Corporate Energy Plan

Region of Waterloo

2024–2033

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Executive Summary

This 2024-2033 Corporate Energy Plan ("the Plan") updates the Region of Waterloo's 2019-2028 Plan and meets the requirements of Ontario Regulation 25/23 which requires public agencies to review and update their energy conservation and demand management plans every five years. The 2019-2028 Plan lists the energy achievements and challenges from the last five years and makes implementation recommendations for 2024-2033. This is also an opportunity for the Region to share stories with the community of our commitment to wise energy management.

This 2024-2033 Plan shows initiatives that were very successful in the first period of implementation between 2019 and 2023. Numerous energy conservation measures were implemented resulting in $2.2 million in energy savings from 2019 to 2024 and will continue to save $1.0 million annually. These projects have saved 3,700 tonnes of greenhouse gas (GHG) emissions from 2019 to 2024 and will continue to save 1,450 tonnes of GHG emissions annually. The Plan also promoted the benefits of energy management on Region operation cost reductions and sustainability. Energy measures implemented covered a broad range of energy management category practices including energy planning, training, audits, studies, projects, and communication.

The 2024-2033 Plan updates include energy conservation recommendations for the next 10 years. These recommendations include: projects improving building envelopes, building equipment, and building controls; constructing new renewable energy systems; staff training; and enhancing predictive maintenance. The recommendations will improve the efficacy of the Plan towards sustainable energy savings by promoting collaboration, reviewing processes, staff training and energy funding coordination with Regional departments. Goals for the 2024-2033 Plan are based on continuing with the goals set in the 2019-2028 Plan. These are to implement 175 energy projects every five years, save an additional $300,000 in utility costs each year, and reduce GHG emissions by an additional 205 tCO2e each year.

Moving forward, this Corporate Energy Plan is placing a stronger emphasis on GHG emission reduction, in alignment with the Region's broader climate change objectives. This means this plan will focus on building electrification to reduce natural gas consumption. This may lead to increases in electricity consumption and overall utility costs but will have a much better environmental impact. The Region will monitor activities in the provincial grid and ensure our approach will result in the least GHG emissions.

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1. Background

In 2022, the Regional Municipality of Waterloo ("the Region") spent approximately $19.5 million on 132.5 million kilowatt-hours of electricity and $2.8 million on 8.1 million cubic meters of natural gas at Regional facilities. Energy management enables the Region to continue to provide excellent services by improving energy conservation and efficiency, reducing energy costs, and supporting the Region's commitment to addressing climate change through reducing GHG emissions.

Following the requirements of Ontario Regulation 25/23, under the authority of Ontario's 1998 Electricity Act, the Region updates its energy conservation and demand management plan, called the Corporate Energy Plan ("the Plan"), every five years. The Region developed its first Plan in 2014, the 2014-2024 Corporate Energy Plan, followed by its second Plan in 2019, called the 2019-2028 Corporate Energy Plan. The following are the requirements set out in the regulation:

- A summary of your organization's annual energy consumption and GHG emissions.
- A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy.
- Estimates of costs and savings for the current and proposed measures.
- Estimated length of time that the current and proposed measures will be in place.
- A summary of renewable energy generation.
- A description of ground source energy utilized, solar energy utilized, and the plan to operate heat pump technology.
- Confirmation that the energy conservation and demand management plan has been approved by the public agency's senior management.

1.1. Region Climate Change Commitments

This Plan supports the Region's broader climate change objectives including the development of a Corporate Climate Action Plan (CorCAP) which will be finalized in 2024. The CorCAP will define the corporate greenhouse gas emission (GHG) targets. As part of the CorCAP, staff are also developing a Carbon Budget, which will integrate annual emissions reduction targets as part of the annual budget process. Separate to the Corporate Energy Plan, Council endorsed the Region's Community Climate Change Action Plan, known as TransformWR in 2021. TransformWR establishes community GHG emissions reduction targets of 50 per cent reduction by 2030 and 80 per cent reduction in 2050 below 2010 levels.

The Region will continue to build on its leadership in energy management, pursuing additional energy, emissions and cost savings initiatives over the next 10 years. The next

sections of this Plan detail how the Region plans to improve its energy management through its 2024-2033 Plan implementation. The Plan also shares success stories that highlight the diversity of operations in the Region's portfolio.

2. Corporate Energy Initiatives

2.1. Historical Utility Use

The historical natural gas and electricity consumption for the Region are shown below in Figures 1 and 2. Complete data for 2023 was not available at the time of report writing.

