2024-2029

Corporate Energy Management Plan

City of Pickering

www.pickering.ca

MESSAGE FROM OUR MAYOR

As we look forward to another year of exciting growth and opportunity in the City of Pickering, I'm pleased to share our 2024-2029 Corporate Energy Management Plan (CEMP), a key initiative that will help us continue to lead in sustainability and climate action.

In recent years, it has become increasingly clear that climate change is no longer a distant concern. From wildfires, heatwaves, to the recent floodings across Ontario, the impacts are being felt. Our residents, businesses, and stakeholders are increasingly concerned, and together, we're committed to addressing these concerns through real, actionable steps.

Sustainability and energy management have always been at the heart of our planning and decision-making in Pickering. The CEMP builds on our community's past successes, providing a roadmap for the next phase of energy management, one that evolves alongside advancing technologies, policies, and ongoing growth.

From the installation of electric vehicle charging stations and high-efficiency modulating condensing boilers to the creation of the new Pickering Heritage and Community Centre — our first net-zero carbon facility — and other forward-thinking projects, we are taking significant strides toward a resilient, low-carbon future.

Through this updated plan, we are reaffirming our commitment to a sustainable future, ensuring that our energy management practices are aligned with our long-term goals for environmental stewardship, economic growth, and the well-being of our residents.

I invite you to explore the 2024-2029 Corporate Energy Management Plan, where we outline our bold and ambitious strategy to reduce energy consumption, lower greenhouse gas emissions, and chart a course for a greener future.

Together, we can continue to build a City that not only thrives today but also ensures a healthier, more sustainable tomorrow for all who call Pickering home.

Yours Truly,

Kevin Ashe
Mayor, City of Pickering

MESSAGE FROM OUR CAO

It is with immense pride and excitement that I introduce the City of Pickering's Corporate Energy Management Plan. This initiative represents a key milestone in our commitment to a more sustainable and environmentally responsible future—one that ensures the well-being of our community today and for generations to come.

In December 2023, Pickering Council endorsed the City's first Corporate Strategic Plan. Among its key priorities, Priority 4 stands out with the ambitious goal of leading environmental innovation and resilience. The Corporate Energy Management Plan is a vital component of this commitment, as it not only defines our energy conservation strategy for the years ahead, but also serves as a roadmap for reinforcing our long-term dedication to environmental sustainability and climate action.

Our mission is clear—to significantly reduce greenhouse gas emissions while fostering the vibrant growth of our city. We forecast a steady reduction in carbon emissions from our municipal buildings between 2018 and 2050, illustrating our commitment to achieving this goal. By optimizing energy use across our operations, we are driving operational efficiency, reducing costs, and most importantly, protecting our planet by curbing greenhouse gas emissions.

This plan is the product of exceptional collaboration, ingenuity, hard work, and passion. I extend my deepest appreciation to our dedicated staff, whose commitment and vision have been instrumental in shaping this initiative. Their efforts, alongside the support of our Council and community, will be crucial in realizing our ambitious, but achievable goals.

Let us seize this opportunity to lead by example and create a legacy of sustainability for future generations. Together, we are building a greener, more resilient Pickering.

Sincerely,

Marisa Carpino
Chief Administrative Officer

A C K N O W L E D G M E N T S

CITY OF PICKERING	
Marisa Carpino	Chief Administrative Officer
Brian Duffield	Director, Operations
Laura Gibbs	Director, Community Services
Kyle Bentley	Director, City Development & Chief Building Official
Stan Karwowski	Director, Finance & Treasurer
Jackie Flowers	CEO/Director of Public Library
Stephen Boyd	Fire Chief
Mark Guinto	Division Head, Public Affairs & Corporate Communications
Vince Plouffe	Division Head, Operations Services
Chantal Whitaker	Manager, Sustainability & Strategic Environmental Initiatives
Dennis Yip	Manager, Facilities Capital Projects
Kevin Hayes	Manager, Facilities Maintenance
Marcos Moreira	Supervisor, Mechanical Systems
Robin Thornton	Supervisor, Energy Management

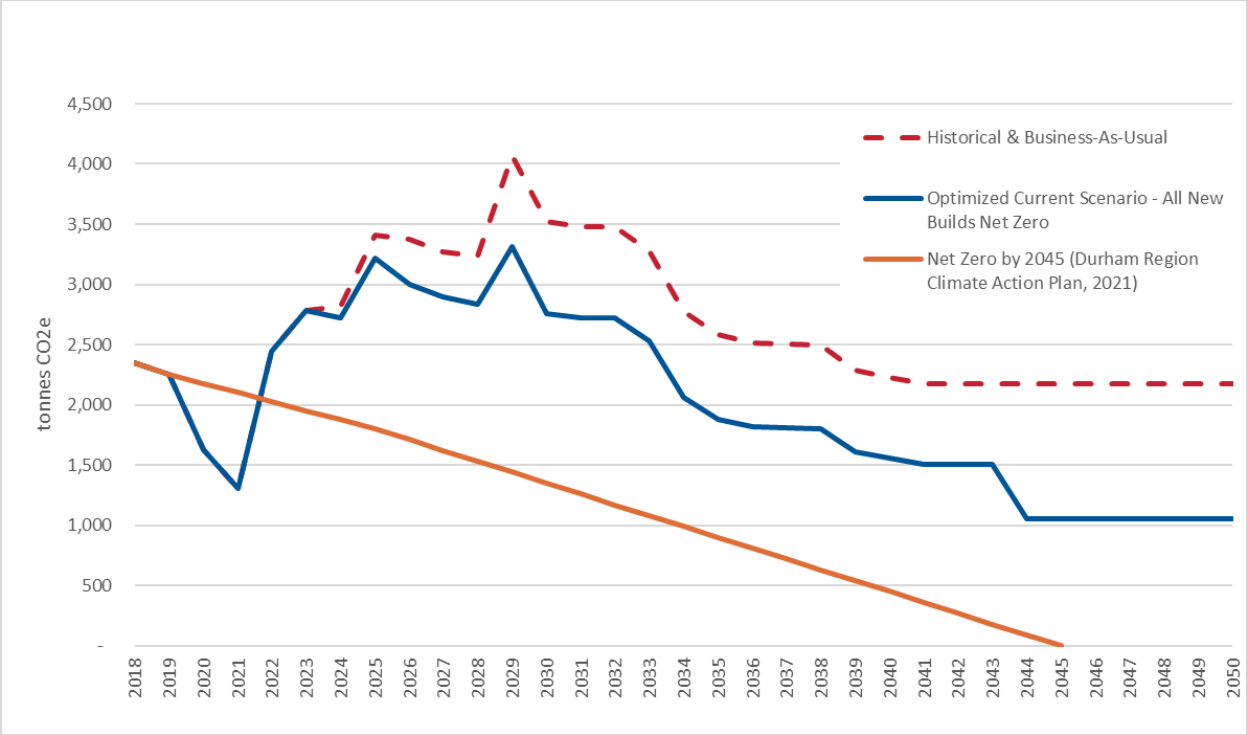
INDECO	
David Heeney	CEO and Founder

TABLE OF CONTENTS

EXECUTIVE SUMMARY

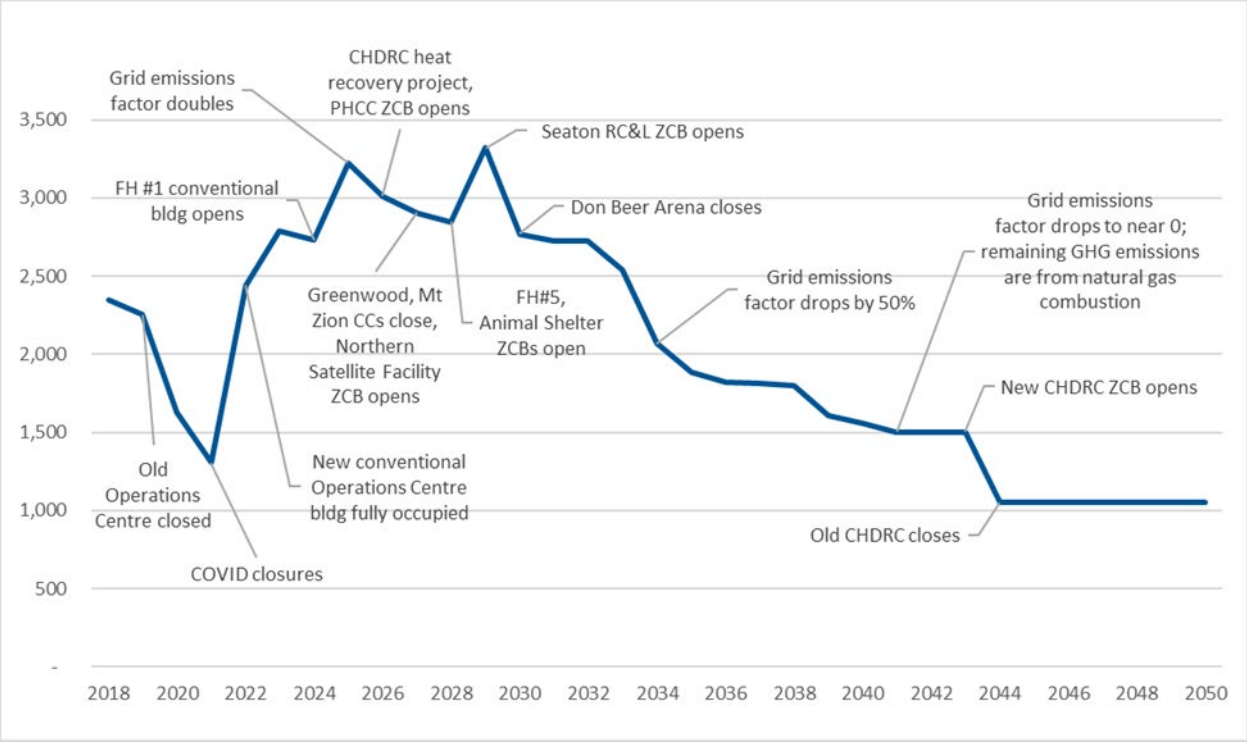
The City of Pickering forecasts a steady reduction in carbon emissions from its municipal buildings between 2024 and 2050. However, the City's population is also increasing, requiring additional capacity and new facilities. Despite conservation efforts, system improvements and replacement of older facilities with new net-zero emissions facilities, total carbon emissions from the Corporate facilities portfolio are increasing in the near term.

Building Portfolio GHG Emissions Trend vs Business-As-Usual and Net-Zero by 2045 (t CO2eq)



Though the City's current emissions trend is significantly improved over conventional "business as usual" building operation, it does not achieve the Paris Agreement target of net zero emissions by 2050, nor the regional target of net zero by 2045. Near-term additional interventions will be required within existing high-emitter facilities to set the emissions trend on a steeper downward trajectory.

Major milestones and assumptions for the achievement of the City's current emissions trend are illustrated in the following graph, including the assumed retirement of facilities near end of life, and future construction focused on delivery of zero carbon building (ZCB) facilities.



Building Portfolio GHG Emissions Trend (t CO2eq) – All New Builds Zero Combustion Scenario

Proposed actions over the 2024-2029 CEMP timeframe have been divided into five action groups, which are titled as separate appendices to enable further independent refinement. The framework for each Appendix is provided.

Appendix 1: Analytics

Achieving energy and emissions reductions will require that data on energy use and equipment maintenance be assembled, analyzed and reported to a greater degree than is currently available.

Eliminating roadblocks to data acquisition will enable the development of reporting tools to demonstrate how actual energy consumption and GHG emission compares against planned targets, progress of planned and completed carbon reduction measures, and performance of carbon reduction measures.

Appendix 2: Carbon Tracking and Accounting

To help ensure emissions targets are met, the City will develop and implement carbon tracking. Staff and Council will be empowered to make climate-informed decisions using a carbon surplus/deficit metric which quantifies carbon emissions impacts specific to a proposed initiative.

Key implementation steps include:

- Establishing annual carbon emissions targets
- Integrating those limits into existing decision-making processes, including asset management plans

- Assessing the climate impact of proposed initiatives
- Tracking and reporting, along with reporting on energy usage.

Appendix 3: Corporate Building Standard

The Corporate Building Standard is intended to become the City's standard for energy and emissions performance, as well as establishing broader corporate building construction requirements specific to City of Pickering facilities.

The Standard introduces a list of objective energy and emissions performance standards for City buildings tailored to their specific end-use. This will clearly communicate performance expectations and objectives to design consultants for new builds and provide accountability for existing buildings.

