



2019-2024 Corporate Energy Management Plan

A Culture of Conservation and Continuous Improvement



2019-2024 Corporate Energy Management Plan

City of Pickering

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A Message From Our Mayor



As Mayor, I am very proud to endorse the City of Pickering's 2019-2024 Corporate Energy Management Plan.

While the City of Pickering had embarked on its sustainability journey over a decade ago, the need to address climate change has become top of mind for residents, businesses, and stakeholders. For this reason, our Corporate Energy Management Plan is not just a blueprint for conserving energy at City facilities over the next five years. It's also our public commitment that we will continue to take a leadership role in terms of resilient development and long-term climate action.

In addition, through innovative energy conservation planning and programs, we can significantly reduce our energy costs in the long run. Implementing cost savings and cost avoidance measures are effective ways of reducing budget pressures and the City's reliance on its tax base.

The City of Pickering is on the cusp of greatness, and invested in a number of transformational projects including Seaton, City Centre redevelopment, the Durham Live entertainment and tourism destination, and the Innovation Corridor. These exciting projects are bringing a whole new dynamic to Pickering.

I want to assure you that we are working with our partners to advocate the importance of energy conservation in all of these key projects. I, and every Member of Council, believe in responsible development that benefits the community on multiple levels – social, economic, and environmental.

I hope you have the opportunity to review the Corporate Energy Management Plan. While it may seem ambitious to some, we feel it is entirely achievable. The key to success is ensuring that we all collectively embrace the culture of conservation.

In closing, I invite you to join our sustainability journey. Together we can achieve our shared goals of energy conservation, prosperity, resilient development, and community-building.

Yours truly

A handwritten signature in black ink that reads "Dave Ryan". The signature is fluid and cursive, with the first name being more prominent.

Dave Ryan
Mayor, City of Pickering

Acknowledgements

The 2019-2024 Corporate Energy Management Plan would like to acknowledge the support from the following stakeholders. Each stakeholder brought a diverse range of skills and expertise that informed the development of the Plan.

CITY OF PICKERING

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Executive Summary

The 2019–2024 Corporate Energy Management Plan (CEMP) provides a roadmap for planning and decision-making for the next phase of the City of Pickering’s energy management program. The CEMP builds on the success of the previous plan, but refocuses the City’s energy management priorities to consider the current context of technology, policy, growth and City development. The City strongly supports its energy management program, and the CEMP was developed through a collaborative effort of stakeholders across City operations, who provided insight and helped shape the goals and objectives for energy management to the year 2024. The report was developed in accordance with Ontario Regulation 507/18, Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans, which establishes a province-wide framework for municipal energy management planning.

Overview of 2014–2019 Results

In 2014, the City of Pickering released its first CEMP, which identified short-, medium-, and long-term priority actions to achieve targets of a 12% reduction in energy intensity and a 14% reduction in greenhouse gas emissions by 2019. While data for 2018 and 2019 are still being collected, analysis up to 2017 indicates that energy use intensity was already 9% lower and greenhouse gas emissions were 34% lower when compared to the 2014 baseline. Some of the project highlights include:

- LED streetlight conversion
- Solar and LED lighting in parks
- Facility retrofits including LED lighting and building system upgrades
- Purchase of electric vehicles to replace gas-powered fleet vehicles
- A 100 kW rooftop solar project implemented on the Dr. Nelson F. Tomlinson Community Centre

It is the responsibility of those managing Pickering’s facilities to ensure reliability and resilience, cost-effective management of facilities and the comfort of building occupants; energy management plays a key role in achieving all these outcomes. The City has made substantial progress in implementing well-established measures, such as lighting and HVAC improvements. These projects have yielded substantial operational savings for the City, with facility retrofits alone resulting in over \$600,000 of avoided energy costs each

year. These measures, in conjunction with greatly reduced emissions intensity of electricity in Ontario, have resulted in overall emissions reductions of 1,040 tCO₂e annually.

To improve understanding of building energy consumption and to enable the next phase of the City’s energy management program, a building automation system (BAS) was also installed. As the energy management program has advanced, it has become increasingly challenging to identify opportunities; much of the low-hanging fruit has been addressed. The BAS will enable the identification of measures and facilitate holistic assessment of energy management opportunities across the City’s facilities.

Development of the Plan

An extensive engagement took place with key stakeholders across City departments that will be involved in implementation of the new plan and represented the diversity of perspectives and experiences. These stakeholders provided a complementary mix of skills and insights on the key opportunities and challenges to be addressed, which informed the goals and objectives for the 2019-2024 energy management program.

Although the Plan was developed to guide Corporate energy management initiatives, it also benefits the broader community. By leading by example, the City is able to encourage others to pursue higher standards for energy management and sustainable development across the community.

Looking Forward: A Culture of Conservation and Continuous Improvement

The 2019–2024 CEMP reinforces a Corporate culture of conservation and continuous energy improvement. Facility retrofits will continue to play a key role in the success of the energy management program, and the City has allocated an annual budget for these projects. In addition, by installing advanced metering infrastructure and leveraging building automation systems, staff will understand how energy is being used and be better equipped to make informed recommendations for future actions.

The City will engage staff at every level to help them understand their role in energy management. Facility energy use will be monitored so that building operators can identify and address deviations in expected building performance. Predictive

maintenance techniques help determine the condition of in-service equipment to estimate when maintenance should be performed. This approach promises cost savings over routine or time-based preventive maintenance. Tasks are performed at end-of-life, which is the most cost-effective opportunity to improve energy efficiency.¹ Predictive maintenance systems will enable proactive identification of problems, before equipment failure occurs or excessive energy is needlessly consumed.

The following table provides a summary of the measures recommended for implementation under this Plan.

It is estimated that there will be a savings of 1,450 MWh in electricity and 150,000 m³ of natural gas within existing buildings. This is equivalent to a 15% reduction in energy consumption and a 15% reduction in GHG targets. In line with these targets, the City also has a goal to construct new buildings that are 15% more efficient than the Ontario Building Code. Achievement of these targets would reduce Pickering's energy costs by approximately \$650,000 per year and decrease total GHG emissions by 310 tCO₂e per year.

Action	Implementation Timeframe	Estimated Annual Savings (electricity, natural gas, \$)	Estimated Incremental Implementation Cost
Predictive Maintenance System – Phase I	2020-2021	240,000 kWh/yr 50,000 m ³ /yr \$50,000/yr	\$200,000
Predictive Maintenance System – Phase II	2022-2023	140,000 kWh/yr 20,000 m ³ /yr \$30,000/yr	\$120,000
Energy Management Information System – Phase I	2020-2021	190,000 kWh/yr 20,000 m ³ /yr \$40,000/yr	\$160,000
Energy Management Information System – Phase II	2022-2023	140,000 kWh/yr 10,000 m ³ /yr \$20,000/yr	\$80,000
Major Capital Replacement (Existing Facilities)	2019-2024	120,000 kWh/yr 20,000 m ³ /yr \$30,000/yr	\$120,000/yr*
Recommissioning for Major Renovations	2019-2024	240,000 kWh/yr 30,000 m ³ /yr 50,000/yr	\$200,000/yr*
Lighting Retrofits (Interior and Exterior)	2019-2024	380,000 kWh/yr 0 m ³ /yr \$60,000/yr	\$460,000
Exceeding Code Energy Performance for New Construction	2019-2024	2,000,000 kWh/yr 200,000 m ³ /yr \$370,000/yr	Estimated to be 15% higher than code compliant facility

*Note: The cost per year is only for the duration of the implementation timeframe of 2019-2024, however the cost savings per year will continue past the five year timeframe.

1 <https://www.reliableplant.com/Read/12495/preventive-predictive-maintenance>

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Introduction

The purpose of the 2019-2024 Corporate Energy Management Plan (CEMP) is to provide a 5-year roadmap that will guide planning and decision-making, setting forth a path for the next phase of Pickering's energy management program. This Plan shall reinforce a culture of conservation, provide an overview of the City's energy management achievements and define future goals and objectives.

The CEMP aligns the City's vision, skills, incentives, and resources into a strategy that encourages the effective implementation of energy management best practices throughout City facilities and infrastructure. The development of the CEMP is an excellent opportunity to highlight the successes, reflect on the missed opportunities, and highlight the cross-departmental collaboration that contributed to building on an exceptional energy management program.

In 2014, the City of Pickering released its first 5-year Corporate Energy Management Plan. The CEMP identified short, medium, and long-term priority organizational and technical actions with a goal to achieve 12% and 14% reductions in energy intensity and emissions, respectively.² The purpose of this report is to identify the successes and lessons learned during the implementation of the first plan, and from this past experience, establish meaningful goals for 2019 to 2024. The CEMP is a 5-year roadmap for energy management and is intended to facilitate planning and decision-making to support low emission, energy reduction and resilient development.

According to the Independent Electricity Operator 2018 Annual Report on Energy Efficiency Activities, "energy efficiency continues to be the most cost-effective resource for maintaining Ontario's power system at only 1.69 cents per kilowatt-hour."³ In consideration of Pickering's growing population, increasing fuel prices, increasing greenhouse gas emissions, and the opportunities for cost effective energy efficiency, it is now more important than ever to fully understand and manage the City's Corporate energy consumption.

Energy management is a key component to building a resilient, prosperous, and sustainable community for residents and businesses. Since 2014, the City has implemented numerous measures to reduce energy consumption and operational costs. Pickering has invested in clean fleet vehicles, smart commute programming, renewable energy, and has prioritized energy efficiency in the development of new and existing municipal facilities.

The City of Pickering is focused on the cost-effective management of risks, both current and future. Effective energy management practices can improve energy performance, system reliability, and cost savings. The City is striving to be a leader in integrating sustainable building design, improving its green infrastructure, and embracing renewables. Collectively, the City is actively working towards a low carbon and resilient future.

² <https://www.pickering.ca/en/living/resources/CorporateEnergyManagementPlan2014.pdf>

³ <http://www.ieso.ca/en/Power-Data/Conservation-Overview/Conservation-Reports>

A short summary of each section of this Plan is provided below.

Section 1: Introduction

Provides a brief introduction of the CEMP by outlining the purpose the plan. This section also provides background information on the previous CEMP.

Section 2: Background

Connects energy efficiency to climate resiliency as an adaptation and mitigation strategy. A high-level background on the City of Pickering is provided, as well as an overview of the energy management team, the methodology used to develop this report and a summary of relevant municipal and regional plans.

Section 3: Goals and Objectives of the CEMP

Unpacks the priorities of the CEMP by communicating its goals and strategy.

Section 4: Pickering's Past Energy Management Progress

Provides a narrative of the City's past projects highlights, impact and lessons learned from the achievements of the 2014-2019 CEMP. This section includes tables and figures that quantitatively characterize the results achieved from actions taken place during the 2014-2019 CEMP.

Section 5: Pickering's Current Energy Use and GHG Consumption

This section provides a summary of the building energy use for 2017.

Section 6: Opportunities for Future Energy Management

This section describes opportunities for future energy management improvements within the 5-year time frame of the plan. The section recommends energy management measures and describes municipal funding pathways that can be linked to the proposed opportunities.