Figure 1: Historical natural gas consumption

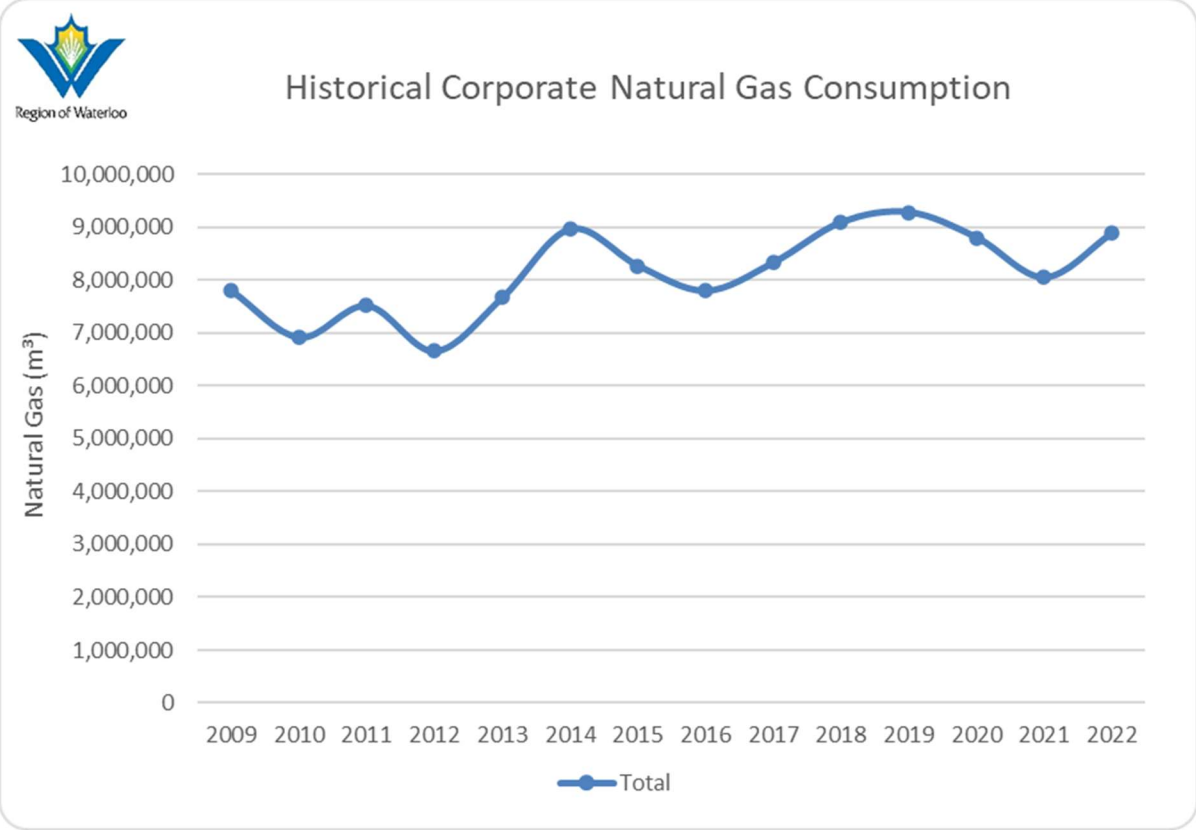
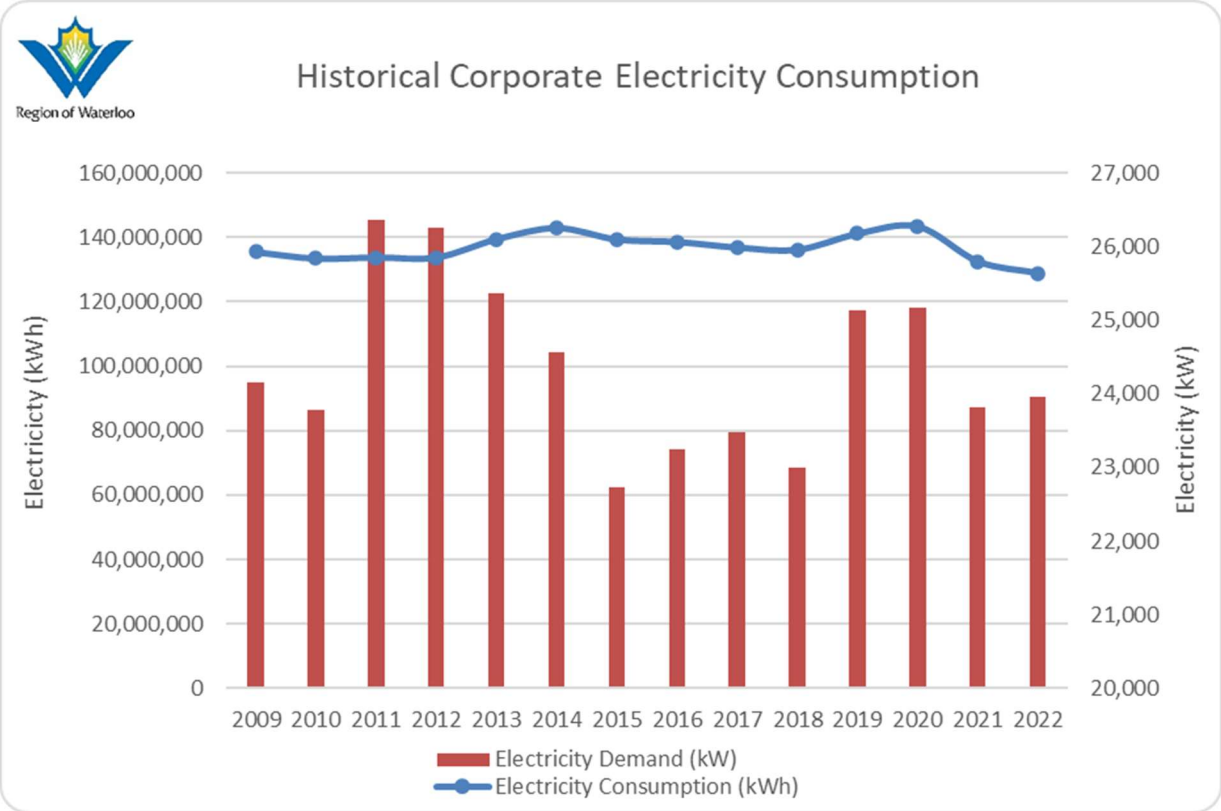
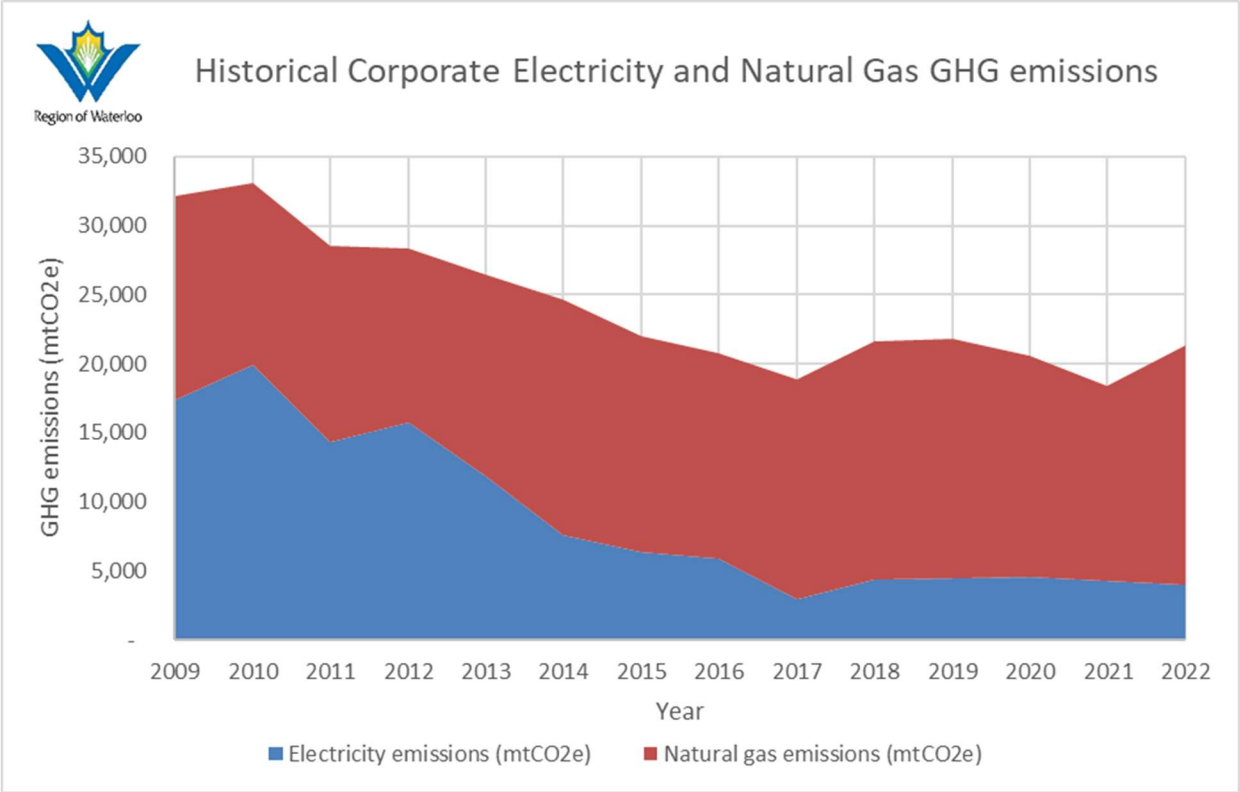