Appendix 4: Carbon Reduction Plan

Achieving emissions targets or meeting the design standards requires specific technological and operational implementation. The City is planning initiatives in four main areas:

- Efficiency measures that reduce current energy use
- Fuel Switching – primarily the adoption of electric heat pumps
- Implementation of renewable energy technologies
- Development of new facilities and major retrofits to existing buildings.

Appendix 5: Fleet Decarbonization

In addition to buildings, fleet emissions represent 35% of the City's total corporate emissions. Further refinement of this appendix will consider the available market solutions to reduce fleet green house gas emissions, challenges of medium- and heavy-duty vehicle electrification in a City that still has significant semi-rural area, and present the successes to date with light-duty vehicle electrification.

Light-duty EVs in fleet configurations are reaching market maturity and could be deployed where appropriate. Analysis of vehicle telematics data will be explored to assist with identifying the most suitable EV deployments. Renewable diesel (RD) has 65% lower emissions than petroleum diesel and leverages capital investments into existing medium-duty fleet equipment. Unfortunately, it will not be produced locally for several years. Sourcing and collaboration opportunities for RD import will be investigated.

Overall progress toward the goals set out in this Plan will be reported to Council on an annual basis.

INTRODUCTION

THE CLIMATE CRISIS

Climate change is a pressing global issue with far-reaching impacts on the environment, human health, and socioeconomic systems. This section examines the latest findings from the Intergovernmental Panel on Climate Change (IPCC) on climate change impacts and risks at the global level, as well as implications for Canada, Ontario, and the City of Pickering specifically. Drawing on IPCC reports and local climate action plans, it provides an overview of observed and projected climate impacts, vulnerabilities, and adaptation strategies across different scales.

Human activities have caused global warming, with the planet's surface temperature reaching 1.1°C above pre-industrial levels in 2011-2020. The IPCC's 2023 Synthesis Report[1] warns of severe consequences even if warming temporarily exceeds 1.5°C, including:

- Increased frequency and intensity of extreme weather events like heatwaves, droughts, and floods
- Mass mortalities of species such as trees and corals
- Acute food and water insecurity for millions, particularly in vulnerable regions like Africa, Asia, and the Arctic
- Heightened risks to infrastructure, coastal settlements, and human health

More recent analyses concluded that stringent reductions *in the current decade* are critical for planetary stability.[2]

Warming temperatures, altered precipitation patterns, and more frequent extreme weather events are projected to significantly impact Canada and Ontario's ecosystems, agriculture, and public health. The IPCC's 2023 report highlights increased risks of

[1] IPCC, “Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change” (Geneva, Switzerland: IPCC, 2023), doi: 10.59327/IPCC/AR6-9789291691647.

[2] Tessa Möller et al., “Achieving Net Zero Greenhouse Gas Emissions Critical to Limit Climate Tipping Risks,” *Nature Communications* 15, no. 1 (August 1, 2024): 6192, https://doi.org/10.1038/s41467-024-49863-0.

heatwaves, wildfires, and heavy precipitation across North America. These changes pose threats to:

- Agricultural productivity due to shifts in growing seasons and increased drought/flood risks
- Public health, especially for vulnerable populations like the elderly
- Infrastructure resilience, including transportation and energy systems
- Natural ecosystems and biodiversity

Ontario's climate is expected to become warmer and more variable, straining existing systems and requiring proactive adaptation measures to enhance resilience across sectors. Pickering is not immune to these (and other) impacts.[3]

Climate change disproportionately affects certain populations, exacerbating existing health disparities and vulnerabilities. Socially vulnerable groups, including low-income communities, certain racial and ethnic minorities, children, older adults, and those with chronic medical conditions face heightened health risks from climate impacts. These populations often have greater exposure to climate hazards, increased sensitivity to health threats, and reduced adaptive capacity due to social, economic, and political factors.

Key climate-related health risks for vulnerable populations include heat-related illnesses, respiratory problems from air pollution and allergens, water and food-borne diseases, and mental health impacts. For instance, low-income urban residents are more susceptible to extreme heat due to the urban heat island effect and limited access to air conditioning. Economically marginalized communities and immigrant groups may lack resources or may face language barriers to prepare for and recover from extreme weather events. Children and pregnant women are particularly sensitive to air pollution and extreme temperatures.

[3] Ontario Climate Consortium, Durham Region, and Toronto and Region Conservation Authority (TRCA), “Climate Change Impacts in Durham Region” (TRCA, n.d.), https://www.durham.ca/en/resources/ClimateChangeInfographic-DurhamRegion-FA.pdf; Durham Region, “Towards Resilience: Durham Region Climate Adaptation Plan” (Whitby, ON: Durham Region, 2016), https://www.durham.ca/en/living-here/resources/Documents/EnvironmentalStability/DCCAP_Print.pdf.

GLOBAL AND NATIONAL TARGETS

To address these challenges, targets have been set at the global, national and local levels.

The Paris Agreement

The Paris Agreement[4] and subsequent global climate efforts have established several key greenhouse gas targets for the international community:

1. Limit global temperature rise to well below 2°C, preferably 1.5°C, above pre-industrial levels
2. Reduce global greenhouse gas emissions by 43% by 2030 compared to 2019 levels
3. Achieve net-zero emissions by 2050

Canada's National Target

To meet these goals, countries have submitted their own national targets, known as Nationally Determined Contributions (NDCs). Canada's national target, as part of its NDC, is to reduce greenhouse gas emissions by 40-45% below 2005 levels by 2030 and net-zero by 2050.[5]

RELATED REGIONAL AND MUNICIPAL PLANS AND INITIATIVES

Growth Plan for the Greater Golden Horseshoe, 2020

The Growth Plan for the Greater Golden Horseshoe is a provincial plan that the City of Pickering leverages. Pickering City Centre has been identified as an "Urban Growth Centre" in the Province of Ontario's Places to Grow Plan. The Growth Plan for the Greater Golden Horseshoe requires municipalities to develop policies in their official plans to identify actions that will reduce greenhouse gas emissions and address climate change adaptation goals. Towards this end, municipalities are encouraged to develop greenhouse gas inventories, establish municipal interim and long-term greenhouse gas emission reduction targets, and identify opportunities for energy efficiency within municipally owned buildings.

---

[4] United Nations, "The Paris Agreement | UNFCCC," 2000, https://unfccc.int/process-and-meetings/the-paris-agreement.

[5] Environment and Climate Change Canada, "2030 Emissions Reduction Plan: Canada's next Steps for Clean Air and a Strong Economy" (Gatineau, QC: ECCC, 2022), https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf.

Durham Region Corporate Climate Change Action Plan, 2021

Durham Region has set a target for its facilities of achieving net-zero emissions by 2045.[6] This goal is more ambitious than the global 2050 target and demonstrates Durham's commitment to climate action. The Plan identifies five-year GHG reduction targets in alignment with the net zero trajectory for 2025 and 2030:

- 2025: 20% below 2019 levels
- 2030: 40% below 2019 levels
- 2045: 100% below 2019 levels

City of Pickering Corporate Strategic Plan, 2023

The City's Corporate Strategic Plan 2024-2028, endorsed by Council in December 2023, identifies a vision, goals, and key actions to be achieved over this term of Council and beyond. Six specific priorities of equal importance are identified to move the city forward as a connected, world class city. Priority 4 is most relevant to this discussion:

> Priority 4: Lead & Advocate for Environmental Stewardship, Innovation & Resiliency seeks to build environmental and infrastructure resilience through proactive climate change mitigation and adaptation measures. Take action and work with partners on climate change mitigation and adaptation measures.[7]

Integrated Sustainable Design Standards, 2022

In September 2022, the City of Pickering adopted new Integrated Sustainable Design Standards (ISDS) for all new development in the city, replacing the 2007 Sustainable Development Guidelines. The Integrated Sustainable Design Standards (ISDS) are intended to support Pickering's goal of reducing community greenhouse gas emissions and encourage the construction of sustainable and climate-resilient buildings and neighbourhoods.

The new standards consist of two tiers of performance criteria. Tier 1 elements are required for all new developments arising from Site Plan and Subdivision applications deemed complete on or after January 1, 2023. Tier 1 elements of the Mid- to High-Rise Residential & Non-Residential checklist also apply to new municipal buildings. The checklist measure ER2 Building Energy Performance and Emissions requires new buildings to be designed and constructed to meet or exceed Energy Performance Emissions' Total Energy Use Intensity (TEUI), Thermal Energy Demand Intensity (TEDI)

---

[6] Durham Region, "Durham Region Corporate Climate Change Action Plan" (Whitby, ON, 2021), https://www.durham.ca/en/resources/CAO-Office/Durham-Region-Corporate-Climate-Action-Plan.pdf.

[7] City of Pickering, "Corporate Strategic Plan: 2024-2028" (Pickering, ON: City of Pickering, 2023), https://www.pickering.ca/en/city-hall/resources/Corporate-Strategic-Plan-Dec12.pdf.

and GHG Emission Intensity (GHGI) targets.[8] However, those targets are geared to commercial and residential buildings and are not specific to municipal building archetypes.

The City's Official Plan, 2022

Prior to 2023, the City of Pickering Official Plan included a policy stating that all new municipal buildings and facilities should strive to achieve a minimum of LEED Silver certification or alternative equivalent.[9] In November, 2023 the City initiated Amendment 50 to the Official Plan (Official Plan Amendment Application OPA 23-005/P[10]) which establishes the ISDS or LEED Silver or alternative equivalent as the standard for municipal development.

City of Pickering Declaration of Climate Emergency, 2019

The City of Pickering declared a climate emergency in December 2019, acknowledging the urgent need for climate action.[11] While the declaration itself doesn't set specific emission reduction targets, it signals a commitment to accelerate efforts to mitigate and adapt to climate change. Pickering has been a leader in promoting sustainability and has continued to promote climate change adaptation and mitigation through the building of resilient, healthy and sustainable communities.[12]

Durham Community Energy Plan, 2019

In 2019, City of Pickering endorsed the Low Carbon Pathway scenario in the draft Durham Region Community Energy Plan in principle, which targets reducing GHG from 2007 levels of 5% by 2015, 20% by 2020 and 80% by 2050.

City of Pickering Measuring Sustainability Report, 2017

This report describes the City's journey to becoming more sustainable by collecting and tracking data on sustainability progress. In 2010, the City first published the Measuring Sustainability Report, later updated in 2012 and 2017, to set a baseline and outline indicators of sustainability in five categories, including: a healthy environment, healthy

---

[8] City of Pickering, "Pickering Integrated Sustainable Design Standards: Mid to High-Rise -- Residential & Non-Residential Checklist" (Pickering, ON: City of Pickering, September 2022), https://www.pickering.ca/en/living/resources/Appendix-II---ISDS-Checklist-Mid-to-High-Rise-ResNon-Res_ACC2.pdf.

[9] City of Pickering, Corporate Initiatives, Pickering Official Plan, Edition 9, Section 14.3e (Pickering, ON: City of Pickering, 2022)

[10] City of Pickering. By-law No. 8054/23. Being a by-law to adopt Amendment 50 to the Official Plan for the City of Pickering (OPA 23-005/P). Enacted 2023-11-23.

[11] "Council Meeting Minutes," 2019., https://corporate.pickering.ca/weblink/1/edoc/223668/December%2016,%202019.pdf.

[12] City of Pickering, "Pickering Official Plan Review" (Pickering, ON: City of Pickering, May 2024), https://www.pickering.ca/en/city-hall/officialplanreview.aspx.

economy, healthy society, responsible development, and responsible consumption. The report identified the following indicators as most relevant to quantifying energy and emissions objectives: energy consumed and GHG emitted by municipal operations per capita based on the number of residents in the community, energy consumed and GHG emitted by community per resident, GHG emissions by sector per capita, number of solar panels permits issued by the City, and daily municipal water consumption and wastewater discharged per capita. The use of per capita indicators presents challenges in a city with rapid population growth, as total GHG emissions may continue to increase in proportion with the population. The City is currently updating its Measuring Sustainability Report.

The City Centre Urban Design Guidelines, 2017

The City Centre Urban Design Guidelines is a set of guidelines that encourage the use of high-quality and energy-efficient materials and sustainable development practices to optimize energy efficiency of new private and public buildings within the City Centre. The Guidelines act as a starting point for conceptualizing the long-term growth of the City. Within the Guidelines, the City promotes sustainability to include the use of recycled, high-performance, and low impact materials that contribute to energy efficiency and on-site stormwater management. The City encourages sustainable development practices such as optimizing energy efficiency of buildings, Leadership in Energy and Environmental Design (LEED) certification or alternative equivalent for new private and public buildings, providing vehicle charging stations, and low impact development practices (i.e., the use of grey water systems).

