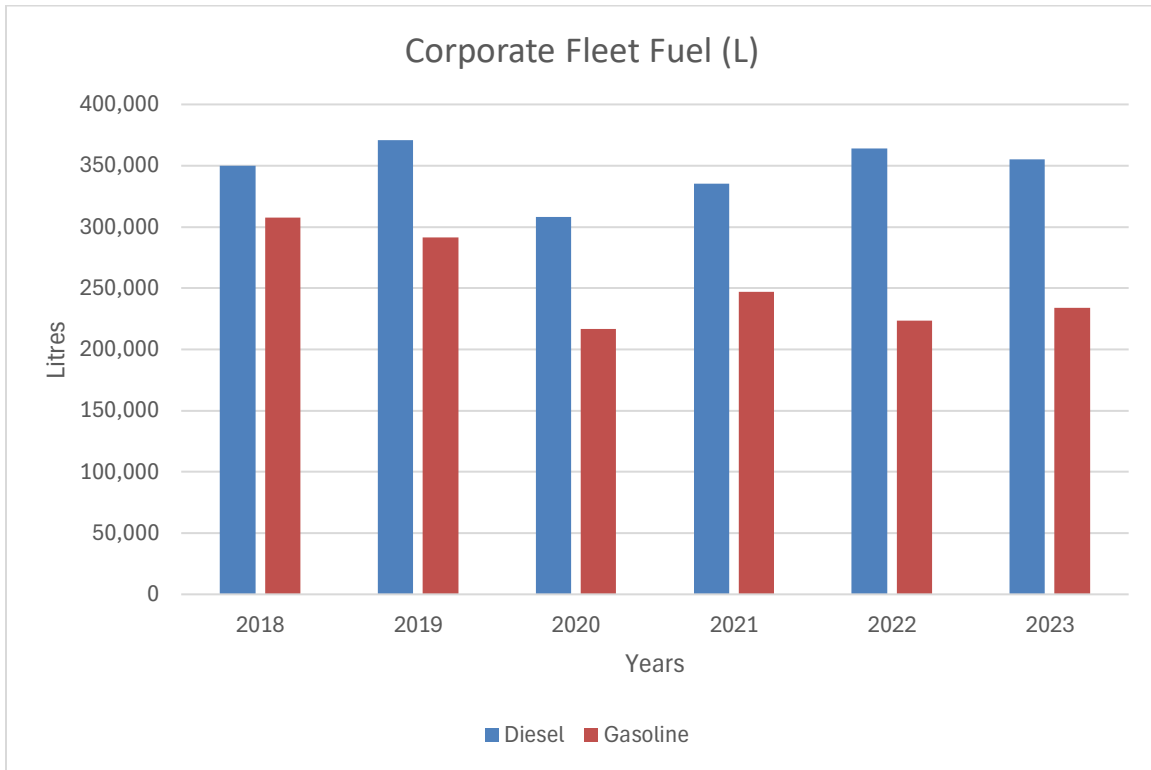
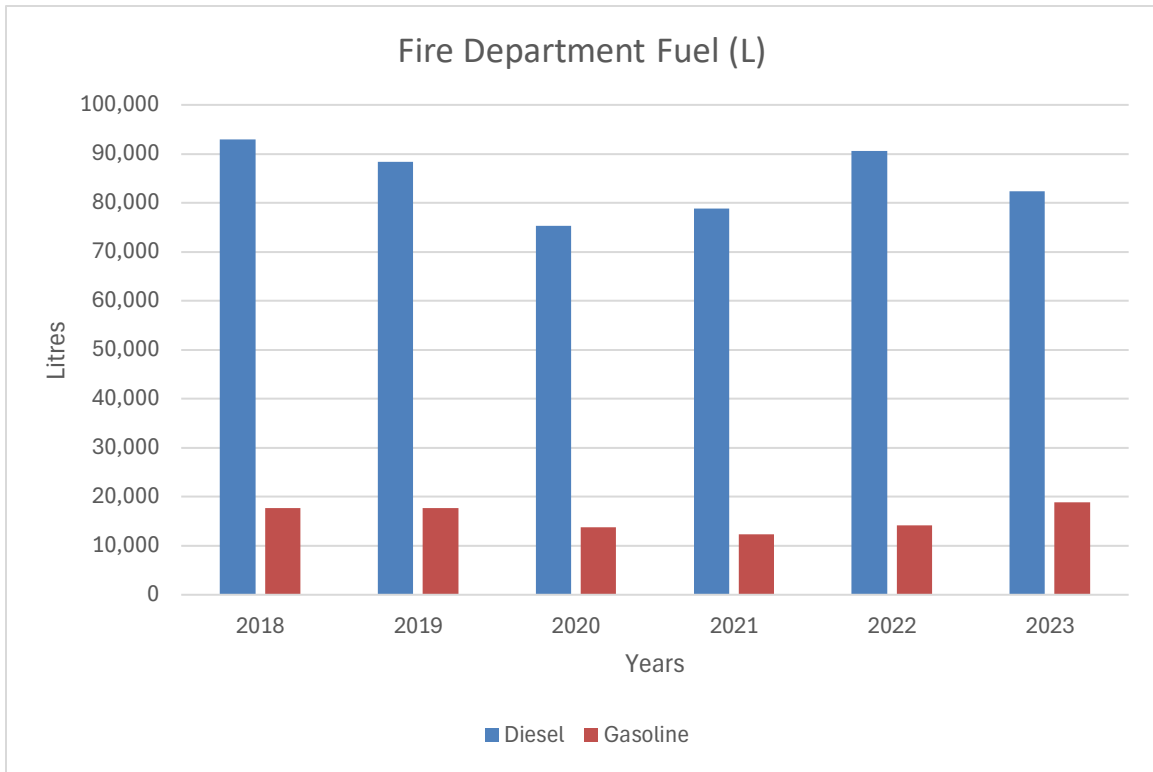


Figure 10 – Fire Department Fuel Use, in Litres



A green fleet strategy was adopted in 2008 and updated in 2023. The City has taken several steps to moderate fuel use by replacing light-duty and passenger vehicles with battery-electric or hybrid-electric alternatives at the end of their expected useful life. Various models in this vehicle segment are beginning to be widely adopted. They can deliver reliable power and range performance at par with diesel and gasoline vehicles. The City has often been rightsizing vehicles and downsizing engine sizes while maintaining performance. Due to industry backlog and supply chain issues, there have been several challenges in the current automotive industry in tendering and procuring green vehicles.