Section 7: Conclusion

This section provides a brief conclusion for the CEMP.

Section 8: Appendix

This section is the appendix for the report.

Background

Canadians are increasingly becoming concerned about climate change as the impacts become evident abroad and at home.

In 2019, the Federal Government's Canada's Changing Climate Report found that both past and future warming in Canada is, on average, double the magnitude of global warming.⁴ According to the Bank of Canada, climate-related damage to property and infrastructure averaged approximately \$1.7 billion annually between 2008 and 2017.⁵ These impacts will increase the financial burden of municipalities due to the costly clean-up efforts and repairs to infrastructure.

In response to the Paris Agreement, the Government of Canada released the Pan-Canadian Framework for Clean Growth and Climate Change (PFCGCC) as a strategic plan to meet Canada's 2030 target of a 30% reduction below 2005 GHG emission levels. Through PFCGCC, the Federal Government recognizes the critical role the public sector can play to achieve the Federal and international climate change goals by setting ambitious targets; cutting emissions from government buildings and fleets; and driving innovation to advance adaptation strategies and build resilient communities.

In Ontario, municipal governments play a critical role in addressing climate change by investing in infrastructure and programs that build more resilient communities. The City's energy management practices help to reduce energy and operational costs, and demonstrates a commitment to long-term climate action, resilient development and environmental sustainability.

Municipal Leadership and Climate Change Resiliency

Pickering is a recognized leader in sustainability and was the first municipal government in the Province of Ontario to establish an Office of Sustainability. In 2007, the City drafted a set of Sustainable Development Guidelines, highlighting best practices as an effective way to integrate sustainability into the development of neighbourhoods planned for Pickering.

In 2015 and 2017, the City of Pickering won the Conservation Champions Award from Elexicon Energy (previously Veridian) in achieving outstanding electricity conservation results. The City was able to achieve electrical savings of 4,468,239 kWh. In addition, in 2018, the City was awarded the Largest

Lighting Savings Award at the Powering Up Durham Save on Energy Symposium.

In recognition for the City's outstanding achievements in energy conservation and climate change action, the City of Pickering has received numerous awards including from the Federation of Canadian Municipalities for meeting its highest milestone in the Partners for Climate Protection Program.

With the understanding that money not spent on energy bills is money that can be better spent on innovative and financially beneficial practices, the City has taken significant steps in implementing energy efficiency measures in facilities and invested in renewable energy generation. The financial earnings generated from the solar PV project and the incentives received for the City's energy management initiatives have been dedicated to an established Green Initiative Fund, which is a revolving fund dedicated for the implementation of sustainable energy projects. A revolving fund is when revenues are "recycled" back into a reserve fund to finance additional energy projects.



2.1 Stakeholder Engagement Workshop

The City engaged key stakeholders to develop the CEMP. Each stakeholder involved represented a diverse area of operations. Interviews were conducted to gather key insights, which informed the design of a half-day workshop. Ultimately, the purpose of the workshop was to establish goals and objectives that considered the unique needs and challenges of each individual's role within City operations. Energy projects are cross-cutting, and therefore require participation from stakeholders across the organization.

⁴ <https://www.nrcan.gc.ca/maps-tools-and-publications/publications/climate-change-publications/canada-changing-climate-reports/canadas-changing-climate-report/21177>

⁵ <https://nationalpost.com/pmnn/news-pmn/canada-news-pmn/bank-of-canada-identifies-climate-change-as-important-economic-weak-spot>

The Energy Management Team will continue to meet quarterly. Key members representing all departments of the City that pertain to energy management will form this dynamic group. They will continue to engage all levels of employees in the identification and implementation of energy efficiency initiatives. The Team is invested in the success of the City's CEMP goals and is committed to creating a culture of energy conservation that will help generate real results, saving money and energy.

2.1.1 Creation of the 2019-2024 Energy Management Plan

The engagement workshop served as a kick-off to the project with the broader City of Pickering team and raised information that guided the development of the CEMP. Prior to the workshop, interviews were conducted with key members of the City team to inform the session design.

City staff participated in the workshop, which yielded a total of 86 ideas from 4 teams of stakeholders. Ideas generated

during the workshop were then mapped to the following categories; best practices, policy, education and engagement, funding, and culture and engagement elements. These are not mutually exclusive categories, as some ideas represent more than one area of focus. "Best Practices" and "Education and Awareness" were the categories that related to the highest number of ideas identified, as outlined in Exhibit 1. Ideas for energy management identified during the workshop are woven into the objectives, opportunities and strategies presented throughout the Plan.

The feedback received from all involved in the workshop helped to inform the measures, objectives and overall strategy of this Plan.

2.2 City Growth and Sustainable Developments

Between 2019 and 2024 the City of Pickering is forecasted to grow from 94,279 to approximately 135,000 residents.⁶ This growth will include new sustainable developments and incorporate energy management practices that enable community resilience. Community resilience plays an important role in the CEMP. The City of Pickering has several new areas being developed that reflect a sustainable direction and enhanced community resilience. For instance, Pickering's City Centre will encompass state-of-the-art buildings providing the City with opportunities to test behavioural and technical energy management measures, thus advancing community resilience. The City Centre is still in the design phase. Another example is the Seaton Community, which has recently started construction. Both developments are leading examples that showcase the City's commitment to energy management. As noted later in this report, given the scale of development that will occur, it is important to take a flexible approach towards energy management, as new developments present an opportunity to invest in technologies that will emerge over the lifetime of the Plan.

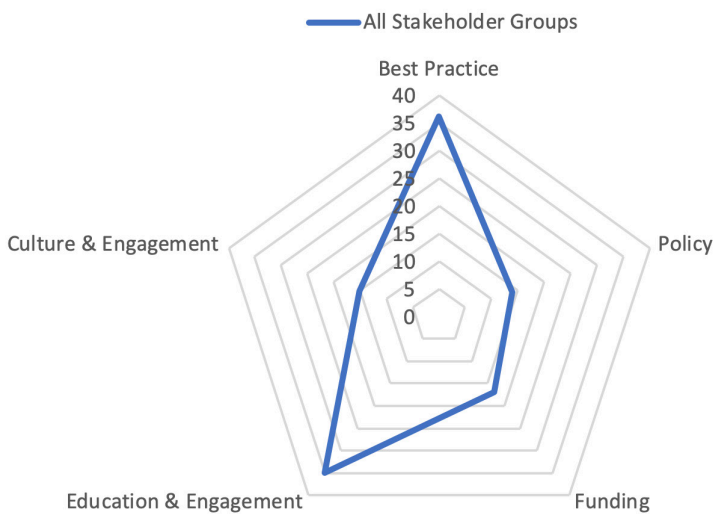


Exhibit 1: Stakeholder Ideas Mapping

⁶ <https://www.pickering.ca/en/business/resources/20YearPopulationForecast.pdf>

Energy Efficiency's Role in Increasing Community Resilience

The American Council for Energy-Efficient Economy (ACEEE) defines community resilience as a community's reduction of, and preparation for, risk.⁷ With the increasing impacts of climate change, the City of Pickering is improving resiliency in many ways such as energy management, green building

design and sustainable procurement policies. Energy efficiency is fundamental to energy management and can support community resilience by strengthening local energy systems and delivering more reliable and affordable energy. Exhibit 2 provides an overview of the resilience benefits to a community by investing in energy efficiency.⁸

Benefit type	Energy efficiency outcome	Resilience benefit
Emergency response and recovery	Reduced electric demand	Increased reliability during times of stress on electric system and increased ability to respond to system emergencies
	Backup power supply from combined heat and power (CHP) and microgrids	Ability to maintain energy supply during emergency or disruption
	Efficient buildings that maintain temperatures	Residents can shelter in place as long as buildings' structural integrity is maintained.
	Multiple modes of transportation and efficient vehicles	Several travel options that can be used during evacuations and disruptions
Social and economic	Local economic resources may stay in the community	Stronger local economy that is less susceptible to hazards and disruptions
	Reduced exposure to energy price volatility	Economy is better positioned to manage energy price increases, and households and businesses are better able to plan for future.
	Reduced spending on energy	Ability to spend income on other needs, increasing disposable income (especially important for low-income families)
	Improved indoor air quality and emission of fewer local pollutants	Fewer public health stressors
Climate mitigation and adaptation	Reduced greenhouse gas emissions from power sector	Mitigation of climate change
	Cost-effective efficiency investments	More leeway to maximize investment in resilient redundancy measures, including adaptation measures

Exhibit 2: Community resilience benefits associated with energy efficiency

⁷ <https://aceee.org/research-report/u1508>

⁸ <http://eecoordinator.info/wp-content/uploads/2016/06/Community-Resiliency-EE.pdf>

Pickering City Centre

The City of Pickering is demonstrating its commitment to community resilience through the development of the new City Centre, which will promote the sustainability and livability of the community as a whole.

The development plan for this Centre supports the tenets of sustainability – bringing together economic, social, and environmental priorities into a singular, exciting, and dynamic new building form. The City’s bold vision for the City Centre will foster a vibrant, sustainable, accessible and bustling downtown. Energy management and sustainable building design will play a key role in this new development. The City of Pickering, Pickering Town Centre (PTC), and Cushman & Wakefield, have developed a unique public-private partnership for the redevelopment of a portion of the mall lands. The City Centre development will encompass state-of-the-art buildings and facilities, including a Performing Arts Centre, new Central Library, combined Seniors & Youth Centre and condominium towers, which will all be seamlessly connected via activated and pedestrian-friendly walkways.

The City intends to enroll this development in the Enbridge Savings by Design program, which is an incentive program to encourage the design and construction of high-performance, energy efficient buildings that are at least 15% better than Ontario Building Code. Another benefit of the program is that past participants have used the best practices knowledge for the construction of other facilities. Over 200 projects have successfully gone through this program and the City Centre initiative would be the first commercial project in Pickering to participate. This development exemplifies the City’s commitment to evolve.

This landmark development project will bring together municipal service delivery, shopping, retail, and residential intensification, into a singular walkable neighbourhood that will become the heart of the City. The City is working to integrate active transportation networks, strategic urban design, sustainable building practices, land use, as well as improving access to public spaces and services.



Rendering - Pickering City Centre Redevelopment Project⁹

Community in North-East Pickering

The City is collaborating on a new development in North-East Pickering based on fostering a wellness-driven community. This connected (Smart) Community is guided by the following planning principals:

- a. A future-focused community that is adaptable and evolving, supporting opportunities for innovative forms of transportation through adaptable infrastructure.
- b. Provides and allows for the potential of various incoming multi-modal transportation opportunities that take advantage of smart technologies including Autonomous Vehicles.
- c. Promotes a more sustainable and healthful way of life through partnerships that support smart technologies, on-site renewable energy systems and district energy opportunities.
- d. Optimizes solar gain opportunities through a grid street network aligned with True North.

This development plan is designed to reflect the GTA’s diversity of people, natural habitats and community resilience.

The Seaton Community

The Central Pickering Development Plan describes a broad vision for Seaton as a sustainable urban community integrated with a thriving agricultural community and an extensive Natural Heritage System with trails. Subsequent work completed by the City sets in place policies for the development of urban Seaton as a walkable, transit-supportive community at densities that support an active street life, including neighbourhood shops, social facilities and parks.