The Seaton Sustainable Place-Making Guidelines, 2011

These guidelines are intended to provide guidance and serve as examples of the key principles and policies to be addressed by the Neighbourhood Plans and by extension to compendium design guidelines. The Seaton Sustainable Place-Making Guidelines address and expand upon these key design elements and provide a greater level of guidance than the Official Plan on urban design and sustainability performance measures and benchmarks for development within the Seaton Urban Area. The purpose of the guidelines is to provide a design vision and guidance for the Seaton Urban Area by addressing the nature, intensity, quality and level of sustainability in both the public and private realms, while still ensuring that the goals and objectives of the Central Pickering Development Plan are achieved.

SCOPE AND PURPOSE OF THE CORPORATE ENERGY MANAGEMENT PLAN

This plan has been developed for the following reasons:

- To reaffirm the Corporate commitment to efficient energy use and greenhouse gas emissions reductions
- To review progress on reducing energy use and emissions over the last five years
- To identify priorities for action in coming years
- To meet the requirements of Ontario Regulation 25/23 for Energy Reporting and Conservation and Demand Management Plans

The primary focus of the CEMP is Corporate facilities. These account for the majority of the City's energy use and emissions and are the focus of Regulation 25/23. There have also been various Council Directives issued in the past pertaining to municipal building design and construction standards. The CEMP and its Appendices will be the single document that provides direction for municipal building design and construction and will supersede past Directives pertaining to this matter.

The next most significant use of energy in the City is fleet vehicles. The CEMP will address fleet emissions reporting and reduction goals. The fleet plan to achieve these goals will be the focus of a separate initiative.

A third use of energy is for streetlighting. In 2018, all City-owned streetlights were converted to energy efficient Light Emitting Diode (LED) lamps, which reduced their energy consumption and energy cost by over 50%.

CURRENT STATE

ENERGY USE AND EMISSIONS PROFILE

Overall energy consumption by the City of Pickering in gigajoules per annum is shown on Table 1. Most consumption is for buildings, totalling approximately 78% in 2023. Overall energy consumption in buildings is roughly the same as in 2018, though electricity use is down by 7% and natural gas use is up by 10%. Energy use in buildings, and the breakdown by energy source is presented graphically in Figure 1. The impact of the shutdowns for COVID in 2020 and 2021 is particularly evident. There are also two buildings that are still using fuel oil for heating. Total use is so small that it doesn't appear on the chart, though the quantity is shown: 293 GJ in 2023, or 0.4% of total building energy use.

Table 1 Overall energy use 2018-2023 (GJ/a)

Energy type	2018	2019	2020	2021	2022	2023
Electricity, Buildings	35,060	34,101	25,482	20,465	26,423	31,680
Natural Gas, Buildings	40,814	39,290	27,431	21,509	43,072	43,812
Heating Fuel Oil, Buildings	372	352	399	434	328	293
Diesel, Fleet	N/A	N/A	15,420	15,566	16,204	15,571
Gasoline. Fleet	N/A	N/A	4,240	5,121	5,645	5,796
Total	**76,247**	**73,742**	**72,972**	**63,095**	**91,672**	**97,153**

Although overall energy use was down slightly (about 1%) in 2023 relative to 2018, 2023 was a much milder year, with 13% fewer heating degree days, and 42% fewer cooling degree days.[13]

[13] Unfortunately, only annual data are available on usage. These do not permit adjusting for weather, though weather is a major determinant of use, particularly for natural gas, which is primarily used for heating, and to some extent electricity, which is used for cooling (air conditioning).

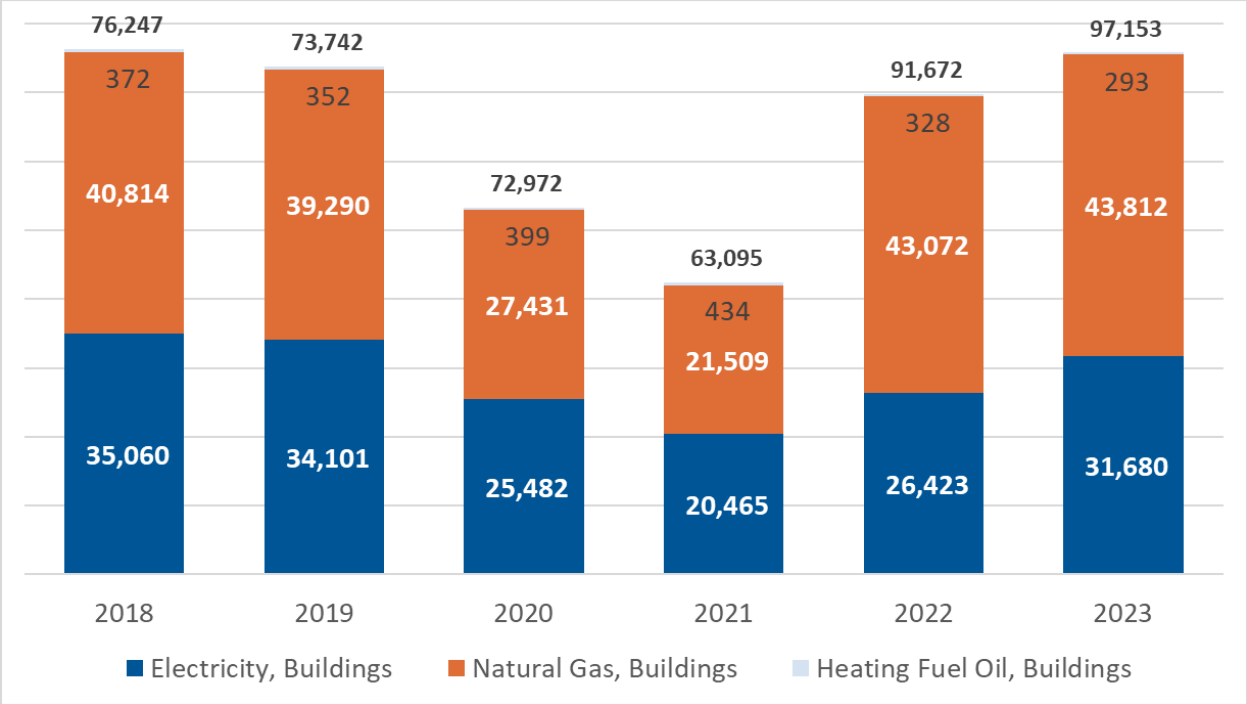


Figure 1 Total energy use in buildings by source (GJ/a)

CHANGES IN ENERGY USE OF INDIVIDUAL FACILITIES

Energy use within individual buildings was much more variable than overall energy use, as shown on Table 2. Energy use was up significantly at Don Beer Arena. Arenas with ice rinks have heavy energy demands, and usage is sensitive to the number of hours and months the arena is in use. The operation of summer ice dramatically increases an ice rink's energy consumption, particularly in an older facility with a poor thermal envelope.

Usage is also up significantly at the new Operations Centre, in correspondence with a significant increase in conditioned space over the old Operations Centre. The Dunbarton Pool and the East Shore Community Centre and Seniors Centre used less energy in 2023 than in 2018.

Table 2 shows the energy use intensity (EUI) for facilities organized by categories. EUI adjusts for the size of a building by reporting energy use per unit area, in this case per square metre of floor space. The categories are broad, and differences in usage within building types may reflect differences in the building's program or may point to where savings might be realized. For example, within the fire stations category, Fire Station #5 is using much more energy per square metre of floor area than are the other two stations, though it includes a significant building addition which hosted Information Technology staff. Fire Station #5 is slated to be replaced in the near future.

Table 2 Energy Use Intensity and changes over time

Facility type	Facility	Floor area (m2)	2018 EUI (kwh/m2/a)	2023 EUI (kWh/m2/a)	Change
Fire Station	Fire Station # 2	739	321	261	-19%
	Fire Station # 5	1,241	396	389	-2%
	Fire Station # 6	848	251	225	-10%
Ice/Curling Rink	Don Beer Arena	8,752	302	497	64%
Indoor Arena	Recreation Complex	21,379	396	334	-16%
Library	Greenwood Library	161	76	69	-9%
	Whitevale Library	84	199	171	-14%
Museum	PMV Conservation Building	555	51	218	331%
	PMV NE/Post Misc Building Use	584	8	20	153%
	PMV Puterbaugh Schoolhouse	45	150	-	-100%
	PMV Redman House	260	364	277	-24%
	PMV Robert A Miller	291	189	138	-27%
Office	Civic Complex (City Hall)	12,812	285	239	-16%
	Operations Centre	6,599	181	364	101%
	Pickering Animal Services	253	358	300	-16%
Other - Recreation	Dunbarton Pool	1,931	698	392	-44%
Social/Meeting Hall	Brougham Hall	223	302	255	-16%
	Centennial Park Club House	144	270	255	-5%
	Dr. Nelson F. Tomlinson CC & Fire Stn 4 & Library	1,689	405	328	-19%
	East Shore CC & Senior's Centre	2,672	253	173	-32%
	George Ashe Library & Community Centre	1,597	486	409	-16%
	Green River CC	298	135	145	7%
	Greenwood CC	780	203	188	-7%
	Mount Zion CC	200	241	221	-8%
	West Shore CC	697	158	160	1%
	Whitevale CC	197	165	101	-39%

Buildings with significant reductions in EUI	Buildings with significant increases in EUI
PMV Puterbaugh Schoolhouse	Don Beer Arena
PMV Redman House	PMV Conservation Building
PMV Robert A Miller	PMV NE/Post Misc Building Use
Dunbarton Pool	Operations Centre
East Shore CC & Senior's Centre	
Whitevale CC	

Programming

Programming decisions can have a tremendous impact on the building portfolio's emissions. During 2023, the extension of the ice season into late spring and the operation of summer ice at Don Beer Arena increased its annual GHG emissions by over 50%. In 2024, Don Beer Arena was closed for the summer, and summer ice was offered instead at CHDRC's O'Brien ice pad. Though the energy and GHG impact of summer ice operations on CHDRC remain to be seen, there are significant benefits to operating summer ice there rather than at Don Beer Arena. CHDRC is still 20 years from the end of its life, enabling investments into alternatives to gas-fired equipment whose asset value will still be fully realized. Further, CHDRC benefits from co-location of the arena (heat rejecter) and the pool (heat consumer), enabling heat recovery methods to reduce the need for gas combustion. An emissions budget should be considered as part of the programming decision process.

CHANGES IN OVERALL EMISSIONS

Table 3 shows overall emissions of greenhouse gases generated by the Corporation. Fossil fuel use generates three primary greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Methane and nitrous oxide contribute much more to climate change on a unit basis (e.g., per gram emitted). For presentation, quantities of methane and nitrous oxide may be multiplied by an adjustment factor (Global Warming Potential) to give carbon dioxide equivalents (CO_2eq).

Table 3 Total corporate emissions (tonnes CO_2eq)

Energy type	2018	2019	2020	2021	2022	2023
Electricity, Buildings	292	275	234	205	279	590
Natural Gas, Buildings	2,026	1,951	1,362	1,068	2,138	2,175
Heating Fuel Oil, Buildings	28	26	30	33	25	22
Diesel, Fleet	1,100	1,100	1,081	1,091	1,136	1,092
Gasoline. Fleet	350	350	293	354	391	401
Total	**3,797**	**3,702**	**3,000**	**2,751**	**3,969**	**4,280**

Note: Diesel and gasoline in 2018 and 2019 are estimated

Most of the City's emissions (65%) are associated with energy use in buildings. Figure 2 shows the changes in emissions from City buildings by fuel source from 2018 to 2023. Total emissions are up by 19% since 2018, even though overall energy use was down by about 1%. This is the result of two factors: the increased onsite consumption of natural gas, and an increase in the Ontario electricity grid's emissions factor.