Figure 11 – Fleet Transitioning Phasing Strategy

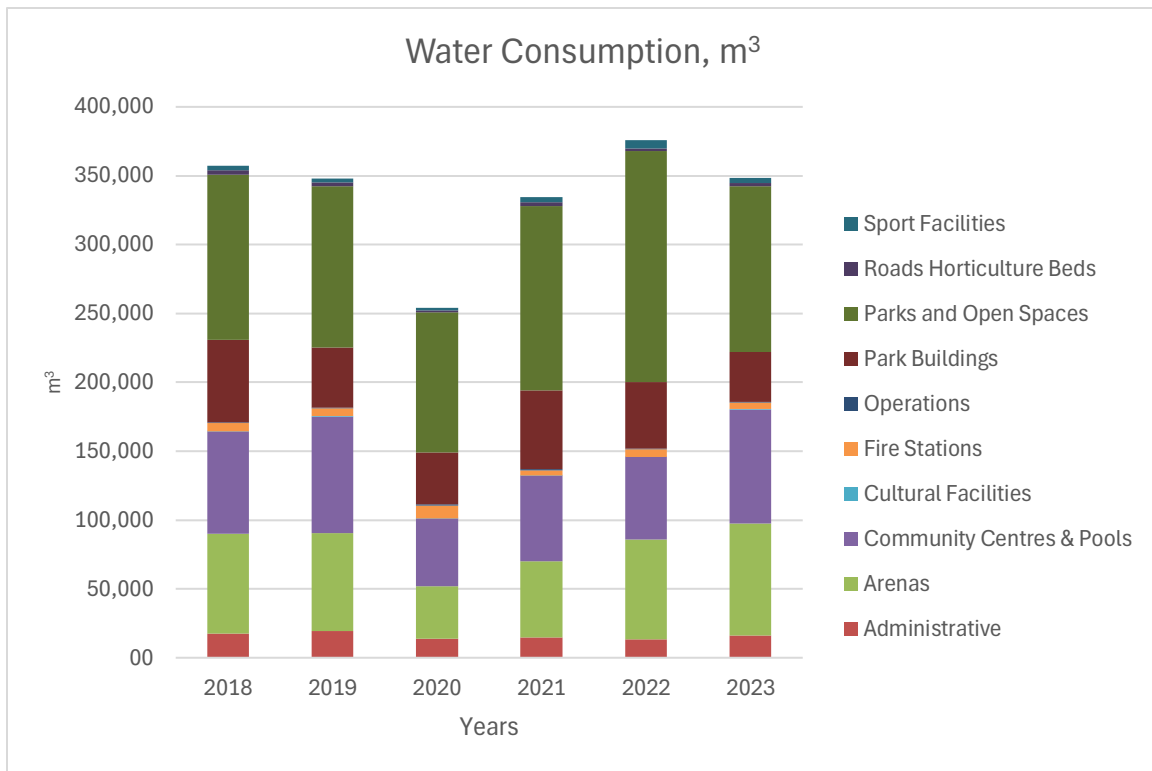


### Water Conservation

Water and wastewater treatment and distribution systems are significant energy consumers for many municipalities. In Burlington's case, these are handled by the Region of Halton. However, Burlington still wants to avoid excessive charges for water and use water efficiently by tracking and monitoring its use within City operations.

Burlington also recognizes that it takes significant energy to pump, produce and treat water. Any efforts to conserve water could transfer to energy savings and, therefore, carbon reduction by Halton Region. Burlington strives to improve water use in its facilities wherever possible during significant renovations, re-builds and regular replacements by installing low flow fixtures. Flow-through splash pads significantly increase water use and offset these efforts overall. The benefits of these types of systems should be re-evaluated, including their environmental impacts. Water consumed in City facilities, parks and open spaces is presented in Figure 12.

Figure 12 – Water Consumption, Cubic Meters



### City of Burlington Climate Change and Environmental Plans

Recognizing the severity of a changing climate, City Council declared a climate emergency in 2019 and approved the 2019-2024 Corporate Energy and Emissions Management Plan. The following are other City-approved plans that support several climate and strategic corporate goals to become a low-carbon, climate-resilient community.

#### Climate Resilient Burlington

[Climate Resilient Burlington | A Plan for Adapting to Our Warmer, Wetter and Wilder Weather](#)

Climate Resilient Burlington (CRB) is a climate adaptation plan identifying 32 actions to implement between 2022-2032 to manage and prepare for the highest projected risks of warmer, wetter, and wilder weather. Objectives of the CRB plan include:

- Focus City efforts on the best opportunities where the City can take the lead or significant role in managing the highest climate risks.
- Align, augment or integrate climate actions into existing City initiatives.
- Work collaboratively by identifying synergies, partnerships and opportunities for alignment with key community stakeholders.

#### Climate Action Plan

[City of Burlington / Climate Action Plan](#)

The Climate Action Plan identifies a target to become a net carbon-zero community by 2050. Incorporating community member and stakeholder engagement builds on Burlington's Climate Emergency Declaration to set a strong direction for the City and our community to mitigate GHG emissions and reduce energy consumption. The Plan identifies seven critical areas of focus, including;

- Low Carbon New Buildings
- Burlington Deep Energy Retrofit Program
- Renewable Energy
- Integrated Mobility Plan
- Electric Mobility and Equipment
- Waste Reduction
- Industrial Innovation

### **Green Fleet Strategy Update 2023**

[\*City of Burlington / Green Fleet Strategy\*](#)

The Green Fleet Strategy's primary objective is to reassess the fleet transition roadmap and its economic and environmental impacts to amend the 2008 Green Fleet Strategy with the most appropriate low-carbon or zero-emissions fleet alternatives which can support the City's broader goal of achieving carbon neutrality for its corporate, fire, transit and equipment fleet by the year 2040.

### **Preferred State of Energy Management**

[\*City of Burlington / Strategic Plan 2015 - 2040\*](#)

The preferred state is where the City of Burlington wants to be regarding energy management and sets out the long-term direction for energy management within the Corporation.

The City's Strategic Plan 2015 – 2040, a 25-year blueprint and guiding document, significantly contributes to the City of Burlington's preferred state. One of the key strategic directions for the City is to be a healthy and greener city with a goal for City operations, including City facilities and fleet, to be net carbon neutral by 2040.

The highlighted box below summarizes the consensus on the City of Burlington's preferred state of energy management, which has not changed since the 2019 CEEMP



Figure 13 – Preferred State of Energy Management

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*The City of Burlington's Preferred State*

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1. The City of Burlington produces no net carbon emissions from its activities. The City includes renewable energy in all of its facilities and fleet.
2. The City of Burlington manages its energy in a way that reduces the burden on ratepayers while maintaining a high level of service for residents, businesses and a healthy work environment.
3. Burlington staff members have the training and information they require to effectively and efficiently manage their energy use and emissions within their responsibilities.
4. The City of Burlington collaborates with others inside and outside the corporation to enhance knowledge of using and managing operation systems to maximize efficiency and reduce emissions.
5. The City of Burlington monitors initiatives in other municipalities and organizations that reduce energy use and emissions. Burlington assesses the applicability of these initiatives to the City facilities and operations.
6. The City is constantly piloting and evaluating innovative ways to increase energy efficiency, use renewable energy, and reduce GHG emissions.
7. New equipment is chosen with a consideration of its energy use, emissions, and life-cycle cost.
8. The City of Burlington communicates its targets and significant milestones regularly along the way.
9. Council and senior management have knowledge of energy use and emissions from City operations and ensure sufficient resources are allocated for plan implementation.
10. The City leverages its expenditures on energy efficiency, renewables, and emission reduction opportunities by taking advantage of incentives offered by utilities and other levels of government.
11. The City of Burlington monitors and tracks energy use and GHG emissions to measure progress against targets.
12. The City of Burlington has operating policies and procedures that ensure its energy-using equipment is maintained and operated to reduce energy use and emissions.