⁹ Courtesy of Architects Alliance. Note, artistic renderings subject to change.



Exhibit 3: O. Reg. 507/18 Approach to Energy Reporting and Conservation and Demand Management Plans

In 2018, it was forecasted that the Seaton Community in will require up to 180 megawatts (MW) of new supply capacity over the next 15 years.¹⁰ In 2017, Pickering Council passed a resolution that all future municipal facilities built in Seaton include systems complete with a rooftop solar array, electric vehicle charging stations and integrate energy storage.¹¹

The Sustainable Seaton: Community-Building Series

The City created the Sustainable Seaton: Community-Building Series to engage and inspire key industry stakeholders to encourage more sustainable home building in Pickering and across Durham Region.¹²

As part of the series, the City collaborated with Seaton landowners to present the Net Zero Energy Housing inaugural workshop. The second workshop, in 2017, discussed Canada's first micro-grid neighbourhood that is planned for Pickering and will consist of state-of-the-art control systems, as well as two-way power flow to the grid.

In 2019, the City hosted its most recent workshop, Building for the Future. The workshop explored the advantages of tall timber construction, addressed energy and water conservation and helped attendees gain practical insight from builders participating in Enbridge's Savings by Design program to exceed Code by 15%. The workshop also showcased Canada's first greywater operating system being installed by a production builder in Pickering.¹³

2.3 Provincial Policy Compliance: O'Reg 507/18 – Overview of Regulation

The Government of Ontario expressed a commitment to greening public sector buildings and developed Regulation 397/11 under the Green Energy Act. The 2009 Green Energy Act called for all public agencies to annually report energy consumption and greenhouse gas emissions beginning July 1st, 2013 and every year thereafter with Ontario Regulation (O.Reg) 397/11. Additionally, O.Reg 397/11 mandated that all public agencies prepare, report and implement energy conservation and demand management plans by July 1, 2014, and update that plan every 5 years thereafter.

On January 1, 2019, the Green Energy Act, 2009 was repealed, along with its regulations. Select conservation and energy efficiency initiatives, such as the Broader Public Sector (BPS) energy reporting regulation, were moved to the Electricity Act, 1998. O. Reg. 397/11 that transitioned to O. Reg. 507/18 (BPS: Energy Reporting and Conservation and Demand Management Plans). The 2019-2024 CEMP serves as the update to progress made through the 2014-2019 CEMP. Exhibit 3 is a visual representation of the requirement for municipal corporate energy management plans.

10 http://www.veridian.on.ca/wp-content/uploads/ESR_Seaton_MTS_1_Final.pdf

11 <https://www.pickering.ca/en/living/resources/2017-measuring-sustainability-report.pdf>

12 <https://www.pickering.ca/en/city-hall/community-building-series.aspx>

13 <https://www.pickering.ca/en/city-hall/community-building-series.aspx>

2.4 Related Municipal and Regional Plans and Initiatives

City of Pickering Official Plan, 2018

The City's Official Plan is a statutory document, which sets out the land use policy directions for long-term growth and development in the municipality. Municipalities in Ontario are required to adopt Official Plans to guide growth and development that will implement the Ontario Planning Act and other relevant legislation and regulations. This is the eighth edition of the Plan and was released in October 2018.

The Plan outlines five principles. The first principle focuses on sustainability: The ability to meet people's needs while ensuring environmentally appropriate actions. Within this principle, the City describes its commitment to encouraging energy and water conservation.

Throughout the Plan, energy management is woven into the policy contents and appears in the goals for rural development, residential growth, land use planning, building design, job creation and diversification, community services, infrastructure, community improvement areas and across all Corporate initiatives.

Durham Community Energy Plan, 2018

The City of Pickering is partnering with the Durham Region to implement the Durham Community Energy Plan, a comprehensive long-term energy plan and a roadmap to achieve deep energy savings and emissions reductions in the Durham Region.

The Community Energy Plan identifies the following short-term implementation programs to support actions in the Low Carbon Pathway:

1. Enhanced energy performance for new buildings through the Durham Green Standard.
2. Deep retrofitting of existing buildings.
3. Simulating local renewable energy projects through a renewable energy cooperative.
4. Encouraging the adoption of EVs.
5. Education and outreach to the community.
6. Embedding land-use policies that enable energy conservation and GHG reduction in official and secondary plans.

The CEMP aligns with the Durham Community Energy Plan's, Low Carbon Pathway that falls within a 2018 and 2050 timeline. Achieving the plan's six programs will reduce energy use by 51%. All of this reduction results from improved energy efficiency, despite doubling in population. The City of Pickering's effective energy management will enhance the Region's ability to reach its energy reduction goal.

City of Pickering Measuring Sustainability Report, 2017

This report describes the City's journey to becoming more sustainable by collecting and tracking data on the sustainability progress. In 2010, the City first published the Measuring Sustainability Report, later updated in 2012 and 2017, to set the baseline and outline indicators of sustainability in five categories, including: a healthy environment, healthy 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. This is the third report that measures sustainability in the community. The report references the 2014-2019 CEMP as a road map for energy management.

Growth Plan for the Greater Golden Horseshoe, 2017

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 2017 Growth Plan for the Greater Golden Horseshoe requires municipalities to develop policies in their official plans that support emission reductions and identify strategies for improved energy and water conservation. 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 improved energy efficiency within existing and planned water and wastewater systems and buildings.

The City Centre Urban Design Guidelines, 2017

The City Centre Urban Design Guidelines are 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).

Durham Community Climate Adaptation Plan, 2016

The Durham Community Climate Adaptation Plan has identified 18 proposed programs in sectors including, but not limited to, buildings, electricity supply and the natural environment to address local adaptation measures in preparing the Durham community including the City of Pickering, for the effects of a changing climate.

Building Retrofits for Climate Resilience is a key program that is proposed that will identify a specific set of energy measures that are appropriate and cost-effective for a given building. Similarly, resilience audits are recommended as an additional scope to the traditional energy audit.

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.

City of Pickering Sustainable Development Guidelines, 2007

The Sustainable Development Guidelines established core principles for the City of Pickering. The Guidelines represent a bold vision for community development for the City. The Guidelines include specific objectives for energy efficiency, land use, transportation, air quality, human communities, cultural resources, natural heritage, water and materials and waste. The energy performance for buildings, the use of energy efficiency appliances, passive solar gain, outdoor lighting and water efficiency contributes to the development's energy efficiency objectives. The Guidelines have been used to inform new development – residential, redevelopment and new designated urban areas. Within this document, energy management plays an essential role in the development guidelines to ensure the efficient use of energy takes place across all development projects in the City. The City of Pickering staff have discussed updating guidelines in the near future.



Rendering - Pickering City Centre Redevelopment Project¹⁴

¹⁴ Courtesy of Architects Alliance. Note, artistic renderings subject to change.



Goals and Objectives of the Corporate Energy Management Plan

3.1 Goals of the 2019-2024 CEMP Update

The CEMP should be treated as a “living document”, from which outcomes will be determined by the City’s Council and staff, and be used to guide the decision-making process for energy management initiatives. The CEMP was developed collaboratively by a diverse group of City staff, and include the following goals that:



1. **Foster a Culture of Conservation, leveraging best practices and technology effectively to embed energy management into City operations.**



2. **Learn from the successes and challenges encountered during the implementation of previous projects.**



3. **Provide a set of recommended energy conservation measures that reduce new and existing building consumption.**

3.2 Flexibility to Grow and Adapt

Woven between each of the goals highlighted in the section above is the theme of flexibility, which is embedded within this Plan. The City implements energy management practices across all departments and buildings that extend beyond a specific project or conservation measures. The CEMP will remain flexible so that as priorities evolve, the energy management team is able to adapt and ensure that the most cost-effective and practical energy decisions remain part of the evolving priorities. Through this approach, the Plan is

able to adapt to changes in funding availability at the federal, provincial and municipal level. As new construction of City assets occurs to accommodate growth, the flexible approach taken in this Plan will ensure resources can be deployed practically and efficiently.

3.3 Energy Management Strategy

According to the IESO's 2018 Annual Report on Energy Efficiency Activities, "energy efficiency continues to be the most cost-effective resource for Ontario's power system at only 1.69 cents per kilowatt-hour."

With that in mind, the City of Pickering has developed a three-pronged approach to tackling energy management:



1. **Improve energy efficiency in the existing municipal building portfolio.**



2. **Incorporate energy efficient technology and controls within design and construction of new facilities.**



3. **Invest in renewable and alternative energy sources to reduce energy, GHG emissions and improve community resilience.**

1) Improve energy efficiency in existing buildings

- **Improve data tracking and use:** Accurate and up to date information on utility consumption and costs is required in order to identify and prioritize opportunities. This can be achieved in a variety of ways, including investing in tracking systems such as utility meters and databases, providing increased funding and staff to facility operations, and empowering facility staff to act on identified opportunities. In order to contribute effectively to energy savings, the data cannot simply be tracked, but needs to be acted upon.
- **Take a portfolio approach:** Prioritize facilities that have high energy consumption compared to the rest of the stock, either because they are large or are poor performers compared to their peers. Street lighting is the biggest electricity consumer in municipalities, while arenas are the biggest users of natural gas. Barriers to implementation should also be considered.
- **Focus on significant end uses:** Similar to the portfolio approach, the largest energy end uses should be prioritized. Street lighting is the largest end use outside of the building portfolio. Within the building portfolio (municipal buildings and arenas), lighting, ventilation, and arena process loads such as ice rink cooling are the largest end uses. Space

heating is by far the largest end use for natural gas, followed by domestic hot water heating.

2) Enable energy efficiency to be embedded in new facilities

- **Prioritize new construction and natural capital replacement:** Energy efficiency is a lot more cost-effective when only the incremental cost compared to standard efficiency equipment must be funded. Incremental costs for many measures are often negligible. Planning for energy efficiency should be undertaken when designing new facilities and planning for major capital replacement.
- **Establish priorities in reduction targets:** Due to the nature of Ontario's electricity generation mix and market factors, electricity has significantly lower GHG emissions compared to natural gas, while natural gas costs about 20% of electricity on a purchased unit energy basis. Therefore, natural gas measures should be favored when seeking to maximize utility cost reductions, and electricity measures should be prioritized when the objective is to maximize GHG emission reductions.

3) Invest in renewable energy

- **Focus on reduction, efficiency, and then generation:** Generation is the last option to consider due to high capital costs and complexity of implementation. Holistic retrofits will minimize energy use through waste reduction and

energy efficiency prior to the implementation of generation. This allows for smaller generating systems or a larger proportion of facility energy use to be produced than would have occurred without these retrofits.

- **Include non-energy benefits in decision making:** Renewable energy can have important non-energy benefits such as improved community resilience and reliability. Renewable energy can provide off-grid solutions where there is no access to power or there are trenched conduits. This can have an impact on diverse areas such as occupant comfort, health and safety, and potable water quality. Factoring in non-energy benefits can be crucial to getting buy in from decision makers and stakeholders, as well as making the business case for renewable energy more compelling.