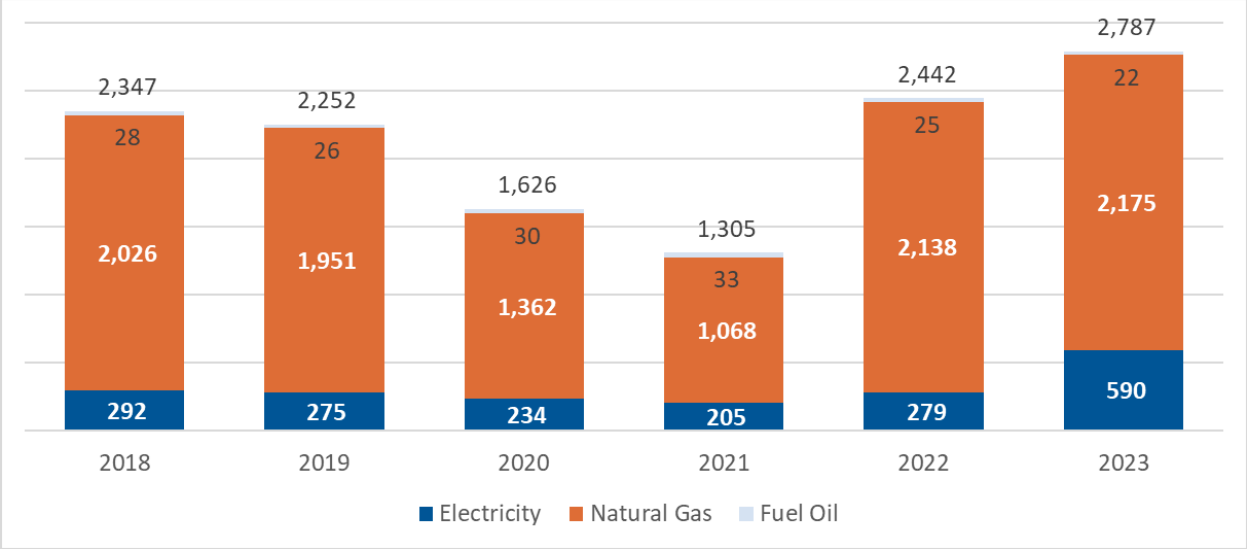


Figure 2 Emission of greenhouse gases from buildings 2018-2023 (tonnes CO_2eq)

Although total electricity consumption in 2023 was 10% lower than in 2018, greenhouse gas emissions from electricity generation are almost double what they were in 2018. This is determined by the greenhouse gas emissions factor for Ontario grid electricity.

A large portion of Ontario's electricity is produced from low- or zero-carbon sources such as nuclear, hydro, wind and solar. Natural gas-fired electricity generators are used for trim and peak demand periods to respond quickly to short-term changes in demand. Increasing overall demand for electricity and the temporary removal of some nuclear-

powered generation from service for refurbishment is projected to increase the proportion of gas-fired generation for baseload power, thus increasing emissions. Drawing on data from the Independent Electricity System Operator, The Atmospheric Fund estimates that the grid emissions factor will increase significantly over the coming years. The annual average emissions factor for electricity in Ontario varied from 18 g/kWh in 2017 to 67 g/kWh in 2023.[14] The average emissions factor for electricity is projected to increase to as high as 145 g/kWh over the next 5 years before eventually declining to near-zero. A comparison of historical and projected emission factors by energy source, before accounting for equipment efficiency at point of use, is illustrated in Figure 3. [15,16]

Despite a near-term increase in grid emissions factor, electricity generation remains a much lower source of emissions than fossil fuel combustion. Further, in thermal (heating and cooling applications), the high efficiency of heat pumps over combustion technology favours fuel switching from natural gas to electricity. This is further discussed in Appendix 4: Carbon Reduction Plan – *Fuel Switching and Electrification.*

Though most electricity used by the City is purchased from the Ontario grid, an increasing component will be produced by the City's solar photovoltaic (PV) systems, which do not release carbon.[17]

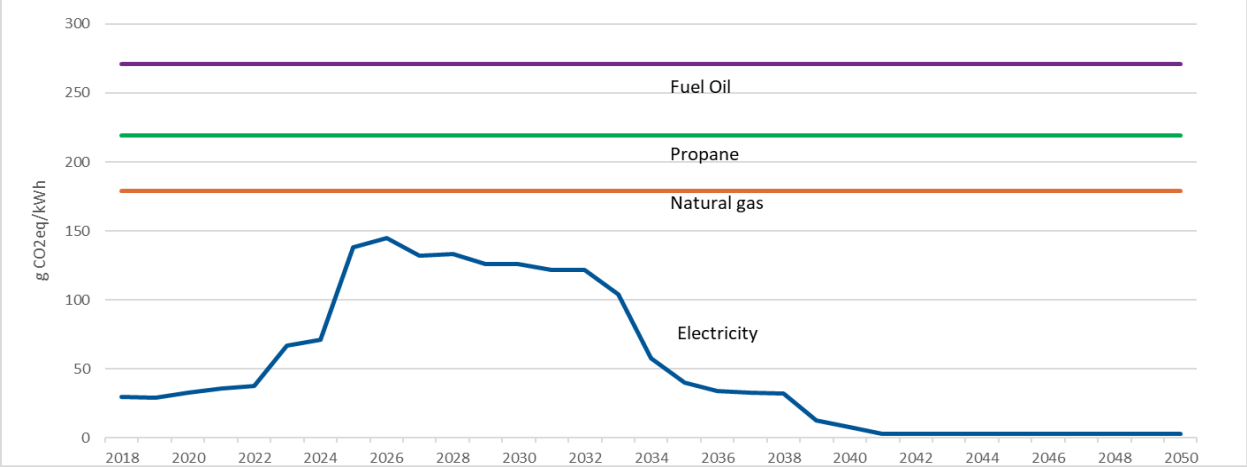


Figure 3 GHG emission factors by input fuel type (grams CO_2eq per kWh)

[14] The Atmospheric Fund (TAF), "Ontario Electricity Emissions Factors and Guidelines." (Toronto: TAF, June 2024), https://taf.ca/custom/uploads/2024/06/TAF-Ontario-Emissions-Factors-2024.pdf.

[15] Environment and Climate Change Canada, "National Inventory Report, 1990–2022: Greenhouse Gas Sources and Sinks in Canada" (Gatineau, QC, 2024), https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html.

[16] The Atmospheric Fund (TAF), "Ontario Electricity Emissions Factors and Guidelines"

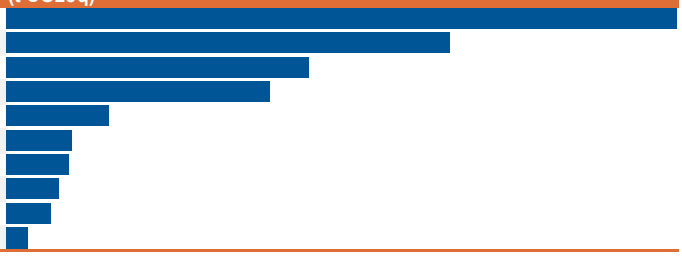
[17] There may be carbon emissions associated with the manufacturing of the panels, but those emissions are considered Scope 3 emissions. Scope 3 emissions, whether associated with electric equipment, upstream oil and gas, or embedded in materials and equipment, will be further considered in the future.

EMISSIONS OF INDIVIDUAL FACILITIES

Table 4 shows the facilities with the highest greenhouse gas emissions in 2023. These same facilities, in the same order, are the facilities with the highest energy use and should be prioritized for conservation measures.

Table 4 Facilities with the highest greenhouse gas emissions in 2023 (tonnes CO_2eq)

	2023 (t CO2eq)
Recreation Complex	881
Don Beer Arena	583
Civic Complex (City Hall)	398
Operations Centre	346
Dunbarton Pool	135
George Ashe Library & Community Centre	86
Dr. Nelson F. Tomlinson CC & Fire Stn 4 & Library	83
Fire Station # 5	68
East Shore CC & Senior's Centre	59
Fire Station # 2	27



Since building emissions are primarily due to onsite fossil fuel combustion, conservation efforts should focus on measures which reduce natural gas use, first through reduction in demand (e.g. exhaust air heat recovery, process heat recovery, envelope thermal performance), followed by fuel switching to lower emitting alternatives (electric heat pumps).

INITIATIVES IMPLEMENTED

Table 5 Energy Conservation Measures Implemented Over Previous CEMP Period (2019-2023)

Facility	Action	Year	Estimated Cost	Energy savings (GJ/year)
CHD Recreation Complex	Replaced mid-efficiency space heating and Domestic Hot Water boilers with high-efficiency modulating condensing boilers	2019	$ 280,000	3,082.30
George Ashe Library & Community Centre	Replaced single-speed gas-fired rooftop heating/AC unit with modulating variable-speed unit	2021	$ 150,000	120.80
CHD Recreation Complex	Tennis court lighting upgraded to LED	2021	$ 185,000	138.00
East Shore Community Centre	Upgraded gymnasium lighting from probe-start metal halide to LED	2022	$ 14,400	7.00
Civic Complex	Replaced mid-efficiency space heating boilers with high-efficiency modulating condensing boilers	2023	$ 400,000	3,406.80
George Ashe Library & Community Centre	Replaced mid-efficiency space heating boiler with high-efficiency modulating condensing boiler	2019	$ 45,000	40.30
George Ashe Library & Community Centre	Upgraded library lighting from fluorescent to LED	2019	$ 73,760	6.50
Bay Ridges Kinsmen Park	Upgraded SE and SW baseball field lighting from metal halide to LED with remote lighting control system	2022	$ 575,000	7.90
Dunmore Tennis Court	Upgraded exterior tennis court lighting poles from metal halide to LED	2023	$ 78,950	6.40

CURRENT AND PROPOSED MEASURES

Table 6 Energy Conservation Measures Planned During the Current CEMP Period (2024-2028)

Facility	Action	Year	Estimated Cost	Energy savings (GJ/year)
Fire Hall #2	Replace gas furnace/AC system with hybrid heat pump/gas furnace	2025	$ 20,000	409.60
East Shore Community Centre	Replace two gas-fired rooftop units with hybrid heat pump/gas units	2025	$ 280,000	241.60
George Ashe Library & Community Centre	Replace two gas-fired rooftop units with hybrid heat pump/gas units with air side heat recovery	2025	$ 430,000	568.60
PMV Conservation Building	Install 48 kWAC rooftop solar array and battery energy storage system (BESS)	2026	$ 254,000	262.10
PMV Puterbaugh Schoolhouse	Replace oil-fired boiler with air-to-water heat pump	2026	$ 50,000	55.20

STAKEHOLDER ENGAGEMENT WORKSHOP

The City engaged key stakeholders to obtain feedback on their respective departmental environmental stewardship goals and plans. Each stakeholder involved represents a diverse area of operations. Surveys were conducted and feedback obtained to gather key insights. The purpose of the surveys was to document departmental goals, opportunities and risks that pertain to environmental stewardship, energy and emissions. This documentation further strengthens the collaborative effort for improved environmental stewardship at the City.

The Operations Department, within which responsibility for Energy Management resides, will continue to consult regularly with key stakeholders to plan and implement opportunities for reduced energy use and emissions. This reinforces the City’s priority to lead environmental innovation and resilience as a world class city.

CHALLENGES AND OPPORTUNITIES

A GROWING POPULATION

The City of Pickering faces the challenge of a growing population, which increases energy demand and emissions. The City's population is expected to increase by about 20% in the next five years and will more than double by 2051.[18] As the city expands, more facilities and infrastructure are required, leading to higher energy use. This growth can counteract the benefits of energy efficiency measures, making it difficult to achieve overall reductions in energy use and emissions. It underscores the need for new and replacement facilities to be energy efficient and to be near-zero CO_2 emissions.

ATTACHMENT TO THE STATUS QUO

A significant barrier to emissions reduction is the attachment to the status quo. Council, staff and residents may be resistant to changes in their environment, whether it involves new technologies, altered workflows, or changes in public spaces. This resistance can stem from a comfort with existing routines, a lack of understanding of the benefits of new measures, a fear of the unknown, or pressures of other pressing commitments. Overcoming this challenge requires effective communication, education, and engagement strategies to help staff and residents understand the importance of energy efficiency and emissions reductions, and to further foster a culture of sustainability within the city.

EXHAUSTION OF LOW-HANGING FRUITS

The City has already implemented many of the most straightforward and cost-effective energy-saving measures, such as upgrading to LED lighting. Further, these measures most often result in electricity savings, which have the lowest emissions impact. As these "low-hanging fruits" are exhausted, the remaining opportunities for energy and emissions reduction often involve more complex, costly, or disruptive actions. This includes comprehensive retrofits, adoption of advanced technologies, or significant

[18] Watson & Associates Economists Ltd., "Durham Region Growth Management Study - Phase 2: Area Municipal Growth Allocations and Land Needs, 2051," 2022, https://www.durham.ca/en/doing-business/resources/Documents/PlanningandDevelopment/Envision-Durham/Growth-Allocations-Report.pdf.

changes to operational processes. The diminishing returns on investment for these more challenging measures can make it difficult for the City to justify the expense and effort, particularly if the financial payback period is long or the building's remaining life is short.