## Objectives and Targets

### Objectives

A key driver of actions over the long term will be the strategic plan objective of ensuring that City operations have net zero carbon releases.

Over the next five years, the primary objectives are to achieve the following:

1. To further build a culture of conservation so that efficient use of energy and limiting greenhouse gas emissions is part of the day-to-day activities of City staff.
2. To enhance the corporate structure and processes for managing all energy and greenhouse gas emissions.
3. Where equipment is being replaced or refurbished, to do so in a way consistent with the long-term goals, particularly for long-life assets.
4. To make good progress on the long-term trajectory towards net zero greenhouse gas emissions, not just focusing on quick payback incremental projects.

### Targets

The updated targets in Table 6 were established using a model for non-fleet energy-consuming City assets created by corporate energy and emissions staff. While the City's overall target is an absolute target, progress toward the target can be measured on a per-square-foot basis due to an overall increase in the City footprint in the coming years following the Asset Management Plan and Live and Play Plans. The fleet targets in Table 6 have been extrapolated from the recently updated Green Fleet Strategy.

Table 6 – 2029, 2040 Emissions Targets

	<b>2018 Baseline</b>	<b>% Reduction</b>	<b>2029 Target</b>	<b>% Reduction</b>	<b>2040 Target</b>
<b>Grid Electricity (kWh / ft<sup>2</sup>)</b>	18.76	7%	17.48	6%	17.73
<b>Natural Gas (m<sup>3</sup> / ft<sup>2</sup>)</b>	1.85	55%	0.82	100%	0.00
<b>Solar Generation (MWh)</b>	0		6,959		12,154
<b>Facility GHG Emissions (kg CO<sub>2</sub>eq / ft<sup>2</sup>)</b>	4.10	31%	2.83	89%	0.44
<b>Fleet GHG Emissions (t CO<sub>2</sub>eq)</b>	1,963	5%	1,872	90%	201

### Updating And Reporting on the Plan

The Corporate Energy and Emissions Management Plan is a living document and should be reviewed at least once a year and updated if required. As part of the annual review, the persons responsible for the Plan should complete the following steps:

- Track the activities implemented based on a checklist of all actions included in the CEEMP.
- Track quantitative progress toward targets using the performance indicators described in this Plan.
- Track progress toward the overall target of being net carbon neutral by 2040 against the modelled activities in this Plan.

- Note any updates to the CEEMP based on new audits, organizational changes, lessons from past projects, and the availability of new technologies or funding sources.
- Identify the priority actions for the coming year and secure funding and resources for their implementation.
- Compile an annual update report describing projects implemented, progress towards targets, updates to the CEEMP, and priority actions for the coming year.
- In 2029, report on the implementation of the CEEMP as required under *Ontario Regulation 25/23*. Include details on energy and greenhouse gas emissions to 2028, current and proposed energy efficiency and demand management measures, report on results achieved, and a revised forecast of the expected results of the current and proposed measures.

## Plan Strategy

The Plan consists of eight essential components:

1. Data management
2. Carbon accounting
3. Training and engagement
4. Policies and procedures
5. Deep energy retrofit studies
6. Budgeting
7. Project management
8. Commissioning/Retro-commissioning

### Data Management

Burlington has adopted a comprehensive system for logging and tracking energy billing associated with facilities: AssetPlanner. Natural gas, electricity and water bills are entered as received and are available to users to assess energy use and changes over time. Data from 2014 is current, and supporting information (e.g. floor area) has been verified.

In addition, Burlington has implemented Centrica's Power Radar in nine of its buildings. This technology provides real-time visibility on energy use. This energy management system is critical, particularly in high-use buildings. An energy management system involves having a power monitoring "current transformer" [CT] on each primary circuit of the building and can offer the user information on how much energy each system uses, showing various lighting systems, cooling, ventilation, and other mechanical systems separately. It also shows which system runs the longest or at different times of the day. The result is the operator having actionable information on what each system is doing "when no one is looking."

This, in turn, allows the operator to predict when a system requires repair (pumps or motors that draw increased current as their bearings fail), has gone offline entirely (drawing zero current when it should be in operation), or requires an adjustment to the control system (a system operating when it is not needed).

Additionally, more granular energy data is collected from individual systems and equipment, including electric vehicle chargers, building automation systems, and solar photovoltaic systems. This and the billing data stored in AssetPlanner are imported into RETScreen Clean Energy Management software.

This software allows energy and emissions staff to adjust for operational fluctuations and weather events to see the actual performance of buildings and systems. It also allows Staff to track performance against projects, events and operational changes and evaluate their effectiveness.

Both the Fire and Corporate Fleet departments maintain information on vehicle fuel use. Both use the WinFuel package, which captures vehicle information, fuel consumption and odometer readings when refuelling. Staff have had difficulty extracting critical information that would support the management of fuel use in the City. However, with the implementation of the Enterprise Asset Management Solution (EAMS), the fleet team will be able to monitor fuel usage per vehicle category more accurately than the previous system.

The EAMS solution is expected to be implemented in late 2025, and data will be utilized to track more key performance indicators.

### Carbon Accounting

Currently, the City uses widely accepted carbon accounting practices. It applies emissions factors found in Canada's official greenhouse gas inventory report, the National Inventory Report, to energy and fuel quantities to establish the City's emissions inventory. While this method is widely accepted, it does not account for the granular effects that some projects and operational changes may have on the City's emissions. Changes in the province's electricity emissions occur hourly and should be accounted for. While accounting for these changes is possible, it is very tedious and time-consuming and is not a practical exercise for ongoing carbon accounting at the current time. Corporate energy and emissions staff are encouraged to pursue new, more accurate ways of performing granular carbon accounting and move to hourly accounting for electricity usage, such as hourly emissions accounting, where possible.

### Training and Engagement

There are opportunities to increase awareness and knowledge related to energy at multiple levels of the Corporation, from Council to senior leadership, facility operators, vehicle users, and all Staff.