The City of Pickering Energy Management Plan upholds a life-cycle philosophy that prioritizes operations and maintenance and continuous commissioning. These practices have underpinned the CEMP. The City owns and operates its equipment in a way that optimizes the potential for energy management through the proper management of the equipment throughout its entire life cycle. This maximization of assets results in increased efficiency and the extension of the equipment's life expectancy.





Pickering's Past Energy Management Progress (Results of the 2014-2019 Plan)

4.1 Project Highlights

Over the course of the 2014-2019 CEMP period the City of Pickering has reduced energy costs and improved performance at a number of facilities. In addition, the City has converted all of its streetlights to LEDs. These two initiatives combined has resulted in an annual energy savings of 4,468,239 kWh and \$622,051 in annual cost. Due to the progress made from the previous plan, the City was awarded the Conservation Champions Award in 2015 and 2017 from Elexicon Energy, and in 2018 the City was awarded the Largest Lighting Savings Award at the Powering Up Durham Save on Energy Symposium.



Due to the scale of the project and the overlay of departments involved, the LED Street Lighting Project reflects the City's ability to transform its infrastructure for the betterment of its residents.

Solar and LED Lighting in Parks

The City has installed solar-powered lights in the parking lot of Grand Valley Off-Leash Dog Park. Previously these parks were poorly lit and there was a prohibitive upfront cost associated with installing underground wiring. For that reason, an innovative and cost-effective solution was found to install 250W – 60 solar cell panels with batteries and a controller which stores the power and releases at night to power 72W LED lights.¹⁵

The new lights enhance the safety and security of the parking area, and illuminate the park, allowing for extended playtime for dogs and their owners during the winter months. The photovoltaic panels generate and store solar power in built-in batteries, which then power LED lights at night in public spaces. The lights are motion-activated and can be controlled remotely to allow for optimal light when motion is detected, such as a car pulling up to the parking lot or a person entering the park. Otherwise, light output is controlled to extend battery life and to ensure sufficient lighting when needed. Based on the success of this initiative, two solar lights were installed in the J. McPherson Park parking lot and four were installed along the new accessible asphalt pathways at Kinsmen Park.

LED Street Light Conversion



In 2018 the City completed a flagship project, converting over 7,000 of the City's streetlights to LEDs. The implementation was completed jointly by the City's Engineering Services, Finance, Operations and Sustainability staff. Replacement of streetlights to LED resulted in:

- An estimated savings of \$457,015 in annual energy and maintenance costs
- LED streetlights provide better visibility than conventional streetlights
- Safety for the residents with better lit roads
- A \$640,000 incentive from the IESO's SaveOnEnergy program

¹⁵ <http://www.illumiant.com/portfolio/city-of-pickering-dog-park>



Facility Retrofits

Energy use is often one of an organization's most substantial operating expenses. Energy audits determine the amount of energy used in the facility (by major equipment) and identify the specific conditions that are affecting the facility's performance and comfort. Over the course of the 2014-2019 CEMP, the City completed several capital projects in separate facilities resulting in \$165,036 in annual cost savings.

Conservation measures included in the capital projects were:

- LED Lighting Retrofits
- Chiller Retrofit
- Dehumidification Project
- Ice Storage Projects
- Refrigeration Integration Upgrade
- Supply Fan, Return Fan
- Boiler Retrofits
- Chiller Retrofits

The picture to the right shows the difference in lighting before and after the LED lighting retrofit and demonstrates the increased brightness for residents who use the facilities, resulting in better visibility, more comfort and greater user satisfaction.



Chestnut Hill Developments Recreation Complex Exercise Room: Before



Chestnut Hill Developments Recreation Complex Exercise Room: After

Electrification of Fleet Vehicles

The City’s Electric Vehicle (EV) strategy is part of the broader vision to create a sustainable and prosperous City as well as an immediate step to reduce the GHG emissions. The electrification of the municipal fleet holds great potential to reduce fossil fuel consumption and greenhouse gas emissions while providing vehicle operating, maintenance and health cost savings, for individuals and the community. The benefits associated with EVs align well with the City’s sustainability and livability goals by contributing to cleaner air, reducing noise pollution, introducing resiliency into the transportation system.

In 2019, the City of Pickering implemented a 7-year Electric Vehicle (EV) Strategy to replace all of the City’s small vehicles (sedans and SUV) with electric vehicles. This Strategy was informed by the success of a pilot EV project that began in 2018 when the City purchased their first electric vehicles. This pilot project provided an opportunity for staff to monitor the performance of these vehicles while reducing associated fuel consumption and carbon dioxide (CO₂) emissions. The results were favourable and the City has a strategy to replace all City small vehicles to electric by 2025.

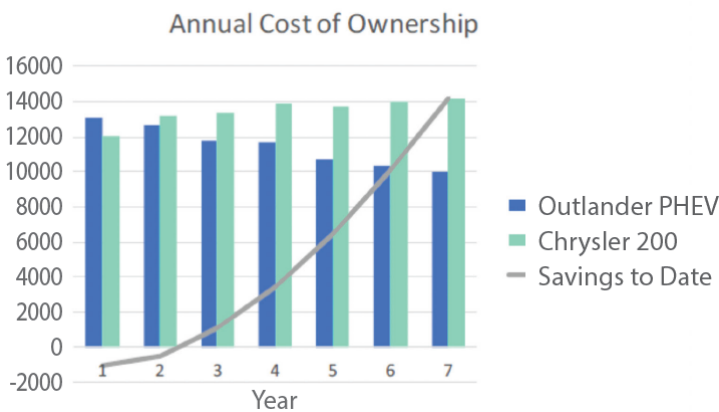


Exhibit 4: Total annual savings of Mitsubishi Outlander

The total cost of ownership and total savings for a 2018 Mitsubishi Outlander PHEV and a 2012 Chrysler 200 were plotted for each year to evaluate the annual savings of electric vehicle ownership. This does not include the resale value of the EVs. The City’s second vehicle Chevrolet Bolt EV has similar results.

The measurement and verification tool used was developed by a company called Fleet Carma to provide telematics devices and software to track energy usage, cost savings, increase fleet

Benefits of electric vehicles include:

- Improved air quality (reduces harmful air pollution from exhaust emissions)
- Costs savings (drivers will save thousands a year on fuel and maintenance costs)
- Low maintenance (does not require regular oil changes, coolant flushes, or mufflers)
- Future potential for Vehicle to Grid strategies, in which the battery capacity of connected vehicles can be tapped to support grid reliability and efficiency

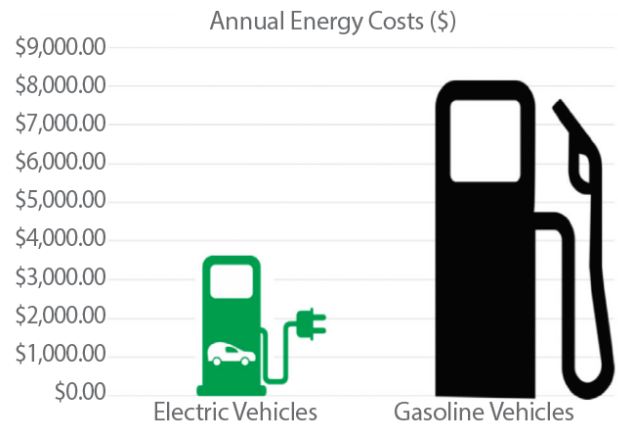


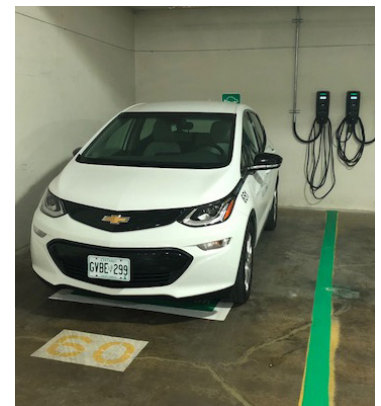
Exhibit 5: Savings in annual fuel costs

efficiency and maximize utilization of the electric vehicles. Please see Appendix for the full report.

Exhibit 5 demonstrates the annual fuel cost savings based on the data collected during the monitoring period from the pilot project.

Electric Charging Stations

To complement the electric vehicles, the City applied for the Workplace Electric Vehicle Charging Incentive Program and was selected to receive funding for electric vehicle charging stations. These stations are installed in the underground parking lot at City Hall for Corporate fleet vehicle charging.





Solar Energy

As part of the City's ongoing commitment to energy sustainability, a solar panel array was mounted on the roof of the Dr. Nelson Tomlinson Community Centre, and Fire Station #4. The 100 kW solar project in 2015 was completed through a joint partnership between Elexicon Energy (Formerly Veridian Connections Inc.), Queen Street Solar and Solera in cooperation with the City of Pickering. The revenue generated by renting the roof of the building will help fund the City's Green Initiative Fund, which focuses on future sustainability projects. The installation of the solar photovoltaic (PV) system is part of the Feed-In-Tariff (FIT) program, offered by the Independent Electricity System Operator.

Panels cover the majority of the south roof slopes, as well as the main roof of the gymnasium. Approximately 100,000 kWh of electrical energy is produced by the panels annually and fed back into Ontario's electricity grid. Additionally, just over 61,000 kg CO₂ emissions are avoided per year.¹⁶

4.2 Summary Table of Project Highlights

The following table provides a brief highlight of the landmark projects completed. It is not a complete list of every capital project completed by the City and does not reflect all energy savings achieved.

16 <https://www.pickering.ca/Modules/News/index.aspx?feedId=5dc74cc8-c7b5-43f1-904c-ab24fc21ae17,ef5adafb-d620-422b-bd9d-b646d8b38d-4c&newsId=d34b2aa6-a927-4fe3-989b-e983236a0c32>

Project Category	Project Name	Project Details	Impact
LED Light Conversion	LED Street Light Conversion	The City converted over 7,000 streetlights to LED.	<ul style="list-style-type: none"> • \$457,015 estimated annual energy cost savings • Better visibility and safety for residents
	Solar and LED Lighting in Parks	The City installed solar-powered lights in the parking lots at Grand Valley Off-Leash Dog Park, Kinsmen Park and J.McPherson Park.	<ul style="list-style-type: none"> • New lights enhance safety and security • Lights are motion-activated and can be controlled remotely to allow for optimal light and extended battery life
Facility Retrofits	Chestnut Hill Developments Recreation Complex	The City converted the lights in the tennis court, exercise room, skating rinks and swimming pool to LED lamps, retrofitted the chiller and supply fans.	<ul style="list-style-type: none"> • \$163,775 estimated annual energy cost savings • Combined these projects use 60% less energy • Better visibility for residents resulting in increased satisfaction
	East Shore Community Centre	The City converted the hallway and various room lights in the community centre to LED.	<ul style="list-style-type: none"> • Reduced energy consumption, better visibility and resident satisfaction • \$1,261 estimated annual energy cost savings
	Mechanical Upgrades	The City installed new energy efficient air handling units with variable frequency drives in fourteen locations throughout the City.	The City received provincial incentives for these upgrades through the SaveONenergy program
	Firehall 6	The City installed LED lighting conversions with controls.	The Firehall has enhanced the safety in the building by increasing the brightness in various rooms and hallways in the building
Electric Vehicle Initiative	Electric Charging Stations	The City was selected for the Workplace Electric Vehicle Charging Incentive Program and received three EV charging stations. Recently, the City expanded its charging infrastructure and now has a total of six EV charging stations.	<ul style="list-style-type: none"> • The EV stations were funded in part by the province • The stations are installed for fleet vehicles in the underground parking lot at City Hall
	Electrification of Fleet Vehicle	EV pilot project launched in 2018 when the City purchased two EVs, the Chevrolet Bolt EV and Mitsubishi Outlander PHEV. In 2019, the City expanded its program with three additional EVs, two Mitsubishi Outlander PHEVs and a Nissan Leaf EV.	The vehicles have a 3-year payback period with an estimated lifetime savings of \$14,166
Renewable Energy	Dr. Nelson Tomlinson Community Centre	100kW rooftop solar project completed in 2015.	<ul style="list-style-type: none"> • The project was developed in partnership with Elexicon Energy, Queen Street Solar and Solera within Ontario's Feed-in Tariff Program • The City leases the roof of the community center and earns \$6,000 annually

Exhibit 6. Pickering's Current Energy Use and GHG Consumption



Pickering's Current Energy Use and GHG Consumption

5.1 Summary of 2017 Building Energy Use

From January 2011 to December 2017, the City of Pickering's energy use intensity and carbon intensity has consistently trended downwards. Weather normalized energy use intensity was 9% lower in 2017 compared to 2011, and carbon intensity was 34% lower in 2017 compared to 2011, reducing greenhouse gas emissions by 1,040 tons CO₂ emissions per year.