Figure 2: Historical electricity consumption



Waterloo Region had 507,000 residents in 2011 (Statistics Canada, 2011 Census) compared to 648,000 residents in 2022 (Council report PDL-CPL-23-003). As the population has grown, new Region buildings have been acquired and built which contribute to increased natural gas use. The Region now owns and operates 850 buildings, 200 of which are new or have been acquired since 2011 (including 50 shelter cabins). Electricity consumption has been relatively constant despite the growing population, likely due to the focus on electricity conservation projects in the past. Electricity conservation projects have more opportunities for utility cost savings compared to natural gas projects. Electricity is more expensive than natural gas so historically, electricity reduction projects have had better business cases and been prioritized as reducing utility costs was the main focus. The Region is working continually to conserve energy and reduce GHG emissions. The historic GHG emissions are shown below in Figure 3.

Figure 3: Historical GHG emissions



Electricity and natural gas GHG emissions have been decreasing since 2010. In 2022, electricity contributed 3,981 tonnes of carbon dioxide equivalent (CO_2e) while natural gas contributed 17,310 tonnes of CO2e to the corporate carbon portfolio. The decrease in electricity emissions is largely due to the removal of coal-fired plants in the Ontario electricity grid. In recent years, Ontario has had relatively low GHG emissions because generation is primarily from low-emitting sources such as hydroelectric and nuclear power.

Going forward, there is an increased focus on electrification to reduce natural gas consumption onsite and the GHG emissions associated with it. Electrification equipment also tends to be more efficient and consume less overall energy compared to traditional natural gas-fired equivalents. Electrification may lead to increases in electricity consumption and overall utility costs but will have a much better environmental impact. The Region will monitor activities in the provincial grid and ensure our approach will result in the least GHG emissions.

2.2. Current Utility Use Breakdown

Below is a breakdown of the 2022 natural gas and electricity consumption and GHG emissions. Complete data for 2023 was not available at the time of report writing.

Table 1: 2022 corporate electricity and natural gas consumption and GHG emissions

Operation Area	Electricity Consumption (kWh)	Natural Gas Consumption (m^3)	GHG Emissions ($mtCO_2e$)
Airport	2,995,371	124,621	327
Community Services	18,199,612	2,838,367	5,940
Cultural Services	2,016,630	223,744	486
EMS	678,970	186,030	374
Facilities	7,036,175	832,490	1,793
GRT	19,564,360	1,133,882	2,742
Police	3,459,419	575,922	1,198
Public Health	151,708	20,829	44
Transportation	1,988,451	37,717	131
Waste Management	3,219,427	255,896	583
Water/Wastewater	66,690,574	2,879,698	7,473
GRT ION	3,019,649	0	91
Other	3,689,361	0	111
Total	132,709,708	9,109,197	21,292

2.3. Energy Conservation Measures Implemented in 2019-2024

2.3.1. Building Related Measures

The Facilities and Fleet Management division at the Region monitors and reports electricity and natural gas consumption at Regional buildings. However, different divisions operate in these buildings such as Water and Wastewater Services, Waste Management, Grand River Transit, Police Services, and Paramedic Services and are responsible for the processes inside the buildings. The Facilities team have implemented over 200 projects between 2019 and 2024 that have resulted in over $2.2 million in savings and will continue to save $1.0 million annually. These projects have saved 3,700 tonnes of greenhouse gas (GHG) emissions from 2019 to 2024 and will continue to save 1,450 tonnes of GHG emissions annually. These projects fall into six categories: building envelope; building equipment; building controls; renewable energy; studies; and other.