#### City Council and Senior Leadership

City Council and senior management receive annual reports on energy use, including changes over time. Council also adopts the five-year Corporate Energy and Emissions Management Plan. Both Council and the Burlington Leadership Team have a critical role in creating and enhancing the 'culture of conservation' by reaffirming their support and encouraging Staff to reduce energy costs, usage and associated greenhouse gas emissions. They need to understand the significance of energy use to the City's budget, how Burlington's commitments and actions compare to those of other municipalities, and how Staff are progressing towards meeting the targets set out in the City's Strategic Plan (net carbon neutrality by 2040) and Corporate Energy and Emissions Management Plan. They need to demonstrate that there will be support and recognition of staff efforts to meet the Council-approved targets.

#### Operations Staff

At the facility level, Staff need to have good information about the systems within their facility and understand how to interpret and act on this information. There are multiple mechanisms through which this may be achieved, including:

- *Regular Training Refreshment* – This is essential as Staff turns over and operators move to other departments, buildings, and roles to allow for continuous career growth. Supporting the operators

with regular efficiency training in each position will improve that person's effectiveness in every role they hold.

- *Regular Exposure & Piloting New Technologies* – is essential as new fleet and equipment technology is brought to market. Supporting the front-line labour force and exposing workers to new technologies will significantly increase the uptake of new technologies and methods to complete work. Testing equipment for City and Commercial purposes is also essential to ensure that levels of services can be maintained in all departments with new technologies.
- *Lunch & Learn* – Inviting the suppliers of various systems into the facility to offer a technical training session on how the system operates and what to watch for is a valuable and (often) free tool to gain insight that may not be available anywhere else. It is also recommended that operators from similar buildings be invited to the sessions to disseminate knowledge to every building of that type.
- *Building Operator Certification* – The BOC program offered by the Canadian Institute for Energy Training focuses on improving buildings' energy management, specifically tailored for building operators. Having each City of Burlington operator work towards this qualification will enhance energy comprehension throughout all operators. Additionally, these courses facilitate dialogue and trading of ideas with operators from other jurisdictions and industries, so attendees often finish the course with exciting projects to investigate.
- *Operator Engagement* – After doing a job for years, the routine of the familiar will always set in unless it is disturbed by an outside force; systems operate the way they always have, and operators stop looking for ways to improve and do things differently. Unless they are engaged with new ideas, strategies for doing things better, or success stories shared with and by colleagues. An active energy training program will revitalize senior Staff to look at building systems with new eyes and fresh motivation to find ways to operate better.

The importance of this last factor cannot be understated: a person will fight for their idea with vigour and creativity, but if that same idea comes from someone else (e.g., an outside consultant or energy auditor), it will often receive a lacklustre effort at best. By promoting operator engagement, ideas will be created and tried, with the motivation to make them work.

### Drivers and Fleet Managers

On the fleet side, regular driver training has been demonstrated to reduce fuel consumption by 5-10% (Federation of Canadian Municipalities, 2010). Still, it must be repeated regularly to be effective (e.g. every six months). The City will need to develop multiple training programs to update each staff segment on changes impacting routine operations as EVs are adopted. Safety training will be paramount for all Staff working near EVs and their associated tooling and charging infrastructure. Familiarity with battery electric technology should not be assumed to be common knowledge. Driver training is described further in Section 7.2 of the Green Fleet Strategy Update 2023.

### Policies and Procedures

#### Corporate Energy and Sustainable Buildings Policy

The Corporate Energy and Sustainable Buildings Policy was updated in 2024 and combines the previous Corporate Energy policy and Sustainable Buildings policy into one concise policy that provides direction to all Staff on standards for renovations and retrofits, replacement of equipment and efficient use of facilities. The updated Corporate Energy and Sustainable Buildings Policy will assist the City in reducing its operational greenhouse gas emissions in its existing facilities, new facilities, major renovations, and

corporate fleet and ensure adapting to our changing climate is also integrated. Ensuring that new buildings and major renovation projects follow the latest version of the Canada Green Building Council's Zero Carbon Building standard will ensure that fossil fuels will be avoided where possible. It will also ensure that embodied carbon is monitored and building envelope improvements will be prioritized to reduce energy use.

### Corporate Fleet Policy

This policy outlines legislated requirements, industry best practices, and procedures resulting in effective asset management and sound business practices that reflect the Corporation's strategic goals, asset management plans, and fleet vehicle and equipment objectives.

### Drivers Handbook

This policy outlines industry best practices and procedures resulting in effective asset use for all equipment and vehicles owned by the City. It emphasizes safety and efficient use of equipment such as anti-idling to ensure that city-owned assets are maintained and used to their fullest potential.

### Deep Energy Retrofit Studies

While many City facilities will be replaced with new low-carbon facilities before 2040, most of the City's current building stock will be in operation long after 2040. It will require significant planning and investment over their life cycle to be converted to low or zero-carbon facilities.

We need to take a more holistic look at the buildings' envelope, systems, and programming or end uses by undertaking deep energy retrofit studies. These studies provide a pathway for our facilities to either become low or zero-carbon facilities while striking a balance with equipment life-cycle costs.

Buildings are selected to undergo a deep energy retrofit study if the facility is expected to be in the City's building stock beyond 2040 and if they have major energy-related building systems up for renewal in the next 3-5 years.

These studies provide cost estimates for budgeting purposes and detailed design briefs that Staff can provide to consulting firms to perform detailed design work that can be tendered to contractors for implementation.

Study teams include Staff from operations, asset management, energy and emissions, project management, as well as the consulting team so that all aspects of the retrofits can be considered, including operational impacts of new systems and construction, constructability, life-cycle impacts, greenhouse gas and energy reduction, and climate resilience.

### Budgeting

Proper budgeting is essential to the success of the energy management and carbon reduction program. Long-term budgeting for energy retrofit projects is established using cost data and averages from previous deep energy retrofit studies. As the retrofit moves closer and a deep energy retrofit is performed for that specific building, a more detailed and accurate budget is produced, as well as a scope of work that can be worked into the capital budget and handed off to a project manager for implementation.

## Project Management

Project management and implementing energy and carbon reduction projects are essential for reaching the City's low-carbon goals. The energy and emissions teams and the project management team manage projects identified as energy conservation initiatives in the capital budget. Smaller, systems-based technical projects are managed by energy staff. In contrast, the project management team manages more extensive energy retrofits with input from the energy team. Energy team members are also included in all extensive renovations and new builds to ensure designs adhere to the corporate energy and sustainable buildings policy and that building systems are appropriately commissioned and are operating optimally at the turnover of the project.

## Commissioning / Retro Commissioning

In simple terms, recommissioning is restoring building systems to how they were intended to operate when they were new. Sometimes, they have drifted from this state due to age, control systems, wear and tear, or other reasons. In other cases, the system may never have been adequately commissioned from the beginning, such that it has never operated correctly.