The most recent full year of energy consumption data available for the City of Pickering is January to December 2017, as reported under Ontario Regulation 507/18. The City reported energy consumption data for 26 facilities comprising 700,000 ft² of floor space.

Total energy consumption was 71,950 GJ consisting of 9,584 MWh of electricity (48.0%), 993,960 m³ of natural gas (51.5%) and 10,065 litres of fuel oil (0.5%). Total GHG emissions associated with this energy consumption were 2,073 tons CO₂, of which electricity contributed 8.0%, natural gas 90.7%, and fuel oil 1.3%.

Energy use is concentrated in a few large facilities, with the three largest consuming over 70%. Exhibits 7 and 8 summarize the City's facility energy use by facility type and end use.

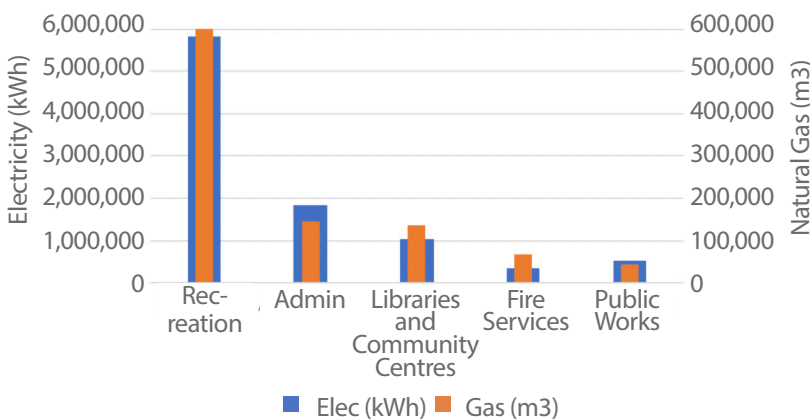


Exhibit 7: 2017 Energy Use by Facility Type

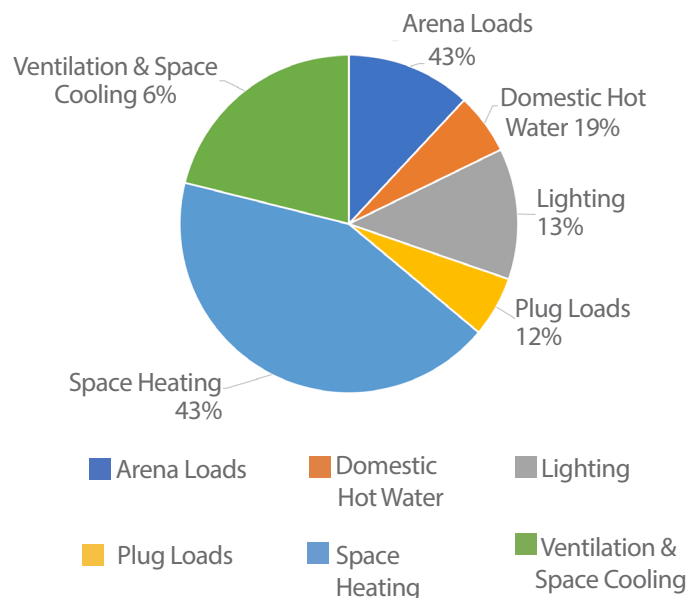


Exhibit 8: Estimated City Energy Usage by End Use



Rendering - Pickering City Centre Redevelopment Project¹⁷

Opportunities for Future Energy Management

Energy management is a cross-cutting issue that impacts numerous departments within the Corporation. Given this complexity, the City views energy management as an opportunity to advance community resilience, increase economic development and improve sustainability. The sections below highlight several opportunities that the City is keen to explore further during the 2019-2024 timeframe.

6.1 Distributed Energy Resources

Most of the City's facilities located in south Pickering are serviced by one transformer station - the Cherrywood Transformer Station (TS). The TS is constrained, meaning it will need to be upgraded if load growth continues, as the load passing through the transformer station cannot be increased without substantial investment in upgrades. The scale of alternative 'distributed energy resources' can vary – from a single home to subdivision or city block. They can increase the City's resiliency, improve reliability, result in bill reduction if deployed strategically, improve energy security, and can help mitigate greenhouse gas emissions.

Accordingly, the City recognizes the Cherrywood constraint as an opportunity to collaborate with developers, the local utility and the tiers of government to explore innovative distributed energy resource (DER) options to managing the grid. These opportunities may be assessed through low cost planning and action one geographic area at a time, with consideration for environmental impacts, for managing electricity supply and demand using all means available and necessary, including demand response, distributed generation (DG), energy efficiency, electricity and thermal storage, and load management.¹⁸ Given the unique status that the Cherrywood TS poses, the City will continue to explore opportunities with the local utilities.

Hydro One will need to upgrade the Cherrywood TS to accommodate the additional load, which will be performed at end of useful life. However, this investment can be deferred by targeted energy efficiency and demand response, and strategic deployment of energy storage and/or renewable energy, such that demand is reduced where the community and energy system will benefit the most. Currently, the Ontario Energy Board is engaged in a series of consultations that will shape the way distributed energy resources are deployed. These policy developments may occur within the lifecycle of the 2019-2024 plan.

¹⁷ Courtesy of Architects Alliance. Note, artistic renderings subject to change.

¹⁸ <https://pubs.naruc.org/pub.cfm?id=536EF440-2354-D714-51CE-C1F37F9B3530>

DERs have the potential to reduce the load on the Cherrywood TS more cost-effectively than large-scale upgrades to the grid. The opportunity to defer investment in this way makes these resources a good investment for the people who live in the region, who will ultimately benefit by increased resilience in the grid and lower increases in energy cost, and for the environment, as these strategies are often 'clean' approaches to energy management.

6.1.1 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.¹⁹

6.2 Community Energy Cooperatives

Energy cooperatives provide an opportunity for investors to pool resources to develop energy projects that are more cost-effective than if deployed on a smaller scale, providing a better rate of return for investment in clean energy.²⁰ A number of energy cooperatives exist in Ontario, but were fueled by the province's Feed-in Tariff program, which is no longer offered. However, the cost of renewable energy (e.g. solar), has become competitive with alternatives and working in collaboration with utilities, regulators, and system operators, there may be future opportunities for local cooperatives, as distributed energy resources are an economically viable resource in the absence of incentives.

In Denmark and Germany, there are collectively over 1,000 wind energy cooperatives.²¹ There are many local economic benefits associated with municipal energy cooperatives, during construction and throughout their operation; they create jobs, and profits are collected by local investors who then re-invest in other local businesses.

In Ontario there are 46 actively registered cooperatives. There is an opportunity for cooperation between renewable energy cooperatives and municipalities by:

- Broaden and deepen energy engagement in communities
- Find untapped resources and skills to resolve Community Energy Plan (CEP) implementation challenges
- Develop new financing options based on shared business models

District energy, demand response, energy storage, energy efficiency, community solar and sustainable transportation are all avenues that new business models can emerge.²²

6.3 Energy Management Best Practices

Energy management requires that staff at all levels understand their role and play a part in achieving the goals of the Plan. Across the City's departments a culture of conservation takes place, for instance, the Parks Operations staff use electric property maintenance tools such as lithium-ion powered line trimmers, hedge trimmers, handheld blowers, and chainsaws as opposed to gasoline powered tools. These electric tools reduce emissions and noise for resident satisfaction. Despite having a culture of conservation, the practice of energy management is often in competition with other priorities. It can be difficult to find the time to think about energy management. In addition to time constraints, the City does not currently have the technology in place, such as sub-metering and advanced building analytics, that enable optimization of energy usage to its full potential. A key recommendation of this Plan is that the appropriate metering be installed. However, the success of the measure depends on prioritizing energy management; making it a key priority for building operators and all City staff, ensuring they have the resources required to achieve energy management goals.

19 <http://www.ieso.ca/en/Learn/Conservation-and-Energy-Efficiency/Municipal-Energy-Profile>

20 <http://www.trec.on.ca/community-power/>

21 https://www.trec.on.ca/wp-content/uploads/2016/08/2016_coop-arecc_report_final_screen.pdf

22 <https://cleanairpartnership.org/cac/wp-content/uploads/2018/06/TREC-Webinar-June-14.pdf>

Energy management best practices have been formalized, and many resources are available through ENERGY Star and NRCan that provide guidance and tools. Best practices place emphasis on setting specific objectives for individuals and facilities in terms of energy performance, implementing dashboards to monitor progress, and adopting a framework of continuous improvement.

A key constraint identified by many stakeholders was a lack of time to focus on energy management. Expanding roles and responsibilities to make energy efficiency a key performance indicator at all levels of the organization is an effective approach. The City will need to explore the adequacy of existing resources as roles and responsibilities expand. Success will come from talking with the various stakeholders in the City to better understand what will motivate them to support and participate in energy management.

Another important element for integrating energy management across the various City departments is to put an emphasis on staff training. Providing training for City staff presents an opportunity to have a more rigorous implementation of the Plan. For example, existing fleet mechanics who may not be well-versed in electric vehicles could be offered training to help them adapt to the changing landscape of technology.²³ Exhibit 9 demonstrates the various benefits of training for a variety of stakeholders. Note: Natural Resources Canada's (NRCan) Exhibit 9 refers to 'Senior Management', for relevance to Pickering, this is implied to include Mayor and Members of Council as well as CAO and Directors.