Building envelope projects improve the building envelope and conserve energy by reducing the loads put on the heating, ventilation, and air conditioning (HVAC) equipment. These projects included:

- roof insulation upgrades
- window upgrades

- envelope sealing and weatherstripping

Building equipment upgrades typically save energy through new technology with a higher efficiency. Building equipment projects included:

- electric vehicle (EV) chargers
- air handling unit electrification with heat pumps
- furnace electrification
- appliance upgrades
- light emitting diode (LED) lighting retrofits
- destratification fans
- low flow water fixtures (showers, faucets, toilets)
- installing piping insulation

Building control improvement projects reduce energy consumption by optimizing operations and ensuring equipment only runs when it is needed. Building control projects included:

- demand control ventilation strategies
- variable frequency drives (VFDs) on motors
- building automation system (BAS) upgrades to Siemens Desigo systems
- BAS recommissioning
- control sequence optimization
- installing lighting controls

Renewable energy production on Regional sites reduces utility costs and GHG emissions for the Region. Renewable energy projects have included solar PV installations.

Studies gather critical information that determines which projects are best for implementation at each facility. Studies have included:

- energy audits
- building condition assessments
- GHG audits
- GHG emission reduction pathway studies
- renewable energy investment plans
- capacitor and harmonics study
- building envelope studies
- boiler system additive pilot

Other energy projects have informed project implementation, reduced utility consumption, and reduced utility costs. These projects have included:

- water meter remote monitoring and analytics

- energy procurement review
- electrical submetering
- net zero carbon new building constructions

The energy efficiency upgrades implemented are expected to stay in place until they reach the end of their service life. The remaining life of equipment and building components is reviewed regularly as part of building condition assessments. The best practice at the Region for many years has been to implement energy efficiency improvements that align with the capital renewal plan. This is good stewardship and ensures that equipment upgrades are made in line with planned equipment replacement. This avoids creating unnecessary waste and minimizes embodied carbon associated with new equipment. Embodied carbon refers to the carbon emissions related to the manufacturing, transport, and construction of building materials and equipment.

2.3.2. Renewable Energy Measures

The Region currently has 18 solar PV arrays. These 18 arrays have a total capacity of 1,359 kW AC. From 2019 to 2023, solar PV at the Region generated 8,251 MWh of electricity. This has saved 248 tonnes of GHG emissions and is enough electricity to power 869 Ontario homes each year, assuming a typical home consumes 9,500 kWh per year. The Region is currently adding a 625 kW AC solar PV array to the rooftop of the GRT Northfield transit garage and is designing systems for the Police Central Division, Heidelburg Yards, and Philipsburg EMS.

The Region also has two solar domestic hot water systems at children's centres. In the future, roof space is more likely to be used for solar PV to support electrification because of its operational simplicity. Solar thermal walls for ventilation air preheat as well as energy recovery ventilators (ERVs) are considered during the design of new facilities to reduce ventilation energy consumption. Feasibility studies have been completed for a few solar thermal walls for existing mid-rise housing buildings, but none have been implemented yet.

Currently, the Region has geothermal systems at the Region Library Headquarters and Sunnyside Supportive Housing. Geothermal has been investigated for more sites as part of renewable energy studies and in building energy audits, but their large capital cost and the limited areas where they are permitted have prevented more systems from being installed. The Region supports geothermal energy systems in areas where they will not pose a risk to the Region's drinking water supply. Waterloo Region gets a large amount of its drinking water from groundwater supply wells. In some areas, the construction of geothermal energy systems can pose risks to the security of the Region's drinking water well sources. To reduce this risk, the Region has wellhead protection areas and policies

that protect the Region's municipal drinking water supplies from adverse impacts related to geothermal energy systems. These policies allow for geothermal energy systems in some locations and restricts them in other locations.

Wastewater has investigated waste heat recovery from the process effluent, but there is not a business case for the project since the installation of the combined heat and power systems. The Region has also explored biomass systems but has not found a good application for them due to the requirements for a reliable feedstock source and a constant heat load.

2.4. Plan Implementation Strategy for 2024-2033

The 2014-2024 and the 2019-2028 Plans state that the Region will be an energy-conscious organization that continually seeks to conserve energy and is committed to supporting the current and future energy needs of the Region in a financially, socially, and environmentally responsible manner. This objective is reflected in this updated 2024-2033 Plan goals of managing energy consumption effectively, reliably, and sustainably. Sustainable energy management will include reducing GHG emissions to support Climate Aligned Growth.

Goals for the next period of implementation are based on continuing with the goals set in the 2019-2028 Plan. These are to implement 175 energy projects every five years, save an additional $300,000 in utility costs each year, and reduce GHG emissions by an additional 205 tCO2e each year.

2.4.1. Projects

The Region is committed to completing more energy conservation projects in Regional facilities. Many of these projects will be similar to those that have already been implemented under the 2014-2023 and 2019-2028 Corporate Energy Plans. This will include more projects related to building envelopes, building equipment, building controls, renewable energy, studies, and other energy projects. More details about these types of projects are given in Section 2.2.

2.4.2. Predictive Maintenance

The Region is dedicated to establishing a predictive maintenance program that prioritizes reliability-centered equipment maintenance. By proactively identifying, assessing, and resolving potential equipment issues, we can optimize energy usage, minimize waste, and reduce maintenance costs. Regular monitoring through fault detection and analytics, along with well-designed maintenance systems, ensures that equipment like HVAC and lighting consume less energy, leading to reduced utility costs.