As evident from the list of simple annual or bi-annual inspection activities below, many are low or no-cost opportunities that can significantly impact facility operation and energy use. It is recommended that a regular recommissioning process be scheduled at each facility, examining each of the major systems on an annual or bi-annual basis, for example:

- Equipment or lighting that is on when it may not need to be
- Systems that simultaneously heat and cool
- Belts and valves that are not functioning properly
- Thermostats and sensors that are out of calibration
- Air balancing systems that are less than optimal
- Economizers that are not working as designed
- Controls sequences that are performing incorrectly
- Variable-frequency drives that operate at unnecessarily high speeds or that operate at a constant speed even though the load being served is variable
- Changing occupancy and occupancy schedules

## Plan Actions

Actions under the Plan are presented in **Error! Reference source not found.** Table 7. Actions should be continually taken to achieve each overall goal.

Table 7 – Actions To Be Undertaken Between 2024-2029

Preferred state		Action	Responsibility
<b>The City of Burlington produces no net carbon emissions from its activities. The City includes renewable energy in all its facilities and fleet.</b>	1	Ensure that renovations and retrofits in City facilities align with the Corporate Energy and Sustainable Buildings Policy.	Facility Assets Team
	2	Continue to plan and perform Deep Energy Retrofit Studies on existing facility assets.	Supervisor, Energy & Emissions
	3	Implement actions in the updated Green Fleet Strategy.	Manager, Fleet Services
	4	Ensure that solar potential is maximized on new facilities and after roof replacements.	Supervisor, Energy & Emissions
<b>The City of Burlington manages its energy in a way that reduces the burden on ratepayers while maintaining a high level of service for residents and businesses and a healthy work environment.</b>	5	Provide regular information on energy usage and costs to facility and vehicle operators.	Analyst, Energy & Emissions
<b>Burlington staff members have the training and information they require to effectively and efficiently manage their energy use and emissions within their responsibilities.</b>	6	Develop a plan for communicating the City's energy reduction programs and initiatives to all Staff.	Energy & Environment Team
	7	Send Staff with energy management and building operations responsibilities to training courses, conferences and trade shows for learning and information-sharing opportunities.	Operational Staff
	8	Develop resources to guide facility operators to make better (energy) choices.	Energy & Emissions Team
	9	Develop guidelines that alert operators on consumption and provide information reports to operators.	Energy & Emissions Team
<b>The City of Burlington collaborates with others inside and outside the Corporation to enhance knowledge of using and managing operation systems to maximize efficiency and reduce emissions.</b>	10	Consider the impact of energy and emissions when other corporate plans and policies are being proposed in a mandatory section of a report or business case.	All Staff with input from the Environment and Energy Team
	11	Participate in multi-municipality groups, e.g. energy managers, fleet managers.	Applicable Staff
<b>The City of Burlington monitors initiatives in other municipalities and organizations that reduce energy use and emissions. Burlington assesses the applicability of these initiatives to the City facilities and operations.</b>	12	Benchmark Burlington energy use and targets against other similar municipalities.	Energy & Emissions Team
	13	Monitor changes in technology, costs, performance, and availability of alternative lower-carbon fuels, including biodiesel, Compressed Natural Gas, renewable diesel, and hydrogen for heavy-duty vehicles.	Energy & Emissions Team / Fleet Team



<b>The City is constantly piloting and evaluating innovative ways to increase energy efficiency, use renewable energy, and reduce GHG emissions.</b>	14	When purchasing new vehicles and other equipment, consider purchasing 'best in class' options, piloting technology, attending lectures/conferences on new technology and considering life-cycle costs and carbon intensity as per green procurement policy.	Manager, Fleet Services
<b>New equipment is chosen with consideration of its energy use, emissions, and life-cycle cost.</b>	15	Set annual targets for each building and category of vehicle to meet the overall efficiency targets.	Energy & Emissions Team
<b>The City of Burlington communicates its targets and significant milestones regularly along the way.</b>	16	Ensure operators have the tools needed to achieve goals.	Operational Staff
	17	Reaffirm/update targets as required to reflect progress.	Energy & Emissions Team
	18	Evaluate the need for additional Staff to meet the City's energy goals.	Facility Assets Team / Environment & Energy Team
	19	Develop energy KPIs to be integrated into the Burlington Leadership Team dashboards.	Energy & Emissions Team, Burlington Leadership Team
<b>Council and senior management have knowledge of energy use and emissions from City operations.</b>	20	Monitor new sources of funding and incentives for energy efficiency or GHG reduction initiatives.	Energy & Emissions Team
<b>The City leverages its expenditures on energy efficiency, renewables, and emission reduction opportunities by taking advantage of incentives offered by utilities and other levels of government.</b>	21	Advocate higher levels of government to support the greening of fleets.	Manager, Fleet Services & Manager, Government Relations
	22	Track and assess progress on interim targets and short-term initiatives.	Energy & Emissions Team
<b>The City of Burlington monitors and tracks energy use and GHG emissions to measure progress against targets.</b>	23	Install sub-meters on major systems in the largest energy-using buildings to provide real-time information to operations staff.	Analyst, Energy & Emissions
	24	Investigate daily and seasonal energy use patterns to take advantage of load-shifting opportunities and reduce electricity use during peak times when it is expensive and more carbon-intensive.	Energy & Emissions Team
	25	Ensure that data systems for fleets capture relevant data on distance travelled, fuel use, fuel and vehicle type, driver, etc. and that Staff know how to extract and analyze data.	Fleet Team
	26	Assess the results of the recent project using telematics of a sub-set of vehicles and determine the need and desirability of increasing the number and duration of vehicles with telemetric capability.	Fleet Team

	27	Identify options for reducing equipment duty cycles while maintaining service performance, for example, using an occupancy sensor to adjust ventilation to occupancy.	Fleet Team
<b>The City of Burlington has operating policies and procedures that ensure its energy-using equipment is maintained and operated to reduce energy use and emissions.</b>	28	Accelerate replacement of oldest, least-efficient vehicles.	Fleet Team

### Capital and Operating Costs of Plan Actions: 2024-2029

The estimated costs of these actions are shown in Table 8. These costs are based on the assumptions previously stated in the Plan **Error! Reference source not found.**, which reflect current costs. They also assume that the programs will be rolled in alignment with the Asset Management Plan and that project management resources are available. Facility portfolio gross square footage is a benchmark for total facility operating costs for utilities.

*Table 8 – Capital and Utility Costs of Retrofits of Existing Facilities*

	2025	2026	2027	2028	2029
<b>Capital costs to perform energy retrofits at existing facilities.</b>	\$8,675,780	\$1,678,980	\$14,290,660	\$14,129,100	\$8,206,320
<b>Facility utility costs</b>	\$6,755,923	\$6,793,110	\$6,918,528	\$7,063,784	\$6,525,216
<b>Estimated facility gross area (sq ft)</b>	1,493,148	1,496,148	1,506,148	1,716,148	1,716,148

Realistically, the costs of the technologies are likely to decline, and the energy costs will almost certainly rise. The analysis has not accounted for non-energy operating costs such as maintenance changes.