AGED BUILDING STOCK

Aged building stock presents a unique challenge for the City. Many of the City's buildings are nearing the end of their useful life[19], making deep retrofits potentially inappropriate or economically unfeasible. These older buildings may have outdated infrastructure that is not compatible with modern energy-efficient technologies, or they may require extensive renovations that are not cost-effective given their remaining lifespan or that would require extended closure of the facility. In such cases, the City must weigh the benefits of retrofitting against the potential costs and disruptions and may need to consider alternative solutions such as new construction or temporary measures to improve energy efficiency in the short term.

EMERGING TECHNOLOGIES

On the opportunity side, there are new technologies for both buildings and equipment that can significantly reduce energy use and greenhouse gas emissions. These include:

- More energy efficient building design
- Heat pumps to maintain thermal comfort
- Solar photovoltaic systems to generate electricity
- Electric vehicles
- Alternative or renewable vehicle fuels

The City will be adopting these technologies in coming years. The rate at which they can be adopted depends in part on the maturity and availability of the technology, turnover rate of existing stock and the availability of financial resources.

[19] City of Pickering Facilities Renewal Study, January, 2024.

TARGETS AND GOALS

The City has adopted targets based on the international and national targets for greenhouse gas emissions, and the previously-described commitments the City has already made:

- The City's Declaration of a Climate Emergency
- The Corporate Strategic Plan
- The City's work on Integrated Sustainable Development Standards
- The City's Official Plan

2030 TARGETS

A reduction of greenhouse gas emissions of 30% by 2030 is recommended. Unfortunately, with the increasing Ontario electricity grid emissions factor, this may not be practical. Consequently, the CEMP is not setting a general emissions target, but rather fuel-specific targets. The targets relative to 2019 that have been set are as follows:

Figure 4 2030 targets (relative to 2019)

With the goal of electrification, much of the reduction in natural gas that is targeted will result in an increase in the demand for electricity, so the target is to limit the increase rather than to realize a reduction. With the achievement of that target, solar generation will strive to displace 10% of the City's grid electricity use.

City of Pickering's 2050 target

By 2050, in keeping with its environmental commitments, the City should aim to reduce all fossil fuel use by 95%. However, the current trajectory will not show reductions to that degree. Achieving such a target will require some combination of:

- New technology, such as higher-capacity and affordable heat pumps, implementation of district thermal energy using waste process heat from nearby industry, or less expensive, lighter and modular solar photovoltaic systems

- Battery and thermal energy storage
- Further development of net-zero building technologies
- Accelerated deep retrofits or replacement of facilities, or replacing less efficient equipment
- Greater availability and affordability of electric vehicles for light-duty applications, and renewable diesel for medium-duty applications
- Disposal of energy-inefficient buildings at end of life

Reducing emissions by that much will also require that grid electricity become significantly cleaner beyond 2030, as currently projected.

Although there are reasons to be optimistic about these being realized, meeting these goals will still likely require increased commitment of City resources.

FINANCIAL CONSIDERATIONS

FUNDING SOURCES

Within a municipality, it is common for maintenance and capital improvements to compete with other budget priorities, including energy projects. In many cases, the measures are aligned but require early and on-going engagement to determine how best to integrate. Close collaboration with all City departments will need to continue to integrate capital projects with carbon reduction, if reductions are to be achieved.

There may be external funding programs to help with implementation of these projects. City staff will continue to explore available programs, including:

- Enbridge – Savings by Design: https://www.enbridgegas.com/ontario/business-industrial/incentives-conservation/programs-and-incentives/new-construction/savings-by-design
- IESO – Save On Energy: https://saveonenergy.ca
- FCM – Federation of Canadian Municipalities grants and loans: https://fcm.ca/en/funding
- Transport Canada – Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles: https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-medium-heavy-duty-zero-emission-vehicles
- Ontario Trillium Foundation – Capital Grants: https://otf.ca/our-grants/community-investments-grants/capital-grant

Examples of aligning external funding programs to environmental stewardship projects include the Federal Government's investment of $16.5 million towards the new net-zero

Pickering Heritage Community Centre and $516,560 towards the Redman House Program Centre Green Retrofit project[20].

PROJECT EVALUATION

Collaboration will continue with City departments to review upcoming projects and associated carbon reduction possibilities. A formalized Governance Framework should be implemented to streamline the project evaluation and funding process, prior to submission for budget consideration

STRATEGIES AND ACTIONS

Proposed actions in the 2025 to 2030 timeframe fall into five primary groups, which are titled as separate appendices to enable further independent refinement. The framework for each Appendix is provided.

- Appendix 1: Analytics
- Appendix 2: Carbon Tracking and Accounting
- Appendix 3: Corporate Building Standard
- Appendix 4: Carbon Reduction Plan
- Appendix 5: Fleet Decarbonization

[20] City of Pickering, “New green community infrastructure coming to Pickering” (Pickering, ON: City of Pickering, 2022), https://www.canada.ca/en/housing-infrastructure-communities/news/2022/08/new-green-community-infrastructure-coming-to-pickering.html

APPENDIX 1: ANALYTICS

Achieving reductions will require that data on energy use and equipment maintenance be assembled, analyzed and reported to a greater degree than is currently available.

At present, information on energy use is extracted from utility bills by the Finance department and provided to the Operations department for reporting to the Ministry of Energy and Electrification (MEE). MEE requires that data on energy use by source, type and facility be uploaded to Portfolio Manager, an online database developed by the United States Environmental Protection Agency and adapted for Canadian conditions and use by Natural Resources Canada.

Historically, MEE required only reporting of annual data, though Portfolio Manager can accommodate entering data according to the billing frequency (e.g. monthly or bi-monthly). For more rigorous analysis, including correcting data for weather conditions, a higher resolution of data is required. In the case of electricity, hourly usage data by facility are available on-line from Elexicon. Monthly gas bills, with usage data, are available on-line from Enbridge. Operational staff will be given access to these accounts so that usage data can be downloaded and analyzed. This higher-resolution data will enable better understanding of patterns of energy use, the relationship to weather, and to help identify changes over time. Historically, there have been challenges in compiling such data while still meeting the needs of the Finance department for paper bills, for example. It may become necessary to engage a third-party who can access these data directly and provide some analysis of them.

In some cases, even higher resolution will be required. For example, it may be desirable to sub-meter particular parts of facilities or specific pieces of equipment. Needs will be determined on a case-by-case basis.

Tools such as dashboards or reporting would then be developed and utilized to analyze the higher resolution data. This can streamline the monitoring and controlling of a building's performance by alerting City staff when performance has deviated from its intended targets. City staff can then implement appropriate corrective action to remedy the deviation, such as education/awareness, training/refreshers, recommissioning, maintenance, and so forth. To have a comprehensive view, the reporting tools should also consider historical utility rates and future trends, including the impact of the Federal Carbon Pricing. The reporting tools can also show how actual energy consumption and GHG emission compares against planned targets, progress of planned and completed carbon reduction measures, and performance of carbon reduction measures.

Information on equipment maintenance and health is currently recorded manually. Maintenance and lower value equipment replacement expenditures are addressed by Facilities Maintenance directly from operating budgets, while capital projects are handled by Facilities Capital Projects. This can result in discontinuity, with Facilities Maintenance investing in expedient solutions to maintain availability of services, and Facilities Capital Projects' desire to integrate equipment performance improvements or design upgrades into asset replacement plans. A Computerized Maintenance Management System (CMMS) is recommended to assist both the maintenance team with tracking assigned and completed tasks in a timely and cost-effective manner, and the Facilities Capital Projects team with monitoring asset health and making informed decisions about asset replacement.

These roadmaps and details will be further developed in future refinements of Appendix 1.

Overall usage, and progress toward the goals set out in this plan will be reported to Council on an annual basis.

APPENDIX 2: CARBON TRACKING

To help ensure targets are met, the City will implement carbon tracking. Key implementation steps include:

- Establishing annual carbon emissions targets
- Integrating those limits into existing decision-making processes, including asset management plans[21]
- Assessing the climate impact of proposed initiatives
- Tracking and reporting, along with the reporting on energy usage

Carbon tracking is used by a growing number of cities. Oslo was the first city to adopt carbon tracking in 2017. The first Canadian city to adopt carbon tracking was Edmonton. The method is used or being developed in Montreal, Toronto, Whitby, Durham Region, Calgary, Canmore and Halifax.[22]

Carbon tracking for municipalities is an emerging tool to monitor and reduce greenhouse gas (GHG) emissions. Specific details will be further developed, but the following presents a typical framework:[23], [24]

Figure 5 Steps in the implementation of municipal carbon tracking

[21] Federation of Canadian Municipalities, "Building Sustainable and Resilient Communities with Asset Management: An Introduction for Municipal Leaders" (Ottawa, ON: FCM, 2018), https://fcm.ca/sites/default/files/documents/resources/case-studies/building-sustainable-resilient-communities-with-asset-management-mamp.pdf.

[22] Yuill Herbert, Ann Dale, and Chris Stashok, "Canadian Cities: Climate Change Action and Plans," *Buildings and Cities* 3, no. 1 (2022): 854–73, https:// doi.org/10.5334/bc.251.

[23] James Nowlan, "Carbon Accountability: Institutionalizing Governance, a Carbon Budget and an Offset Credits Policy" (Toronto: City of Toronto, 2023),Sall.

[24] City of Edmonton, "2023-2026 Carbon Budget," Council Report (Edmonton: City of Edmonton, 2022).

1. Setting targets:

The municipality establishes a total carbon allocation based on its long-term emission reduction goals. This allocation represents the maximum amount of GHG emissions allowed over a specific period, usually aligned with the City's climate goals (e.g., net-zero by 2040 or 2050).

2. Allocation and planning:

The total allocation is divided into smaller annual or multi-year emission limits. These act as checkpoints to ensure the municipality stays on track to meet its overall targets.

3. Integration with budgeting processes:

The carbon target is integrated into the municipality's existing budgeting and decision-making processes. This allows climate impacts to be considered alongside other factors like economic and social considerations when making investment decisions.

4. Project assessment:

All proposed projects, programs, and initiatives undergo a GHG impact assessment. This can be done through:

- Qualitative assessments for projects in early planning stages
- Detailed quantification of GHG emissions where possible
- Use of standardized tools like GHG calculators for typical municipal projects[25]

5. Prioritization and decision-making:

The carbon impacts of various proposals are used to inform budget allocation decisions, helping prioritize low-carbon initiatives.

6. Monitoring and reporting:

The municipality tracks actual emissions against the carbon target, typically on an annual basis. This involves:

- Maintaining a GHG inventory
- Comparing actual emissions to the target
- Identifying surpluses or deficits

[25] Town of Canmore, “Climate Emergency Action Plan: Carbon Budget Report” (Canmore, AB: Town of Canmore, 2024), https://www.canmore.ca/public/download/files/247349.

7. Accountability and adjustment:

Regular reporting keeps Council and the public informed of progress. If emissions are projected to exceed the target, it triggers the need for remedial actions or adjustments to stay on track.

8. Continuous improvement:

As carbon tracking is a new field, municipalities refine their processes over time, improving data collection, quantification methods, and integration with existing systems.

By implementing carbon tracking, municipalities can:

- Create a structured approach to achieving climate targets
- Enhance transparency and accountability in climate action
- Integrate climate considerations into municipal decisions
- Provide a clear framework for monitoring and reporting progress

APPENDIX 3: CORPORATE BUILDING STANDARD

In 2013, the City of Pickering Council approved and adopted a Canada Green Building Council Leadership in Energy and Environmental Design Silver (CaGBC LEED-NC Silver) standard, or equivalent performance, for all new construction of City buildings.

While the LEED Silver standard has been successful in addressing a range of environmental performance areas, it now lags the more ambitious targets that many cities and provinces have set, particularly with respect to energy and emissions. Experience has shown that the relative performance path (i.e. “x% better than Code”) identified in the CaGBC LEED Optimize Energy Performance credit often does not result in better performing buildings. An absolute performance compliance path is preferred. The City will develop performance criteria for municipal buildings.

The City has been a leader in developing its Integrated Sustainable Design Standards for new developments.[26] These set out a broad range of standards for sustainable development addressing energy, land use and nature, water, waste, transportation, education, accessibility and safety, primarily targeting private developments.

Targeted performance levels for energy use, thermal energy use and greenhouse gas emissions are included in two tiers, as summarized in Table 7. Energy Use Intensity (EUI) is the total amount of energy used by a facility, converted to equivalent units (kWh or GJ), divided by the facility’s area. The result is typically expressed in kWh/m^2 or GJ/m^2.

Although overall energy use is important, a key consideration is the proportion of fossil fuel consumed, which largely determines a facility’s greenhouse gas intensity (GHGI), expressed in grams, kilograms or tonnes of carbon dioxide equivalent per unit area (CO_2eq/m^2).