2.4.3. Staff Training

Energy efficiency training for operations staff will be redone to ensure new staff and experienced operators are equipped to reduce building energy. Training will raise awareness about operation and maintenance's impact on facility energy consumption and will improve staff's knowledge and skills required to find opportunities to operate and maintain the facilities more efficiently.

Energy training will continue to be provided in other staff areas such as asset management and project management. As new technologies are explored, various departments will require staff training related to energy costs, energy consumption, project financials, GHG emissions, integrating design into existing facilities, and equipment operation and maintenance. These technologies may include:

- rooftop and ground mounted solar PV
- building integrated PV in wall cladding and roofing components
- geothermal systems
- heat pumps
- micro-grids made up of battery storage, renewable energy generation, and an energy management system; geothermal and district energy systems
- hydrogen-powered fleet
- level 2 and level 3 EV chargers

Training will increase awareness about energy management opportunities when planning new capital and capital renewal projects. Training ensures that staff is equipped to identify energy savings opportunities in the planning and design stages of any new assets at the Region.

2.4.4. Reducing GHG Emissions

Along with reducing utility costs and conserving energy, the Region is reducing its environmental impact through reducing GHG emissions. The Region is doing this through improved building energy efficiency, electrification projects, renewable energy projects, and net zero carbon new building constructions.

Energy Efficiency

Building energy efficiency will be further improved with building envelope upgrades, high-efficiency equipment upgrades, HVAC control improvements, and energy-conscious behavioural changes. Most energy conservation measures already implemented fall into this category. Energy conservation is the priority because avoiding energy consumption is the best for the environment.

Building and Fleet Electrification

Electrification will include replacing natural gas boilers, rooftop units, air handling units, radiant heaters, unit heaters, and domestic hot water heaters with electric alternatives at the end of the equipment's useful life where technically and financially feasible. In the Waterloo Region Housing portfolio, electrification studies have been completed and space heating electrification with air source heat pumps or geothermal and domestic hot water (DHW) electrification with electric resistance tank heaters and air source heat pumps are being considered. For apartment buildings in the portfolio where the building does not have enough electrical capacity for a fully electric system or where the natural gas boiler is relatively new, hybrid DHW systems with an air-to-water heat pump for preheat and the existing natural gas boiler for high-temperature top off and redundancy are being considered.

Fleet electrification will continue with the installation of more EV chargers and the purchase of more electric and hybrid vehicles. Light-duty fleet vehicles that have electric equivalents that can fully meet the current internal combustion engine (ICE) vehicle use are being replaced at end of life. Then, vehicles that have electric equivalents that can meet most of the current ICE vehicle use but may require some program and/or operational changes will be replaced. Another ongoing initiative is right-sizing vehicles for their applications. The primary future Fleet initiatives will be continuing light-duty fleet electrification where feasible and evaluating low GHG alternatives for heavy-duty fleet. Hydrogen, biodiesel, and electric technologies are evolving for heavy-duty fleet and their viability for the Region will be considered as the technologies develop. Biodiesel has not been implemented yet because it currently has performance and maintenance concerns associated with its use. Another future Fleet initiative is developing a Region-wide policy for efficient driving practices. This could be enabled by expanding the use of the existing telematics system to encourage drivers to drive with a lighter foot and reduce idling time.

Renewable Energy

The Region will continue to deploy renewable energy projects, including solar photovoltaic (PV), solar thermal, and geothermal systems to obtain clean energy.

Net Zero Carbon New Buildings

Finally, some new buildings are being designed to a net zero carbon standard. This includes three social housing apartments, the new landfill waste transfer station, and the new Region Airport terminal. Two of the three social housing apartments are in construction and the net zero carbon cost premium is estimated to be 10-15 per cent.

2.4.5. Heat Pump Technology

The Region is working to reduce GHG emissions and electrification will play a large role in fulfilling this commitment. Facilities has been identifying existing gas-fired equipment that can be electrified with air-source heat pumps (ASHPs) or ground-source heat pumps (GSHPs), also known as geothermal energy. An ASHP domestic hot water (DHW) heater has been installed at the Paramedic Services headquarters and an ASHP rooftop unit (RTU) is being installed at a housing site. These are pilot projects as Region staff becomes more familiar with the operation and maintenance requirements of these technologies and their costs. There are still barriers to implementing heat pump technology broadly across the Region's facilities.

The barriers of cost, equipment lead times, operational complexity, lack of skilled trade workers, and facility electrical infrastructure have delayed the widespread adoption of heat pump technology at the Region.

- Currently, the capital cost of heat pump technology is greater than traditional gas-fired equipment and the heat pumps will have higher utility costs due to electricity being more expensive than natural gas. The economics should improve for heat pumps as the carbon tax increases, however, as the electricity grid becomes constrained and new generation is needed, electricity rates may increase as well.
- Another challenge with some heat pump technology is the long equipment lead time. This means that in cases of unexpected gas-fired heating equipment failure during the heating season, there is not enough time to design, purchase, and install the heat pump system.
- Heat pump technology is also more complex than gas-fired equipment due to it being based on a refrigeration cycle. This requires a refrigeration technician to install and maintain many heat pump systems. There will be an increasingly high demand for refrigeration technicians as heat pumps become more widespread.
- Another complexity of heat pumps is the limited temperature water that they can supply, usually limited to 60 Celsius (140 Fahrenheit). This means that in buildings with an existing high-temperature heating loop (80 Celsius or 180 Fahrenheit), a direct replacement is not possible.
- Another consideration with ASHPs is the reduced efficiency and heating output capacity as the outside air gets colder. This may require full backup electric resistance heating to ensure buildings do not lose heat on the coldest days. GSHPs avoid this issue with a near-constant ground temperature year-round but come with a higher capital cost and are not permitted at every site location.
- Finally, most facilities at the Region do not currently have enough spare electrical capacity to electrify the buildings' heating. This means that service upgrades from the

local distribution companies and expensive upgrades to building electrical infrastructure are needed before heat pumps can be installed.