Primary benefits of energy management training				
Benefit	Senior management	Energy manager	Facility operators/ managers	Building occupants
Gain new knowledge and skills		✓	✓	
Increase energy savings and cost savings	✓	✓		✓
Reduce downtime and maintenance costs		✓	✓	
Increase staff engagement	✓	✓		✓
Enhance corporate culture	✓	✓		
Contribute to professional development or certification		✓	✓	
Reduce environmental impact	✓	✓	✓	✓
Enable a better built environment	✓	✓	✓	✓

Exhibit 9: Benefits of Energy Management Training

23 https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oeefiles/pdf/publications/commercial/EMT_Primer_en.pdf

6.4 Water Conservation Best Practices

With 34% of municipal electricity consumption and 11% of natural gas consumption being used for water and wastewater treatment and pumping, 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. Per capita consumption in 2011 was estimated at 250L/day.²⁴ In Durham, on average, household use 270L/day, 20L more than the national average.²⁵ More broadly, the City's Corporate water consumption is illustrated in Exhibit 10. Concurrently, commercial and industrial operators are paying to dump raw or partially treated industrial wastewater directly to municipal sewers. Reducing water and wastewater means less energy consumed for pumping and treatment.²⁶

The following measures are best practices for water conservation:

1. **Water efficient fixtures:** Installing low flush toilets and urinals, low flow faucet aerators, motion sensor activated fixtures.
2. **Diversion and collection:** Installing water collection in institutional buildings to be reused for landscaping.
3. **Non-potable water use:** Installation of infrastructure to capture and distribute non-potable water such as greywater and rainwater for non-drinking applications such as gardening and toilet flushing.

The benefits of using water efficiently include:

- A reduced water bill,
- The ability to delay expensive upgrades to the system, and
- The efficient use of resources for future generations.

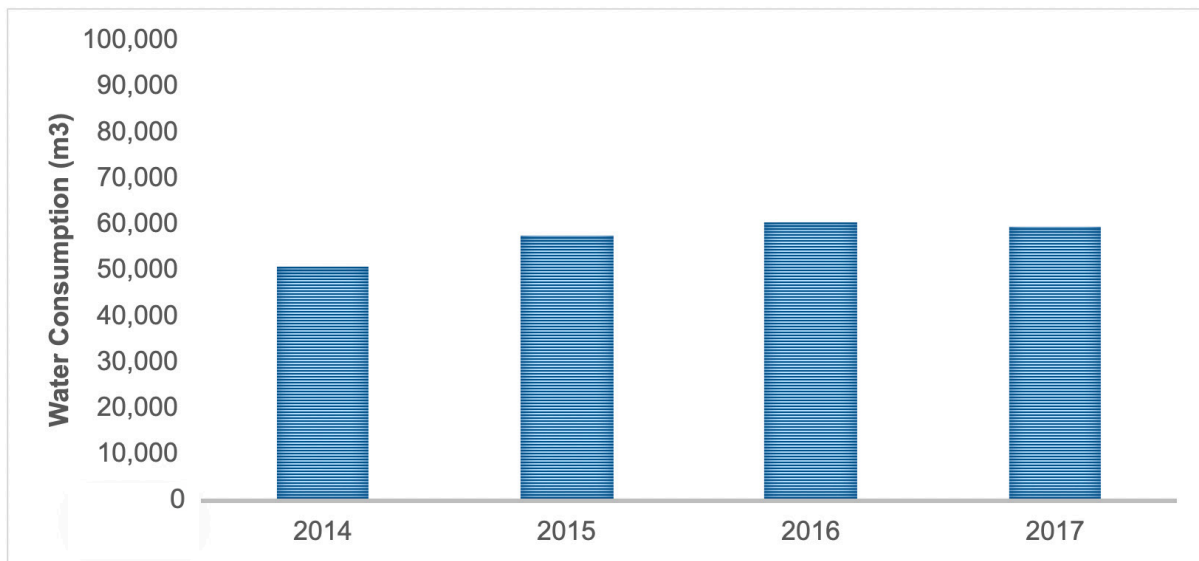


Exhibit 10: City of Pickering Corporate Water Consumption

24 <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/residential-water-use.html>

25 <https://www.oshawa.ca/residents/conserving-water.asp>

26 <http://www.ieso.ca/en/Learn/Conservation-and-Energy-Efficiency/Municipal-Energy-Profile>

6.5 New Municipal Construction Projects

Pickering is experiencing a major intensification of development. Development of new buildings will result in increased energy consumption, water, waste and GHG emissions. There is a need and an opportunity to integrate energy management practices at the onset of development.

The City's Sustainable Placemaking Policy is about the transformation of the City from a suburban community to a sustainable city. It is about transforming the City into a unique place that celebrates its past, capitalizes on its existing attributes and assets, while planning for current and future generations. It cannot rely on conventional planning processes — the journey to achieve a truly sustainable city requires new and innovative ways of doing business.

The City's approach to Sustainable Placemaking is founded on 10 principles:

1. Draw on the expertise of the community
2. Encourage collaboration at all levels
3. Go beyond design Codes; pay attention to function, appearance and experience
4. Aim for zero impact as the ideal, in carbon, and other footprints
5. Design and plan for people
6. Strive to make Pickering a distinctive community
7. Adapt to change
8. Learn by doing: use pilot projects and experiments to test new ideas
9. Keep moving in the right direction; the journey will never be finished
10. Strive always to achieve the greater public good

Developing solar-ready roofs is one example where Sustainable Placemaking converges with new developments and energy management. In addition, the City is working closely with Enbridge to incorporate "Savings by Design", a program that supports improved energy and environmental performance in new construction projects.²⁷ New developments are a long-term investment and contribute to the broader vision of creating a sustainable city.

Within the next 5-8 years the City of Pickering has several anticipated buildings that are in the design phase. The City will target 15% above Code, where feasible for the listed buildings.

- Performing Arts Centre
- Seniors & Youth Centre
- Central Library Facility
- Pickering Heritage & Community Center
- Seaton Recreation Complex & Library
- Seaton Regional Library
- Animal Shelter
- Fire Station A
- Fire Station B
- Northern Satellite Operations Centre

²⁷ <http://commercial.savingsbydesign.ca/>

Early engagement in the design process is necessary to understand opportunities for energy management and potential funding. The difference between designing these buildings to Code versus designing to meet high performance standards could result in long term energy cost savings. As part of this Plan, decision-makers, such as City planners and developers are encouraged to contact the City's energy management team so that the alignment of development is in sync with energy management opportunities. Pilot projects to test innovative ideas and approaches are encouraged as long as it's proven technology and is able to reduce risk of energy savings not being achieved. If the energy savings are not realized as claimed, the extended payback period would result in a lack of funding available for other important projects, especially those projects that are part of the City's facilities and operations and maintenance cycle. Moreover, the development lifecycle for new builds often exceeds five years. Energy management measures identified in the design phase may extend beyond this CEMP planning cycle. Ensuring early and on-going engagement throughout the new construction process is important especially because provincial and federal policies change and opportunities may arise enabling the City to secure funding to implement energy management practices into the new development.

Early and ongoing engagement with stakeholders could uncover unique and collaborative projects that can combine energy management technology and community resilience. For instance, the Pickering City Centre presents an opportunity to explore microgrid feasibility. A microgrid could increase the community's resilience by enabling buildings to operate during electrical brownouts. In order to operationalize this opportunity, an early commitment is required to conduct a pre-feasibility study.

6.6 Tools to Monitor Building Systems Performance and Perform Evaluation, Measurement, & Verification

The City has a Building Automation System (BAS) Standardization. Based on the life cycle replacements of equipment, the City seeks to enhance the BAS system so that over time it is integrated across all buildings resulting in enhanced capacity for evaluation, measurement and verification.

Currently, the City uses variable frequency drives (VFDs) as a standard, for reducing energy consumption and enabling soft

starts of equipment that do not stress the power supply or cause energy spikes during start up. The City also uses lighting control system and occupancy sensors to achieve lighting efficiencies and control lighting use in unoccupied times.

The City is exploring options to increase the effectiveness, including the installation of equipment such as:

- an energy management software
- building automation system upgrades
- sensors
- control equipment
- metering equipment
- related communication systems

With this approach, the City is able to consider the design and installation of back up equipment that would enable planned and preventative maintenance. As buildings become 'smarter', managing their day-to-day energy use efficiently could be furthered by information systems that can track and monitor usage, and identify abnormally high building consumption in real-time. These alerts can prompt building operators to intervene to correct the abnormal building behaviour. In addition, improved planned and preventative maintenance extend the life cycle of major equipment deferring capital replacement costs. Consequently, poorly serviced equipment costs more to operate. Building automation systems optimize the energy consumption of buildings. Many of these systems are complex, and building operators may require specialized training to realize the automation system's full benefit. Building operators need to be familiar with the BAS interface and have a clear understanding of how their actions influence energy consumption and demand. Building operator training is done prior to turnover of any construction, renovation or energy retrofit project and on an ongoing basis as required.

Moreover, BAS systems can also be used to track behavioural events or programs which rely upon 'whole building' analysis of energy use to derive performance and energy savings. Advanced data systems and monitoring systems can allow facility operators to identify faulty equipment in advance of the point of failure. For example, when a motor is running hotter than usual, this can trigger the dispatching of a technician to diagnose and resolve issues proactively, avoiding costly business interruptions. The BAS upgrade and system expansion directly aligns with the City's continuous re-commissioning philosophy.

6.7 Proposed Measures for 2019-2024

Action	Description	Implementation Timeframe	Estimated Annual Savings (electricity, natural gas, \$)	Estimated Incremental Implementation Cost
Predictive Maintenance System – Phase I	Install a predictive maintenance system to support facility staff in operations, maintenance, and continuous commissioning activities. Begin with the largest buildings and sub-systems.	2020-2021	240,000 kWh/yr 50,000 m ³ /yr \$50,000/yr	\$200,000
Predictive Maintenance System – Phase II	Continue incorporating buildings and sub-systems into the predictive maintenance system.	2022-2023	140,000 kWh/yr 20,000 m ³ /yr \$30,000/yr	\$120,000
Energy Management Information System – Phase I	Install sub-metering equipment and energy management software to enable facility staff to identify energy savings opportunities, benchmark facility energy use, set performance targets, and monitor progress. Begin with the largest buildings and sub-systems.	2020-2021	190,000 kWh/yr 20,000 m ³ /yr \$40,000/yr	\$160,000
Energy Management Information System – Phase II	Continue incorporating buildings and sub-systems into the energy management information system.	2022-2023	140,000 kWh/yr 10,000 m ³ /yr \$20,000/yr	\$80,000
Major Capital Replacement (Existing Facilities)	Provide dedicated Energy Management Team resources to evaluate energy efficient options for equipment or processes purchased for end of life replacements for existing facilities. Lifecycle costing incorporating energy and operation and maintenance costs should be employed to determine the best net present value. Incorporate new equipment in the Building Automation System.	2019-2024	120,000 kWh/yr 20,000 m ³ /yr \$30,000/yr	\$120,000/yr*
Recommissioning for Major Renovations	Recommission all energy consuming equipment at the end of major renovations to meet the current needs of the facility.	2019-2024	240,000 kWh/yr 30,000 m ³ /yr \$50,000/yr	\$200,000/yr*
Lighting Retrofits (Interior and Exterior)	The lighting retrofits have been grouped together into a "Lighting Bundle". The remaining interior and exterior lights, including the parking lot lights at City buildings, will be replaced with LED lights.	2019- 2024	380,000 kWh/yr 0 m ³ /yr \$60,000/yr	\$460,000
Exceeding Code Energy Performance for New Construction	New City of Pickering facilities are designed and constructed to exceed applicable building Code by at least 15%.	2019-2024	2,000,000 kWh/yr 200,000 m ³ /yr \$370,000/yr	Estimated to be 15% higher than Code compliant facility

*Note: The cost per year is only for the duration of the implementation timeframe of 2019-2024, however the cost savings per year will continue past the five year timeframe.