Much of the energy use in buildings is for heating and cooling requirements. The subcomponent of total energy use for heating and cooling is the thermal energy demand intensity (TEDI). EUI, TEDI and GHGI are often used to compare building performance

[26] City of Pickering, “Building Green - User Guide. Pickering Integrated Sustainable Design Standards” (Pickering, ON: City of Pickering, August 2022), https://www.pickering.ca/en/living/resources/Attachment-1---ISDS-User-Guide_revisedversion-LD-Formatting_ACC.pdf.

against their peers within building categories. As the table indicates, these standards apply to residential and commercial new developments but direct applicability to existing and new building stock is difficult due to differences in building use.

Table 7 City of Pickering's Integrated Sustainable Design Standards for energy (kWh/m^2/a) and greenhouse gas emissions (kg CO_2eq/m^2/a)

	Tier 1 EUI	Tier 2 EUI	Tier 1 TEDI	Tier 2 TEDI	Tier 1 GHGI	Tier 2 GHGI
Multi-unit Residential >= 4 storeys	135	100	50	30	15	10
Multi-unit Residential < 4 storeys	130	100	40	25	15	10
Commercial Office	130	100	30	22	15	8
Commercial Retail	120	90	40	25	10	5
Mixed Use Buildings	Calculated using an area weighted average of other building types					

Few municipalities have developed such criteria. One exception is the City of Mississauga which developed the criteria set out in Table 8.[27]

Other jurisdictions such as the City of Toronto have introduced absolute performance targets. However, only a very small range of building archetypes has been defined, and those archetypes do not correspond with typical municipal building types. The City of Mississauga's Corporate Green Building Standard–introduced in 2019 includes ambitious, tiered, absolute performance targets for municipal building types, including fire halls, arenas, swimming pools, and libraries. Although mechanical systems technology has progressed significantly since those Corporate Green Building Standard targets were developed, they serve as a useful starting point to inform the development of the City of Pickering Corporate Building Standard for current and future city facilities.

Table 8 Mississauga's Corporate Design Standards

Building Archetype	Level 1			Level 2			Level 3		
	EUI	TEDI	GHGI	EUI	TEDI	GHGI	EUI	TEDI	GHGI
Office building	110	55	15	90	35	10	60	15	5
Fire Hall	195	75	11	80	60	5	60	30	5
Library	140	50	15	110	40	10	60	25	5
Rec Centre	160	45	20	140	35	15	70	15	5
Transit Station	230	100	25	180	50	15	150	15	10
Transit Repair Station	300	120	38	280	100	15	130	20	10
Ice Rink	380		46	335		38	200		17
Swimming Pool	3700		560	2700		3500	1800		90

Note:
EUI in kWh/m2/a
TEDI in kWh/m2/a
GHGI in kg CO2eq/m2/a

Although less comprehensive than the Mississauga table, some governments have set standards for the greenhouse gas intensity (GHGI), essentially requiring buildings to be

[27] City of Mississauga, "The City of Mississauga's Corporate Green Building Standard: Program Manual" (Mississauga, ON: City of Mississauga, 2019), https://www.mississauga.ca/publication/corporate-green-building-standard/.

net zero. For example, Toronto requires all new buildings and additions greater than one hundred square metres that are part of the Corporate Real Estate portfolio to be net zero emissions.[28] Toronto has also set a total EUI of 100 kWh/m^2/a and a TEDI of 30 kWh/m^2/a. It is not clear how this can or will be applied to more intensive building types, like swimming pools or ice rinks, though there is work on net zero pools,[29] and arenas with ice pads.[30]

To monitor and control building performance, energy management processes will be included through the iterative design process. Energy modelling conducted throughout the design process informs the building design and the feasibility/viability of energy management measures over a life cycle basis, considering both costing capital requirements and operating requirements. Energy modeling reports, construction cost estimates, life cycle cost analysis, and life cycle analysis throughout the design and construction phases are tools that can be employed to manage building performance throughout the project delivery phases.

Complicating Factors for Energy Use Intensity and emissions intensity metrics

These metrics must be considered within their context. Facilities may vary significantly in their operating hours or their seasonal usage. For example, arenas operating 12 months per year will clearly consume much more energy than arenas which are closed during the summer. Standalone facilities will consume more energy than co-located facilities. For example, swimming pools require a large amount of heat energy, whereas arenas must dispose of a large amount of heat energy. When co-located, these two end-uses can significantly reduce their overall EUI. Also, multi-use facilities will have less exposed envelope area (due to shared walls and gross-up space), which will significantly lower energy use for space conditioning.

Given the above, the application of a weighted average of end-use EUI and GHGI budgets to a mixed-use facility may result in an overall excessive energy and carbon limit, while standalone facilities may find it arduous to meet the prescriptive targets. As stated, there can be significant variations in occupancy hours or facility utilizations.

---

[28] https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/city-agency-corporation-division-owned-facilities-version-4/buildings-energy-emissions-resilience/

[29] Federation of Canadian Municipalities, “Getting to Net-Zero in Community Centres with Indoor Pools: Chinguacousy Wellness Centre in Brampton, Ontario” (Ottawa: FCM, 2024), https://media.fcm.ca/documents/programs/gmf/getting-to-net-zero-in-community-centres-with-indoor-pools.pdf.

[30] Federation of Canadian Municipalities, “Taking Your Indoor Ice Rink to Net Zero” (Ottawa: FCM, 2022), https://media.fcm.ca/documents/programs/gmf/getting-to-net-zero-in-community-centres-with-indoor-pools.pdf.

Since the City defines how its buildings are used, it would be appropriate to develop consistent assumptions to be used by design consultants to inform the modelling process to determine new building energy and emissions performance.

The Corporate Building Standard is intended to become the City's standard for corporate facilities, particularly for energy and emissions performance.

Table 9 New construction EUI/GHGI limit by building archetype (SI units)

	Level 1		Level 2		Level 3	
Building Archetype	**EUI (kWh/m2)**	**GHGI (kg CO2e/m2)**	**EUI (kWh/m2)**	**GHGI (kg CO2e/m2)**	**EUI (kWh/m2)**	**GHGI (kg CO2e/m2)**
Office	110	15	90	10	60	5
Firehall	105	11	80	5	60	5
Library	140	15	110	10	60	5
Rec Centre	160	20	140	15	70	5
Transit Station	230	25	180	15	150	10
Transit Repair Station	300	38	280	35	130	10
Ice Rink	380	46	335	38	200	17
Swimming Pool	3700	560	2700	350	1800	90

Table 10 New construction EUI/GHGI limit by building archetype, (I-P units)

	Level 1		Level 2		Level 3	
Building Archetype	**EUI (kWh/ft2)**	**GHGI (kg CO2e/ft2)**	**EUI (kWh/ft2)**	**GHGI (kg CO2e/ft2)**	**EUI (kWh/ft2)**	**GHGI (kg CO2e/ft2)**
Office	10	1	8	1	6	0
Firehall	10	1	7	0	6	0
Library	13	1	10	1	6	0
Rec Centre	15	2	13	1	7	0
Transit Station	21	2	17	1	14	1
Transit Repair Station	28	4	26	3	12	1
Ice Rink	35	4	31	4	19	2
Swimming Pool	344	52	251	33	167	8

The interim targets in Table 9 and Table 10 were generated over 5 years ago. Given advancements in building and systems design as well as the City's leadership role, new municipal buildings should target Level 2 performance as a minimum. The GHGI allowance is relatively high to allow for increases in grid emissions factor, not for gas-fired equipment. Design teams should target all-electric designs.

To assist with achieving absolute performance targets, design teams should strive to achieve the following key design principles:

1. **Ensure specific spatial programming and psychological needs of building occupants and visitors are addressed.** This means ensuring that buildings achieve higher levels of environmental performance while maintaining user comfort as well as the core function, aesthetic, and health of the building or facility.
2. **Design building systems, materials, and technologies to be mutually supportive.** This represents the need to ensure that design and cost efficiencies are harnessed wherever possible. An example is the colocation of swimming pool

and ice arena facilities. Waste heat from one process should be harvested and reused for as many other processes as possible (desiccant dehumidification recharging, refrigerant dehumidification reheat, pool heating, DHW pre-heating, arena spectator warming, arena resurfacing slush pit, exterior snow melt) before being rejected outside the thermal envelope. For this to be effective, equipment must be in proximity to each other to improve the business case for heat recovery.

3. **Meet environmental performance targets in a financially sustainable manner.** While cost premiums can be a factor in higher environmental performance buildings, design teams should seek to minimize added costs wherever possible by taking an integrated approach to design. Regardless, a 'business-as-usual' design should no longer be an option against which low carbon design is compared for costing.
4. **Make use of "simple" systems that are designed for long operational life and lower maintenance costs.** This means design teams should focus on well-known technologies, low carbon footprint materials, and passive design strategies as much as possible to reduce the need for expensive maintenance and challenges to daily operations. Enduring passive components such as building envelope which are not feasible to upgrade later should be prioritized. Building envelope components' effective thermal performance should meet or exceed the prescriptive requirements for fenestration, roofs, opaque wall, floor and roof assemblies of the most current version of the National Energy Code of Canada for Buildings. Active mechanical and electrical systems should not be used to offset poor envelope thermal performance or inefficient building form factor.

   Design the building to achieve an efficient form factor of 3 or less. 'Heat Loss Form Factor' is measured as the ratio of thermal envelope surface area to the treated floor area (TFA). In other words, the ratio of surface area that can lose heat (the thermal envelope) to the floor area that gets heated (TFA). Form Factor is essentially the building's surface to volume ratio.

   The Heat Loss Form Factor is a useful measure of the compactness of a building. It is easier to be energy efficient with a more compact building whereas the less compact a building, requires more insulation for the building to be energy efficient.

Resiliency Planning

Climate change mitigation and adaptation, sustainability and resilience will also be key considerations in future Corporate Building Standards. Resiliency includes factors such as future weather patterns, climate change, pandemic responses, electrical back up power, and distributed energy resources. Electrical back up power can consider redundant backup electricity generators sized together to maintain full facility operation, including load management, soft-start and equipment staging systems if necessary to reduce generator sizes.

Energy modeling in the design process can assist with resiliency planning through hourly simulation generated by industry-accepted simulation programs such as Carrier HAP, eQuest, EnergyPlus, DesignBuilder or IESVE, using the Toronto-Buttonville 716390 CWEC 2020 weather file as a baseline. Since municipal buildings are long-life assets, energy simulations, analysis and reporting should include results from corresponding Pacific Climate Impacts Consortium future-shifted 2050s and 2080s weather files. Hourly simulation should be complemented by RETScreen, bin- or hourly-data hand calculations, PVWatts, and Ground Loop Design, LoopLink Pro or equivalent as required. Life-cycle costing should include analysis for sizing heating and cooling energy distribution systems for this future-shifted weather and provision of space and infrastructure for future addition of plant equipment if necessary.

APPENDIX 4: CARBON REDUCTION PLAN

Achieving targets or meeting the design standards comes down to specific technological and operational implementation. The City is planning initiatives in four main areas:

- Efficiency measures that reduce current energy use
- Fuel Switching – primarily the adoption of electric heat pumps
- Implementation of renewable energy technologies
- Development of new facilities and major retrofits

These areas overlap and are considered distinct solely for discussion purposes. Within this discussion, efficiency measures and electrification apply primarily to existing facilities, though they will be incorporated into new facilities as well. Renewable technologies, in particular photovoltaic systems, may be integrated into existing or new buildings, or operate on a stand-alone basis. On-site energy storage may be required where options are limited by the condition of local grid infrastructure.

Efficiency measures

Many efficiency measures have already been adopted by the City, including replacing older incandescent and fluorescent lights with LEDs, and installing motion detectors to reduce energy use in unoccupied rooms.

Measures that are planned to be adopted include the following, particularly when equipment is at the end of life, the facility is considering a major renovation, or in new construction.

Rooftop HVAC Units and Small Furnace/ACs

- Install air-to-air energy recovery ventilators
- Replace gas-fired rooftop units with hybrid heat pump units
- Where possible, purchase semi-custom units with higher insulation levels rather than packaged units

Air and Ground Source Heat Pumps

Air-source and ground-source heat pump options or a hybrid solution should be evaluated. This includes modelling using hourly ground loop and energy modelling software as appropriate. Onsite fuel combustion should only be considered for heating backup (during heat pump equipment failure, extreme cold weather, or grid power outages) and for backup electrical power generators.