For these reasons, heat pump technology has not yet been widely deployed at the Region. However, heat pump technology will be pursued where it is feasible because of its efficiency and the low GHG emissions associated with electricity.

2.5. Implementation Costs

The Region has already implemented most low-cost energy saving measures across the building portfolio. Therefore, as the Region continues to reduce energy consumption and GHG emissions, project costs are expected to increase. Energy-efficient equipment upgrades are being added to the capital renewal plan and are being budgeted so that they align with end-of-life equipment replacement to minimize upgrade costs. Annual capital renewal budgets will be refined as more energy efficiency measures are embedded into them and in alignment with Council's Carbon Budget. The Carbon Budget is being developed as part of the CorCAP and will integrate annual emissions reduction targets into the annual budget process.

The approved 2024 Facilities capital renewal budget includes a provision of $26.3 million for equipment and building components that impact facility energy consumption. The total 2024-2030 facilities capital renewal cost with energy impacts is $122.7 million. Of this total, $54.9 million is for housing and $67.8 million is for non-housing. For division-specific process improvements, budgets will be set by those divisions in future years.

For new building constructions, the net zero carbon cost premium is expected to be 10-15 per cent. Two net zero carbon affordable housing units are under construction and reflect this 10-15% cost premium. They are 420 Kingscourt Drive, Waterloo with 73 units and a construction cost of $33.5 million, and 82 Wilson Avenue, Kitchener with 48 units and a construction cost of $28.2 million. The third net zero carbon, affordable housing apartment at 581-585 Langs Drive, Cambridge will have 136 units but has not yet been tendered.

3. Success Stories and the Way Forward

The Facilities and Fleet Management Division has been working to reduce energy consumption associated with the buildings themselves, while other divisions that occupy these buildings are working to reduce the energy consumption in division-specific processes. The following are stories about completed and planned energy conservation initiatives that the Region is proud of.

3.1. Facilities Management

Completed Energy Initiatives

Facilities Management has completed projects that improved building envelopes, HVAC systems, and renewable energy systems on behalf of the Region. These projects have been discussed above in Section 2.3. Since 2014, Facilities have been implementing a variety of energy conservation measures through previous Plans with energy savings and avoidance amounting to $15.2 million as of 2023. Facilities also applies for incentive funding where applicable to complete building studies and implement energy efficiency projects.

Future Energy Initiatives

Going forward, Facilities will continue electrification in existing facilities and build new, high-efficiency, net zero carbon buildings. Facilities is leading electrification studies for the GRT garages to support future electric bus expansion. Electrification for Waterloo Region Housing (WRH) is beginning with the design of hybrid domestic hot water systems in apartment buildings and electric resistance rental tanks in townhomes. Facilities will continue to perform electrification studies for buildings across the portfolio and is developing a comprehensive building electrification strategy and plan. Some new buildings are now being built as net zero carbon facilities including three new apartment buildings in the WRH master plan. A net zero carbon standard for new constructions is being developed.

3.2. Water and Wastewater Services

Completed Energy Initiatives

The Water and Wastewater Services division has been working to reduce natural gas and electricity consumption through a variety of different ways. SaveONEnergy incentives have helped to complete electricity conservation projects. Energy efficiency is a core value of this division and high energy efficiency is always considered during equipment renewals and new equipment purchases. This division uses business intelligence dashboards to monitor energy performance and inform maintenance and operations.

Water and Wastewater Services has also implemented new technologies and completed heat recovery studies to save energy. Three wastewater treatment plants have had combined heat and power (CHP) systems installed. These CHP systems serve approximately 60 per cent of the electricity needs for these sites and are fueled by a blend of methane produced from anaerobic digestors on site and natural gas from

offsite. All the heat can be used in the wastewater treatment process. It is expected that, before the end of life of these units, they will run on 100 per cent methane produced on site due to the Region's growing population. Plant performance dashboards, including the CHP systems, are reviewed monthly. A wastewater heat recovery study was completed but does not currently have a business case for implementation now that the CHP systems are installed. This is a potential heat source for a future district energy system connecting to buildings and institutions in the immediate area.

Future Energy Initiatives

Water and Wastewater Services is working on a new Water Supply Strategy that will holistically consider GHG emissions of chemicals, pumping, and source location when new water supply is needed as the population in the Region grows. Energy consumption and GHG emission baselines for new water supply are being set as part of this process. There are multiple technologies being considered for future projects to conserve energy. Blower replacements are in progress that will have more sophisticated, automated controls and are expected to have save significant amounts of electricity at multiple sites. Membrane Aerated Biological Reactors (MABRs) are being investigated for their feasibility and potential energy savings in wastewater treatment. More water distribution optimization and wastewater biosolid studies are planned. A new Wastewater Treatment Strategy master plan will also be developed.

3.3. Waste Management

Completed Energy Initiatives

For the Waste Management division, waste reduction is a core operating principle. Waste Management operations, community engagement, and education programs are centered on the value of waste reduction. In operations, processes are optimized and high-efficiency solutions are considered when procuring new equipment. In the community, campaigns such as "Save Space in the Landfill" work to promote a circular economy.

Future Energy Initiatives

In the short term, Waste Management is conducting GHG emission studies focused on landfill emissions and participating in various research programs. Currently, the Waterloo Landfill collects methane gas produced from the decomposition of organic matter and sells it to another company that burns it to produce clean electricity. A new Waste Management master plan is being developed that will include advanced waste strategies, identifying the potential value of source-separated organics, and exploring new

technologies as they become commercially available. This master plan will guide long-term strategic initiatives.