## Conclusions and Recommendations

Significant technological, behavioural, and operational changes must occur within facilities and fleets to reduce energy use and help the City move towards its long-term strategic plan goal of making City operations net carbon-neutral.

On the facilities side, Individual facilities will continue to be studied through deep energy retrofit studies where specific low-carbon pathways can be established for each principal building. Through conservation initiatives, Burlington will take advantage of opportunities to reduce overall electricity and natural gas use, thereby reducing overall demand in City facilities. Moving away from fossil fuels used for space and water heating is required, primarily achieved by converting to heat pump-based systems and focusing on harvesting residual waste heat.

On the fleet side, a move away from gasoline and diesel is required to get to net zero carbon. For light-duty cars, the conversion to hybrid and fully electric vehicles can begin immediately; however, they represent a small portion of the overall fleet. Low-carbon technologies for trucks and medium- and heavy-duty vehicles are emerging but are not yet commercial.

These changes are essential to meeting the strategic objective of net zero carbon and need to be seen as investments.

## Appendix A. List of Acronyms

ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

BAS – Building automation system

BLT – Burlington Leadership Team

CDM – Conservation and Demand Management

CEEMP – Corporate Energy and Emissions Management Plan

CO<sub>2</sub>eq – a quantity of greenhouse gas or collection of greenhouse gases expressed as a carbon dioxide (CO<sub>2</sub>) equivalent

ekWh – equivalent kilowatt-hour, a measure of energy. Electrical energy is typically measured in kilowatt-hours (kWh), but other forms of energy are not. ekWh is sometimes used to indicate that some or all of the reported energy quantity is not electrical.

EnPI – Energy performance indicator

EUI – Energy use intensity, for buildings it is typically measured in energy use per unit of floor area

EV – Electric vehicle

GHG – Greenhouse gas compounds that contribute to climate change

GJ – gigajoule, a billion joules. A measure of energy

GWh – gigawatt-hour, a million kilowatt-hours. A measure of energy

HVAC – Heating, ventilation and air conditioning

IESO – Independent Electricity System Operator

KPI – Key performance indicator

LED – Light emitting diode

NPV – Net present value

RPF – Roads, Parks and Forestry

## Appendix B. Facility Energy Use, 2018-2023

Table 9 - Facility Energy Use (Electricity and Natural Gas) in Equivalent kWh

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Burlington Transit Bus Terminal</b>	721	Admin	48,932	45,602	44,482	35,047	21,698	21,013
<b>Burlington Transit Headquarter</b>	67,554	Admin	2,167,328	2,012,276	1,474,579	1,596,063	1,893,914	1,270,633
<b>City Hall</b>	91,988	Admin	2,226,475	2,199,817	2,114,613	2,012,248	1,837,015	1,839,607
<b>Roads and Parks Maintenance Headquarter</b>	50,084	Admin	1,466,733	1,785,154	1,870,813	885,817	788,336	1,202,780
<b>Sims Square</b>	60,571	Admin	00	1,389,328	1,184,833	1,178,444	1,244,574	955,117
<b>Traffic Supervisors Office</b>	2,315	Admin	47,083	44,171	39,794	41,010	45,534	39,103
<b>Aldershot Arena</b>	26,135	Arenas	838,526	911,922	785,667	839,091	961,936	988,550
<b>Appleby Ice Centre</b>	130,944	Arenas	7,497,270	8,264,795	3,788,658	4,934,640	7,387,232	7,435,942
<b>Central Arena</b>	44,692	Arenas	1,378,419	1,426,286	1,527,058	1,140,087	1,384,636	1,003,815
<b>Mainway Recreation Centre</b>	79,438	Arenas	2,904,539	2,568,579	1,643,483	1,926,257	2,184,904	2,304,739
<b>Mountainside Arena</b>	30,521	Arenas	1,418,692	1,375,249	1,138,375	1,032,126	1,488,095	1,656,335
<b>Nelson Recreation Centre</b>	29,532	Arenas	1,426,035	1,206,123	920,181	1,078,098	1,664,669	1,591,256

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Skyway Arena</b>	22,206	Arenas	523,998	558,907	352,727	251,374	154,630	00
<b>Aldershot Pool</b>	16,167	Community Centres & Pools	1,700,688	1,753,134	901,700	1,155,864	1,417,919	1,404,442
<b>Angela Coughlan Pool</b>	15,037	Community Centres & Pools	1,804,779	1,146,047	680,025	1,306,258	1,806,903	1,807,147
<b>Brant Hills Community Centre</b>	19,827	Community Centres & Pools	573,445	585,938	444,698	463,653	534,811	550,065
<b>Burlington Seniors' Centre</b>	16,523	Community Centres & Pools	893,449	882,763	671,074	733,042	674,934	647,126
<b>Centennial Pool</b>	17,427	Community Centres & Pools	1,691,672	1,850,215	1,091,709	1,246,207	1,317,173	1,026,097
<b>Ella Foote Hall</b>	1,550	Community Centres & Pools	35,312	37,194	31,323	33,356	31,848	30,626
<b>Haber Recreation Centre</b>	53,884	Community Centres & Pools	2,066,048	2,123,577	1,363,325	1,361,367	2,079,366	1,735,862
<b>LaSalle Outdoor Pool</b>	-	Community Centres & Pools	10,605	10,965	9,862	12,254	11,891	11,028
<b>Mountainside Pool</b>	5,700	Community Centres & Pools	391,099	414,141	244,253	430,188	43,283	367,269
<b>Robert Bateman High School</b>	185,760	Community Centres & Pools	00	00	00	00	890,885	3,295,091
<b>Rotary Youth Centre</b>	12,723	Community Centres & Pools	110,974	113,985	96,535	94,373	105,039	95,767
<b>Sherwood Forest Park Community Centre</b>	11,248	Community Centres & Pools	330,018	328,188	254,891	246,132	300,456	293,619