Boilers for Hydronic Heating Loops

- Where boilers must be used, install modulating condensing boilers which can operate at lower water temperatures
- Reduce supply water temperatures to 55 C (130 F) or lower wherever possible to enable a condensing boiler to operate at higher efficiency, and to provide an opportunity for displacement of heating load using an air-to-water heat pump
- Where major renovations are being performed, select new heat emitters to operate at 49 ºC (120 ºF) or lower average water temperature at design conditions
- Where a facility might have simultaneous low-temperature heat rejection from cooling or refrigeration and high-temperature heat generation from a boiler, install a heat recovery chiller to recover and boost the quality of heat from heat source to heat sink
- Install an air-to-water heat pump in series with existing boiler loop between return water and boiler
- If the facility has a chilled water loop, size air-to-water heat pump according to cooling load to share the same electrical infrastructure

Domestic Hot Water

- Install low-flow fixtures or flow restrictors in existing systems to reduce domestic hot water flows to 1.9 lpm or less for a lavatory or 5.7 lpm or less for a shower
- Before rejecting any waste heat outdoors, examine opportunities to pre-heat domestic cold water inlet for domestic hot water systems
- Install a heat recovery chiller to recover and boost the quality of heat
- Where no waste heat sources exist or have been exhausted, install CO_2-based air-to-water heat pumps which are capable of extracting heat from cold outdoor air to generate high temperature water

Computers and other equipment

New computer and other equipment procurement should give precedence to equipment with the Energy Star certification.

Planned measures

Measures that the City plans to implement are shown on Table 11. Other measures may be adopted as opportunities arise.

Table 11 Planned efficiency measures

Facility	Action	Year	Estimated Cost	Energy savings (GJ/year)
Fire Hall #2	Replace gas furnace/AC system with hybrid heat pump/gas furnace	2025	$ 20,000	409.60
East Shore Community Centre	Replace two gas-fired rooftop units with hybrid heat pump/gas units	2025	$ 280,000	241.60
George Ashe Library & Community Centre	Replace two gas-fired rooftop units with hybrid heat pump/gas units with air side heat recovery	2025	$ 430,000	568.60
PMV Conservation Building	Install 48 kWAC rooftop solar array and battery energy storage system (BESS)	2026	$ 254,000	262.10
PMV Puterbaugh Schoolhouse	Replace oil-fired boiler with air-to-water heat pump	2026	$ 50,000	55.20

Building Envelope

Major renovations and new facilities also present opportunities for improved building envelope performance. Such performance should include envelope effective thermal characteristics that meet or exceed the prescriptive requirements for fenestration, doors, opaque wall, floor and roof assemblies of the National Energy Code of Canada for Buildings, 2020.

Active Integrated Energy Recovery Systems

These include but are not limited to heat rejection from exhaust air, arena compressors, pool dehumidification, chillers for reuse in arena desiccant dehumidification, pool air heat/reheat, pool water heating, DHW and ice-resurfacer water pre-heating, outdoor air preheating, snow melt, and other suitable uses before being rejected outside the facility. An energy recovery ventilator installed on a heating, ventilating and air conditioning unit typically reduces annual heating energy consumption by 40-50% and significantly increases the number of hours per year when heating requirements can be met with an air-source heat pump.

Fuel Switching and Electrification

Where the electricity is being used for heating and cooling, the most efficient technology available is heat pumps. These may be ground-source heat pumps, that extract heat from pipes embedded in the ground, or air-source heat pumps. Of the two options, air-source heat pumps typically require 60% lower initial capital investment than ground-source systems but operate at 20-30% lower average annual efficiency.

During especially cold periods when air-source heat pumps are supplemented by electric resistance heating with a Coefficient of Performance of 1, there may be limited environmental gain to electrification, while requiring significant upsizing of building electrical capacity.[31] In the near term, a hybrid solution should be considered in which heat pumps transition dynamically to natural gas backup once outdoor air temperatures and heat pump COPs drop below a calculated threshold. When combined with an energy recovery ventilator, a hybrid system can satisfy well over 80% of annual heating hours using the electric heat pump.

Combustion of fossil fuel is an energy conversion process in which the fuel's chemical energy is converted to heat. This process is always less than 100% efficient. Gas-fired rooftop units and mid-efficiency boilers operate at an efficiency of approximately 80%. The highest efficiency furnaces and boilers available may operate as high as 98% efficiency under ideal circumstances, though 90% is a more typical average. This means that 80% to 90% of the energy in the fuel becomes heat and the other 10% to 20% escapes up the chimney and elsewhere. As a result, the emissions from the combustion of fuel for heating must be divided by an energy conversion factor of 0.8 to

[31] Coefficient of Performance (COP) is a measure of the efficiency of the equipment. It essentially measures useful energy (heating or cooling) produced per unit of energy input (typically electricity).

0.9, resulting in effective emissions of 199-203 g/kWh for natural gas, and 301 to 338 g/kWh for fuel oil.

Direct conversion of electricity to heat is a near-100% efficient process. However, heat pump technology does not directly convert electricity to heat. Rather, electricity is used to drive a compressor motor which allows the system to absorb heat from one area (outdoor air or the ground) and move or pump that heat to another area (building interior). For every unit of electrical energy the compressor motor consumes, an average of 3 times that amount of energy is moved for an air-source heat pump, and 4 times for a ground-source heat pump. As a result, the effective emissions from an electrically-powered air-source heat pump for heating must be divided by an energy conversion factor of 3, resulting in effective emissions of about 23 g/kWh if the electricity is sourced from today's grid. The net emissions associated with delivered heat energy is illustrated in Figure 6. Further, unlike fossil fuel, it is possible to generate the required electricity to drive a heat pump from onsite or offsite zero-emissions sources (e.g. rooftop solar), resulting in effective emissions of 0 g/kWh.

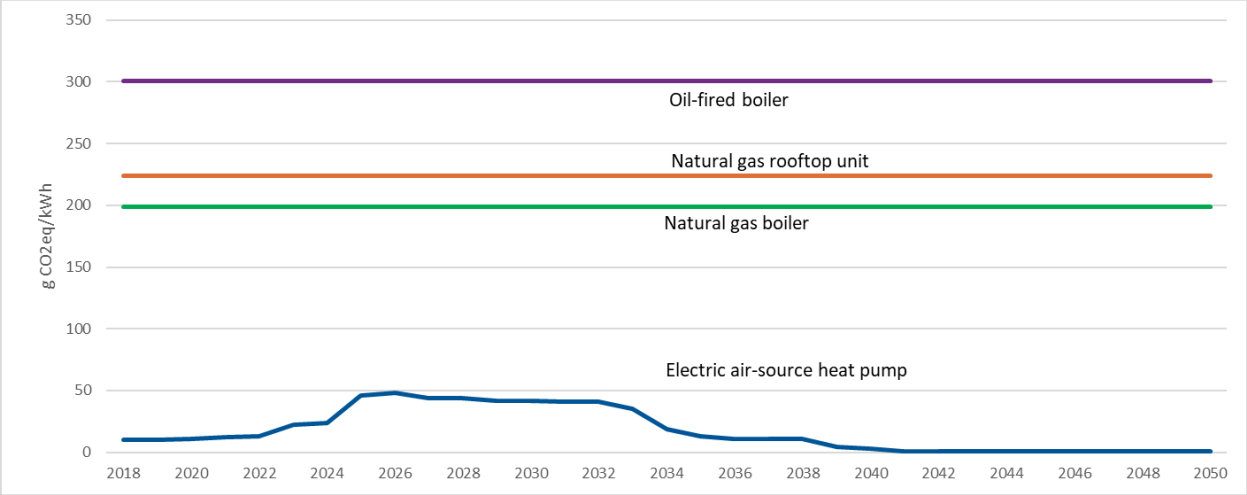


Figure 6 GHG emissions per delivered unit of heat energy

A challenge often raised with the proposed installation of air-source heat pumps is their reduced ability to extract heat from the outdoor air as the air temperature decreases. Simultaneously with the outdoor air temperature decreasing, the building's heat loss (and therefore the heat load on the heat pump) is increasing. Figure 7 illustrates a building's heating requirement at its maximum at the lowest outdoor air temperature, with an air source heat pump (ASHP) at its minimum capacity and lowest Coefficient of Performance (COP).[32] The point where the two lines cross is known as the Balance Temperature, which is typically in the range of -7C to -1C. Above this temperature, a facility's entire heating requirement can be satisfied by a heat pump.

[32] Daniel Overbey, "Gauging the Seasonal Efficiency of Air-Source Heat Pumps," *Building Enclosure*, February 23, 2015, https://www.buildingenclosureonline.com/blogs/14-the-be-blog/post/85012-gauging-the-seasonal-efficiency-of-air-source-heat-pumps.

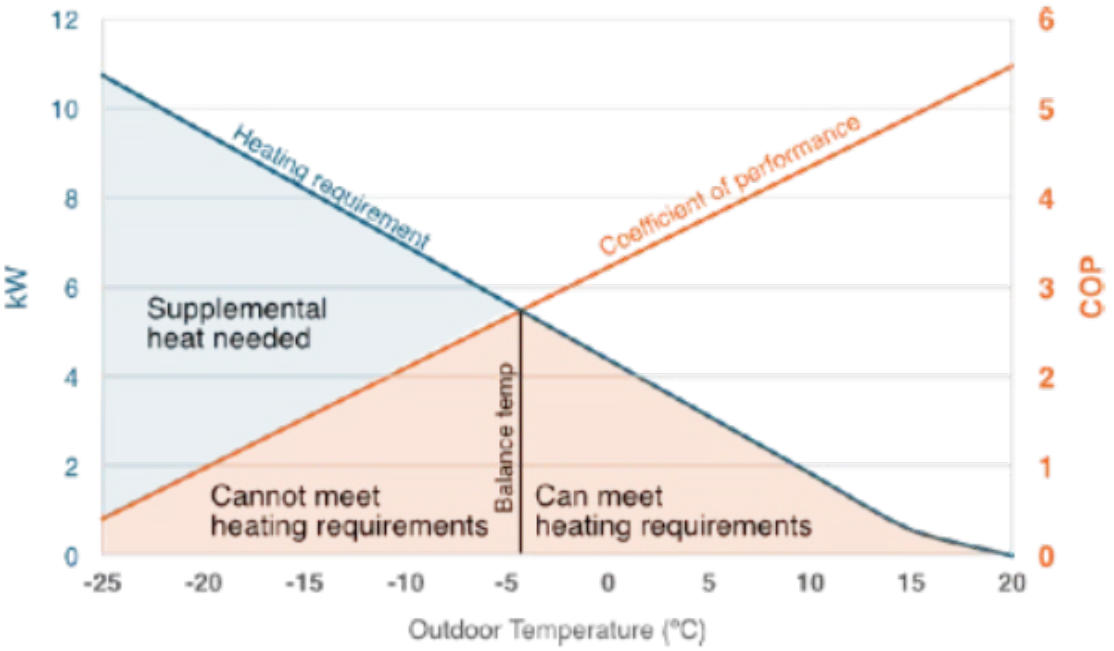


Figure 7 Air-source heat pump balance temperature

A historical analysis of local climate underscores the potential of air source heat pumps. Table 12 sorts the 2015-2020 historical hourly temperatures recorded at Oshawa airport into “bins” of temperature ranges.

Table 12 Historical heating hours by outdoor air temperature range

Temperature range (C)	Hours per year during heating season	Percent of heating season	Heat pump Coefficient of Performance
-27 to -25	4	0.08%	1.82
-25 to -20	41	0.84%	2.03
-20 to -15	104	2.12%	2.31
-15 to -7	556	11.32%	2.15
-7 to +2	2,333	41.34%	2.89
+2 to +7	1244	25.34%	3.11
+7 to +12	693	14.11%	3.32
+12 to +15	239	4.87%	3.56
Total	**4,910**	**100.00%**	**2.94**

Notes: weather data from Oshawa airport, nominal 40-ton air-to-water heat pump

Table 12 illustrates that of the average 4,910 heating hours per year, 45% are between 2 C and 15 C, well within the capabilities of a hybrid rooftop HVAC unit. With the addition of air-to-air heat recovery, the temperature range within reach of a heat pump can be extended; over 85% of annual heating hours occur at outdoor air temperatures between -7C and 15C, with an average COP greater than 3.

Planned implementations

Pickering currently plans to install heat pumps at three existing facilities within the timeframe of this plan. These are listed on Table 13.