Exhibit 11: Proposed Measures for 2019 – 2024

6.8 Funding Pathways

Within a municipality, it is very common for maintenance 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. This Plan has been developed bearing in mind the evolving policy landscape and is designed to be flexible to changes in the availability of funding. The available incentive programs and carbon pricing mechanisms are changing; there is some uncertainty as to whether or not such sources of funding will exist throughout the lifecycle of the Plan to fund projects. To realize the goals and objectives outlined in this Plan, the City has a variety of funding mechanisms that can be leveraged to fund energy management initiatives.

Funding Mechanism	Description	Considerations
Capital Budget	Each year City Council approves an annual budget for all of the City's operational areas.	The project must have 4 year payback to be included in the capital budget, where possible.
Bundling Cost	Bundling measures with short payback (e.g. lighting) with measures that have longer payback periods is a great way to get the buy-in for large-scale projects of high capital costs.	Bundling high payback end of life asset replacement projects with high energy saving projects of shorter payback periods to reduce the overall payback period to fewer number of years and increase the likelihood of a successful business case for the project.
Government and Utility Incentives	<p>Enbridge Gas Distribution offers incentives to help offset the cost of installing energy efficient natural gas equipment in buildings.</p> <ul style="list-style-type: none"> Enbridge's Savings by Design is a green building initiative created to help builders design and construct buildings and houses with high energy performance and to help homebuyers and residents save on their energy costs. This comprehensive program offers support and financial incentives during the design and construction stages of building and housing projects. <p>The Federation of Canadian Municipalities has:</p> <ul style="list-style-type: none"> The municipal asset management program which delivers asset management training to municipalities, The Green Municipal Fund (GMF) that finances capital projects focusing on those related to fossil fuel in fleets, projects that reduce GHGs and storm water and wastewater. 	<ul style="list-style-type: none"> Government and utility incentives change and evolve based on the political agenda of the political party in power. Continuous monitoring of policy directives will provide insights on new incentive programs on the horizon. The GMF as of March 31, 2018, has \$599 million available to fund green municipal initiatives across Canada. Application for Savings by Design are found on the Enbridge website and a limited number of applications are accepted on a rolling basis. Save on Energy programs by the IESO are scaling down as of March 2018, however they will remain in operation until 2020 and may be extended beyond this time period.
Green Initiative Fund	In 2016, the City developed a fund that was established to finance energy management initiatives from the revenue generated from the City's 100kW solar system and incentives dollars from energy retrofits. Revenues are "recycled" back into a reserve fund to finance additional sustainability projects.	<ul style="list-style-type: none"> The key success factor is early engagement with facility operators. This provides a head start on soliciting project ideas and to address any potential challenges associated with the project. The City may consider matching these funds initially to build up the reserve. The reserve can be used to finance (in whole or in part) energy projects, energy studies, pilot projects and other similar energy related activities. Policies are typically used to define how the revenues will be used and the steps that must be fulfilled to supersede those conditions. A simple proposal template can be used as a tool to aid decision makers on proposed projects to fund. Projects through this fund should aim for 4 year payback, where possible.

Exhibit 12: Funding Pathways

6.9 Education and Awareness

The City of Pickering is increasing its focus on energy awareness to further encourage energy conservation and efficiency. The City has a newsletter that provides updates on completed and on-going projects to keep residents informed. There are also numerous resident outreach events such as the Energy Booth at Sustainable Pickering Day and the Farmers Market. During these events, the Energy Management Team educates residents on how the City is reducing energy consumption and costs. The team also provides recommendation on how residents and businesses can reduce their own energy consumption and costs. Following the City on social media (Facebook, Twitter and Instagram) is a great way to stay up to date with the energy management engagement initiatives.

The Energy Management Team actively engages staff by coordinating site tours of neighbouring municipalities and institutions energy efficient buildings. The Team also hosts presentations for City staff with subject matter experts and creates continuous learning opportunities by frequently sharing webinars and conferences series with relevant staff and departments. In 2019, the City's Energy Management Team hosted workshops where subject matter experts shared insight on Net Zero, and Passive House Buildings. The impact

of developing a strongly engaged and supportive team is that staff are more informed, educated, and more likely to consider energy in their operations.

There is an increasing opportunity for facility staff to get technology-specific training and attend in-depth energy management courses to expand on their system and energy management knowledge. For example, Building Environmental Systems (BES) Operator training, is designed to train technicians in the operation of today's complex buildings. In addition, the Local Authority Services has a Train the Trainer program, which is helpful for building operators. These programs focus on the concept that "buildings are systems", in which heating, air conditioning, refrigeration, ventilation, electrical power, lighting, water and air supply are not isolated, but connected and interdependent.²⁸ Incorporating behaviour-based incentives such as providing recognition through competitions and awards is an excellent way to keep City staff engaged in energy saving activities at the workplace.



City's first 100% Electric Vehicle

28 Seneca's Building Environmental Systems (BES) Program.



Conclusion

The CEMP 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 2014 to 2019 CEMP. The proposed measures outlined in this plan have a 15% energy reduction and 15% reduction in GHG targets. In line with these targets, the City has a goal to construct new buildings that are 15% more efficient than the Ontario Building Code. Achievement of these targets would reduce Pickering's energy costs by approximately \$650,000 per year and decrease total GHG emissions by 310 tCO₂e per year.

The City of Pickering is committed to energy conservation as a critical component of its operations. By leveraging best practices and technology, the City will effectively integrate energy management into its operations. The City's energy management strategy will guide the implementation of this Plan. The three-pronged approach consists of the following elements;

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

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

Energy management requires that Members of Council and staff at all levels understand their role and play 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 develop its culture of conservation and continuous improvement.

One Team. One Vision. Infinite Possibilities.

Appendices

8.1 2014-2017 City of Pickering Energy Consumption and Greenhouse Gas Emissions Report

The tables below are summaries of the energy consumption and greenhouse gas emissions reporting data for 2017 for the City of Pickering.

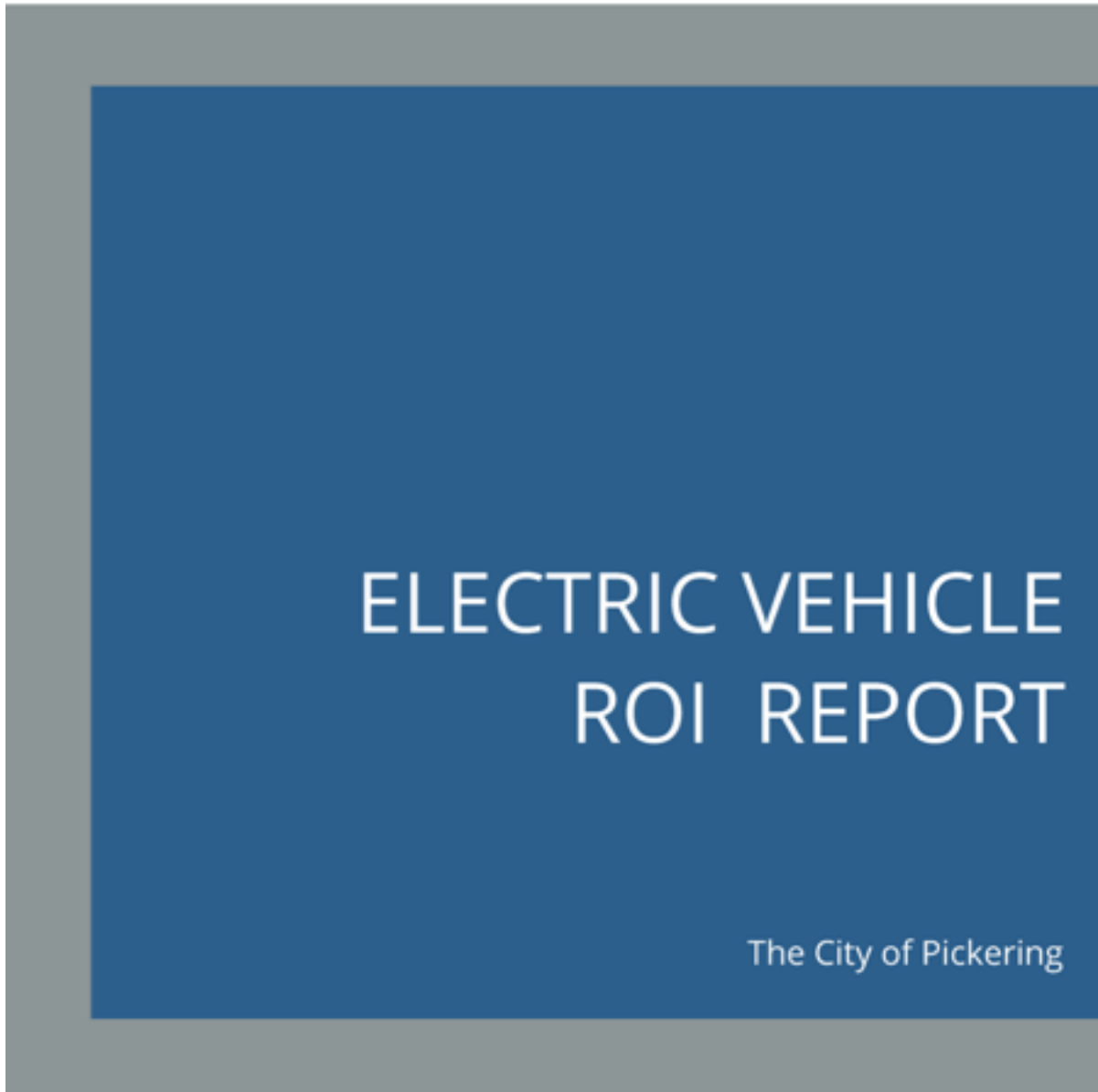
2014-2017 Energy Consumption and Greenhouse Gas Emissions Report