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Tansley Woods Community Centre</b>	69,298	Community Centres & Pools	3,990,465	4,323,630	3,471,923	3,984,369	4,576,468	4,335,641
<b>LaSalle Park Pavilion</b>	17,804	Cultural Facilities	584,434	1,340	00	00	00	291,508
<b>Music Centre</b>	11,162	Cultural Facilities	236,729	221,867	177,971	199,077	216,817	198,439
<b>Student Theatre Centre</b>	6,394	Cultural Facilities	128,318	133,001	112,691	111,519	130,868	119,534
<b>City Hall EV Chargers</b>	-	EV Charging Stations	4,322	4,900	1,940	3,931	5,598	7,969
<b>Parking Garage EV Chargers</b>	-	EV Charging Stations	4,365	9,650	4,019	4,729	9,269	10,955
<b>Parking Lot 1</b>	-	EV Charging Stations	00	00	00	00	4,570	19,711
<b>Parking Lot 10</b>	-	EV Charging Stations	00	1,305	1,760	10,095	7,918	12,593
<b>Parking Lot 2</b>	-	EV Charging Stations	00	6,884	4,126	8,107	9,967	18,795
<b>Parking Lot 3</b>	-	EV Charging Stations	00	6,153	6,810	10,648	18,281	24,994
<b>Parking Lot 4</b>	-	EV Charging Stations	00	11,114	10,845	12,686	22,071	27,880
<b>Parking Lot 5</b>	-	EV Charging Stations	00	588	2,720	2,717	2,714	2,727
<b>Parking Lot 6</b>	-	EV Charging Stations	00	8,940	10,202	12,703	10,324	4,827

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Parking Lot 7</b>	-	EV Charging Stations	00	6,731	4,644	5,422	12,879	19,262
<b>Fire Station 1 Headquarter</b>	27,426	Fire Stations	874,149	888,267	831,672	844,430	926,439	920,806
<b>Fire Station 2</b>	8,310	Fire Stations	200,113	172,405	168,833	179,736	186,822	172,739
<b>Fire Station 3</b>	7,707	Fire Stations	173,969	171,410	149,383	151,896	167,698	156,271
<b>Fire Station 4</b>	8,321	Fire Stations	353,193	334,288	295,620	307,139	362,925	337,581
<b>Fire Station 5</b>	4,693	Fire Stations	121,537	132,037	95,322	101,560	142,340	83,840
<b>Fire Station 6</b>	10,000	Fire Stations	225,233	224,059	191,014	185,017	190,280	209,544
<b>Fire Station 7</b>	7,201	Fire Stations	271,789	237,951	211,431	188,576	239,386	183,050
<b>Fire Station 8</b>	7,257	Fire Stations	255,239	259,309	259,492	254,358	245,005	226,678
<b>6 Misc Billing</b>	-	Lighting	1,747	3,233	2,490	1,747	2,483	2,556
<b>72 Misc Billing</b>	-	Lighting	25,800	25,800	25,800	25,800	25,800	25,800
<b>Brant Street Lighting</b>	-	Lighting	70,029	72,665	68,305	62,445	62,819	73,511
<b>Brant Street Pier</b>	-	Lighting	48,402	54,863	44,196	45,061	46,805	49,156



Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
Lakeshore Road Lighting	-	Lighting	18,669	14,932	13,407	13,295	13,104	12,472
Maria Street Lighting	-	Lighting	19,681	21,496	21,190	18,653	18,814	18,755
Streetlights	-	Lighting	5,295,399	4,798,239	4,813,544	4,804,104	4,810,455	4,814,032
Traffic Signals	-	Lighting	511,224	515,509	515,520	515,520	519,198	535,219
847 Cumberland	7,000	Operations	-	00	00	00	00	70,538
Animal Shelter	6,415	Operations	477,732	452,671	426,238	403,522	438,277	334,942
Fairview Street Bus Pads and Shelter	200	Operations	00	00	00	1,209	2,714	3,842
Forestry Group Building	3,560	Operations	00	00	00	00	00	38,416
Parking Garage	133,358	Operations	213,179	215,248	198,558	206,970	218,426	193,882
Roads and Parks Maintenance East Storage	10,290	Operations	6,070	11,699	13,010	15,211	13,188	20,264
Roads and Parks Maintenance Northeast Compound	-	Operations	21,141	12,163	20,948	24,440	17,264	7,489
Roads and Parks Maintenance Salt Domes	10,010	Operations	910	1,630	1,404	1,225	1,020	1,831
Roads and Parks Maintenance West Storage	4,801	Operations	15,569	18,141	23,056	27,979	28,381	24,471

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Student Theatre Storage Building</b>	2,013	Operations	60,024	119,084	73,081	72,270	76,822	58,067
<b>Teen Tour Way Bus Pads and Shelter</b>	200	Operations	00	00	00	266	369	328
<b>Transportation Building</b>	3,400	Operations	00	00	00	37,362	67,254	60,723
<b>Transportation Storage Building</b>	3,622	Operations	00	00	00	17,011	71,010	59,680
<b>Walkers Line Pumping Station</b>	538	Operations	45,539	37,349	60,869	40,014	38,144	45,214
<b>Beachway Pavilion Snack Shack</b>	538	Park Buildings	42,542	44,858	13,371	12,499	40,060	38,636
<b>Beachway Pumpouse</b>	732	Park Buildings	38,580	28,977	11,612	35,913	17,869	21,115
<b>Central Park Maintenance Building</b>	1,259	Park Buildings	47,065	47,565	41,891	40,498	40,821	40,652
<b>Central Park Washroom Building</b>	355	Park Buildings	11,632	12,302	9,443	7,773	8,998	9,884
<b>City View Park Maintenance Building</b>	2,433	Park Buildings	20,609	34,742	17,367	14,297	17,579	19,567
<b>City View Park Pavilion</b>	4,305	Park Buildings	56,446	55,829	36,661	98,786	132,476	131,255
<b>Elgin Park Maintenance Building</b>	2,433	Park Buildings	74,683	110,649	77,260	77,246	74,566	67,719
<b>Greenwood Cemetery Office &amp; Maintenance Building</b>	1,098	Park Buildings	53,869	56,830	44,415	46,302	51,979	50,529

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Greenwood Park Barn</b>	2,217	Park Buildings	54,812	38,596	33,591	42,824	44,871	42,049
<b>Hidden Valley Park Maintenance Building</b>	807	Park Buildings	25,676	28,498	29,210	26,740	27,049	27,879
<b>Hidden Valley Park Washroom Building</b>	1,550	Park Buildings	13,360	8,244	2,381	11,440	13,379	13,999
<b>Ireland Park Concession &amp; Washroom Building</b>	1,216	Park Buildings	51,748	47,589	26,498	40,663	38,150	25,641
<b>Ireland Park Maintenance Building</b>	1,572	Park Buildings	53,495	51,510	47,989	48,127	49,577	46,806
<b>Lowville Park Old School House</b>	1,389	Park Buildings	16,877	6,126	4,609	3,726	8,005	10,001
<b>Lowville Park Pavilion</b>	3,272	Park Buildings	27,181	24,583	22,612	24,616	24,968	26,914
<b>Millcroft Park Maintenance Building</b>	1,787	Park Buildings	54,093	67,259	59,034	57,328	60,589	65,904
<b>Nelson Park BMFA/RPM Building</b>	3,324	Park Buildings	232,909	257,968	220,768	234,341	253,761	176,687
<b>Nelson Park Washroom Building</b>	1,904	Park Buildings	14,455	00	784	541	12	00
<b>Orchard Park Maintenance Building</b>	1,163	Park Buildings	23,382	25,235	23,926	23,629	22,731	23,155
<b>Paletta Lakefront Park - Gatehouse</b>	1,661	Park Buildings	63,620	62,598	46,283	42,513	49,391	48,558
<b>Sherwood Forest Park Maintenance &amp; Washrooms Building</b>	1,130	Park Buildings	26,104	24,122	17,328	25,403	30,068	28,099