The large medium-term project for Waste Management is the design of a new waste transfer station and staff building for the Waterloo Landfill site. The new facilities are being designed using net zero carbon principles. Solar PV panels are expected to provide renewable energy at the site and heating and cooling will be done with heat pumps. This design will consider both embodied and operational carbon to take a more holistic approach to sustainability. This project will also increase their electrical service capacity to future-proof for the electrification of the fleet.

3.4. Grand River Transit

Completed Energy Initiatives

The Region's transit service, Grand River Transit (GRT), is undertaking exciting new projects to reduce energy consumption. Record-setting ridership in 2023 has led to further investment in transit services, demonstrating transit is a critical tool for the Region to make sustainable transportation the easy choice and reduce community emissions as the population grows. In 2023, GRT had its busiest year ever with annual ridership of 26.4 million, an increase of 48.3 per cent over 2022. This is also an increase of 20.1 per cent over the previous high of 22 million in 2019.

GRT has been procuring low-emission vehicle (LEV) hybrid buses (diesel/electric) since 2008 with a major acquisition in 2024. The new ION light rail transit in the Region is served by zero-emission vehicles. Diesel bus fuel consumption is being reduced through the following projects:

- Implementing anti-idling technology which forces automatic shutdown of all conventional buses which have been idle for over six minutes, resulting in an annual fuel use reduction of 100,000 litres.
- Introducing an enhanced engine tuning regime for all conventional buses to maximize engine performance, engine emission and fuel economy.
- Substituted fuel types in 2018 from Ultra Low Sulfur Diesel (ULSD) Gold to ULSD Clear to achieve a higher fuel economy and reduce emissions.

There has also been work done to "right size" certain routes with smaller 30-ft buses. Other initiatives include installing solar lighting at some transit shelters, a rain harvesting bus wash station at the new transit garage, and solar PV on the roof of 300 Northfield Dr E, Waterloo and 85 Chandler Dr, Kitchener.

Future Energy Initiatives

The following is a progress update for the GRT e-bus pilot:

- GRT's zero-emission electric bus pilot officially launched with the first vehicle delivered and in service in January 2024 and 10 more e-buses to arrive and enter service in 2024.
- GRT will review the performance of e-buses over two years and provide an initial update in fall 2024 and a subsequent full report at the end of the pilot. Part of the pilot includes evaluating charge management software to meet service needs and minimize utility costs. Pending satisfactory initial findings, GRT will consider a measured expansion of the e-bus pilot (e.g., additional vehicles, station and facility charging equipment) to better inform GRT's long-term zero-emission transition strategy and infrastructure needs.
- During the e-bus pilot project, GRT continues to purchase hybrid-electric buses as an interim emissions reduction strategy. This approach takes advantage of the proven environmental and operating benefits of the established hybrid bus technology while integrating more electric vehicles into the fleet as the technology matures.

Future initiatives for GRT include evaluating renewable diesel as it becomes available for diesel buses until they reach end of service life and are phased out of the fleet. Studies will also be done to determine the viability of hydrogen fuel for buses as the technology develops and becomes commercially available. GRT is now developing its 2025-2030 Business Plan. The plan will operationalize GRT's role in achieving the Region's commitment to reduce community emissions, and align GRT services, policies, and programs to the Region's new Strategic Plan. GRT has developed a preliminary methodology to benchmark and monitor emissions associated with its services as the fleet diversifies and ridership increases. As more hybrid and battery-electric buses enter service, GRT's corporate and community impact will continue to improve. However, regardless of engine type, investing in transit services in the immediate future to optimize the existing fleet will help increase ridership, enable more riders to "share" transit emissions, and help reduce the number of personal vehicle trips locally.

3.5. Police Services

Completed Energy Initiatives

Police Services have been upgrading their facilities and building new, high-efficiency buildings to reduce their energy consumption. In these buildings, fluorescent fixtures that were previously retrofitted with LED lamps are now being replaced with full LED fixtures as the buildings are refreshed. Other equipment upgrades include low-flow faucet aerators where they meet service requirements, uninterruptible power supplies (UPSs) to protect sensitive equipment, and natural gas generators to ensure service

resiliency. The new central division building was designed as a Leadership in Energy and Environmental Design (LEED) Silver facility with a high-efficiency HVAC system and capacity for an approximately 90 kW AC rooftop solar PV system that will be designed and installed later this year.

The Police Service is also working to electrify its fleet. The police-marked patrol fleet now consists of 36 hybrid SUVs with 12 more being added in 2024. There are five hybrid SUV's and vans in the administration fleet with an additional van being added in 2024. These benefit from regenerative braking and reduced fuel consumption. There currently is not a fully electric vehicle (EV) option for police-marked patrol vehicles that meet the service use intensity and range requirements. An anti-idling campaign was introduced to staff to promote more efficient driving.

Future Energy Initiatives

Design is beginning for a new public safety communications centre that will also be designed to LEED Silver including rooftop solar PV. Rooftop solar PV will be added to other police facilities where it is structurally and electrically feasible. Future projects include investigating cisterns for rainwater collection for use in landscaping and envelope investigations to identify window seals that have failed and need replacement.

Electric vehicle solutions for police-marked patrol vehicles will be considered as the technology develops to meet the service needs. Vehicles with lower usage intensity are being replaced with EV alternatives. Most police division buildings already have public EV chargers with plans to install public chargers at the remaining sites. The police facilities are facing electrical capacity constraints when considering more fleet and building electrification projects, like many Region buildings, and electrical service upgrades will be needed to support future projects.