Table 13 Planned electrification measures

Facility	Action	Time
East Shore CC & Senior's Centre	Replace gas-fired rooftop units with hybrid heat pump/gas units.	2025
George Ashe Library & Community Centre	Replace gas-fired rooftop units with hybrid heat pump/gas units.	2025
PMV Puterbaugh Schoolhouse	Relocate building and install heat pump	2026

Renewable energy implementation

The City has made plans to significantly increase the amount of electricity supplied by solar systems. Planned installations are shown on Table 14. In the past the City's ability to install PV systems was constrained by the grid's distribution system, but there may now be additional capacity.

These four facilities are expected to generate approximately 700,000 kWh/a once implemented, based on the feasibility studies Pickering has undertaken. That amount of electricity is approximately 10% of the anticipated electricity required at that time.

Table 14 Planned solar installations

Facility	Action	Time
PMV Conservation Building	Install 73 kW rooftop solar PV	2025
Operations Centre	Install 454 kW rooftop solar PV	2027
Pickering Heritage and Community Centre	Install 91 kW rooftop solar PV (new facility)	2026
Seaton Recreation Complex and Library	Install 91 kW rooftop solar PV (new facility)	2029

Future renewable implementation planning should include for analysis of solar energy potential and provision for an onsite islanded photovoltaic system that includes a battery energy storage system (BESS) for full self-consumption of generated electricity and UPS-speed seamless switchover from- and to-grid. This includes analysis of appropriate loads to be serviced by the system, consideration of structural capacity of roof, rooftop mechanical equipment or other encumbrances on the roof, electrical room spatial requirements and cooling for transformers, inverters, transfer switch and BESS.

District Energy

The City of Pickering is continuously exploring partnership opportunities to develop district energy. Municipalities are increasingly using district heating and cooling for operations related to municipal buildings, multi-purpose facilities, and arenas. In Ontario, several municipalities such as Guelph, Markham, Toronto, and Windsor have district energy systems for their buildings.

Typically, district heating energy use will be dominated by space heating, with the balance being used for domestic hot water heating and process loads. The majority of

district cooling energy is used for space cooling, with the balance being used for process cooling, such as in data centres.

District energy can provide cost-effective heating, cooling, and/or electricity using local energy sources. It can also reduce peak power demand, GHG emissions, and provide backup power during emergencies resulting in increased community resiliency and energy cost savings.

Water Conservation

Water conservation can have a significant impact on municipal energy use. Despite improvements in household water conservation, Canada remains one of the largest per capita users of fresh water in the world. Reducing water consumption and associated wastewater means less energy consumed for pumping and treatment.

Domestic Hot Water (DHW), used primarily for handwashing and showering, also requires large heat energy input. Due to the elevated temperatures and volume of hot water required, DHW is typically heated using natural gas combustion.

Low-flow fixtures should be installed wherever possible, particularly for high-use shower facilities such as pool change rooms.

Water conservation measures will continue to be developed and implemented.

New facilities and major retrofits

Several City facilities are within or beyond the last third of their expected lifecycles. Deep retrofits to these facilities are difficult to justify, as neither the financial nor the embodied-carbon investments will be offset by operational savings before the facility is inevitably decommissioned. For new builds the opportunity exists to build fully electric facilities whose operational carbon emissions can approach zero. Despite near-term increases in electricity grid emissions, the amplifying benefit of electrical heat pump efficiency and the potential for onsite electricity generation from renewable sources mitigate the grid emissions. On the other hand, further construction of new conventional gas-heated buildings would significantly hamper the City's carbon reduction efforts for many years.

Old buildings approaching end of life should be replaced with new net-zero carbon buildings. Potential candidates are shown on Table 15. The new Pickering Heritage & Community Centre is currently under construction and will be a net-zero facility.

Table 15 End-of-life buildings eligible to be decommissioned and replaced with new buildings

Old facility	New facility	Time
Don Beer Arena	Seaton Recreation Complex & Library	2030
Fire Station # 5	Building to be replaced with new facility	2027
Greenwood CC	Pickering Heritage & Community Centre	2027
Greenwood Library	Pickering Heritage & Community Centre	2027
Mount Zion CC	Pickering Heritage & Community Centre	2027

IMPACT OF ALL PLANNED MEASURES OVER TIME

The impact of all planned measures on overall greenhouse gas emissions is shown on Figure 8. The figure illustrates the increase in emissions associated with the opening of the new Operations Centre and Fire Hall #1, and conversely the substantial emissions benefits achieved during the future potential decommissioning of older conventional facilities such as Don Beer Arena and CHDRC when newer facilities come online.

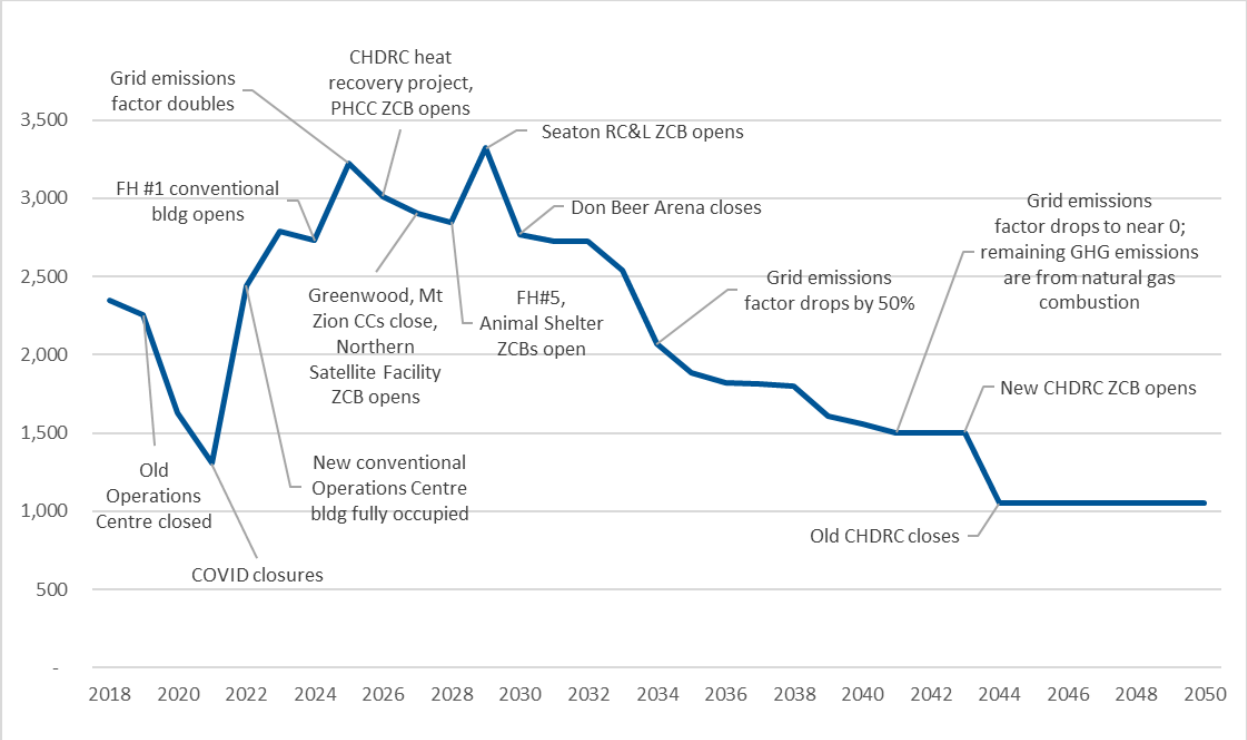


Figure 8 Impact of proposed measures on greenhouse gas emissions (t CO_2eq)

The figure indicates a rapid increase in Corporate building portfolio emissions this decade, followed by a long-term decline. The decline is predicated on all new facilities being zero operational carbon (i.e., no new fossil fuel HVAC equipment added to the corporate portfolio) in concert with a predicted decline in grid emissions factor after 2033. Despite this projected decline, a comparison of 2018 to 2033 emissions shows minimal absolute change to Corporate building portfolio emissions.

Further emission reductions will require additional measures to retrofit existing building assets to reduce natural gas consumption. That would require focusing on the buildings with the highest greenhouse gas emissions. These are shown on Table 4, above.

Recognizing that the environmental landscape will continue to evolve, future refinements of this appendix will include processes for regular review and updates, such as adjusting targets based on new technologies or changing circumstances, and incorporating lessons learned from implemented projects.

APPENDIX 5: FLEET DECARBONIZATION

In 2023, 35% of the City's GHG emissions came from its fleet vehicle fossil fuel consumption. Decarbonization of fleet operations will require separate intensive study.

Light-duty vehicles can be electric, though adjustments are likely required to current operational procedures to accommodate periodic stops for recharging. During peak periods, some City fleet vehicles are in operation 16-23 hours per day. The city will consider detailed study of available telematics data to assist with identifying the most appropriate candidate vehicles for electrification. Telematics devices retrieve data generated by the vehicle, like GPS position and speed. The key will be to study current means and methods to recognize natural pause periods when staff can be performing other duties while vehicles are charging.

Medium-duty vehicles and equipment, which are typically diesel-fueled, may potentially operate on renewable diesel fuel. Renewable diesel (RD) has 65% lower emissions than petroleum diesel. Since RD is a drop-in replacement requiring no technical modifications to the equipment, it leverages existing capital investments. However, it will not be produced and available locally for several years. Importing RD from the United States is possible via rail tanker. The City will consider the feasibility of partnering with the Region of Durham and other lower-tier municipalities to achieve sufficient volume for import.

Further refinement of this Appendix will consider the available market solutions to reduce fleet green house gas emissions, challenges of medium- and heavy-duty vehicle electrification in a City that still has significant semi-rural area, and present the successes to date with light-duty vehicle electrification for building inspectors and electrification of landscaping trim-crew equipment.

Right-sizing vehicles

The concept of right-sizing vehicles refers to ensuring that a vehicle's size and power are selected appropriately to the vehicle's primary end-use, and not for infrequent events. This is often referred to as the 80/20 rule. However, the City currently operates a lean fleet, where few vehicles are limited to a single end-use, such that vehicles are often interchanged between staff or refitted to different uses depending on the season. This is cost-effective and efficient but can be a hindrance to the purchase of small short-range and lower-cost EVs dedicated to light-duty passenger use, for example.

Fleet EV Availability

EVs are still higher-cost vehicles, due primarily to their battery packs. To improve the profitability of EV offerings, vehicle manufacturers have targeted early adopters willing and able to pay for high trim levels. The City purchases mainly base-model fleet vehicles, which are only recently being offered as EVs in Canada. With the narrowing of the purchase cost difference between an Internal Combustion Engine (ICE) vehicle and an EV vehicle, the City will continue to evaluate appropriate EV use cases.

EV Charging

Electric Vehicle Charging stations were recently installed at the Operations Centre and Chestnut Hill Developments Recreation Complex. Usage has been monitored and findings will be presented in a forthcoming summary (Electric Vehicle Charging Pilot Study). Financial viability and usage findings will be included.

RECOMMENDATIONS

It is recommended that:

- Methods be explored to improve access to granular energy and emissions data in a format which is conducive to data analysis
- Carbon tracking and GHG surplus/deficit metrics be developed and attached to capital project and programming proposals
- The City adopt and refine the Tier 2 Energy Use Intensity and Greenhouse Gas Intensity targets for new construction as defined in Appendix 3: Corporate Building Standard
- A framework be developed for identification and prioritization of emissions-reduction capital projects and operational adjustments
- Fleet analytics be used to identify light-duty vehicles suitable for EVs
- Opportunities be explored for sourcing renewable diesel fuel, including collaborative efforts to achieve sufficient volume to justify fuel import

CONCLUSION

The CEMP and its appendices will act as a living document to enable the City's energy management goals, foster a culture of conservation, leverage best practices and technology, and learn from the projects undertaken throughout the 2019 to 2024 CEMP.

The City of Pickering is committed to environmental stewardship as a critical component of its operations. By leveraging best practices and technology, the City will continue to effectively integrate energy management into its operations. The City's energy management strategy guides the implementation of this Plan, with a three-pronged approach consisting of the following elements:

1. Improving energy efficiency in the existing municipal building portfolio
2. Incorporating energy efficient technology and controls within the design and construction of new facilities
3. Investing in renewable and alternative energy sources to reduce energy consumption, GHG emissions and to improve community resilience

There are opportunities for further energy conservation through recommissioning of the City's existing buildings and incorporating conservation and sustainability into new building designs.

Energy management relies upon members of Council and staff, at all levels, understanding their role and playing a part in achieving the goals of the Plan. Engagement will continue to play an integral part during the implementation period of the CEMP.

Through this proactive approach, the City of Pickering will actively practice its culture of conservation, continuous improvement, commitment to energy efficiency and will reduce emissions.