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Tansley Woods Park Maintenance &amp; Washrooms Building</b>	721	Park Buildings	26,593	24,489	31,231	31,160	35,643	33,125
<b>Tyandaga Golf Course Maintenance Building</b>	5,995	Park Buildings	64,648	54,899	65,598	58,441	56,026	45,233
<b>Berton Park</b>	-	Parks and Open Spaces	1	00	00	00	01	01
<b>Bolus Community Parkette</b>	-	Parks and Open Spaces	65	130	85	81	104	58
<b>Bridgeview Park</b>	-	Parks and Open Spaces	8	00	00	278	08	00
<b>Burloak Waterfront Park</b>	-	Parks and Open Spaces	00	00	88	1,627	1,057	2,126
<b>Central Park Parking Lots</b>	-	Parks and Open Spaces	31,021	29,651	29,050	26,842	27,187	28,861
<b>Desjardin Splash Pad</b>	-	Parks and Open Spaces	00	00	00	103	204	165
<b>Doug Wright Park</b>	-	Parks and Open Spaces	14,666	16,188	714	7,540	7,730	13,347
<b>Elgin Promenade</b>	-	Parks and Open Spaces	00	00	00	00	616	1,093
<b>Emerson Park</b>	-	Parks and Open Spaces	3	04	03	02	04	02
<b>Greenwood Park</b>	-	Parks and Open Spaces	5,719	6,502	6,736	8,508	8,182	5,146
<b>Ireland Park</b>	-	Parks and Open Spaces	6,858	8,009	7,972	8,230	8,408	5,430

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
<b>Kerns Park</b>	-	Parks and Open Spaces	984	790	496	967	1,202	1,161
<b>Lowville Park Baseball Diamond</b>	-	Parks and Open Spaces	1,109	1,226	548	549	543	1,259
<b>Maple Park 2</b>	-	Parks and Open Spaces	8,820	10,633	8,168	15,404	18,061	15,461
<b>Maplehurst Park</b>	-	Parks and Open Spaces	478	475	452	310	435	154
<b>Millcroft Park</b>	-	Parks and Open Spaces	48,443	47,880	25,492	35,175	41,190	31,511
<b>Nelson Park East Baseball Diamond</b>	-	Parks and Open Spaces	13,738	12,813	7,079	9,510	9,438	10,597
<b>Nelson Park West Baseball Diamond</b>	-	Parks and Open Spaces	25,321	21,177	14,176	17,320	18,170	19,567
<b>Newport Park</b>	-	Parks and Open Spaces	00	00	00	00	00	02
<b>Norton Community Park</b>	-	Parks and Open Spaces	81,658	84,778	64,307	65,710	76,667	82,571
<b>Orchard Park</b>	-	Parks and Open Spaces	39,073	45,978	29,895	31,527	42,465	44,296
<b>Palmer Park</b>	-	Parks and Open Spaces	5,440	6,960	00	8,480	14,320	16,514
<b>Roly Bird Park</b>	-	Parks and Open Spaces	123	117	108	91	71	107
<b>Sherwood Forest Park West</b>	-	Parks and Open Spaces	12,889	10,918	3,670	9,836	7,068	10,480

Facility	Facility Size	Building Type	2018	2019	2020	2021	2022	2023
Sioux Lookout	-	Parks and Open Spaces	2,221	2,218	1,685	1,701	2,602	1,974
Spencer Smith Park East 1	-	Parks and Open Spaces	44,323	45,126	32,522	34,124	46,996	43,901
Spencer Smith Park North	-	Parks and Open Spaces	4,866	4,561	2,137	2,131	5,702	4,838
Nelson Park Baseball Building	1,905	Sport Facilities	12,547	10,717	11,534	12,010	11,493	11,906
Nelson Park Braves Building	3,331	Sport Facilities	15,310	33,020	59,179	61,240	66,712	66,296
Tyandaga Golf Course - Pro shop/Restaurant	20,140	Sport Facilities	267,174	264,682	211,139	225,643	235,769	223,005

## Appendix D. Conversion Factors

Table 10 – Energy Density of Fuels

Energy Source	To Convert	To	Multiply By	Source <sup>i</sup>
Natural gas	m3	ekWh	10.88	
Natural gas	m3	MJ	39.17	A
Diesel	L	ekWh	10.65	
Diesel	L	MJ	38.68	B
Gasoline	L	ekWh	9.29	
Gasoline	L	MJ	34.66	B
Any energy source	kWh	MJ	3.6	
Any energy source	MJ	ekWh	0.27777778	

Table 11 – Global Warming Potential

GHG	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	Source
GWP	1	28	265	E

**Note: 100-year GWPs**

Table 12 – Emissions of Ontario Fuels

Fuel	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> eq	Source
Natural gas	1,921	0.037	0.035	1,931	D
Diesel	2,681	0.084	0.2	2,731	F
Motor gasoline	2,307	0.1	0.01	2,315	F

- Note: Natural gas is a marketable gas in Ontario. CO<sub>2</sub>eq is the sum-product of the emission factor of each contaminant and the global warming potential.

Table 13 – GHG Intensity of Ontario Electricity

Year	Intensity	Units	Source
2018	30	g CO <sub>2</sub> eq/kWh	C
2019	29	g CO <sub>2</sub> eq/kWh	C
2020	33	g CO <sub>2</sub> eq/kWh	C
2021	36	g CO <sub>2</sub> eq/kWh	C
2022	38	g CO <sub>2</sub> eq/kWh	C
2023	38	g CO <sub>2</sub> eq/kWh	

<sup>i</sup> Sources:

- A Enbridge Gas, Unit of Measure Conversion Information
- B Canada Energy Regulator, Energy Conversion Tables
- C Environment and Climate Change Canada (ECCC), National Inventory Report – 2023 Edition, Part 3, Table A13-7
- D Environment and Climate Change Canada (ECCC), National Inventory Report – 2023 Edition, Part 2, Table A6.1–1 and Table A6.1–3
- E Greenhouse Gas Pollution Pricing Act (S.C. 2018, c. 12, s. 186)
- F Environment and Climate Change Canada (ECCC), National Inventory Report – 2023 Edition, Part 2, Table A6.1–14, Average