3.6. Paramedic Services

Completed Energy Initiatives

Paramedic Services has been conserving energy by following operational best practices and starting fleet electrification. Staff ensures that overhead bay doors are closed as much as possible during the winter to reduce heating loads. The paramedic buildings use cold water for vehicle washing, lighting control systems with occupancy sensors, building automation systems with temperature schedules, and two solar PV systems (120 Maple Grove Rd, Kitchener and 1001 Erb's Rd, Waterloo) to conserve energy. Paramedic Services also has four electric vehicles. Three are used for the community paramedic program and one is an administrative vehicle. More electric vehicle replacements are planned for superintendents and emergency response paramedics.

Future Energy Initiatives

Paramedic Services plans to further save energy through additional fleet electrification and considering new technologies. Electric ambulances are currently much more expensive than their traditional gas equivalents, but the technology will continue to be monitored as it becomes more affordable and widely deployed. Other new technologies are being reviewed for implementation in the short term such as an idling technology that allows the engine to shut off when parked while maintaining charge for radios, lights, and sirens to function. Future paramedic and office staff energy awareness training will help achieve additional energy savings.

3.7. Fleet Management

Completed Energy Initiatives

Light duty fleet electrification, separate from buses, has begun at the Region. In Phase 1, fleet vehicles that have electric equivalents that can fully meet the current internal combustion engine (ICE) vehicle use are being replaced at end of life. Then, in Phase 2, vehicles that have electric equivalents that can meet most of the current ICE vehicle use but may require some program and/or operational changes will be replaced. Compressed natural gas (CNG) heavy-duty fleet replacement options were evaluated but the conclusion was that the new required infrastructure would be cost-prohibitive relative to the GHG emissions reduction in contrast to remaining on fossil fuels (gasoline, diesel, and dyed diesel) until electric alternatives are developed. Another ongoing initiative is right-sizing vehicles for their applications. An example of this is reducing engine size during vehicle replacement if a smaller engine can still meet the job-specific towing requirements.

Future Energy Initiatives

The primary future Fleet initiatives will be continuing light-duty fleet electrification where feasible and evaluating low GHG alternatives for heavy-duty fleet. Hydrogen, biodiesel, and electric technologies are evolving for heavy-duty fleet and their viability for the Region will be considered as the technologies develop. Biodiesel has not been implemented yet because it currently has performance and maintenance concerns associated with its use. Another future Fleet initiative is developing a Region-wide policy for efficient driving practices. This could be enabled by expanding the use of the existing telematics system to encourage drivers to drive with a lighter foot and reduce idling time. New technologies will be adopted as they emerge to reduce fuel consumption and improve the services offered by Fleet.

3.8. Information Technology Services

Completed Energy Initiatives

Region Information Technology Services (ITS) has also been helping to reduce energy consumption. The new laptop models being provided to staff use less electricity than previous models and, through the pandemic and the shift to hybrid working, all staff desktops have been replaced with laptops that use less energy.

Future Energy Initiatives

ITS is now working to centralize the Region's physical servers. A singular, centralized data center will replace the existing servers at multiple sites and will improve redundancy, resiliency, and energy efficiency. Redundancy is being improved by going from one internet connection and one internal network connection for the existing server infrastructure to a single site that has two internet connections with separate providers and an automatic failure switchover and two internal network connections with a manual switch over. Resiliency is being improved with generator backup and an uninterruptible power supply to ensure the site does not lose power and the facility has an improved fire protection system. Energy efficiency is being improved by using a LEED-certified building with a more efficient HVAC system that uses free cooling to meet 80 per cent of the year's cooling loads and the waste heat is used in other parts of the building.

3.9. Region of Waterloo International Airport

Completed Energy Initiatives

The Region of Waterloo International Airport (YKF) has been reducing energy consumption by completing LED retrofits of interior lighting, exterior lighting, and airfield lighting. Electric vehicle chargers have been installed at the site to promote electric vehicle usage and prepare for ground fleet electrification. The site has also undergone a BAS upgrade that allows for easier control of the HVAC systems and enables future potential savings with better equipment monitoring and scheduling. The Airport has been supporting sustainability through the installation of an electric plane charger, increased public transportation options, and supporting the work of the Waterloo Institute of Sustainable Aeronautics.

Future Energy Initiatives

The Airport will be updating the 2017 Airport Master Plan to include a section on Sustainability. This will include a decarbonization strategy along with short-term

sustainability commitments and long-term targets. YKF strives to provide leadership and support in the decarbonization of the aviation industry. The Airport recently achieved Level 1 of the Airport Carbon Accreditation (ACA) program, which is the only institutionally endorsed global carbon management certification standard for airports. The Airport plans to maintain and improve the certification level in this program over time.

Short-term energy reduction measures are cost-effective projects that can be implemented in the next few years. These include recommissioning the BAS, completing lighting retrofits and control upgrades, installing low-flow water fixtures, installing EV charging stations, conducting an electrical capacity study of the existing infrastructure, and installing electrical submeters throughout the site to prepare for site electrification. The Airport also plans to create tenant guidelines to promote sustainable development for any tenants or developers onsite. As part of the ACA program, the Airport will develop a Carbon Management Plan to decarbonize airport operations and development activities, and a Stakeholder Engagement Plan to promote wider airport-based emissions reductions from major activities that the airport can guide or influence.

Medium-term initiatives are largely based on capital renewal plans. These include replacing building systems with new high-efficiency, low-carbon building options at end of life, electrifying airport fleet vehicles, and exploring renewable fuels and carbon credits where electrification is not possible. The Airport also plans to start the design of a net-zero terminal building and explore options to support the use of alternative aviation fuels such as hydrogen and sustainable aviation fuels.

Long-term strategic initiatives include planning for on-site renewable energy production, and construction of a new terminal that will be designed as a net zero carbon facility. Renewable energy could consist of solar PV arrays, solar PV carports, battery storage, and geothermal to reduce GHG emissions. Many of the buildings at the airport facility are rentals and discussions are ongoing about emission targets and responsibilities for those buildings.