Operation Name	Operation Type	Total Floor Area (sqft)	Avg hrs/wk	Electricity Quantity (kWh)	Natural Gas Quantity (m ³)	Fuel Oil 1 & 2 Quantity (L)	GHG Emissions (kg)	Energy Intensity (ekWh/sqft)
Animal Services	Offices, facilities, council chambers	2,725.00	34	35151.80		5253.80	14978.02	33.68
Brougham Hall	Community centres	2,400.00	3	53668.85			928.36	22.36
Centennial Park Club House	Community centres	1,545.00	13	34365.24			594.45	22.24
City Hall	Offices, facilities, council chambers	137,908.00	48	1789262.46	145685.11		306386.86	24.20
Claremont CC & Fire Stn 4 & Library	Community centres	18,183.00	17	136298.00	38859.00		75825.56	30.21
Don Beer Arena	Indoor ice rinks	94,211.00	104	1578598.00	77862.00		174514.59	25.54
Dunbarton Pool	Indoor swimming pools	20,790.00	102		106969.00		202238.48	54.68
East Shore CC & Senior's Cntr	Community centres	28,766.00	91	271956.85	31259.50		63804.36	21.00
Fire Station # 2	Fire stations, incl. offices and facilities	7,955.00	168	64737.14	34646.00		66622.49	54.42
Fire Station # 5	Fire stations, incl. offices and facilities	13,360.00	168	181757.91	24020.00		48556.91	32.71
Fire Station # 6	Fire stations, incl. offices and facilities	9,130.00	168	102245.02	10600.00		21809.28	23.54
Green River CC	Community centres	3,210.00	1	32787.72			567.16	10.21
Greenwood CC	Community centres	8,400.00	27	76979.85	6215.00		13081.84	17.03
Greenwood Library	Public libraries	1,728.00	12	6583.76	1962.00		3823.30	15.88
Mount Zion CC	Community centres	2,150.00	25	4650.22		3544.00	9773.83	19.93
Operations Centre	Storage facilities	71,035.00	55	541092.00	43665.00		91914.04	14.15
Petticoat Creek Community Centre	Community centres	17,190.00	68.5	247832.00	44011.00		87495.38	41.63
PMV Gas & Steam Barn	Cultural facilities	5,975.00	48	7304.94	1933.00		3780.94	4.66
PMV NE/Post Misc Building Use	Cultural facilities	6,290.00	30.5	5625.69			97.31	0.89
PMV Puterbaugh Schoolhouse	Cultural facilities	480.00	30.5			1266.90	3465.17	28.45
PMV Redman House	Cultural facilities	2,803.00	56	32619.97	5969.00		11849.41	34.27
PMV Robert A Miller	Cultural facilities	3,127.00	48	42211.05			730.17	13.50
Recreation Complex	Indoor recreational facilities	230,120.00	113	4258205.84	414840.00		857966.15	37.66
West Shore CC	Community centres	7,500.00	58	39528.28	5462.00		11010.36	13.01
Whitevale CC	Community centres	2,120.00	12.8	24547.80			424.63	11.58
Whitevale Library	Public libraries	900.00	11	15774.34			272.86	17.53

8.2 2014-2017 City of Pickering Water Consumption Data

Facilities	2014	2015	2016	2017
Centennial Park Club House	162	160	262	133
Chestnut Hill Developments Recreation Complex (Arena), 1867 Valley Farm Rd	3,163	3,411	7,955	3,817
Chestnut Hill Developments Recreation Complex (Pool), 1867 Valley Farm Rd	14,234	15,351	13,550	17,178
Chestnut Hill Developments Recreation Complex, 1867 Valley Farm Rd	14,234	15,351	13,550	17,178
Civic Complex, One The Esplanade	2,774	3,738	3,606	2,429
Don Beer Arena, 940 Dillingham Rd	8,852	11,524	11,131	10,225
East Shore Comm Centre, Senior's Centre, 910 Liverpool Rd	968	1,342	1,631	1,156
East Shore Community Centre, 910 Liverpool Rd	968	767	1,631	1,130
Operations Centre, 2570 Tillings Rd		74	1,265	730
Petticoat Creek Community Centre, 470 Kingston Rd	273	187	240	223
Petticoat Creek Community Centre, Library, 470 Kingston Rd	273	187	240	223
Pickering Fire Station # 2, 553 Kingston Rd	412	610	390	505
Pickering Fire Station # 5, 1616 Bayly St	625	790	1,164	940
Pickering Fire Station # 6, 1115 Finch Ave	731	855	687	738
Pickering Public Library, Central Branch, One The Esplanade	2,774	1,792	2,835	2,429
Progress Club House, 680 Front Rd	9	733		
West Shore Community Centre, 1011 Bayly St	309	546	445	485
GRAND TOTAL	50,760	57,417	60,581	59,518

8.3 Fleet Carma Report



The City of Pickering

NOVEMBER 2018
7 YEAR SERVICE LIFE



8.3 Fleet Carma Report



Electric Vehicle ROI Report: City of Pickering

Welcome to your Electric Vehicle ROI Report. Using the data collected on your current electric vehicles, we are able to determine what the cost savings of operating these vehicles compared to conventional vehicles. We are excited to share this report with you, and hope you feel empowered to drive electric.

Section 1: Current Vehicle Statistics

2018 Mitsubishi Outlander PHEV



2018 Chevrolet Bolt BEV



These four statistics allow us to see the big picture as to how your current vehicles operate.

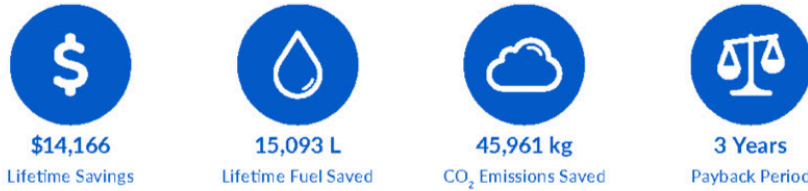
- The annual mileage demonstrates the overall use of the vehicle and impacts the total costs to operate it over the course of any given year.
- The fuel consumption shows the current equivalent amount of fuel needed to operate your vehicle and the possible efficiencies that have been gained by switching to electric vehicles.
- The distance per driving day shows the range required for each electric vehicle on average. This provides you with insight of how far you are going on the days you use your vehicle.
- The CO₂ emissions rate from your current electric vehicles allows you to establish a new carbon footprint baseline, demonstrating all the good you are doing by driving electric.

8.3 Fleet Carma Report

Section 2: What Have I Saved?

2018 Mitsubishi Outlander PHEV

Using your driving data, we evaluated the 2018 Mitsubishi Outlander PHEV currently in use by the City of Pickering to a comparable non-electric vehicle, the 2012 Chrysler 200. This is the vehicle the Outlander was chosen to replace and has been used in this analysis to determine the return on investment. This analysis calculated a payback period of 3 years, the minimum time recommended to keep the EV to have a positive return on investment.

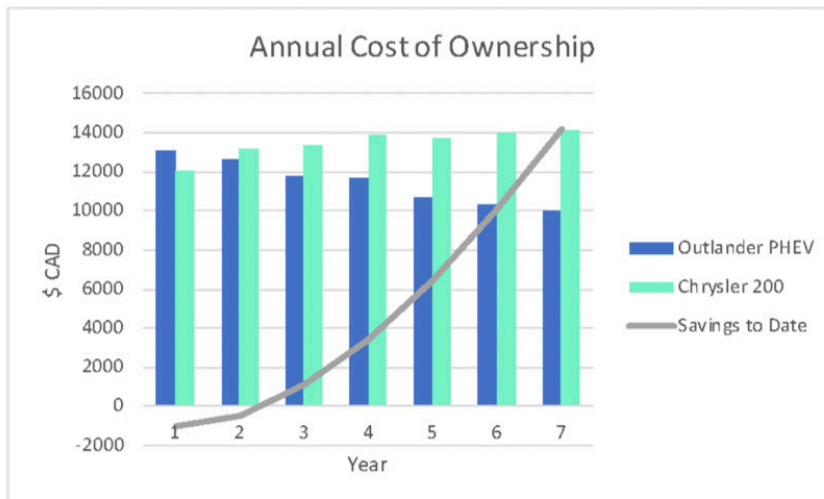


The total cost of ownership and total savings for a 2018 Mitsubishi Outlander PHEV and a 2012 Chrysler 200 were plotted for each year to evaluate the annual savings of electric vehicle ownership.



2018 Outlander PHEV - \$45,054 (MSRP)

2012 Chrysler 200 - \$26,266 (MSRP)



8.3 Fleet Carma Report

Section 2: What Have I Saved?

2018 Chevrolet Bolt BEV

Using your driving data, we evaluated the 2018 Chevrolet Bolt BEV currently in use by the City of Pickering to a comparable non-electric vehicle, the 2018 Honda Pilot. The City of Pickering would have considered a mid-size SUV within the price range of \$35,000 to \$45,000 if the Bolt was not purchased. The Honda Pilot is well suited for this analysis with an MSRP of \$40,500. Using these two vehicles, the analysis calculated a payback period of 2 years, the minimum time recommended to keep the EV to have a positive return on investment.



\$12,945
Lifetime Savings



11,656 L
Lifetime Fuel Saved



35,224 kg
CO₂ Emissions Saved



2 Years
Payback Period

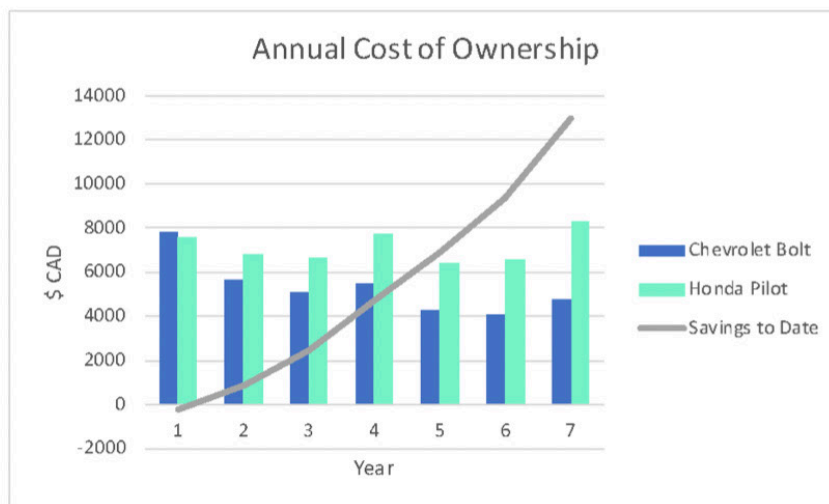
The total cost of ownership and total savings for a 2018 Chevrolet Bolt BEV and a 2018 Honda Pilot were plotted for each year to evaluate the annual savings of electric vehicle ownership.



2018 Bolt BEV - \$51,990 (MSRP)



2018 Pilot - \$40,500 (MSRP)



8.3 Fleet Carma Report

Appendix: Summary Table

The following table outlines the savings that may be achieved by having the 2018 Mitsubishi Outlander PHEV in place instead of the 2012 Chrysler 200, and the 2018 Chevrolet Bolt BEV in place instead of a 2018 Honda Pilot.

This analysis used the following assumptions:

- Cost of Fuel = \$1.30/L
- Cost of Electricity = \$0.10/kWh (off-peak), \$0.16/kWh (on-peak)
- Vehicle Service Life = 7 years
- Inflation = 5%

Savings	2018 Mitsubishi Outlander PHEV	2018 Chevrolet Bolt BEV
Annual Fuel Saved	2,156 L	1,665 L
Annual CO ₂ Emissions Saved	6,566 kg	5,032 kg
Payback Period	3 years	2 years
Lifetime Fuel Saved	15,093 L	11,656 L
Lifetime CO ₂ Emissions Saved	45,961 kg	35,224 kg
Lifetime Savings	\$14,165.73	\$12,944.66

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